Examining human-wild carnivore conflicts in Kargil trans-Himalayas, India

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Acknowledgements

"…anyone who is grateful to others does so to the profit of his own soul…"

Holy Quran, Surah Luqman, Verse:12

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In loving memory and prayers of my sister

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&

Dedicated to my Parents

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for being there always, not only through my PhD

but every day of my life!

Abbreviations

CAML- Conservation Action and Measures Library

CAP – Conservation Action Plan

CD – Community Development

CMP- Conservation Measures Partnership

CITES- *Convention on International Trade in Endangered Species*

COVID-19 – Coronavirus Disease 2019

FAO – Food and Agriculture Organisation

FGD – Focus Group Discussion

GSLEP – Global Snow Leopard & Ecosystem Protection Program

H- Kruskal-Wallis one-way analysis of variance

HH - Household

HWC – Human-wildlife Conflict

IUCN – International Union for Conservation of Nature

KWS – Kenya Wildlife Service

LAHDC – Ladakh Autonomous Hill Development Council

MoEFCC - Ministry of Environment, Forest and Climate Change, Government of India

msl – mean seal level

NCF – Nature Conservation Foundation

NWFP – Non-Wood Forest Products

PA- Protected Area

PoK – Pakistan occupied Kashmir

PaK- Pakistan administered Kashmir

PRA – Participatory Rural Appraisal

SARS-CoV-2 - Severe Acute Respiratory Syndrome Coronavirus 2

SLC – Snow Leopard Conservancy

SLN – Snow Leopard Network

SPSS – Statistical Package for Social Science

ToC- Theory of Change

U- Mann-Whitney U test

WII – Wildlife Institute of India

WPA – Wildlife Protection Act (India), 1972

ABSTRACT

The inevitable human interaction with wildlife often gives rise to human-wildlife conflicts inflicting tangible (e.g., financial, persecutions) and intangible (e.g., emotional) losses on both sides. Despite the lack of scientific records in Kargil trans-Himalaya (India), there appears to have been an increase in negative human wild-carnivore interactions through undocumented reports. Livestock rearing is one of the essential sources of income for the local human population, and livestock depredation by wild carnivores instils fear and anger among the farmers, which sometimes results in retaliatory killings of the species responsible. Hence, this project aimed to understand and examine human wild carnivore conflicts in Kargil and to frame a conservation action plan for the region.

To study the level and pattern of livestock depredation by wild carnivores, 334 households across 18 villages were interviewed. The Himalayan brown bear (*Ursus arctos isabellinus*) was reported as the main species responsible for livestock depredation cases (n=112). The preponderance of incidents involving livestock predation were documented to occur in the winter season (n=139) and the autumn season (n=132). Despite the documented instances of significant livestock losses resulting from predation, the local farmers reported a positive perspective towards the wild carnivores of the region.

Furthermore, awareness and attitudes toward wildlife species among the university students from Kargil were studied through online surveys. The findings indicated that the students exhibited a good level of knowledge and a favourable attitude toward the wild carnivores indigenous to the local areas. Analyzing the main conservation challenges in the region through available literature and from the findings of this study, Miradi was employed to frame a conservation action plan for the study area.

In summary, this study aimed to establish baseline information on human-wild carnivore conflicts in the Kargil region. It achieved this by assessing the scale and patterns of livestock depredations by various carnivore species, understanding the local communities' perception and awareness of wildlife, and framing a conservation action plan. The conservation action plan, derived from the study's findings and existing available literatures, will constitute the strategic framework for future initiatives. It aims to foster collaborative partnerships with local stakeholders, governmental bodies, and non-governmental organizations. This project will additionally provide valuable insights to guide forthcoming conservation endeavours within the region, including government policies.

COVID-19 Impact Statement

In the wake of the far-reaching and unforeseen challenges brought about by the global COVID-19 pandemic, the initiation of my doctoral fieldwork, which was originally slated to commence in March 2020, confronted a series of significant delays and transformations. These disruptions had profound repercussions on the trajectory of my research and necessitated a detailed reassessment of its objectives.

The initial setback was precipitated by the imposition of stringent international travel restrictions and public health measures designed to contain the spread of the virus. These restrictions compelled us to postpone our fieldwork for an approximate duration of one year. During this period, the COVID-19 pandemic continued to evolve, and the landscape of international travel and health regulations remained complex and unpredictable. Even when fieldwork managed to resume in September 2021, the lasting influence of local pandemic laws and continued safety concerns persisted. Given the nature of our research, which demanded face-to-face interviews and direct engagement with respondents, these challenges presented insurmountable hurdles, leading to another delay, this time spanning six additional months.

However, it is vital to emphasize that this protracted hiatus was not a period of inactivity. Instead, it was strategically employed to undertake several essential tasks. First and foremost, rigorous training programs were instituted for the local field assistants and interviewers. These programs were meticulously designed to impart the requisite skills and expertise necessary for data collection, ensuring that our team was proficient in the established research methodologies. Additionally, comprehensive efforts were directed towards equipping the local interviewers with an in-depth comprehension of the overarching research objectives, the nuances of the study area, and the ethical considerations inherent to our work. Simultaneously, seizing the opportunity to bolster the theoretical underpinnings of the thesis, a substantial portion of this period was dedicated to an extensive review of relevant literature. This exercise allowed us to enrich the theoretical framework of the research, aligning it with contemporary scholarship and ensuring that the study was rooted in a comprehensive understanding of the ecological, wildlife conservation, and sociocultural contexts pertinent to the Kargil region.

The prolonged disruptions caused by the pandemic had profound implications on the original goals and scope of the PhD project. As such, the alterations in research objectives were a direct response to the exceptional circumstances encountered. Most notably, the strategic decision was made to shift the research focus away from one of the initial goals of surveying and estimating the populations of prey species, including ibex and urial, within the Kargil region. This strategic pivot was undertaken with the intention of optimizing our research approach to account for the persistent challenges and uncertainties posed by the pandemic while still maintaining the overarching commitment to make a substantial contribution to the field of wildlife ecology and conservation.

In summary, the COVID-19 pandemic, with its ensuing global disruptions and persistent local restrictions, necessitated a series of adjustments and innovations in our research plan. This adaptation, marked by thorough training, an enriched theoretical foundation, and a recalibrated research focus, underscores the resilience and adaptability of the research team and the enduring commitment to producing valuable contributions to the wildlife ecology and conservation field despite the unforeseen obstacles encountered.

Chapter 1 - INTRODUCTION

1.1 Human-wildlife interactions

Given the documented species losses over the last several years and millennia, biologists today believe that a sixth mass extinction is underway (Barnosky et al., 2011; Kolbert, 2014). Approximately 99 per cent of the four billion species thought to have evolved on Earth during the previous 3.5 billion years have vanished (Novacek, 2001). There are now about 142,500 species on The IUCN Red List, including over 40,000 threatened with extinction, including 41% of amphibians, 37% of sharks and rays, 34% of conifers, 33% of reef-building corals, 26% of mammals, and 13% of birds (IUCN Red List of Threatened Species, 2022).

The worldwide landscape of the twenty-first century is becoming increasingly human-dominated, with reports claiming that human activities have now affected every ecosystem on the planet's surface (Diaz et al., 2019; Dodds et al., 2013; Elmgren, 2001; Vitousek et al., 1997; Zalles et al., 2021). How much humanity has boosted species extinction rates is a significant indicator of humanity's worldwide effect. Common assertions say these are 100–1000 times pre-human or background extinction levels (De Vos et al., 2015). Humans are considered to have converted around 40-50 per cent of the Earth's surface, mostly with significant ecological consequences: for example, 10-15 per cent of the global landmass is now covered by either row-crop agricultural production or large cities, while another 6-8 per cent has been converted to pasture (FAO, 2012, Olson et al., 1983; Vitousek et al., 1997).

The impact of modification by humans on Earth's biological resources—its species and genetically distinct populations—is significant and growing. Species extinction is a natural process, but the current pace of genetic variability loss, population loss, and species extinction is substantially higher than background rates; it is continuing and represents an irreversible global shift (Vitousek et al., 1997). Human actions have wiped out a quarter of the world's bird species in the last two millennia, primarily on marine islands (Vitousek et al., 1997). Simultaneously, human-mediated species migration throughout the globe is homogenising the Earth's biota, introducing numerous species into new locations where they can disturb both natural and human systems (Vitousek et al., 1997). As stated above, the resulting human change in the global environment has been so significant that it has been dubbed the 'Anthropocene' a new geological epoch (Sanderson et al., 2002; Steffen & Tyson, 2001).

Since the beginning of human evolution, there have been interactions with wildlife (Albarella et al., 2017). These interactions can be positive as well as negative in nature. Humans have lived beside wildlife and competed with them for natural resources throughout history. As the human population has been expanding rapidly since the Industrial Revolution, the demand for natural resources is also increasing, which has resulted in increased competition and intensified pressure on wildlife and the natural ecosystem, which serves as the primary habitat for wildlife. Biodiversity suffers both direct (Dickman & Hazzah, 2016) and indirect loss, and, again, there is a decline in human well-being (both physical and psychological) due to anthropogenic activities expanding across the world (Dickman & Hazzah, 2016).

1.2 General overview of conflicts between humans and wildlife

Human-wildlife conflict (HWC) has existed since the dawn of humans; the earliest forms of competition predated prehistoric person's forebears and early hominoids (Berger & McGraw, 2017; Lee-Thorpe et al., 2000). In the present Cenozoic era, this later spread to agricultural and livestock depredations, first reported approximately 10,000 years ago (Gordon, 2009).

Today, HWCs are on the rise in many human-dominated ecosystems, posing severe threats to biodiversity conservation across the world (Acharya et al., 2016; Anand & Radhakrishna, 2017; Redpath et al., 2013; Ruyle, 2018). HWCs typically occur due to close contact between people and wildlife and often due to finite resource rivalry. It may be referred to as negative encounters between humans and wild animals, with repercussions for humans, their assets, wildlife, and their habitat (IUCN, 2023). Due to human population growth and land use expansion in many parts of the world, these tensions have escalated over recent decades (Woodroffe, Thirgood, & Rabinowitz, 2005). HWC is a serious global challenge to the economy, sustainable livelihood, food security, and species conservation in rural and urban landscapes. In general, the effects of HWC include crop damage, livestock loss, property/infrastructure damage, human injuries and fatalities, and disease transmissions (usually between wildlife and domesticated animals) (Food and Agriculture Organisation, n.d.).

HWCs are further determined by how people see wildlife, and depending on the circumstances, such conflicts might be translated into coexistence, neutrality, or negative situations (Frank et al., 2019). Humans may accept or reject a wildlife species based on how the wildlife is classified and where the border between human and animal spaces is drawn in a given community (Knight, 2013; Philo & Wilbert, 2004; Creager & Jordan, 2002). For example, Buddhist communities might be more tolerant of such conflicts due to their belief systems (Höhne, 2006).

1.3 Defining Human-wildlife Conflicts

The concise Oxford dictionary (Stevenson & Waite, 2011) defines conflict as "a condition of hostility or hostilities", "a battle or a struggle", and "a clashing of opposite principles".

HWC can be defined as any adverse interaction between humans and wildlife (Messmer, 2009). Humans have frequently retaliated against species that constituted actual or imagined dangers to people's existing or claimed interests, resulting in recent extinctions (e.g., Tasmanian wolf (Paddle, 2000)) (Woodroffe & Ginsberg, 1998; Treves & Karanth, 2003). HWC is defined as conflict or negative interaction between humans and wildlife (Woodroffe et al., 2005; Conover, 2002); human or wildlife actions that hurt/harm the other; wildlife threats to human life, economic security, or recreation (Trever & Karanth, 2003); or the perception that wildlife poses a threat to human safety, health, food, and property (Peterson et al., 2010). Some of the standard definitions for HWCs by various important organisations are as follows -

'*Human-wildlife conflict occurs when animals pose a direct and recurring threat to the livelihood or safety of people, leading to the persecution of that species'* - IUCN SSC HWC Taskforce, 2019.

'Human-wildlife conflict - when struggles arise from people and animals coming into contact - often leads to people killing animals in self-defence or as pre-emptive or retaliatory killings, which can drive species to extinction' – UNEP, 2021.

'*Human-wildlife conflict refers to the negative interactions between humans and wild animals, with undesirable consequences for both people and their resources and wildlife and their habitats'* - IUCN, 2020.

Conover (2002) defined Human-wildlife conflicts as *'situations occurring when an action by either humans or wildlife has an adverse effect on the othe*r'.

When the needs and behaviour of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife' (Recommendation 5.20, 2003 World Parks Congress).

For this study, we adopted the definition of human-wildlife conflict provided by the IUCN SSC HWC Taskforce in 2019.

1.4 Types of human-wildlife Interactions and Conflicts

Human-wildlife interactions range from positive to negative, from minor to severe in intensity, and from rare to common in frequency (Nyhus, 2016) (Figure 1). Top predator attacks on humans, such as tigers, lions, and sharks, are becoming less common, yet

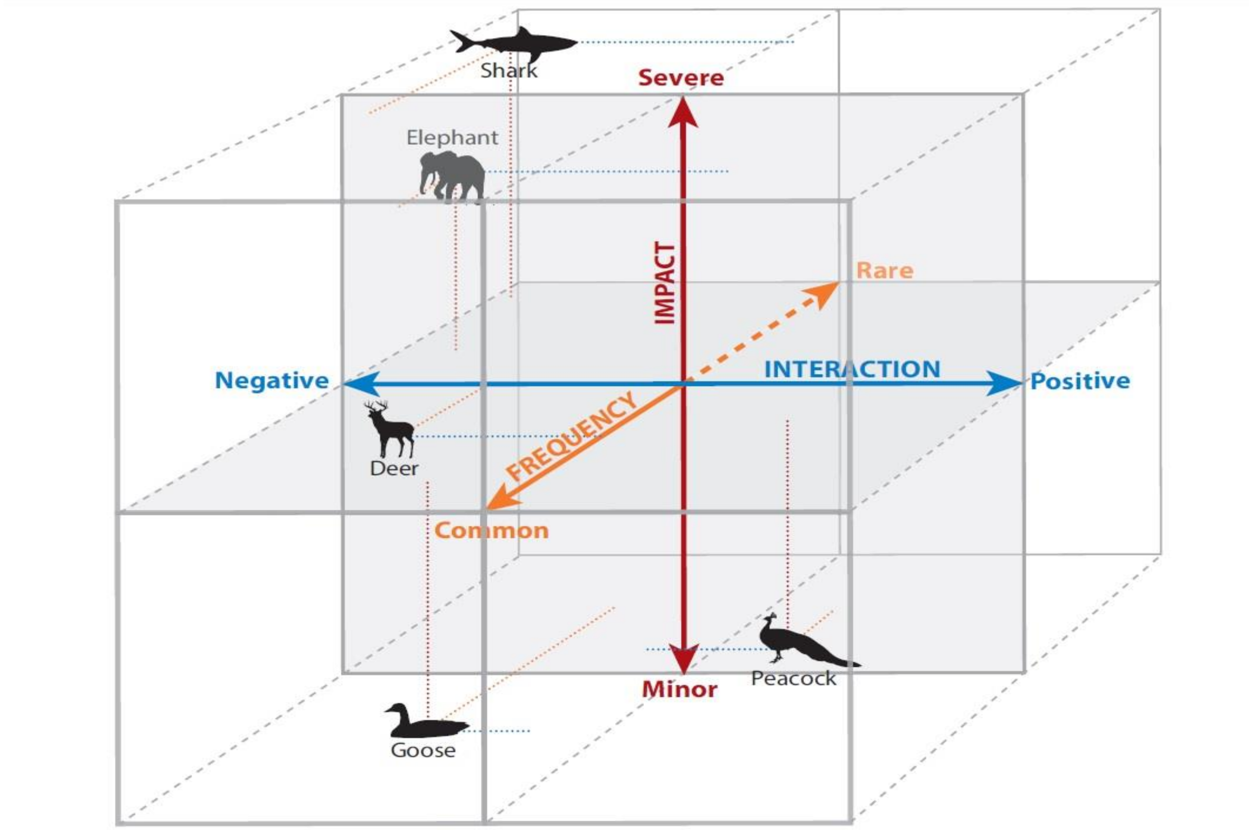

Figure 1 Conceptualizing different types of human-wildlife interactions with the impact range, frequency, and types of interaction. (Source: Nyhus, 2016).

they may be deadly and elicit intense public reactions (Conover, 2002). Conflicts between humans and common garden pests or birds like geese may be more prevalent but cause less concern. The incidence of conflict varies significantly within and between geographic regions (Nyhus, 2016).

Conflicts between humans and animals have severe implications for human health, security, well-being, biodiversity, and ecological function (Woodroffe et al., 2005). Human effects might be direct or indirect. Human injury and death can occur when animals bite, claw, gore, or otherwise attack people, collide with vehicles, trains, aircraft, boats, ships, and other vehicles, and when a zoonotic illness or parasite is transmitted (Conover, 2002). Crops, livestock, game animals, and human property can all suffer direct material and economic harm because of HWC (Woodroffe et al., 2005; Linnell et al., 2010; Gittleman et al., 2001; Loveridge et al., 2010; Maheshwari et al., 2020; Sathyakumar, 2003). Potential costs to farmers and managers associated with protecting crops or livestock, lower psychological well-being, economic loss (e.g., livestock depredation, crop damage), and food insecurity are all indirect effects of HWC that are more difficult to quantify (Barua et al., 2013; Conover, 2002, Dickman et al., 2011; Gittleman et al.,2001; Hoare, 2012; Linnell et al., 2010).

1.4.1 Livestock Predation

People throughout the globe have expressed strong opposition to local populations of large carnivores because of the actual and perceived threats they pose to human health and livelihood (Chapron et al., 2014; Treves & Karatnth, 2003). Because of their broad habitat range, physical stature, and nutritional requirements, felids and canids are highly vulnerable to human conflict (Macdonald & Sillero-Zubiri, 2004; Macdonald & Loveridge, 2010).

Livestock predation, especially by big predators, is the most common cause of human-wildlife conflict worldwide (Thirgood & Woodroffe, 2005). It is among the most common and well-studied form of human-carnivore conflicts (Wilkinson et al., 2020). Disputes stemming from carnivore-livestock interactions are one of the significant challenges to carnivore conservation globally (Ripple et al., 2014; Conover, 2002; Nyhus, 2016), with approximately 4.2 billion cows, sheep, goats, and pigs grazing on 30% of the planet's land (Robinson et al. 2014; FAO, 2018). Livestock predation by wild carnivores was cited as the primary reason for human-carnivore conflicts by more than 40% of researchers involved in carnivore conservation studies (Sillero-Zubiri & Laurenson, 2001). The problem of livestock depredation is prevalent across the globe, from snow leopards (*Panthera uncia*) in India and Nepal, bears in Norway and India, tigers (*Panthera tigris*) in India, and lynxes (*Lynx lynx*) in France.

Research findings indicate that approximately one-third of jaguars' dietary preferences include cattle, leading to economic losses for ranchers and subsequent retaliatory killings (Mongabay, 2023). In an investigation in central Amazonia, interviews disclosed that 42% of the communities reported at least one incident of livestock depredation by felines within two years and in 83% of these instances, the identified predator was the jaguar (Del Toro-Orozco unpublished data, as cited in Marchini et al., 2017).

Although livestock predation puts a substantial loss on the local farmers, disease has also been reported as a primary cause of livestock loss. In 1996, villagers reported 63% of all livestock loss in Nepal due to predation by snow leopards and other associated species (Jackson et al., 1996). However, low livestock loss can also instil intolerance towards wild carnivores, especially in economically poor farmers (Stander, 1997). Moreover, if the livestock in question is precious, represents a significant lineage, or has cultural as well as economic value, as is the case in many traditional communities, the effect of such losses can be amplified further (Mech, 1991; Sillero-Zubiri & Laurenson, 2001).

Some of the factors identified by Thirgood & Woodroffe, 2005, that contribute to livestock depredation situations by wild carnivores are as follows.

- Domestic livestock are easy prey for wild predators since they have less anti-predator behaviour.
- Prey species populations and densities may be reduced due to grazing competition with livestock.
- Changes in livestock grazing patterns, particularly in areas where predator density has plummeted.
- Livestock is no longer guarded by people or dogs in most of Europe and North America, making them easy prey for carnivores.

Despite the prevalence of conflict between predators and livestock-raising populations worldwide, few studies have measured the magnitude of livestock predation and its economic impact on herders (Thirgood & Woodroffe, 2005). Where local people have been unable to limit and endure the harmful influence of wildlife on their livelihoods, they have taken harsh measures to eliminate the number of problematic species (i.e., retaliatory killings; Menon et al., 1998; Tuyttens et al., 2000).

1.4.2 Attacks on Human

The apprehension of potential harm or fatality resulting from interactions with apex predators or megaherbivores constitutes a significant catalyst for human-wildlife conflict (Thirgood & Woodroffe, 2005). However, not as equal to livestock predation, attacks on humans by wild carnivores or megaherbivores can result in intense conflicts (Quigley & Herrero, 2005).

1.4.3 Crop Raids and Destructions

Crop raiding and damage by wild animals have caused substantial conflict between local human residents and wildlife in many parts of the world (Thirgood & Woodroffe, 2005). Large vertebrate herbivores can generate friction with humans by trampling, directly devouring, or damaging crops important to local communities' socio-economy (Estes et al., 2011; e.g., elephants in India (Sukumar et al., 1999)).

Although crop raiding by wild animals is not a new occurrence or a threat to wildlife conservation and local economies, megaherbivores such as Asian elephants (*Elephas maximus*) (Joshi, 2009; Zimmermann et al., 2009; Ekanayaka et al., 2011; Montgomery et al., 2021) and African elephants (*Loxodonta africana*) (Hoare, 2000; Osborn & Parker 2003) have received much attention from wildlife conservationists throughout the world due to the severity of the conflict. According to a report by the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India (2017), the annual loss caused by elephant crop raiding was estimated between 1.5 to 2.0 billion Indian National Rupees (~$18 million) (Ministry of Environment, Forest and Climate Change, Government of India, 2017). Similarly, according to research by the Kenya Wildlife Service (KWS), agricultural damage caused by elephants and other human-wildlife conflicts was predicted to cost over 12 billion Kenyan Shillings (~ $110 million) in 2019 (Kenyan Wildlife Service, 2019).

1.4.4 Disease transmission

The transfer of diseases from animals to people and from people to wildlife is a unique but frequent aspect of human-wildlife conflict (Solsbury &White, 2015). Many animal species serve as pathogen reservoirs, and zoonotic and vector-borne illnesses (e.g., rabies (Knobel et al., 2005); bovine tuberculosis (*Mycobacterium bovis*) (Michel et al., 2010); avian influenza (Alexander, 2007)) offer significant health concerns to cattle, humans, and wildlife (Daszak et al., 2000).

1.5 Impact of Human-wildlife conflicts

1.5.1 On Humans

To policymakers, environmentalists, the general public, and residents at human-wildlife interfaces, a conflict is complex and sensitive. Improper resolution of disputes between humans and wildlife can severely disrupt the ecological balance of an area and cause significant harm to the local communities that share the region with wildlife (Dickman, 2010). Such damage can take both direct and indirect forms, as will now be discussed.

The direct impact of human-wildlife conflicts on humans may range from injury or loss of human lives to livestock loss, competition for resources, crop damage, and more (Woodroffe et al., 2005). The injury or killing of humans by large predators and mega herbivores is one of the most significant consequences of HWC. Species of felid, ursids, and canid attacks on people have been documented in both historical and contemporary contexts worldwide. Fear of carnivores is deeply ingrained in the human mind and has been regarded as an anti-predator reflex (Kruuk, 2002; Quammen (2004). Although comprehensive verification of allegations of human injuries and deaths is sometimes impossible, a large amount of evidence shows that hundreds of humans are killed each year by wildlife across the world (Kruuk, 2002; Quigley &Herrero, 2005). Big cats, particularly lions (*Panthera leo*) and tigers (*Panthera tigris*) are the most responsible for human deaths. Two lions in Kenya killed around 100 railway employees in the early twentieth century, while eight tigers in India were responsible for over 1,000 human mortality reports across the country (Kruuk, 2002). Between 1985 and 2001, tigers in the Kanha tiger reserve in Madhya Pradesh, India, killed 22 people, and lions in the Gir forest in Gujarat, India, killed 28 people between 1978 and 1991 (Saberwal, 1994). Bears have also been frequently reported to attack humans (Herrero, 1985; Quigley & Herrero, 2005). Brown bears in North America were responsible for 23 human fatalities from 1900 to 1980; most of the deaths were reported in parks and were females defending their cubs (Woodroffe et al., 2005). Sloth bears were reported to have caused 48 human fatalities in India and injured 687 others in Madhya Pradesh from 1989 to 1994 (Rajpurohit & Krausman, 2000). Attacks on humans by wolves (*Canis lupus*), although not as frequent as the level of cats and bears, have been categorised into three types: attacks by rabid wolves, defensive attacks, and predatory attacks (Linnell et al., 2002). Rabid wolves attack people, reported throughout their habitat range (Woodroffe et al., 2005). Hundreds across Europe were killed in the eighteenth and nineteenth centuries (Kruiuk, 2002). In India, attacks of wolves on children were more frequent in rural India during the nineteenth century (Linnel et al., 2002). Mega herbivores are also responsible for human fatalities across their habitat range and are similar in numbers to predators (Woodroffe et al., 2005). In India, Asian elephants (*Elaphas maximus*) are responsible for 100-200 human fatalities annually (Veeramani, 1996). The International Fund for Animal Welfare (IFAW, 2023) suggests that each year in India, roughly 400 people lose their lives in conflicts with elephants. Over the period from 2010 to 2017 in Kenya, approximately 200 individuals died as a result of human-elephant conflicts. Although the loss of human lives to wildlife is minor compared to other causes of mortality, such as diseases, famine, and natural disasters, it may be crucial in defining local people's tolerance of wildlife.

Zoonotic diseases have been one of the leading public health challenges worldwide. Wild carnivores can act as reservoirs of various zoonotic diseases. There have been severe implications of disease transmission from wild animals to humans. Over 400 years, the black death plague (*Yersinia pestis*) killed over 50% of the human population in China, 33% of Europe, and 17% of Africa (Conover & Vail, 2014). Approximately 60% of the globally emerging infectious diseases are zoonotic diseases affecting animals and wildlife (Conover & Vail, 2014), and 72% originate from nature (Jones et al., 2008). Some of the zoonotic diseases that have adversely impacted the human population around the globe include bacterial infections like plague, anthrax, salmonellosis, and *Escherichia coli*; viral diseases such as rabies, influenza, encephalitis; and transmissible prion diseases such as mad cow disease, chronic wasting disease, and scrapie (Conover & Vail, 2014). Other recent zoonotic disease outbreaks include ebola, avian influenza, swine flu, Middle East respiratory syndrome, cholera, and coronavirus-19 (Covid-19) (World Health Organisation, n.d). Wild carnivores can act as a reservoir of rabies, a viral disease which attacks the central nervous system (Woodroffe et al., 2005). The severe symptom of this disease includes paralysis followed by death. Before the vaccine was developed for rabies, it was also lethal to humans; however, in some countries (e.g., India), it remains a major human killer (Woodropffe et al., 2005). Globally, rabies is responsible for around 59,000 human deaths annually, with ~10,000 deaths occurring in India alone (World Health Organisation, 2018).

Due to conflict with wildlife, direct material and economic damage to crops, livestock, and property is evident throughout regions where a proper conservation approach is absent. These losses could put a substantial toll on the local communities, particularly on agro-pastoral societies that depend on such resources for survival.

Opportunity costs to local populations with protecting crops or animals, lower psychological well-being, loss of livelihoods, and food shortages are all indirect effects of HWCs that are more difficult to quantify (Woodroffe et al., 2005; Solsbury &White, 2015; Dickman et al., 2011; Linnel et al., 2010; Gittleman 2013; Hoare, 2012; Barua et al., 2013).

Indirect costs to people may be imposed by wildlife in the form of time and money spent mitigating wildlife damages (Emerton, 2001; Norton-Griffits & Southey, 1995). Fear and anger among local populations due to sharing space with large carnivores may lead to restless nights and reduced psychological wellbeing (Woodroffe et al., 2005). These feelings can occasionally lead to pre-emptive kills of large mammals. There have been several un documented incidents in Kargil, India, where locals have resorted to killing brown bears out of fear and anger, even though there have been no reports of livestock damage or property destruction by the species. Further research is required to understand the link between local populations' pre-emptive killings of large carnivores and other intangible costs.

1.5.2 On wildlife

Even a localised lethal control of a species can have a wide-ranging effect on populations. According to Frank et al. (2005), lethal control of livestock predating lions in 180 square kilometres resulted in a ‘sink’ that impacted the lion population over at least

2000 square kilometres. A similar study by Mace and Waller (1998) concluded the impact of brown bear mortality on the regional population of the species. The more widely the distribution range of a species, the more will be the impact of lethal removal of individuals on its wider population.

According to the International Fund for Animal Welfare (IFAW, 2023), annually, Sri Lanka documents approximately 200 elephant fatalities resulting from incidents involving human-elephant conflicts, while in India, an estimated 100 elephants succumb each year due to conflicts with humans. In Kenya, wildlife authorities report the necessity to euthanize up to 120 elephants annually as a consequence of human-elephant conflicts.

In areas where people share resources with local wildlife, it can threaten wildlife. One example is from Algonquin park in northern Canada, where wolves were driven to decline at a sharp pace due to persecution by local communities when the animal ranged beyond the park's boundaries (Forbes & Theberge 1996). However, strict laws banning the killing of wolves close to the park border reduced the overall mortality of the wolves (Forbes & Theberge, 1996).

Human-wildlife conflicts can have consequences beyond adversely impacting a species' population by disrupting the ecosystem's functioning. Conflict species are frequently keystone species whose removal or sharp population decline affects the ecosystem's overall structure (Woodroffe et al., 2005). For example, the extinction of grey wolves and grizzly bears from the Rocky Mountains (USA) impacted the density and behaviour of ungulate species and the habitat appropriateness of migrating bird species (Berger et al., 2001).

Another excellent example of the impact of HWCs on the ecosystem imbalance involves the prairie dogs (Genus *Cynomys*) in northern America. Prairie dog colonies are a unique ecosystem supporting biodiversity communities (Kotliar et al., 1999). The disappearance of the black-footed ferret (*Mustela nigripe*), a highly specialised animal that is an obligate predator of prairie dogs, was one of the principals and notable negative consequences of systematic attempts to eradicate prairie dogs from their home environment (Galván, 1999). Elephants can profoundly affect the structure of the ecosystems in which they live; hence, a reduction in their population could impact the entire ecological setting of the ecosystem (Woodroffe et al., 2005).

In the worst-case scenario, negative human-wildlife interactions can result in habitat disruption, fragmentation, and destruction (Woodroffe et al., 2005). For example, in Kenya, land conversion was the principal cause of an 81 per cent fall in the number of wildebeest (*Connochaetes taurinus*). Habitat deterioration also resulted in a symbiotic relationship between wildebeest and livestock, which influenced the transmission of the malignant catarrhal fever illness (particularly during wildebeest calving (Talbot, 1963)) from wildebeest to domesticated animals, resulting in significant livestock mortality.

1.6 Managing Conflicts

HWCs can be dealt with in several ways. Prevention techniques aim to prevent conflict from arising in the first place and address the fundamental causes of the competition (Woodroffe et al., 2005). Protection strategies are implemented when negative interactions between humans and wildlife are likely to develop or have already occurred (Inskip & Zimmermann, 2009). Mitigation strategies are aimed to diminish the problem by reducing the amount of effect (Redpath et al., 2015). The critical distinction between the choices is the timing of the measure's implementation (Woodroffe et al., 2005).

The cost of deploying a technique or strategy to mitigate HWCs is only cost-effective if the cost of the harm is less than that of the method or approach. In the following sections, some of the most important management options for minimising HWCs were explored.

1.6.1 Managing Conflicts – Wildlife

To prevent conflict or minimise the frequency or intensity of HWCs, a wide range of strategies have been developed to manage wildlife, broadly classed as lethal and nonlethal measures.

1.6.1.1 Lethal Control

When wildlife causes or is perceived to cause substantial harm to humans and their livelihoods, it is expected to practice killing them (Woodroffe et al., 2005). People have subjected wildlife to lethal control for centuries. Bounties or appreciations were once widely used to reduce or eliminate the predator population from a region. For instance, the *Champawat tiger* (a Bengal tiger) in Nepal and the Kumaon region of India was responsible for an estimated 486 human fatalities in the early twentieth century (Mills, 2004). Jim Corbett removed this species by shooting it in 1907 (Mills, 2004). Another example is North America in the twentieth century, where wolves and cougars (*Puma concolor*) were nearly eradicated due to a predator control program (Nowak & Watkins, 1971; Riley et al., 2004).

Lethal management is becoming more prevalent to control abundant species like coyotes (*Canis latrans*) or selectively eliminate aggressive individuals that pose a direct threat to human life (Hoare, 2012). Private individuals, informally organised communities, bounty hunters, and local and national governments hunt wildlife deemed to be "problematic animals" both legally and unlawfully (Woodroffe et al., 2005).

Shooting, trapping, and poisoning are the most prevalent means of killing 'problematic animals' in modern countries, but traditional methods are also used occasionally (Woodroffe, 2005). In Africa, spears are used to kill African elephants and chimpanzees (*Pan troglodytes*) (Ghiglieri, 1984; Moss, 2001); however, large carnivores are not hunted with this strategy (Frank et al., 2005). Innovative methods have also been devised for the lethal control of wildlife species. For example, in India, modification of power lines to electrocute crop-raiding Asian elephants or controlling fruit bats, electric fencing of crop fields, and housing boundaries are the methods adopted to prevent conflicts (Menon, 1998).

The deliberate utilization of toxic substances and trapping to intentionally eradicate wildlife exhibits a longstanding global historical precedence. Various categories of agents, comprising both naturally occurring toxins derived from plants and animals, as well as synthetic pesticides, have been employed for the purpose of wildlife extermination. This method is characterized by its quiet, cost-effective, facile, and efficacious nature. Among the diverse classes of pesticides applied in wildlife poisoning, noteworthy examples include organochlorines, organophosphates, carbamates, and pyrethroids (Project Vulture, 2021). Poisoning frequently results in collateral damage by not exclusively impacting the intended target individual or species. Instead, it precipitates the demise of a myriad of unintended species, for example in case of vultures (Project Vulture, 2021). Similar challenges emerge in the context of wildlife species control through trapping, where numerous unintended casualties among wildlife are documented. Any form of trap, whether it is a foothold/leghold, conibear, or snare/cable restraint, has the potential to capture unintended species, including those that are endangered or domestic pets (Born Free USA, 2013).

1.6.1.2 Non-lethal Control

There are various non-lethal methods for reducing conflict, which are frequently preferred for species of conservation concern. These include moving wildlife, separating wild animals from people and livestock, and deterring wildlife with guard animals, mechanical instruments, and pesticides.

Wildlife managers and authorities can relocate animals from areas where conflicts are likely to arise. Despite the poor success rate and high cost of translocations (Loveridge et al., 2010; Fotorbel et al., 2011), a variety of animals, including bears, elephants, wild cats, and wolves, have been translocated to resolve conflicts (Linnel et al., 1997). In a review of translocation events used to control carnivore–human interactions, less than half were effective, with human-caused mortality accounting for 83 per cent of fatalities following translocations (Fotorbel et al., 2011). The challenges linked with translocations include the mortality of target animals, animals returning to their original capture site, or animals continuing aggressive behaviours in new areas (Linnel et al., 1997; Linnet et al., 2012).

Artificial barriers (e.g., fences) and natural barriers (e.g., vegetation) are commonly employed to limit animal damage. Fencing confines wildlife to restricted regions, prevents disease transmission, and protects fragile, valuable, or critically endangered species by limiting the movement of undesired or invasive species (Woodroffe et al., 2014). Barriers can be enormous enough to divide countries (e.g., the dingo fence in Australia; Newsome & Catling, 1987) and protected regions or small enough to protect a single town, farm, house, or even a single person (Reidinger & Miller, 2013).

Habitat manipulation by growing buffer crops to prevent crop-raiding has shown limited success. In small-scale experiments in Asia and Africa, efforts to persuade farmers to increase chilli plantations have had modest success against elephants (Haore, 2012; Hedges & Gunaryadi, 2010).

Large-scale obstacles like fencing, on the other hand, can have significant conservation consequences, such as dividing wildlife populations, altered and restricted gene flow, vegetation modification, lowering carrying capacity, and generating local enmity if conventional human mobility patterns are also impeded (Woodroffe et al., 2014). Elephants, for example, can break fences or move vast distances to avoid them, and fence installation and management can be costly (Hoare, 2012).

People accompanying their livestock or crops is one of the oldest and most effective techniques for minimising conflict. However, the high labour expense and the necessity for continuous attention is the major drawback of this approach (Nyhus, 2016). People may be unable to deter big predators like lions and tigers and megaherbivores like elephants, especially at night (Inskip & Zimmermann, 2009; Linnel et al., 2012). People may restrict livestock from roaming freely and confine them to enclosures at night to reduce the possibility of confrontation with wild predators (Woodroffe et al., 2005; Loveridge et al., 2010).

Guard animals, notably dogs, are trained by farmers in various locations to protect livestock against predator attacks. Dogs have been domesticated for at least 9,000 years and maybe as long as 30,000 (Gompper, 2014)). Prohibiting lethal control methods in Europe and North America has led to a return to the employment of dogs to protect livestock from wolves (Gompper, 2014). In many places, dogs are used to protect livestock: from cheetahs (*Acinonyx jubatus*) in Namibia (Marker et al., 2005); wolves, coyotes, and bears in North America; wolves and bears in Europe (Shivik, 2006); and dingoes (*Canis lupus dingo*) in Australia (Vanak et al., 2014). The method of guarding livestock by dogs is also practised in India, especially in some agro-pastoral communities in the high-altitude region of the Himalayas (Maheshwari, 2010). Some of the challenges associated with this technique include extensive dog training, behavioural problem control, and the avoidance of premature death of the trained dogs (Rust et al., 2013). Farmers may respond with retribution and resentment if wild predators kill a trained dog (Vanak et al., 2014).

Several methods are utilised to catch and trap problematic species. Foothold traps, snares, nets and cages, and other restraining traps allow animals to be captured and released (Conover, 2002; Reidinger & Miller, 2013). Fear-inducing stimuli, chemicals, or gadgets that shock or distract animals can all be used to repel them (Conover, 2002; Reidinger & Miller, 2013). People in Asia, for example, use firecrackers, torches, or bang pots to scare elephants and bears away (Menon, 1998).

1.6.2 Managing conflicts – Humans

Besides managing wildlife or constructing artificial or natural barriers to address the severity of HWCs, there is a great need to consider human behaviour and approaches in managing HWCs. Simply reducing the damage caused by wildlife is not sufficient to address the adverse impact of HWCs on humans as well as wildlife (Decker et al., 2012; Dickman, 2010). Standard practices to study the anthropological aspect of HWCs includes surveys, interviews, field observations, ethnographic studies, Focus Group Discussions (FGDs), and other forms of direct engagement with local communities and other stakeholders of a region (Woodroffe et al., 2005; Redpath et al., 2013; Reidinger & Miller, 2013; Biotani & Powell, 2012; Decker et al., 2012). Some of the approaches that are often regarded as successful strategies to address HWCs are further discussed.

Community awareness

Community awareness raising can occur at several levels, such as in schools or adult education settings, community awareness workshops, and village and other regional programs. Educating youngsters, combined with developing awareness among adults through the traditional authority of local community heads and concerned wildlife protection organisations (governmental and non-governmental), could undoubtedly be a cost-effective method of dispute resolution (Food and Agriculture Organisation of United Nations, 2021).

Governance and Policy

Strong laws and policies, which are enforced, can be vital to preserving wildlife species and their habitat in any region. Illegal wildlife activities and human encroachments in eco-sensitive zones can be regulated and controlled through national, international and regional laws, policies, and frameworks. For some people, nature is uncontrolled and dangerous, while for others, it is exciting and precious (Weston, 1999). Humans see problematic tigers and locusts differently and ignore the less attractive/enigmatic species (Western and Waithaka, 2005). Hence, policies at various regional levels targeting the protection of overall biodiversity are crucial for regional wildlife, especially the eco-sensitive and ecologically important areas.

Economic response

Compensation usually entails reimbursing persons who have suffered wildlife damage to crops or animals and physical harm or danger from wildlife with cash or in-kind payment. These subsidies generally aim to enhance wildlife tolerance (Nyhus et al., 2005) (e.g., wolf-livestock depredation program in the USA (Bangs et al., 2007); Livestock and crop damage compensation in India (Mishra & Fitzherbert, 2004); compensation and insurance scheme for damages by elephants in Sri Lanka (Nyhus et al., 2003).

1.7 Human-wild carnivore conflicts

Conflicts between people and carnivores are the most prevalent harmful HWCs. HWC is one of the primary causes of wild carnivore population decline worldwide (Woodroffe, Thirgood, & Rabinowitz, 2005; Inskip & Zimmermann, 2009). The rapid increase in the human population has led to encroachment into wildlife habitats. The increased competition for food, shelter, and other resources between humans and wild animals has led to negative interactions (e.g. livestock killing, followed by revenge killings of carnivores by humans, Thirgood et al., 2005). The prey species population has reduced significantly due to grazing competition and illegal hunting across their habitats (Woodroffe, Thirgood & Rabinowitz, 2005), forcing wild carnivores to prey on livestock, leading to retaliation killing by the affected farmers. These conflicts put a significant toll on local communities in the form of tangible (e.g. loss of animals) and intangible loss (e.g. negative emotional states due to the threat of carnivores on livestock) (Thirgood, Woodroffe, & Rabinowitz, 2005) while also causing wild carnivore populations to decline at a rapid pace due to habitat loss, habitat degradation, illegal hunting and retaliation killings (Vie et al., 2009).

Livestock depredation by wild carnivores tends to be expected in places where humans have encroached upon a previously protected sanctuary or on the outskirts of wildlife habitats (Mishra, 1997). These human-wildlife conflicts further complicate conservation efforts as local stakeholders may not support them (Bagchi & Mishra, 2006; Conforti & de Azevedo, 2003; Wang & Macdonald, 2006).

1.8 Human-wildlife conflicts in India

With a population density of 464 people per square kilometre (Census of India, 2011) in a country with such a diverse range of ecosystems and biodiversity, it is no surprise that human-wildlife conflicts abound in India. Wild animals are responsible for damage to crops (Asian elephants (*Elephas maximus*) (Sukumar, 1990), Asiatic black bears (*Ursus thibetanus*) (Charoo et al., 2010), and blackbucks (*Antelope cervicapra*) (Jhala, 1997)); livestock predation (Himalayan brown bears (*Ursus arctos isabellinus*) (Sathyakumar, 2003), wolves (*Canis lupus*) (Shahi, 1982; Maheshwari et al., 2010), snow leopards (*Panthera uncia*) (Mishra, 1997; Maheshwari, 2010) and leopards (*Panthera pardus*) (Athreya, 2004)); and consequentially negative impacts on human lives (Asian elephants (Williams et al., 2001), leopards (Athreya, 2004), sloth bears (*Melursus ursinus*) (Rajpurohit, 2000) and wolves (Shahi, 1982)). The situations arising from such conflicts often instil fear and anger amongst human populations living adjacent to wild animal habitats, sometimes resulting in retaliation killing of the problematic species.

1.9 The need to address HWCs outside protected areas

Remarkably, the species that generate the most violent conflict with local people are also the ones most likely to have positive effects on a global scale (Dickman, 2010). Large carnivores often play a role as keystone or flagship species of an ecosystem, maintaining the ecological balance, for example, by regulating prey species numbers and thereby maintaining a healthy ecosystem (Dickman, 2008). Elimination of top predators can result in a significant change in community structure which can adversely impact the ecology of the habitat (Dickman, 2008).

The primary objective of biodiversity conservation is at the centre of the discussion. Many species have ecological importance beyond protected areas' boundaries (Barnes et al., 2019). Despite being significant, these protected areas might not completely cover a species' range or sufficiently to safeguard essential populations. To protect biodiversity in general, dealing with conflicts outside these zones becomes essential (Dickman et al., 2019). Because of habitat fragmentation brought on by human intrusion into natural ecosystems, wildlife is now compelled to travel outside protected areas in search of resources (Woodroffe et al., 2005). The necessity for conflict resolution to lessen the adverse effects of habitat fragmentation is accentuated by the increased interaction between humans and wildlife (Inskip & Zimmermann, 2009). Conflicts between people and nature can have significant socio-economic repercussions (Inskip & Zimmermann, 2009). Effective conflict management is crucial in areas where agriculture and livestock raising are the main economic activities to safeguard valuable assets and guarantee the financial stability of impacted people.

The need to address human-wild carnivore conflicts and to conserve large carnivores beyond protected areas stems from a complex interplay of ecological, socio-economic, and ethical considerations. Large carnivores, such as apex predators, hold pivotal roles in ecosystems by regulating prey populations, influencing trophic cascades, and enhancing overall biodiversity (Estes et al., 2011); their presence fosters ecosystem resilience and stability. Furthermore, large carnivores often serve as flagship species, drawing attention to broader conservation issues (e.g., tigers) and generating ecotourism revenue, which can contribute to local economies (Lindsey et al., 2012). The conservation of large carnivores in shared landscapes can thus bolster not only ecological integrity but also socio-economic well-being (Estes et al., 2011).

Burgeoning human populations and habitat fragmentation increase human-carnivore conflicts, including livestock depredation and threats to human safety (Dickman, 2010). These conflicts, if left unaddressed, can result in negative attitudes toward carnivores, retaliatory killings, and population declines (Dickman, 2010).

Beyond the confines of protected areas, strategies and research are required to address the HWCs' concerns mentioned above. Community-based conservation initiatives, which incorporate local knowledge and engage community conservation (e.g., the ‘Living with Lion’ program in Kenya (Hazza et al., 2017), Carnivore friendly grazing in Europe (Hull et al., 2017); Project Snow Leopard in India (MoEFCC, 2020)) effectively foster coexistence (Woodroffe et al., 2005). Innovative conflict mitigation methods and public awareness campaigns are essential to successful conservation efforts (Treves & Karanth, 2003).

Even though 15.73 % of the total terrestrial land is protected (World database on Protected Areas, n.d.), it is unclear that this will be enough to ensure the long-term conservation of many vulnerable species. Large species, especially carnivores, have massive home ranges, and many protected areas/reserves are too small to ensure long-term conservation (Brashares et al., 2001; Woodroffe & Ginsberg, 1998).

1.10 Bibliographic trend

The exploration of human-wildlife interactions is a fundamental endeavour in the realm of conservation biology and ecology. These interactions occur ubiquitously across diverse ecosystems worldwide and are paramount in understanding the intricate relationships between humans and the wildlife with which they share their environments. The extensive research on this subject underscores its pivotal role in contemporary ecological discourse (Figure 2). Indeed, comprehending the dynamics of these interactions is essential not only for elucidating the environmental intricacies of coexistence but also for devising effective strategies for conflict mitigation and conservation management.

A foundational step in this endeavour is the examination of the potential factors that underlie these encounters. Chandola (2012) noted that it is imperative to delve into these factors as a precursor to fully grasping the multifaceted concept of human-wildlife interactions and the associated interfaces and conflicts. This exploration is intellectually stimulating and instrumental in informing evidence-based conservation strategies.

The factors contributing to human-wildlife interactions span a spectrum of ecological, anthropogenic, and behavioural dimensions. In environmental terms, the availability and distribution of resources play a pivotal role. As humans encroach upon natural habitats or alter landscapes for agriculture and urbanisation, they inevitably intersect with wildlife populations. Consequently, habitat fragmentation and resource availability significantly influence the frequency and nature of these interactions (Dorning et al., 2019).

Anthropogenic factors are equally influential. The expansion of human settlements, land use change, and the proliferation of infrastructure intersect with wildlife habitats, leading to increased opportunities for encounters. The degree of urbanisation, in particular, has been linked to escalated human-wildlife interactions, as urban areas may provide novel attractions for wildlife, including food resources and shelter (Bateman & Fleming, 2012).

Behavioural aspects also come into play, both for humans and wildlife. Understanding the behavioural responses of wildlife to human presence and activities, as well as human behaviours that may inadvertently attract or provoke wildlife, is integral to deciphering the dynamics of these interactions (Knight & Cole, 1995). Behavioural studies show how animals adapt to anthropogenic landscapes, potentially altering their movement patterns and resource utilisation strategies to coexist with human neighbours.

In recent years, a substantial number of studies (Bawa et al., 2004; Bremner et al., 2010; Cardilo et al., 2006; Gadgil, 1990; Hannah et al., 1994; Imhoff et al., 2004; Mittermeier et al., 2003) have demonstrated the reality that almost all of the natural habitats around the globe are under threat because of extensive use by humans. People living in and around a forested region extensively use the resources for their everyday livelihood. Many researchers have focussed on the direct use of natural resources acquired from the local population living in and around the fringes of PAs, where communities depend on the resources for food, shelter, firewood, timber, Non-wood Forest Products (NWFPs), land livestock grazing (Awasthi et al., 2003; Badola, 1999; Baral & Heinen, 2007, Bhatnagar et al., 1999; Bhatnagar et al., 2006; Bhattacharya & Sathyakumar, 2011; Chandola et al., 2007; Dixon & Sherman, 1991; Fiallo & Jacobson,1995; Karanthet al., 2012; Ogra & Badola, 2008; Ogra, 2008; Soliku & Schraml, 2018; Vijayan and Pati, 2002). However, there is little literature available on such interactions outside PAs.

HWCs are not of recent origin, but data indicates that aggressive interactions have increased in recent years (Conover, 2002; Sawarkar, 1986) because of the increased human population, loss of natural habitat, and animal population growth in some regions as a result of successful conservation programs (Rodgers, 1989; Saberwal et al., 1994). In today's era, human-wildlife disputes are emerging in regions where resource depletion, socio-economic imbalance, and human population expansion threaten environmental priorities, and habitat preservation is high (Limenh, 2007). The magnitude and intensity of these impacts are expected to increase with time if proper mitigation and conservation plans are not implemented (Madden, 2004).

Over the past two decades, the interest in studying human-wildlife conflicts has increased, with more conservation researchers pursuing the subject. This is evident through the correlation test performed between the year and the number of publications, which shows a significant rise ($r = 0.989$, $n = 20$, $p < 0.001$) in the number of published scientific articles on the subject between the years 2000 and 2019, as retrieved from the Web of Science database (Figure 2) using the keyword: ‘human-wildlife conflicts’.

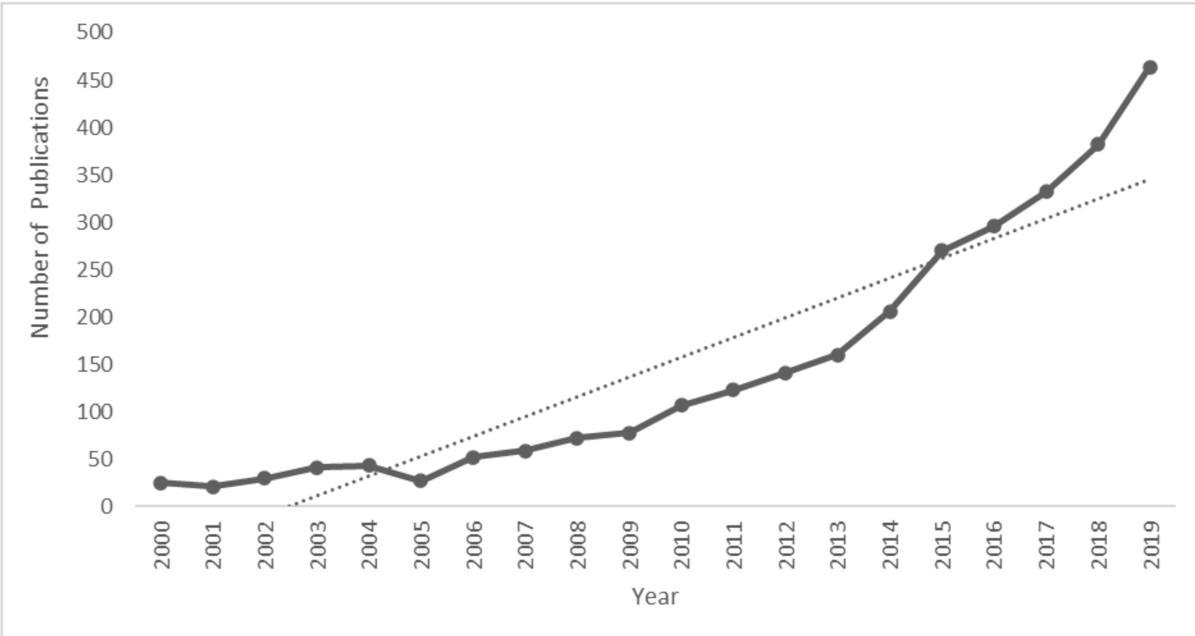

Figure 2 Figure 2 Total number of published articles returned through a search using the keyword 'human-wildlife conflict' from 2000-2019. Source: ISI Web of Science Database. Retrieved on 11-12-2019.

Different factors have been related to reliance on natural resources, ranging from unrestricted access to resources, conventional utilisation, and the absence of alternative resources. Increased human population has also destroyed wild habitat, leading to a network of overlaps between natural and human environments. The continuous and unplanned use of resources has contributed to reforms in land-use patterns, evidenced in the depletion of habitat and biodiversity-rich areas. Another conventional human use of the surrounding ecosystem or landscapes is livestock grazing, which has repercussions for grazing wild ungulates in the same landscape (i.e., the prey species of carnivores).

Wild ungulates play a vital role in habitat sustainability by impacting soil arrangement, the composition of plant organisms, and biogeochemical cycles (Bagchi & Ritchie, 2010). The abundance in the wild ungulate population is one of the most significant determinants of large wild carnivore density (Karath et al., 2004). The population of the vulnerable snow leopard (*Panthera uncia*) are affected explicitly by the numbers of their mountain ungulate prey, especially in a livestock-dominated ecosystem (Johansson et al., 2015; Suryawanshi et al., 2017).

Continuous observation of a species helps determine its population status, guide conservation efforts, and assess the influence of management actions. Data obtained from such tracking activities helps to create sometimes missed baseline information. It also helps to measure population trends over time, frame conservation targets, determine their viability, guide actions, and establish a period during which success can be measured (Bull et al., 2014).

In Ladakh (India), particularly in Kargil, there is a gap in scientific studies on human-carnivore conflicts despite the region being rich in wild carnivores (Pfister, 2004). Therefore, the motivation behind undertaking this study is to offer baseline information on the level and pattern of human-wild carnivore conflicts, along with identifying the factors influencing such conflicts. Additionally, the objective was to comprehend people's perceptions and attitudes towards wildlife in Kargil trans-Himalayas, India, through this study. Although not adequately documented scientifically, reports of livestock depredation by wild carnivores followed by retribution and pre-emptive killings of predators by local farmers are recorded in Kargil frequently (Figures 3 and 4).

Figure 4 A Himalayan brown bear being attacked pre-emptively by local villagers in TSG block, Kargil (an administrative block in the study area) out of fear.

Figure 3 A Snow leopard is pictured in a sheep shed just after it attacked and killed seven livestock, including 6 sheep and a goat. Source: Tsewang (2015).

1.11 Aims and objectives of the study

1.11.1 Primary Aim

The study aimed to establish the first comprehensive baseline information on human-wildlife conflicts in Kargil and formulate a conservation action plan for the region. This study will be a first in its conservation approach towards endangered wild carnivore species of Kargil.

1.11.2 Key research questions

- What is the extent and prevalence of livestock predation by large carnivores in the Kargil region?
- Which specific wild carnivore species are identified as the most problematic regarding livestock predation in Kargil, and can they be ranked in order of significance?
- Which parts, regions, or Community Development (CD) blocks are more susceptible to human-carnivore conflicts within the Kargil region?
- How do the local human populations in Kargil perceive and interact with the wild carnivore species inhabiting the region?
- Is there a discernible correlation between the gender of individuals and their perceptions and attitudes towards wild carnivores within the local population?
- Does the level of education influence the framing of awareness and attitude towards wild carnivores among students in the Kargil region?

1.11.3 Specific objectives

- To systematically investigate the contributing factors, including seasonal variations and specific geographical incidences leading to instances of human-carnivore conflicts.

- To examine the local population's prevailing attitudes and perceptions towards the indigenous wild carnivore species within the region.
- To empirically assess the role and influence of education and awareness initiatives on shaping the attitudes and perceptions of individuals towards wildlife, particularly wild carnivores.
- To formulate a comprehensive and evidence-based conservation action plan designed to safeguard the populations of wild carnivores and associated species within the study region.

1.12 Significance of the Research

This study will be novel in generating baseline information on the human-wildlife interaction from Kargil trans-Himalaya. It will provide crucial information to assist future conservation practices across the Himalayan ecosystem.

The study will further contribute to the existing database of human-wild carnivore conflicts and people's perceptions of wild carnivores. Local communities sharing habitat and resources with wildlife are amongst the main stakeholders in any conservation effort. The outcomes from this study will help conservationists, environmentalists, and other government and non-government agencies working towards protecting and conserving wildlife species and their ecosystem in the Himalayan landscape in general and Ladakh specifically.

Conservation Implications: This research holds significance for conserving large carnivores by offering insights into the dynamics of conflicts they face outside protected areas. The findings will guide conservation strategies to protect these apex predators and maintain ecosystem balance.

Ecosystem Health: Understanding the ecological importance of large carnivores is essential. This research will highlight their roles in regulating prey populations and influencing trophic cascades, which is crucial for biodiversity conservation.

Community-Based Conservation: By engaging with local communities, this study will inform the development of community-based conservation initiatives. These strategies foster coexistence, reduce conflicts, and generate local support for carnivore conservation.

Socio-economic Impact: Livestock depredation by carnivores often leads to economic losses. This research will identify ways to mitigate these losses, potentially improving the financial well-being of residents.

Cultural Values: Large carnivores hold cultural significance in many regions. This study will help preserve cultural values and traditional practices related to wildlife, fostering a sense of pride and heritage among the local human populations of Kargil.

Global Conservation Relevance: The insights from this study extend beyond Kargil and contribute to the broader global discourse on wildlife conservation and human-wildlife coexistence. The results of this project and lessons learned here can be applied to similar conflict scenarios worldwide, especially in similar ecosystems and socio-economic setups, enhancing the global relevance of this research.

1.13 Organisation of the Thesis

The organisation of this thesis follows a structured and comprehensive approach to delve into the intricate aspects of human-wildlife interactions and conflicts, with a specific focus on the Kargil trans-Himalayas region. In Chapter 1 - Introduction, the foundational concepts are laid out, beginning with exploring human-wildlife interactions. This chapter then offers a general overview of conflicts between humans and wildlife, followed by a precise definition of human-wildlife conflicts. It categorises these conflicts into various types, including livestock predation, attacks on humans, crop raids and destruction, and disease transmission. Furthermore, the chapter elaborates on the multifaceted impacts of these conflicts on humans and wildlife.

Chapter 1 continues by delving into the strategies and methods employed to manage these conflicts, distinguishing between approaches aimed at wildlife and those directed at humans. It mainly explores the complex realm of human-wild carnivore conflicts and their relevance within the Indian context. The chapter culminates by emphasising the pressing need to address these conflicts and conserve large carnivores outside protected areas. Moreover, it highlights the existing bibliographic trends in this field, setting the stage for the study's objectives, their significance, and the overall structure of the thesis.

Transitioning to Chapter 2 - Study Area, the geographical and sociocultural landscape of the Kargil region takes center stage. This chapter provides a comprehensive understanding of the study area, commencing with an overview of the Trans-Himalayan region and Ladakh. It then zeroes in on Kargil, the intensive study area, offering insights into its historical, administrative, sociocultural, geographical, and economic dimensions.

Additionally, this chapter provides a detailed account of the region's river valleys, human demographics, and livestock-rearing practices, creating a holistic backdrop for the subsequent research.

The thesis then advances to Chapter 3 - General Methodology, which forms the methodological foundation of the research. This chapter summarises the tools and techniques employed in data collection and analysis, ensuring transparency and rigour in the research process. It outlines the ethical considerations and presents the software utilised for data analysis.

Chapter 4 - Reported Level and Pattern of Livestock Depredation by Various Predators Across Kargil Trans-Himalayas, India, takes the thesis further into the empirical realm. It introduces the research objectives and methodology for assessing livestock depredation by various predators in the Kargil region. The chapter comprehensively presents the results, including demographic information of respondents, livestock holding data, and the reported patterns of livestock depredation by different carnivores. It offers a robust discussion and concludes by drawing valuable insights from the data.

Chapter 5 - aims to understand local communities' perception of wild carnivores in the region and explore any association between respondents' characteristics and perception towards wildlife.

Chapter 6 - Knowledge and Attitude Towards Wild Carnivores Among University Students from Kargil continues the empirical exploration, shifting focus to the knowledge and attitudes of university students regarding wildlife. The chapter outlines the study area, methodology, results, and discussions, shedding light on the perspectives of the younger generation towards wildlife conservation.

In Chapter 7, the thesis takes a visionary turn by proposing a 20-year Conservation Action Plan for the Wild Carnivore Population of Kargil Trans-Himalayas, India, from 2025 to 2045. This chapter elaborates on the conceptualisation and development of the plan, offering strategies, result chains, and objectives aimed at preserving the region's carnivore population. It underscores the adaptive management approach and open standards for effective conservation, providing a forward-looking perspective.

Each chapter and subsection in this thesis serves as a building block, contributing to a comprehensive exploration of human-wildlife conflicts and conservation strategies in the Kargil trans-Himalayas region.

The thesis adheres to the APA7 format for all its references, ensuring a standardised and organised presentation of cited sources. The references cited in this study are listed in the Reference section. All the essential files are incorporated in the dedicated Appendix section of the thesis.

Chapter 2 – STUDY AREA

2.1 Introduction

Swedish geographer Sven Hedin introduced the term "Trans-Himalaya" in the early 19th century for the greater Himalayan region, characterised by less precipitation rate, vegetation, and unique geographical features. The Trans Himalaya is a cold desert region, with altitudes ranging from 2,000m to over 7,000m above mean sea level (msl), with dry, hot days and freezing nights. During the winters, the temperature in some parts of this region may drop below minus 40° Celsius (C). An annual precipitation rate of 100-1,000 mm is received in this region, which gradually decreases from north to east (Fox et al., 1994).

According to the Wildlife Institute of India (WII) report of 2009, the trans-Himalayan region, classified by Rodgers and Panwar (1988) and later amended by Rodgers et al. (2000), divides the Himalayas into two biogeographical zones: the Trans-Himalaya (Zone 1) and the Himalaya (Zone 2). It is expanded over the northernmost part of India from

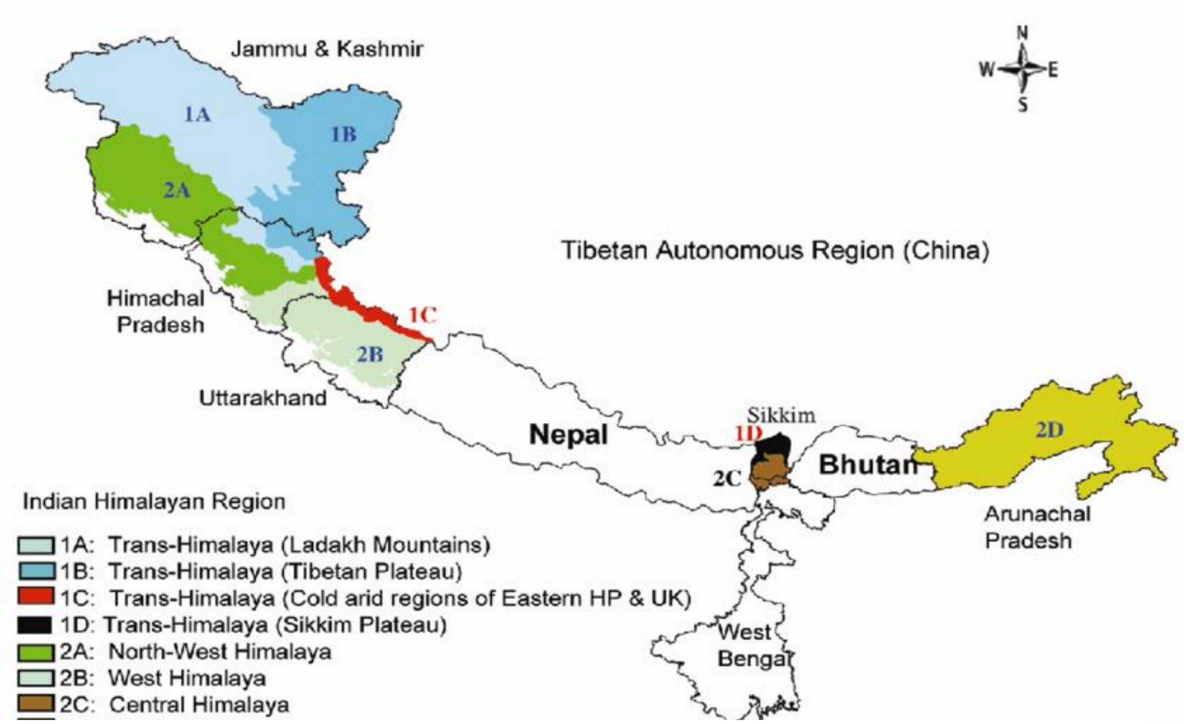

Figure 5 The Trans-Himalaya and greater Himalaya of North India (Source- Kumar et al., 2022).

Kashmir in the Northwest to the North-Eastern states, viz., the "Ladakh mountains", or zone 1A; the "Tibetan Plateau", or Zone 1B; and the "Himalaya Sikkim", or zone 1C (Figure 5). The union territory of Ladakh comprises the largest of the total area of the Trans-Himalayan zone of India. Indus river and its main tributaries of Zanskar, Suru, and the Shyok river form the main drainage of the region (Negi, 1991).

The Trans-Himalayan zone in Ladakh stretches from the Zanskar range in the south and east and the Ladakh range in the west, lying between 32°27' to 36° N and 76°15' to 80°15' E. Western Ladakh is the confluence point of the Zanskar range and the Pir Panjal range of Kashmir. Vegetation is scarce due to the soil's high aridity and typical high-altitude cold desert characteristics, making the vegetation diversity unique and endemic. There are few green fields and shrubs for grazing animals (Chandola, 2012). In the valleys, willow and poplar groves occur.

2.2 Ladakh – An overview

As a union territory, Ladakh is administered by India and formerly formed a part of the broader Kashmir zone, which has been the subject of conflict between India, Pakistan, and China since 1947 (Akhtar & Kirk, 2020; Jan et al., 2003). It is bordered to the east by the Tibet Autonomous Region, to the south by the Indian State of Himachal Pradesh, to the west by both the union territory of Jammu and Kashmir (India) and the Pakistan-administered Gilgit-Baltistan, and to the far north by the southwest corner of Xinjiang (China) across the Karakoram Pass. It stretches northward from the Siachen Glacier in the Karakoram range southward to the Greater Himalayas (Jina, 1996).

Ladakh was an administrative division of the Indian-administered state of Jammu and Kashmir until October 2019. An Act that led to the state's bifurcation into two union territories (the Union territory of Ladakh and the Union territory of Jammu and Kashmir) was published, passed, and signed in August 2019 by the parliament of India and adopted on 31st October 2019.

In Ladakh, the largest town is Leh, followed by Kargil, each with a district headquarters. Leh district comprises the valleys of the Indus, Shyok, and Nubra rivers. The Kargil district comprises the valleys of the Suru, Dras, and Zanskar rivers. There are several brackish and freshwater lakes, both small and vast. The river valleys are the major inhabited areas, but the mountain slopes sustain the pastoral communities, such as *Changspa* nomads. The region's major religious communities are Islam (mainly Shia school of thought) (46%), Tibetan Buddhism (40%), Hinduism (12%), and others (2%) (Kaur, 2019).

With a population density of 6.5 persons per square kilometre (Census of India, 2011), Ladakh is one of India's most sparsely inhabited regions of India. It is also known as the "Little Tibet" because its culture and history are closely connected to that of Tibet (Pile, 2019). In ancient times, the region was also termed 'Maryul' (Francke, 1907) (Figure 6).

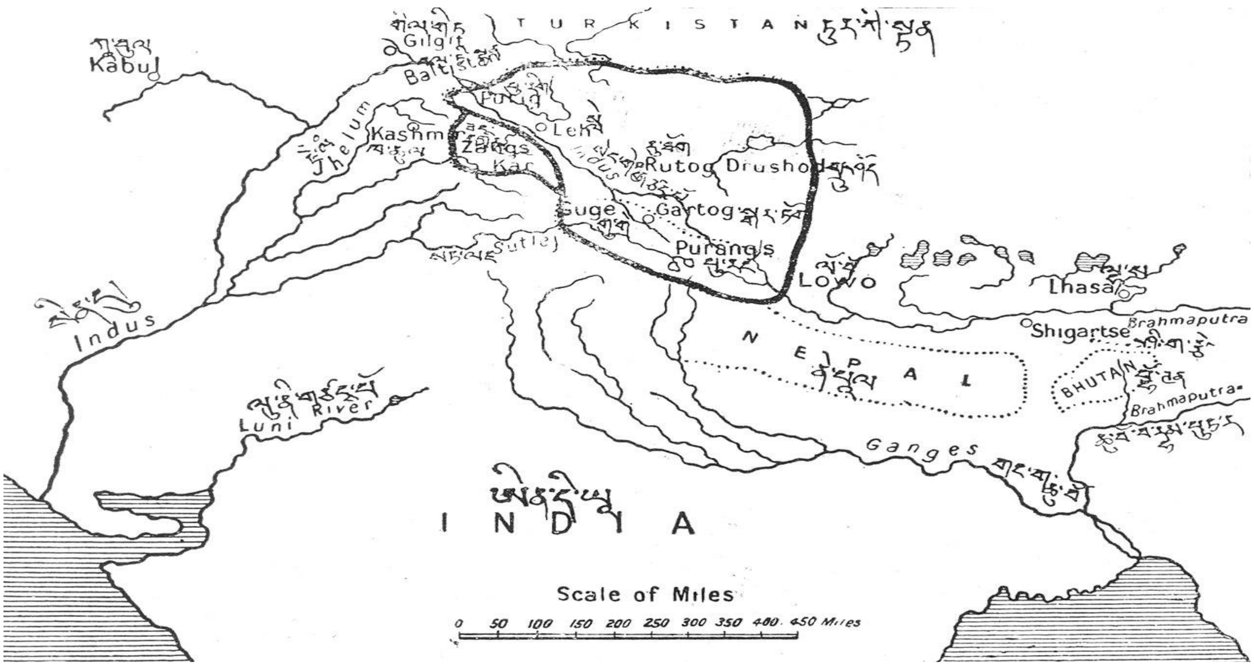

Figure 6 Maryul (then Ladakh), shown in fainted dotted line (975 AD - 1000 AD). (Source: Francke, 1907).

Historically, the area included the valleys of Baltistan (Baltiyul) (now mostly part of Pakistan-administered Kashmir), the entire upper Indus Valley, Zanskar, Lahaul, and Spiti to the south, most of Ngari including the Rudok and Guge region in the east, Aksai Chin in the northeast, and the Nubra Valley in the Ladakh Range to the north over Khardong La. Contemporary Ladakh borders Tibet to the east, the northern regions of Lahaul and Spiti, the eastern areas of Kashmir, Jammu and Baltiyul, and the southwestern corner of Xinjiang across the Karakoram Pass. Baltistan, now under Pakistani jurisdiction, was a district in Ladakh before the partition of India and Pakistan. The winter capital of Ladakh was Skardu, while the summer capital was Leh before the partition of India and Pakistan in 1947. Before Ladakh was opened for tourism in 1974, the region had little contact from outside the country. Since then, Ladakh has seen economic development from building bridges, sanctioning new airports, and a substantial influx of tourists and traders (Fox et al., 1994). Tourism has become one of Ladakh's leading and robust income-generating industries, especially after the limelight of the region in recent Bollywood movies (Sruthijith, 2013). This has resulted in an influx of uncontrolled and unplanned domestic tourists, which may alter the area's fragile ecosystem (Sruthijith, 2013).

Mountain agriculture provides people with the resources to preserve the capacity for minimal agriculture in harsh climatic conditions (Ehlers & Kreutzmann, 2000). Agriculture and livestock rearing are the two significant livelihood components for the people of Ladakh. Agriculture season is minimal, from May to late August, allowing the locals to opt for a single cropping pattern above 3,000m. Traditional greenhouses and small kitchen gardens are sources of carrots, cabbage, potatoes, and other green vegetables. In Ladakh, land resources are vast, but dry conditions limit arable land (Ehlers & Kreutzmann, 2000).

Table 1 Livestock of Ladakh. (Source: Compiled and modified from Koshal (2001).

Local Name	Common Name	Sex	Cross-breed		Occurrence
			Male	Female	
Lubaq	Sheep	Male/Female	-	-	Common
Rabaq	Goat	Male/Female	-	-	Common
Balang	Cow	Female	-	-	Common
Langto	Bull	Male	-	-	Common
Hrta	Horse	Male/Female	Horse	Horse	Common

Bongboo	Donkey	Male/Female	Donkey	Donkey	Common
Ti-u/Khachhar	Mule	Male	Horse	Donkey	Common
Dzo	-	Male	Bull	Yak	Common
Do-mo	-	Female	Bull	Yak	Common
Stol	-	Male	Bull	*Dzo-mo*	Rare
Stol-mo	-	Female	Bull	*Dzo-mo*	Rare
Gar	-	Male	Yak	*Dzo-mo*	Rare
Gar-mo	-	Female	Yak	*Dzo-mo*	Rare
Zgyir	-	Male	*Gar*	*Garmo*	Rare
Zgyir-mo	-	Female	*Gar*	*Garmo*	Rare
Loq	-	Male	*Zgyir*	*Zgyir-mo*	Rare
Loq-mo	-	Female	*Zgyir*	*Zgyir-mo*	Rare
Serlingzgyir	-	Male	*Loq*	*Loq-mo*	Rare
Serlingzgyirmo	-	Female	*Loq*	*Loq-mo*	Rare
Biamo/biapho	Hen/Cock	Male/Female	-	-	Common
Batiaq	Duck	Male/Female	Duck	Duck	Common

With the short agricultural period and limited crop type, the Ladakhi people depend on livestock products for sustenance. Sheep, goat, cattle (yak, cow, and cross-breeds of yak and cow), and equid (horses, donkeys, and mules) are reared for the supply of dung (used as fuel and manure), source of protein (as meat), transportation, labour, wool, milk, and other dairy goods (Table 1).

In 1820, William Moorcroft was the first European to research this area's wildlife, accompanied by Ferdinand Stoliczka, an Austrian-Czech palaeontologist, who carried out a major expedition in the 1870s.

In Ladakh, vegetation is exceptionally scarce except along stream banks, wetlands, high hills, and irrigated areas. Approximately 1250 plant species have been reported from Ladakh, including crops (Dvorsky, 2018). Native vegetation exists mainly around watercourses and in high-altitude regions with more snow and colder summer temperatures. The season for growth begins with summer, which is short (Anon, 2001).

Although not present in some areas of the Zanskar and Sham regions, Bharal or blue sheep (*Pseudois nayaur*) is the most abundant ungulate in Ladakh (Namgail et al., 2004). Asiatic ibex, a mountain goat, is found in the western part of Ladakh. With a population of ~6000, it is the second most abundant mountain ungulate in the area (Namgail, 2006). It is suited to harsh regions and steep terrains and can climb cliffs effortlessly when confronted (Namgail, 2006). Another unique mountain sheep, endemic to Ladakh that inhabits the high mountains is the Ladakh urial (*Ovis vegnei*). Their population is decreasing, and they are reportedly persecuted by local communities for crop raiding (Namgail, 2006b). Ladakh is also home to the largest wild sheep species in the world, the Tibetan argali (*Ovis ammon*) or Nayan. This sheep species is distributed around 2.5 million km^2 along the Tibetan plateau and western trans-Himalayan region. Unlike goats, they prefer open terrains. Their population is estimated to be about 400 in Ladakh (Namgail, 2009). Tibetan antelope (*Pantholops hodgsonii*), or Chiru, an endangered species, is also found in Ladakh. They have been traditionally hunted for '*shahtoosh*' wool, infamous for its finest quality and a signature of pride to own one (i.e., status symbol; Namgail et al., 2008). Ladakh is also in the home range of the Tibetan gazelle (*Procapra picticaudata*), distributed across the eastern border of Ladakh.

Feral dogs pose a significant threat to wildlife in various regions, including Ladakh. Research has shown that feral dogs can have destructive effects on wildlife through direct predation, competition with other species, transmission of diseases, fear-mediated behavioral changes, and hybridization (Khattak et al., 2023). They can be successful competitors with wildlife in reserve boundaries due to their high densities, physical dominance, and greater tolerance to human disturbance (Lacerda et al., 2009). Feral dogs have been identified as one of the invasive species with the most pervasive effects on global biodiversity, along with cats, rodents, and pigs (Doherty et al., 2016). They not only impact wildlife through predation but also cause behavioral changes in both wildlife and livestock and play a role in disease transmission (Lepe et al., 2017). The detrimental impacts of feral and free-roaming dogs on wildlife include rabies outbreaks and the costs associated with proactive measures to reduce their effects on wildlife (Young et al., 2011). In areas where threatened wildlife already face immense anthropogenic pressures, the presence of canine distemper virus in domestic and feral dogs further threatens their existence (Adhikari et al., 2020). Feral dogs are efficient hunters of wild ungulates in many parts of the world (Duarte et al., 2016). Their predation on native species, transmission of diseases, and competition with other predators can destabilize ecosystems (Rochefort & Root-Bernstein, 2021). Effective livestock husbandry practices, such as closely herding livestock during the day and keeping them in bomas with watch dogs and high levels of human activity at night, can help limit depredation by wild predators (Ogada et al., 2003). In some cases, lions, hyenas, and leopards have been observed preying on domestic dogs, highlighting the vulnerability of dogs to retaliatory killing by these predators (Kissui, 2008).

2.3 Intensive Study Area – Kargil

2.3.1 Location and brief History

The Kargil district, known as '*Purig*' in ancient times, is located in the union territory of Ladakh, India. It was part of the *Ladakh Wazarat* (province) before the partition of India

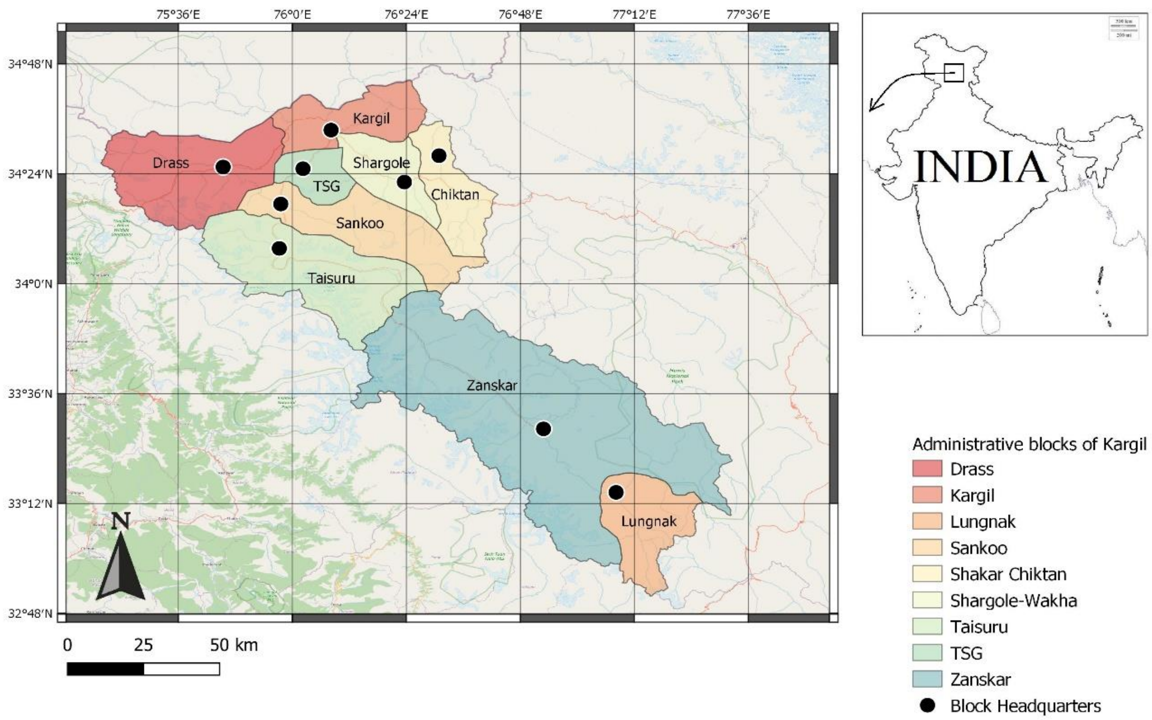

Figure 7 Map of Study area, Kargil, with Community Development block headquarters.

in 1947. Leh and Kargil were bifurcated from the district of Ladakh in 1979 and granted individual district status. Kargil district stretches over an area of 14086 km^2 (5439 sq. miles) and is located between the geographical coordinates of 32° 82ˈ N to 34° 46ˈ N and 75° 34ˈ E to 77° 15ˈ E. With a population density of ~10 people per km^2 (District Census Handbook, 2011), human settlement is strictly confined to adjoining major water bodies (glacial streams, rivers, and river tributaries). Administratively, Kargil is divided into nine

Community Development (CD) blocks viz., Kargil, Dras, Sankoo, Shargole, Taisuru, Trespone-Saliskote-Gundmangalpore (TSG), Lungnak, Zanskar, and Shakar-Chiktan (Figure 7 and 8).

The Parliament of India passed an Act in August 2019 consisting of provisions to make Kargil a district of Ladakh's newly formed union territory, which was established on 31 October 2019. Along with Leh, Kargil town is designated as the joint capital of the union territory of Ladakh. An independent body, the Ladakh Autonomous Hill Development Council – Kargil (LAHDC-K), administers the Kargil District. LAHDC-K was set up in 2003.

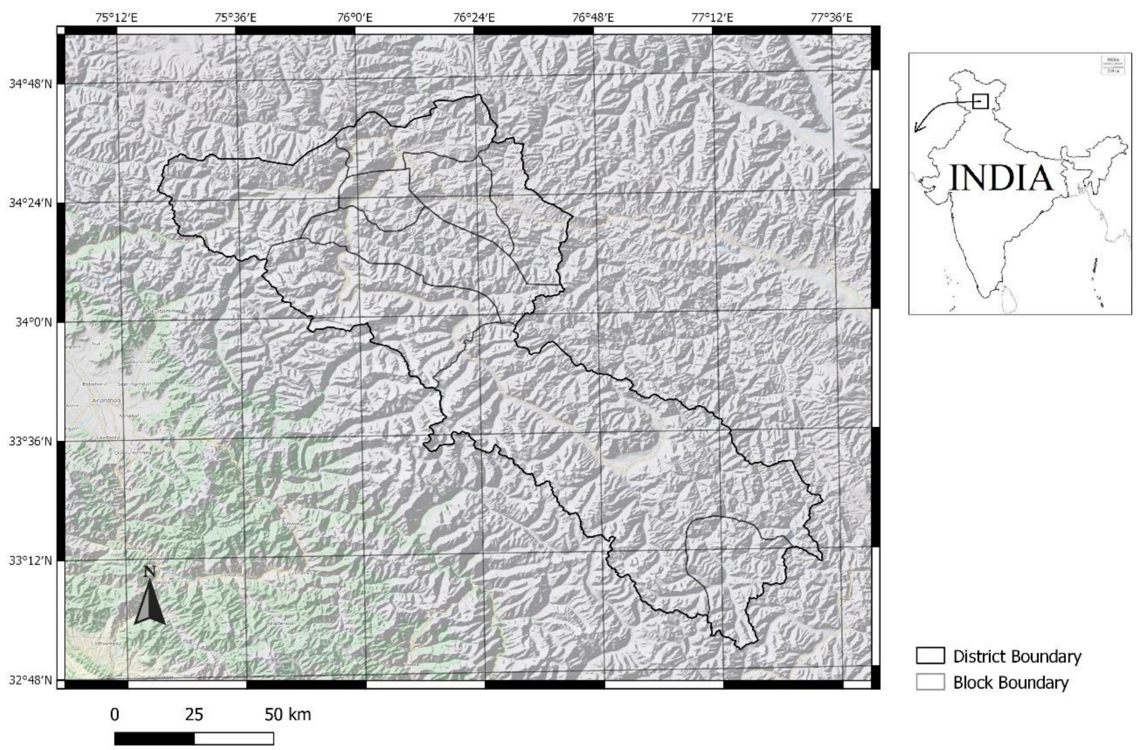

Figure 8 Elevation map of the Kargil study area with CD block Boundaries.

Kargil district is bordered in the North by Gilgit Baltistan (PoK (Pakistan occupied Kashmir) and to the east by the Leh district of Ladakh. In the west and the southwest, the district shares its boundary with the Kashmir division of the union territory of Jammu and Kashmir that borders it. In the south, it is contiguous with the state of Himachal Pradesh (India).

Unfortunately, the region is infamous worldwide for the India-Pakistan military conflict in 1999. The Kargil War resulted in casualties on both sides, with soldiers and civilians losing their lives (Bharati, 2022; Bhat et al., 2023). The conflict's legacy continues to influence the India-Pakistan relationship and their respective approaches to the Kashmir conflict and border security (Bhat et al., 2023). Although not documented, the war also had environmental and ecological consequences in the conflict-affected region, including habitat disruption, deforestation, soil erosion, and pollution. The impact of the military conflict on the natural environment and wildlife can be an essential topic to be studied and explored in the future as many studies have indicated the negative impact of such conflicts on wildlife by habitat destruction (Dando, 2014), pollution (Loucks et al., 2007), disruption of wildlife movements (Davenport & Davenport, 2006), direct harm to wildlife (National research council, 1999), and poaching and illegal wildlife trade (Dudley et al., 2002).

The district headquarters of Kargil, Kargil town (Figure 9), is situated at a distance of 204 km from Srinagar (Kashmir), 59 km from Dras, 235 Kms from Leh, and 240 km from Padum to the southeast.

Human settlements are generally confined to the areas in and around the Dras, Suru, Kartse, Wakha, and Zanskar rivers.

The abrupt disconnection from the outside world during this period due to the closure of the main highways linking the region to neighbouring areas accentuates the significance of local resources. The Zojila pass, a lifeline for resource transportation from the Kashmir region, becomes impassable due to heavy snowfall, rendering road transportation infeasible for three to four months in the winter. Similarly, road connectivity remains blocked from the Himachal Pradesh side for four to five months. Consequently, local communities become increasingly reliant on their immediate environment, with livestock emerging as a lifeline, particularly when agricultural practices become untenable amidst the harsh winter conditions (Kargil Gazetteer, 2014; Kumar et al., 2019).

Figure 9 Bird's-eye view of Kargil town in the autumn, with the Suru River in the background.

2.3.2 Administrative setup

Kargil district has a population of 140,802 according to the District Census Handbook, 2011 and is ranked 603rd out of India's 640 districts in terms of the total population. The population density of the district is among the lowest in India. Its population growth rate was 20.18 per cent over the 2001-2011 decade. Kargil has a sex ratio of 810 females for every 1000 males and a 71.34 per cent literacy rate (District Census Handbook, 2011). Around 87% of Kargil's population is classified as a Scheduled Tribe by the Indian government (District Statistics & Evaluation Officer Kargil, 2020).

Table 2 Demographic profile of Kargil. Source: Compiled and modified from District Census Handbook of Kargil, 2011.

CD Block	Total number of villages	Households	Population	Male population	Female population
Kargil	22	3293 (plus2191 MC)	25174	12723	12451
Dras	18	2149	21988	14731	7257
TSG	5	1482	12754	7113	5641
Shargole	15	1625	11728	6024	5704
Sankoo	14	2340	17735	9063	8672
Taisuru	17	1322	10059	5170	4889
Zanskar	19	1991	11653	5858	5796
Lungnak	6	336	2140	1150	990
Shakar-Chiktan	11	1609	11233	5871	5362
Total	**127**	**18338**	**140802**	**77785**	**63017**

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Administratively, Kargil is divided into three *tehsils*, Kargil, Sankoo, and Zanskar, and a solitary urban unit of Kargil Municipal Committee. Kargil has 9 CD (Community Development) blocks (Table 2). There are 127 villages in the district, of which 125 are inhabited, and two villages have no human settlements (District Statistics & Evaluation Officer Kargil, 2020).

2.3.3 Socio-religious and cultural setup

Of the total human population, 73% are Muslims, of which 63% follow the Shia school of thought of Islam. Most of the district's Muslim population lives in Kargil town, Dras, and the north's lower Suru valley (Census of India, 2011). Of the remaining, Tibetan Buddhism and Bön are practised by 17% of the total population, mainly located in Zanskar with minor communities in the upper Suru valley (Rangdum) and around the Shergol-Mulbekh area. Hinduism and Sikhism are also practised by 8% of the native population (Census of India, 2011).

While earlier Tibetan connections had profoundly impacted the people of Kargil and Leh, the people of Kargil were strongly influenced by Persian culture after Shia Islam's rise around the late 16th century (Gellnar, 2013). This is noticeable in the rigorous use of prevalent Persian words and phrases in religious texts, such as *marsias* and *qasidas*. Until recently, some of the Kargilis, especially those of the Agha family descendants of Syed preachers, who had descended directly from the last Islamic prophet, were sent to Iraq or Iran for education (Rizvi, 1996). Native Kargilis attend seminaries in Najaf, Iraq, and Qom, Iran, for higher Islamic studies. These non-Agha scholars are commonly referred to as "Sheikh".

Many practices and traditions are standard for Muslims and Buddhists in social ceremonies like weddings, community feasts, and seasonal festivals. Kargil has a more diverse ethnic population between the two districts of Ladakh, and hence, compared to Leh, there are more rural dialects spoken in Kargil. Local folk songs, such as *rgya-glu* and *balti ghazals,* are still prevalent and are performed vigorously at various social events.

2.3.4 Geographical and geological Characteristics

Kargil lies on the Himalayas rain shadow side, where the dry monsoon winds reach after depositing their moisture. Due to the high altitude and low precipitation rates, the region exhibits characteristics of both arctic and desert-type climates. The part is hence often referred to as a 'cold desert'. In the form of snowfall during winter, precipitation results in snow cover ranging from 2 to 5 feet. Rainfall is negligible, with ~26 cm annually. The hottest month is July, with an average temperature of 26°C. The district experiences severe cold during winter (November to February) when the temperature dips to around -48˚C at night. The coldest month is January, with an average temperature of -8^{o}C. Dras, the second coldest human-inhabited place in the world after Siberia, is in Kargil (Kohli, 2004).

With rock and stones scattered all over, valleys are rough and rocky. These valleys are lined by steep mountain peaks, with altitudes ranging from 2,500m to 4,000m around settlement regions and over 7000m in uninhabited areas.

The main rock types found in the area are slate, phyllite, schist, quartzite, crystalline limestone, and dolomite. Tertiary and Mesozoic sedimentary formations can define the geology of the region. Due to solar weathering, the exposed rocky areas on the mountainsides offer the hills and mountains exquisite colour (Walia et al., 1999).

The composition of the soil ranges from coarse sandy to skeletal loam. The river valleys are the most fertile region of Ladakh. Places adjoining the Suru and Dras river and their tributaries are suitable for vegetation; hence, most of the total population are found near the river or adjoining streams. In nature, the valley bottoms are typically sandy clay. The soil is low in carbon and nitrogen and is acidic in major parts around Kargil, limiting its suitability for cultivation (Walia et al., 1999).

The salient characteristics of the geography of Kargil are:

- The precipitation rate is low, mainly in the form of snow during winter.
- Wide fluctuations in temperature: between -48˚C during winters and +35˚C during summers (LAHDC Kargil).
- The entire region is almost devoid of natural vegetation except for small shrubs and agroforestry plantations near river valleys and glacial streams.
- Soil is thin, sandy, porous, and deficient in organic matter.
- Irrigation is mainly along streams or small channels originating from glaciers.

2.3.5 Drainage basin

The Suru river is around 185 kilometres long, originating from the glacier of Panzella near the Drang Drung Glacier at Pensi La Pass. The glacier also gives rise to the Stod River, which streams in the opposite direction. The River Suru source is 142 kilometres south of Kargil and 79 kilometres north of Zanskar. The Suru river system forms the primary river system in Kargil.

In the Suru valley, the Suru river drains the Nun Kun mountain massif of the Zanskar range and is joined by a tributary, "Shafat Nala", at the Gulmatango pastures. This stream originates from the Glacier of Shafat (Jina, 1996). There are substantial possibilities for rafting on the Suru River, practised throughout the summer. The Suru valley is the starting point for rafting journeys, and the Nun Kun mountain massif is also a base for mountain expeditions (Bali & Somi, 2005).

The Suru river defines the western and northern limits of the Zanskar range. The Suru river meets the Indus at Marol in Baltistan, which is now on the Pakistani side of the Line of Control, after receiving the waters of Kartse river at Sankoo, combined waters of the Dras and Shingo rivers at Kharul (7 Km distance north of Kargil town), and Wakha river at the centre of Kargil town.

During the winter, most of the Suru River and its tributaries freeze due to extremely low temperatures (Figure 10).

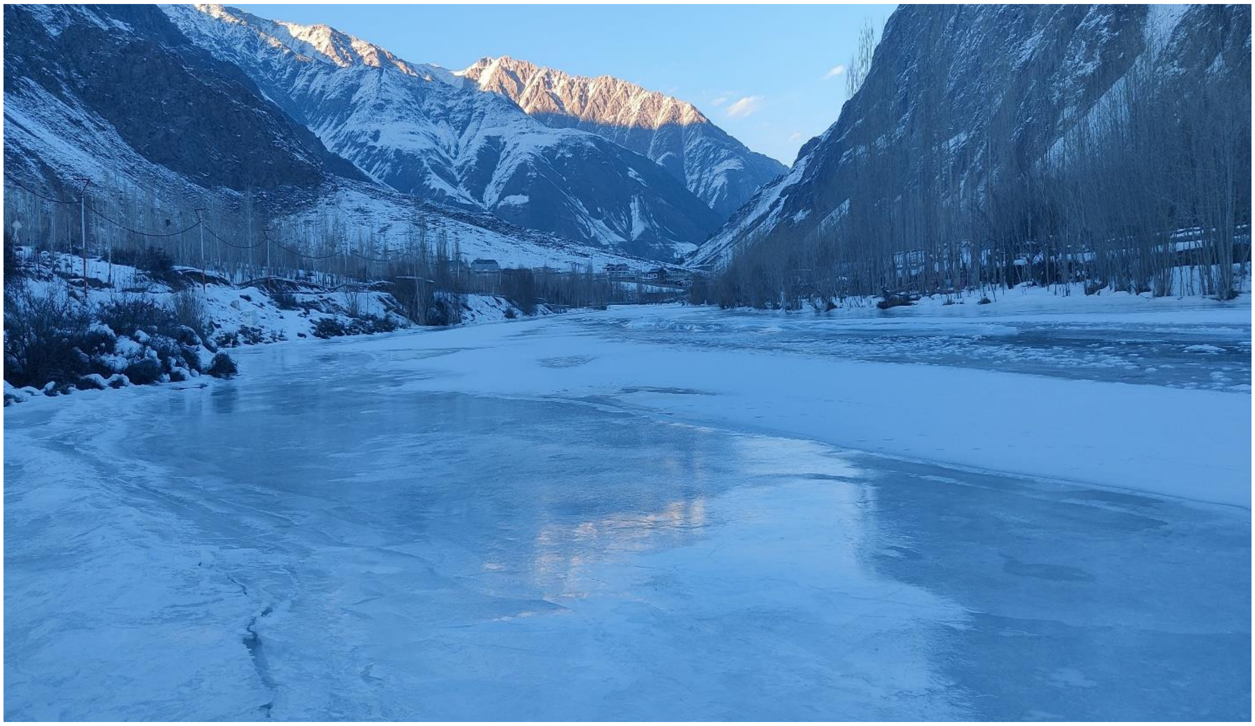


Figure 10 The Suru river in winters. A significant part of the river freezes in the winter as the temperature generally remains below freezing point.

2.3.6 River valleys of Kargil

2.3.6.1 Suru valley

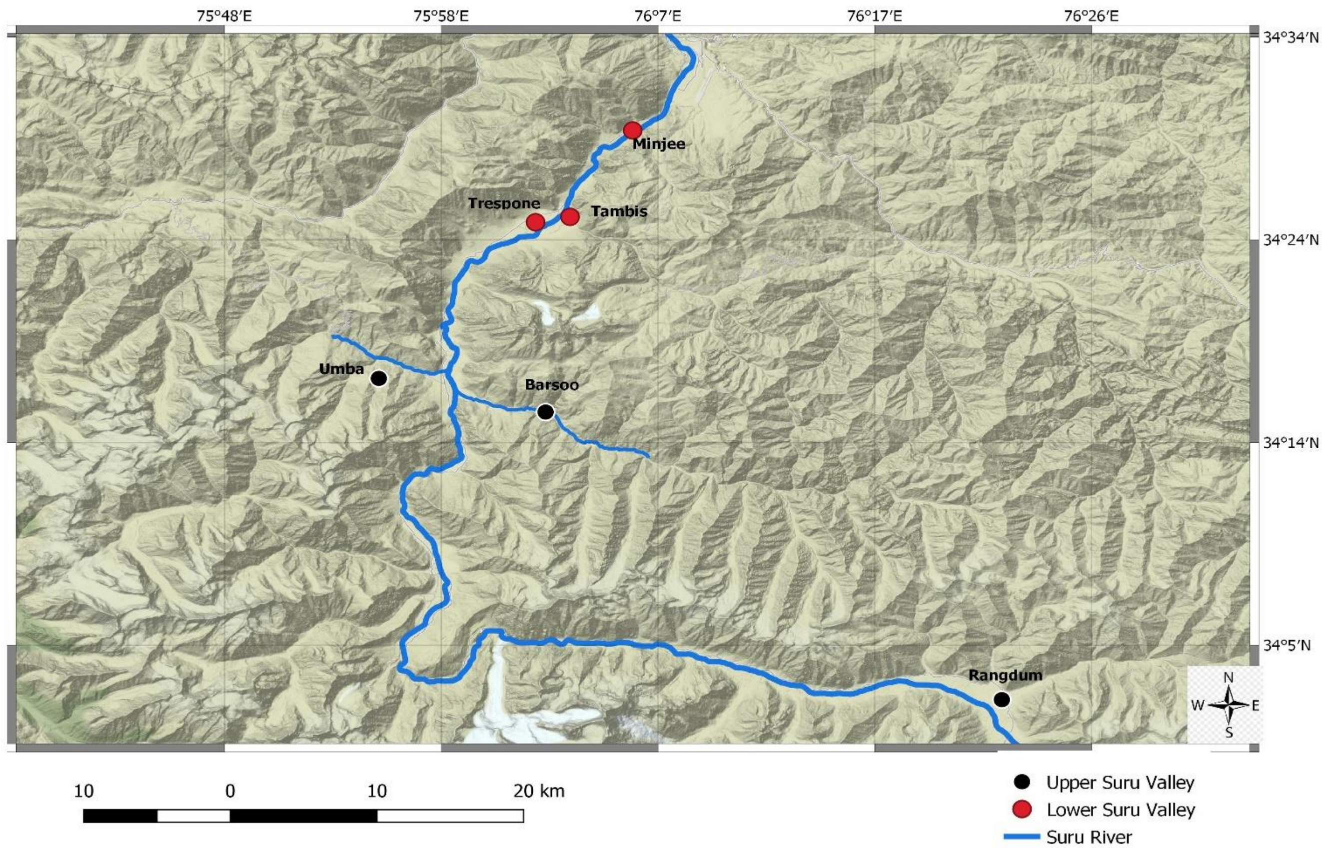


Figure 11 The Suru valley, Kargil region, India with important villages and the Suru river.

The Suru valley rises from Rangdum to 4400 meters at Pensi-la, the gateway to Zanskar. Before 1947, Kargil, the only town in the Suru valley, was an important station on the commercial caravan routes, more or less equidistant, approximately 230 kilometres from Srinagar, Leh, Skardu, and Padum. Although on the northern side of Pensi-la, Rangdum is considered part of Zanskar rather than Suru, both socially and culturally. The last inhabited region in the Suru valley is the Rangdum Monastery and the attendant village of Julidok in the south; it is also the destination of the nomadic herd people called Bakarwals, who trek up from the Jammu region every summer (Rizvi, 1996).

Due to the dry climate, agriculture is scarce in Ladakh and is restricted to the river valleys (Figure 11). The valley of Suru, formed by the Suru river catchment, receives irrigation through the Suru River canals. Barley, buckwheat, turnips, and mustard are among the main crops grown in the valley (Ramchandani, 2000).

Figure 12 Sankoo, the most populous region of the Suru valley in Summer, also serves as the headquarter for Sankoo Tehsil.

Figure 13 Sankoo in winter.

The zone faces intense climatic conditions observed in daily and seasonal temperature fluctuations. Temperatures in summer vary from 30°C during the daytime to 3-4°C at night. However, among the highest in Ladakh, a low precipitation rate is recorded during the winters, often in snowfall. During winters, at night, temperatures fall below zero degrees centigrade (-10°C to -25°C) and an average temperature of 0°C during the day, which freezes the Suru during the winters.

The Suru valley is the most populous region in Kargil, and Sankoo serves as the headquarters for the Sankoo tehsil (Figures 12 and 13).

2.3.6.2 Dras valley

Dras river originates from the Machoi glaciers near the Kargil side of the Zojila pass and flows towards Kargil, joining the Shingo river near Kharboo village, and the Suru river at Kharul, 7 km north of Kargil town, near the village of Slilikchey. It traversed the NH-1D National Highway, which connects Srinagar and Leh. This national highway is of immense strategic importance to India, as it serves as the lifeline for the people of Ladakh to connect with the Kashmir Valley and is the only transportation medium for the defence force of the Indian Army. The total stretch of the Dras river is approximately 87 km and flows through the Dras valley.

Dras town, the second coldest inhabited place after Siberia (Kohli, 2004), has the most significant human settlement in the valley (Figure 14).

Figure 14 Dras town in summer, which also serves as the headquarters of Tehsil Dras.

2.3.6.3 Zanskar Valley

Zanskar river is one of the significant and largest tributaries of the Indus river. Zanskar river has two main branches. The first one is the Doda river, which has its source near the Pensi la, and the other branch is the confluence of the Kargyag river originating from Shingo La and the Tsarap river arising from the Baralacha La. The Kargyag and Tsarap rivers join near Purne villages to form the Lungak river. The river flows through the Lungnak valley and joins the Doda river near the central valley of Zanskar. The Zanskar river then flows toward the Northwest and joins the Indus at *Sangam*, near the village of Nimoo in the Leh district.

Zanskar town is the most populous region of the valley. It serves as the tehsil headquarters and records among Ladakh's highest tourist footfall region. There are various Buddhist monasteries in the Zanskar valley, with the Phugtal monastery being one of the most prominent and vital (Dorjay, 2011).

2.3.7 Human Population (Demographics)

The majority of the human population in Kargil is confined to rural setups, with ~88% of the total population residing in the rural parts of the region. The population density of Kargil was recorded at ten people per square kilometre during the Census of India (2011). The population growth was estimated at 18.02% between 2001 and 2011, and the literacy rate was 71.34% in 2011 (Census of India, 2011). The sex ratio for Kargil was 810 females for every 1000 men in 2011.

2.3.8 Human welfare (Economic)

Much of the district's economy is devoted to agriculture, horticulture, and animal husbandry (Statistical Handbook of Kargil, 2019). These continue to be the only primary source of income for the district's rural population, which makes up 95% of the total population. This is due to the district's unique geophysical qualities (Statistical handbook of Kargil, 2019).

In light of the economic importance that the horticulture sector has acquired, the government has introduced several schemes and programs to advance horticulture. Under these initiatives, in addition to expanding the area under fruit cultivation, quality plant material is being produced for distribution to potential growers, and farmers are also given technical assistance to increase the production of high-quality fruits (Statistical Handbook of Kargil, 2019).

The rural people in general and the migrant population in particular (i.e., livestock herders), who rely heavily on livestock for their livelihood, engage in the vital occupation of raising livestock. According to the 19th Livestock Census of India, completed in 2012, the district has 293,324 livestock (Statistical Handbook of Kargil, 2019).

2.3.9 Livestock Rearing

Domestic animals are an essential and integral element of the Ladakhi economy. A family's wealth is determined by the quantity of animals it possesses. Livestock rearing is a significant part of the agricultural economy (Koshal, 2001). These domestic animals contribute to the Ladakhi economy by supplying milk, wool, dung (fuel), a source of protein, and their services (carrying loads) to the local community (Koshal, 2001). Most small and large male stocks are castrated to make them stronger and capable of carrying heavy loads, particularly for goods transportation.

Pastoral farming and agriculture are the Ladakhis' primary sources of income (Koshal, 2001; Maheshwari, 2014). All Ladakhi are pastoral farmers, albeit to varying degrees. Hence, livestock rearing is a significant source of livelihood and income for the region's residents.

It is essential to rear livestock in this cold desert region, where agriculture is hampered by various variables, such as shorter planting seasons, challenging environments, and marginal land holding (Ahmed et al., 2017). It not only offers a source of revenue but also assures the nutritional security of the home and the creation of jobs (Ahmed et al., 2017). However, similar to other high-altitude areas in South Asia, Ladakh's 'traditional' agro-pastoral land utilisation system has undergone substantial changes in recent years as a result of household income diversification (e.g., shifting from agriculture and other traditional practices to government jobs, entrepreneurship, and daily-wage jobs (Ahmed et al., 2017; Kreutzmann, 2006; Nüsser & Gerwin 2008).

2.3.9.1 Livestock holding information of the region

The livestock holding information gathered from the Animal Husbandry Department of Kargil and the Statistical Handbook of Kargil (2019) is shown in Table 3.

Table 3 Livestock holding information across all the CD blocks. Source: Sheep Husbandry officer Kargil (Statistical handbook of Kargil).

	Cattle	Sheep	Goat	Equids	Poultry	Total
Kargil	9478	23383	18710	1228	22834	52799
Dras	4998	20251	12083	1676	6518	39008
Shargiole	4419	12104	9462	533	7892	26518
Chiktan	3815	12243	23360	1634	7260	41052
TSG	4768	18884	13321	5	8743	36978
Sabnkoo	7514	18950	13650	358	7697	40472
Taisuru	6740	13932	14887	304	4299	35863
Zanskar	9408	73707	20631	364	171	103910
Lungnak	4593	0	0	857	0	5450
Total	55733	193454	126104	6959	65414	382050

2.3.9.2 Livestock grazing pattern

The livestock grazing follows the laws and regulations of a village, where cattle are taken to common pastures. Every household within a village with livestock holding rotates the responsibility of taking the entire village's livestock to the uphill pastures for grazing (Figures 15 and 16). This traditional method of livestock grazing is practised throughout the study area. The household responsible for the cattle herd ensures the animals' safety from wild carnivores and safe return to their respective owners. In winters, where available, livestock grazes near the village daily and is sent to pastures situated at higher altitudes in summers. Because the productivity of the plants is low and limited to the summer months and is used by animals (ungulates and livestock), forage plants such as Alfalfa (*Medicago spp*.) and dried grasses grown on the fields, and agricultural fields, tree leaves, and crop hay are used as winter feed (Statistical Handbook of Kargil, 2019).


Figure 16 In summers in the Kargil region, livestock are herded to high altitude pastures for grazing.


Figure 15 Livestock grazing in Kargil region on green pastures, in summers.

Villagers generally farm sheep, goats, cattle, and poultry as their livestock. Mostly, goats and sheep are taken for grazing in high-altitude pastures, whereas cattle are fed with stocked fodder. However, the cattle are left in uncultivated fields near and around the village to graze on the limited resources available in winter. In Zanskar, the yak is of utmost importance. Yaks are used to plough the ground, thrash crops, and carry essential and heavy loads, and their dung not only acts as a fertiliser but is also the region's only usable heating fuel. They are a crucial source of dairy products and sometimes protein (but seldom). The Yak's fur makes clothes, carpets, ropes, and bed covers (Weiner, 2003).

2.4 Large wild mammals of Kargil

The unique geographical characteristics make Kargil home to some of the endangered wild mammals listed in Table 4 (Boitani et al., 2018; Breitenmoser et al., 2015; Hoffmann & Sillero-Zubiri, 2016; Maheshwari, 2010; McCarthy et al., 2017; McLellan et al., 2017; Pfister, 2004; Reading et al., 2020; Ross et al., 2020; & Sathyakumar, 2003).

Table 4 Large wild mammals of Kargil.

Name			Reference
Scientific	Common	Local	
Panthera uncia	Snow leopard	*Hrchan/chan*	McCarthy et al., 2017
Ursus arctos issabellinus	Himalayan brown bear	*Drenmo/denmo*	McLellan et al., 2017
Canis lupus chanco	Wolf	*Shangkoo*	Boitani et al., 2018
Vulpes vulpes	Red fox	*Watse/Watsay*	Hoffmann, & Sillero-Zubiri, 2016
Lynx lynx	Lynx	*Eeh*	Breitenmoser et al., 2015
Otocolobus manul	Pallas's cat	*Ribila*	Ross et al., 2020

Capra Ibex sibirica	Asiatic ibex	*Skin/Skeen*	Reading et al., 2020
Ovis vignei	Urial	*Shapo/Shamo*	Michel, & Ghoddousi, 2020.

2.4.1 Description of wild carnivore species focussed on for this study

Six species of large carnivores have been reported from Ladakh (Pfister, 2004). The unique geographic location and biogeographic characteristics make Ladakh home to one of the most elusive cat species, the snow leopard (*Panthera uncia*) (McCarthy et al., 2017). Snow leopards in Ladakh are estimated at around 200 individuals (McCarthy et al., 2017). Throughout Ladakh, it is distributed mainly between 3000 m and 5000 m in the south and central regions. The Himalayan brown bear (*Ursus arctos isabellinus*) has been recorded from south and southwestern Ladakh. The animal climbs up to 5500 m to the snow line in summer and descends in autumn to lower regions. Another unique cat species that prey on smaller herbivores in Ladakh is the Eurasian lynx (*Lynx lynx*). It is mainly found in Nubra, Changthang, and Zanskar (Namgail, 2004). Among the wild carnivores, the Tibetan wolf (*Canis lupus chanco*), which often predates livestock, is the most persecuted (Namgail et al., 2007). Ladakh is also home to the red fox (*Vulpes vulpes*), distributed throughout Ladakh, and the elusive Pallas's cat (*Octolobus manul*) (Namgail et al., 2005). Pallas's cats usually avoid human settlements and interaction with humans. However, there are undocumented reports from the Suru Valley in Kargil of them feeding on domesticated fowls. Marmots, hares, and many species of pika and vole are common among smaller animals encountered (Bagchi et al., 2006).

2.4.1.1 Snow leopard (Panthera uncia)

Order: Carnivora, Suborder: Feliformia, Family: Felidae, Sub Family: Pantherinae, Genus: *Panthera*, Species: *uncia.*

Distribution

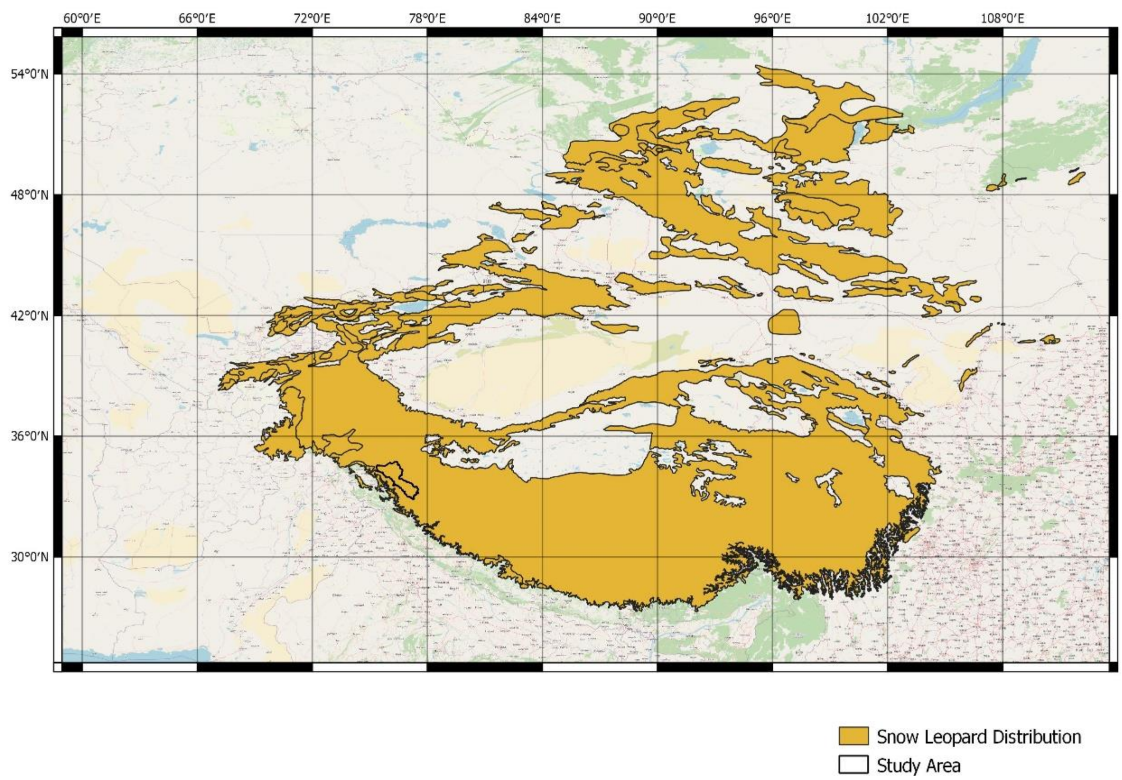


Figure 17 Distribution range of snow leopard.(Source: CITES, 2022)

India, China, Kazakhstan, Nepal, Kyrgyzstan, Mongolia, Pakistan, Bhutan, Russia, Tajikistan, and Uzbekistan form the range of snow leopards (McCarthy et al., 2017) (Figure 17). Snow leopards are frequently sighted from an altitude of 3000m to over 5000m in Central Asia's Himalayan and Tibetan plateau, but in Russia and Mongolia at as low as 600 m (McCarthy et al., 2017). Up to one-third of the entire distribution range of snow leopards occur near international borders, some of which are politically volatile, making cross-border conservation efforts more difficult (SLC, n.d). Early diagrams of snow leopards have been discovered in petroglyphs in Ladakh and Kurgan artefacts around Tien Shan, depicting the coexistence and association between snow leopards and humans over a considerably significant period (Salopek, 2017).

Field characters

With adults ranging from 75cm to 150 cm in length, snow leopards are among the smallest members of the genus *Panthera*. The fur of the snow leopard exhibits a hue ranging from pale yellow to grey, featuring black/grey spots or rosettes on the head and body. Notably, the back, flanks, and bushy tail showcase more prominent rosettes (Kitchener et al., 2016). The abdomen part is whitish. The colour of its eyes is grey or pale green. Its muzzle is short, and it has a domed forehead. It has large nasal cavities. The fur is thick, with hair size ranging between 5 and 12 cm long. Its body is short-legged and relatively more minor, reaching a shoulder height of 56 cm, relative to other cats of the 'big cat' family. The snow leopard's tail size ranges from 80 to 105 cm and is approximately 80% of its body length (Hemmer, 1972; Fox & Chundawat, 2016; Johansson et al., 2013). The long, fat, thick tail helps balance and can be bundled for warmth around the body in winter (Sunquist & Sunquist, 2002).

Behaviour and ecology

Snow leopards mostly live solitarily but share common space among other snow leopards and wild mammals, covering an extensive home range. During breeding and following the birth season, they can be seen up to a group of four (Jackson, 1996). They are primarily active at dawn until sunrise and again in the afternoons and the early evenings termed the 'crepuscular activity pattern' (Carlson, 2017). Primarily, they rest near cliffs and ridges that offer shade and a view of the landscape. According to Fox and Chundawat (2016), the breeding season for a snow leopard in captivity and wild is during the late winters, typically between April and June. Females generally remain together with their cubs, raising them for long periods in dens in the mountains until the cubs are around two years of age and head off on their own (Snow Leopard Trust, n.d).

Like most cats, snow leopards use scent marking to mark their territory and standard travel routes. These are done mainly by scratching the ground before depositing urine or scat with hind paws, and they often urinate on sheltered rock patches (Sunquist & Sunquist, 2002). However, due to their throat physiology, snow leopards do not roar but make a non-aggressive puffing sound called a 'chuff' instead. Snow leopards are not aggressive towards humans. A confirmed snow leopard attack on a human has never been recorded (Snow Leopard Trust, n.d). A snow leopard is more likely to run away than to protect a site, even if interrupted when feeding (Snow Leopard Trust, n.d).

Conservation status

Snow leopards are listed as Vulnerable C1 in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, meaning that the observed, predicted, or forecast decline is anticipated to be 10% in 10 years or three generations (22.62 years in case of snow leopards), and their population is above 2,500 but less than 10,000 in the wild (McCarthy et al., 2017). This classification is a downgrade following the last evaluation in 2008, before which the snow leopards were placed in the Endangered C1 category in 1986 (McCarthy et al., 2017). The downgrade of the threat status was controversial and a topic of debate among the scientific and snow leopard conservation communities (Khadka, 2017). Opposing the move, experts believe that there has been no robust scientific study to prove the snow leopard population's stabilisation, and this rare cat species is still under threat from retaliatory killings, global warming, habitat and prey loss, and illegal poaching (Khadka, 2017). A notable opposition regarding the downgrade of snow leopard status comes from The Global Snow Leopard & Ecosystem Protection Program (GSLEP). The other group's scientists claimed that a down-listing is a promising move and would enable donor governments to continue support, even for snow leopards, as they will see that conservation efforts are successful (Khadka, 2017).

Although legally protected in India under the Wildlife Protection Act (1972), there have been reports of snow leopards being poached throughout their range for their coat and use in traditional medicine. They are also prosecuted in retaliation for livestock depredation (Ali, 2015; Pfister, 2004). A serious challenge to snow leopard conservation throughout its range has been retaliatory killing in response to livestock predation (Li & Lu, 2014).

2.4.1.2 Himalayan Brown Bear (Ursus arctos)

Order: Carnivora, Family: Ursidae, Genus: *Ursus*, Species: *Arctos*, Subspecies: *isabellinus*

Distribution

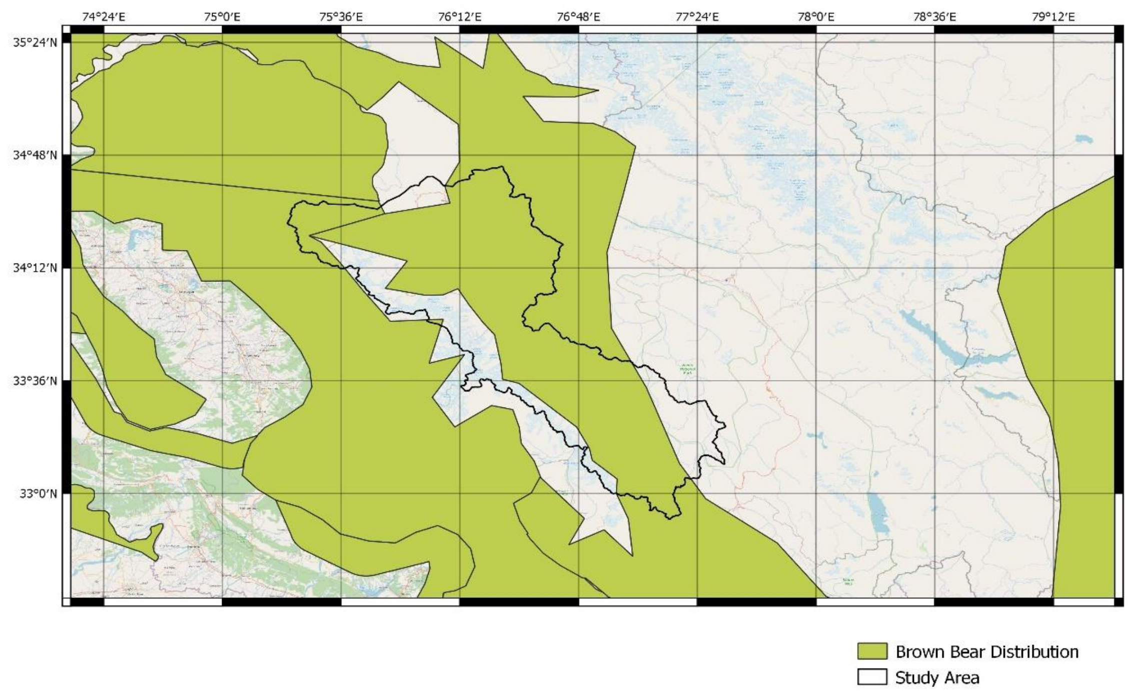


Figure 18 Distribution range of Brown bears around the study area. Source: CITES, 2022

Globally, researchers have identified 44 brown bear subpopulations, most occurring across the northern hemisphere in the southern regions of their circumpolar range (McLellan et al., 2017). Although limited subpopulations of brown bear subspecies, such as the Himalayan brown bear, exist in various parts of Asia, our understanding of their connectivity remains limited (McLellan et al., 2017). This bear species inhabits Nepal, Tibet, western China, northern India, northern Pakistan, Uzbekistan, Tajikistan, Kyrgyzstan, and southeastern Kazakhstan. In Bhutan, there is now speculation about their extinction (McLellan et al., 2017). Phylogenetic analysis has revealed the presence of Gobi desert bear clusters within the Himalayan brown bear, potentially indicating a relict population of this subspecies (Lan et al., 2017). In Kargil, brown bears are most frequently sighted in Suru and Zaskar valleys (Sathyakumar, 2003). Their presence has also been recorded in Wakha-Nala and the lower Markha valley (Maheshwari, 2010).

Field character

In the Himalayas, they are the largest species and usually are sandy or reddish-brown. Males measure between 1.5 and 2.2 m long, and females are between 1.37 and 1.83 m long (McLellan et al., 2017). They exhibit sexual dimorphism.

Behaviour

A wide range of habitats is used by brown bears, from dry Asian steppes to Arctic shrublands to temperate rainforests (McLellan et al., 2017). They range from sea level to 5,000 m altitude (Sathyakumar, 2006). From April to July, breeding occurs, but blastocyst implantation is postponed until late autumn. Cubs are born in January or early February while the mother is in hibernation, usually in litters of 1 to 3 (rarely 4 or 5) (McLellan et al., 2017). Female bears typically have their first litter in North America at 5 to 8 years and only every three to four years after that (Schwartz et al., 2003). On the other side, litter formed by Himalayan brown bears in northern Pakistan averages just 1.3 cubs every 5.7 years, on average every 5.7 years (Nawaz et al., 2008).

Brown bears are omnivores whose diet comprises fruits, berries, roots, grasses, insects, and small mammals. Occasionally, they also prey on large mammals, including goats and sheep. During winters, around late October, Himalayan brown bears hibernate in dens or caves until April or May (McLellan et al., 2017).

Conservation status

Although brown bears, as a species in general, are classified as 'Least Concern' by the IUCN (McLellan et al., 2017), the Himalayan brown bear subspecies is highly endangered throughout its range. It is estimated that 120-220 bears exist in Pakistan and India's Himalayas mountains, an isolated brown bear subpopulation (Abbas et al., 2015; Sathyakumar et al., 2012). The population in this region is thought to be declining at an accelerated rate because of habitat loss, fragmentation, and poaching (Sathyakumar et al., 2012). They are hunted for their fur and use of body organs/parts in traditional medicine throughout their habitat.

Brown bears as a genus are listed in Appendix-II of CITES. The subspecies of *Ursus arctos isabellinus* or the Himalayan brown bear (northern India, Pakistan, Afghanistan, Kazakhstan, and the Gobi desert) is listed in Appendix-I of CITES (McLellan et al., 2017).

2.4.1.3 Tibetan/Himalayan wolf (Canis lupus)

Order: Carnivora, Family: Canidae, Genus: *Canis*, Species: *lupus*, Subspecies: *chanco.*

Distribution

There are two sub-species of grey wolves found in India: the Tibetan grey wolf (*Canis lupus chanco*) (Gray, 1863) and the Indian grey wolf (*Canis lupus pallipes*) (Sykes, 1831). The Tibetan Grey wolf habitat is distributed throughout the high-altitude region of Ladakh and the regions adjoining the Tibetan plateau.

Historically, the grey wolf (*Canis lupus*) was the world's most commonly dispersed mammal with 13 subspecies (Jhala & Sharma, 2009). However, it is currently limited from around 75°N to 12°N latitude to the wilderness and isolated regions of Canada, Alaska, the northern USA, Europe, and Asia (Mech & Boitani, 2004). The Tibetan wolf (*Canis lupus chanco*) is distributed in 2 Union territories (The Union territory of Jammu and Kashmir and the union territory of Ladakh) and two states in India (i.e., Himachal Pradesh and Uttarakhand (Habib et al., 2013).

Field character

The wolf is one of the largest wild canids (up to 62 kg), with a shoulder height of 75-80 cm and a length of 95-140 cm. The sexes look the same and are 25-35 kg in weight, but males are larger and heavier than females. The fur colour varies from light to darker sandy brown to grey-brown, dark grey, or black, with varying intermediate shades. The fur's thickness varies with the season.

Behaviour

Grey wolves are pack-living animals, with family groups of 2-6 individuals forming most packs. The life cycle of a wolf in the wild is around 13 years (Mech, 1988). They are opportunistic hunters. Wolf feed on lagomorphs, rats, birds, and insects with a range of prey from wild and domestic ungulates (Kubarsepp & Valdmann, 2003; Nowak et al., 2005; Sharma et al., 2006; Valdman et al., 1998).

In Ladakh, their diet mainly consists of goats, hares, pika, marmots, and birds. In Kargil, they are responsible for most livestock depredation cases (Ali, 2015; Maheshwari, 2010).

Conservation status

Due to poisoning and systematic persecution when they are engaged in livestock depredation, the grey wolf population declined dramatically to one-third in its distribution territory (Boitani et al., 2018). After the assessment in 2018, the population of wolves around its distribution range is considered stable and is categorised in the Least Concern category by IUCN Red List data for Threatened Species (Boitani et al., 2018). It is listed under Appendix I of CITES and Schedule I of the Wildlife Protection Act, India (Anon, 2008).

2.4.1.4 Red fox and Tibetan fox (Vulpes vulpes/ Vulpes ferrilata)

Order: Carnivora, Family: Canidae, Genus: *Vulpes*, Species: *vulpes/ferrilata*

Distribution

The Tibetan fox, a true fox species, is native to the high Tibetan plateau, Nepal, Sikkim, China, Bhutan, the Ladakh plateau, and up to an altitude of around 5300m, is also known as the Tibetan sand fox. Its distribution is limited to the Tibetan plateau in western China and northern India to the Ladakh plateau. It occurs in the northernmost frontier region of Nepal and India, through Tibet, and in parts of the Qinghai, Gansu, Xingjiang, Yunnan, and Sichuan provinces of China, north of the Himalayas (Harris, 2014).

Locally known as '*watse*', two sub-species of fox are recorded in Ladakh: the red fox (*Vulpes vulpes*) and the Tibetan fox (*Vulpes ferrilata*). They are common and distributed throughout Kargil along the Suru, Zanskar, and Indus valleys (Maheshwari, 2016).

Field Character

The red fox possesses an elongated body, relatively short limbs, and a tail that is longer than half the body's length (Heptner, 1998). When in a standing state, it is fluffy and touches the ground. The pupils of their eyes are oval and positioned vertically (Heptner, 1998). They are the largest species of the genus *Vulpes* (Sillero-Zubiri, 2004). However, red foxes are much lighter than equally sized dogs in the genus *Canis* compared to their proportions. On average, adults with tails measuring 30-55.5 cm, 35-50 cm high at the shoulder and 45-90 cm in body circumference. They measure 7.7- 2.5 cm for the ears and 12-18.5 cm for the hind feet. Weights vary from 2.2-14 kg, with vixens usually weighing 15 - 20 per cent less than males (Nowak, 1999; Burnie & Wilson, 2005). They have dense, fluffy, silky, and comparatively long winter fur. The fur is long, thick, and fuzzy for the northern foxes but thinner, sparser, and coarser for the southern forms (Heptner, 1998). The North American varieties typically have the crispiest guard hairs for northern foxes, although most Eurasian red foxes have thicker coats (Bachrach, 1953).

Behaviour

Red foxes have been reported in environments as diverse as tundra, desert (though not extreme deserts), woodland, and city centres of European countries (Hoffmann and Sillero-Zubiri, 2016). Their natural ecosystem is a dry, mixed landscape with plentiful scrub and forest "edge". They are also familiar from sea level to 4500 above msl on moorlands, mountains (even above the treeline, known for passing alpine passes), dunes, and farms (Hoffmann & Sillero-Zubiri, 2016).

Foxes with a widely diverse diet are omnivores. A study in the former Soviet Union found that red foxes consume more than 300 animal species and a few dozen plant species (Heptner, 1998). In Ladakh, foxes chiefly prey on hare, pika, wildfowl, and rodents, including marmots. Foxes generally encounter humans during winter when they enter settlements searching for food (Pfister, 2004). They are infamous in Ladakh for the depredation of domesticated fowls.

Foxes tend to hunt in the early morning hours before dawn and late evening (Heptner, 1998). While they usually forage individually, in resource-rich environments, they can aggregate (Hunter, 2011). They first locate their targets' position by sound while chasing mouse-like prey, then dive, soaring high over their quarry, navigating with their tails in mid-air before landing on the target up to 5 meters away (Hoffmann & Sillero-Zubiri, 2016).

Conservation status

Due to its high adaptability, strong disposition, and varied diet, the red fox population is stable. Species are classified as Least Concerned in the Red Data List of Endangered Species (lUCN, 2016) and the Wildlife Protection Act (1972), India as Schedule II species (Anon, 2008). The red fox is, however, not mentioned in CITES.

CHAPTER 3 - General Methodology

Chapter Summary

This chapter overviews the general methods adopted in this thesis and specifics on the usual analytical approaches employed once the data are gathered and compiled. Most of the information was gathered through semi-structured interviews with local communities' households across the Kargil district in the Union Territory of Ladakh, India. For different sections of the thesis, semi-structured and unstructured interview tools were employed, with extra relevant data gathered via secondary data available in the form of literature and departmental data. Throughout the thesis, a range of parametric and non-parametric statistics was performed. At the beginning of each analytical/data chapter, more information is provided on the procedures utilised.

In the realm of investigating the intricate dynamics between humans and wildlife, particularly in the context of conflicts that arise from these interactions, a prominent and enduring challenge that warrants our attention revolves around the necessity to foster a comprehensive understanding of a myriad of interrelated factors that span across the domains of both social science and wildlife ecology. As underscored by Chandola (2012), this imperative demands not only acknowledging but also delving deeply into the intricate web of elements that influence and shape these interactions. Without doing so, finding solutions to the problems becomes challenging.

It is paramount to note the insightful observation made by Stebbins (2001), which elucidates the profound nature of social science exploration. It is described as a wide-ranging, purpose-driven, and meticulously structured endeavour to maximise general principles' revelation. These principles, in turn, facilitate our ability to both explain and grasp the underlying mechanisms governing the phenomena under scrutiny.

Furthermore, depending on the specific objectives and goals aimed at through investigative pursuits, one is confronted with the flexibility of adopting various methodologies within social science. These methodologies may assume a qualitative, quantitative, or even a combined approach, and their selection is contingent upon the nuanced intricacies of the research. In the following sections, the discussion will expound on many techniques commonly employed in the present study, delving into the intricacies and nuances that define each.

The conceptual framework illustrated in Figure 19 outlines the research strategy employed to comprehensively investigate human-wild carnivore conflicts in the Kargil region of India.

Framework for the study

STUDY FRAMEWORK

Objectives

To assess the level, magnitude, and patterns of livestock depredation by various predators across Kargil	To understand local peoples' perceptions and attitudes towards carnivores of the region	To understand the knowledge and attitude of students in higher education towards the wildlife of Kargil	To frame a conservation action plan for the Snow leopard and Himalayan brown bear population in Kargil

↓

Broad hypotheses

The distribution of livestock depredation by various carnivores is the same across all CD blocks of Kargil.	There is no difference in the pattern (seasonal, location, time) of livestock predation.	People's awareness and attitude towards wild carnivores vary across gender categories.	There is no relation between knowledge score and attitude score among university students in Kargil.

↓

Methods

Schedule survey (semi-structured interviews) 334 households (198 males,198 females) in 18 villages across nine blocks in Kargil Multi-stage sampling approach	Online questionnaire survey Students in Higher education from Kargil	Adaptive Management Theory of Change Open standard Miradi version 4.5.0

↓

Analysis, Results, Discussions, and Recommendations

Figure 19 Framework for the study.

For chapters Four and Five, following Bhatia (2017) and Maheshwari & Sathyakumar (2020), a household or *Nangpa* was chosen as the sampling unit, and interviews were limited to one adult respondent per family. At each village, the head of the village, *Sarpanch*, *Panch*, or *Numberdar,* was approached, and detailed research and the methodology for collecting data were explained. In some cases, the head of the village agreed to accompany us during the field interviews. In 62 instances, a household head or a necessary adult member was absent or did not consent to participate in the study.

The most senior member of the household was briefed about the research, and a request for permission for the interview was presented. The interview was initiated after the consent and willingness to participate in the survey were recorded.

3.1 Tools and Techniques

Different tools and techniques were adopted throughout the study to achieve the aims and objectives of the research. A brief review of the tools intended for use in this research follows.

3.1.1 Pilot/reconnaissance survey

Efficiency represents a critical aspect of conducting surveys and other data collection endeavours. To attain a satisfactory success rate in the execution of surveys, especially those involving many participants, it is essential to optimise the utilisation of resources, time, and effort, as highlighted by Bryman (2016). Researchers commonly undertake a preliminary survey, known as a pilot survey, to ensure the reliability and feasibility of their survey methodology.

In contrast to the planned sample size for the primary study, a pilot survey employs a smaller sample size to validate the schedule. This schedule is administered to a subset of the overall respondent population, often constituting a convenience sample, particularly in more informal settings (Bryman, 2016). It is anticipated that logistical, technological, and other issues or challenges will arise during the pilot survey phase. After collecting and reviewing the pilot survey data, efforts are made to address and resolve these issues.

Subsequently, after conducting a reconnaissance survey, adjustments to the schedule's content, interview format, or overall survey methodology may be necessary to align more effectively with the research objectives. Following the survey's revision, a second pilot survey may be carried out, if required, to assess the effectiveness of the solutions implemented to address any errors or problems.

In this specific study, a pilot investigation was conducted involving 40 respondents in Kargil's Parkachik, Sankoo, and Pashkum villages.. This preliminary study aimed to gain insights into the clarity and duration of interviews. Similarly, pilot surveys were administered to 10 students from Kargil who were enrolled in various colleges and universities before conducting the primary online surveys.

3.1.1 Structured interviews

A structured interview is a specific format characterised by the interviewer asking a predetermined set of standardised questions. In structured interviews, questions are carefully planned to ensure that all respondents are asked the same questions in the same sequence. In the context of this research, structured interviews were utilised as a method to gather data on various aspects, including household information, incidents of livestock depredation, the socio-economic conditions of households, patterns of livestock ownership, the local community's perceptions of human-wild carnivore conflicts, and their attitudes and levels of tolerance toward the wild carnivores in the study area. Additionally, the information collected through these structured interviews informed the design and approach of subsequent in-depth and semi-structured interviews.

3.1.2 Semi-Structured interviews

Semi-structured interviews were utilised to gain insights from individuals representing various organisations involved in diverse developmental and conservation initiatives. These interviews were deemed suitable when the interviewer was not inclined to conduct repeated interviews with the same individuals, as Bernard (1995) suggested. The information and findings obtained from the structured interviews played a pivotal role in determining the sample and respondents for the subsequent semi-structured interviews. The semi-structured interviews involved engaging with government officials, village elders, scholars specialising in faith and culture, and educators. These interviews aimed to gain a deeper understanding and firsthand observations from the study area.

3.1.3 Online survey

The internet has witnessed a rising popularity as a tool for conducting and a subject of investigation within the realm of social scientific research, as documented by Van Selm and Jankowski (2006). Online surveys have gained prominence due to their advantages, encompassing speed, extensive reach, convenience, cost-effectiveness, adaptability, and automation, as underscored by Ball (2019).

In this study, the potential of an online survey tool, specifically Google Forms, was harnessed to solicit responses from students in higher education institutions across the Kargil region. Our objective was to explore the role of education in shaping individuals' perceptions toward wildlife. For an in-depth understanding of the research methodology, please refer to the specific chapter, where the details of methodological approach is elaborated.

3.2 Data Collection

In July-August 2019, an initial field visit was conducted to secure the necessary permissions from the relevant authorities in the study area. Approval for the study and the associated permissions were obtained from the district administration of Kargil, as documented in Appendix II.

Originally, field visits for data collection were scheduled to commence in April 2020. However, the advent of the global COVID-19 pandemic led to the implementation of widespread travel restrictions across numerous countries. Countries like India and the United Kingdom, including many others, enforced lockdown measures, and individuals were strongly advised to practice social distancing and self-quarantine to curb the spread of the virus. The United Kingdom government introduced stringent travel restrictions, including guidelines discouraging non-essential travel. Our institution, the University of Salford, was also aligned with these guidelines. This situation resulted in a considerable postponement of the field trips.

In the face of persistent delays brought about by the pandemic, data collection was eventually initiated in April 2021 after securing the necessary travel permissions from the local administration. The field surveys continued until September 2022.

3.3 Research Ethical Statement

The project, with the ethical application number STR1920-14 (Appendix I), was submitted to and approved by the Science and Technology Research Ethics Panel under the Research, Innovation, and Academic Engagement Ethical Approval Panel of the University of Salford in January 2020.

3.4 Tools/Software used for data analysis and visualisation

Microsoft Excel™

Compared to specialised statistical software products, using a Microsoft Excel spreadsheet for data entry is considered one of the software's most practical applications, as Warner and Meehan emphasised (2001). Consequently, Microsoft Excel was chosen as the tool for data entry in this project.

SPSS 27 (Inc., Chicago, USA)

The data was initially compiled within Microsoft Office 365 Excel, provided by Microsoft, and subsequently exported to the Statistical Package for Social Science (SPSS) PC version 27, developed by SPSS Inc. in Chicago, USA, for conducting the statistical analysis. It is important to note that unless explicitly mentioned otherwise, all statistical analyses were performed using SPSS version 27.

QGIS 3.16.3

The QGIS Development Team produced Quantum GIS, or QGIS, 2002 as a free, open-source GIS software program. This software was used to map the study area and explore the spatial distribution of livestock predation across the various CD blocks of Kargil.

Miradi version 4.5.0

Miradi is a widely recognised conservation software tool that has garnered substantial adoption within the conservation community, with prominent organisations incorporating its use to structure and plan projects by the principles outlined in the Conservation Measure Practices (CMP) guidelines (CMP, 2020). This software has been cultivated through a collaborative effort between Sitka Technology Group and CMP, demonstrating its alignment with Open Standards in conservation planning and implementation.

Miradi is an invaluable conservationist resource by providing a systematic project development and management framework. One of its notable features is its ability to guide conservation practitioners through a series of well-structured interview procedures. These procedures are designed to facilitate the collection of pertinent information and insights necessary for the effective design and execution of conservation initiatives.

The utilisation of Miradi in this research endeavour is expounded upon comprehensively in Chapter Seven of this thesis. This chapter presents detailed explanations of the specific methods employed and the associated terminologies used in conjunction with Miradi, offering a comprehensive insight into utilising this conservation tool within the context of the study.

Statistical Analysis

The respective analytical/data chapters detail the statistical analysis performed in this project.

The nature of the study is characterized as an initial exploration, with a limited sample size. Consequently, the decision was made to employ bivariate statistical analysis to facilitate the clear isolation of relationships, hypothesis testing, and interpretability.

Limitations

Although utmost care has been taken while implementing the methodological approaches, some limitations were observed, detailed below, which should be taken care of while interpreting the conclusion of the study:

Sample Selection and Representation: The methodology primarily relies on semi-structured interviews with local community households in the Kargil district. While this approach provides valuable qualitative insights, it may not capture the perspectives of individuals unwilling to participate in the study. This could potentially introduce selection bias, impacting the representativeness of the sample.

Resource and Time Constraints: The COVID-19 pandemic caused significant delays in field visits and data collection, resulting in an extended timeline for the research. These delays may have affected the timeliness and relevance of some data, particularly in rapidly changing situations.

Generalisation Limitations: While the study aims to investigate human-wild carnivore conflicts in the Kargil region, the findings may not be directly transferable to other areas with different socio-cultural contexts or wildlife dynamics. Care should be taken when generalising the results beyond the study area.

Data Quality and Validity: Ensuring the quality and validity of data collected through semi-structured interviews and surveys can be challenging. Respondents' recall bias, subjectivity, and social desirability bias may influence the accuracy of the information provided.

Mitigation strategies were implemented to eliminate bias and subjective information. Each respondent received an information sheet, which was thoroughly read out when deemed necessary (anonymity). Confidence in data protection and anonymity was established (confidentiality). A trustful environment was cultivated with the respondents through rapport-building efforts (rapport building). Questions that were deemed more sensitive or difficult to understand during the pilot survey were excluded from the final schedule (pilot surveys).

Despite the implementation of these measures, it is acknowledged that complete elimination of bias and untruthfulness may not be feasible.

Technology Dependency: The reliance on online surveys, such as Google Forms, assumes access to the internet and digital literacy among respondents. This may exclude individuals who do not have access to these resources, potentially leading to underrepresentation of specific demographics.

Recruitment Challenges: In some cases, household heads or necessary adult members did not consent to participate in the study, potentially introducing non-response bias. Efforts to address this challenge may affect the data's completeness and representativeness.

Pilot Survey Constraints: While pilot surveys were conducted to enhance the research's efficiency, they may not fully replicate the conditions of the main study. Factors that emerge during the larger-scale data collection may not have been adequately anticipated in the pilot phase.

These limitations should be carefully considered when interpreting the findings and drawing conclusions from the research. Efforts to mitigate these limitations, such as enhancing data quality control and diversifying data collection methods, may strengthen the robustness of the study.

Chapter 4 - REPORTED LEVEL AND PATTERN OF LIVESTOCK DEPREDATION BY VARIOUS PREDATORS ACROSS KARGIL TRANS-HIMALAYAS, INDIA

Chapter Summary

Mitigating the often intricate and multifaceted challenges posed by human-wildlife conflicts demands a comprehensive assessment of the scope of these conflicts and their implications for local communities and wildlife populations. This critical aspect of conflict management has been underscored by research such as that conducted by Walpole et al. in 2003. These conflicts affect the livelihoods and well-being of residents and have significant repercussions for the survival and conservation of wildlife species in a given region. Among the myriad factors that contribute to human-wildlife conflicts on a global scale, attacks on livestock by wild predators have emerged as a pivotal and recurrent concern.

The present chapter delves into the multifaceted realm of human-wildlife conflicts, focusing on the Kargil trans-Himalayan region in India. The magnitude of reported livestock losses within this geographically distinct and ecologically significant area was meticulously examine and quantified. This encompasses a broad spectrum, including losses in poultry, attributed to various causal factors. These factors contain not only the direct predation by wild carnivores but also the indirect consequences stemming from disease outbreaks and the impacts of extreme weather events. These losses have been observed and documented over two years, from 2019 to 2021.

For several reasons, understanding the dynamics of livestock losses within this context is pivotal. Firstly, it enables us to gauge the economic and subsistence impact on local communities, where livestock is often a primary source of sustenance and livelihood. Secondly, discerning the patterns of livestock depredation by wild carnivores and feral dogs provides deeper insights into the specific challenges posed by different predator species. This knowledge is instrumental in formulating targeted and effective mitigation strategies. Additionally, it sheds light on the interactions between humans, wildlife, and domestic animals in this unique ecological setting, facilitating the development of harmonious coexistence strategies.

Our research in this chapter embarks on an empirical investigation aimed at quantifying and characterizing the diverse facets of livestock losses, a crucial step in the overarching effort to foster peaceful and sustainable human-wildlife cohabitation in the Kargil trans-Himalayas. Discerning the intricate interplay between predation, disease, and climatic events is aimed at providing valuable insights that can inform the development of tailored conservation and conflict mitigation strategies. In doing so, the endeavour is to protect the region's rich biodiversity and the well-being of its human inhabitants.

4.1 Introduction

Crop damage by wild herbivores, livestock predation by carnivores, and human casualties by predators and mega-herbivores impose a wide range of costs on local populations, leading to a lack of enthusiasm for conservation and a hostile attitude towards wild carnivores (Rastogi et al., 2012; Dinerstein et al., 2007; Dickman et al., 2011; Inskip & Zimmermann, 2009; Macdonald et al., 2010).

There have been conflicts with large carnivores in the form of attacking livestock since humans domesticated the first animals many thousand years ago. In retaliation, people have attempted to persecute predators responsible for livestock depredation (Kruuk, 2002). Every year, wild carnivores kill thousands of sheep, goats, cattle, domesticated birds, and farmed fish worldwide (Thirgood & Woodroffe, 2005).

Predation of livestock by mammalian predators causes enormous economic losses to poor farmers worldwide (Bano et al., 2021). Livestock predation significantly impacts the effective cohabitation of large animals with pastoral people (Amaja et al., 2016; Decker et al., 2002; Habib et al., 2015; Eklund et al., 2018). Such conflicts lead to an unfavourable attitude among residents toward the animals responsible for livestock predation, which might also result in reprisal or retribution (Bano et al., 2021).

Livestock husbandry is an essential aspect of the rural economy in mountainous regions, especially within the agro-pastoral communities in Kargil (District Handbook of Kargil, 2020). Human-wildlife conflict in the trans-Himalayan area is caused mainly by livestock depredation by snow leopards, brown bears, and Tibetan wolves (Bhatnagar et al., 1999; Chavan et al., 2021; Fox et al., 1988; Mallon, 1991; Maheshwari, 2021; Maheshwari & Sathyakumar, 2020; Meriggi & Lovari, 1996; Mishra, 1997; Nowell & Jackson,1996; Oli et al., 1994; Schaller, 1977). The socio-economic consequences of livestock depredation are particularly severe in economically deprived areas where pastoralism is a significant source of income (Aryal et al., 2014; Chetri et al., 2019; Oli et al., 1994).

Local communities face economic and psychological consequences because of livestock loss to predators. Livestock losses to wild predators, snow leopards, and grey wolves were documented in two published studies from pastoralist communities in the Himalayas, and the related financial loss appears to be quite large, with up to 50% of yearly income lost to depredations (Oli et al., 1994; Mishra 1997). Following incidences of livestock loss, retaliatory killings occur, and the local populace's hostile attitude toward the wild population and conservation measures grows (Chandola, 2012). Animal husbandry is among the primary sources of income in the rural Himalayas, where traditional agro-pastoralists make up most of the population (Chetri et al., 2019). The carnivore species engaged in the human-animal conflict in Ladakh are severely endangered throughout its range and constitute a significant threat to the people's livelihood, resulting in intense conflicts (Chandola, 2012).

Until now, studies undertaken in Ladakh have focussed more on the eastern part of the region, particularly the Leh district. The only studies available attempting the quantification of livestock depredation in Kargil are by Sathyakumar, 2003 (From the Suru valley region of the district) and Maheshwari and Sathyakumar, 2012 (From Wakha, Suru and Kanji Valley). In this chapter, attempts have been made to quantify and generate information on livestock depredation patterns by various predators from 9 CD blocks across the Kargil district. The specific aims of this chapter were –

- To describe the demographic characteristics of the respondents of this study in terms of gender, religious belief, livestock holding, and livelihood sources, which are predicted in this study to impact their attitude towards wild carnivores of the region.
- Examine the magnitude of livestock loss, including poultry, to snow leopard, Himalayan brown bear, wolf, fox, and feral dogs as reported by the respondents across Kargil for 2019-21.
- Assess the causes (disease, predation, extreme weather) of livestock loss from sampled villages (across 9 CD blocks of Kargil) for 2019-21.
- Determine the pattern of livestock depredation by predators across various blocks and assess the association among variables (season, location, time of the attack).

The null hypotheses tested in this chapter are-

- Livestock holding distribution is the same across all the CD blocks of Kargil.
- The distribution of livestock loss attributed to various reasons is the same across all the CD blocks of Kargil.
- Livestock depredation pattern by various predators is the same across all the CD blocks of Kargil.
- The pattern of livestock depredation by various predators is the same across the season, location, livestock shed condition, and attack time.

4.2 Methodology

4.2.1 Pilot survey

Two preliminary surveys were conducted before initiating the final survey. First in August 2019 and then through a telephonic interview in 2020 to check the clarity of the schedule and understand the applicability of the proposed sampling approach. Ten adult males and ten adult females were interviewed from two villages, Titichumik and Skamboo, from the Kargil block of the study area in 2019, and 10 males were interviewed telephonically in 2020 from Baroo village of the Kargil block.

Questions that were difficult to understand by the enumerator and respondents were modified. After the required amendments, the final version of the schedule was utilized for the data collection.

4.2.2 Sampling unit

Following previous studies of the exact nature (Bhatia et al., 2017; Dickman, 2009; Maheshwari & Sathyakumar, 2020), a household or *nangpa* was chosen as the sampling unit for the study.

4.2.3 Sample Size

The sample size for the study was determined using Yamane's (1967) sample size determination formula. A similar approach has also been successfully implemented in studies (Tamrat et al., 2020; Mekonen, 2020) to study human and animal interactions. Yamane's formula used to determine the target sample size for this study is given below.

$$n = \frac{N}{(1 + N(e)^2}$$

n = target sample size

N = total number of sampling Units (Household = 18338)

e = level of precision

The representative sample size was calculated as 390 households (95% confidence level and ±5% precision. However, to achieve equal representation from each CD (Community Development) block of the study area, 396 households were targeted, representing two villages from each block and 22 respondents from each sampled village.

4.2.4 Sampling Approach

This study employed a multi-stage sampling approach (Figure 21). In the first stage, all 9 CD blocks of District Kargil, viz., Sankoo, TSG, Zanskar, Dras, Shakar-Chiktan, Kargil, Lungnak, Shargole, and Taisuru, were included purposively in the survey to assess the level and patterns of livestock depredation incidents and loss due to wild carnivores and feral dogs. The justification of this approach was to achieve the study's primary aim to assess the pattern of livestock depredation across all the district blocks.

In the second stage, two villages from each block were selected using a simple random sampling method, totalling 18 villages across 9 CD blocks (Figure 20). The list of villages in each block was obtained from the census of India (2011), and two villages

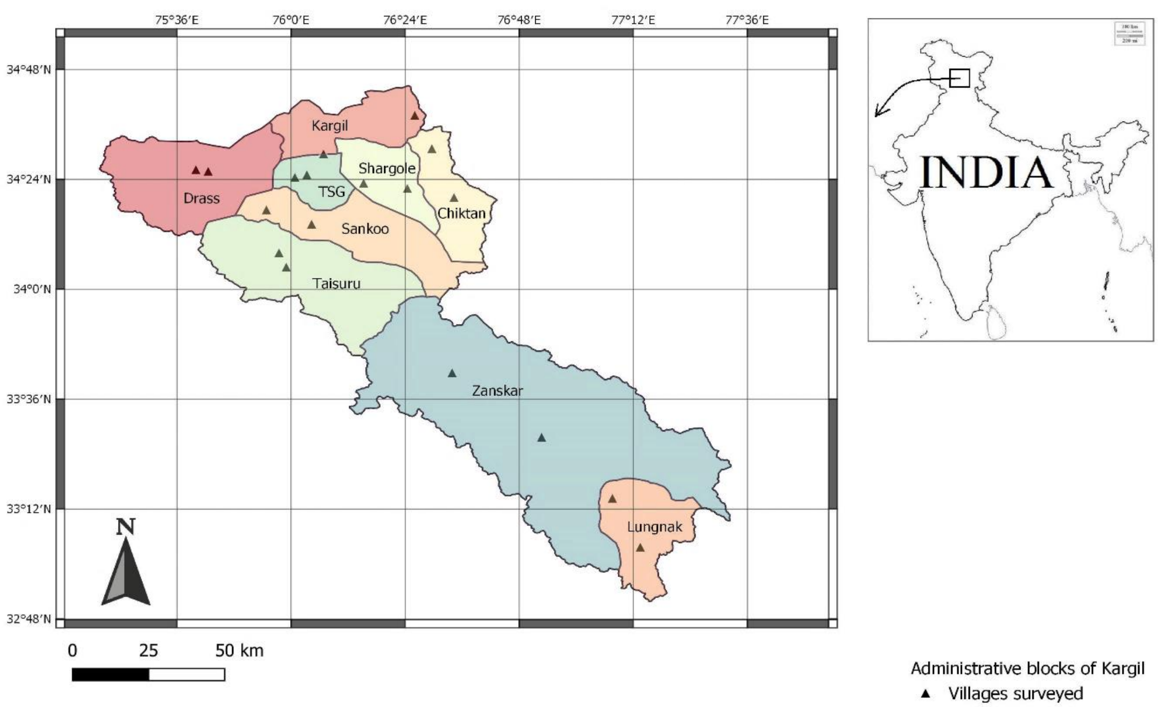


Figure 20 Map of the study area representing the villages surveyed.

were selected using the random number generator formula in a Microsoft Excel spreadsheet by assigning unique numbers to each village. The formula for randomly generating the village was' =randbetween (1, total numbers assigned to each village)'.

At the last stage of the multi-stage sampling approach, systematic random sampling was adopted to interview 22 households from each village at *i*th intervals. The *i*th interval for selecting the target household was calculated by using the formula:

Interval (*i*th) = total number of households in the village divided by the target interviews (22 for each village)

Systematic random sampling is the most appropriate technique at the household level where house listing of the target region//area is unavailable (Maheshwari & Sathyakumar, 2020). In Ladakh, various studies (Bhatia et al., 2017; Maheshwari & Sathyakumar, 2020) have successfully adopted a systematic random sampling approach at the household level to get insight into human-wildlife conflicts.

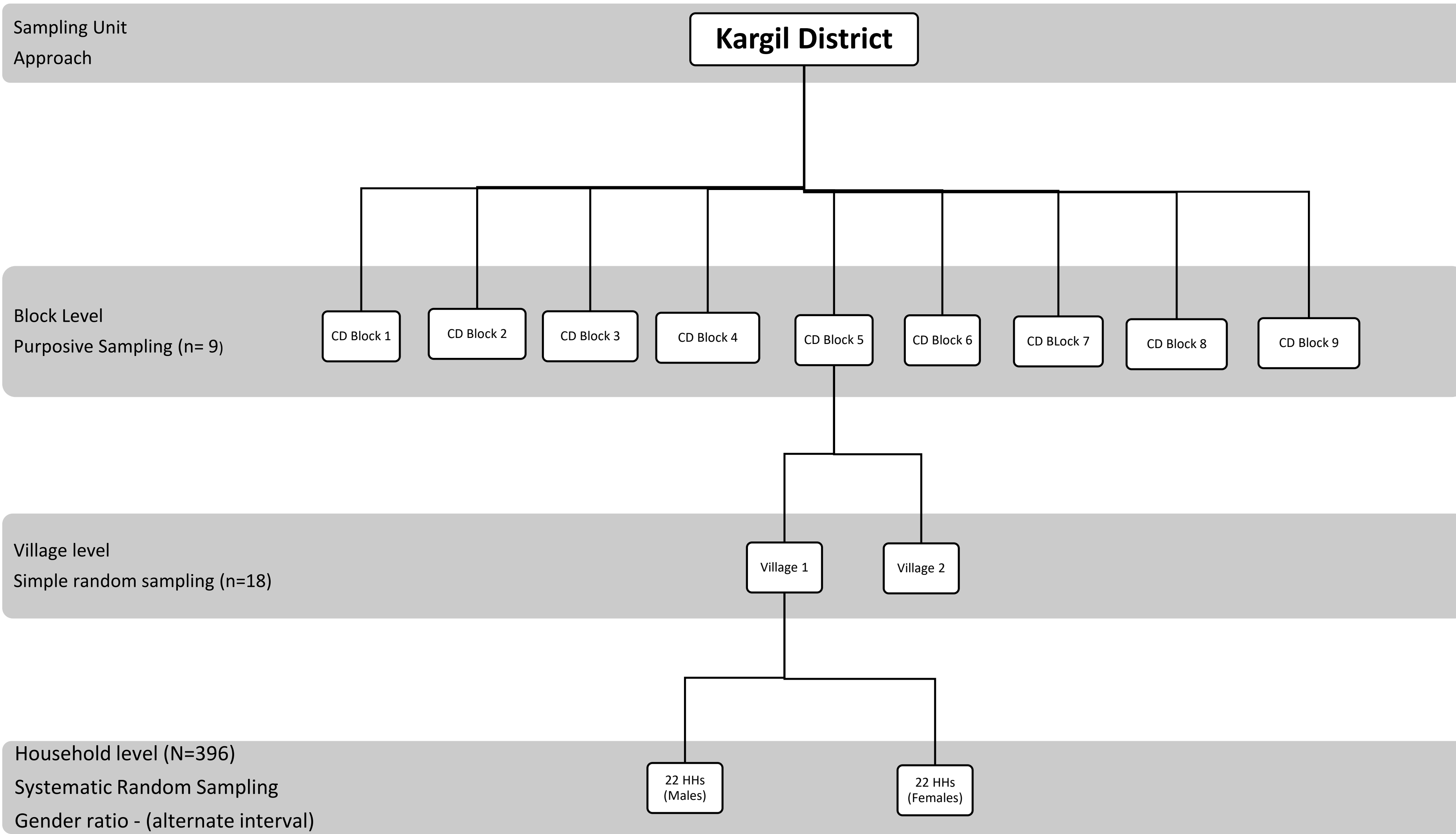


Figure 21 Sampling approach for the study (CD = Community Development; HHs = Households).

4.2.5 Schedule/Survey sheets

The development of the comprehensive schedule for this study culminated in creating a finalized close-ended survey sheet, divided into three distinct and interconnected sections, as detailed in the appended materials (Appendix 5).

The first section of the schedule serves as the foundational component, with its primary purpose being to collect essential demographic information concerning the households the respondents represent. This critical demographic data encompasses a range of factors, including gender, faith, educational background, livelihood, and the integral dimension of livestock rearing within these households. These details are instrumental in contextualizing the responses and facilitating a more nuanced understanding of the socio-cultural and economic dynamics within the study area.

The schedule's second section explores livestock predation events perpetrated by various carnivorous species. Here, respondents are presented with questions designed to elicit comprehensive insights into the nature and extent of livestock losses attributable to various carnivores. These inquiries serve as a crucial step toward elucidating the intricate dynamics between local communities and wildlife populations, shedding light on the challenges posed by such interactions. The analysis of reports detailing livestock predation events by carnivorous species underwent comprehensive scrutiny. Following meticulous examination, incorporating due diligence, and ensuring accurate predator identification, the respective species responsible for the predation incidents were documented. In cases where the available information failed to specify the involved species and lacked detailed data, the incident was categorically recorded as unidentified.

Finally, the schedule's third and equally indispensable section delves into mitigation measures, perceptions, and the socio-economic ramifications stemming from human-wildlife conflicts. Within this section, respondents can articulate their perspectives on the conflicts and the associated losses they incur. Additionally, they are invited to provide insights into their perceptions of the mitigation strategies in place, thereby offering valuable feedback that can inform future conservation and conflict management efforts.

This well-structured schedule represents a cornerstone of our data collection methodology. It endeavours to unearth valuable information that addresses the specific research objectives and contributes to a broader understanding of the complex interplay between human communities and wildlife in the study area. By synthesizing data acquired across these three comprehensive sections, the aspiration is to forge a more informed and holistic perspective on the challenges and opportunities inherent in human-wildlife coexistence within the Kargil trans-Himalayan region.

4.2.5 Data collection protocol

The Research, Innovation, and Academic Engagement Ethical Approval Panel approved the study with number - SRT1920-14 (Appendix 1).

The survey for this research project was conducted by a proficient team comprising six members, which included the researcher and five local field assistants. The field assistants were selected based on their familiarity with the study area and its communities. The team underwent comprehensive training, a significant part of which was conducted online in 2020. Subsequently, in 2021, additional in-person training was carried out to ensure a robust understanding of the research procedures and protocols.

The training encompassed various essential aspects, including the systematic sampling approach, adherence to COVID-19 safety protocols, disseminating research information to respondents, securing informed consent, conducting, and proficiently collecting and inputting data into Microsoft Excel© for subsequent analysis.

One noteworthy aspect of the survey team's composition was the inclusion of female field assistants. This decision was informed by the insights gained during the preliminary/pilot survey in 2019, where it was observed that female respondents exhibited greater comfort and openness when interviewed by female interviewers. This gender-sensitive approach aimed to enhance the quality of data collection by fostering an environment conducive to candid responses.

The intensive field surveys were conducted for several months, commencing in September 2021. During the fieldwork, the survey team proactively engaged with community leaders, such as the head of the village, Numberdar, or Panch, to discuss the survey's objectives and garner support for the systematic sampling approach. This collaborative approach ensured the efficient and effective execution of the survey.

Before starting each interview, the survey team diligently obtained informed consent from the respondents. An information sheet detailing the purpose and scope of the research was provided to each participant. When respondents faced challenges in reading or comprehending the information sheet, the team took additional measures to ensure a clear understanding of the project and its research objectives. Only after securing explicit consent did the team proceed with the interview process.

Moreover, formal permission was sought and granted from the office of the District Magistrate in Kargil, as evidenced by permission number DMK/JC permission-2019 (Appendix 2). This step was essential to ensure compliance with all relevant regulations and to uphold the ethical standards of the research. Since data collection coincided with the ongoing COVID-19 pandemic, the survey team rigorously adhered to pandemic-related rules set up by the local government of the study area. An information sheet outlining the interview protocol was meticulously prepared and verbally conveyed to respondents before data collection commenced.

Additionally, when required, the team sought and obtained vehicle permissions from the relevant authorities to facilitate field surveys, especially in light of restricted travel access in the study area. This comprehensive and meticulous approach to survey planning and execution underscores the commitment to conducting the research with the utmost professionalism, ethical integrity, and sensitivity to local customs and circumstances.

4.2.6 Limitations in the Sampling Approach

Unfortunately, systematic random sampling was not applicable in five villages viz., village 8, village 15, village 16, village 17, and village 18 because the household was distributed in clamped clusters. There is no proper study on the housing construction guidelines or regulations followed in the rural areas of Kargil. The clamping of houses in the rural setup of Kargil may be due to cultural factors (extending families living near each other), geographical factors (availability of water, fertile land), or social factors (particular social or economic groups). This may be an essential topic to explore and research in the future.

Hence, in the villages where systematic random sampling was impossible, the first 22 households were targeted for the interview, maintaining the gender ratio at an alternate interval. In other sampled villages, the systematic random approach was followed by interviewing families at the ith gap (Bhatia et al., 2017).

4.2.7 Livestock Economic Value

Secondary data on the economic value of livestock and poultry heads was obtained from the Sheep and Animal Husbandry Department of Kargil (Table 5). This was used to assess the economic loss incurred upon households due to the predation of livestock by various predators across Kargil for 2019-21. The conversion/exchange rate from INR to USD was calculated on 29-04-2022.

Table 5 Economic value of domesticated livestock. (Source: Department of Sheep and Animal Husbandry, Kargil).

Domesticated species	Economic value for an adult in INR (USD)	Economic value for a young in INR (USD)
Sheep	10000 (130.62)	3000 (39.19)
Goat	10000 (130.62)	3000 (39.19)
Cattle	40000* (522.47)	20000* (261.23)
Equid	50000 (653.09)	20000 (261.23)
Poultry	700 (9.14)	-

*Average value of a male and female cattle

4.2.8 Statistical analysis

The data collected were entered and coded in Microsoft Excel© and exported to SPSS 27 (SPSS Inc, Chicago). Simple quantitative descriptive analysis was performed in Microsoft Excel and SPSS 27.

In the statistical analysis of this study, SPSS version 27 played a pivotal role as the primary software for conducting hypotheses testing. One of the crucial assumptions underpinning many statistical tests is the assumption of normality. The Shapiro-Wilk test was performed to check the normality of the data. Data transformations were employed as corrective measures when the normality assumption was violated. Specifically, log and square root transformations were applied to the data to align them with the normality assumption (Jackson & Wichern, 2007).

Subsequently, based on the outcome of the normality assessment, the choice of statistical tests was tailored to best suit the nature of the data. Parametric tests were employed when the data exhibited a normal distribution, while non-parametric tests were applied when the normality assumption was not met. This cautious approach to data analysis ensured the accuracy and reliability of the statistical inferences drawn from the study.

In the course of hypothesis testing, several critical statistical tests were harnessed. These tests included the Mann-Whitney U, Kruskal-Wallis H, Spearman's rho correlation, and chi-square tests. Variants of the chi-square test, including the Pearson chi-square test, Fisher's exact test, and likelihood ratio test, were applied to suit the specific research questions and data characteristics. In our analysis, residuals with an absolute value of less than 1.96 are considered non-significant ($p \geq 0.05$). A negative residual indicates that the observed value is lower than expected, while a positive residual suggests that the observed value is higher than expected.

All statistical tests were conducted as two-tailed tests, allowing for a comprehensive examination of both directions of the hypotheses. The predefined threshold for significance was set at $p < 0.05$, ensuring a robust and stringent criterion for the acceptance or rejection of assumptions.

Furthermore, to enhance the analytical depth of the study, geospatial information regarding the distribution of livestock depredation incidents and kills across various blocks within the study area was generated. This was accomplished using QGIS version 3.16.13, a versatile and powerful open-source GIS software (QGIS Development team, 2021). The geospatial analysis provided valuable insights into the spatial patterns and trends of livestock depredation, contributing to a holistic understanding of the interactions between wildlife and human communities in the research area.

In addition to its role in data entry, Microsoft Excel was a valuable tool for data visualization and generating descriptive statistics in this research project. Excel's versatile capabilities facilitated the transformation of raw data into meaningful insights, contributing to a comprehensive understanding of the study's findings.

4.3 Results

4.3.1 Demographic information of the respondents

Of the 396 targeted interviews, 334 responses were recorded after completing the final survey across 9 CD blocks of Kargil and used for the data analysis (Table 6). The response rate for the survey was 84.34%. In 62 (15.66%) instances, the respondents were either unavailable or did not consent to participate in the survey.

The responses received and used for the data analysis give us a confidence level of 95% and a ±5.4% margin of error. Although an equal ratio of male and female respondents was targeted, 174 adult males and 160 adult females' responses representing 344 households were recorded for the final data analysis. The mean age of the respondents was 33.07 years (±10.998), with the lowest reported age of 18 years and the highest respondent being 69 years in age. Further detailed demographic information of the respondents is given in Table 7.

Table 6 Targeted and achieved responses for the study.

CD Block	Village	Responses Targeted	Responses received	Non-Response	Response rate (%)
TSG	Village 1	22	22	0	100.00
	Village 2	22	18	4	81.82
Dras	Village 3	22	21	1	95.45
	Village 4	22	19	3	86.36
Chiktan	Village 5	22	18	4	81.82
	Village 6	22	19	3	86.36
Shargole	Village 7	22	18	4	81.82
	Village 8	22	20	2	90.91
Taisuru	Village 9	22	16	6	72.73
	Village 10	22	21	1	95.45
Sankoo	Village 11	22	18	4	81.82
	Village 12	22	19	3	86.36
Kargil	Village 13	22	19	3	86.36
	Village 14	22	17	5	77.27
Zanskar	Village 15	22	21	1	95.45
	Village 16	22	18	4	81.82
Cha	Village 17	22	17	5	77.27
	Village 18	22	13	9	59.09
	Total	396	334	62	84.34

Table 7 Demographic information of the respondents surveyed to study the level and pattern of livestock depredation by various predators.

Category	Frequency	Percentage (%)
Sex		
Male	174	52.1
Female	160	47.9
Age		
18-29	160	47.9
30-49	135	40.4
>50	39	11.7
Formal Educational Background		
No Education	49	14.7
Middle	107	32.0
High School	121	36.2
Graduation	53	15.9
>Graduation	4	1.2
Religious affiliation		
Islam	222	66.5
Buddhism	112	33.5
Livestock rearing		
Yes	315	94.3
No	19	5.7
The primary source of livelihood		
Livestock rearing	142	42.5
Agriculture	39	11.7
Daily wage	60	18.0
Government Services	76	22.8
Business/entrepreneurship	16	4.8
Others	1	0.3

Cross-tabulation between various demographic categories

There was a significant relationship between the level of education and gender categories (χ^2 (4) =12.894, p= 0.012). The test revealed that male respondents were more educated compared to their female counterparts. This is also evident through the cross-tabulation of gender and level of education in Table 8.

Table 8 Cross-tabulation of gender and level of education of the respondents.

	Level of Education					
Gender	No education	Middle	High School	Graduate	Above Graduation	Total
Female	30	48	64	18	0	160
Male	19	59	57	35	4	174
Total	49	107	121	53	4	334

However, there was no significant association between faith categories and the education level of the respondents ($\chi2(4)$, 2.882, p= 0.578) (Table 9).

Table 9 Cross-tabulation of faith and level of education.

	Education Level					
Faith	No education	Middle	High School	Graduate	Above Graduation	Total
Islam	35	69	80	34	4	222
Buddhism	14	38	41	19	0	112
Total	49	107	121	53	4	334

Further, there was no association between the education level of the respondents across the 9 CD blocks ($\chi2$ (32), 40.539, P = 0.143) (Table 10).

***Table 10* Cross-tabulation of CD block and level of education of the respondents.**

Block	Education Level: No education	Middle	High School	Graduate	Above Graduation	Total
TSG	5	12	15	8	0	40
Dras	5	17	15	3	0	40
Shakar-Chiktan	4	10	16	6	1	37
Shargole	6	9	16	7	0	38
Taisuru	6	13	13	4	1	37
Sankoo	11	11	12	3	0	37
Kargil	4	6	12	12	2	36
Zanskar	5	17	14	3	0	39
Cha	3	12	8	7	0	30
Total	49	107	121	53	4	334

Source of sustenance

Combined, agriculture and livestock rearing were reported as the primary source of sustenance for more than half of the respondents (54.2 %) (Table 11 and Table 12).

Table 11 Reported primary source of livelihood of the respondents.

Source of livelihood	Frequency	Percent (%)
Livestock rearing	142	42.5
Agriculture	39	11.7
Daily Wage	60	18.0
Government Services	76	22.8
Business	16	4.8
Others	1	0.3
Total	334	100.0

Table 12 Cross-tabulation of the reported primary source of livelihood across various blocks.

	The primary source of income/livelihood						
Block	Livestock rearing	Agriculture	Daily Wage	Government Services	Business	Others	Total
TSG	18	5	4	11	2	0	40
Dras	16	5	11	8	0	0	40
Shakar-Chiktan	17	2	10	8	0	0	37
Shargole	15	0	12	11	0	0	38
Taisuru	24	0	5	8	0	0	37
Sankoo	20	4	8	5	0	0	37
Kargil	10	4	8	14	0	0	36
Zanskar	16	9	0	6	7	1	39
Lungnak	6	10	2	5	7	0	30
Total	142	39	60	76	16	1	334

Religious affiliation

Out of the total 334 respondents, 222 (66.3%) reported their religious affiliation to Islam and 112 (33.4%) followed Buddhism (Table 13).

Table 13 Cross-tabulation of reported religious affiliation of the respondents across various blocks.

	Faith		
CD block	Islam	Buddhism	Total
TSG	40	0	40
Dras	40	0	40
Shakar-Chiktan	20	17	37
Shargole	21	17	38
Taisuru	37	0	37

Sankoo	37	0	37
Kargil	20	16	36
Zanskar	7	32	39
Lungnak	0	30	30
Total	222	112	334

Household member size information

The average household size was reported to be 7.31 (±2.652) members per household for the sampled 334 respondents. The total number of household members ranged between and including 3 and 18.

4.3.2 livestock holding information

A total of 315 (94.31%) respondents reported owning livestock (including poultry) in various capacities. The total livestock holding for 334 sampled respondents

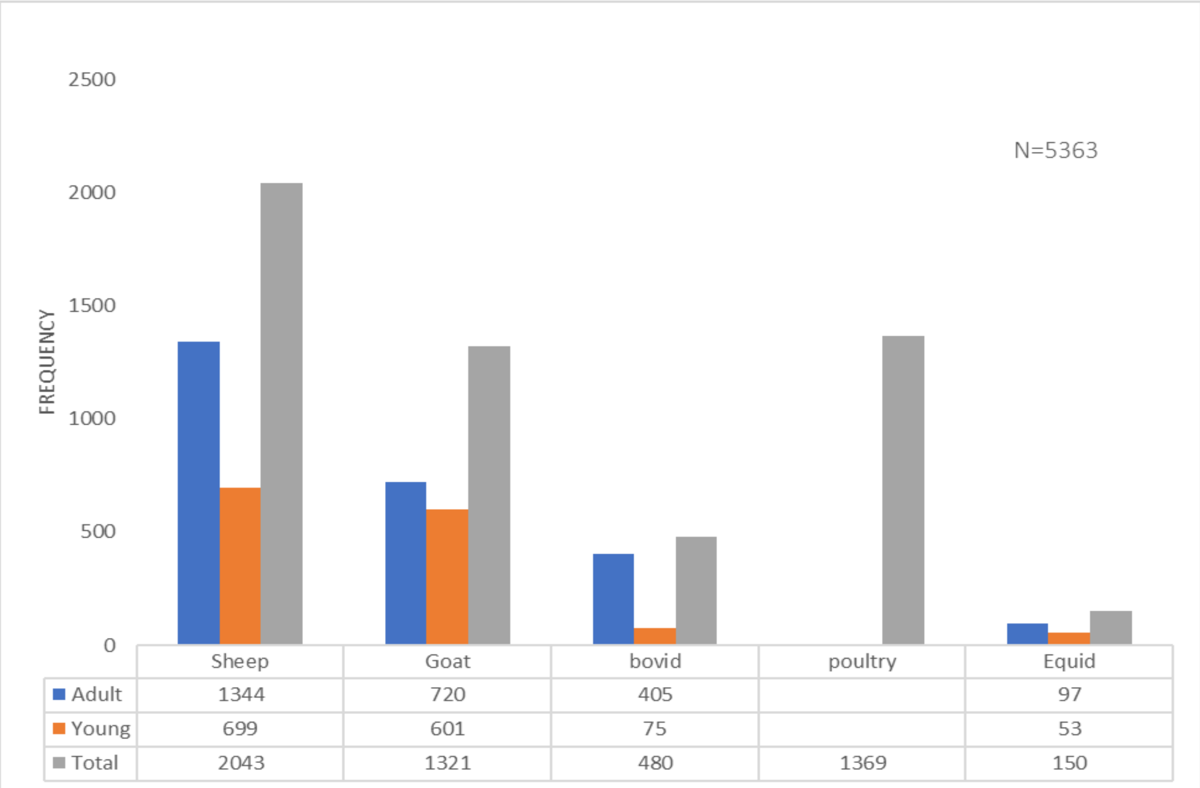


Figure 22 Livestock holding information across various blocks in Kargil region, India.

in 18 villages across 9 CD blocks of district Kargil was 5363, averaging 16.059 (±8.971) per household. The livestock holding information of the respondents is summarized in Figure 22 and Table 14. The mean average of livestock holding per household across different CD blocks in Kargil is given in the boxplot Figure 22.

Table 14 Livestock holding information of the respondents.

CD Block	Sheep		Goat		Bovid		Poultry	Equid		Total
	Adult	Young	Adult	Young	Adult	Calf		Adult	Calf	
TSG	204	85	102	78	51	9	184	0	0	713
Dras	163	92	93	71	58	7	169	18	6	677
Shakar-Chiktan	196	100	114	74	36	7	176	5	6	714
Shargole	133	89	78	74	44	9	149	9	11	596
Taisuru	165	89	52	85	39	11	187	3	7	638
Sankoo	233	88	99	71	49	7	195	4	5	751
Kargil	143	63	114	56	36	13	197	10	3	635
Zanskar	104	89	66	82	48	4	109	26	15	543
Lungnak	3	4	2	10	44	8	3	22	0	96
Total	1344	699	720	601	405	75	1369	97	53	5363

The distribution of livestock holding was not the same, $H(8) = 75.210$, $p<0.001$, across various blocks of Kargil, detailed in the pairwise average rank comparison, Figure 24.

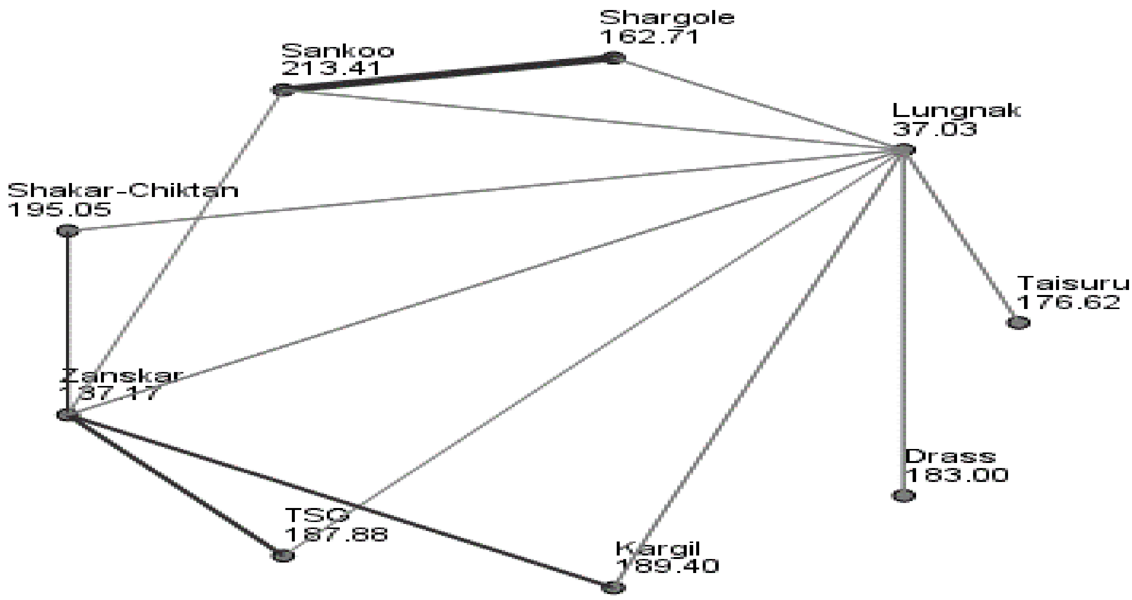


Figure 24 Pairwise comparison of livestock holding across various CD blocks. (Each node shows the sample average rank).

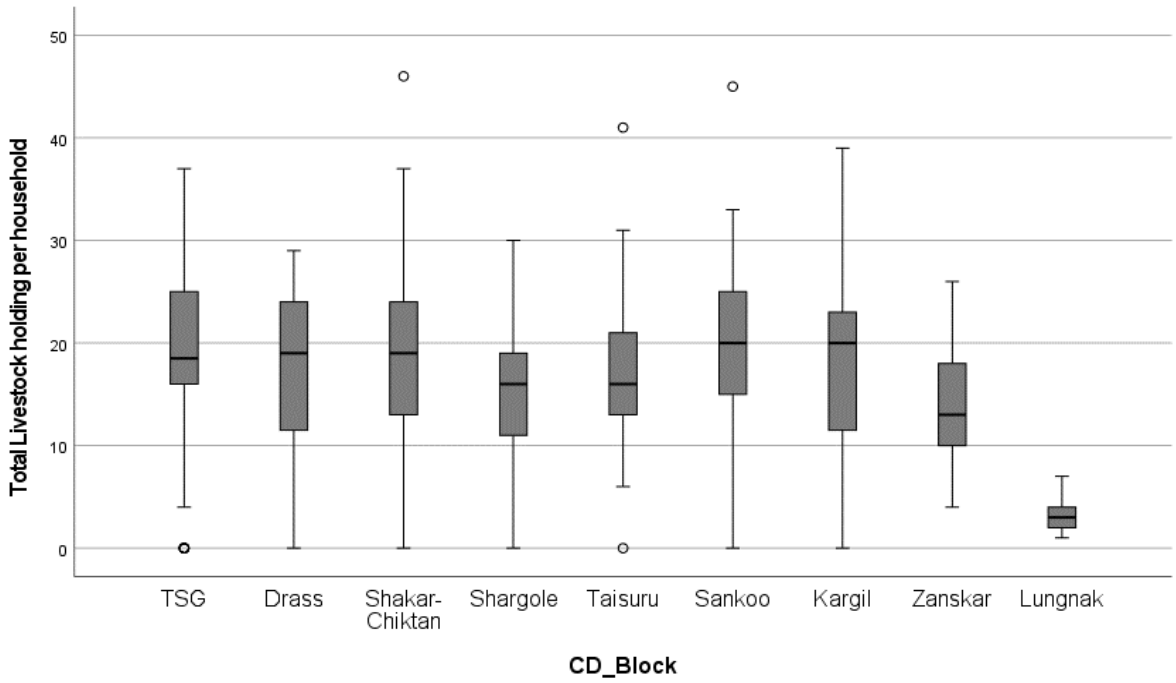


Figure 23 Mean livestock holding per household across various blocks.

Sheep

A total of 81.7% (n=273) of the 334 respondents owned sheep, with numbers ranging from 1 to 27. The average number of sheep owned per household was 6.12 (± 4.842). The mean average of sheep holding per household across various blocks of Kargil is given in a box plot graph in Figure 25. The distribution of the sheep population by households was not the same across various CD blocks of Kargil, $H(8) = 73.038$, $p < 0.001$.

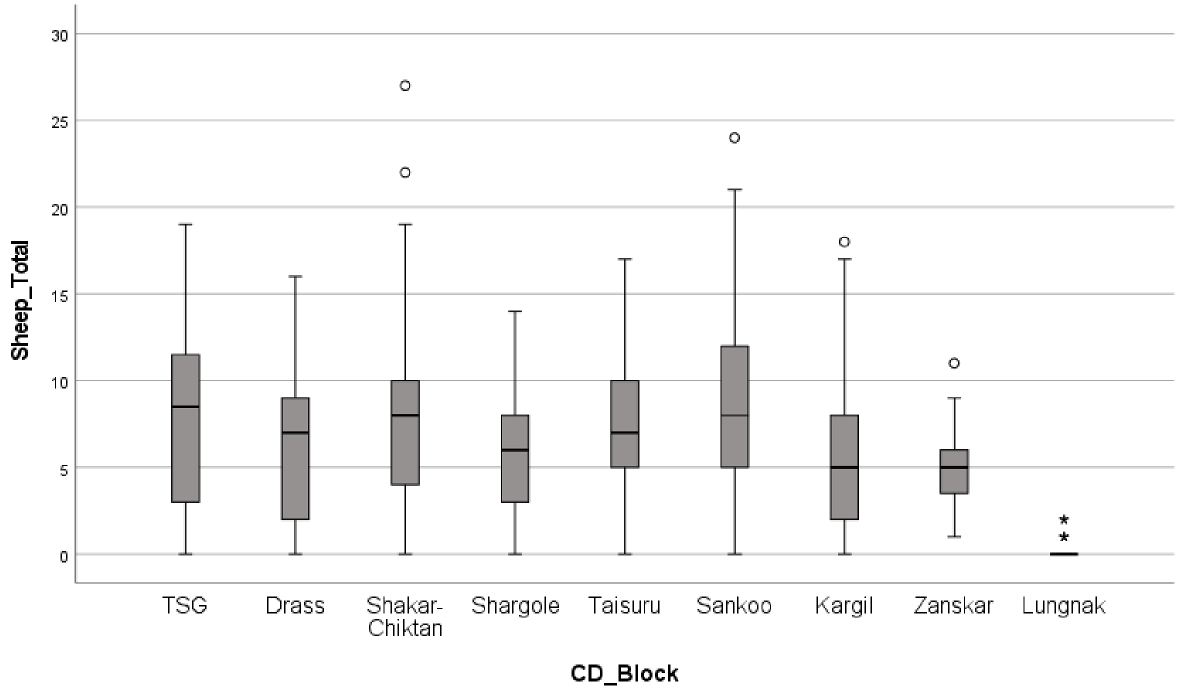


Figure 25 Mean sheep holding per household across the 9 CD block of the study area.

Goat

A total of 278 (83.2%) households were reported to own 1528 goats. 56 (16.8%) did not own or rear goats. The mean average of goats per household was 3.96 (± 3.115). The distribution of the mean average goat per household owning it across CD blocks of Kargil is summarized as a box plot graph (Figure 26). Further, the holding of a goat by household was the same, H (8) = 5.815, p = 0.668. across 9 CD blocks of Kargil.

Cattle

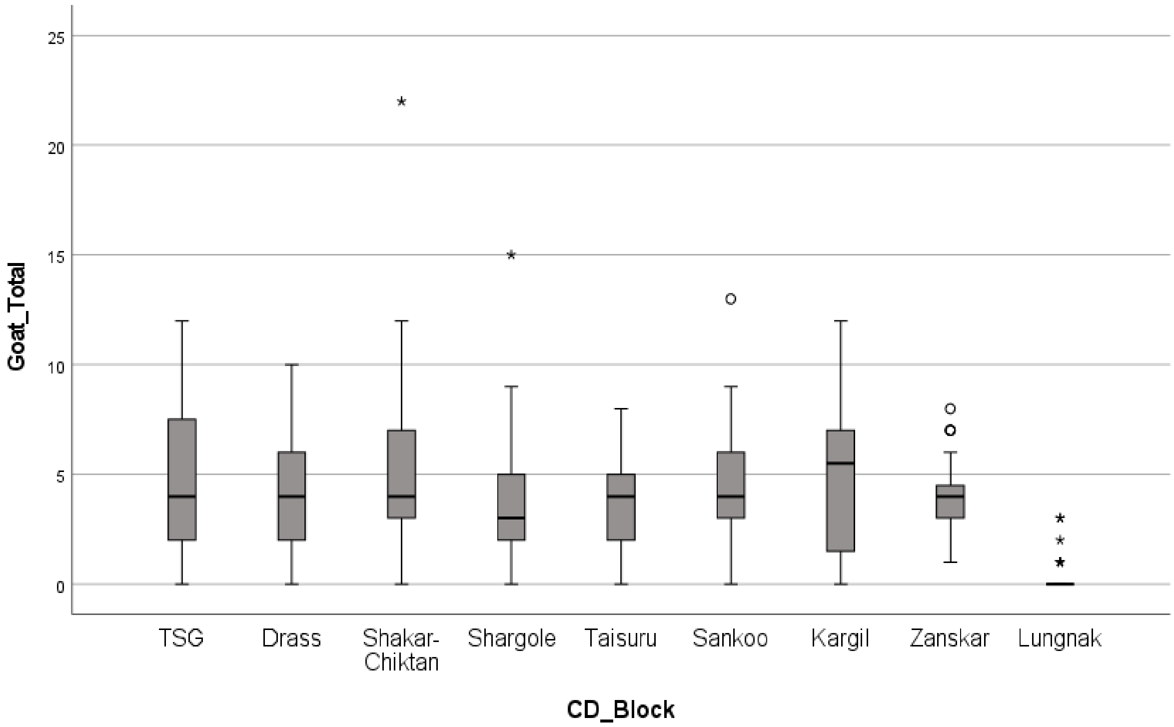


Figure 26 Mean goat holding per household across 9 CD blocks of Kargil.

A total of 489 bovid species with an average of 1.44 (± 1.250) per household was reported by 264 (79.04) of the total 334 respondents. The mean holding of cattle across the 9 CD blocks of Kargil is given in Figure 27. The distribution of cattle across various blocks of Kargil was the same, H(8)= 10.538, p= 0.229.

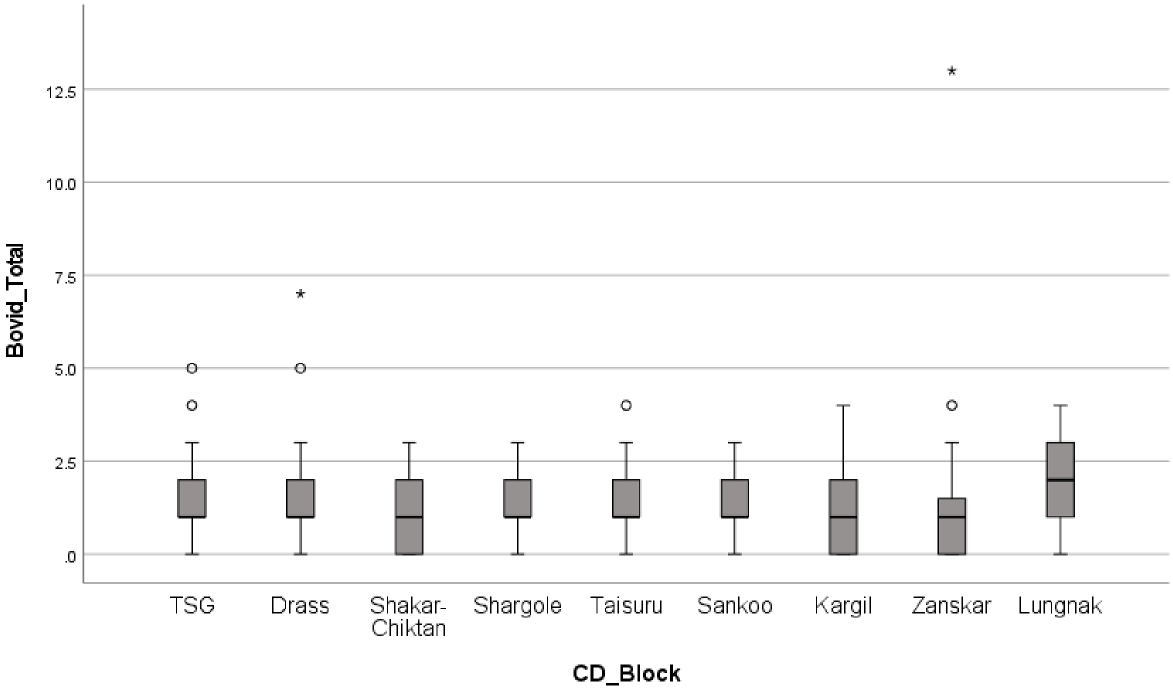


Figure 27 Mean cattle holding per household reported across 9 CD blocks of Kargil.

Poultry

With a total of 1528 birds, the average poultry holding was 4.41(± 4.183) per household across the study area. 77.22% (n=278) of the total 360 respondents reported owning poultry. The mean holding per household across the 9 CD blocks of Kargil is given in Figure 28. Further, the distribution of poultry birds was not the same, H(8)= 82.111, p<0.001, across various blocks.

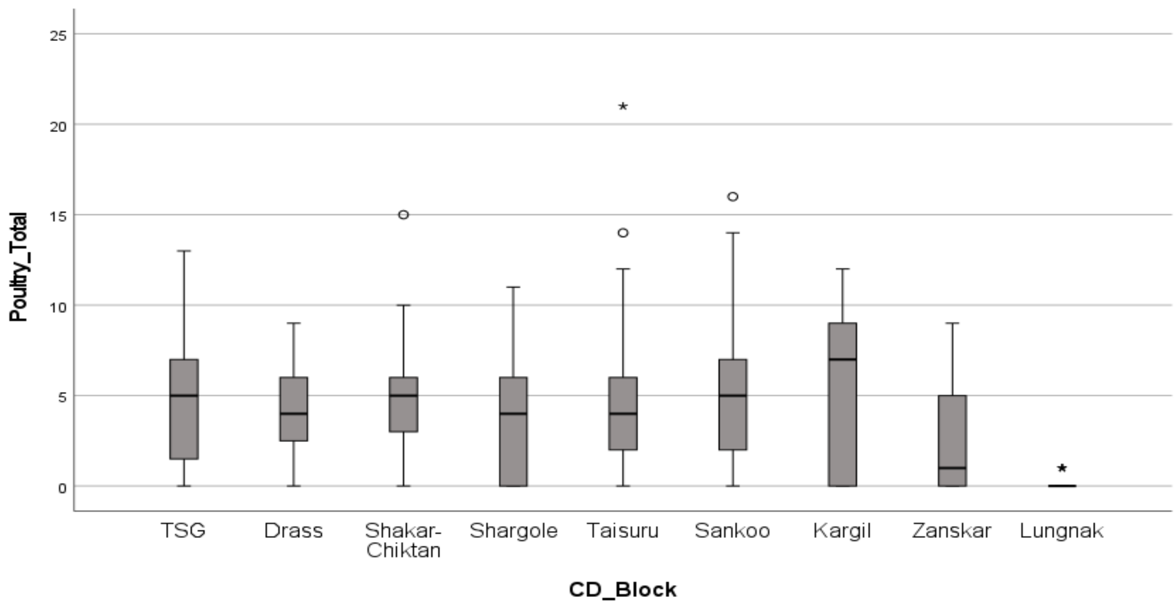


Figure 28 Mean poultry (domestic bird) holding per household across 9 CD blocks of Kargil.

Equids

In the study area, 29.16% (n=105) of 334 respondents stated that they owned equids. Two hundred fifty-five respondents did not own any equid (horse, donkey, or mule). A total of 166 equids with an average of 0.46 (± 0.847) individuals per household was reported in the study area. The mean distribution of equids in the study area is given in Figure 29. The distribution of equid was not the same, H(8)= 23.485, p < 0.001, across the CD blocks, represented by a pairwise comparison in Figure 30.

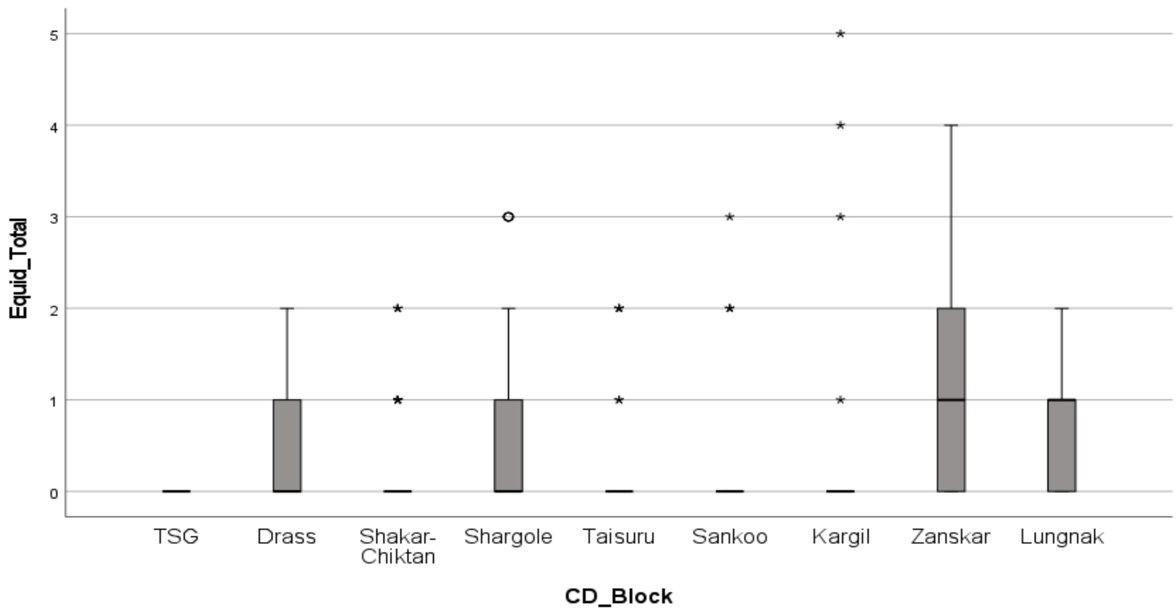


Figure 29 Mean domesticated equid holding per household reported across 9 CD blocks of Kargil.

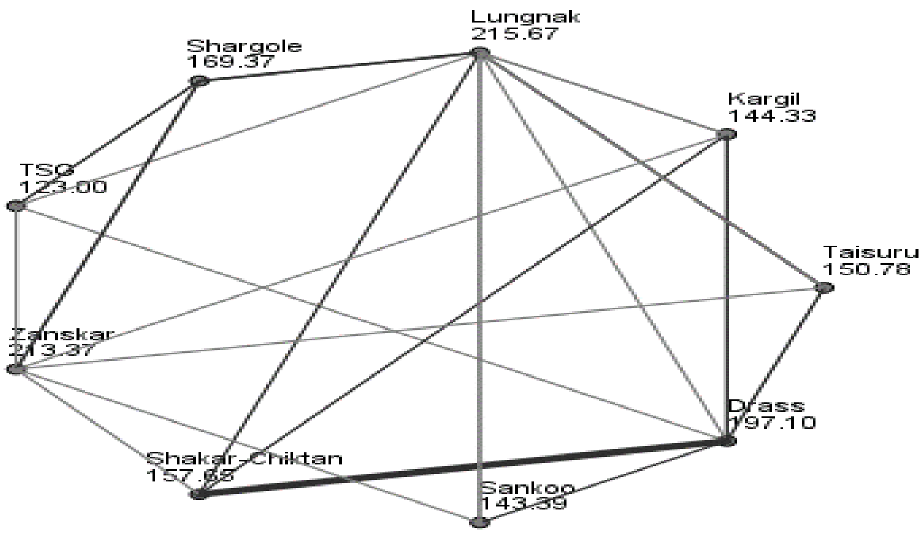


Figure 30 Pairwise ranking of equid holding reported across 9 CD blocks of Kargil.

4.3.3 Livestock Loss

Causes of livestock loss

In total, 79.34% (n= 265) of the 334 respondents reported a loss of livestock due to various causes across the 9 CD blocks of Kargil. Out of the total respondents, 86.49% and 79.47% reported a loss of livestock due to various causes in the Shform akar-Chiktan and Zanskar blocks of the study area, respectively. This was followed by Shargole, Taisuru, and Sankoo, with 78.90 % of the interviewed households reporting a loss of livestock. In Dras and Kargil, 75 % of the respondents stated that they lost livestock due to disease, carnivore predation, extreme weather, and unknown causes. In Lungnak, 80 % (n= 24) of the total 30 respondents reported a loss of livestock due to various reasons for 2019-21. This is also summarized in the cross-tabulation Table 15.

Table 15 Livestock loss reported for various reasons across Kargil for 2019-21.

Block	**Livestock Loss Reported**		**Total respondents**
	No	Yes	
TSG	10	30	40
Dras	10	30	40
Shakar-Chiktan	5	32	37
Shargole	8	30	38
Taisuru	7	30	37
Sankoo	6	31	37
Kargil	9	27	36
Zanskar	8	31	39
Lungnak	6	24	30
Total	69	295	334

A total of 1128 livestock losses from the study area were reported for 2019-21. Of this, 58.86% (n = 664) were reported to be predated by wild carnivores, including feral dogs, 234 (20.75%) were reported due to diseases, followed by extreme weather

13.74% (n= 155), and unknown/unidentified loss (n= 75), which is also summarized in Table 16.

Table 16 Frequency of Livestock loss reported by sampled respondents due to various causes for 2019-21.

Cause of livestock loss	**Frequency of loss (%)**
Carnivore depredation	664 (58.86)
Disease	234 (20.75)
Extreme weather conditions	155 (13.74)
Unknown (Unidentified)	75 (6.65)
Total	**1128 (100%)**

Reports of livestock loss across CD Blocks

The number of livestock losses reported across 9 CD blocks of Kargil due to carnivore predation, disease, extreme weather, and unidentified causes is

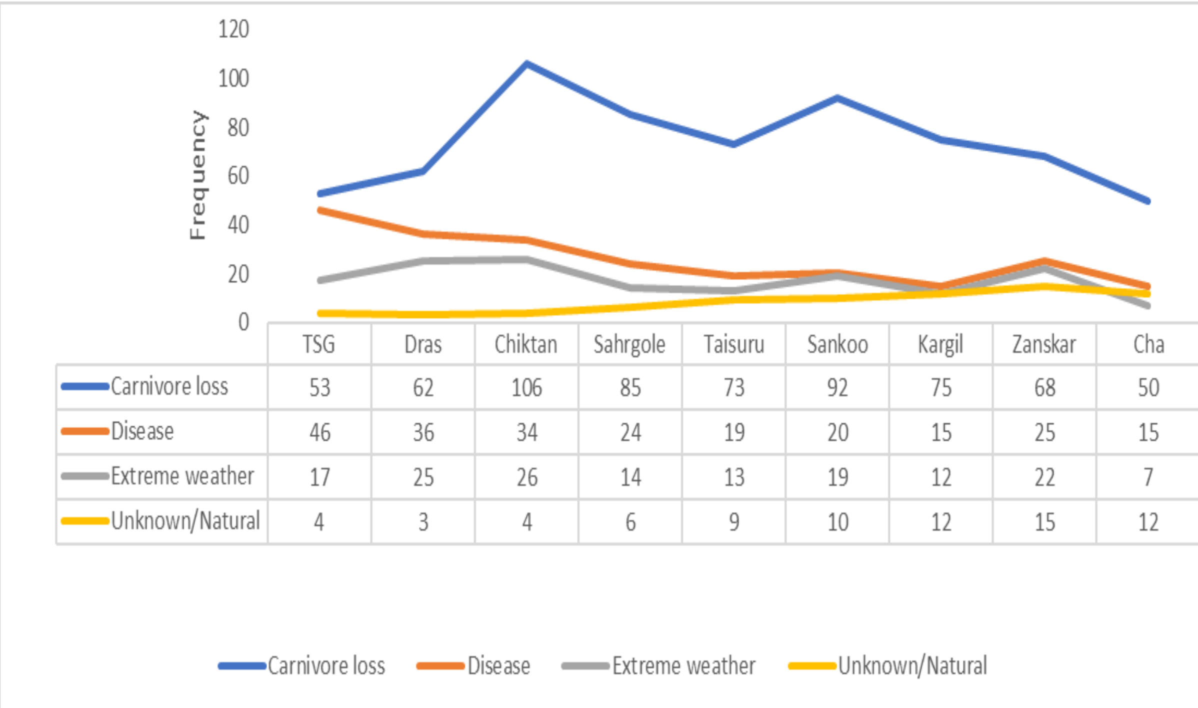


Figure 31 Livestock loss reported by sample respondents due to various causes across the 9 CD blocks.

summarized in Figure 31. For various reasons, an average of 3.38 (±0.73) livestock loss per household for 2019-21 was reported from the study area (Figure 32). This comes to an average loss of 1.56 (±0.37) livestock per household per year. Kruskal Wallis test revealed that the distribution of total livestock loss was the same, $H(8) = 6.220$, $p = 0.623$, across the 9 CD blocks of Kargil. Further, the test revealed no significant difference in the distribution of livestock loss due to carnivores, $H(8) = 7.496$, $p = 0.484$; Disease, $H(9) = 11.229$, $p = 0.189$; and extreme weather, $H(8) = 10.870$, $p = 0.209$ across the 9 CD blocks of Kargil.

Shakar-Chiktan

Among the respondents hailing from the Shakar-Chiktan block, a substantial number reported experiencing livestock loss, with a total of 170 such instances documented. These losses were categorized into different causes, shedding light on the multifaceted challenges faced by the local community.

Predation by wild carnivores and feral dogs emerged as the predominant cause of livestock loss, accounting for 62.35% of the total cases, translating to 106 instances. This finding underscores the significant impact of carnivore predation on the livelihoods and economic well-being of the respondents in this particular block.

In addition to predation, other factors contributed to livestock losses as well. The disease emerged as the second most common cause, responsible for 20.00% of the total livestock loss cases. This highlights the vulnerability of livestock to diseases and the need for effective disease management strategies.

Extreme weather events were also a notable factor, contributing to 13.94% of the total livestock loss cases. This category encompasses adverse weather conditions that can harm livestock, further emphasizing the community's diverse challenges.

It is important to note that in some instances, respondents could not identify or ascertain the specific cause of livestock loss, accounting for 4 cases. This category of "unknown" or unattributed causes signifies the complexity of livestock loss incidents and the difficulties in pinpointing a singular cause.

Sankoo

A total of 141 livestock loss was reported from Sankoo for 2019-21. Of the total livestock loss reported, 65.25 % was due to livestock predation. 14.18% of the total livestock loss was reported due to diseases, and 13.48 % was attributed to extreme weather conditions. In the case of 7.09%, the reason for livestock loss was unknown or unidentifiable by the respondents.

Shargole

From two sampled villages of Shargole block, a total of 170 livestock loss was reported for the year 2019-21. Predation by wild carnivores and feral dogs (65.89%) was reported as the primary cause of livestock loss in the Shargole block. This was followed by 18.60% and 10.85 %, respectively, attributed to disease and extreme weather. In 4.65% of the livestock loss reported, the cause was unknown and not identifiable by the respondent.

Zanskar

130 livestock loss was reported from the two sampled villages of Zanskar block for 2019-21. Of the total livestock loss, 52.31% was reported to be predated by wild carnivores and feral dogs. The respondent did not know the cause for 11.54 % of the livestock loss. 19.23% of the livestock loss was due to disease, and 16.92% was due to extreme weather.

Dras

Respondents from the Dras block reported a total of 126 livestock losses due to various causes. 49.21% of the loss was attributed to predation by wild carnivores and feral dogs. 19.84 % of livestock loss was due to extreme weather conditions. Disease was also responsible for the loss of 28.57% of the total livestock loss. In 2.38% of the total loss, the cause of livestock loss was unknown.

TSG

A total of 120 livestock loss was reported by 40 Households from the two sampled villages TSG block. 44.17% of the livestock loss was reported due to wild carnivores and feral dog predation. 46 (38.33%) livestock loss due to disease was reported from this block. Extreme weather was responsible for 14.17% of the total livestock loss reported from TSG. 3.33% of livestock loss was unknown or identifiable by the respondents.

Taisuru

A total of 114 livestock losses attributed to various causes were reported from the Taisuru CD block of Kargil. 64.04% of the total loss was attributed to predation by wild carnivores and feral dogs. In 14.18 % of the total loss, disease was the cause of livestock loss, followed by extreme weather with 11.40 %. In 9 cases, the cause for the livestock loss was unknown/natural.

Kargil

Two sampled villages of the Kargil block reported a total loss of 114 livestock for 2019-21. 65.79% of the total loss was attributed to predation by wild carnivores and feral dogs. Disease was reported as the cause of 13.16% of the total livestock loss. 10.53% of the livestock loss was reported due to extreme weather. In 10.53 % (n = 12) of the total livestock loss, the cause was unknown or unidentifiable.

Lungnak

Respondents from Lungnak CD block reported a total loss of 84 livestock for the year 2019-21. 59.52% of the total livestock loss was due to predation by wild carnivores and feral dogs. 17.86% and 8.33% of the loss were reported due to disease and extreme weather. In 14.29% (n=12), the cause for the livestock loss was unknown.

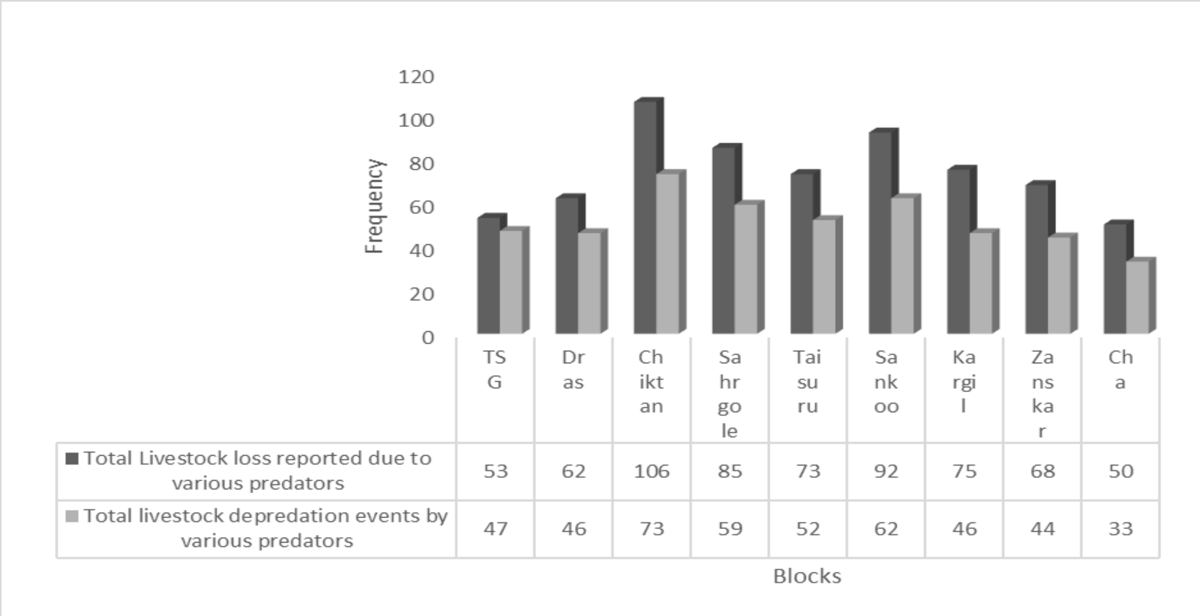
4.3.4 Reported livestock depredation pattern by various predators across Kargil

A total of 462 livestock depredation incidents by various large carnivores and feral dogs were reported across the study area, resulting in the loss of 664 livestock (Table 17 and Figure 32). The Himalayan brown bear was reported as the primary carnivore responsible for livestock depredation with 191 kills, followed by the snow leopard with 165 kills and the fox with 111 kills. Wolves were responsible for 18.37 % of the total kills. Feral dogs were also reportedly responsible for 75 livestock kills.

Table 17 Livestock loss reported by various predators for the year 2019-21 in the Kargil region.

Carnivore Species	Total kills reported (%)	Total livestock depredation incidents (%)
Snow leopard	165 (24.85)	92 (19.91)
Himalayan Brown Bear	191 (28.77)	112 (24.24)
Wolf	122 (18.37)	95 (20.56)
Fox	111 (16.72)	109 (23.59)
Dogs	75 (11.30)	54 (11.69)
Total	664 (100)	462 (100)

An average of 1.99 (± 0.173) livestock loss per household was reported for the year 2019-21 due to wild carnivore and feral dog predation (Figure 33)



	TSG	Dras	Chiktan	Sahrgole	Taisuru	Sankoo	Kargil	Zanskar	Cha
Total Livestock loss reported due to various predators	53	62	106	85	73	92	75	68	50
Total livestock depredation events by various predators	47	46	73	59	52	62	46	44	33

Figure 33 Reported livestock predation incidents and loss across 9 CD blocks of Kargil for the year 2019-21.

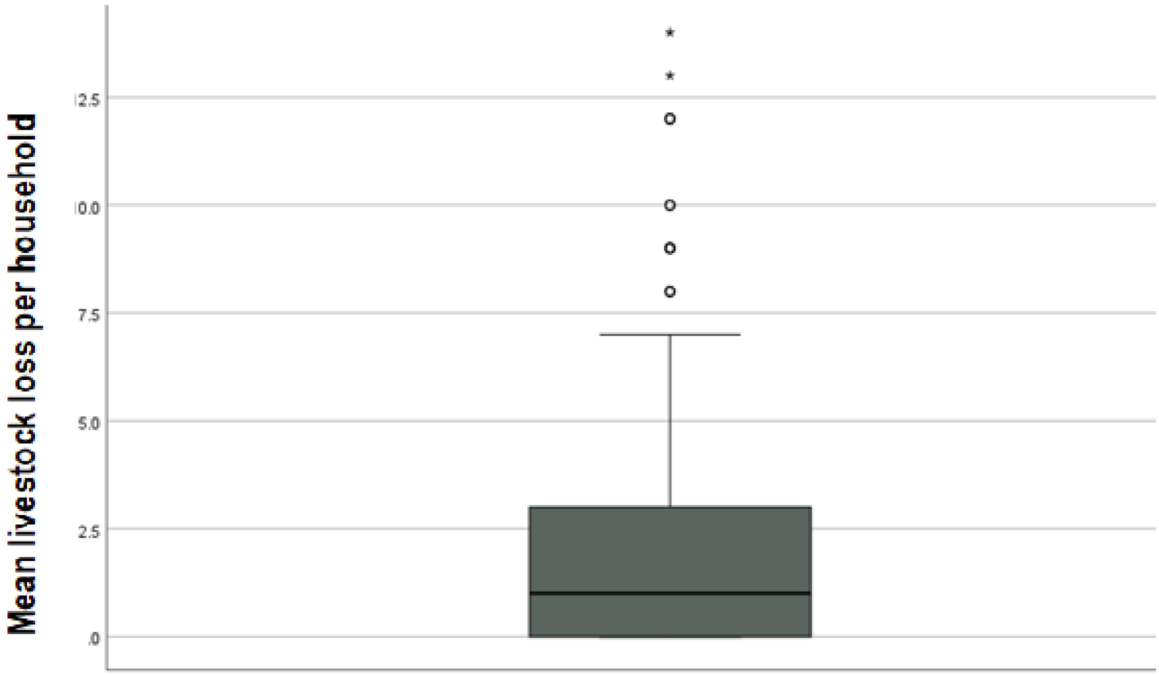


Figure 32 Box plot for mean livestock head loss per household reported for the year 2019-21 in Kargil region, India (the circles and asterisks displays the outliers and extreme outliers).

Type of livestock loss reported due to various carnivores.

Of the total 664 livestock losses by various predators reported across Kargil, poultry birds were the primary victims of wild carnivores with 40.55%, followed by sheep with 256 individuals (176 adults, 80 young). The goat was also reported to be

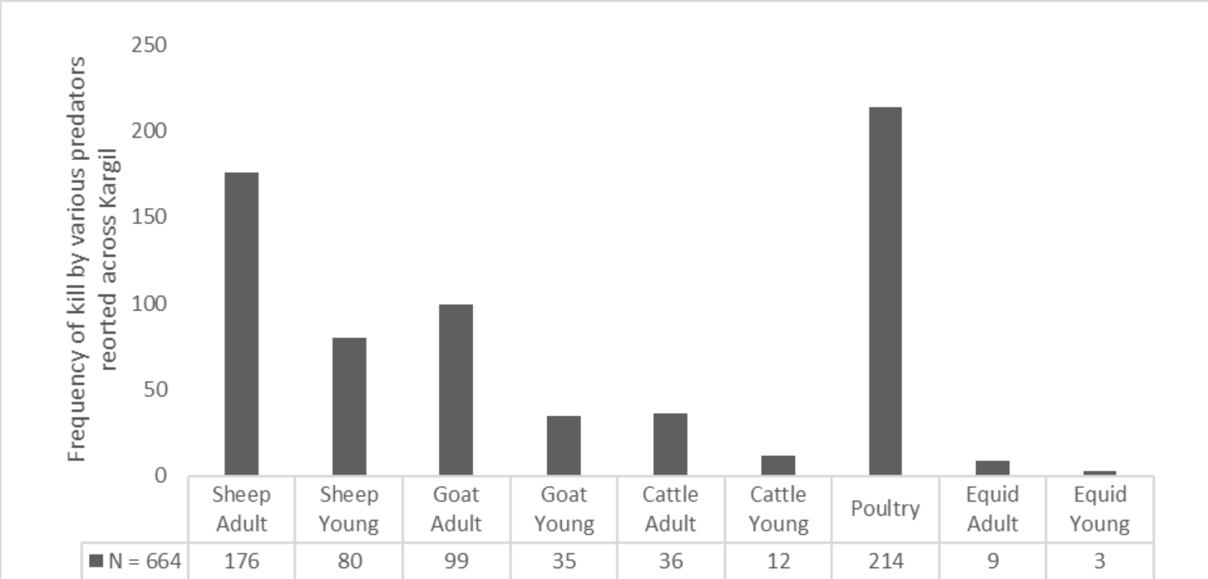


Figure 34 Type of livestock loss reported by the sampled respondents for the year 2019-21.

predated upon by wild carnivores, with 124 of the total livestock kills comprising 99 adults and 35 young goats. Cattle and equids were reported as the least predated livestock, with 4.51% and 0.10% of the total livestock kills, respectively (Figure 34).

Block-wise distribution of livestock predation

The spatial maps presented in Figures 35 and 36 visually represent the distribution of livestock predation incidents across the diverse CD (Community Development) blocks within the Kargil region.

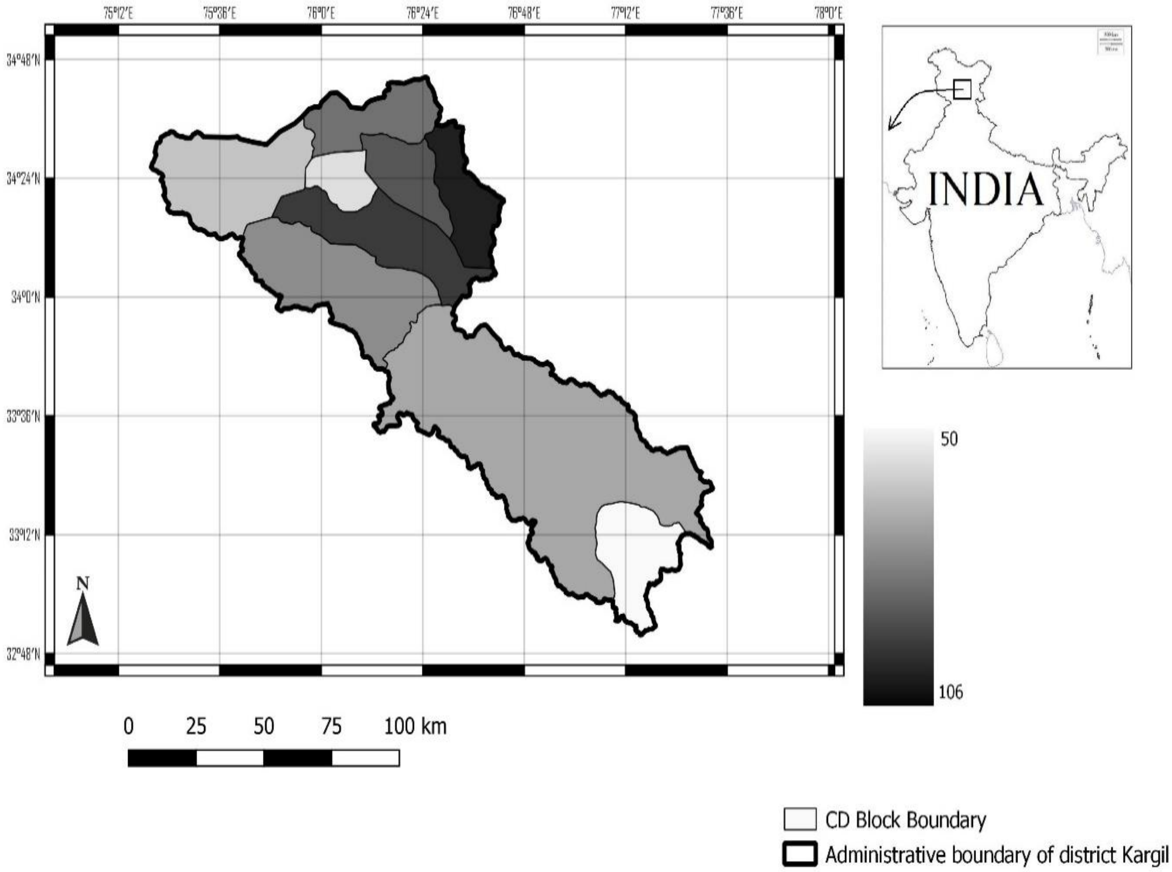


Figure 35 Spatial map showing the distribution of livestock loss due to predation across the 9 CD blocks of Kargil for the year 2019-21 (n = 664).

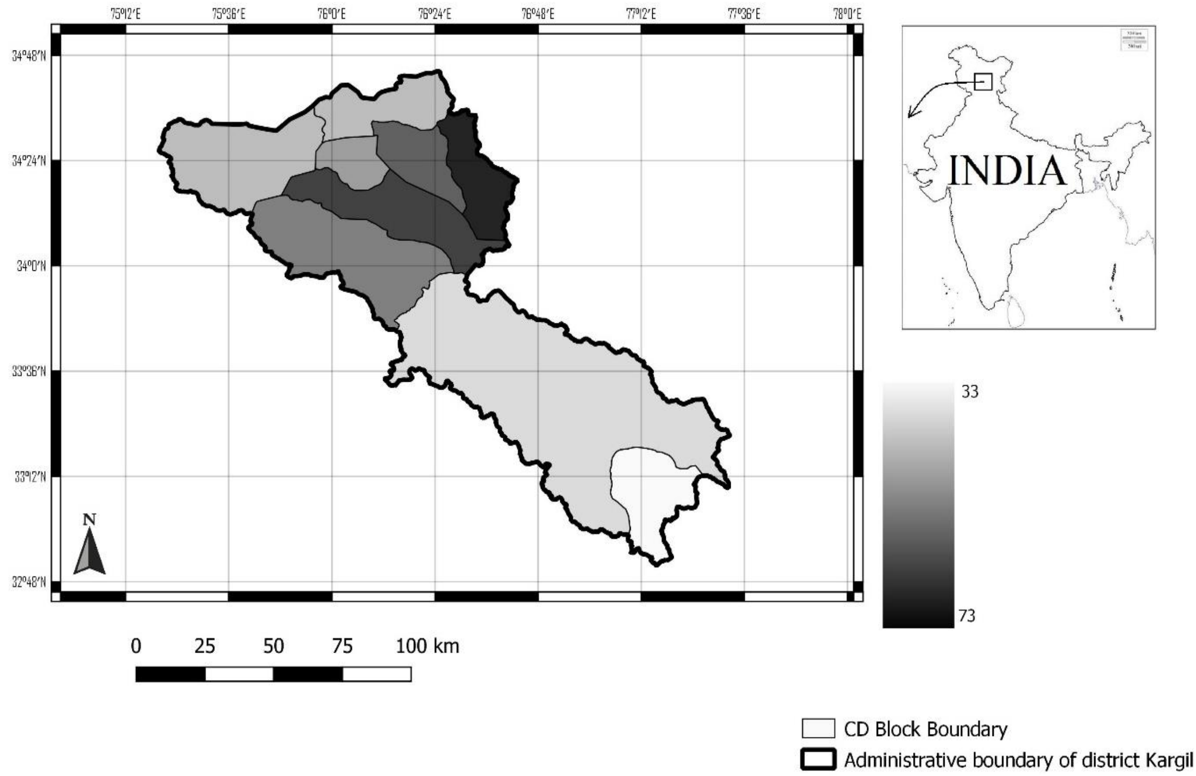


Figure 36 Spatial map showing the distribution of livestock predation incidents across the 9 CD blocks of Kargil for the year 2019-21 (n = 462).

Snow Leopard

Livestock depredation by snow leopard across 9 CD blocks

A total of 92 livestock depredation incidents resulting in 165 livestock losses were reported due to snow leopards across the 9 CD blocks of Kargil (Figure 38). A mean of 0.49(±1.225) livestock loss per household was reported due to snow leopards across the 9 CD blocks of Kargil for the year 2019-21. Shakar-Chiktan block reported the highest livestock kills due to snow leopards, with 35 livestock losses attributed to snow leopards, followed by Zanskar with 25 kills. Dras block reported the lowest loss (n = 6) of livestock due to predation by snow leopards. The spatial distribution of livestock kills due to snow leopards is given in Figure 37.

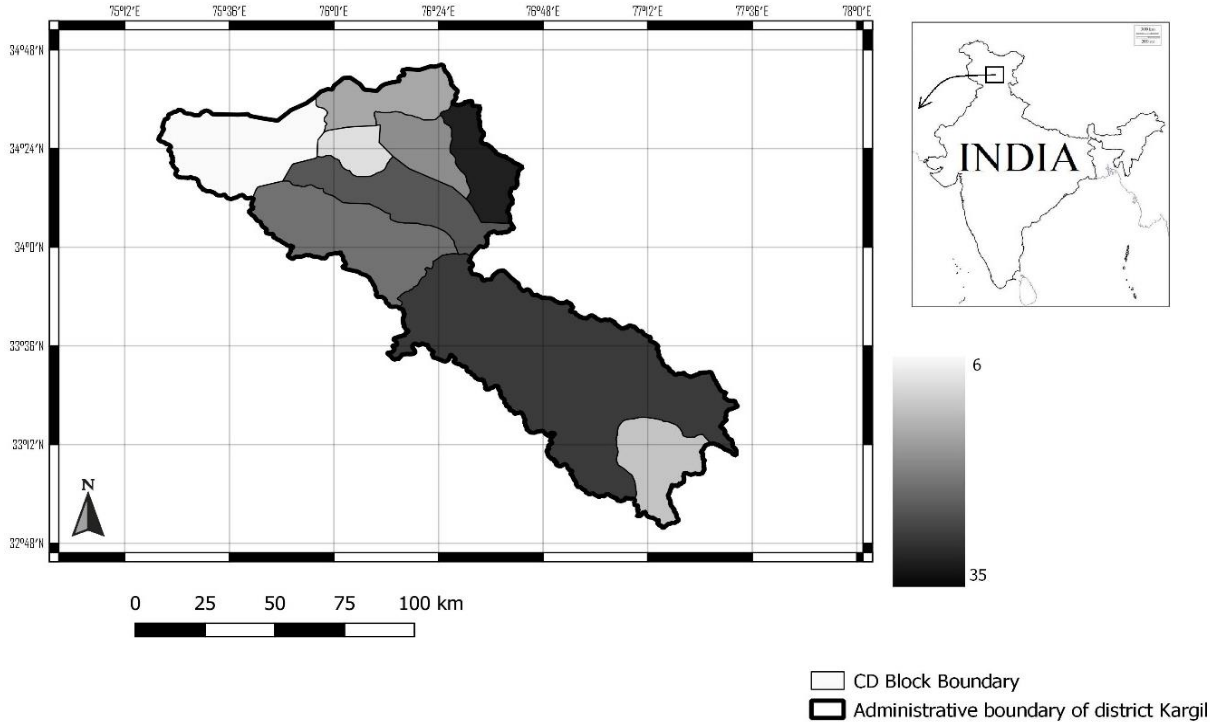
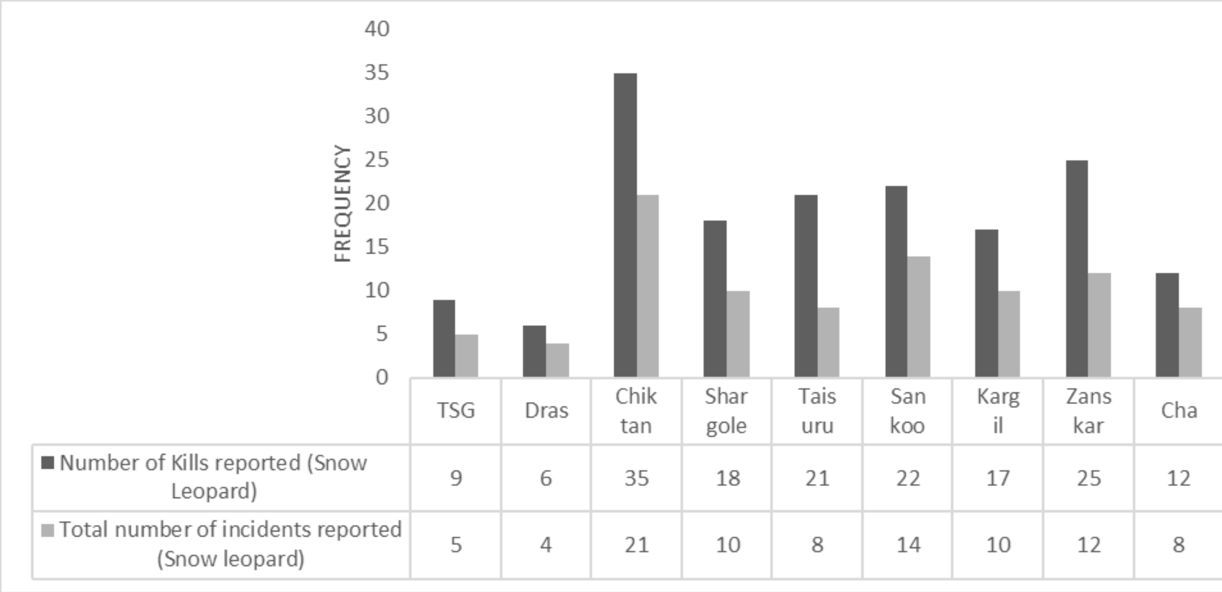


Figure 37 Distribution of livestock kills reported due to snow leopard across the 9 CD block of Kargil for the year 2019-21.



	TSG	Dras	Chik tan	Shar gole	Tais uru	San koo	Karg il	Zans kar	Cha
Number of Kills reported (Snow Leopard)	9	6	35	18	21	22	17	25	12
Total number of incidents reported (Snow leopard)	5	4	21	10	8	14	10	12	8

Figure 38 Frequency of livestock kill by snow leopard across the 9 CD block.

Kruskal Wallis test revealed that the distribution in the pattern of livestock predation by snow leopards was significantly different, H (8) = 18.572, p= 0.017, across the 9 CD blocks of Kargil. The mean rank for livestock depredation by snow leopard reported across the 9 CD blocks is given in (Figure 39).

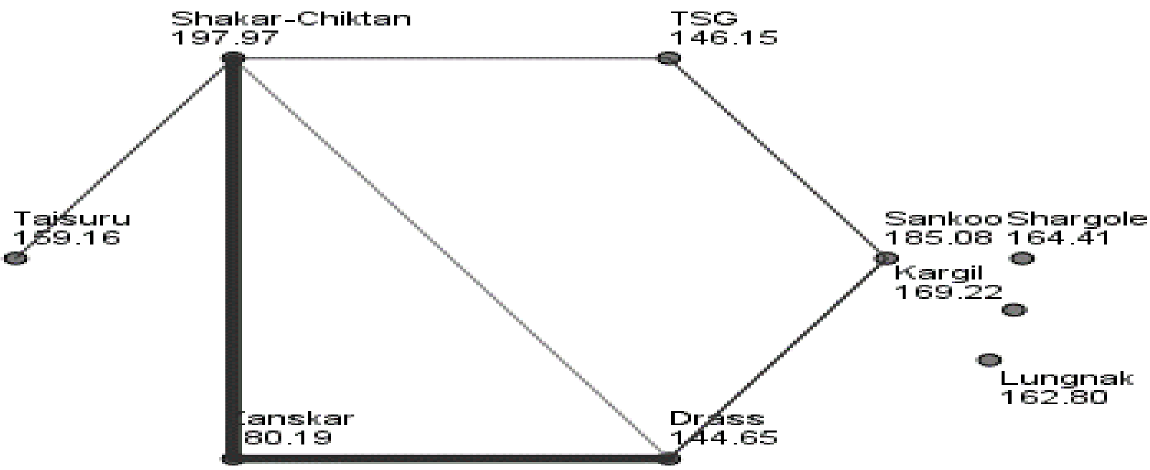


Figure 39 Pairwise comparison of livestock kills by snow leopard reported across 9 CD blocks. (Each node shows the sample average rank of CD block).

Snow leopard and type of livestock loss reported

57.23% of the total kills reported due to snow leopards comprised of sheep, followed by goats with 21.81% (Figure 40). Snow leopards also tend to predate on domestic birds (poultry), with 11.51% of the total livestock loss reported due to snow leopards comprised of poultry. In 16 instances, snow leopards were also reported to predate on cattle (4 adults, five calves) and equids (4 adults and three calves).

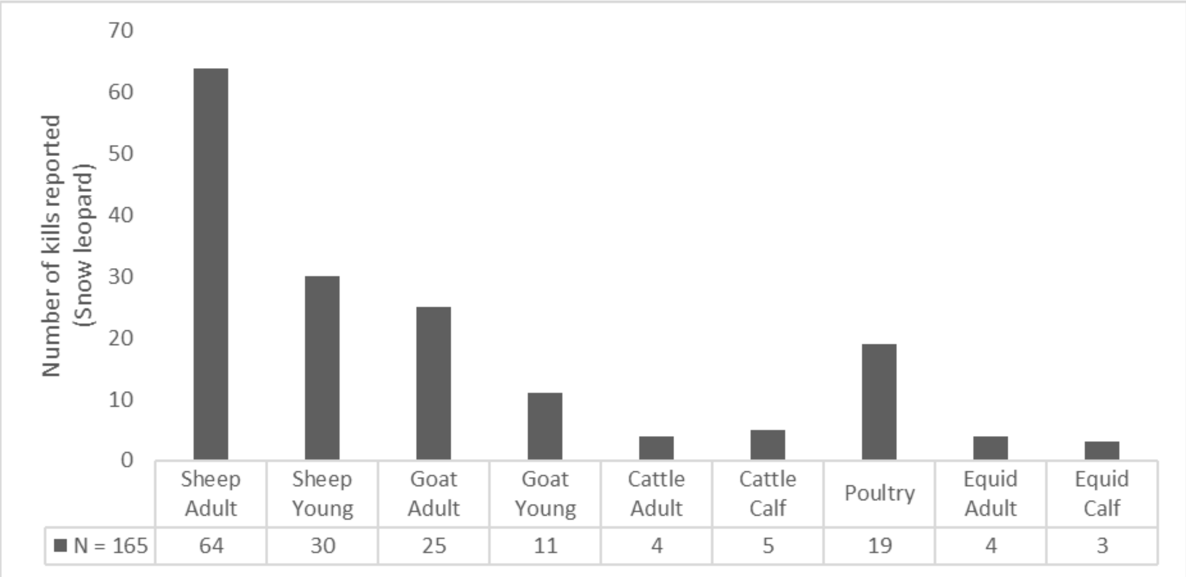


Figure 40 Type of livestock kill by snow leopard reported across the study area.

Himalayan Brown Bear

Livestock depredation by Himalayan brown bear across 9 CD blocks

A total of 112 livestock depredation incidents resulting in 191 livestock loss was reported due to Himalayan brown bears across 9 CD blocks of Kargil (Figure 42). A mean of 0.57 livestock loss per household per year was reported due to brown bears across 9 CD blocks of Kargil. Shargole block reported the highest livestock kills due to brown bears, with 35 livestock losses attributed to brown bears, followed by Dras with 29 kills. Shakar-Chiktan block reported the lowest livestock loss (n = 6) due to predation by Himalayan Brown bears. The spatial distribution of livestock kills due to Himalayan brown bears is given in Figure 41.

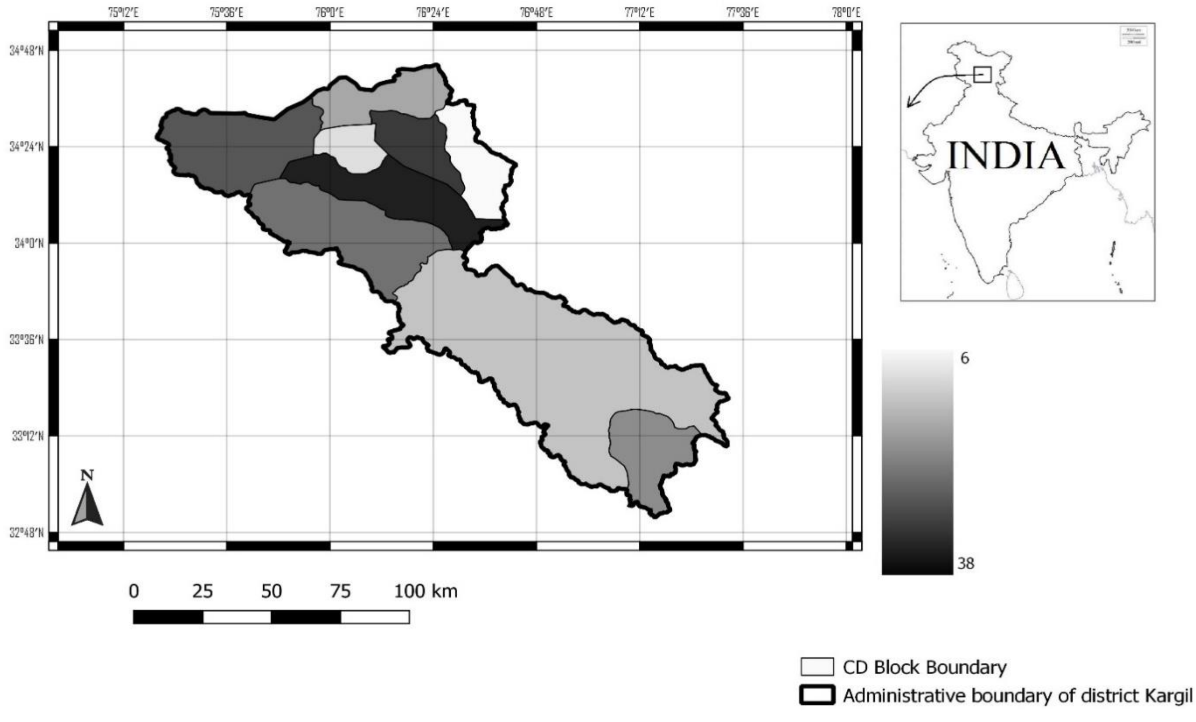
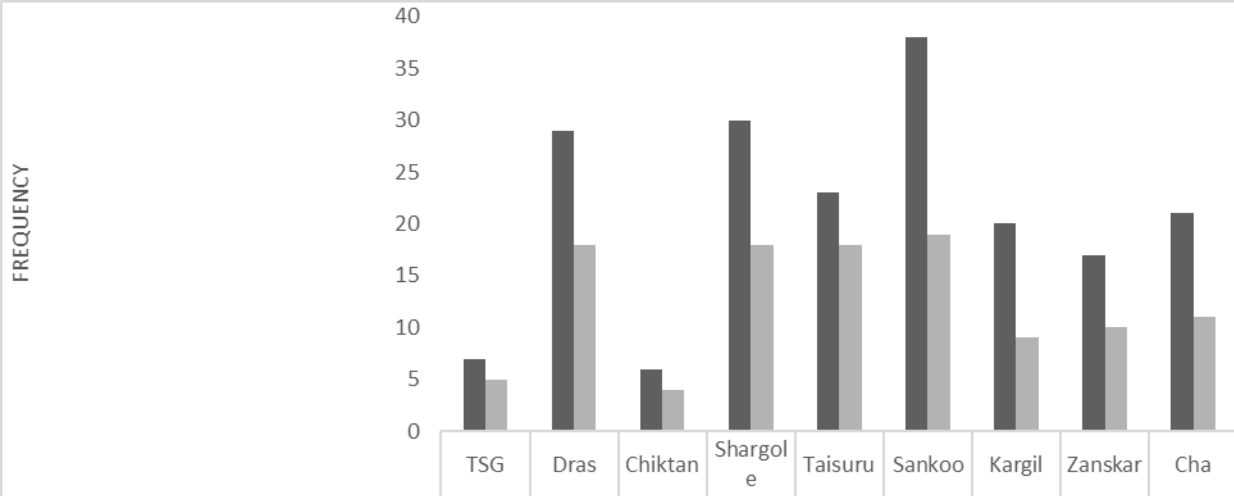


Figure 41 Distribution of reported livestock depredation by brown bear across 9 CD blocks of Kargil for the year 2019-21.



	TSG	Dras	Chiktan	Shargole	Taisuru	Sankoo	Kargil	Zanskar	Cha
Total number of kills reported (Himalayan Brown bear)	7	29	6	30	23	38	20	17	21
Total number of livestock depredation incidents reported (Himalayn Brown Bear)	5	18	4	18	18	19	9	10	11

Figure 42 Frequency of livestock depredation by snow leopard across 9 CD blocks.

The distribution pattern of livestock predation by the Himalayan brown bear was not the same, H(8) = 19.918, p= 0.011, across the 9 CD blocks of Kargil (Figure 43).

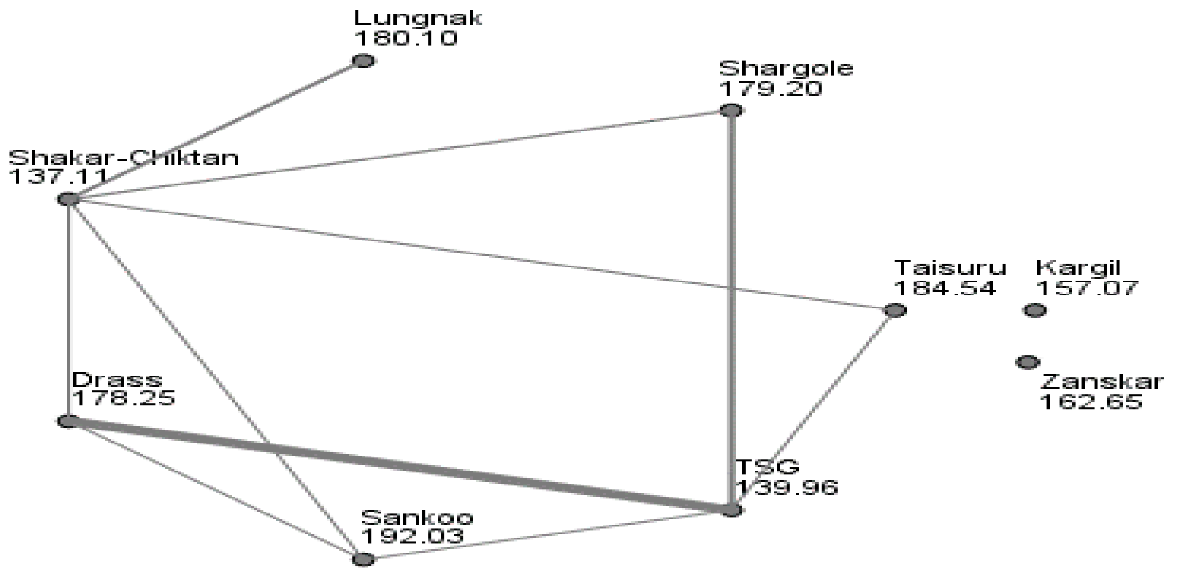


Figure 43 Pairwise comparison of livestock depredation by brown bear across 9 CD blocks. Each node shows the sample average rank.

Brown bear and type of livestock loss

Sheep (n = 90) were reported as the primary victims of depredation by Himalayan brown bears, followed by goats (n = 50) across the study area (Figure 44).

This subspecies of brown bears also predated on large domestic livestock, like cattle (n= 37) and Equids (n= 5) in the study area.

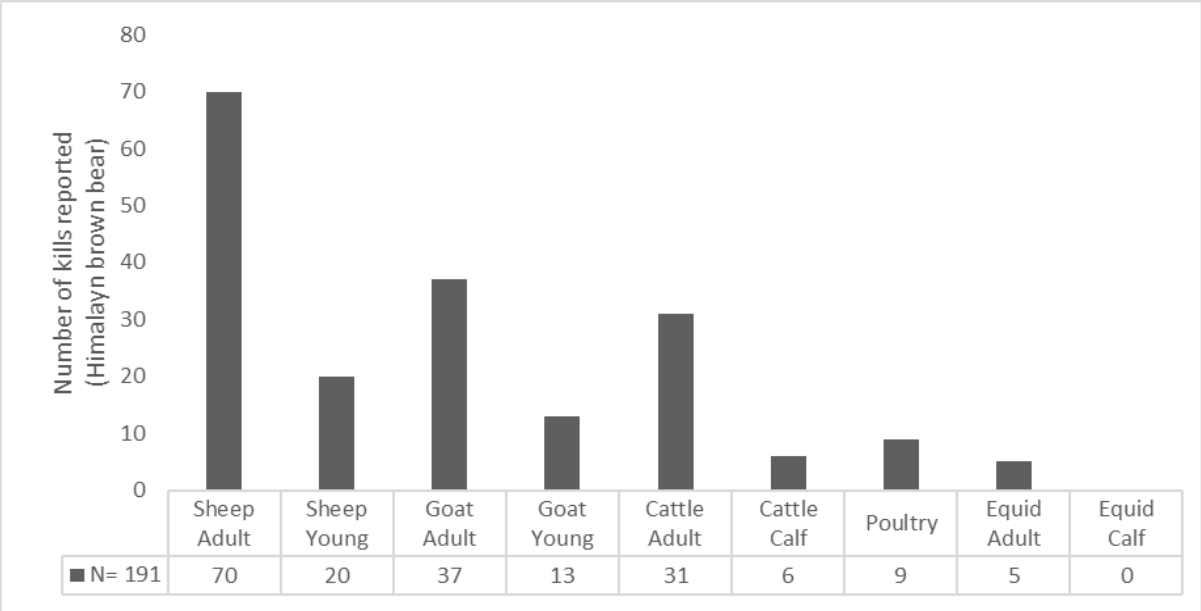


Figure 44 Type of livestock kills by brown bear reported across the study area.

__Wolf__

Livestock depredation by wolves across 9 CD blocks

A total of 122 livestock losses were reported due to wolves in the study area in 95 depredation incidents (Figure 45 and Figure 46). 26.05% (n= 87) of the total 334 respondents stated that they lost livestock due to predation by wolves. Chiktan block (n = 22) reported the highest number of kills attributed to wolves, followed by the TSG block, Sankoo block, and Lungnak Block, with 15 livestock kills each. Dras block reported the lowest kills attributed to predation by wolves.

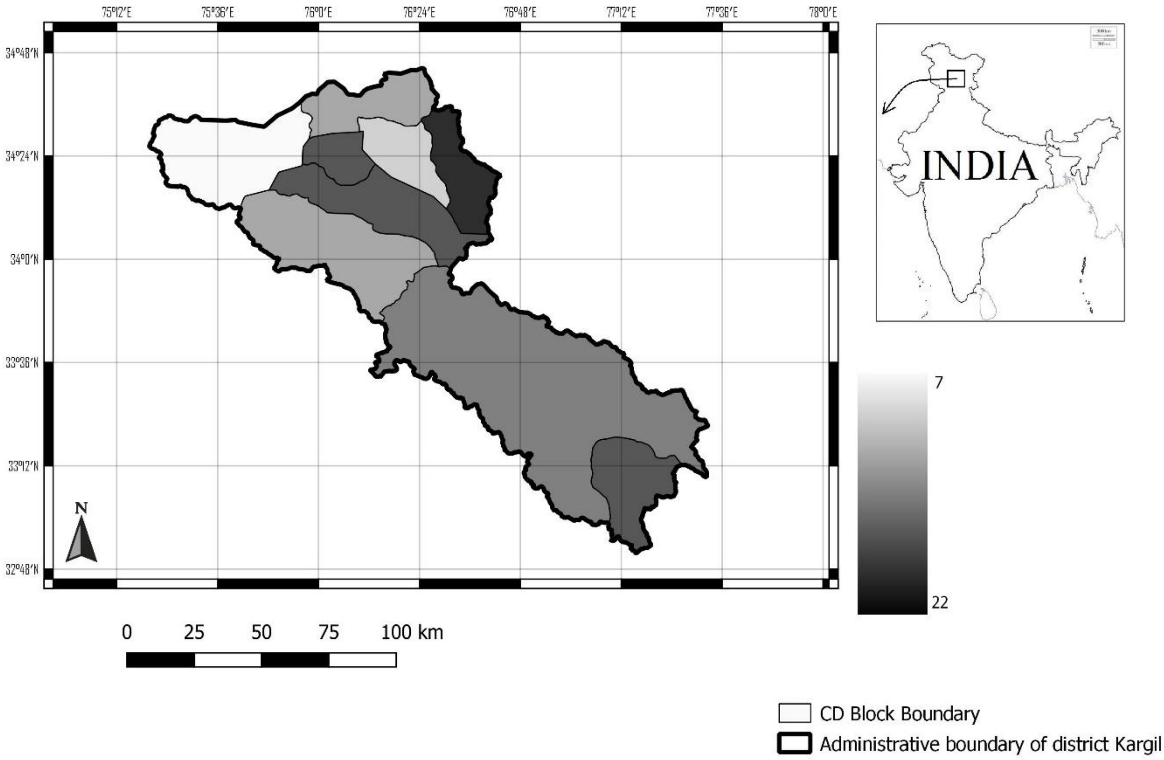


Figure 45 Distribution of livestock depredation by wolves across the 9 CD blocks of Kargil.

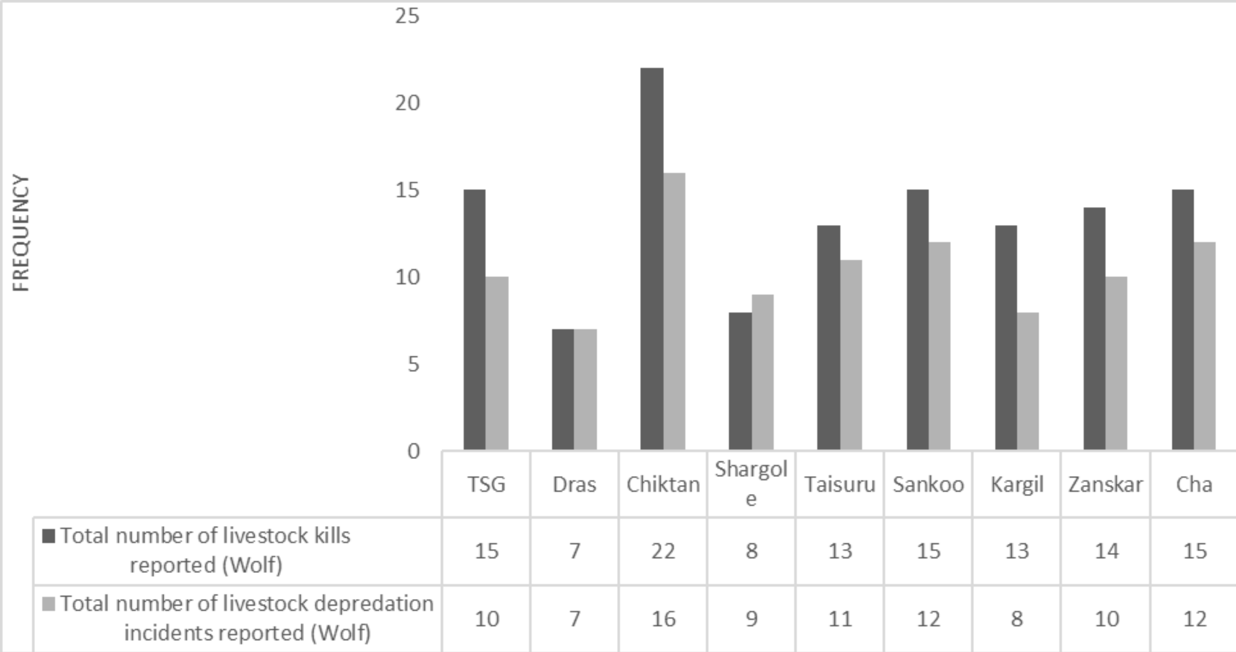


Figure 46 Frequency of livestock kills reported due to wolves across 9 CD block.

Kruskal Wallis test revealed that the distribution pattern of livestock predation by wolves was the same, H (8) = 0.517, p= 0.301, across the 9 CD blocks of Kargil.

Wolf and type of livestock loss

Sheep (n = 55) and goats (n = 46) were reported as the main victims of depredation by wolves, together forming ~82.78% of the total livestock loss attributed to wolves (Figure 47). 15.57% of the total loss attributed to wolves comprises poultry. Although

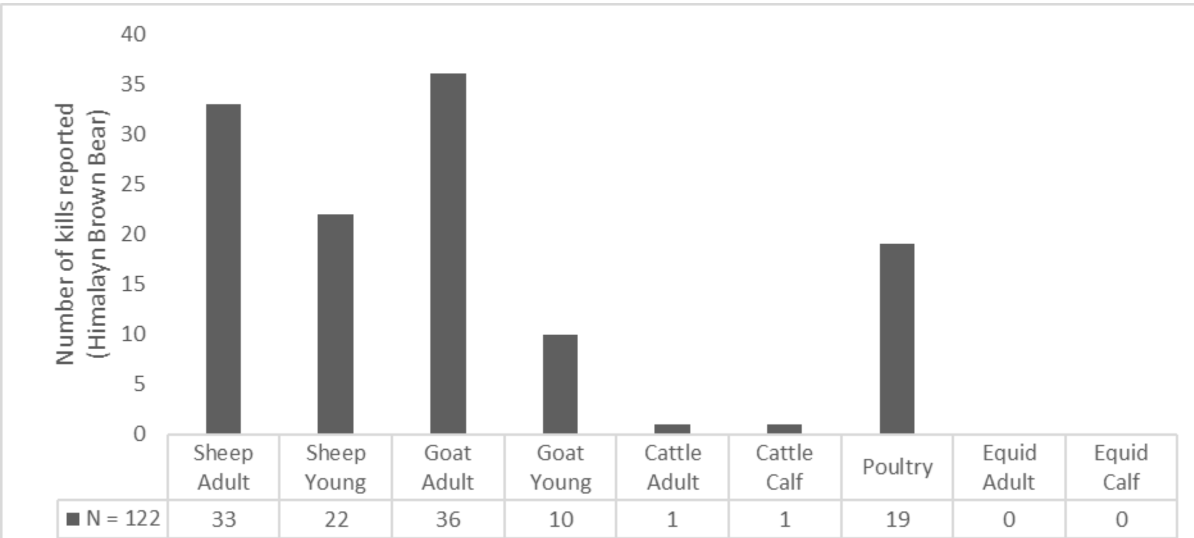


Figure 47 Type of livestock loss reported due to wolves depredation.

there were no reports of wolves' predation of equids, in two instances, wolves were reported to predate upon cattle (1 adult, one calf).

Fox

Livestock depredation by fox across 9 CD blocks

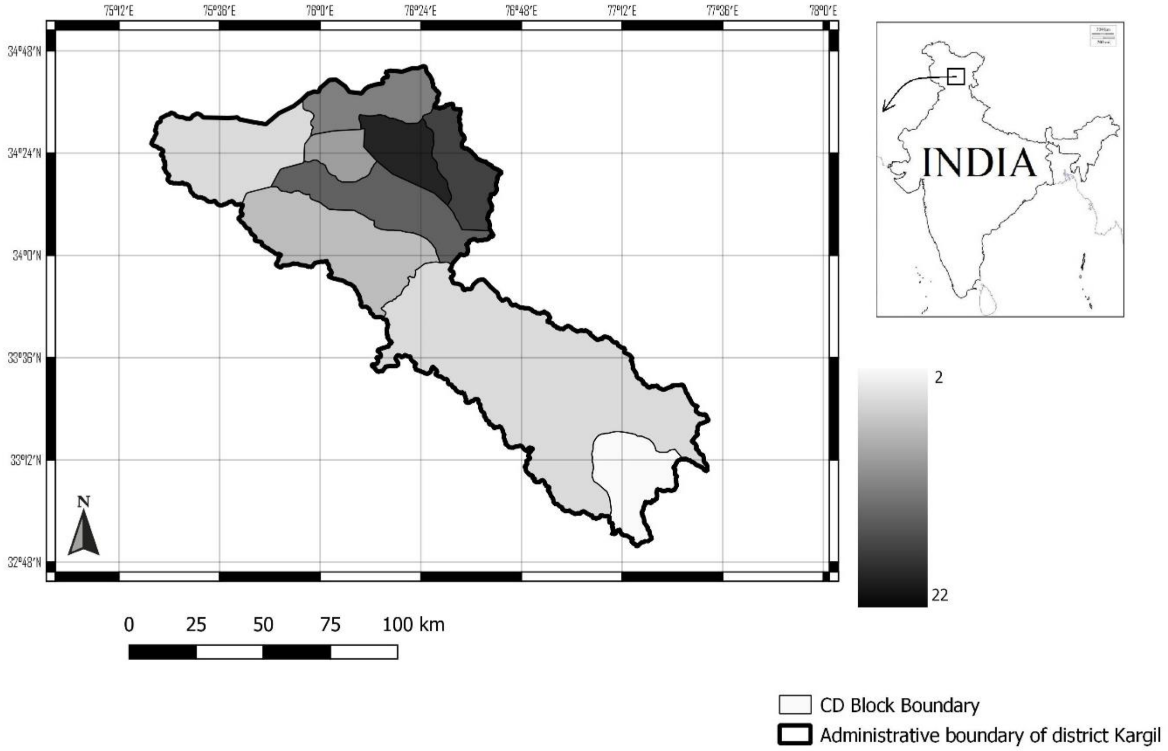


Figure 48 Distribution of livestock depredation by fox across 9 CD blocks of Kargil for the year 2019-21.

One hundred nine livestock depredation incidents resulting in 111 livestock kills were reported due to foxes across the 9 CD blocks of Kargil (Figure 49). A mean of 0.33 (±0.702) livestock loss per household was reported due to fox across the 9 CD blocks of Kargil for 2019-21. Shargole block reported the highest number of livestock kills due to foxes, with 22 livestock losses attributed to foxes, followed by Chiktan and Sankoo, with reports of 20 and 16, respectively. Lungnak block reported the lowest livestock (n = 2) predation by fox. The spatial distribution of livestock kills due to foxes is given in Figure 48.

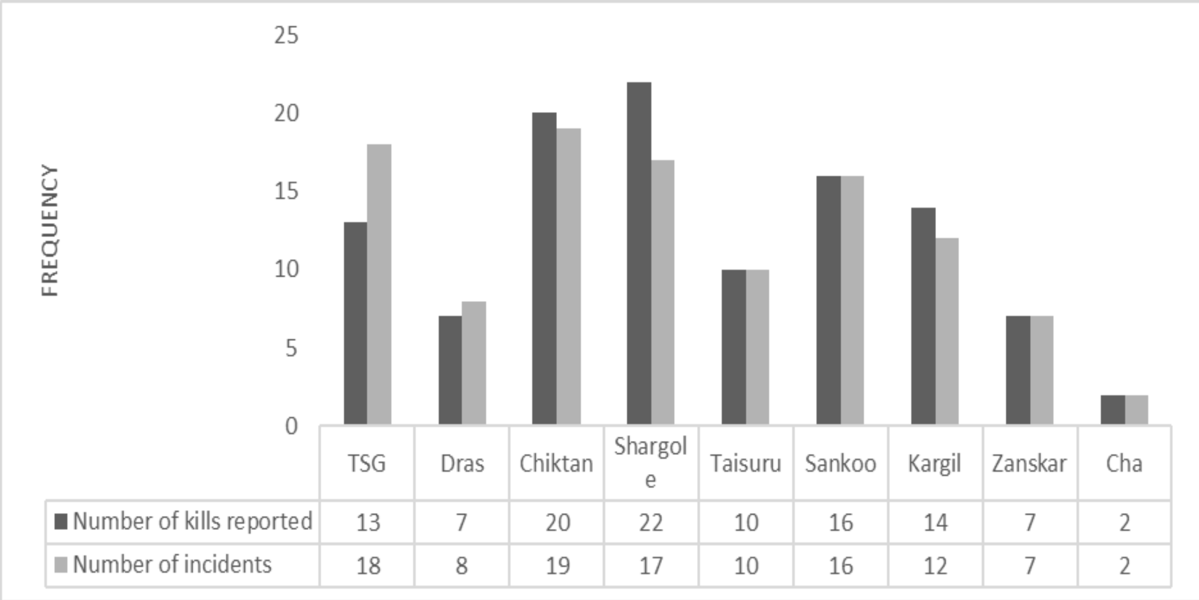


Figure 49 Frequency of livestock kills reported due to fox across the 9 CD blocks of Kargil.

The distribution pattern of livestock predation by fox was the same, $H(8) = 0.517$, $p = 0.141$, across the 9 CD blocks of Kargil.

Fox and type of livestock loss

97.29% (n = 108) of the total 111 livestock losses reported due to foxes comprised of poultry (domestic birds) (Figure 50). In three instances, the fox was reported to predate on sheep (1 adult, two young).

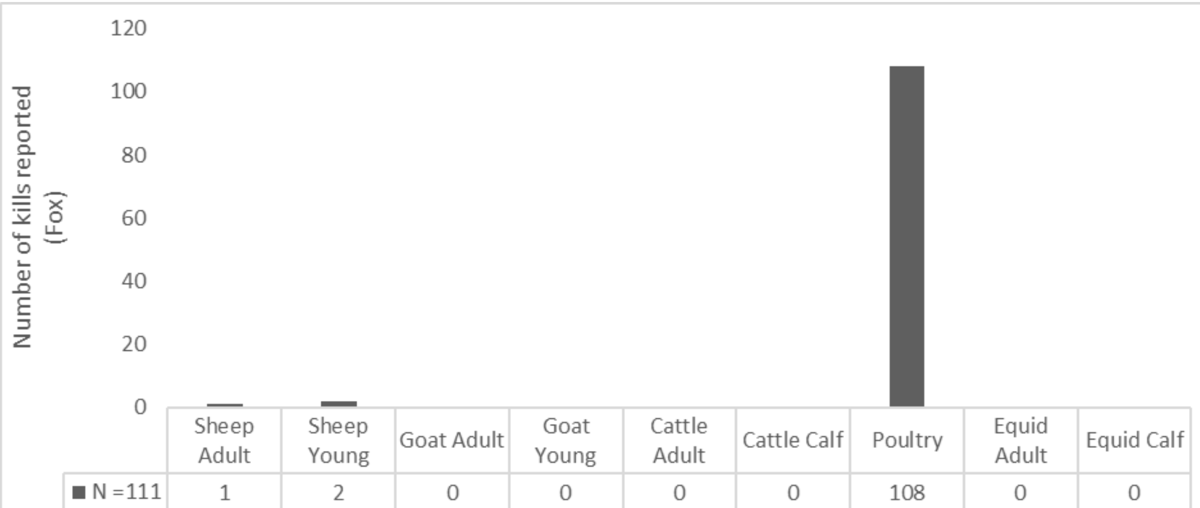


Figure 50 Type of livestock kills reported due to fox.

Feral dogs

Livestock depredation by feral dogs across 9 CD blocks

With a mean of 0.22 (± 0.606) livestock loss per household for 2019-21, a total of 75 livestock losses were reported due to feral dogs in the study area resulting from 95 depredation incidents (Figure 51 and Figure 52). 16.17% (n= 54) of the total 334 respondents stated that they lost livestock due to predation by feral dogs. Chiktan Block (n = 23) reported the highest number of kills attributed to wolves, followed by Dras Block, Kargil Block, and TSG Block with 13, 11, and 9 livestock kills, respectively. Lungnak Block did not report any loss of livestock by feral dogs.

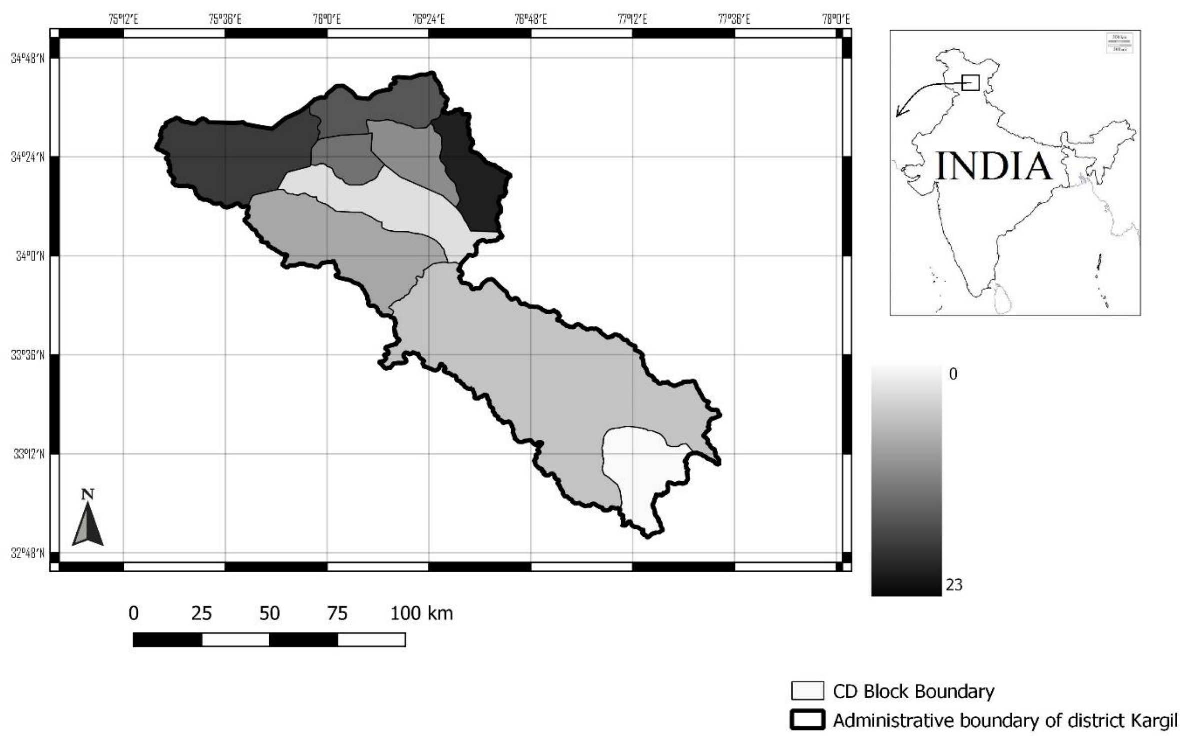
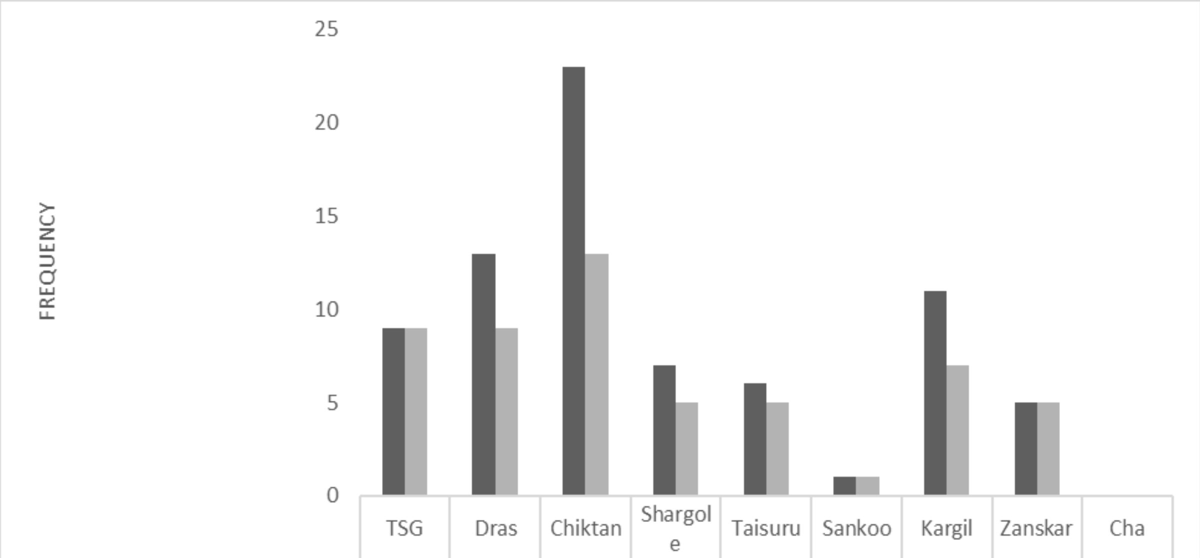


Figure 51 Distribution of livestock kills reported due to feral dogs across Kargil for the year 2019-21.



	TSG	Dras	Chiktan	Shargole	Taisuru	Sankoo	Kargil	Zanskar	Cha
Number of kills reported	9	13	23	7	6	1	11	5	0
Number of incidents reported	9	9	13	5	5	1	7	5	0

Figure 52 Type of livestock kills reported due to feral dogs.

Kruskal-Wallis test revealed a significant difference in the distribution pattern of livestock predation by feral dogs, H (8) = 27.957, p< 0.001, across the 9 CD blocks of Kargil (Figure 53).

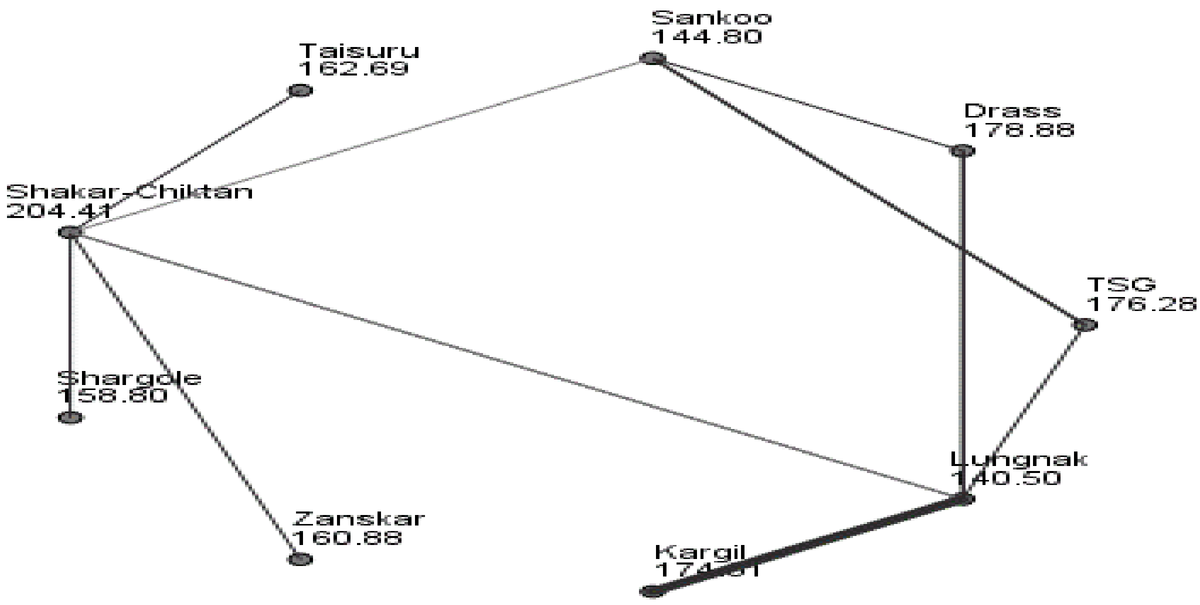


Figure 53 Pairwise comparison of livestock kills by feral dogs across 9 CD blocks of the study area. Each node shows the sample average rank of block.

Feral dogs and types of kills

78.66% of the livestock loss attributed to feral dogs comprises poultry (domestic birds) (Figure 54). In 16 instances, dogs were also reported to predate on sheep (n =14) and goats (n = 2).

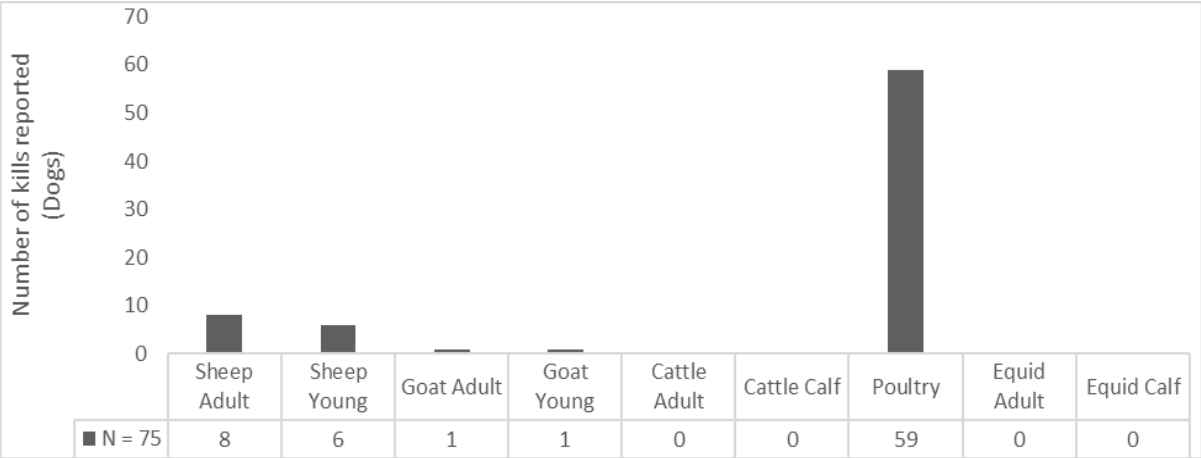


Figure 54 Type of livestock kills reported due to feral dogs.

Seasonal pattern of livestock depredation

Table 18 Seasonal pattern of livestock depredation pattern by various predators reported from the study area.

Species	Season: Summer	Winter	Spring	Autumn	Total Livestock depredation incidents
Snow Leopard	17	34	29	12	92
Bear	5	7	11	89	112
Wolves	17	43	28	7	95
Fox	26	36	31	16	109
Feral Dogs	18	19	9	8	54
Total	83	139	108	132	462

Most livestock depredation incidents were reported during the winter, followed by autumn and spring (Table 18 and Figure 55).

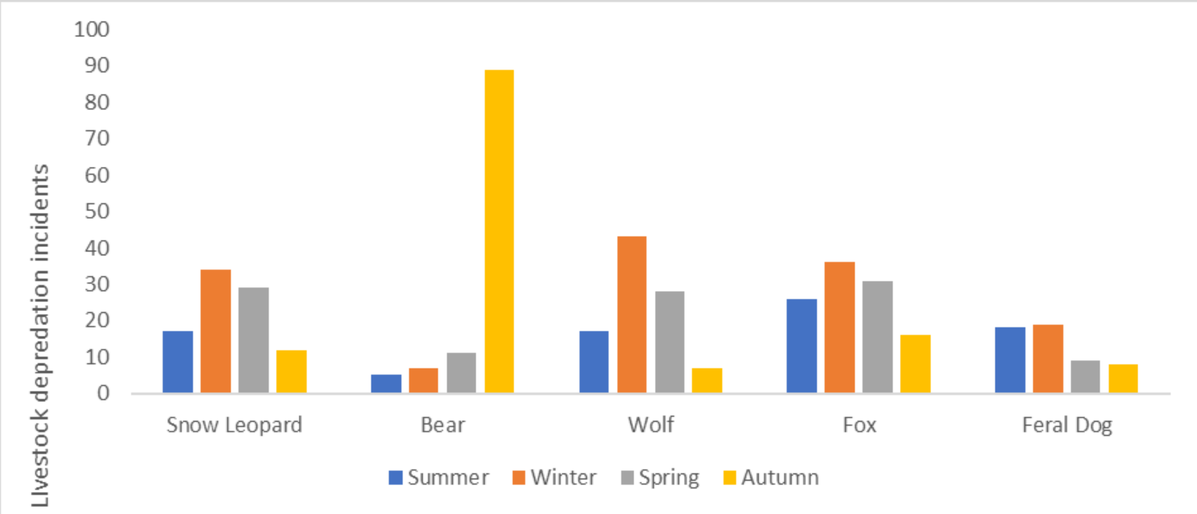


Figure 55 Graphical representation of seasonal pattern of livestock depredation.

Snow Leopard

There was a significant difference in the livestock depredation pattern by snow leopards across the various seasons χ^2 (3) = 13.652, p = 0.003. The majority of the incidents by snow leopards were reported during the winter (n= 34), followed by spring (n = 29) (Table 19).

Table 19 Observed expected count and residual livestock depredation incidents by snow leopards across the various seasons.

Season	Observed N	Expected N	Residual
Summer	17	23.0	-6.0
Winter	34	23.0	11.0
Spring	29	23.0	6.0
Autumn	12	23.0	-11.0
Total	92		

Brown Bear

Most brown bear attacks on livestock were reported during Autumn (n = 89). There was a significant difference in livestock depredation incidents by brown bears across the four seasons χ^2 (3) = 177.857, $p < 0.001$ (Table 20).

Table 20 Observed expected count and residual of livestock depredation incidents by brown bears across various seasons.

Season of attack	Observed N	Expected N	Residual
Summer	5	28.0	-23.0
Winter	7	28.0	-21.0
Spring	11	28.0	-17.0
Autumn	89	28.0	61.0
Total	112		

Wolf

Statistically, the distribution of livestock depredation by wolves was not the same across the various seasons χ^2 (3) = 30.095, $p <0.001$ (Table 21).

Table 21 Observed, expected count and residual livestock depredation incidents by wolves across the various seasons.

Season of attack	Observed N	Expected N	Residual
Summer	17	23.8	-6.7
Winter	43	23.8	19.3
Spring	28	23.8	4.3
Autumn	7	23.8	-16.7
Total	95		

Fox

Statistically, the reports of livestock predation by foxes were not different across the various seasons, χ^2 (3)= 8.028, p = 0.045 (Table 22).

Table 22 Observed, expected count and residual livestock depredation incidents by fox across the various seasons.

Season of attack	Observed N	Expected N	Residual
Summer	26	27.3	-1.2
Winter	36	27.3	8.8
Spring	31	27.3	3.8
Autumn	16	27.3	-11.2
Total	109		

Feral Dogs

There was no significant difference in the pattern of livestock depredation incidents reported across various seasons by feral dogs χ^2 (3) = 7.481, p = 0.058 (Table 23).

Table 23 Observed, expected count and residual livestock depredation incidents by feral dogs across the various seasons.

	Observed N	Expected N	Residual
Summer	18	13.5	4.5
Winter	19	13.5	5.5
Spring	9	13.5	-4.5
Autumn	8	13.5	-5.5
Total	54		

Location of reported livestock depredation incidents

The majority of the livestock depredation by various predators was reported to take place in livestock sheds (n = 210), followed by around villages in the open (n = 197) Table 24 and Figure 56).

Table 24 Reported location of livestock depredation by various predators across the study area for the year 2019-21.

	Location of attack			
Species	Shed	Around village (in open)	Pasture	Total Livestock depredation incidents
Snow Leopard	54	16	22	92
Bear	76	8	28	112
Wolves	40	51	4	95
Fox	33	76	0	109
Feral Dogs	7	46	1	54
Total	210	197	55	462

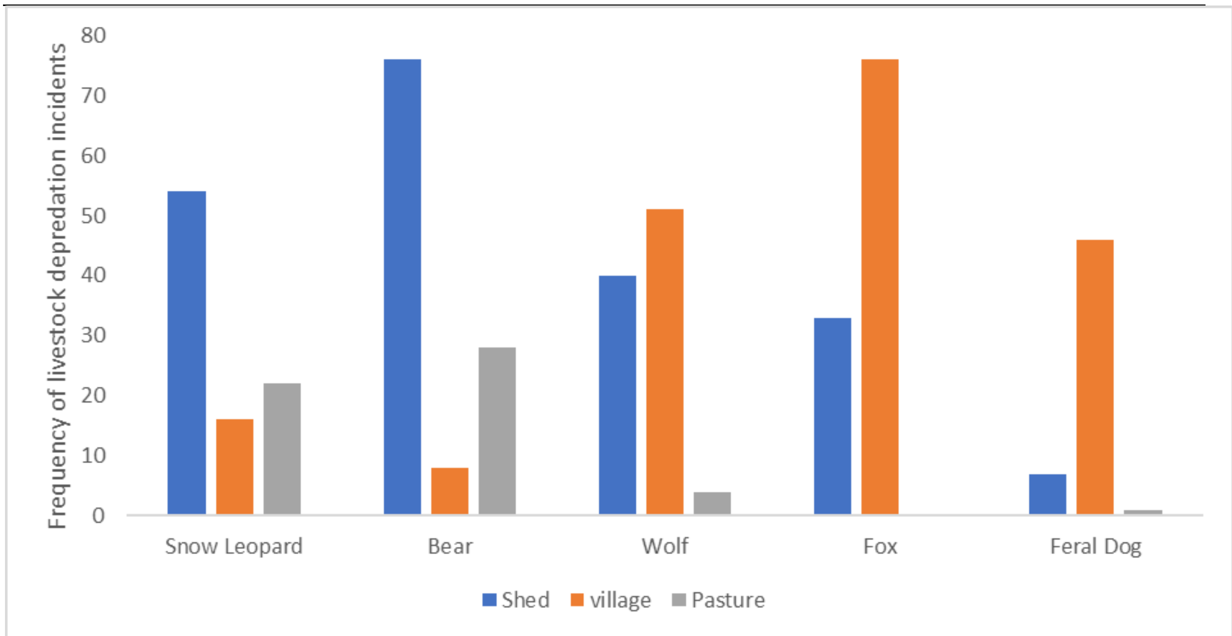


Figure 56 Graphical representation of livestock depredation incidents across various locations.

Snow Leopard

Livestock depredation snow leopard was primarily reported in a livestock shed. There was a significant difference in livestock depredation by snow leopards across the location of the attack χ^2 (2) = 27.217, p < 0.001 (Table 25).

Table 25 Observed, expected count and residual livestock depredation incidents by snow leopards across various locations.

Location of attack	Observed N	Expected N	Residual
In Shed	54	30.7	23.3
Around village	16	30.7	-14.7
Pasture	22	30.7	-8.7
Total	92		

Brown Bear

The distribution of reported livestock depredation by the brown bear was not the same across the location of the attack χ^2 (2) = 65.429, p <0.001 (Table 26). Most of the attack (n= 76) was reported in livestock sheds, followed by pasture (n= 28).

Table 26 Observed, expected count and residual livestock depredation incidents by brown bears across various locations.

Location of attack	Observed N	Expected N	Residual
In Shed	76	37.3	38.7
Around village	8	37.3	-29.3
Pasture	28	37.3	-9.3
Total	112		

Wolf

Further, the distribution of livestock depredation by wolf was not the same across the location of the incidents, χ^2 (2) = 38.168, p <0.001 (Table 27). Most of the incidents were reported in open areas around the village.

Table 27 Observed, expected count and residual livestock depredation incidents by wolves across various locations.

Location of attack	Observed N	Expected N	Residual
In Shed	40	31.7	8.3
Around village	51	31.7	19.3
Pasture	4	31.7	-27.7
Total	95		

Fox

Most of the incident of livestock predation by fox was reported around the village in the open (n = 76), followed by attacks in the shed (33). There were no reports of predation in pastures by a fox. Further, there was a significant difference in livestock predation by foxes across the location χ^2 (1) = 16.963, p <0.001 (Table 28).

Table 28 Observed, expected count and residual livestock depredation incidents by fox across various locations.

Location of attack	Observed N	Expected N	Residual
In Shed	33	54.5	-21.5
Around village	76	54.5	21.5
Total	109		

Feral Dogs

There was a significant difference in the livestock depredation incidents by feral dogs across the location $\chi^2(2) = 66.333$, $p<0.001$ (Table 29). Most incidents were reported around the villages in the open (n = 46).

Table 29 Observed, expected count and residual livestock depredation incidents by feral dogs across various locations.

Location of attack	Observed N	Expected N	Residual
In Shed	7	18.0	-11.0
Around village	46	18.0	28.0
Pasture	1	18.0	-17.0
Total	54		

Time of Livestock depredation

Most of the livestock depredation incidents were reported during dawn (n = 147) and morning (98) for various predators across the study area (Table 30 and Figure 57).

Table 30 Time of attack by various predators on livestock reported across the study area.

Species	Time of attack						Total Livestock depredation incidents
	Dawn	Morning	Afternoon	Evening	Dusk	Night	
Snow Leopard	48	6	8	11	15	4	92
Bear	36	14	13	1	9	39	112
Wolves	28	46	14	1	6	0	95
Fox	26	22	20	9	17	15	109
Feral Dogs	9	10	11	23	1	0	54
Total	**147**	**98**	**66**	**45**	**48**	**58**	**462**

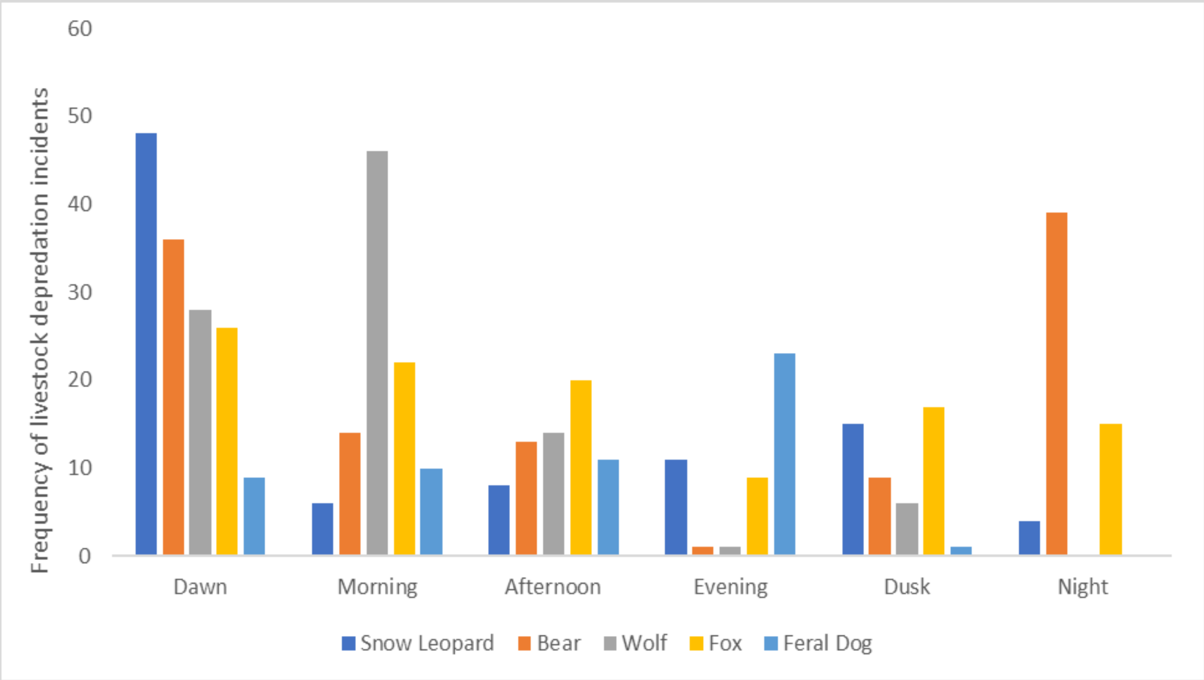


Figure 57 Graphical representation of the time of attack by various predators across the study area.

Snow Leopard

With most of the livestock depredation by snow leopard attacks reported at dawn, there was a significant difference between livestock depredation incidents across various times χ^2 (5) = 88.391, $p < 0.001$ (Table 31).

Table 31 Observed, expected count and residual of livestock depredation incidents by snow leopard across various times of depredation incident.

Time of attack	Observed N	Expected N	Residual
Dawn	48	15.3	32.7
Morning	6	15.3	-9.3
Afternoon	8	15.3	-7.3
Evening	11	15.3	-4.3
Dusk	15	15.3	-.3
Night	4	15.3	-11.3
Total	92		

Brown Bear

The distribution of livestock depredation incidents by the brown bear was not the same across the location of the incidents, χ^2 (5) = 62.857, $p <0.001$ (Table 32).

Table 32 Observed expected count and residual of livestock depredation incidents by brown bears across various times of depredation incident.

Time of attack	Observed N	Expected N	Residual
Dawn	36	18.7	17.3
Morning	14	18.7	-4.7
Afternoon	13	18.7	-5.7
Evening	1	18.7	-17.7
Dusk	9	18.7	-9.7
Night	39	18.7	20.3
Total	112		

Wolf

The pattern of reported livestock depredation by wolves was different across the time of the attack $\chi^2(5) = 68.895$, $p < 0.001$ (Table 28). Most of the incidents occurred in the morning (n = 46), followed by dawn (n = 33).

Table 33 Observed, expected count and residual of livestock depredation incidents by wolves across various times of depredation incident.

Time of Attack	Observed N	Expected N	Residual
Dawn	28	19.0	9.0
Morning	46	19.0	27.0
Afternoon	14	19.0	-5.0
Evening	1	19.0	-18.0
Dusk	6	19.0	-13.0
Total	95		

Fox

There was no significant difference in the time of attack by foxes $\chi^2(5) = 9.624$, $p = 0.087$ (Table 34).

Table 34 Observed, expected count and residual of livestock depredation incidents by fox across various times of attack.

Time of attack	Observed N	Expected N	Residual
Dawn	26	18.2	7.8
Morning	22	18.2	3.8
Afternoon	20	18.2	1.8
Evening	9	18.2	-9.2
Dusk	17	18.2	-1.2
Night	15	18.2	-3.2
Total	109		

Feral Dogs

A significant difference was observed for the livestock predation by feral dogs at the time of the attack $\chi^2(4)= 23.037$, $p<0.001$ (Table 35). The majority of the incidents involving feral dogs took place in the evening, followed by in the afternoon.

Table 35 Observed expected count and residual of livestock depredation incidents by feral dogs across the time of depredation incident.

Time of Attack	Observed N	Expected N	Residual
Dawn	9	10.8	-1.8
Morning	10	10.8	-.8
Afternoon	11	10.8	.2
Evening	23	10.8	12.2
Dusk	1	10.8	-9.8
Total	54		

The economy of livestock predation

Over the three-year period from 2019 to 2021, the collective economic loss reported by all sampled households amounted to INR 5,434,169 or USD 70,988.49, primarily due to livestock predation by wild carnivores and feral dogs, which encompasses poultry as well (as outlined in Table 36). Calculating the annualized loss for this total sample equates to INR 2,717,084 or USD 35,494.25 per year. This figure represents the average annual economic impact experienced by the sample group, emphasizing the ongoing financial burden imposed by human-wildlife conflict incidents.

Furthermore, when considering the mean economic loss attributed to livestock predation by various predators in the Kargil region, it becomes evident that the typical annual loss for each household averages INR 8,134.98 or USD 106.26.

Table 36 Economic value in INR of the livestock loss reported across Kargil due to predation.

Species	Adult	Young	Total
Sheep	22989.12	3135.2	26124.32
Goat	12931.38	1371.65	14303.03
Cattle	18808.92	3134.76	21943.68
Equid	5877.81	783.69	6661.5
Poultry	1955.96		1955.96
Total	62563.19	8425.3	70988.49

Discussion

The report of 94.17% of the total 334 respondents actively engaged directly or indirectly in various aspects of livestock rearing underscores the critical role that livestock plays in the lives of the local community in the Kargil region. Beyond being a source of livelihood, it assumes a pivotal role as a primary means of sustenance during the harsh winter season.

The multifaceted issue of livestock depredation in the Kargil region warrants a more comprehensive exploration, considering its intricate implications for the local community and wildlife conservation. While it is acknowledged that various factors, including diseases and extreme weather conditions, contribute to livestock losses in the region, the study illuminates the stark reality that livestock depredation by wild carnivores stands out as the predominant and pressing concern.

The data presents a staggering annual loss of 6.19% of livestock, encompassing mammals and poultry, to various predators during the years 2019-21.

Among these predators, the Himalayan brown bear and the snow leopard are prominent, reflecting the complex interplay between apex predators and the local community (Bhatnagar et al., 2006; Chundawat and Rawat, 1994; Jackson et al., 2008; Mishra et al., 2003; Sharma et al., 2014). These apex predators, crucial components of the local ecosystem, have inevitably come into conflict with the residents' livelihoods in this trans-Himalayan landscape (Bhatnagar et al., 2006). Recognizing the complex interplay between these species and the communities that coexist with them is essential.

However, the narrative takes an unexpected and concerning turn as the data highlights the significant involvement of feral dogs (*Canis lupus familiaris*) in livestock depredation. Having turned feral, these domesticated canines become not only a new threat to local livestock but also introduce a unique challenge to the conservation of wild carnivores and their associated species. This revelation necessitates a nuanced approach to mitigate conflicts, considering the presence of these feral dogs within the ecosystem.

The comparison with two earlier studies conducted in the region, namely Sathyakumar (2003) and Maheshwari and Sathyakumar (2012), provides a valuable historical context. While there appears to be a slight decrease in reported livestock depredation cases, this decline should be considered within the region's broader narrative of evolving human-wildlife interactions and conservation efforts. It could signify the impact of mitigation measures, increased awareness, or shifts in the dynamics of human-carnivore coexistence.

An intriguing pattern emerges when comparing these findings to two similar studies conducted in the region, namely Sathyakumar (2003) and Maheshwari and

Sathyakumar (2012). While there is a discernible decrease in reported livestock depredation cases, it is essential to note that this decline should not be viewed in isolation. Instead, it should be contextualized within the broader narrative of evolving human-wildlife interactions and regional conservation efforts. This slight decline may signify some level of success in implementing mitigation measures, raising awareness, or altering the dynamics of human-carnivore coexistence (Maheshwari & Sathyakumar, 2012). Further investigation is warranted to elucidate the intricate factors contributing to this pattern, ultimately enriching our understanding of Kargil's evolving relationship between humans and wild carnivores.

The high dependence on livestock as a source of livelihood and sustenance, coupled with the substantial losses incurred due to carnivore predation, underscores the urgent need for comprehensive conservation strategies in this region. Such strategies should not only aim to reduce livestock depredation but also consider the broader ecological significance of carnivores in maintaining ecosystem health (Estes et al., 2011). Furthermore, they should address livestock losses' economic and social impacts while fostering coexistence between humans and carnivores through community engagement and awareness programs (Treves & Karanth, 2003).

The observed differences in livestock depredation cases among the various blocks in Kargil may be influenced by a combination of Ecological (Prey availability, habitat suitability), Geographical (proximity to species habitat, altitude, and climate), and Anthropogenic (Livestock husbandry practices, human population density, and community awareness and engagement) factors. Understanding these factors is essential for developing targeted mitigation strategies that address the specific challenges faced by each CD block, which is highly recommended to be intensively studied in the future.

For example, within the region's principal geographical habitat for bears, namely Drass, Shargole, and Sankoo, the species emerged as the predominant contributors to livestock losses. Conversely, areas characterized by a dense human population witnessed a higher incidence of livestock fatality attributed to feral dogs. Notably, in the case of foxes and wolves, a consistent pattern of livestock depredation was discernible across the various CD blocks.

The findings further align with previous research on predator behaviour and ecological dynamics, highlighting the complex interplay between predators and livestock.

Overall Seasonal Patterns: Consistent with this study's findings, previous research has shown that livestock depredation often varies seasonally. For instance, a study by Bagchi et al. (2013) in the Himalayas found that snow leopards predominantly target livestock during winter when natural prey is scarcer. This aligns with the current study's observation of increased snow leopard depredation during winter.

Snow Leopard: The observed significant seasonal pattern in snow leopard depredation aligns with documented snow leopard behaviour. Snow leopards are known to descend to lower elevations during the harsh winter months, increasing the likelihood of encountering and preying on livestock (McCarthy et al., 2017).

Brown Bear: The preference of brown bears for attacking livestock during the autumn season is consistent with studies on brown bear ecology. Bears, including brown bears, often exhibit hyperphagia during the pre-hibernation period, where they actively forage and consume large quantities of food to build fat reserves (Hilderbrand et al., 1999). This behaviour likely drives their predation on livestock during Autumn.

Wolves: The seasonal variation in wolf depredation, with an increased incidence during winter, reflects their opportunistic predation behaviour. Wolves target livestock when natural prey, such as ungulates, is less accessible due to harsh winter conditions (Treves et al., 2017).

Fox: The absence of a significant seasonal difference in fox predation aligns with foxes' generalist and opportunistic nature. They adapt their diet based on food availability, including small mammals, birds, and scavenging (Kauhala and Holmala, 2006).

Feral Dogs: The lack of a significant seasonal pattern in feral dog depredation is consistent with their close association with human settlements, where they rely on livestock as a constant food source (Vanak et al., 2009).

Location of Livestock: Depredation Incidents The prevalence of livestock depredation incidents in livestock sheds and around villages in open areas corroborates the importance of securing livestock in protected enclosures (Bagchi et al., 2010). Adequate measures to safeguard livestock can reduce the vulnerability of animals to predation.

Time of Livestock: Depredation The findings regarding the time of livestock depredation incidents, with most occurring during dawn and morning, correspond to the diurnal activity patterns of many predators (Ordiz et al., 2011). Predators, such as snow leopards and brown bears, are often more active during these periods, increasing the likelihood of encounters with livestock.

Economic Impact: The calculated economic losses due to livestock predation underscore the substantial financial burden on local communities. This aligns with numerous studies highlighting the economic costs of human-wildlife conflicts (Barua et al., 2013; Treves et al., 2017). Effective mitigation strategies, such as improved livestock protection measures and compensation programs, can play an essential role in reducing these economic losses and promoting coexistence between humans and wildlife.

Examining the mean economic loss per household further elucidates the magnitude of this issue. On average, each household in the study area incurred an annual economic loss of INR 8,134.98 or USD 106.26 due to livestock predation by various predators. This annual loss represents a significant portion of the income and resources available to these households, highlighting the direct and indirect costs of living in an area where human-wildlife conflicts are prevalent.

These statistics are a stark reminder of the pressing need to address the economic toll of livestock predation in regions like Kargil. The burden falls disproportionately on local communities, often facing economic challenges, and can undermine conservation efforts by fueling negative attitudes towards wildlife. Mitigating these losses requires a multifaceted approach, including developing effective conflict prevention and compensation mechanisms, improved livestock management practices, and community engagement.

In Southeast Asia, where human-wildlife conflicts are prevalent, these findings resonate with similar studies conducted in the region. For example, research in Bhutan (Dorji et al., 2012) and Nepal (Thapa et al., 2020) has also highlighted the economic impact of livestock depredation by wildlife. These studies emphasize the need for context-specific strategies that balance conservation goals with the socio-economic well-being of local communities.

Conclusion

Conservation of biodiversity in human-dominated areas is indeed a challenging endeavour, fraught with many complex factors that need to be addressed for effective conservation outcomes. Beyond the boundaries of protected areas, the dynamics of wildlife conservation become intertwined with the livelihoods and aspirations of local populations. This interplay between conservation and human interests has been a subject of extensive research and study, shedding light on the intricacies of the issue (Saberwal et al., 1994; Mishra, 1997; Woodroffe & Ginsberg, 1998; Madhusudan, 2003; Traves & Karanth, 2003).

One of the critical aspects of this challenge lies in the resource dependency of local communities in such areas. These communities often rely on natural resources for their sustenance through agriculture, livestock rearing, or other means. Balancing the needs of wildlife conservation with the livelihoods of these resource-dependent populations presents a delicate conundrum. Strategies must be developed to ensure that humans and wildlife coexist harmoniously while minimizing conflicts and negative impacts on biodiversity.

Furthermore, the political dimensions of conservation in human-dominated areas cannot be overlooked. Local populations often possess varying political influence, which can significantly shape conservation policies and their implementation. Depending on their interests and perspectives, politically connected individuals and groups can support and obstruct conservation efforts. Understanding and engaging with these political dynamics is crucial for the success of conservation initiatives.

Another layer of complexity in human-dominated areas is the diversity of attitudes and views towards wildlife. Different community members may hold contrasting beliefs and perceptions about the value of wildlife and the risks and benefits associated with coexistence. These attitudes can influence behaviours and actions that contribute to or hinder conservation efforts. Consequently, conservation strategies must account for this diversity to be effective.

The findings of the study in question have the potential to provide valuable insights into the development of future management techniques. Specifically, the study's focus on combatting livestock depredation is paramount. Livestock predation by carnivores can lead to significant economic losses for local communities and can also result in retaliatory killings of these predators. Practical strategies to mitigate livestock losses while ensuring the safety of carnivores are essential for fostering coexistence.

Additionally, the study's emphasis on identifying regions prone to human-wild carnivore conflicts is a pivotal step in proactive conservation planning. By pinpointing areas where conflicts are most likely to occur, resources and efforts can be strategically allocated to minimize such conflicts and protect both human and wildlife interests. This predictive approach can enhance the efficiency and success of conservation initiatives in these regions.

In the Kargil trans-Himalayas context, the conservation stakes are exceptionally high. This region is home to diverse and ecologically significant carnivore species, and their long-term survival is at risk due to human pressures and conflicts. Therefore, the findings of the study not only have theoretical significance but also practical implications for the preservation of these charismatic and ecologically vital species.

In conclusion, biodiversity conservation in human-dominated areas demands a nuanced understanding of the challenges and complexities involved. From resource dependency and political connections to diverse attitudes and views of wildlife, these factors must be considered in designing and implementing conservation strategies. The study's findings promise to develop effective management techniques, reduce livestock depredation, and strategically address human-wild carnivore conflicts in the Kargil trans-Himalayas, ultimately contributing to the long-term survival of these magnificent creatures and their ecosystems.

The study's findings illuminate the intricate web of human-wildlife interactions and the challenges of carnivore predation in Kargil. When integrated into holistic conservation efforts, these findings can pave the way for sustainable coexistence between local communities and the region's remarkable wildlife, preserving both livelihoods and biodiversity in this unique trans-Himalayan landscape. The decline in livestock depredation cases, albeit modest, offers a glimmer of hope, suggesting that with concerted efforts, humans and carnivores can find common ground for coexistence. However, ongoing research and adaptive conservation strategies are essential to further solidify this delicate balance in the years to come.

Recommendations for future research underscore the necessity of delving into the myriad ecological factors, including prey availability and habitat suitability, geographical variables such as proximity to species habitat, altitude, and climate, as well as anthropogenic influences encompassing livestock husbandry practices, human population density, and community awareness and engagement. These investigations will undoubtedly shed light on the intricate interplay of these factors and their impact on the patterns of human-wildlife conflict cases, thereby facilitating the development of effective and targeted mitigation strategies.

CHAPTER 5- Reported Perceptions and Attitudes of the Local Human Population Towards Wild Carnivores in Kargil Trans-Himalayas, India

Chapter Summary

In this chapter, the focus is on understanding how the local communities in the Kargil Himalayan region of India perceive and feel about sharing space with wild carnivores. Beginning by highlighting the importance of comprehending these attitudes to develop strategies for reducing conflicts between humans and carnivores while conserving these animals. Acknowledging that as large carnivore populations decline globally, it gives rise to conflicts between humans and carnivores, and sometimes becomes inevitable, especially when they share spaces and compete for resources. Moreover, emphasises the significance of protected areas and human-dominated regions in sustaining carnivore populations due to the inadequacy of many protected areas. It is crucial to note that communities residing outside protected areas and engaged in pastoral activities often harbour negative attitudes towards large carnivores due to perceived threats or dangers they pose. These negative perceptions sometimes lead to retaliatory or preventive killings. Additionally, economic factors like reliance on a limited source of income further contribute to hostility towards animals, especially when their actions jeopardise people's livelihoods. Lastly, delving into how beliefs, religious practices, gender roles, education levels, and awareness influenced people's tolerance towards carnivores.

Moving on to the Methodology section, which details the research approach utilised in this study. The study focuses on the Kargil region, India, which includes 18 villages across 9 CD blocks in the trans-Himalayas. One of the challenges mentioned is the absence of designated protected areas in Kargil, which poses difficulties for wildlife conservation efforts. This study's targeted carnivores are snow leopards, Himalayan brown bears, wolves, foxes, and feral dogs.

Schedule surveys/interviews were conducted through structured surveys and in-depth interviews from April 2022 to September 2022 to gather information for the study. The design of the schedule was carefully tested during reconnaissance surveys.

The Results section provides a summary of the study's findings. A total of 334 responses were recorded from both men and women belonging to 334 households. Notable findings include perceptions among respondents that the populations of snow leopards and bears are declining in Kargil while those of wolves and foxes are increasing. It further explores associations between respondents' characteristics (gender, religion/faith, level of education, dependency on livestock) and their perception of the region's carnivores. The section also presents data on respondents' support for increasing the populations of these carnivores, with foxes receiving the support.

Furthermore, the study identifies threats to wild carnivores, including habitat loss, climate change, human interference (conflicts), decline in prey species population and disease outbreaks. Moreover, the findings indicate the favoured approaches among the participants for safeguarding wildlife. Establishing protected areas garnered the highest level of support, followed by initiatives in education and awareness, research and monitoring, livestock protection, improved compensation practices and enforcing laws. Notably, it highlights that most respondents express dissatisfaction with existing conservation efforts.

Moving forward, the Chapter delves into an exploration of these findings. Provides insightful discussions, conclusions, and recommendations based on the study outcomes.

5.1 Introduction

Understanding people's attitudes toward wild carnivores, their perceptions of danger, and the variables that drive these attitudes are essential for designing successful human-carnivore conflict mitigation techniques for carnivore conservation (Mkonyi, 2017). Large carnivore populations have been on the decline all around the world (Ripple et al., 2014). For instance, the reduced habitat of cheetahs and African wild dogs in Africa has resulted in a current confined habitat range of only 6% and 7% of their previous habitat range (IUCN, 2019). Conflict arises when humans and carnivores dwell in confined spaces, particularly when they share a common space and compete for natural resources (Thirgood & Woodroffe, 2005).

Human perception plays a crucial role in wildlife conservation efforts. Understanding how humans perceive wildlife and the conflicts that arise from human-wildlife interactions is essential for effective conservation strategies (Dickman, 2010). Social factors strongly influence perceptions of human-wildlife conflict, and considering these factors is essential for resolving conflicts and promoting coexistence (Dickman, 2010). Stakeholders' and the publics' perceptions of wildlife reintroduction projects can determine the success or failure of such initiatives (Auster et al., 2019). Therefore, studying the perceptions of stakeholders and the general public is essential in wildlife conservation (Auster et al., 2019). Local communities' attitudes and perceptions toward wildlife are significant factors in wildlife management policies and the sustainability of wildlife populations (Mogomotsi et al., 2020). By understanding these attitudes and perceptions, conservationists can develop policies sensitive to local conditions and promote coexistence between humans and wildlife (Mogomotsi et al., 2020).

Additionally, investing in improving the quality of life of forest communities can incentivize increased perceptions of human-wildlife conflict and contribute to conservation efforts (Sabuhoro et al., 2023). Perceptions also affect urban wildlife species' conservation interest and management (Mormile & Hill, 2016). Understanding how people perceive and interact with urban wildlife can inform conservation and management strategies in urban areas (Mormile & Hill, 2016). Furthermore, there can be gaps between human perceptions of wildlife actions and the biophysical realities, contributing to human-wildlife conflicts (Giefer & An, 2020). Bridging these gaps and aligning perceptions with the actual behaviour of wildlife is crucial for effective conflict resolution (Giefer & An, 2020). Shared risk perception among communities can also lead to emergent conservation outcomes in human wildlife systems (Carter et al., 2020). When communities perceive similar risks related to economic damages caused by wildlife, this perception can be transmitted through social networks and lead to collective action for conservation (Carter et al., 2020). Therefore, studying and understanding human perception of wildlife and the conflicts that arise from these perceptions is essential for successful wildlife conservation efforts.

Many protected areas (PAs) are insufficient to support viable predator populations due to the wide home ranges of big carnivores compared to the size of PAs (Woodroffe & Ginsberg, 1998). As a result, non-protected and human-dominated settings where large carnivores cohabit with humans may be necessary for the survival of sustainable populations (Breitenmoser et al., 2005), posing a conservation challenge. Agro-pastoral populations outside of PAs have significant unfavourable attitudes and danger perceptions of large carnivores, which often leads to retaliatory or preventative carnivore killings (Dickman, 2008; Kissui, 2008).

People who rely on a single or limited source of income are more likely to be hostile to wild animals, as the potential repercussions of resource destruction are amplified by a lack of other assets or income sources (Dickman, 2010). For example, in the Himalayas, local communities are mainly agro-pastoralist and heavily depend on livestock rearing and agriculture, forming a subsistence economy (Maheshwari, 2020; Mishra,1997). Losing livestock to wild predators could lead to negative perceptions and antagonism towards wild animals. Similarly, in Brazil, people living adjacent to forest areas and sharing space with puma (*Puma concolor*) and jaguar (*Panthera onca*) are more likely to lose livestock and be attacked by animals than others. However, if a person is wealthy and has several sources of income, they may be less vulnerable than others and, therefore, be more tolerant of HWC (Dickman, 2010; Naughton-Treves & Treves, 2005).

People's tolerance for large carnivores is influenced by their attitudes and risk perceptions, which might differ depending on culture, religious beliefs, gender, education level, and awareness of wildlife (Dickman, 2010; Mishra, 1997). Because of their cultural or religious beliefs, Buddhists in Nepal, for example, tolerate snow leopards preying on cattle; nonetheless, killing them is considered a sin (Ale, 1998). Although both animals are reported to have livestock depredations, wolves (Canis lupus) are frequently hunted in India due to unfavourable cultural ideas about wolves compared to snow leopards (Mishra, 1997). In Tanzania, the Maasai communities view spotted hyenas (*Crocuta crocuta*) as hostile and antagonistic compared to other species (Maddox, 2003). A more profound knowledge of people's attitudes toward large carnivores and the causes of these attitudes is required to resolve human-carnivore conflict (Oli et al., 1994).

Gender plays a significant role in shaping attitudes towards wildlife. Studies have shown that men and women often have different perceptions of wildlife, which can influence their willingness to coexist with wildlife (Carter & Allendorf, 2016). For example, a study conducted in Chitwan National Park, Nepal, found that gendered perceptions of tigers were influenced by factors such as the direct costs of wildlife, fear and perceptions of risk, and lack of information and knowledge about conservation and wildlife (Carter & Allendorf, 2016). Women, in particular, may have more significant direct costs associated with wildlife and perceive higher risks, leading to more negative attitudes towards wildlife (Carter & Allendorf, 2016). Furthermore, gender roles and customs can also impact attitudes towards wildlife conservation. In Maasai communities in Kenya, for instance, a lack of gender equality in the awareness of traditional conservation methods and attitudes towards wildlife conservation was attributed to customs and gender roles (Ochieng et al., 2021).

On the other hand, women have been found to play a significant role in shaping attitudes and perceptions related to wildlife in various contexts. In the rural landscapes of the southern Andes, women have been silently paving the way toward human-wildlife coexistence through their distinct forms of environmental knowledge and their influence on the use of natural spaces and human-wildlife interactions (Almuna et al., 2022). It is worth noting that gender differences in attitudes towards wildlife may also be influenced by factors such as education and socioeconomic status. Studies have shown that education level can affect attitudes towards wildlife conservation (Bitanyi et al., 2012). Additionally, socio-demographic factors such as age and settlement structure can interact with gender to shape wildlife perception (Kimmig et al., 2020).

The role of religion in shaping perceptions towards wildlife is a complex and multifaceted issue. Several studies have highlighted the influence of social factors, including religious affiliation, on attitudes towards wildlife and human-wildlife conflict (Dickman, 2010; Bhatia et al., 2019; Kumar et al., 2019). These studies emphasize that people's attitudes towards wildlife are shaped by various factors, including religion, ethnicity, and cultural beliefs (Dickman, 2010). A study suggests that religious beliefs can drive crimes against wildlife and that priming religion can further reinforce positive views towards such crimes (Minton, 2020). This indicates that religiosity can play a significant role in shaping perceptions and behaviours related to wildlife. Religion also intersects with other factors, such as gender, socio-economics, and literacy, which collectively influence people's responses to wildlife (Bhatia et al., 2019).

Additionally, studies have found that religious factors should be considered in conservation management, as religious individuals may have different attitudes towards forest management and can contribute positively to pro-environmental behaviours and attitudes (Yang et al., 2010). Furthermore, culture and religion may mediate perceptions of risk and tolerance towards wildlife, including carnivores (Lute & Carter, 2020). In some cases, culture and religion may promote more tolerance towards wildlife and shape perceptions of coexistence (Lute & Carter, 2020).

Numerous studies have demonstrated that educational programs can positively impact wildlife conservation by increasing knowledge about endangered species and habitats, promoting sustainable behaviour, and fostering positive animal attitudes (Freund et al., 2019; Hazzah et al., 2013). For instance, a study conducted in Indonesia evaluated the effectiveness of a wildlife education program for school-aged children and found that it contributed to increased knowledge and positive attitudes towards orangutans and their conservation (Freund et al., 2019). Similarly, a study in Kenya found that higher education and age were associated with increased interest in the environment and more positive attitudes towards wildlife (Hazzah et al., 2013).

Moreover, the level of education has been found to influence attitudes towards wildlife in different settings. A study conducted in Ethiopia found that improving the educational status of the community, particularly the youth, can lead to improved attitudes towards wildlife (Biru et al., 2017). Another study in Sri Lanka revealed that the level of education, along with factors such as age, gender, ethnicity, and religion, influenced attitudes towards non-human primates (Kumara et al., 2018).

Similarly, a study in Myanmar found that attitudes towards protected areas were correlated with the perception of extraction benefits, conflicts with park staff, and crop damage by wildlife (Allendorf et al., 2006). It is important to note that the impact of education on wildlife perception and attitude may vary in the short and long term. While conservation education programs have been shown to have positive effects in the short term, ongoing environmental education activities may be necessary to sustain these positive changes (Bernárdez-Rodríguez et al., 2021). Additionally, the local context and concrete experiences with wildlife encounters can significantly shape attitudes towards wildlife management actions (Kaltenborn et al., 2006). Factors such as the presence of wildlife in urban areas can also influence perceptions and attitudes towards wildlife conservation and management (Mormile & Hill, 2016).

Establishing successful human-carnivore conflict mitigation techniques within communities requires a thorough knowledge of people's attitudes and perceptions of the danger of big carnivores and the variables that influence these attitudes (Mkonyi et al., 2017). Hence, the specific aim of this Chapter was to assess the attitude and perception of local communities in the Kargil region towards wild carnivores and their association with various characteristics of the respondents mentioned in Chapter Four of this thesis.

5.2 Methods

5.2.1 Study Area

The study was conducted in 18 sampled villages across 9 CD blocks of Kargil trans-Himalayas, India. With a total land area of approximately 14000 square km, Kargil district is one of the two districts in Ladakh's newly formed Union territory (erstwhile an administrative division in Jammu and Kashmir, India). It is bordered by the Leh district on the eastern side and the Kashmir division of the Union territory of Jammu and Kashmir on the western side. Kargil shares its southern border with the state of Himachal Pradesh, India, and on the northern side, it shares an international boundary with Pakistan-administered Kashmir (PaK). There is a lack of protected areas in Kargil, which has also resulted in challenges to wildlife conservation in the region. Wild mammalian carnivore fauna include snow leopards, Himalayan brown bears, Tibetan wolves, foxes, Pallas's cat, and lynx. The study focused on the four wild carnivore species more associated with conflicts with humans: snow leopard, Himalayan brown bear, wolves, and fox. Himalayan brown bears as a subspecies are listed as Critically Endangered, snow leopards are listed as Vulnerable, and wolves and foxes are listed as Least concerned (IUCN, 2019). The local communities are primarily agro-pastoralists and heavily depend on livestock as their primary source of livelihood (Maheshwari, 2020). The principal livestock species that the local communities hold are sheep, goats, cattle, and equids. The study area is further detailed in Chapter 2 of the thesis.

5.2.2 Interview design

Surveys were conducted from April 2021 to September 2022 using semi-structured interviews. The schedule used in this study is given in Appendix 5 and was pre-tested during reconnaissance surveys. Further details on the procedures are discussed in Chapter 3 and Chapter 4 of the thesis.

5.2.3 Overview of Survey

Chapters Three and Four of the thesis explain the sampling techniques, and the survey approach utilised for this study.

During the reconnaissance survey, it was noted that questions about the perception and perceived severity of a particular species as problematic presented difficulties for respondents to comprehend. In response to this challenge, a strategy was implemented wherein participants were presented with various scenarios related to the carnivore species in question. These scenarios, which included aspects such as livestock loss, economic impacts, and emotional responses like fear and anger, were thoroughly discussed to ensure a comprehensive understanding. The respondents were subsequently provided with explanations to facilitate their comprehension of the Likert scale levels.

The difficulty in conveying information to participants was found to be dependent on their individual knowledge levels regarding the specific species. To address potential biases and misunderstandings, the survey aimed to elicit more precise and accurate responses. Recognizing the challenges associated with understanding questions related to species perception, modifications were made to the Likert scale for responses.

Originally designed with five levels, the Likert scale was streamlined to three levels for the final survey. This adjustment aimed at improving respondent comprehension, simplifying the response process, and obtaining more straightforward and accurate feedback regarding the perceived levels of species-related concerns.

In-depth interviews with 30 respondents chosen from the initial survey respondents (n=334) also served as a data source for this Chapter. These participants were chosen randomly from the 'population' of participants who participated in the significant survey covered in Chapter Four. The discussion took place individually after obtaining the consent to participate in the research, and the information sheet was handed/read to the participants in the local language and was translated into English, following the guidelines by Tuckman (1972). The purpose of the interview was explained before the discussion was started. No identifiable information was collected and deleted if observed in the reporting. The participants were assigned numbers for identification purposes. The interview took time ranging from 45 minutes to 2 hours in duration to complete.

5.2.4 Data analysis

All the data were entered into Microsoft Excel. Descriptive statistics were performed to accomplish the study objectives. Quantitative data analysis was performed using SPSSv27, SPSSv29 and Microsoft Excel. Pearson's Chi-square test was performed to explore any association between various characteristics of the respondents and their responses to perceptions and knowledge questions. Further methodologies adopted in this Chapter has been detailed in Chapter Three and Four of this thesis.

5.3 Result

A total of 334 responses were recorded for the study. Although an equal gender ratio was targeted, 174 men and 160 women representing 334 households were achieved for the study. The socio-demographic information of the respondents is further detailed in Chapter Four of the thesis.

The average age of the respondents for the in-depth interviews, which included 11 females and 19 males, was 43 years.

5.3.1 Perception of the Status of Wild Carnivore Population

With 217 and 63 mentions of declining populations, respectively, snow leopards and bears are among the significant wild carnivore species widely believed to be experiencing population decreases in Kargil (Figure 58). However, the population trends of wolves and foxes were perceived as increasing, with 167 and 153 responses.

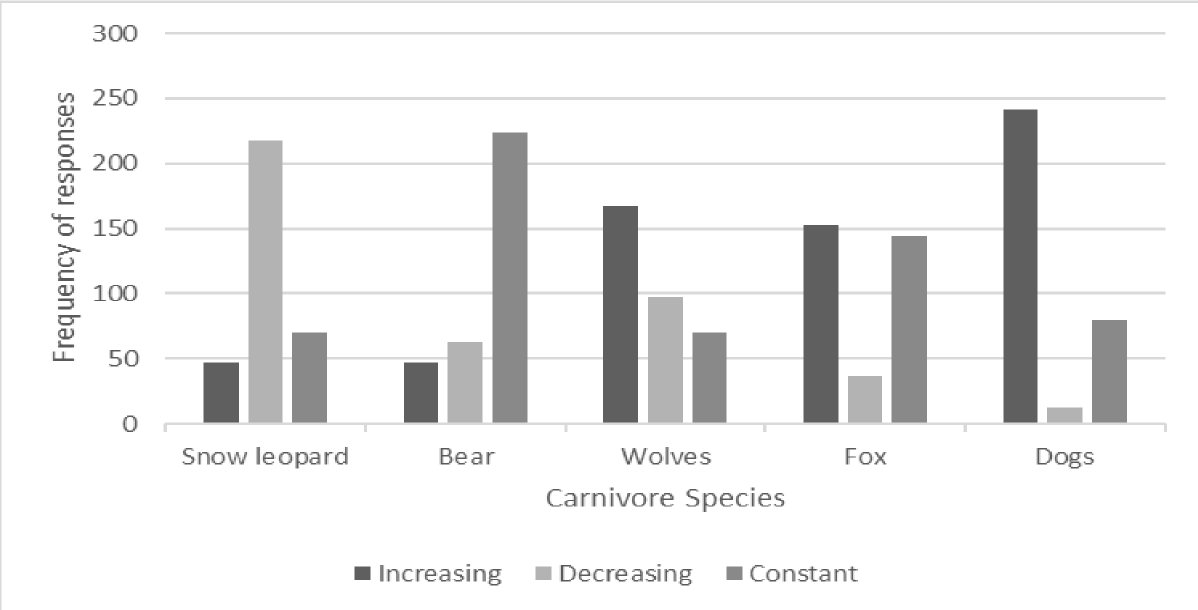


Figure 58 Reported present status of wild carnivore polution in Kargil.

Discussing the wild carnivore population trend in Kargil, a respondent stated:

"…in my childhood, before the Kargil war of 1999,…I remember at least seven encounters with snow leopards during the winters..and I would easily see flocks of ibexes just across the windows on the ridges of the nearby hills….bears were a menace in our area where people used to guard the villages…but since the war, I have observed a sharp decline in their population,… may be due to the war disturbances or maybe due to growth in human population."

Respondent-12, 63-year-old male

Another *respondent (19)* stated,

"…in this era of human population expansion across Kargil, we can see humans everywhere..the animals may shy in nature and hence avoid humans…so we see fewer snow leopards and bears compared to a decade or two ago…"

Respondent-19, 43-year-old female

There was no significant association between the respondent's characteristics and their perception of the region's current population status of various carnivores.

5.3.2 Reported ranking of problems for various carnivore species

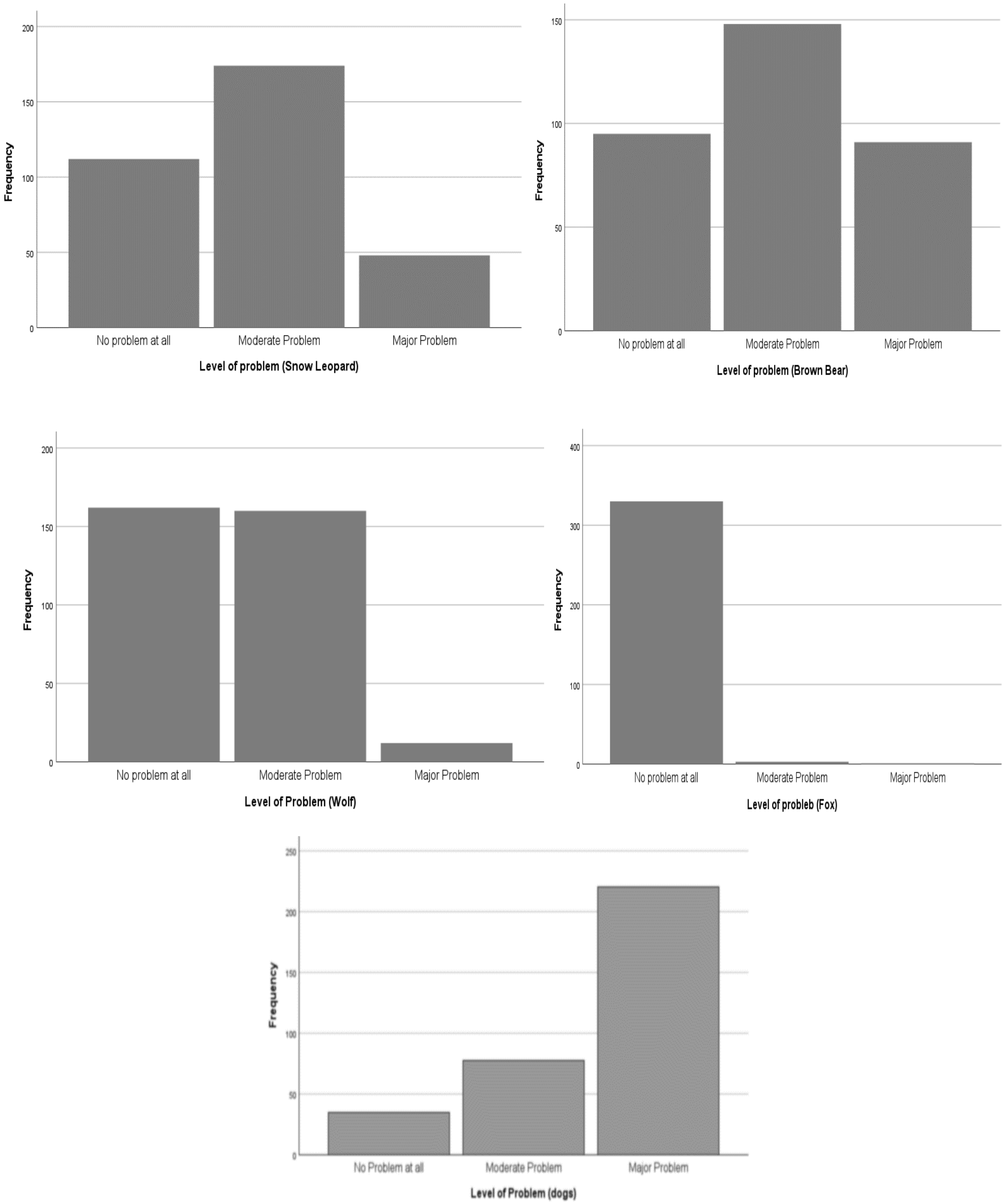


Figure 59 Level of problem reported for various carnivore spcies in Kargil. Clockwise from the top left (Snow leopard, Brown bear, fox, dogs and wolf)

The extent to which respondents from the Kargil region perceive different wild carnivore species as problematic was investigated and is presented in Figure 59. A little over 33.5% of those surveyed responded that they had "No problem at all" living with snow leopards. The snow leopard was described as a "Moderate Problem" by 52.1% and a "Major Problem" by 14.14%.

Most respondents perceived bears in the surrounding area as a moderate problem (39.8%). At the same time, a sizable portion of respondents (24.4%) stated that sharing space with bears was "a major problem." Living with bears was reported as "no problem at all" by 25.5% of the respondents.

The majority of the participants reported wolf, either "No problem at all" (43.4%) or a "Moderate Problem" (42.9%), while only a tiny proportion reported a "Major Problem" (3.2%). For foxes, the preeminent majority of the respondents reported "No problem at all" (88.5%), while a minimal number reported "Moderate Problems" (0.8%) or "Major Problems" (0.3%).

There was a significant association between the level of education of the respondents and carnivores being perceived as problematic ($\chi2$ (8, 334) = 31.034, $p < 0.001$ (snow leopards), $\chi2$ (8, 334) = 80.552, $p < 0.001$ (bears), $\chi2$ (8, 334) = 16.454, $p = 0.036$ (wolves), and $\chi2$ (8, 334) = 24.590, $p = 0.002$ (dogs)). Respondents with lower level of education perceived carnivores as problematic, but it decreased with the increase in level of education. There was a slight association between the level of education and foxes being problematic ($\chi2$ (8, 334) = 8.263, $p = 0.082$). Further, there was no significant association between gender and a species perceived as problematic. Similarly, religion was not associated with a species perceived as problematic. However, there was a significant association between the religion/faith of the respondents and bear being a problematic species ($\chi2$ (2, 334) = 13.007, p = 0.001) (Table 37).

Table 37 Cross-tabulation of respondents' faith/religion and bear being perceived as problematic species.

		Bear is perceived as a Problem.			
		No Problem at all	Moderate Problem	Major Problem	Total
Religion	Islam	50	111	61	222
	Buddhism	45	37	30	112
Total		95	148	91	334

Similarly, respondents with livestock rearing as their primary source of livelihood had a significant association with bears being perceived as a problem species ($\chi2$ (2, 334) = 25.904, $p < 0.001$) (Table 38). Respondents with livestock as their primary source of income perceived bears as a problematic species. However, there was no significant association between respondents with livestock rearing as their primary source of livelihood and perceiving snow leopards, wolves, foxes, and feral dogs as problematic species.

Table 38 Cross-tabulation of livestock as the primary source of livelihood and bears being perceived as problematic species.

		Bear			
		No Problem at all	Moderate Problem	Major Problem	Total
Livestock is the Main Source of livelihood	Yes	37	86	69	192
	No	58	62	22	142
Total		95	148	91	334

Furthermore, there was no significant association between various respondent characteristics and a species perceived as problematic.

5.3.3 Reported preferred future population of various carnivore species

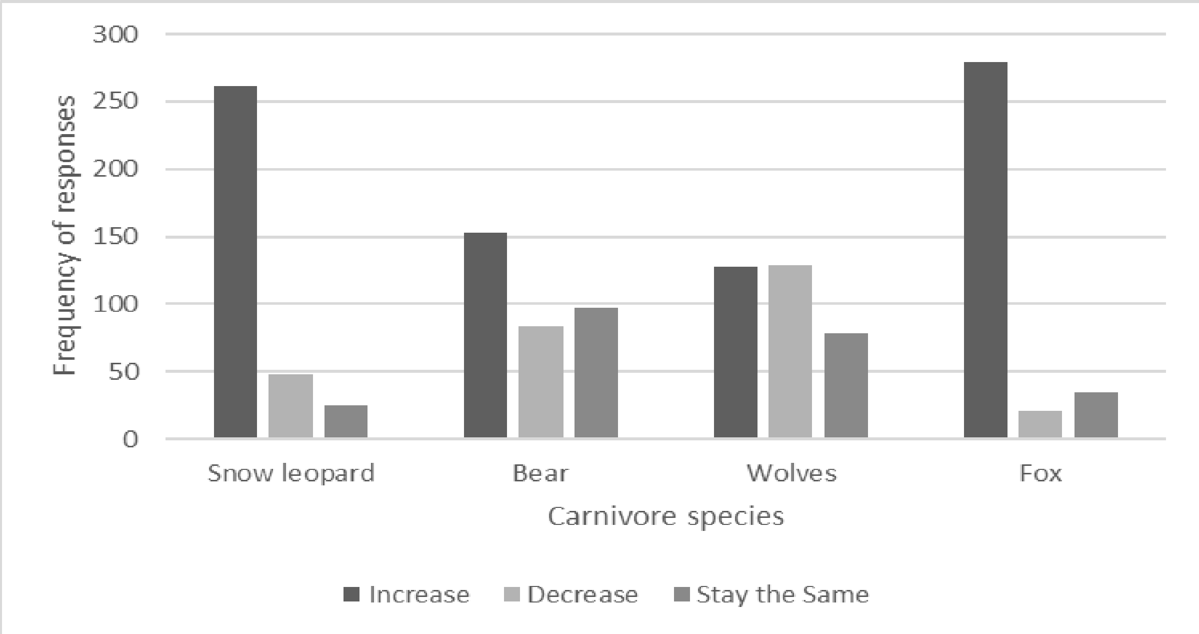


Figure 60 Reported preferred future population of various carnivore species.

With 261 responses (~78%) in favour, a sizable majority of respondents expressed their support for increasing snow leopards. Similarly, 153 respondents, or ~46% of the total, indicated they wanted to see more bears in the wild. The respondents' preferences were evenly distributed for wolves, with 129 responses (~39%). On the other hand, Foxes had strong public support for population growth, with 279 respondents (~84%) indicating this preference, showing a favourable opinion of these smaller animals (Figure 60).

There was no significant relationship between gender and perception on future carnivore population trend of the region ($\chi2$ (2, 334) = 0.101, p= 0,951 (snow leopard), $\chi2$(2, 334) = 1.573, p= 0.455 (bears), $\chi2$ (2, 334) = 1.219, p = 0.544 (wolves), $\chi2$ (2, 334) = 0.067, p = 0.967 (foxes), and $\chi2$ (2, 334) = 3.662, p = 0.160 (feral dogs). Although a slight significance was reported for religion and future population trend of snow leopards ($\chi2$ (2, 334) = 5.694, p= 0.058) (Table 39) in the region and a significant relationship for religion and preferred future bear population trend ($\chi2$ (2, 334) = 9.161, p = 0.010) was reported (Table 40), there was no significant relationship between religion/faith and the respondents' preferred future population trend of wolves ($\chi2$ (2, 334) = 2.938, p = 0.230), foxes ($\chi2$ (2, 334) = 3.728, p = 0.155), and feral dogs ($\chi2$ (2, 334) = 1.574, p = 0.455) population in the region.

Table 39 Cross-tabulation of religion/faith and preferred future population of snow leopards.

		Preferred future population trend of Snow Leopard			
		Increase	Decrease	Remains the same	Total
Religion	Islam	166	39	17	222
	Buddhism	95	9	8	112
Total		261	48	25	334

Table 40 Cross-tabulation of religion/faith and preferred future population of bears in Kargil.

		Preferred future population trend of Bears			
		Increase	Decrease	Remains the same	Total
Religion	Islam	93	67	62	222
	Buddhism	60	17	35	112
Total		153	84	97	334

Respondents' dependency on livestock as their primary source of livelihood had a slightly significant association with snow leopards preferred future population ($\chi2$ (2, 334) = 5.927, p = 0.052) and significant association with their preferred future population trend of bears ($\chi2$ (2, 334) = 28.491, $p < 0.001$), wolves ($\chi2$ (2, 334) = 14.202, $p < 0.001$), foxes ($\chi2$ (2, 334) = 14.553, $p < 0.001$) (Table 41). Respondents demonstrating a substantial reliance on livestock expressed a disinclination towards advocating for an augmentation in the population of wild carnivores within the region. Conversely, individuals with minimal or no dependence on livestock as a primary source of income exhibited a preference for a prospective increase in the population of wild carnivores in the region. However, there was no association between livestock being the primary source of income and the preferred future population trend of dogs in the region ($\chi2$ (2, 334) = 2.449, p = 0.294).

Table 41 Coss-tabulation of livestock as primary source of livelihood and reported preferred future carnivore population.

Preferred future population trend of carnivores					
		Snow Leopard			
		Increase	Decrease	Remains the same	Total
Livestock is the main source of livelihood	Yes	141	33	18	192
	No	120	15	7	142
Total		261	48	25	334
		Bears			
Livestock main source of livelihood	Yes	64	58	70	192
	No	89	26	27	142
Total		153	84	97	334
		Wolves			
Livestock main source of livelihood	Yes	67	90	35	192
	No	60	39	43	142
Total		127	129	78	334
		Foxes			
Livestock main source of livelihood	Yes	150	20	22	192
	No	129	01	12	142
Total		279	21	34	334
		Feral Dogs			
Livestock main source of livelihood	Yes	2	5	56	192
	No	5	97	40	142
Total		7	231	96	334

There was a significant association between the level of education of the respondents and the preferred future population trend of carnivores of the region ($\chi2$ (8, 334) = 46.061, $p < 0.001$ (snow leopard), $\chi2$ (8, 334) = 88.368, $p < 0.001$ (bears),

$\chi2$ (8, 334) = 64.196, $p < 0.001$ (wolves), and $\chi2$ (8, 334) = 53.226, $p < 0.001$ (foxes)). Respondents possessing higher educational qualifications demonstrated support to increase in the population of wild carnivores in the region. However, there was no significant association between the level of education and the preferred future population trend of dogs in the region ($\chi2$ (8, 334) = 13.490, $p = 0.096$) (Table 42).

Table 42 Cross-tabulation of the respondents' education level and preferred future population of carnivores in Kargil.

		Preferred future population trend of carnivores			
		Snow Leopard			
		Increase	Decrease	Remains the same	Total
Level of Education	No Education	21	18	10	49
	Upto Middle school	89	11	7	107
	Upto High School	106	12	3	121
	Graduate	41	7	5	53
	Post Graduate	4	0	0	4
		Bears			
		Increase	Decrease	Remains the same	Total
Level of Education	No Education	5	28	16	49
	Upto Middle school	32	25	50	107
	Upto High School	77	29	15	121
	Graduate	36	2	15	53
	Post Graduate	3	0	1	4
		Wolves			
		Increase	Decrease	Remains the same	Total
Level of Education	No Education	7	31	11	49
	Upto Middle school	47	52	8	107
	Upto High School	61	24	36	121
	Graduate	11	19	23	53
	Post Graduate	1	3	0	4
		Foxes			
		Increase	Decrease	Remains the same	Total
Level of Education	No Education	31	13	5	49
	Upto Middle school	83	7	17	107
	Upto High School	114	1	6	121
	Graduate	47	0	6	53
	Post Graduate	4	0	0	4
		Dogs			
		Increase	Decrease	Remains the same	Total
Level of Education	No Education	1	29	19	49
	Upto Middle school	1	79	27	107
	Upto High School	5	89	27	121
	Graduate	0	31	22	53
	Post Graduate	0	3	1	4

Discussing the experience of sharing space with wild carnivores, a person stated:

> "…although sometimes we fear the presence of such large animals in our surroundings,…if their presence is taken care of…like controlling their entry to human settlements, we would be more than excited if they are protected…people in our village lose sheep and goats to animals every year, there are no proper regulations to mitigate such incidents and also no proper compensation scheme,…if these are taken into consideration by concerned authorities, I think people are ready to co-exist with the animals…"

Respondent-10, 58-year-old male

Another female participant shared her views on the future of the wild carnivore population in the Kargil region:

> "snow leopard, brown bear, ibex and other wildlife had been part of our culture and served as our identity….I strongly favour its protection, but the local people's welfare should also be considered….."

Respondent-8, 26-year-old female

5.3.4 Reported main threat to the wild carnivores of the region

Figure 61 illustrates the respondents' responses to the main threat to the wild carnivore population of Kargil. "Habitat loss, destruction, and disturbances", which received 122 mentions (~36.5% of respondents), was one of the main threats to the wild carnivore population of Kargil that was mentioned the most. With 101 responses (~30% of respondents), "Climate Change" was another concern among the respondents. Contrarily, "Poaching and Hunting" was mentioned much less frequently, with only nine respondents (~2.7%) designating it as the main threat. With 42 instances (about 12.6%), "Human interference (Conflicts)" was identified as a significant problem. Forty-nine respondents, or roughly 14.7%, cited "Decline in Prey Species Population" as a cause for concern. Last but not least, "Disease Outbreak" had 11 mentions (~3.3%). While no significant associations were observed between respondents' characteristics and reported threats to the wild carnivores in the region, a marginal association was found between respondents' upbringing environment (rural or urban) and their perception of threats to regional wildlife ($\chi 2$ (5, 334) = 9.813, p =0.081) (Table 43).

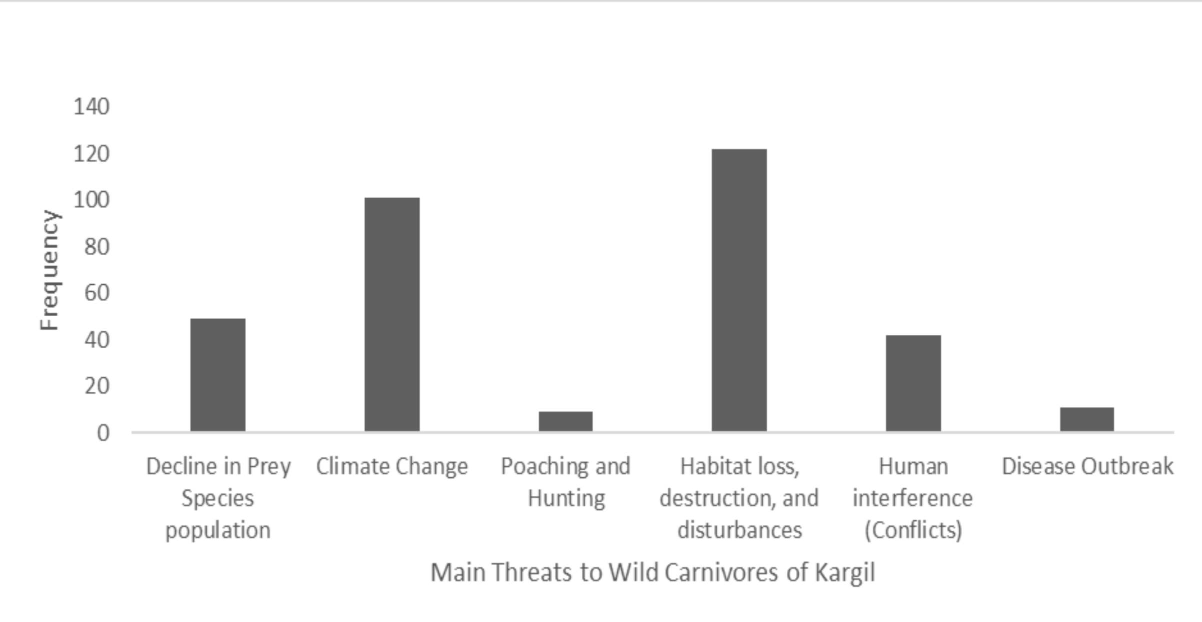


Figure 61 Reported main threats to wild carnivores in Kargil.

Table 43 Coss-tabulation of respondents' growth setup and reported perceived main threat to wild carnivores of Kargil.

		Perceived Threats To Wildlife						
		Deline in Prey Species Population	Climate Change	Poaching and Hunting	Habitat Loss and Destruction	Human interference/Conflicts	Disease outbreak	Total
Growth Setup	Rural	39	85	8	101	29	6	268
	Urban	10	16	1	21	13	5	66
Total		49	101	9	122	42	11	334

Sharing his personal views on the threats to the wild carnivore population in Kargil, a person stated:

"…personally, I think that there are various factors which are threats to the survival of the animals in the wild…for example, in the past, we had never experienced flash floods and scorching summers, but if we look at the last ten years, we have experienced flood like situation every year, this may also degrade the habitat of the animals,…and also, there is no specific protected area in Kargil to keep the animals safe, which will also keep people safe….."

Respondent-6, 50-year-old male

A female participant shared her experience while discussing the threats to wildlife in Kargil:

"…I, as a woman, am responsible for fetching water for my household use from the nearby streams,….and when I was a child, I remember we did not have to walk long distances for water as it was available nearby….but now I think that the change in weather has resulted in less glacial water..this might be the same case with the animals…scarcity of water can contribute to their decline in population…"

Respondent-30, 52-year-old female

5.3.5 Reported best strategy to protect the wildlife of the region

Notably, "Creation of Protected Areas" appeared as the approach that was most widely supported, with a significant 213 respondents (or roughly 63.5% of participants) backing it as their primary strategy for reducing threats to wild carnivores in Kargil (Figure 62). Only 21 respondents (or about 6.3%) favoured applying more onerous legal restrictions, indicating that a few people accept the "Strict Laws" concept. In order to lessen threats to the wild carnivore population of Kargil, "Education and Awareness" efforts, according to 27 respondents (or roughly 8.1%), are the best course of action. Twelve respondents (about 3.6%) said "research and monitoring" were essential. "Livestock protection and better compensation" garnered notable support, with 61 respondents (approximately 18.3%) advocating for measures to safeguard livestock and provide fair compensation to mitigate human-wildlife conflicts. While no significant associations were observed between respondents' characteristics and reported threats to the wildlife in the region, a marginal association was found between respondents' upbringing environment (rural or urban) and their perception of threats to regional wildlife ($\chi 2$ (4, 334) = 8.543, p = 0.074) (Table 44).

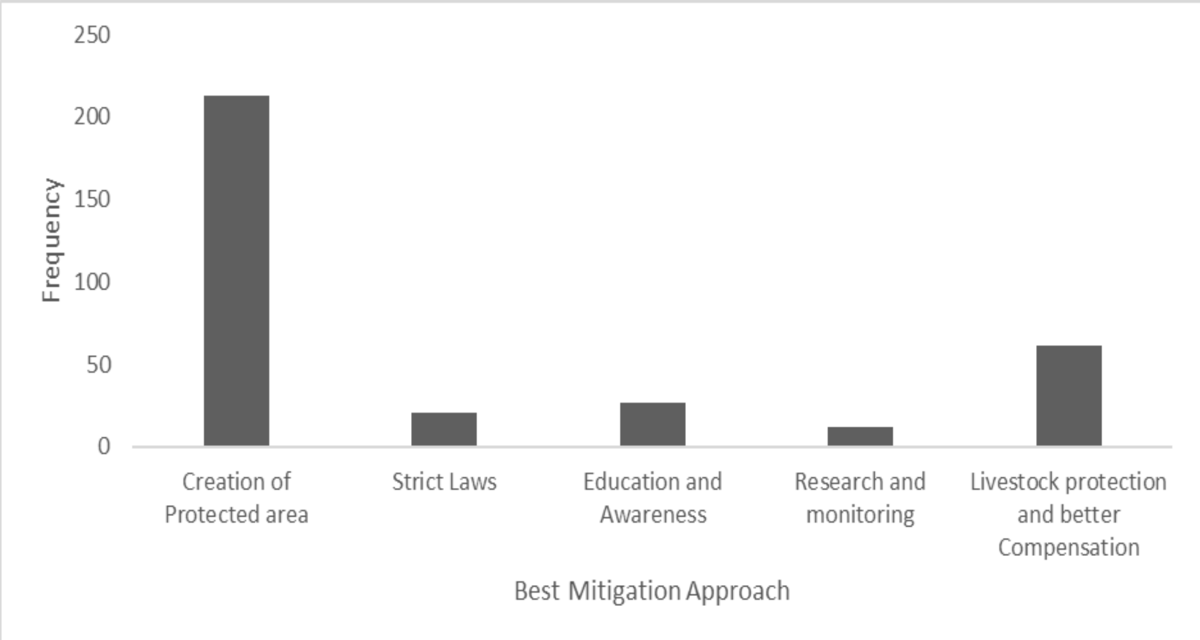


Figure 62 Reported best mitigation approach to protect wild carnivores of Kargil.

Table 44 Cross-tabulation of respondents' growth setup and best strategy to mitigate wild carnivore threats in Kargil.

		Reported Threat Mitigation					
		Creation of Protected Area	Strict laws	Education and Awareness	Research and monitoring	Livestock protection	Total
Growth Setup	Rural	179	14	20	11	44	268
	Urban	34	7	7	1	17	66
Total		213	21	27	12	61	334

A male *participant* with a post-graduate educational qualification background stated:

"…..I have studied in different parts of India and have visited at least three national parks….I am very surprised that there is no protected area in the Kargil region besides having a good population of some of the endangered wildlife species…If no protected area is created in the coming five to ten years, we will lose some of the charismatic wild animals from Kargil….".

Respondent-11, 50-year-old male

A female participant shared her view:

"…I have been married in this village for 13 years…in my parent's home village, there were a lot of attacks by bears and wolves…one of my uncles lost 17 livestock in a year, and livestock rearing was his primary source of income…he tried to reach the wildlife department to seek compensation, although it was time-consuming and hectic, he tried his best to get compensated, but he never received any monetary compensation…beside his livestock, he lost time and money trying to get compensated..this made him more angry and he hates the animals…if there is a good and productive compensation scheme for livestock loss, I think people can think positively of the animals too….."

Respondent-7, 59-year-old female

5.3.6 Satisfaction with the current conservation efforts in the region

A sizable part of the respondents, precisely 97 responses (or ~29% of the total respondents), expressed satisfaction with the ongoing wildlife conservation efforts in Kargil. However, a more considerable portion of the community—237 respondents, or around 71% of all respondents—expressed unhappiness with the current conservation initiatives (Figure 63). There was no significant association between the characteristics of the respondents and their satisfaction with current conservation efforts in the region.

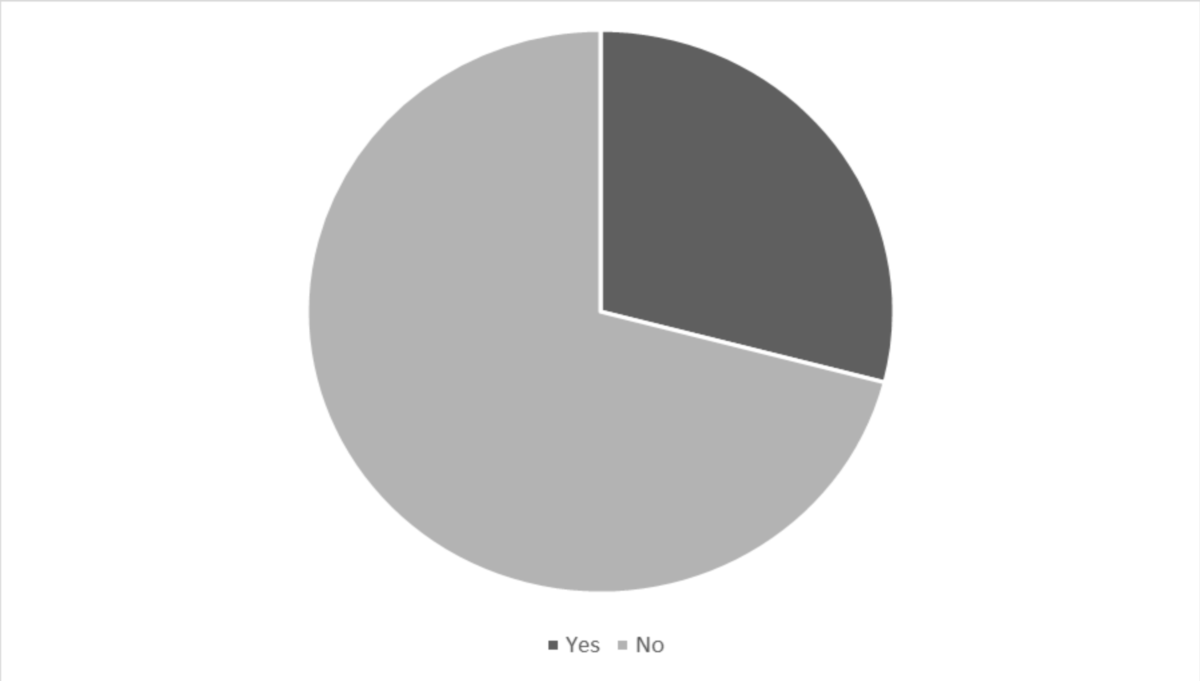


Figure 63 Reported satisfaction with ongoing wildlife conservation efforts in Kargil.

Expressing dissatisfaction with the existing wildlife conservation approach in the region, a participant stated:

"…frankly speaking, I have not even studied up to primary school level…I don't have shame in telling that…. because there are many people like me….I don't even know whether a department dedicated to wildlife exists in our region…the only Department I am familiar with is the PWD (Public Works Department), where I worked as a daily wage labourer to earn some money for my family…."

Respondent-12, 63-year-old male

Another female participant stated:

"… We get updates of the outer world only because of the sole radio in our house…I remember an officer from *jangalat (forest)* having a discussion with the host of the programme about disease outbreaks and what to do in wildlife interaction scenarios… Besides this, I don't have any knowledge about the Department of Wildlife…"

Respondent-14, a 32-year-old female

Another in-depth interview participant stated:

"…I have observed that in last 4-5 years, 3 NGOs came for some sort of survey in our village…they ask about wildlife in the surrounding areas and never returned back…they do not care about our concerns…they are here for their job which makes them money, and then they vanish in the thin air…"

Respondent-6, a 50-year-old male

5.3.7 Reports of Carnivore Persecution

While the study period did not document any instances of retaliatory actions against wild carnivores, reports did indicate cases of proactive measures involving the killing of brown bears within the Drass and TSG blocks of the study area. These incidents primarily involved mob-induced actions, where groups of individuals resorted to killing brown bears due to concerns about potential human injuries and livestock depredation. A participant recalled an incident of a brown bear killing in their village.

"…..I was irrigating my agricultural field around the afternoon, and suddenly, I heard a person addressing everyone on the local mosques' loudspeaker, warning people about a bear that had entered the village…I was in the field with my 12-year-old son and rushed home with him,…my neighbour came and informed me about a crowd gathering to spot and attack the bear… we were frightened about our lives and livestock…all the males gathered at the mosque and started a search patrol for the bear…after 3 hours, a group located the bear in one of the fields near the main village road…all the people rushed to the spot…we informed the wildlife department about the situation…but they arrived when people had already killed the bear with stones and sticks…we can't wait for the bear to attack someone and regret it, so we resorted for this action to defend ourselves and our animals."

Respondent -30, a 52-year-old male

Discussion

The findings of this study shed light on the perceived population trends of wild carnivore species in the Kargil region, with a notable focus on snow leopards, bears, wolves, and foxes. The results indicate distinct patterns in the community's perceptions of these species, and these observations are consistent with broader trends in carnivore conservation. Snow leopards, renowned for their elusive nature and vulnerability, garnered significant attention in the responses, with 217 mentions indicating a perception of declining populations. This aligns with the global status of snow leopards as an endangered species facing threats such as habitat loss and poaching (Jackson et al., 2020). The concerns about snow leopard populations in Kargil underscore the need for targeted conservation efforts to protect these iconic felids.

Similarly, the Himalayan brown bears were perceived as facing declining populations, with 63 mentions. This aligns with the broader challenges bear populations face in the Himalayan region, including habitat fragmentation and human-wildlife conflicts (Bhatnagar et al., 2019). The perception of declining bear populations in Kargil suggests a shared concern about the conservation status of these large mammals.

Conversely, the population trends of wolves and foxes were perceived more positively, with 167 mentions of growing wolf numbers and 153 references to increasing fox populations. This optimism may indicate successful conservation initiatives or changing ecological dynamics that favour these species. Such perceptions align with studies highlighting the adaptability and resilience of canid species, including wolves and foxes (Ripple et al., 2014). These findings reflect the local community's perceptions and awareness of the status of these carnivore species in their region. While perception may not always align precisely with scientific population assessments, it is a valuable indicator of community engagement and interest in wildlife conservation. In Kargil, the perceived population declines of snow leopards and bears suggest a need for targeted conservation measures, such as habitat protection and anti-poaching efforts. Conversely, the positive perceptions of wolf and fox populations indicate opportunities for further research into the factors contributing to their apparent growth.

The high level of support for the increase in the snow leopard population reflects the global recognition of snow leopards as an endangered and iconic species (McCarthy et al., 2016). It also underscores the importance of preserving this elusive predator and its vital role in the ecosystem. Despite reports of high conflicts, 46% of respondents wanted to see more bears in the wild. This preference highlights bears' cultural and ecological significance in the Himalayan region (Bhatnagar et al., 2019). It also suggests that while human-wildlife conflicts may exist, there is a willingness among the local community to co-exist with and conserve these charismatic animals. Wolves received relatively even support, with approximately 39% of respondents favouring their population growth. This balanced preference for wolves may reflect recognising their ecological role and the need for coexistence strategies (Ripple et al., 2014). The most notable finding is the strong public support for the population growth of foxes, with approximately 84% of respondents indicating this preference. This favourable opinion of foxes aligns with their smaller size and potentially lower impact on human activities, making them more amenable to coexistence. These preferences highlight the importance of engaging local communities in carnivore conservation efforts. Public support can play a critical role in the success of conservation initiatives (Dickman, 2010). However, it is essential to recognise that preferences alone do not address the complex challenges of carnivore conservation. Conservation strategies should be evidence-based, considering ecological factors, human-wildlife conflicts, and habitat protection (Jackson et al., 2020; Bhatnagar et al., 2019).

Habitat loss, destruction, and disturbances emerged as the most prevalent threat to the wild carnivore population, mentioned by approximately 36.5% of respondents, aligning with global concerns about habitat degradation (Wilcove et al., 1998). Climate Change was also a significant concern, with about 30% of respondents perceiving it as the main threat to the wild carnivores of the region. This finding underscores the increasing influence of climate change on ecosystems and species distribution, leading to habitat alterations and biodiversity loss (Bellard et al., 2012). The decline in Prey Species Population was cited by roughly 14.7% of respondents, emphasising the interconnectedness of carnivores and prey (Ripple et al., 2014).

Regarding conservation strategies, "Creation of Protected Areas" was strongly supported by approximately 63.5% of participants, emphasising the significance of habitat preservation (Joppa et al., 2016). The absence of designated Protected areas in Kargil can be an essential factor in increased human-wildlife conflicts. "Education and Awareness" initiatives were seen as vital by around 8.1% of respondents, emphasising the role of community engagement (Veríssimo et al., 2019).

Approximately 3.6% of respondents recognised the importance of "Research and Monitoring" for data-driven decision-making (MacKenzie et al., 2006). "Livestock protection and better compensation" received notable support, with approximately 18.3% advocating for measures to mitigate human-wildlife conflicts (Treves et al., 2006). "Strict Laws" were less favoured, with only about 6.3% of respondents endorsing them as a conservation approach (Pires and Moreto, 2011). These findings underscore the region's complex nature of carnivore conservation and the need for diverse, collaborative efforts to safeguard these species effectively.

A substantial majority, comprising around 71% of all respondents or 237 individuals, expressed dissatisfaction with Kargil's current state of wildlife conservation efforts. This sentiment of discontent may stem from various factors, including the perceived ineffectiveness of conservation measures, conflicts with wildlife leading to economic losses, or challenges in co-existing with carnivores (Treves et al., 2006; Dickman, 2010). Conservation authorities and stakeholders need to acknowledge and address this significant discontent within the local community to ensure the success of future conservation initiatives, as community support and engagement are often crucial for effective wildlife conservation (Lindsey et al., 2007; MacKenzie et al., 2006). Understanding and responding to the concerns of the dissatisfied majority is imperative for crafting more inclusive and effective conservation strategies that align with the needs and aspirations of the local population. Engaging in dialogues and participatory approaches with the community can improve conservation outcomes, reduce conflicts, and create more harmonious coexistence between humans and wildlife (Treves et al., 2006; Veríssimo et al., 2019).

The emergence of proactive measures, such as killing brown bears by community members in response to perceived threats, highlights the complexity of human-wildlife interactions in regions like the Drass and TSG blocks. These mob-induced actions underscore the challenges associated with mitigating human-wildlife conflicts in areas where the coexistence of humans and carnivores is fraught with risks and uncertainties. While the study period did not record retaliatory actions, the incidents of proactive killings indicate the need for nuanced approaches to managing such conflicts. This phenomenon resonates with findings from other conflict-prone regions, where fear and concerns about safety drive communities to take swift and often lethal measures in response to wildlife encounters (Inskip & Zimmermann, 2009).

The case presented by *Respondent-30* provides a firsthand account of the urgency and fear that can characterise these situations. It underscores the critical importance of rapid response and effective communication between local communities and wildlife authorities. To reduce such incidents, strategies should focus on improving public awareness, education, and building community capacity to respond to wildlife encounters safely (Dickman et al., 2014).

The findings of this study suggest that gender does not play a significant role in shaping perceptions of future carnivore population trends in Kargil. This implies that both men and women have similar perceptions regarding the region's future population trends and a species perceived as problematic. The role of gender in shaping people's attitudes towards wildlife has been a topic of interest in environmental psychology. Although studies suggest that gender may influence attitudes towards wildlife (Bitanyi et al., 2017; Gore & Kahler, 2012; Kahler & Rinkus, 2021; Miao et al., 2020; Ochieng et al., 2021; Song et al., 2021), the finding of this study suggests that gender has no significant role in shaping a person attitude towards wildlife.

Similarly, the study's findings reveal that religion/faith has no significant association in shaping people's attitudes towards wildlife. This aligns with previous studies that argued that a person's religious belief does not impact their attitude towards wildlife (Bhatia et al., 2016). At the same time, other studies argue that religion plays a significant role in shaping attitudes towards wildlife (Kenkins & Chapple, 2011).

Livestock dependency, where respondents reported livestock as their primary source of livelihood, significantly shaped their attitude towards wild carnivores. Several studies have examined this relationship, highlighting the impact of livestock on attitudes and perceptions of carnivores (Bagchi & Mishra, 2006; Gebo et al., 2022; Home et al., 2017; Kusi et al., 2019; Li et al., 2015; Li et al., 2022; Mishra et al., 2003; Røskaft et al., 2007; Suryawanshi et al., 2014; Uduman et al., 2021). Studies have found less dependence on livestock for income is associated with more positive attitudes towards carnivores (Suryawanshi et al., 2014). Conversely, communities relying heavily on livestock for their livelihoods may develop negative attitudes towards carnivores due to the economic losses caused by livestock predation (Kusi et al., 2019). The trauma of experiencing livestock predation firsthand can also contribute to negative attitudes towards carnivores among farmers (Røskaft et al., 2007). Livestock predation by carnivores and the subsequent retaliatory persecution by pastoralists are global conservation concerns (Bagchi & Mishra, 2006). The depletion of wild prey due to poaching and competition from livestock can indirectly threaten carnivores in certain regions (Mishra et al., 2003). Livestock depredation by carnivores can lead to negative attitudes towards problem carnivores among pastoralists (Li et al., 2015). Additionally, attitudes towards carnivores are significantly linked to livestock factors rather than other socioeconomic factors (Gebo et al., 2022). Livestock-dependent human communities are at risk of conflict with carnivores, which can impact attitudes towards them. Livestock depredation by wild carnivores threatens both carnivore populations and the livelihoods of communities (Uduman et al., 2021). Misidentifying the carnivores responsible for livestock depredation can also lead to negative attitudes towards carnivore conservation (Home et al., 2017).

The study further reveals the significant impact of the respondent's level of education on their perception and attitude towards carnivores of the region. Several studies have highlighted the positive impact of education on promoting environmental knowledge, attitudes, and behaviour (Ballantyne et al., 2011; Freund et al., 2019). Improving the educational status of individuals, particularly the younger generation, has been identified as a means to improve community attitudes towards wildlife (Biru et al., 2017).

Limitations

Perception vs. Scientific Assessment: The study relies on the local community's perceptions, which may not always align with scientific population assessments. While perceptions are valuable indicators of community engagement, they may not provide precise population data. Therefore, conservation strategies should integrate local perceptions and scientific research (McCarthy et al., 2016).

Sample Size and Representation: While informative, the study's sample size of 334 respondents may not fully represent the diversity of perspectives within the Kargil region. Variability in attitudes and awareness among different communities and regions could be missed. Future studies could aim for more extensive and stratified sampling to address this limitation. Further, the small sample size for in-depth interviews will be a challenge to generalising the study's findings.

Social Desirability Bias: Respondents may have provided answers they perceived as socially desirable, potentially influencing their responses. Measures to minimise social desirability bias, such as anonymous surveys and ensuring confidentiality, should be considered in future research (Treves et al., 2006).

In conclusion, while this study provides valuable insights into the perceptions of wild carnivore populations and conservation efforts in Kargil, it is essential to acknowledge its limitations. Addressing these limitations and building on the recommendations can contribute to more effective and inclusive regional carnivore conservation strategies.

Conclusion

Although this study tried to explore the local population's perception towards the trend of the wild carnivore population in Kargil, It is crucial to acknowledge that perceptions alone may not provide a comprehensive understanding of population dynamics. Scientific monitoring and research are essential for accurately assessing population trends and guiding conservation strategies (Macdonald et al., 2015). Therefore, combining local knowledge and scientific research can enhance our understanding of carnivore populations and inform practical conservation efforts in the Kargil region.

The findings of this study provide valuable insights into the perceptions and concerns of the Kargil community regarding the population trends of wild carnivore species in the region. Snow leopards, a species of global conservation concern, were strongly associated with declining populations, aligning with their vulnerable status worldwide (McCarthy et al., 2016). The perceived decline in snow leopard populations underscores the urgency of targeted conservation efforts, emphasising the need for habitat protection and anti-poaching initiatives. Similarly, the perception of declining Himalayan brown bear populations in Kargil reflects broader challenges bears face in the Himalayan region, emphasising the importance of addressing issues like habitat fragmentation and human-wildlife conflicts.

The dependency on livestock plays a crucial role in shaping attitudes towards wild carnivores. Livelihood dependence on livestock can lead to negative attitudes due to economic losses caused by predation. Conversely, less dependence on livestock is associated with more positive attitudes towards carnivores. Livestock predation and retaliatory actions by pastoralists are global conservation concerns. The depletion of wild prey and misidentification of carnivores responsible for livestock depredation can also impact attitudes towards carnivores (Home et al., 2017). Understanding the relationship between livestock dependency and attitudes towards carnivores is essential for developing effective strategies for human-carnivore coexistence.

Similarly, the study revealed a significant impact of the respondents' education level on shaping attitudes towards the region's carnivores. Providing education and conducting educational programmes and seminars, particularly for younger generations, can foster a greater appreciation and understanding of wildlife, leading to more positive attitudes and behaviours towards their conservation.

Despite their elusive nature and conflicts, public support for increasing snow leopard populations underscores the global recognition of snow leopards as iconic and endangered species (McCarthy et al., 2016). Similarly, despite reported conflicts, the desire to see more bears in the wild highlights the cultural and ecological significance of bears in the Himalayan region (Bhatnagar et al., 2019). These preferences indicate a willingness among the local community to co-exist with and conserve these charismatic species. The balanced support for wolf populations may reflect recognition of their ecological roles and the need for coexistence strategies (Ripple et al., 2014). The strong public support for fox population growth aligns with their smaller size and potentially lower impact on human activities, making them more amenable to coexistence.

The perceived threats to wild carnivores in Kargil, including habitat loss, climate change, and human-wildlife conflicts, reflect global concerns about these conservation challenges (Wilcove et al., 1998; Bellard et al., 2012; Treves et al., 2006). Conservation strategies in the region should consider these threats comprehensively, focusing on habitat preservation, community engagement, research and monitoring, and mitigation of conflicts (Joppa et al., 2016; Veríssimo et al., 2019; MacKenzie et al., 2006; Treves et al., 2006; Pires and Moreto, 2011).

The high level of dissatisfaction with current conservation efforts among the majority of respondents highlights the need for addressing perceived ineffectiveness and conflicts associated with wildlife conservation (Treves et al., 2006; Dickman, 2010). Engaging in dialogues and participatory approaches with the local community is essential to ensure the success of future conservation initiatives and promote a harmonious coexistence between humans and wildlife (Lindsey et al., 2007; MacKenzie et al., 2006).

In conclusion, this study comprehensively assesses local peoples' perception of wild carnivores from Kargil trans-Himalayas, India. The scarcity of research literature from the trans-Himlayan region and the study area, in particular, is one of the main obstacles in decision-making and policies about wildlife conservation. This study will serve as baseline information for future researchers and policy-making bodies to consider the attitude and perception of local communities in planning better stakeholder-led action plans.

Recommendations

Community Engagement and Education: Given the strong public support for carnivore conservation in Kargil and the impact of education on shaping attitudes towards carnivores of the region, it is recommended that conservation authorities and organisations engage with the local community through education and awareness programs. These programs can focus on the ecological importance of carnivores, the benefits of coexistence, and the implementation of best practices for mitigating human-wildlife conflicts. Engaging the community can foster a sense of ownership and collaboration in conservation efforts (Veríssimo et al., 2019).

Targeted Conservation for Snow Leopards and Bears: The perception of declining populations of snow leopards and bears highlights the need for targeted conservation measures. Conservation authorities should prioritise the protection of critical snow leopard and bear habitats, implement anti-poaching initiatives, and work closely with local communities to address human-wildlife conflicts. Collaborative efforts can help secure the future of these vulnerable species (McCarthy et al., 2016; Bhatnagar et al., 2019).

Research on Wolf and Fox Populations: The positive perceptions of growing wolf and fox populations offer opportunities for further research. Scientific studies should investigate the ecological factors contributing to the apparent growth of these species in Kargil. Understanding the drivers of their population trends can inform future conservation strategies and help maintain the balance of ecosystems (Ripple et al., 2014).

Evidence-Based Conservation Strategies: Conservation strategies in Kargil should be evidence-based and consider ecological factors, habitat protection, community involvement, and conflict mitigation. The creation of protected areas, supported by most respondents, should be accompanied by effective enforcement and habitat management. As the study revealed a significant impact of livestock dependency on shaping attitudes towards wildlife of the region, a conservation approach that fosters the local communities' needs by introducing alternative sources of income (e.g., eco-tourism, local handicraft promotions, and many more) can positively impact the efforts to protect the wildlife of the region. Conservation authorities should also continue monitoring carnivore populations to assess the impact of conservation efforts (Joppa et al., 2016; MacKenzie et al., 2006).

CHAPTER 6 - KNOWLEDGE AND ATTITUDE TOWARDS WILD CARNIVORES AMONG UNIVERSITY STUDENTS FROM KARGIL

6.1 Introduction

Humans have been sharing space with wildlife and competing with them for natural resources throughout history. As the human population is expanding rapidly, demand for natural resources also increases, resulting in inflated competition for resources and intensified pressure on wildlife (Conover, 2002; Woodroffe, 2000). Due to anthropogenic activities expanding across the world, biodiversity suffers a direct loss, and also, there is a decline in human well-being (Dickman & Hazzah, 2016). The exponential increase in the human population has led to increased human-wildlife conflicts worldwide (Conover, 2002; Woodroffe, 2000). The degradation and fragmentation of wildlife habitats through intensive human use have brought wildlife and humans closer than ever before. Attacks by large predators on humans and their livestock and agricultural damage by large herbivores have always occurred but have gained increased attention in recent decades (Inskip & Zimmermann, 2009). These occurrences have led to misconceptions and incorrect notions/emotions about the behaviour of non-charismatic carnivores and large herbivore species in rural areas where people share land and resources with such species (Castillo-Huitrón et al., 2020, Dickman et al., 2014; Marchini & Macdonald, 2012).

In the case of emotions and attitudes towards a wild carnivore, physical traits of animal species, as well as human-created "personalities", have elicited a wide range of emotions (Castillo-Huitrón et al., 2020; Kellert et al., 1996; Kruuk, 2002; Prokop & Randler, 2018). Large charismatic creatures that have historically been viewed as dangerous, yet intelligent, elicit emotions that can lead to protective acts, as has been the case with lions (*Panthera leo*), tigers (*Panthera tigris*), leopards (*Panthera padrus*), snow leopards (*Panthera uncia*), and different species of bears (*Ursus*) (Dickman et al., 2014; Marchini and Macdonald, 2012). Knowledge of the behaviour of culturally significant species develops better in rural communities where people contact wildlife regularly than in other locations (Castillo-Huitrón et al., 2020). This allows the anthropomorphization of particular animals, which enhances dread and rejection toward them by labelling them "shy," "noxious," and "monstrous," among other descriptors (Castillo-Huitrón et al., 2020; Lescureux & Linnell, 2010). Furthermore, if the existence of an animal causes community members to suffer economic losses, their central perspective will be negative, resulting in resentment that may lead to fatal management (Naughton-Treves, 1997).

The environmental ethics of the Abrahamic monotheistic faiths—Christianity, Judaism, and Islam—are all based on the concept of stewardship, which implies human responsibility for preserving nature (Bhagwat et al., 2011). Further, religions evolved in Asia (Buddhism, Hinduism, Jainism, Taoism, and Sikhism) place a high value on the holiness of nature and its animals and principles that might elicit environmental awareness and action (Bhagwat et al., 2011). Moral ideals are derived from and legitimized by religion/faith and can significantly address today's global environmental issues (Mcleod & Palmer, 2015). Religion can assist in developing compassion towards an animal/creature, which is the primary ethics of all faiths but sometimes not valued on an individual level (Mcleod & Palmer, 2015).

Community knowledge, engagement, and the impact of conservation measures depend on public attitudes toward conservation. Assessing local people's perspectives can reveal how they will act, whether they will comply with wildlife protection rules, respond to wildlife-related economic losses, and how eager they are to cohabit with wildlife (Megaze et al., 2017). Local community knowledge is regarded as an essential component in expressing feelings toward animals (Castillo-Huitrón et al., 2020). Moreover, local knowledge and emotional ties with animals can be essential in identifying strategies to promote environmental awareness (Bowen-Jones & Entwistle, 2002).

Individuals' emotional responses to animals are influenced by various factors, including their gender, age, cultural and natural settings, and perceived sensitivity to each species (Johansson et al., 2012). Significant disparities in fear of wildlife species have been discovered among persons with various levels of education; those with higher educational levels are frequently less fearful of wild animals than those with lower educational levels (Røskaft et al., 2003). Understanding the attitude and perception of local people towards wildlife and conservation approaches is necessary to improve favourable human-wildlife interactions (Ciocănea et al., 2016; Mir et al., 2015; Shrestha & Alavalapati, 2006; Vodouhê, 2010) and how the future of wildlife conservation is shaped (Adams & Hutton, 2007; Barua et al., 2013; Lyamuya et al., 2014; Røskaft et al., 2007). In addition, local communities' views and attitudes toward wildlife are essential in resolving conflict problems, which put a negative toll on the local communities living adjacent to wildlife habitat and the wildlife species (Naughton-Treves & Treves, 2005). Further, individuals with higher education are likely to have more opportunities to learn about the Environment and, in particular, wild animals, which may help individuals realize the ecological advantages given by non-charismatic species, reducing their unfavourable preconceptions and beliefs about them (Castillo-Huitrón et al., 2020).

Given that values evolve at a young age (Schwartz, 2006), understanding how the younger generation understands and perceives wildlife is critical. These values eventually impact attitudes and behaviour related to wildlife and human-wildlife conflict. No study from the Kargil district, India, addresses the awareness of wildlife among university students and how they perceive wildlife species. Hence, this study aimed to fill the gap and targeted respondents studying at the university level to explore and assess their knowledge and attitude towards wildlife of the region in general and wild carnivores in particular. Kargil, although a region of unique geographical features and biodiversity (Pfister, 2004), is less studied in terms of intensive wildlife research. To assist in implementing concrete, successful, and sustainable conservation efforts in the region, it was felt necessary to conduct this study with the specific objectives: (1) to understand the knowledge and attitude towards wildlife among students from Kargil; (2) to identify the factors and associations, if any, between various respondent categories and knowledge and attitude scores and variables within; and (3) to examine if there is any relationship between knowledge of students and their attitude towards wildlife.

6.2 Study area

Administratively, Kargil is divided into 15 Community Development (CD) blocks (District Statistics & Evaluation Officer Kargil, 2020). However, with demographic

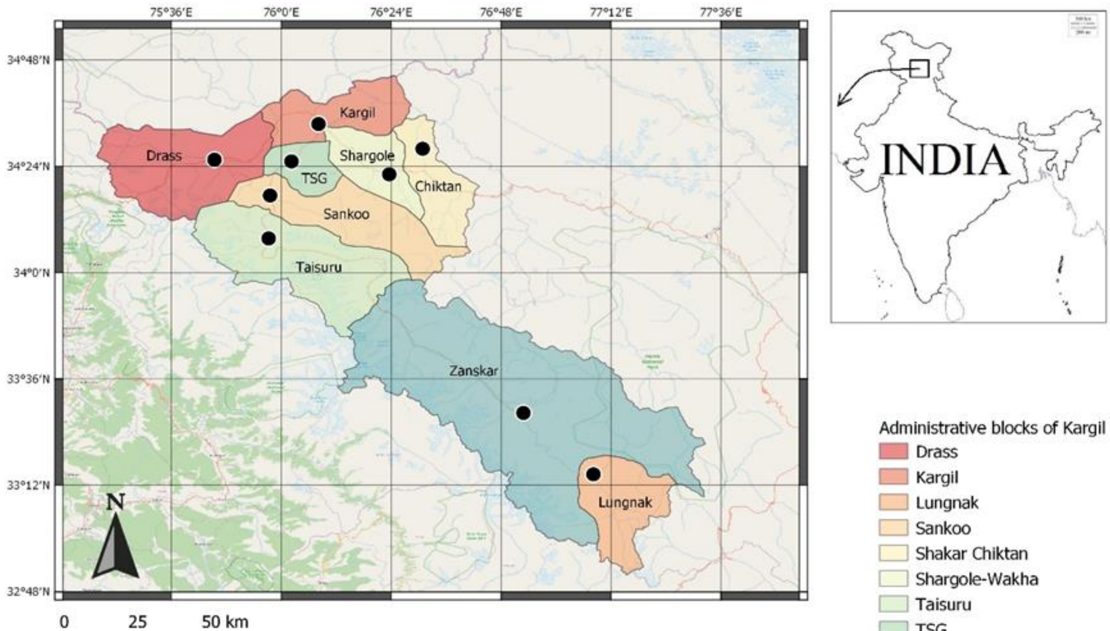


Figure 64 Kargil district in the union territory of Ladakh, India with important CD block headquarters.

insights and data available according to the past demarcation of nine CD blocks of the district, the data was adapted and utilized according to the nine CD blocks of the study area (Census of India, 2011; District Statistics & Evaluation Officer Kargil, 2020) (Figure 64).

Kargil is one of the two districts in Ladakh, India's newly formed Union Territory. Before 2019, it was a district in the former state of Jammu and Kashmir. Often referred to as a 'cold desert' in the scientific community, Kargil has a unique floral and faunal assemblage (Pfister, 2004) with cold and temperate climatic characteristics. Kargil is home to some of the important and endangered wild carnivores and ungulate species such as snow leopard, Himalayan brown bear (*Ursus arctos isabellinus*), wolf (*Canis lupus*), fox (*Vulpes vulpes*), Pallas's cat (*Otocolobus manual*), Asiatic ibex (*Capra ibex sibirica*) and Ladakh urial (*Ovis vignei*) (Pfister, 2004). This region's primary traditional livelihood practices are livestock rearing and sustenance agricultural practices (Barthwal & Mathur, 2012). Notably, in Kargil and Zanskar regions, livestock rearing is one of the most important sources of income for agro-pastoral communities (Maheshwari, 2016; Maheshwari & Sathyakumar, 2020). Kargil is one of India's least densely populated districts, with a total human population of 140,802 (Census of India, 2011) and a geographical area of 14,036 square kilometres. The human population is distributed along the glacial streams and the three central river valleys (Suru, Drass, and Wakha), forming important Indus River tributaries. The majority of the human population in Kargil belongs to the tribal community of the Purigpa and Balti people of Tibetan descent mixed with the Dard, Mon, and other Aryan people (Gellner, 2013).

Education in Kargil has transitioned since the beginning of the 21st century. Until 1998, 95% of Ladakhi (Kargil and Leh district) students failed to complete their high school exams (10th class, as per the education system of India) every year

(SECMOL, 2022). This reflects that modern education is very new to the region. However, some significant steps have been taken by the then-state of Jammu and Kashmir and the government of India to boost the education quality in the region. To improve and provide accessible higher education to the people of the region, the former state of Jammu and Kashmir established the Degree College Kargil by Order No: 138-HE of 1995 dated 31.03.1995 (District Statistics & Evaluation Officer Kargil, 2020). The College was founded on 29 June 1995, and the operation of this district's top seat of Higher education learning marked the beginning of a new era in the educational development of Kargil's steep, under-developed, and sensitive border region (District Statistics & Evaluation Officer Kargil, 2020). The University of Ladakh, established in 2019, is the sole trans-Himalayan institute of higher learning and research in the Union Territory of Ladakh (University of Ladakh, 2020). Both Leh and Kargil are home to the University's administrative offices. The University has campuses in both Leh and Kargil and six constituent colleges. In August 2021, to ensure quality education and higher educational requirements for people residing in Ladakh, a bill was passed in the Indian parliament to establish a central university in the Union territory of Ladakh (The Hindu, 2021). Besides the efforts to improve the quality of education, from an early age, many pupils are admitted to renowned Indian colleges to prepare for and participate in competitive postsecondary education (Smith & Gergan, 2015). Likewise, in the case of Kargil, to pursue quality education, students frequently travel to bigger cities like Jammu, Srinagar, Delhi, Chandigarh, and Mumbai.

Kargil has been disregarded in terms of intense wildlife studies and follow-up conservation efforts since it was an armed conflict zone in the late 1990s and early 2000s (Maheshwari, 2016). Although human-wildlife interaction is not unique to Kargil, people in this region are particularly vulnerable owing to the high reliance on livestock, limited agriculture season, and pasture lands, which restricts conflict mitigation strategies. Understanding human-wildlife interactions requires understanding how the local communities living adjacent to wild carnivore species' habitats perceive and respond toward the species (Woodroffe, 2005).

The findings in Chapter Four of this thesis reveal the substantial influence of two key variables, the level of education and dependency on livestock, on people's perceptions of carnivores in the region. Both of these factors significantly impacted the formation of individuals' attitudes towards wildlife. Remarkably, over 90% of the survey respondents reported some form of involvement in livestock husbandry. Consequently, our study aimed to delve into the knowledge and attitudes held by higher education students regarding the indigenous wild carnivores in the region. The rationale behind this approach stems from the recognition that these students, by their education, can influence the perceptions of their families, elders, villagers, and local communities through disseminating knowledge about the region's wildlife.

This study also sought to explore the extent to which the youth in the region are informed about the wildlife in their immediate surroundings. This investigation is significant as it addresses the knowledge and attitudes of a demographic cohort that holds great promise for shaping future conservation efforts and coexistence strategies related to the region's carnivore populations.

6.3 Methods

6.3.1 Online survey

Nonprobability convenience sampling was adopted for the application of an online survey. The inclusion criteria were students resident of Kargil, aged 18 years or above, and pursuing graduation or higher degree education in Kargil and other parts of India. A preliminary version of the questionnaire was distributed among 40 respondents (primarily students in higher education) to adapt the questions and improve the clarity of the language. The final set of the questionnaire was distributed among the students through executive members of various student organizations in Kargil and other parts of India, emails (colleges and universities), media outlets, and virtual platforms (WhatsApp, Facebook, and Instagram) from 8 November 2021 to 8 December 2021. This sampling approach and technique ensures the sample's representativeness and equity (Boso et al., 2021).

The first page detailed the information and purpose of the study. The responsible researcher's name, email address, and other contact information were available on this page if the respondents needed more information and clarity on the purpose of the study. This section highlighted the ethical measures to protect the participants' integrity, anonymity, and well-being. The page ended with the respondent's consent to participate in the study with a 'Yes' or 'No' response. The participants were allowed to proceed further to the completion of the complete survey only upon their consent to participate in the research.

6.3.2 Questionnaire design

An online questionnaire form was drafted using the Google Form survey sheet (Supplementary). The questionnaire was divided into three sections. Being one of the three official languages of Kargil ("Kargil district - Wikipedia", 2021) and a compulsory subject at primary, middle, high, and higher secondary school education levels across Kargil, English was adopted as the medium of language for the questionnaireThe decision was made to exclude responses that stated English was not a subject at their higher secondary education level and also where the respondents stated difficulty understanding the questionnaire.

Section one of the questionnaire obtained the socio-demographic information (gender, faith, age, CD block of residence, level of education, current place of study, subjects at higher secondary level, environmental science in higher secondary) of the respondents. The section also explored whether the respondent studied English as a subject at their school level to understand the clarity of the questionnaire.

Section two explored the knowledge score of the respondents through 12 sets of questions or statements about the wildlife of Kargil. This section included questions with 'Yes' or 'No' responses or text space to identify wild carnivore species of the region. The pictures of the mammal species that were included to be identified by the respondents were a red fox, a Himalayan brown bear, a snow leopard, and a wolf (supplementary). The correct answer to each knowledge question was given a score of '1' and '0' for incorrect responses. Hence, the overall knowledge score of the respondent was accumulated to a maximum of 12.

Section three examined the attitude scores of the respondents. This section consists of 12 statements/questions intended to assess the respondents' attitudes towards the region's wildlife. A favourable response/attitude towards wildlife was scored '1', and a negative response was scored '0'. Hence, the accumulated maximum attitude score for a respondent was 12.

A question was included to determine whether the questionnaire was intelligible to the respondents. One open-ended question was also included in the last section of the questionnaire to explore their experience, further comments on the region's wildlife, and the scope for future studies.

6.3.3 Statistical analysis

A one-sample Shapiro-Wilk test was performed to assess the normality of the data. Square root and log transformation were performed on non-normally distributed data to obtain normality. None of the variables satisfied the normality criterion after log and square root transformations. Hence, non-parametric tests were used to guarantee that the findings were reliable.

The Chi-square test (Pearson chi-square, Fisher exact test, likelihood ratio) was used to assess any association between two categorical variables. The Kruskal-Wallis test was used to compare the knowledge and attitude scores with more than two independent categories of socio-demographic variables. The Mann-Whitney U test was performed to compare the attitude and knowledge scores with two independent paired socio-demographic categories. To evaluate the relationship between the total knowledge and attitude score, Spearman's correlation test (rho) was performed. All the data handling and statistical analysis were performed in Microsoft© Excel and SPSS© 27.

This study was approved by the Research, Innovation and Academic Engagement Ethical Approval Panel of the University of Salford, United Kingdom, with application number – SRT1920-14

6.4 Results

In total, 385 responses were received. Nine respondents did not consent to participate in the study. A total of 14 additional responses were removed from the final data list. These were the responses that indicated difficulty in understanding the questionnaire (n=6) and the responses where English was not one of the subjects at their higher secondary education level (n=8). Hence, 362 responses were considered fit for the final data analysis. The age of the participants ranged between 18 and 33 years, with a mean of 23.10 years ±3.368. The detailed demographic information of the respondents is shown in Table 45.

Table 45 Socio-demographic profile of the respondents (N=362).

		Frequency	Percent (%)
Gender	Male	247	68.2
	Female	114	31.5
	Prefer not to say	1	.3
Faith	Islam	307	84.8
	Buddhism	38	10.5
	Bon-chhos	10	2.8
	Prefer not to say	7	1.9
Resident (Block)	Kargil	123	34.0
	Zanskar	15	4.1
	Shakar-Chiktan	30	8.3
	Sankoo	68	18.8
	Drass	35	9.7
	Taisuru	30	8.3
	Cha/Lungnak	4	1.1
	Shargole	33	9.1
	TSG	24	6.6
Current place of study	Kargil	158	43.6
	Leh	17	4.7
	Srinagar	22	6.1
	Jammu	59	16.3
	Delhi	38	10.5
	Chandigarh	32	8.8
	Dehradun	5	1.4
	Others (Outside Kargil)	31	8.6
Subject in Higher Secondary (10+2)	Science	252	69.6
	Arts	78	21.5
	Commerce	22	6.1
	Others	10	2.8
Environmental Science Subject in Higher Secondary	No	95	26.2
	Yes	267	73.8

6.4.1 Knowledge Score

The total knowledge score for the respondents ranged from 3 to 12, with a mean score of 9.68 ±1.565. The accurate responses (in percentage) for the knowledge statement by the respondents are detailed in Table 46.

Table 46 Response to the knowledge statement of the questionnaire.

Question/Statement	Accurate response (%)
Identification of regional wildlife Species (Fox)	91.4
Identification of regional wildlife Species (Bear)	98.3
Identification of regional wildlife Species (Snow leopard)	70.4
Identification of regional wildlife Species (Wolf)	86.5
Kargil has a unique and rich biodiversity owing to its special geographicalcharacteristics	91.2
There are many protected areas for wildlife in Kargil	57.7
Wolves are omnivorous animals?	67.1
Kargil (Ladakh) is sometimes referred to as 'cold desert' in the scientific community	90.6
Each wild carnivore plays an important role in the 'food web.'	95.0
The scientific name of the fox is (*Vulpes vulpes* or *Canis lupus*)	75.7
The largest carnivore species of Kargil is the brown bear or Snow leopard)	66.3
Tigers (*Panthera tigris*) are also found in Kargil	77.9

6.4.2 Identification of species

Identification of different wild carnivore species and their association with various categories of respondents are laid out in Table 47. Three hundred thirty-one respondents correctly identified Fox. However, it was confused for wolf (*Canis lupus*) and typical dog (*Canis familiaris*) by 8.65% (n= 31) of the total respondents. The chi-square test of independence was performed to assess the relationship between the respondents' various demographic categories and the species identification. There was a significant relationship between the identification of fox and the students who studied environmental science at the higher secondary school level χ^2 (1, 362) = 3.949, p = 0.047. Students with environmental science as one of their subjects at a higher education level were able identify the fox more accurately (93.26%) than students without an environmental science background (86.32%).

Bear was the easiest species to be identified by respondents, with 356 (98.3%) respondents correctly identifying the species. Consideration was given to responses where the brown bear was also referred to as 'bear' by the participants. However, responses with 'polar bear (*Ursus maritimus*)' were excluded. Six respondents could not identify the brown bear correctly, confusing it for the polar bear.

The snow leopard was the least identified species by the respondents. It was correctly identified by 255 (70.4%) of the 362 respondents. Regarding identification, the respondents confused the snow leopard for the typical cat (*Felis catus*), cheetah (*Acinonyx jubatus*), tiger, and other cat species. There was a significant relationship between gender and identification of snow leopard, χ^2(2, 362) = 11.128, p = 0.004, with male respondents identifying the species more accurately (75.71%) as compared to female counterparts (58.77%).

Three hundred thirteen of the total 362 respondents could identify the wolf correctly. However, 13.5% (n=49) confused it for dog, fox, and jackal (*Canis aureus*).

Table 47 Association between respondents' categories and identification of species.

Respondent categories	Variables	Fox					Bear					Snow Leopard					Wolves				
		Correct identification (%)	Incorrect identification (%)	Association	df	Sig. (p value)	Correct identification (%)	Incorrect identification (%)	Association	df	Sig. (p value)	Correct identification (%)	Incorrect identification (%)	Association	df	Sig. (p value)	Correct identification (%)	Incorrect identification (%)	Association	df	Sig. (p value)
Gender	Male	92.31	7.69				98.38	1.62				75.7	24.3				87.04	12.96			
	Female	90.35	9.65	5.328 (G^2)*	2	0.07	98.25	1.75	0.042(G^2)	2	0.979	58.78	41.22	11.128(G^2)*	2	0.004	85.09	14.91	0.542(G^2)	2	0.762
	Prefer not to say	0	100				100	0				100	0				100	0			
Faith	Islam	91.86	8.14				98.7	1.3				71.66	28.34				85.99	14.01			
	Buddhism	92.11	7.89				100	0				71.05	28.95				89.47	10.53			
	Bos-	70	30	5.128(G^2)	3	0.163	90	10	6.183(G^2)	3	0.103	20	80	12.023(G^2)*	3	0.007	90	10	0.492(G^2)	3	0.921
	Prefer not to say	100	0				85.72	14.28				87.5	12.5				85.72	14.28			
Block resident	Kargil	90.24	9.76				98.38	1.62				65.04	34.96				85.37	14.63			
	Zanskar	93.34	6.66				100	0				60	40				80	20			
	Shakar-Chiktan	96.67	3.33				100	0				73.34	26.66				83.34	16.66			
	Sankoo	92.65	7.35	8.139(G^2)	8	0.42	97.06	2.94	4.759(G^2)	8	0.783	73.53	26.47	5.911(G^2)	8	0.657	85.3	14.7	17.458(G^2)*	8	0.026
	Drass	85.72	14.28				97.14	2.86				80	20				74.29	25.71			
	Taisuru	83.34	16.66				96.67	3.33				76.67	23.33				100	0			
	Lungnak	100	0				100	0				50	50				100	0			
	Shargole	96.97	3.03				100	0				72.73	27.27				90.91	9.09			
	TSG	87.38	12.62				100	0				70.84	29.16				95.84	4.16			
Current education level	Graduatio	93.37	6.63				99.45	0.55				71.27	28.73				90.06	9.94			
	Masters	91.21	8.79	2.364(G^2)	3	0.5	97.71	2.29	4.288(G^2)	3	0.232	67.04	32.96	6.623(G^2)	3	0.085	85.72	14.28	10.534(G^2)*	3	0.015
	PhD	86.37	13.63				100	0				90.91	9.09				95.46	4.54			
	Other	88.24	11.76				97.06	2.94				66.18	33.82				75	25			
Current place of study	Kargil	92.41	7.59				99.37	0.63				62.66	37.34				82.09	17.91			
	Leh	94.12	5.88				100	0				64.71	35.29				78.58	21.42			
	Srinagar	81.82	18.18				100	0				77.28	22.72				84.21	15.79			
	Jammu	89.83	10.17	4.078(G^2)	7	0.771	98.31	1.69	5.436(G^2)	7	0.607	64.41	35.59	21.189(G^2)*	7	0.003	90.74	9.26	3.699(G^2)	7	0.814
	Delhi	89.47	10.53				94.74	5.26				86.84	13.16				81.25	18.75			
	Chandigar	93.75	6.25				96.875	3.125				78.13	21.87				85.72	14.28			
	Dehradun	100	0				100	0				100	0				100	0			
	Others	93.55	6.45				96.77	3.23				87.1	12.9				85.19	14.81			
Subject in Higher Seconda	Science	92.46	7.54				98.41	1.59				72.23	27.77				88.1	11.9			
	Arts	89.74	10.26	4.433(G^2)	3	0.218	97.44	2.56	1.415(G^2)	3	0.702	64.11	35.89	4.552(G^2)	3	0.208	80.77	19.23	2.660(G^2)	3	0.447
	Commerc	81.82	18.18				100	0				63.64	36.36				86.37	13.63			
	Others	100	0				100	0				90	10				90	10			
EVS in 10+2	Yes	86.32	13.68		1	0.053(Ꝑ)	96.84	3.16		1	0.188(Ꝑ)	72.63	27.37	0.297(χ2)		0.586	82.11	17.89	2.091(χ2)	1	0.148
	No	93.26	6.74				98.88	1.12				69.66	30.34				88.02	11.98			

G^2 – Likelihood ratio, Ꝑ – Fisher exact, χ2 – Pearson's chi-square, *=significant at 0.05.

6.4.3 Knowledge score and various factors

The Kruskal-Wallis test revealed a non-significant difference, H(2)= 3.885, p= 0.143, in the total knowledge score across three gender categories. However, the distribution of the total knowledge score was significantly different, H(3) = 12.724, P = 0.005, across four categories of faith (Islam, mean rank = 185.45; Buddhism, mean rank =178.93; Bon-chhos, mean rank = 68.35; prefer not to say, mean rank = 183.64). The distribution of total knowledge scores was significantly different, H(3)= 10.626, P= 0.014 across the different levels of education (graduation, mean rank = 175.05; masters, mean rank= 194.25; PhD, mean rank= 236.82; others higher than 10+2, mean rank= 163.71). The distribution of total knowledge score was not the same, H(3)= 10.120, P= 0.018, across the categories of academic subjects of the respondents at the higher secondary education level (Science, mean rank =191.73; Arts and Humanities, mean rank = 159.65; Commerce, mean rank = 140.20; Others, mean rank = 192.85).

To evaluate the difference in knowledge scores among students who studied environmental science as a subject in their higher secondary education level, a non-parametric Mann-Whitney U test was performed. The effect size (r) statistic was calculated using the below formula:

$$r = \mathrm{Z}/\sqrt{\mathrm{N}}$$

Z is the Z statistic from the Mann-Whitney U test, and N is the number of cases. The test revealed a significant difference in knowledge scores among students who studied environmental science as a subject at their higher secondary school level (median = 10, n=267) and students who did not study environmental science at their higher secondary school (median = 9, n=95), U= 9978.000, z= -3.159, p= 0.002, r= 0.166.

Table 48 Percentage of the respondents with favourable responses to attitude statements/questions.

Question/Statement	Favorable response (%)
Do you think there should be more emphasis on the wildlife-related curriculum/subjects in schools?	92.5
There should be more protected areas in Kargil to conserve and protect biodiversity.	90.3
Local people living in areas adjacent to wild carnivores should be educated and awareof wild carnivores.	88.7
Wild carnivores should be protected even if it incurs a loss of some livestock	82.9
Would you be interested or thrilled to see a snow leopard in the wild?	91.2
It is important to protect the wild carnivores of Kargil	75.4
I feel relieved and comforted when there are efforts to protect the wildlife of Kargil	94.2
Conservation of the wild carnivores is necessary for human survival	91.7
Curriculum/subjects focusing on local and global wildlife should be included in school education	95.5
In geographically challenging regions, like Kargil, the wise use of natural resources isnecessary	96.7
Every student especially in higher education must have good basic knowledge of the wildlife of his/her region	90.9
We should respect and strive to protect all living beings, including wild carnivores as an integral part of the ecosystem	95.0

6.4.4 Attitude score of the respondents

The overall attitude score for the respondents ranged from 4 to 12, with a mean score of 10.19 ±1.417. In general, students in higher education had a favourable attitude toward the region's wildlife (Table 48).

A significant difference, $H(3) = 20.286$, $p = <0.001$, was observed in the distribution of total attitude score across various categories of faith of the respondents (Islam, mean rank = 183.09; Buddhism; mean rank = 201.36, Bon-chhos, mean rank = 47.50; Prefer not to say, n = 195.43). The distribution of the total attitude score of the respondents was not the same, $H(3) = 17.006$, $p = <0.001$, across four categories of the current level of education (graduation, mean rank = 177.80; masters, mean rank = 189.30; PhD, mean rank = 254.45; others (higher than 10+2), n = 157.32). The distribution of overall attitude score was significantly not uniform, $H(3) = 5.523$, $p = 0.037$, across categories of respondents' subjects of study (Science, n= 252; Arts/Humanities, n= 78; Commerce, n= 22; Others, n= 10). Further, the Kruskal-Wallis test of the independent sample reflected that the distribution of the total attitude score was significantly different, $H(7) = 22.547$, $p = 0.002$, in the categories of the current place of study (Kargil, mean rank= 168.76; Leh, mean rank= 195.00; Srinagar, mean rank = 214.43; Jammu, mean rank = 166.95; Delhi, mean rank= 236.05; Chandigarh, mean rank = 201.36; Dehradun, n= 201.90; Others, mean rank= 152.71). Mann Whitney U test revealed a non-significant difference in the total attitude score among students who studied environmental science as a subject at their higher secondary school level (median= 11, n= 267) and students who did not study environmental science in their higher secondary school level (median= 11, n= 95), $U = 11466.000$, $z = -1.476$, $p = 0.140$. The difference's effect size ($r = 0.077$) was negligible/minimal (Cohen, 1988).

6.4.5 Relationship between Knowledge Score and Attitude Score

A non-parametric correlation test (Spearman's rho) was performed to explore the relationship between the total knowledge and attitude scores. Spearman's correlation of knowledge score and attitude score was moderately positive and statistically significant, $r_s = 0.255$, $p < 0.001$, $N = 362$. This correlation, though weak, reflected that the increase in knowledge of the region's wildlife increases the favourable attitude of students in higher education towards wildlife.

Discussions

Although several studies have indicated that females are more afraid of wild animals and have a negative attitude toward them than males (Arrindell, 2000; Costello, 1982; Kellert & Berry, 1987; Kirkpatrick, 1984), this study revealed that there was no significant difference in the attitude of university students from Kargil towards wildlife across different gender categories. Although females are more afraid of wild animals, they, on the other hand, place a higher value on wildlife as objects of affection and are more concerned about wildlife exploitation (Kellert & Berry, 1987).

The study also revealed that the distribution of the knowledge score was not the same across the different levels of education of the respondents. The knowledge score increased with an increasing level of education. These findings are consistent with the findings of previous researchers who determined that education plays a significant role in influencing knowledge (Barthwal & Mathur, 2012; Fiallo & Jacobson, 1995; Gillingham & Lee, 1999; Pyrovetsi & Daoutopoulos, 1997).

The results presented in Table 39 provide valuable insights into the respondents' identification of different wild carnivore species and the factors influencing their ability to identify these species correctly. The study involved the identification of fox, bear, snow leopard, and wolf, and it is evident that some species were more easily identified than others.

Fox, a regional wildlife species, was correctly identified by most respondents (331 out of 362), indicating a relatively high level of recognition (Smith et al., 2019). However, it is noteworthy that 8.65% of the total respondents (n=31) confused the fox with the wolf (Canis lupus) and the common dog (Canis familiaris). This confusion suggests further education and awareness programs, especially for those encountering these species in the wild (Dayer et al., 2017).

One significant finding was the relationship between the identification of the fox and the respondents' background in environmental science at the higher secondary school level. The chi-square test of independence revealed a statistically significant relationship. Students with environmental science as one of their subjects at the higher education level were more accurate (93.26%) in identifying the fox than those without an environmental science background (86.32%). This highlights the positive impact of environmental education on species identification and underscores the importance of including wildlife-related subjects in the curriculum (Ballouard et al., 2019).

Bear emerged as the species that respondents could most easily identify, with 356 (98.3%) respondents correctly recognizing it (Mehlman et al., 2019). It is essential to note that even though some respondents responded with "bear" for brown bear (Ursus arctos), this was considered an accurate response, while responses mentioning "polar bear (Ursus maritimus)" were excluded. Despite this high accuracy, a small proportion (6 respondents) incorrectly identified the brown bear as the polar bear, indicating that specific regional wildlife education might be necessary to distinguish between these species (Glikman et al., 2019).

In contrast, the snow leopard was the most challenging species to identify among the respondents (Alexander et al., 2016). Only 70.4% of the total 362 respondents correctly identified the snow leopard. This species was frequently confused with other feline species, including the common cat (Felis catus), cheetah (Acinonyx jubatus), tiger, and other cat species. Gender differences were also observed in the identification of the snow leopard, with male respondents (75.71%) being more accurate than female counterparts (58.77%). This finding suggests the potential influence of cultural and societal factors on species recognition and warrants further investigation (Inskip & Zimmermann, 2009).

The wolf, another regional carnivore was correctly identified by 313 (86.5%) respondents. However, 13.5% of the respondents (n=49) confused the wolf with the common dog, fox, and jackal (*Canis aureus*) (Wang et al., 2020). This confusion highlights the importance of distinguishing between similar-looking species, especially for wildlife management and conservation purposes (Treves et al., 2017).

Regarding the knowledge score, the study found no significant difference in the total knowledge score across three gender categories. However, significant differences were observed in knowledge scores across different faiths, levels of education, academic subjects, and current study places (Azevedo-Santos et al., 2016). Notably, students who studied environmental science at the higher secondary level demonstrated significantly higher knowledge scores compared to those who did not study environmental science. This emphasizes the positive impact of environmental education on wildlife knowledge (Dayer et al., 2019).

The attitude score revealed that students in higher education generally had a favourable attitude toward the region's wildlife, with scores ranging from 4 to 12

(Bruskotter et al., 2017). Significant differences in attitude scores were observed across categories of faith, current level of education, subjects of study, and current place of study (Schultz et al., 2018).

The relationship between knowledge and attitude scores indicated a moderately positive and statistically significant correlation (Damerell et al., 2013). This suggests that an increase in knowledge about regional wildlife is associated with a more favourable attitude towards wildlife among students in higher education (Arimoro et al., 2019).

The attitude of students towards wildlife

The study also revealed that the distribution of the total attitude score was not the same across categories of the subject of the respondents' education at the higher secondary level. Students with an educational background in Arts and Science possess a more favourable attitude than those in Commerce and other streams. This could be because students with Arts and Science as their main subject have an option for choosing Environmental Science as a subject in their Higher secondary school education level.

The study also informed that the increase in knowledge of the region's wildlife increases the favourable attitude of students in higher education towards it. This, on some level, confirms past studies that reveal education and awareness can improve attitudes and tolerance for wild carnivores (Woodroffe, 2005), which may further assist in translating knowledge into positive behavioural changes within the student population. Another reason could be that living close to native species improves awareness of their ecology and behaviour, enabling the development of improved management techniques and responses to them (Røskaft et al., 2003).

Conclusions

Students from Kargil in higher education possessed good knowledge and information about their local wild carnivores and had a favourable attitude towards them. 78.3% of the respondents studied Environmental Science at their higher secondary education level, showing students' interest in understanding and exploring more about the natural Environment. Several studies (Bhatia et al., 2017; Kellert, 1985; Røskaft et al., 2007; Suryawanshi et al., 2014) have revealed that people with higher levels of education and awareness have higher levels of tolerance towards wild carnivores and other non-charismatic species. Considering knowledge as an essential component of human emotions (Castillo-Huitrón et al., 2020), the recommendation is that the perception and emotions of wild carnivores among local students can be improved by organizing regular awareness campaigns and programs in schools and higher education institutions across Kargil. This approach can also assist in shaping the need to translate knowledge into positive behaviour change in local communities toward wildlife.

Studies have also indicated that education and awareness can improve attitudes and tolerance for wild carnivores (Woodroffe, 2005); however, educating people who have a negative attitude about large carnivores due to a lack of interest in knowing more about them might be challenging (Bath & Majic, 2001; Kaczensky 2003). Better direct experiences, such as understanding the importance of species in tourism and their aesthetic values, can help alleviate fear and promote favourable attitudes toward wildlife (de Pinho et al., 2014). Implementing proper livestock compensation schemes by considering the tangible and intangible cost of livestock loss (e.g., loss of sleep due to worry) by the local communities, setting up proper livestock insurance programs, and promoting eco-tourism could be some of the positive steps in reducing poor attitudes and perceptions towards wildlife and can also serve as initial steps in enhancing their interest in knowing more about species of the region.

The study also reflected that students with environmental science as a subject at their higher secondary education level possess more knowledge about the region's wildlife. Although Environmental sciences, as a subject, was taught at a higher secondary school level across Kargil within Science and Arts stream as an optional subject, prioritizing the subject at a other school level education is recommended to promote knowledge and awareness of wildlife in the region specifically and the environment in general. Future research could intensively look into the factors that influence the formation of social attitudes toward wildlife.

Chapter 7 A PROPOSED 20-YEAR CONSERVATION ACTION PLAN FOR THE WILD CARNIVORE POPULATION OF KARGIL TRANS-HIMALAYAS, INDIA, 2025-2045

Photo source: Niaz Khan

Chapter Summary

This chapter delves into the fundamental concepts of Adaptive Management (AM) (Holling, 1978), Open Standards, (Conservation Measures Partnerships (CMP, https://www.conservationmeasures.org/), and Theory of Change (ToC) within the context of wildlife conservation (Margulis et al. 2009, Schwartz et al., 2012). These concepts provide a solid foundation for informed decision-making and strategic planning in conservation initiatives. The imperative for adaptive management arises from the need for conservation practitioners and decision-makers to have a deep understanding of both the successes and failures of their actions, along with the ability to gauge the effectiveness of these actions under varying circumstances (Bottrill et al., 2011; Pullin & Knight, 2000; Redford & Taber, 2000).

One critical challenge facing conservation efforts is the historical lack of robust monitoring and assessment of the efficacy of conservation activities. Often, conservation practices have been driven more by anecdotal experience than empirical evidence (Brooks et al., 2006; Pullin et al., 2004; Pullin & Knight, 2001; Sutherland et al., 2004). This gap between action and knowledge has hindered the progress of conservation and limited its impact.

To address these challenges, frameworks like the Open Standards for the Practice of Conservation have emerged (https://www.conservationmeasures.org/; Shwartz et al, 2012). These frameworks provide a structured approach to adaptive management and effective conservation. They emphasise the importance of setting clear conservation goals, defining measurable indicators, and continuously monitoring and evaluating progress. By integrating these principles into conservation planning, practitioners can enhance the likelihood of achieving meaningful and lasting conservation outcomes.

In the context of this chapter, Miradi Version 4.5.0 serves as a practical tool for translating these concepts into action. Through Miradi, a comprehensive 20-year conservation action plan has been developed for the snow leopard and Himalayan brown bear populations, the two key carnivores identified in this study, in the Kargil trans-Himalayan region of India. This plan not only exemplifies the application of adaptive management principles but also represents a commitment to evidence-based conservation. It underscores the importance of strategic planning and systematic evaluation in safeguarding the future of these carnivore species.

7.1 Introduction

7.1.1 Conservation Measures Partnership (CMP)

CMP is a collaborative effort amongst conservation-minded NGOs, government agencies, and funders to achieve a greater effect. Current CMP members consist of many organisations such as the African Wildlife Foundation; Bush Heritage Australia; Conservation International; The David and Lucile Packard Foundation; Disney's Animals, Science, and Environment; Durrell Wildlife Conservation Trust; Foundations of Success; The Gordon and Betty Moore Foundation; International Crane Foundation; International Fund for Animal Welfare; Jane Goodall Institute; Keith Campbell Foundation for the Environment; Margaret A. Cargill Foundation; National Fish and Wildlife Foundation; The Nature Conservancy; Nature Conservancy of Canada; Nature Serve; Puget Sound Partnership; Rare; The Summit Foundation; US Agency for International Development; US Fish and Wildlife Service; Walton Family Foundation; Wildlife Conservation Network; Wildlife Conservation Society; and WWF.

7.1.2 Theory of Change

The theory of Change (ToC) outlines the logic behind an effort or program at its core. It establishes long-term objectives and then works backwards to find improvements that must be made sooner (Taplin et al., 2013). A document of the change model that explains how and why a goal will be attained is the result of the process of developing the theory, which is often done in group sessions of practitioners and stakeholders under the direction of a skilled facilitator (Taplin et al., 2013). In simple words, ToC is a thorough explanation of what is anticipated to happen once an action is taken to bring about the intended change. To accomplish the intended overall change, assumptions are made about how the implementation will result in changes. These assumptions form the basis of ToC. ToC can be used as an intervention to assess whether all influencing factors on outcomes have been properly taken into account (RARE, 2014). Hence, ToC can assist and help in project management, monitoring, and evaluation.

As a planning tool, ToC enables organisations to ask crucial inquiries about their operations. It can improve collaborations, aid in organisational growth, and improve communication. Since the ToC was designed as an evaluation tool, it explains the change paths that lead to the long-term goal as well as the relationships between the activities, outputs, and outcomes that take place at each stage along the route (Taplin et al., 2013). ToC was created as a community-based program since it helps with managing the achievement of ambitious goals (Allain, 2016).

Weiss (1995) generated a significant study on recognising and addressing stakeholder challenges in theory-based evaluation. Weiss proposed that because of poorly stated assumptions, complicated programs can be difficult to evaluate.

7.1.3 Adaptive Management and Open Standards

The Adaptive Management (AM) strategy was developed (Rist et al., 2013) to deal with the unpredictability that is frequently involved with managing natural resources. Holling (1978) was the first to advocate using AM to manage the environment under the name adaptive environmental assessment and management. AM highlights the significance of recognising uncertainty in the dynamics of natural resource management and how these uncertainties can be reduced through the design of diagnostic management experiments (Walters, 2007). AM is a way of working with complicated issues or situations that emphasises acting, perceiving, and responding. It considers that solutions cannot be totally understood ahead of time, and so interventions cannot be fully planned ahead of time. AM is a way to make better judgments on strategies, measure the efficacy of those strategies, and learn and adjust to make them better. It refers to a dynamic project plan in which data is gathered during the project, results are evaluated, and the plan is updated in a feedback loop as the project progresses. This guarantees that the project plan is appropriate for the circumstances in which it is implemented and that users may minimise or correct any problems that arise.

Based on Hollings, 1978 and Walters, 1986, the learning cycle for AM is distilled into six stages (Rist et al., 2013) (Figure 65). These six stages are:

1. Assess problem - Defining and characterising the management problem, as well as establishing management objectives.
2. Current knowledge - As a foundation for ongoing learning, current understanding is represented using system models that incorporate assumptions and predictions.

3. Identify uncertainty - Uncertainties are identified, and different hypotheses based on data and experience are proposed.
4. Implement - Actions/policies are implemented to enable continuing resource management while learning.
5. Monitor - Monitoring the impact of new policies and activities
6. Evaluate – Evaluation of the outcome of the action plan and strategies.

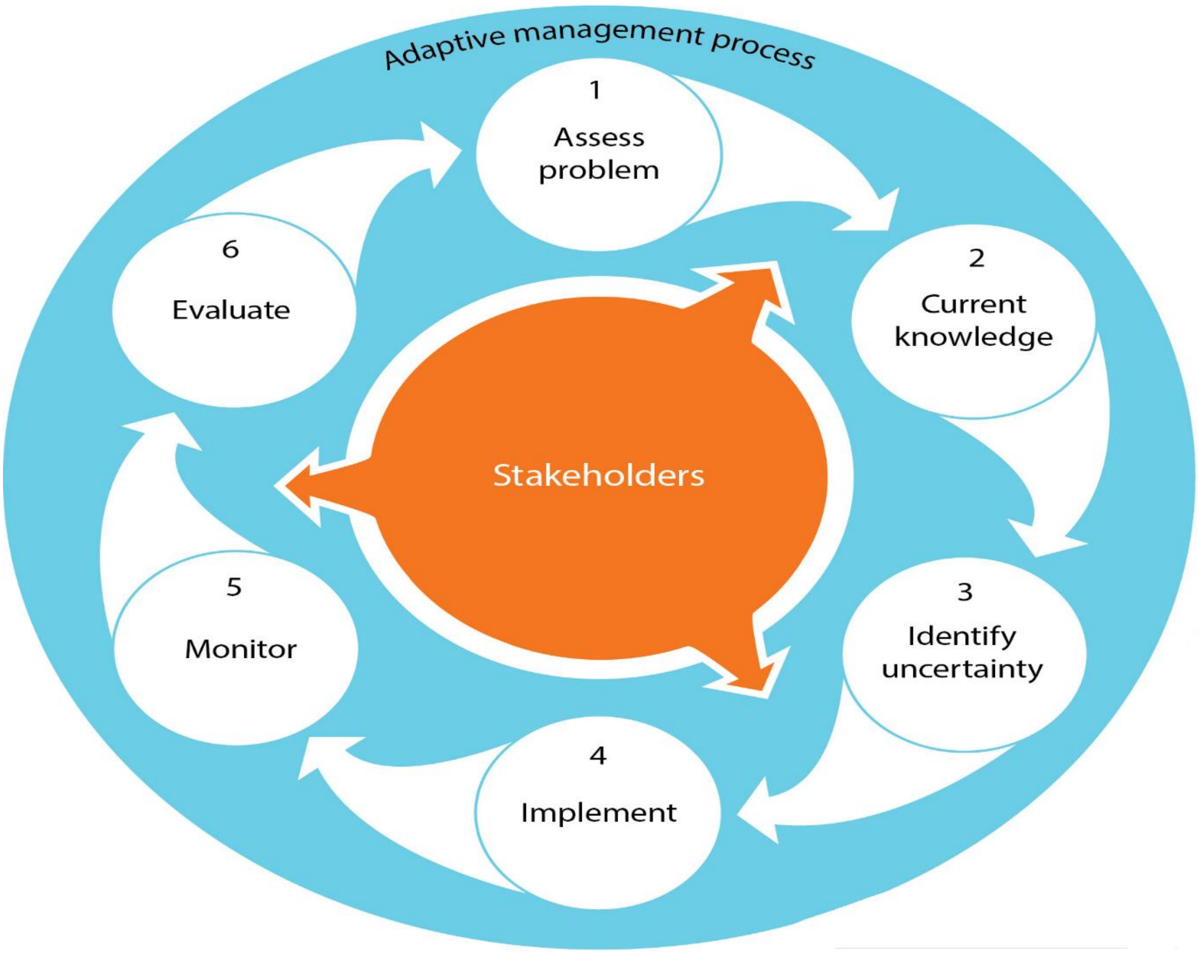


Figure 65 The process of Adaptive Management based on Holling, 1978 and Walters,1986. (Source - Rist et al., 2013).

Since the past four decades after AM was introduced, other frameworks have been developed that draw on its fundamentals, such as The Cambridge Conservation Forum Framework and Evaluation tool, the Landscape species approach by the

Wildlife Conservation Society, and The Nature Conservancy Conservation Action Planning Basic Practices. Besides all the frameworks and efforts, it still unclear, and confusion remains whether AM can be applied successfully. Hence, there is a difference in the definition of the AM. Further debate is ongoing on whether to apply AM on small-scale or large-scale projects.

Although AM has become a popular notion in natural resource management, it is still a relatively unexplored study topic (Rist et al., 2013).

7.1.4 Open Standards

Figure 66 Five steps project management cycle in the Open Standards.

The CMP's collective effort resulted in the Open Standards for the Practice of Conservation. The Measuring Conservation Impact Initiative, a 2002 research that analysed experiences across seven sectors, including conservation, to discover common methods for excellent project design, management, and monitoring, informed

Version 1.0 (2004). Since then, several efforts have sprung up to assist the Standards to become commonplace in the conservation community. It was revised in 2007 and then in 2013. The process employs adaptive management to assist users in developing effective conservation programs, using feedback from hundreds of projects across several disciplines.

The project management cycle in the Open Standards is organised into five steps management cycles (Figure 66), described as follows:

1. Conceptualising

Conceptualisation is the initial step. Defining the Project Team and planning is the primary requirement and process for this step. From the beginning, the Planning Purpose should be specified with transparency regarding the decision-making process. Every member of the project team should understand their roles and duties within the team, and the team should normally have one leader. This step also includes the creation of a Scope, Vision, and Conservation Target for the project. In the Open Standards, the Scope of a project is what the project intends to impact, which can either be area-based or thematic-based. The vision statement of a project should be concise but visionary and general at the same time. A conservation target may be species-based or habitat bases, depending upon the demands and nature of the project. Critical threats to the conservation target/s are identified at this stage. The direct threats (also referred to as pressures) that have an impact on the prioritised conservation targets are identified using the evidence that is currently available. The majority of human activities that directly harm a conservation target are known as direct threats, such as irresponsible fishing, irresponsible hunting, oil drilling, road construction, industrial pollution, and the introduction of exotic invasive species. In rare instances, natural phenomena whose impact is heightened by additional human activities (such as a potential tsunami that threatens the last remaining population of an Asian rhino) may also pose direct threats. Examples include increased extreme

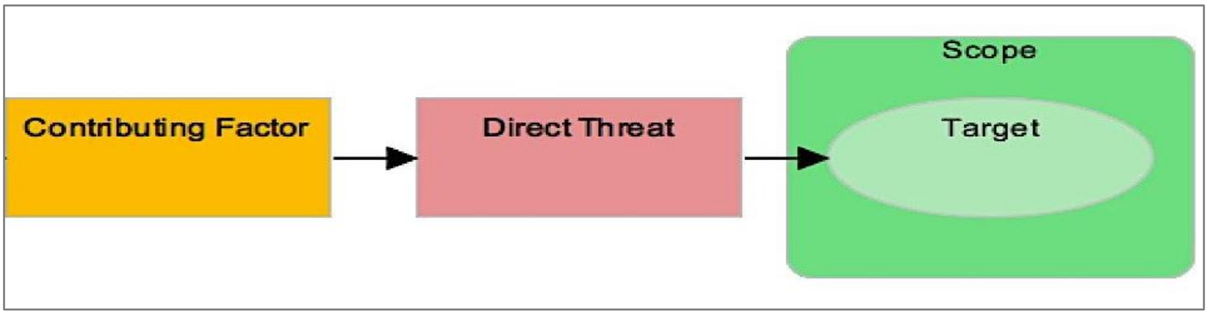


Figure 67 A conceptual model in Miradi Version 4.5.0 with four of the initial elements. (Source: CMP, 2020).

storm events or increased evaporation as a result of global climate change (CMP 2020). Threat rating and ranking tools can be used to identify the critical threats to the target. The relation between the Conservation target, Direct threats, and driving factors is conceptualised as the initial 'Conceptual model' (Figure 67).

2. Designing an action and monitoring plan.

In this step, Goals, Strategies, Assumptions, and Objectives are developed. Goals are official statements of the impacts that the Project Team hopes to achieve during and on the completion of the project. According to CMP (2013), a 'good' Goal should be specific, time-limited, measurable, and linked to the target. Goals are associated with a project's conservation targets and show how those targets should progress over

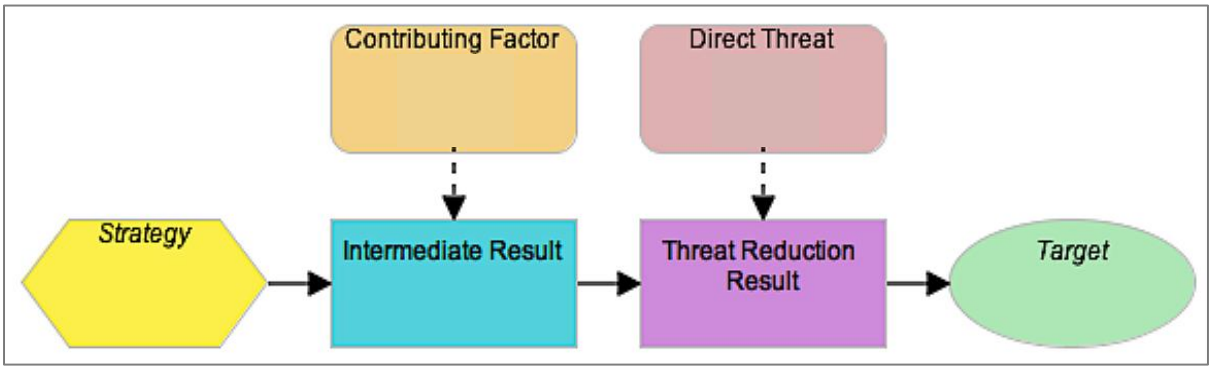


Figure 68 Representation of Result chain in Miradi 4.5.0.

time. They are official declarations of the results you intend to achieve. Further, a good goal meets "SMART" criteria: specific, measurable, achievable, results-oriented, and time-limited (CMP, 2020). Strategies are the essential points of the planning process that will be employed to carry out the project's Vision (Figure 68). An important part of strategic planning is figuring out who you need to persuade, where and how you will intervene, and where you will not. The geographical and temporal dimensions of actions are taken into account in sound strategic planning (CMP, 2020). Then, strategies can be graded to make a final decision that is realistic, targeted, and appropriate. Following the selection of the strategies, each strategy's underlying presumptions are elucidated in order to help achieve both short-term and long-term conservation and human well-being objectives. This is also known as the "theory of change," which can be presented verbally, visually, or in other ways. A "results chain" is a diagrammatic tool that illustrates a theory of change in a causal ("if-then") succession of anticipated intermediate results over the short- and long-terms that result in conservation outcomes over the long-term. The tool can also display the temporal nature of anticipated outcomes due to the if-then structure of a results chain (CMP, 2020). Within the result chains, objectives can be set, which are formal statements of outcomes and desired changes related to any goal. A good objective should meet the 'SMART' criteria (CMP, 2020).

1. *Implementing Actions and Monitoring the impacts*

In this step, work plans and timetables are made to specify what has to be done, who is responsible for it, when it should be done, and how much money and resources are required. The Work Plan should contain enough information to create a timeline and guarantee that the Project Team is not overbooked, which could have an impact on the budgetary estimates. With anticipated prices for certain operations and expected prospective expenditures throughout the course of the entire project, the budget needs to be prepared and refined. Implementing Actions is a crucial stage for step three and the overall process. At this point, the strategic plan is implemented. Monitoring data are also collected throughout the implementation of the strategies. During this phase of the project, all the data captured are monitored, and project updates are reported to the main organisation, funders, and other project stakeholders.

2. Evaluating the efficacy of actions by analysing the data.

Managing your data as it comes in and routinely evaluating it to turn it into useful information and knowledge are part of this stage of the Conservation Standards (Figure 69).

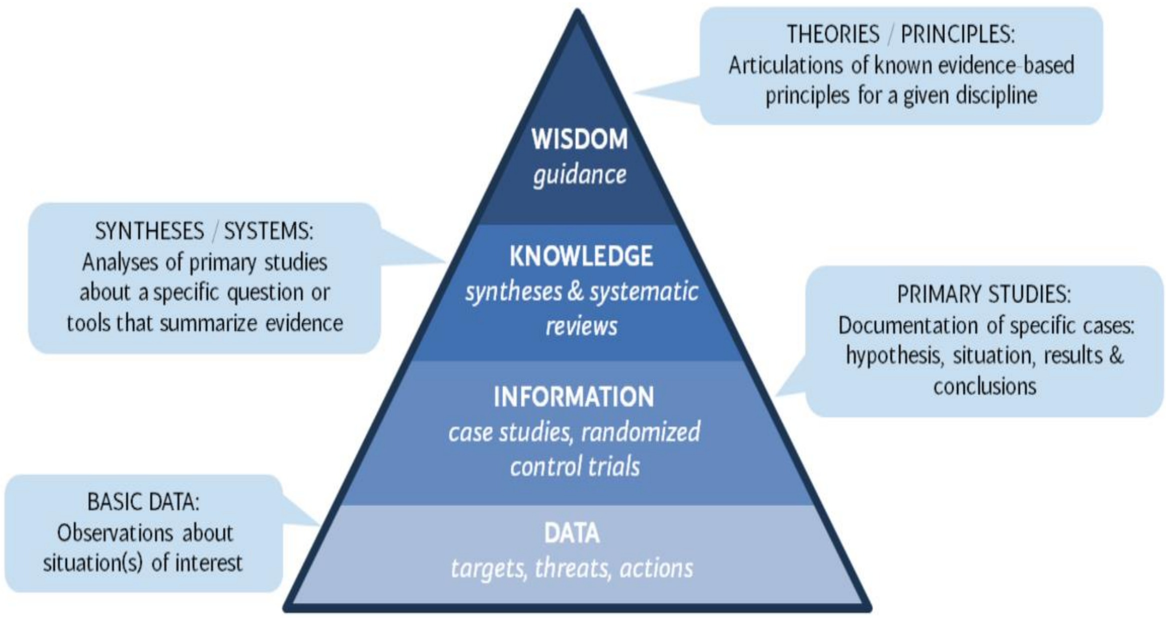


Figure 69 Schematic representation of the evidence base for a question of interest (Source: CMP, 2020 and adapted from Salafsky et al., 2019).

Particularly, the project's outcomes, fundamental presumptions, significant uncertainties, and pertinent operational and financial data are examined, and the work plan is then adjusted as required. As a result, they result in a lot of data that they have not yet examined or utilised. Project managers frequently underestimate the time required to accomplish this step. This stage involves transforming the raw data into useful information. Although CMP, 2020 suggests that the analysis of a project should not be carried out at only one stage, it should be continuously monitored to understand the nature of the action plan and observe the changes required for a successful project. Monitoring and carefully assessing the situation regularly to attain stated goals and objectives is a crucial component of successful conservation management (CMP, 2020)

This step helps in the identification of successes and failures of the strategic actions, which help to identify the next step in the project. It assists in determination over how effective a particular intervention plan has been in achieving and reaching the Goals and Objectives of the Project. Changes are made if specific strategic plans are failed, and the drawbacks are identified. The last step of this process is using the knowledge gained from the analyses and conversations to adjust and improve your portfolio of strategies and activities as necessary. This is the foundation of ethical conservation behaviour.

3. Fostering learning, capturing and sharing the project with relevant external and internal audiences.

Sharing formal goods and lessons with important internal and external audiences constitutes the final stage of the Conservation Standards cycle. Additionally, it entails providing and receiving criticism as well as fostering a learning culture. The project team, partners, and stakeholders should all be encouraged to learn from one another because the lessons acquired from previous work will be crucial inputs for each phase of the upcoming cycle of the project. Additionally, it is crucial to encourage learning within organisations and generally across the conservation community. The Conservation Standards contain procedures that a project and an organisation could use to promote learning and sharing in light of this.

7.1.5 Conceptualisation and Development

Miradi Software

Miradi, which means "project" in Swahili, is a rapidly expanding software tool that assists conservation project teams in implementing an adaptive management method like the Open Standards. This adaptive management software was developed by CMP and the Sitka Technology Group and supported by Open Standards (https://www.conservationmeasures.org/). Miradi walks conservation practitioners through a series of step-by-step interview wizards.

Miradi Software (available in various languages) is developed to guide practitioners through the Conservation Standards' major processes. The program helps organisations visualise and document what they want to conserve, as well as important threats and opportunities, priority strategies and particular actions, expected outcomes, related goals and objectives, and progress toward those goals and objectives. Miradi contributes to the creation of a visual language for individuals familiar with the Conservation Standards by using standard colours and forms.

Miradi also has numerous spaces for documenting critical debates, evidence, and judgments, which is a crucial component for adaptive management, evidence-based conservation, and learning in general. Miradi's transfer to the cloud (through Miradi Share) adds new features for team collaboration and cross-project and cross-organisational learning. Miradi Share also contributes to the Conservation Actions and

Measures Library (CAML), a collection of approved templates and examples for outlining theories of change and desired outcomes in conservation programs.

Project teams, advisors, peers, and interested parties can view, work together, share, and engage on shared projects using the Miradi Share, an online platform for practitioners. Through this platform, projects can also benefit from the insightful opinions of other experts on open standards, adaptive management, and project management. Additionally, users can post their projects on this platform at any stage for assessment or publication. On Miradi Share (miradishare.org), there are more than 950 projects, the majority of which are open to the general public. Several distinct initiatives from organisations like The Nature Conservancy are included in these projects. Given that it illustrates the complete conceptualisation process from implementation to adaptation, this is a priceless resource for the conservation community. This also assists practitioners in meeting with step five of the Open Standards to publish and share their projects by highlighting AM and Conceptual models to improve conservation learning among stakeholders, practitioners, and project managers.

The desktop version of Miradi was used in this project (Miradi Version 4.5.0).

Proposed 20-year Conservation Action plan for the wild carnivore population of Kargil trans-Himalayas, India, 2025-2045

7.2 Methodology

Miradi Version 4.5.0 was adopted to create a conservation action plan for the snow leopard and Brown bear population of Kargil trans-Himalayas, India, adopting and following the guidance of the Open Standards. The approach for this chapter and the CAP framed in this chapter used the findings from the previous chapters of this thesis and also available literature resources to draft a 20-year conservation action.

7.2.1 Conceptualisation

The CAP created is limited to steps one and two of the Open Standards as the CAP is planned to be implemented in the study area from 2025; hence, steps three, four, and five of the Open Standards will be adopted once the project is implemented. The available scientific information across the range of the target species and information from Chapters One, Two, Four, and Five of this thesis have been utilized. Following specific commands to conceptualise the CAP, Miradi software was used. This follows the first stage of the Open Standard to conceptualise the CAP and create

Stage 1: Design a Conceptual Model Step A1: Review and Compile Existing Information Step A2: Develop an Initial Conceptual Model Step A3: Identify and Rank Threats Stage 2: Develop a Management plan Step B1: Develop a Goal Step B2: Develop Objectives Step B3: Develop Activities Stage 3: Develop a Monitoring Plan Step C1: Determine Needs, Strategies and Indicators Step C2: Select Methods

Figure 70 Summary of steps in designing, managing and monitoring conservation projects. Adapted from Margolis and Salafsky (1998).

the initial conceptual model. The recommendations from Margolis and Salafsky (1998) were used to support each of the Open Standards phases in addition to adhering to the procedures in the Open Standards. The summary of the steps that were followed following Margolis and Salafsky (1998) is given in Figure 70.

7.2.2 Development

After the completion of the initial conceptual model in Miradi, the CAP was developed by selecting the target, defining and rating the threats, contributing factors to threats, and framing strategies to combat the threats. This is generally referred to as stages two and three of the Open standard.

7.2.3 Project Team

As the project is in its conceptualisation phase, an existing NGO in Kargil under the name of LEARNS Ladakh will be the sole organisation to implement the project, and the team members will be recruited as per the positions assigned and required for the CAP. The roles and positions for the CAP were created as per the requirements of the project. The positions created for the successful implementation of the CAP project are – Director of the Project, Head of Research, Head of Education and awareness campaign, Head of Public/community relations, Head of Communications, head of finance, and Project advisors (Table 49).

During the preliminary conceptualization phase of the project, consultations were conducted with the relevant organizations (Table 50) to solicit guidance and advice. The Department of Wildlife Protection in Kargil played a pivotal role as a key member of the primary advisory team throughout the formulation of the conceptual model and have ensured future support throughout the project, if implemented.

Table 49 Core team members of the CAP for wild carnivore population of Kargil trans Himalayas, 2025-45.

Organisation	Position	First Name	Last Name	ID	Roles
LEARNS Ladakh	Head of Research	Position	-	HoR	Team Member;
LEARNS Ladakh	Head of Education and Awareness outreach	Position	-	HoEA	Team Member;
University of Salford	Project Advisor (Action plan and monitoring)	Position	-	AT1	Project Advisor; Team Member;
LEARNS Ladakh	Head of Public/Community relation	Position	-	HoPR	Team Member;
LEARNS Ladakh	Head of communications	Position	-	HoC	Team Member;
LEARNS Ladakh	Head of Finance	Position	-	HoF	Team Member;
LEARNS Ladakh	Director	Iftikar	Ali	001A	Leader/Manager;Team Member;Team Contact;

7.2.4 Organisations

Besides the core team members of the CAP project, Organisations working in Ladakh trans-Himalayas and national-level organisations working for wildlife conservation will be approached to assist as advisors, collaborate, and support in successfully implementing the project (Table 50).

Table 50 Organisations to be approached for support during the implementation and collaborations of the CAP.

ID	Name	Role(s)
Org001	WWF India	Advisor
Org002	NCF India	Advisor
Org003	Wildlife Institute of India	Advisor
Org003	Department of Wildlife Protection, Kargil	Advisor, facilitator

7.2.5 Project Description

The snow leopard is the flagship species of the trans-Himalayan ecosystem. But they are also responsible for livestock depredation across the region, and livestock being one of the significant parts of the local economy and livelihood, people sometimes resort to killing these endangered wildlife species across their habitat. Hence, it was felt necessary to come up with a conservation action plan to protect these species considering the human perception of these species. This conceptual project will assist in the protection of snow leopards and the Himalayan brown bears population in Kargil by identifying threats to its conservation and framing strategies to combat such threats as previously identified in this thesis.

Although the primary aim of this conceptual project is to conserve the Snow leopard and the Himalayan brown bear population, it may also provide some benefits to associated species of the region like the Tibetan wolf, Fox, Lynx, Pallas's cat, Asiatic ibex, and Ladakh Urial.

7.2.6 Site Description

Due to its location in the deep southwestern Himalayas, the Kargil district has a cold, moderate temperature. While winters are long and severe, with temperatures frequently falling to 15 °C (5 °F), temperatures as low as 60 °C (76 °F) have been recorded in the tiny village of Dras, located 56 kilometres (35 miles) from the Kargil town. Summers are mild with cool nights. It is colder in the Zanskar Valley. The area of the Kargil district is 14,086 km2 (5,439 sq mi). The District is traversed by the Suru River.

Numerous endangered wildlife species, including the Ladakh urial (*Ovis vignei vignei*), Himalayan brown bear (*Ursus arctos isabellinus*), Asiatic ibex (*Capra ibex*), snow leopard (*Panthera uncia*), Tibetan wolf (*Canis lupus Chanco*), musk deer (*Moschus spp.*), pikas, marmots, and hares. Along with mammals, reptiles play a significant role in the Kargil biodiversity. Due to the infamous Kargil war of 1999, the region still lacks proper research in terms of wildlife and other biodiversity.

7.2.7 Project vision

"The vision of the project is to safeguard and conserve the population of snow leopards and Himalayan brown bears and their habitat in Kargil Trans Himalayas, India. This will be achieved through generating reliable scientific information on the status and distribution of Snow leopards and Brown bears across Kargil by lessening the highest identified risk threats, creating local awareness, collaborating with local stakeholders, reducing human-wildlife conflicts, assessing and improving prey species population, and reducing habitat disturbances and fragmentations."

Conceptual Model

After the initial conceptual model was created (Figure 71), the Scope, Target, Direct Threats, Contributing Factors, and Strategies will be displayed from the Miradi file report.

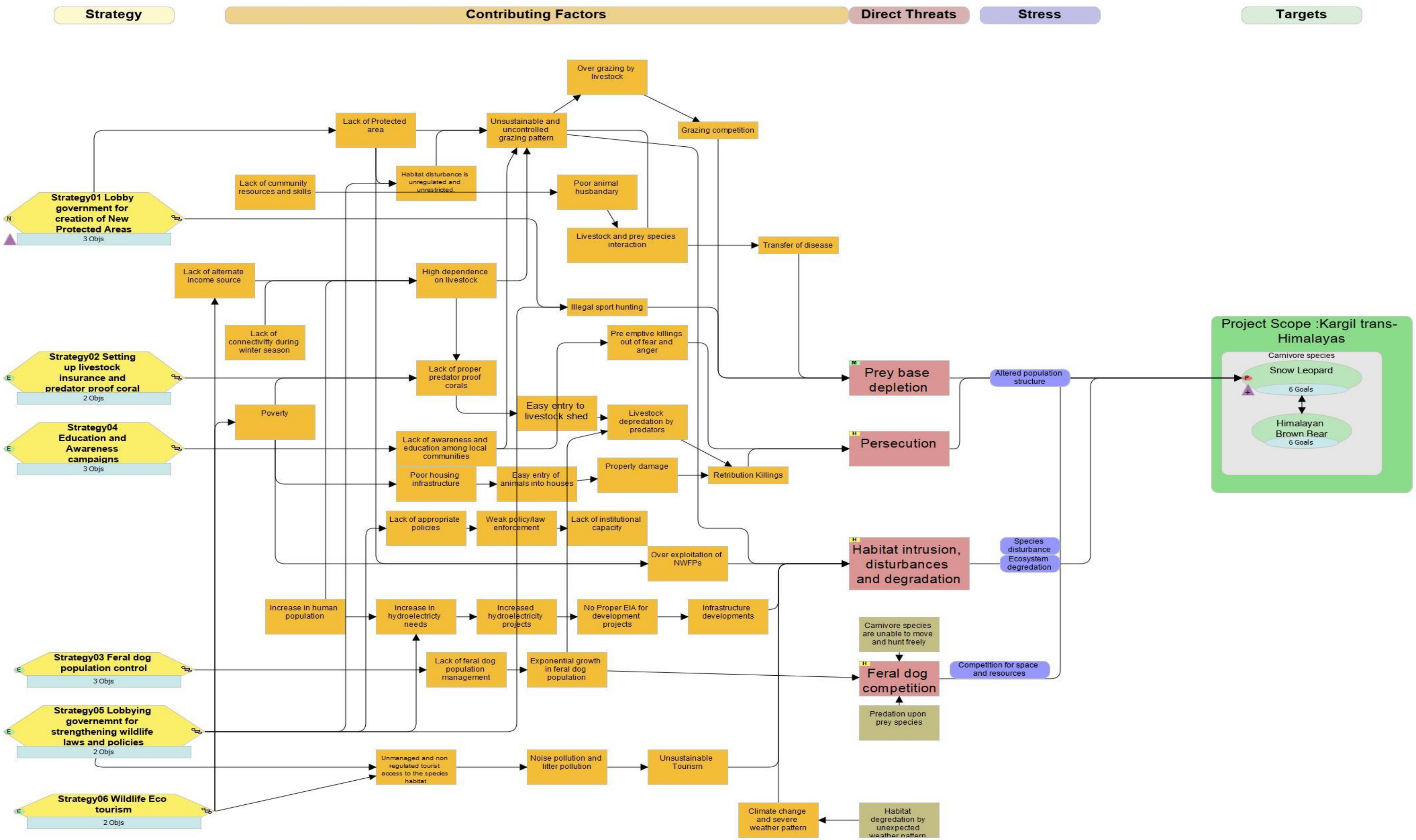


Figure 71 Conceptual model for the CAP.

7.2.8 Scope

Often referred to as the 'cold desert' due to its unique geographical characteristics, Kargil is home to some of the endangered wildlife species (Pfister, 2006), including the snow leopard, Himalayan brown bear, Tibetan wolf, fox, Pallas's cat, Ladakh urial and Asiatic Ibex. The region was in a hostile position during the infamous Kargil war of 1999, which also restricted research efforts in the area. Central to this project, although there is a huge gap in research information on snow leopards and Himalayan brown bears from the region, undocumented reports of livestock depredation, retribution killings, and similar negative interactions with humans are recorded from the area. Hence, it was felt necessary to come up with a concrete conservation action plan for the area to ensure these flagship species of the trans-Himalayan geographic region thrive and assist in the ecological balance of the fragile ecosystem. Even though it is rich in biodiversity, the District does not have a single protected area over a span of 14082 square kilometres area.

7.2.9 Targets

Snow Leopard (*Panthera Uncia*)-

Himalayan Brown Bear (*Ursus arctos isabellinus*)-

Goals

Goal 1: Population

By 2035, at least two complete surveys to estimate the abundance of snow leopards and Himalayan brown bears in Kargil trans-Himalayas, and by 2035, follow-up surveys to monitor the abundance of the species. By 2045, the population of snow leopards in Kargil will be at least >30 individuals and >50 Himalayan brown bear individuals.

Indicator – Number of snow leopard and Himalayan brown bears from population estimation surveys.

Goal 2: Prey species population

By 2035, two complete population estimation (abundance and density) surveys of two main prey species in Kargil, Asiatic ibex, and Ladakh Urial, using the Double observer Survey Method. And by 2045, the overall population of prey species is increased by at least 15%.

Indicator – Density of Asiatic ibex and Ladakh urial from abundance surveys.

Goal3: Persecution

By 2035, there were no reports of Retaliation or retribution killings throughout Kargil trans-Himalayas. Although no reports of retaliation killings of Snow leopards have been recorded from Kargil, experts believe that with high human-wildlife conflicts, the predictability of such adverse actions against a species cannot be ruled out.

Indicator – Number of snow leopards and Himalayan brown bears killed pre-emptively or in retaliation for livestock predation.

Goal 4: Feral dog competition

By 2030, the density estimation of feral dogs is completed, and key sites for the sterilisation programs of feral dogs will be identified. By 2045, the target is to achieve a stable and controlled feral dog population in Kargil, with reports of harassing snow leopards and associated wildlife species decreased by more than 50%.

Indicator – Controlled and stable feral dog population density

Goal 5: Habitat improvement

By 2045, designation of at least two wildlife sanctuaries covering at least 30% of the land area in Kargil for the protection of snow leopards, Himalayan brown bears, and their associated species and habitat. Although the whole area of the Scope falls in the habitat range of the Snow leopards and Himalayan brown bears, there is not a single protected area designated for the snow leopard in Kargil trans-Himalayas.

Indicator – Number of protected areas designated and % of the area under protection.

Goal 6: Insurance and predator-proof coral schemes

By 2030, effective livestock insurance and predator-proof corral schemes will be drafted, and by 2035, implementation of the scheme will commence, and by 2045, the number of livestock depredation by various predators will decrease by >75%.

Indicator – Number of livestock loss reported to snow leopard and associated species.

7.2.10 Direct Threats

At the initial stage of the CAP, more than ten direct threats were identified from available literature sourvses. Finally, four main direct threats were identified for the snow leopard and brown bear populations in Kargil trans-Himalayas, India, identified in Chapter four and five of this thesis, and primary threats discussed in available literature sourvces from the Himalayan region (Table 51).

Summary Target Threat Rating for Snow Leopard – **High**

Summary Target Threat Rating for Himalayan Brown Bear – **High**

Overall Project Threat Rating – **Very High**

Table 51 Threats and Threat rating for Snow leopard and Himalayan Brown bear.

	Threats \ Targets	Snow Leopard	Himalayan Brown Bear	Summary Threat Rating
	Persecution	Medium	High	Medium
	Prey base depletion	High	Low	Medium
	Habitat intrusion, disturbances, and degradation	High	High	High
	Feral dog competition	High	High	High
Summary Target Ratings:		High	High	Very High

1. Persecution

Retribution killing of snow leopards and brown bears for livestock predation is one of the main threats contributing to the survival of the species in the wild. Most of the human population in Kargil rear livestock and depend on livestock as their main source of protein, especially during the winter season when the region is cut off from the outside world, resulting in a halt on essential goods imported from the other states of India. This high dependency on livestock creates high tension among the local community, especially within the human-wildlife conflict scenarios when there are reports of livestock loss to wild carnivores. Snow leopards and Himalayan brown bears, being opportunistic predators, hunt livestock even by entering livestock sheds and corrals. Due to the low income and reliability of local resources, the livestock sheds are poorly constructed, allowing easy entry to the predators. Lack of guarding practices also results in livestock depredation in this region. Some farmers have also resorted to the pre-emptive killing of wild carnivore species even without reports of livestock depredation to prevent such incidents.

Ratings

Scope: High

For Snow leopard

Severity – High

Irreversibility – High

Himalayan Brown Bear

Severity – Medium

Irreversibility – Medium

Summary Threat Rating: Medium

2. Prey base depletion

Asiatic Ibex and Ladakh urial are the main prey species of snow leopard in Kargil trans-Himalays. Ladakh urial is classified as 'Vulnerable' as per the IUCN Red List of Threatened Species. Asiatic Ibex is classified as Least Concern. Unmanaged livestock grazing and illegal hunting are the main drivers for the decline in their population throughout its range. The prey species population is also considered a direct determinant of a healthy habitat ecosystem.

Ratings

Scope: High

For Snow leopard

Severity – High

Irreversibility – High

Himalayan Brown Bear

Severity – High

Irreversibility – High

Summary Threat Rating: High

3. Habitat intrusion, disturbances and degradation

Although the whole region of the Scope falls in the habitat range of the Snow leopard, there is not a single protected area designated for the snow leopard in Kargil trans-Himalayas. The lack of protected areas results in unmanaged and uncontrolled use of natural resources by the local communities and access to the sensitive wildlife habitat of the region.

Threat ratings

Scope: High

For Snow leopard

Severity – Medium

Irreversibility – Very High

Himalayan Brown Bear

Severity – High

Irreversibility – High

Summary Threat Rating: High

4. Feral dog competition

Reports of feral dogs chasing and snatching prey from snow leopards and brown bears have emerged from Ladakh. Video footage of dogs chasing an endangered crane species, as the state bird of Ladakh, the Black-necked crane (*Grus nigricollis*), has also surfaced from Ladakh. Besides these incidents, human fatalities have also been reported due to feral dogs. Although not reported from the region, another important risk associated with feral dogs is transfer of diseases to the wild carnivores. Feral dogs are emerging as a new challenge for conservationists in the region to implement successful conservation efforts.

Threat ratings

Scope: High

For Snow leopard

Severity – Very High

Irreversibility – Medium

Himalayan Brown Bear

Severity – Very High

Irreversibility – High

Summary Threat Rating: High

7.2.11 Contributing factors to the main threats in the conceptual model

Table 52 Contributing factors for various threats in the Conceptual model.

Contributing Factors	Description	Link to Direct Threat
Transfer of Disease	Asiatic Ibex and Ladakh urial reside in open terrain at low altitudes, especially during early and late winters, frequently near human-populated regions where cattle, sheep, and goats graze, all of which are ecological grazing rivals and, when interacted, may infect them with various biological diseases.	Prey Base depletion
Grazing Competition	Wild ungulates share space and resources with domestic cattle, sheep, and goats. This led to competition for resources and grazing.	Prey Base depletion
Overgrazing by livestock	Due to the limited resources available because of the desert nature of the region, there is constant competition for grazing among wild ungulates and livestock.	Prey Base depletion
Unsustainable and uncontrolled grazing pattern	The grazing pattern in Kargil follows the traditional method of pasturing *'rha-res'* in the mountains with no regulation and management.	Prey Base depletion Habitat intrusion, disturbances, and degradation
Lack of Protected Area	The lack of protected areas contributes to mismanaged grazing patterns by the local community, and there is no regulation, which leads to interaction with wild ungulates and also the competition for resources within domestic livestock and prey species.	Prey Base depletion Habitat intrusion, disturbances, and degradation Persecution

Livestock and prey species interaction	Asiatic Ibex and Ladakh urial reside in open terrain at low altitudes, especially during early and late winters, frequently near human-populated regions where cattle, sheep, and goats graze, all of which are ecological grazing rivals and, when interacted, may infect them with various biological diseases.	Prey Base depletion
Poor animal Husbandry	Untreated diseases from livestock transfer to wild ungulates and result in prey species mortality. Poor animal husbandry also results in the loss of livestock.	Prey Base depletion
Habitat disturbance is unregulated and unrestricted.	The lack of protected areas results in unregulated and unrestricted access to wildlife habitats.	Prey Base depletion Habitat intrusion, disturbances, and degradation Persecution
Lack of community resources and skills	-	Prey Base depletion
Illegal sport hunting	Although not documented properly, there have been reports of illegal prey hunting for bush meat in several parts of the region.	Prey species depletion
High dependence on livestock	The agro-pastoral community of Kargil is highly dependent on livestock rearing and agriculture for their livelihood. For many local communities, livestock rearing is the main source of livelihood.	Prey Base depletion Persecution
Lack of alternate income source	The agro-pastoral community of Kargil is highly dependent on livestock rearing and agriculture for their livelihood. In the main parts of the region, people rear livestock to overcome the nutritional requirement during the harsh	Prey Base depletion Persecution

	winter season, when the region is cut off from the outer world due to heavy snowfall and limited transportation options. This further deepens their dependency on livestock.	
Lack of connectivity during the winter season	In many parts of the region, people rear livestock to overcome the nutritional requirement during the harsh winter season, when the region is cut off from the outer world due to heavy snowfall and limited transportation options. This further deepens their dependency on livestock. Although the government of India has taken an initiative to build a 22 Kilometers long tunnel to tackle the lack of connectivity during the winters. Its repercussuion on the natural world is to be observed and studied in the future.	Prey Base depletion
Pre-emptive killings out of fear and anger	Several reports of the pre-emptive killing of the Brown bear have been reported from Kargil. With high reports of livestock depredation by snow leopards from the region, the possibility of retribution and pre-emptive killing of the species can not be eliminated.	Persecution
Easy entry into livestock shed	Lack of predator-proof shed leads to easy entry of predators into livestock shed.	Persecution
Retribution Killings	Retaliation killing of predators for livestock kills is often reported from the region.	Persecution

Livestock depredation by predators	Livestock depredation by various predators is reported from almost all the CD blocks of Kargil. This instils a feeling of fear and anger among the poor local communities, and sometimes they resort to killing the animal responsible.	Persecution
Lack of proper predator-proof corals	Weak shed structure and traditional shed designs allow an easy entry of predators into the shed, resulting in the loss of livestock to various predators.	Persecution
Poverty	The low income of the local population has contributed to poor corral infrastructure.	Prey Base depletion Persecution
Property damage	Damage to property, especially in the case of brown bears, instils a feeling of anger among the local community, resulting in retaliation killing of the species.	Persecution
Easy entry of animals into houses	Poor housing infrastructure allows easy entry of predators into houses.	Persecution
Poor housing infrastructure	-	Persecution
Over-exploitation of NWFPs	Over-exploitation of Non-Wood Forest Products.	Prey Base depletion Habitat intrusion, disturbances, and degradation
Infrastructure developments	Poor and unplanned housing development in areas prone to predator attacks results in livestock depredation.	Habitat intrusion, disturbances, and degradation
No Proper EIA for development projects	Large-scale projects in the region have not been following proper	Habitat intrusion, disturbances, and degradation

	Environmental Impact assessment protocols.	
Increased hydroelectricity projects	Various hydroelectricity projects have altered the ecosystem balance in the region.	Habitat intrusion, disturbances, and degradation
Increase in hydroelectricity needs	The demand for hydroelectricity, especially from the neighbouring states, has resulted in many large and small-scale hydroelectricity projects in the region.	Habitat intrusion, disturbances, and degradation
Increase in human population	Although it is one of the least populated districts in India, the increasing human population has contributed to many needs and demands for resources, which ultimately results in increased habitat intrusion and dependency on natural resources.	Prey Base depletion Habitat intrusion, disturbances, and degradation Persecution
Exponential growth in the feral dog population	Due to the lack of management of feral dogs, exponential growth in the population of feral dogs is observed in the region.	Feral dog Competition
Lack of feral dog population management	There is no proper feral dog population management program in the region, which results in the exponential growth of the species and ultimately competing with wildlife for space and resources.	Feral dog Competition
Unsustainable Tourism	Unsustainable, uncontrolled, and mismanaged tourism causes habitat damage and interference for animals. In regions where there is wildlife that draws visitors, a portion of the wildlife's habitat is destroyed to make room for tourist-oriented facilities such	Prey Base depletion Habitat intrusion, disturbances, and degradation

	as resorts (Green & Higginbottom 2001). The unique geographical characteristics, photogenic landscapes, and being home to some of the flagship and charismatic species of trans-Himalayas, such as snow leopard, brown bear, Tibetan wolf, Ladakh Urial, and Kargil is witnessing exponential growth in domestic and international tourists annually. There is a lack of proper policy to regulate the inflow and regulations on tourism in the region. This may adversely hamper the ecological structure of the region if not addressed on a priority base.	
Noise pollution and litter pollution	Disturbance to wildlife species by noise pollution and habitat degradation by litter pollution due to unsustainable and unregulated tourism.	Habitat intrusion, disturbances, and degradation
Unmanaged and non-regulated tourist access to the species' habitat	Due to the lack of protected area, there is no regulation and control on the tourism activity and entry to the ecologically sensitive region of the Scope.	Habitat intrusion, disturbances, and degradation
Climate change and severe weather pattern	In the last 20 years, the Tibetan plateau, which is home to more than half of the surviving snow leopards, has warmed by 3 degrees. The changes have an influence on the entire ecosystem, including flora, water resources, and wildlife, and they might render a third of the snow leopard's habitat	Prey Base depletion Habitat intrusion, disturbances, and degradation

	unsuitable (Snow leopard Trust, 2022).	

7.3 Strategies and Result Chains

Six Strategies in Miradi were created for the Conservation Action Plan of Snow Leopards and Himalayan brown bears in Kargil trans-Himalayas viz: 1. Lobby government for the creation of new protected areas; 2. Setting up livestock insurance programs and predator-proof coral schemes; 3. Education and awareness Campaigns; 4. Feral dog population control; 5. Lobbying the government to strengthen wildlife laws and policies; and 6. Wildlife Eco-tourism.

Based on the confidence in the evidence of the results and the Goals and Objectives to achieve, the strategies were rated on a scale available in the Miradi, including Not specified, Low, Medium, High, and Very High. The potential impact of the strategy is also rated according to time, resources, staff, finance, and ethics. The overall rating for the plan can be Unknown, Not Effective, Need More Info, Effective, or Very Effective, based on the grades chosen for Prospective Impact and Feasibility. Further, to classify the categories of the strategy, the classification list of Miradi was used to select the nature of the strategy. Strategies are further classified into sub-categories in Miradi within the main categories, including Land/Water Protection, Land/Water Management, Species Management, Education and Awareness, Law and Policy, Livelihood, Economics and Other Incentives, and External Capacity building (Figure 72).

The results chain with strategy desired Intermediate result, Threat reduction result, and the conservation target was created in Miradi (Figure 73). To measure the success of the results, Objectives and Indicators were given.

Figure 72 Strategy classification in Miradi. (Source: Miradi 4.5.0)

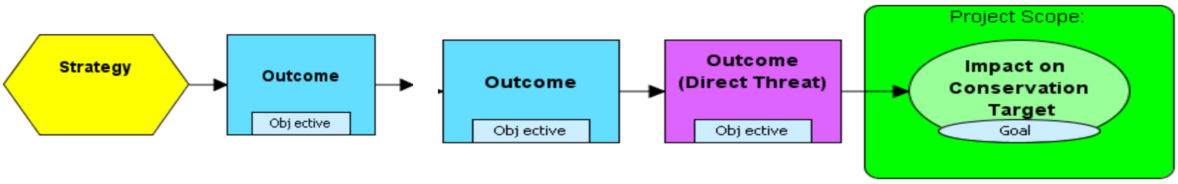


Figure 73 Result chain representation in Miradi.

Strategy One: Lobbying the Government for the creation of New Protected Areas

The lack of protected area in Kargil has been an important factor for species disturbances and uncontrolled and unmanaged livestock grazing patterns. This strategy will focus on working with the concerned department of the region for the creation of at least two protected areas for the snow leopard, Himalayan brown bear, and associated species.

Classification: Site/Area Protection

Ratings:

Potential Impact: Very High

Feasibility: Medium

Roll up: Need More Info

Theory of Change for Result Chain 01 – Creation of Protected Areas

Over a span of 14000 square kilometres in area and home to some of the endangered wildlife species such as the snow leopard, Himalayan brown bear, and Ladakh urial, the Kargil District in the Union territory has not a single Protected area to conserve the wildlife of the region. This strategy will involve lobbying the government of the Union Territory of Ladakh to designate at least two protected areas in the region to conserve and protect the wildlife of the region. The strategy relies on the assumption that the government will understand the need for PAs in the region to control wildlife habitat intrusion and disturbances and for the population of the wildlife region to thrive. Intense wildlife research will be carried out in collaboration with the wildlife authorities to identify the potential areas to be designated as PA. Support for conducting research will be offered to the government, which will create greater ease in lobbying the government. The demarcation of wildlife PAs will help in checking illegal wildlife activities and also help to prevent any further decrease in the population of snow leopards, Himalayan brown bears, and other associated species and allow them to thrive in their natural habitat without human disturbances. Snow leopard covers large distances to hunt and move freely, thus, the PAs will ensure the future of the snow leopard and other endangered species of the region. The intermediate results in the Result chain for this strategy is detailed in Table 53, and the Threat reducation results of the result chain is laid in Table 54.

Table 53 Intermediate results in the Results Chain for Strategy 01: Lobbying the Government for the creation of New Protected Areas

Intermediate results	Details	Objective	Indicator
Intensive research is conducted to identify the potential PAs	Intensive research in collaboration with the local wildlife authorities and other research organisations will be carried out to identify the potential Protected Areas in the region.	By 2035, intensive research for the identification of areas to be covered under PA will be completed.	Number of intensive research undertaken to
Protected Areas are designated and created.	Assumption - The local concerned department of wildlife protection will support and understand the need for creating new protected areas for habitat improvement and conservation of wildlife species.	By 2040, at least two Protected areas will be created in Kargil for the conservation of wildlife species.	Number of new Pas designated
Strict regulations and policies on checking illegal	-	-	-

activities are put in place.			
Regulation and restrictions are in place to control human intrusion and disturbances, especially in ecologically sensitive zones.	The creation of two new protected areas covering 30% (>4225 sq Km) of the total land cover will assist in controlling human intrusion and habitat disturbances in critical wildlife habitats.	By 2045, habitat disturbances by local communities will be controlled with the creation of two new Protected areas.	-
Traditional livestock grazing pattern is replaced by managed and controlled grazing patterns.	-	By 2045, the creation of protected areas and strengthening of wildlife laws and policies will replace the existing traditional livestock grazing pattern with managed and controlled alternatives,	The number of villages adopting the new sustainable grazing methods in place of the existing traditional grazing method.
Interaction between livestock and wild ungulate is decreased with managed livestock grazing patterns in place.	-	-	-
Illegal hunting of wild ungulates is stopped.	-	-	-
Decreased interaction between livestock and wild ungulates resulted in less transfer of diseases.	-	-	-
With the creation of new protected areas, over-	-	-	-

exploitation of NWFPs is checked.			

Table 54 Threat reducation results in the Result Chain.

Threat Reduction result	**Detail**	**Indicator**	**Objective**
The prey species population is stable or increasing	The creation of new protected areas in the region will ensure the wild population of wild ungulates thrives, and their population is stable in the region.	Number of Ladakh Urial and Asiatic Ibex in the wild.	By 2045, the population of prey species is stable and increased by at least 15%
Habitat intrusion, disturbances, and degradation are controlled	Human movement in the protected areas will be restricted and regulated, which will reduce habitat disturbances and intrusion in wildlife habitats.	-	By 2040, at least two Protected areas will be created in Kargil for the conservation of wildlife species. By 2045, Human intrusion and disturbances will be stopped in and around the two designated protected areas.

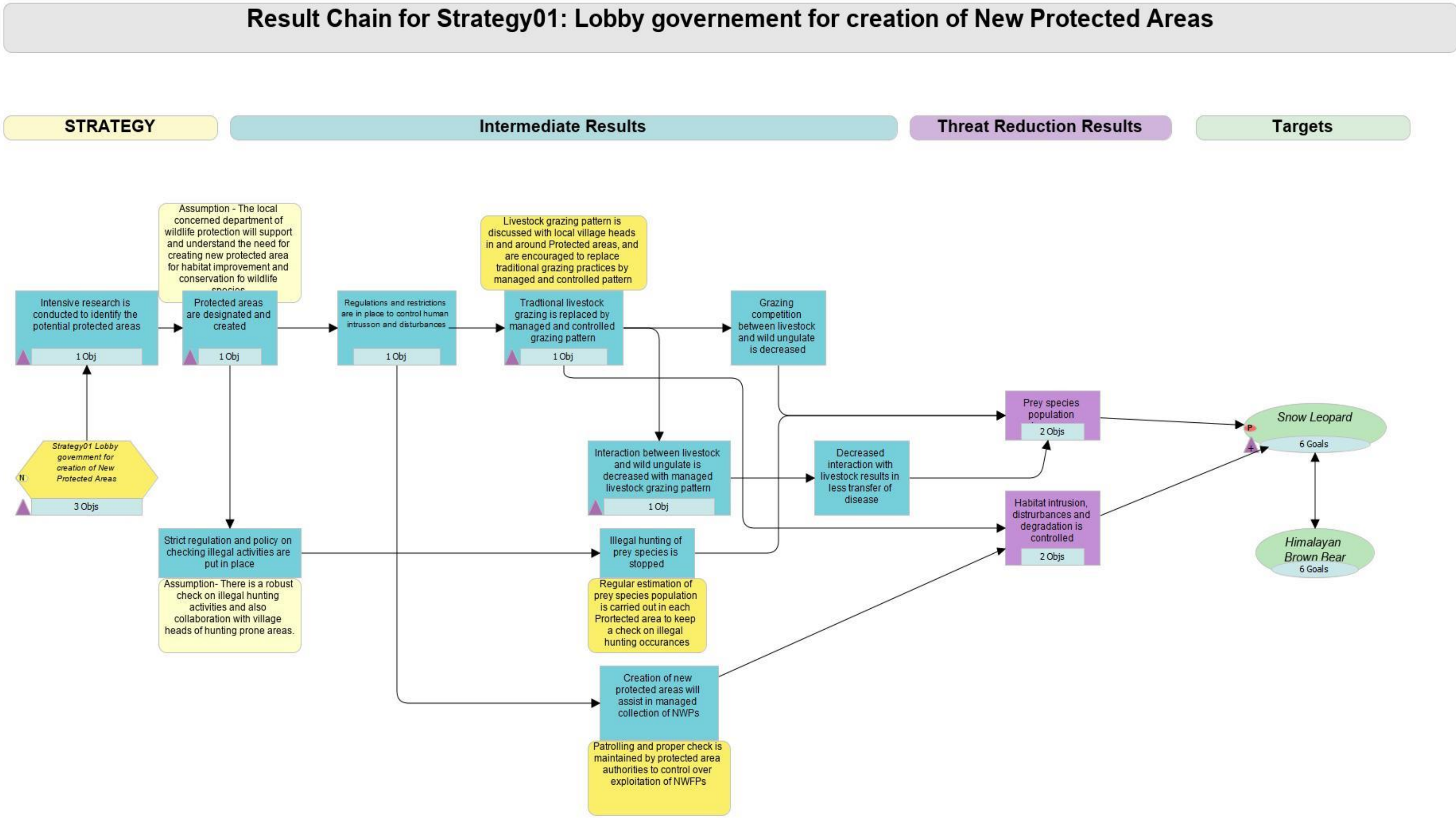


Figure 74 Results Chain for STRATEGY 01: Lobby government for the creation of new Protected Areas

Strategy Two - Setting up livestock insurance and predator-proof coral schemes

Livestock depredation and property damage are among the severe consequences of human-wildlife interactions in Kargil, as observed from the previous chapters and also through available literature. There have been various reports from the region of retaliation as well as pre-emptive killings of Himalayan brown bears in response to livestock predation and property damages. Although reports of snow leopard killing in retaliation have not been reported from the region, it cannot excluded owing to the high level of conflict. Chapter four of the thesis further discusses the need to work on community level to ensure livestock safety.

This strategy includes setting up livestock insurance and predator-proof coral schemes in the areas more prone to wild carnivore predation reports.

Standard classification- Livelihood, Economic, and other incentives

Ratings

Potential Impact – High

Feasibility- High

Roll-up – Effective

Intermediate results

Theory of Change for Results Chain 02: Livestock insurance and predator-proof coral schemes

Livestock rearing is one of the main sources of livelihood in Kargil. The theory of change for this strategy is that if locals are provided with infrastructure materials to build predator-proof corals, there would be fewer reports of livestock predation by wild carnivores and feral dogs, as the compensation from Insurance programs will help in the reduction of retaliation killings of snow leopard and brown bears. The strategy relies on the assumption that proper support is provided by the local government, as reliable funding organisations are available to run the schemes successfully. Livestock herders will be made to sign contracts to report any illegal wildlife activities and they will not disturb the wildlife in and around the villages in return for providing materials for predator-proof sheds and signing in for insurance programs. This will reduce illegal hunting as well as the persecution of wild carnivores. The intermediate results in the result chain and threat reducation results in the result chain is further detailed in Table 55 and 56.

Table 55 Intermediate Results in the Results chain for Strategy 02: Setting up livestock insurance and predator-proof coral schemes.

Intermediate results	Details	Objectives	Indicators	Targets impacted
Predator-proof livestock sheds are constructed in conflict-prone villages	Activities: Intensive survey to identify the livestock depredation-prone villages Collaboration with the local wildlife department, village heads, and other wildlife NGOs to assist in providing logistic support for setting up predator-proof corals and a livestock insurance program	By 2035, at least 100 households will be covered under the scheme.	Number of households covered under the scheme	Snow Leopard Himalayan Brown Bear

	Logistics and required equipment for setting up predator-proof sheds are provided to identified households.			
The livestock Insurance program is set up in conflict-prone villages/regions.	A livestock insurance program is set up through rigorous meetings and discussions with village heads (villages prone to livestock predation), Local NGOs, and the concerned wildlife department.	By 2035, livestock insurance programs will be started in at least five conflict-prone villages.	Number of villages covered under the scheme	Snow Leopard Himalayan Brown Bear
Easy entry of predators into livestock shed is stopped/ reduced	With more strong and predator-proof corals, the easy entry of predators is reduced.	-	-	Snow Leopard Himalayan Brown Bear
Monetary compensation for livestock losses to wild predators	-	-	-	Snow Leopard Himalayan Brown Bear
Decrease in livestock predation incidents.	-	By 2040, reports of livestock depredation by various predators will decrease by 50%	-	Snow Leopard Himalayan Brown Bear
Retribution killing is stopped.	-	-	-	Snow Leopard

				Himalayan Brown Bear
Economic loss from livestock predation is compensated.	-	By 2045, at least 50% of the livestock loss is compensated	Number of compensation granted.	Snow Leopard Himalayan Brown Bear

Table 56 Threat reduction result inputs for the Result Chain Two.

Threat Reduction result	Details	Objectives	indicators
There are no/reduced reports of retribution killings of wild Snow leopards and Himalayan Brown bears.	With the reduction of livestock depredation cases due to predator-proof corals and also compensation through insurance programs, retribution killing will be reduced to a great level.	By 2045, there were No reports of persecution of snow leopards and Himalayan brown bears in retaliation killings of livestock depredation.	The number of persecution of wild carnivores reported.

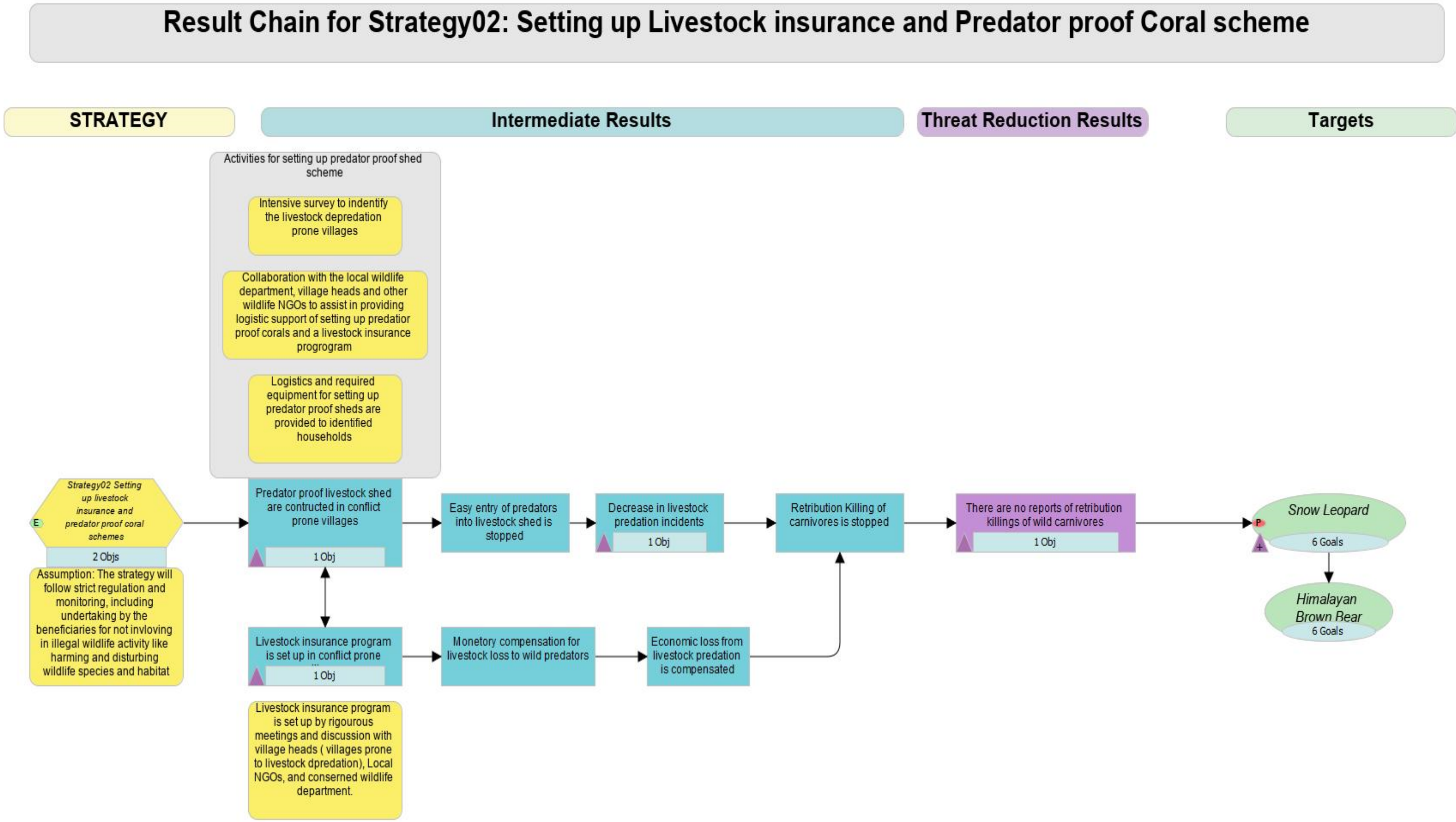


Figure 75 Results Chain for Strategy Two: Setting up livestock insurance and Predator-proof coral scheme.

Figure 76 Results Chain for Strategy Three: Feral dog population ControlFigure 77 Results Chain for Strategy Two: Setting up livestock insurance and Predator-proof coral scheme.

Strategy Three – Feral dog population control

The rising threat of feral dog populations and the impact they cause on snow leopards, brown bears, and their prey will be the focus of this strategy. In the past, feral dogs have increased conservation difficulties. Snow leopards have been reported to be harassed by dog packs chasing and cornering them, resulting in injury. These groups of feral dogs hunt on snow leopard prey and livestock, diminishing the prey base and causing human-wildlife conflict, which has a far-reaching deleterious effect, reducing snow leopard livestock predation tolerance. There have been several video footage from Kargil where packs of feral dogs chasing and harassing snow leopards and brown bears emerging lately, which have been a concern to the wildlife conservationists in the region as well as the local communities. Although the severity of the threat is yet to be examined scientifically and rationally, the threat is increasing in the region, which is well evident through various undocumented reports.

Standard classification: Invasive/Problematic species Control

Ratings-

Potential impact: High

Feasibility: High

Roll-up: Effective

Objectives

Objective 01: Identification of the most affected areas

By 2030, the density estimation of feral dogs is completed, and key sites for the sterilisation of feral dogs will be identified.

Objective 02: Sterilisation of feral dogs

By 2035, the Sterilisation program for feral dogs will be initiated

Objective 03: Population control

By 2045, the population of feral dogs is stable as per the survey of 2030, and reports of harassing wildlife species by feral dogs have decreased by 75%.

Theory of Change for Results Chain 03: Feral dog Control

The main assumption behind this strategy is that the control of the feral dog population in the region will reduce the numbers of feral dogs in the wild, which will result in fewer reports of wildlife harassment and livestock loss to feral dogs. Livestock depredation by feral dogs is increasing at an alarming rate in the region, which is evident in the previous chapter of this thesis. Another assumption in this strategy is that the local animal husbandry department and district authority will assist in the program to control the feral dog population of the region. The accumulated assumption behind this strategy is a reduction in the feral dog population, fewer reports of livestock depredation by feral dogs, and a reduction in the number of incidents of feral dogs harassing snow leopards and brown bears. The intermediate results and threat reduction results in the result chain is detailed in Table 57 and 58, respectively.

Table 57 Intermediate results inputs for Result Chain Three - Feral dog control.

Intermediate result	**Details**	**Indicator**	**Objective**	**Target/s Impacting**
A new policy is drafted by the local government/ authorities to control the	The local government body is approached for framing a policy to control the	Number of meetings held with the local authorities	By 2030, a policy is drafted to control the feral dog	Snow leopard Himalayan brown bear Associated wildlife species

feral dog population.	local feral dog population.		population in Kargil.	
The new policy is adopted at the block level in the whole District.	The new policy is adopted at the block level in the whole District.	Number of Blocks adopting the new policy	By 2035, all blocks will be covered under the new policy.	Snow leopard Himalayan brown bear Associated wildlife species
The new policies are successfully enforced.	-	-	By 2035, the new policy on feral dog population control will be enforced.	Snow leopard Himalayan brown bear Associated wildlife species
Local organisations and communities are approached through awareness programmes.	After the drafting of the new policy, the local communities and organisations working on feral dog population control are approached and aware of the policy.	Number of policy awareness programmes held	By 2035, All the blocks will be covered in awareness programmes for the new policy to control the feral dog population.	Snow leopard Himalayan brown bear Associated wildlife species
Feral dog population management is in place.	-	-	-	Snow leopard Himalayan brown bear Associated wildlife species
Exponential growth in the feral dog	-	Change in feral dog population over the period of time	By 2045, the population of feral dogs is under control	Snow leopard Himalayan brown bear

population is controlled.		Number of individuals	and not increasing exponentially.	Associated wildlife species
Bi-monthly visits of veterinary staff to each block	-	Number of visits by a veterinary expert to teach blocks in a month	By 2035, regular bi-monthly visits by veterinary staff to each block will be achieved.	Snow leopard Himalayan brown bear Associated wildlife species
Sterilisation of feral dogs is carried out bi-monthly	-	Number of dogs sterilised each month.	By 2045, at least half of the feral dog population will be sterilised.	Snow leopard Himalayan brown bear Associated wildlife species
The number of infertile dogs population increases.	-	Number of dogs sterilised.	-	Snow leopard Himalayan brown bear Associated wildlife species
Local communities are trained in capturing, displacing, and sterilisation of feral dogs.	This step is undertaken with the support of the local animal husbandry department.	-	-	Snow leopard Himalayan brown bear Associated wildlife species
Bi-monthly visits by ABC staff are undertaken to villages to support and train local communities	-	-	-	Snow leopard Himalayan brown bear Associated wildlife species

on handling and the procedures to sterilise feral dogs.				
Locals are encouraged to adopt dogs.	-	The number of families that adopted dogs.	By 2045, at least 20 families adopted dogs.	Snow leopard Himalayan brown bear Associated wildlife species
The population of fertile feral dogs population decreases.		Number of fertile feral dog populations in the region.	By 2045, there will be at least a 75% decrease in the fertile feral dog population.	Snow leopard Himalayan brown bear Associated wildlife species
Livestock depredation by a feral dog is controlled.	-	Number of livestock depredation incidents by feral dogs	By 2045, there will be a 75% decrease in livestock attacks by feral dogs.	Snow leopard Himalayan brown bear Associated wildlife species
Retribution killings of wildlife species are stopped.	-	Number of carnivore persecutions reported.	By 2045, the persecution of wild carnivores will be stopped.	Snow leopard Himalayan brown bear Associated wildlife species

Table 58 Threat reduction Result in the result chain for Strategy three.

Thread Reduction Result	Indicator	Objective
Persecution of Snow leopards and Brown bears is controlled	A number of Snow leopards and Brown bears were persecuted in retaliation, killing	By 2045, No reports of retaliation killings from the region
Competition with feral dogs for food and space is reduced.	Number of reports and evidence of feral dogs and wild carnivore interactions	By 2045, there will be no reports or evidence of feral dogs harassing snow leopards and brown bears.

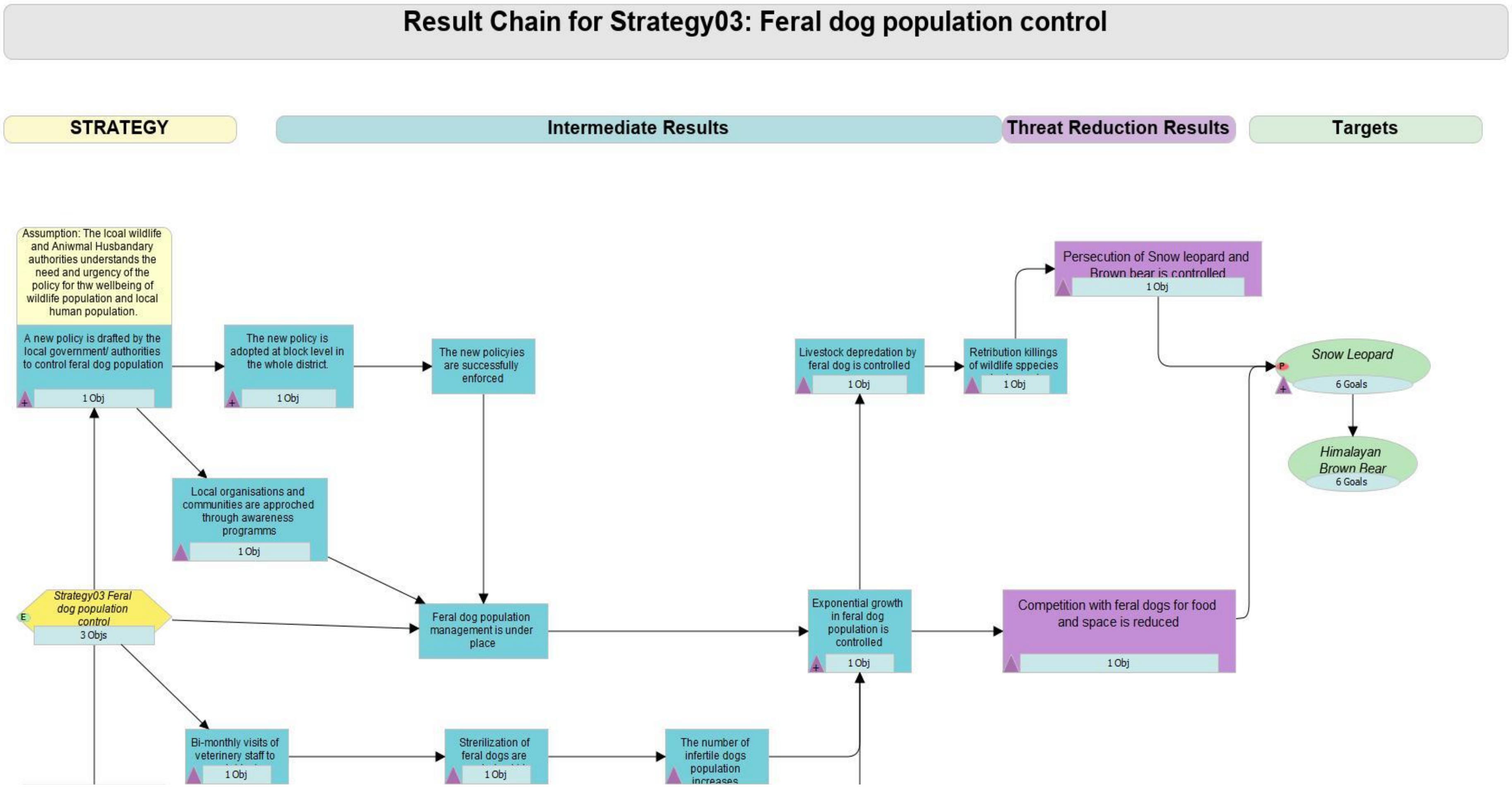


Figure 78 Results Chain for Strategy Three: Feral dog population Control

Figure 79 Results Chain for Strategy four: Education and Awareness Campaigns.Figure 80 Results Chain for Strategy Three: Feral dog population Control

Strategy Four – Education and Awareness Campaigns

Education and awareness can play an important role in combating negative perceptions of the local wildlife, especially the large carnivores of the region. This strategy will aim to target village panchayats, school children, and concerned government departments working for the conservation of wildlife and livestock husbandry. This campaign will also aim at passing conservation education by the attendees to other members of the society. These workshops will act as a loop to spread wildlife awareness to the larger part of society. The objective of the strategy is to complete the awareness campaign at each block level, school, and other higher institutions by 2045. This will assist in a 100% decrease in pre-emotive killings of wildlife species, responsible use of natural resources, and also making the local community sustainable livestock grazing practices.

Standard classification: Awareness and Communication

Ratings-

Potential impact: High

Feasibility: Very High

Roll-up: Effective

Objectives

Objective 01- Awareness campaign for farmers

By 2035, at least four awareness campaigns at the block level and one in each block of the District comprising local farmers will be completed.

Objective 02- Education awareness workshops for students

By 2035, at least ten conservation education workshops will be completed at Higher secondary schools and degree college levels across the District.

Objective 03- District-level awareness campaigns

By 2045, the celebration of International Snow Leopard Day at the district level every year, comprising important stakeholders (Wildlife researchers, experts, students, farmers, wildlife authorities, Non-governmental organisations, and other concerned government departments) is targeted.

Theory of Change for Result Chain Four: Education and Awareness Campaigns

The main assumption of this strategy is that if people are made aware of wildlife conservation, their negative attitude will change into a positive one toward wildlife, especially the wild carnivores of the region. This will further result in a decrease in illegal wildlife activities and also stop the persecution of wild carnivores in the region. Information packs will be produced in English and local languages and distributed among the local population, which will be a source of useful information on the wildlife of the region. This will also be followed by awareness campaigns at the village level, where the reports of human-wildlife conflict are intense. Further educational workshops will be conducted at higher education institutes to include the youth of the society in the protection of wildlife. All these activities will collectively assist in changing the negative perception of the local communities and preserve the wildlife species and habitat of the area. This will further result in the stabilisation of the wildlife population in the region, with a decrease in the persecution of wild carnivores and the cessation of illegal hunting of wild ungulates. The intermediate results and threat reduction results in the result chain is detailed in Table 59 and 60, respectively.

Table 59 Intermediate Result inputs for Result Chain Four.

Intermediate Result	Details	Indicator	Objective	Target/s Impacting
The Wildlife Department and Education Department of Kargil are approached to collaborate in various education and awareness programs at the village, block, and district levels.	The local concerned authorities are approached in order to smooth the functioning of the programs to be run at a different level in the District. Logistics and staff support will also be discussed during the meetings.	The number of successful meetings with the local government and NGOs. The type of support agreed upon by the concerned organisations and government authorities Permission to conduct awareness and education workshops programs across the District	By 2026, meetings have successfully taken place with local government and non-government authorities. Permission to conduct awareness programs has been achieved from the concerned authorities. Logistic and staff support is provided by the government and NGOs in the region.	Snow Leopard Himalayan Brown Bear Other associated species of the region
Information packs (Pamphlets. Leaflets, pocketbooks) in English and local	Information packs with wildlife conservation knowledge	The number of information packs drafted, produced, and distributed.	By 2030, all the blocks will be covered, and at least	Snow Leopard Himalayan Brown Bear

languages are drafted and produced to create wildlife awareness among local communities.	will be distributed among local communities to make them aware of the wildlife of the region and the importance of conserving them.		1000 information packs will be distributed among the local human population.	Other associated species of the region
Local Schools, colleges, and other education institutes are approached for wildlife education programs.	Heads of educational institutes are approached to plan education awareness programs.	The number of the head of educational institute heads approached.	By 2030, all educational institute heads will be contacted, and meetings will be held to plan education workshops.	Snow Leopard Himalayan Brown Bear Other associated species of the region
Students attend wildlife education programs at the school and college level.	-	Number of students attending education workshops	-	Snow Leopard Himalayan Brown Bear Other associated species of the region
Village-level community heads	At the village level,	Number of Villages covered	By 2045, all villages will	Snow Leopard

(Panch and Sarpanchs) are approached to plan awareness campaigns.	the head of the community is approached for awareness campaigns.		be covered under the awareness campaign project.	Himalayan Brown Bear Other associated species of the region
The local communities attend the awareness programs in each village.	-	Number of locals attending the campaign.	By 2045, all village heads have attended the awareness campaign	Snow Leopard Himalayan Brown Bear Other associated species of the region
Attitude and perception towards wild Snow leopards and Himalayan brown bears improve.	-	-	-	Snow Leopard Himalayan Brown Bear Other associated species of the region
Local livestock farmers pledge to follow a controlled grazing pattern.	-	The number of villages adopting sustainable grazing patterns.	By 2045, at least 50% of the villages have replaced the existing traditional grazing method with a	Snow Leopard Himalayan Brown Bear Other associated species of the region

			sustainable method.	
Grazing competition with wild ungulates is reduced.	-	-	-	Snow Leopard Himalayan Brown Bear Other associated species of the region
Residents pledge to report any illegal activities in and around the village to the wildlife authorities.	Within the awareness campaign, the attendees are made to pledge to report any illegal wildlife activities to concerned wildlife authorities.	A number of residents agreed to report illegal activities in their villages.	By 2040, more than 70% of the residents attending awareness campaigns pledge to report illegal wildlife activities.	Snow Leopard Himalayan Brown Bear Other associated species of the region
Illegal hunting and retribution killing are controlled.	By reporting illegal wildlife activities like hunting, more arrests are made, which in turn will reduce the illegal wildlife	Number of illegal wildlife activities reported	By 2045. The illegal hunting of wild ungulates is stopped	Snow Leopard Himalayan Brown Bear Other associated species of the region

	activities in the region.			
Illegal hunting if prey species are reported	-	Number of illegal wildlife activities reported	-	Snow Leopard Himalayan Brown Bear Other associated species of the region
Convicts of illegal wildlife activities are arrested.	With more strict wildlife policies in place, arrests are made for any illegal wildlife activities.	Number of arrests made related to illegal wildlife activities	-	Snow Leopard Himalayan Brown Bear Other associated species of the region
Local students and other residents pledge not to harm or disturb the wildlife of the region.	With more awareness and learning the importance of conserving wildlife, more locals pledge to protect the wildlife of the region.	-	-	Snow Leopard Himalayan Brown Bear Other associated species of the region

Table 60 Threat reducation Result in the result chain.

Threat Reduction Result	Details	Indicator	Objective
Stable and increased prey species population	With locals more aware and educated on the importance of wildlife, resulting in illegal wildlife activities, especially illegal hunting, the wild ungulate population is stable and increasing.	The population of wild ungulates	By 2035, the population of wild ungulates is stable, By 2045, the number of Ladakh urial and Asiatic ibex is increased by 15%.
Retribution and pre-emptive killings of	Through education and awareness programs, people will be more aware of how to handle wild carnivores' interaction situations, and retribution killing will be reduced.	Number of retribution killings reported	By 2045, the persecution of Snow leopard and Himalayan Brown bear is stopped.

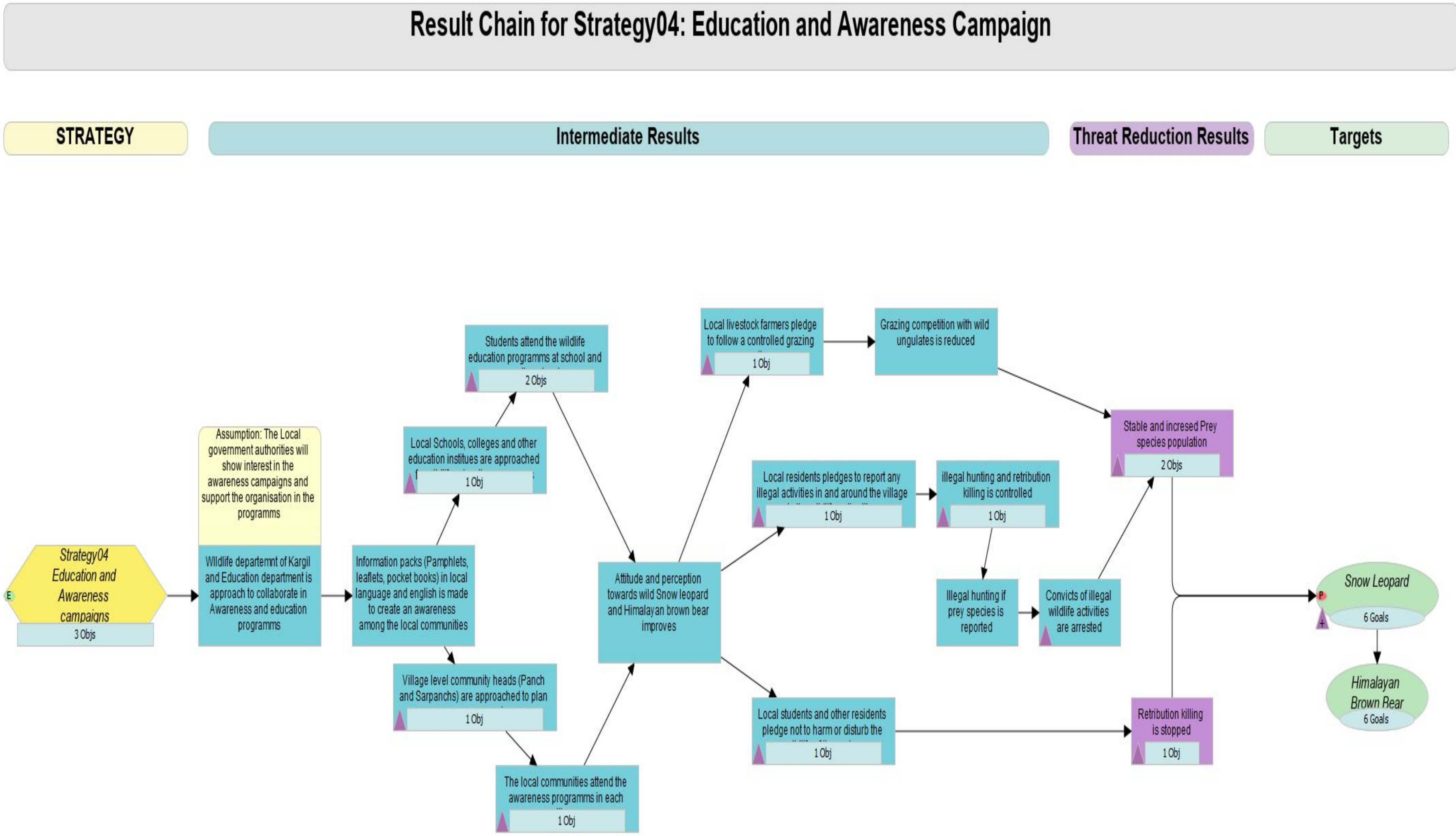


Figure 81 Results Chain for Strategy four: Education and Awareness Campaigns.

Figure 82 Results Chain for Strategy Five: Lobbying the Government for strengthening wildlife laws and policies.Figure 83 Results Chain for Strategy four: Education and Awareness Campaigns.

Strategy Five: Lobby the Government to strengthen existing wildlife Laws and Policies

The priority for this strategy is to lobby the government to bring together all the stakeholders, such as the administration, concerned departments, local communities, and wildlife experts, to strengthen the existing policy of wildlife protection in the region.

Standard classification: Policies and Regulation

Ratings-

Potential impact: Very High

Feasibility: High

Roll-up: Effective

Objectives

Objective 01- Strict law enforcement

By 2035, with new and strict wildlife laws and policies in place, strict surveillance and patrolling of illegal wildlife activities in prone areas will be started.

Objective 02- Wildlife Policy strengthening

By 2045, a proper and strong policy will be framed by the administration of the Union Territory of Ladakh in consultation with wildlife experts and local stakeholders.

Theory of Change for Results Chain Five: Lobby Government to strengthen existing wildlife Laws and Policies

This strategy will focus on lobbying the government to strengthen existing wildlife Laws and policies. Once the government is lobbied, discussions to improve and amend the existing laws and policies will be made through intense meetings.

These meetings will also include stakeholders like livestock farmers, students, researchers, wildlife experts, and concerned government bodies. Once the laws are improved and improved, the illegal hunting of wild ungulates will stop, and the wild carnivore population will also thrive, which in turn will result in fewer reports of livestock depredation cases. With strict regulations, upcoming mega projects in the region will be monitored, and proper EIA guidelines will be followed, which will result in less pressure on the wildlife habitat of the region. Overexploitation of forest products will be monitored regularly and strictly, which will improve wildlife habitat.

The assumption that will be followed throughout the strategy is that the government will understand the need to amend the existing wildlife laws and policies and also support the stakeholders in the process. In conclusion, this strategy will improve the existing laws in place, increasing the detection rate of illegal activities, raising awareness, and harsh penalties for involvement in illegal activities. The intermediate results and threat reduction results in the result chain is detailed in Table 61 and 62, respectively.

Table 61 Intermediate Results input for Result Chain Five.

Intermediate Results	Details	Indicator	Objectives	Target/s impacting
The wildlife department is approached to discuss the appropriate changes in existing wildlife Laws and policies.	-	Number of successful meetings held	By 2030, five successful meetings will be held to discuss the existing wildlife laws and policies.	Snow leopard Himalayan brown bear Associated wildlife species
The problems in existing laws	Assumption - The	-	-	Snow leopard

and policies are amended.	policymakers and the wildlife authorities understand the need for amendments and strengthing existing wildlife laws and policies to protect the wildlife and its habitat of the region.			Himalayan brown bear Associated wildlife species
The new wildlife policies are enforced.	-	Number of amendments accepted and passed by the local wildlife Authority	By 2035, newly amended laws will be passed by the local authorities.	Snow leopard Himalayan brown bear Associated wildlife species
Tourism in the eco-sensitive zone is regulated and managed.	With the new strict policies in place, unregulated tourism is regulated and controlled.	-	-	Snow leopard Himalayan brown bear Associated wildlife species
Various tourism stakeholders are approached and made aware of the new wildlife laws and policies.	-	-	-	Snow leopard Himalayan brown bear Associated wildlife species
Sustainable tourism is practised.	-	-	-	Snow leopard Himalayan brown bear Associated wildlife species

Litter and noise pollution in wildlife habitat zones are regulated and controlled.	-	-	-	Snow leopard Himalayan brown bear Associated wildlife species
Habitat intrusion and disturbances are stopped.	-	-	-	Snow leopard Himalayan brown bear Associated wildlife species
The new policies are covered in the media.	-	-	-	Snow leopard Himalayan brown bear Associated wildlife species
The amended policies are reaching the local communities through radio programmes, social media and other print media platforms.	-	-	-	Snow leopard Himalayan brown bear Associated wildlife species
Irregulated and uncontrolled livestock grazing pattern is controlled.	-	Number of villages adopting the new regulated pattern of livestock grazing	By 2045, all villages covered under the project will adopt the new sustainable grazing method.	Snow leopard Himalayan brown bear Associated wildlife species
Illegal prey species hunting is stopped.	-	Number of hunting of wild prey species reported	By 2045, no reports of illegal hunting are reported.	Snow leopard Himalayan brown bear Associated wildlife species

Proper EIA guidelines are followed for new macro and mega projects in the region.	-	-	-	Snow leopard Himalayan brown bear Associated wildlife species
Reduction in the interaction between wildlife ungulates and livestock	-	-	-	Snow leopard Himalayan brown bear Associated wildlife species
Transfer of diseases is stopped.	-	Number of wild ungulate deaths reported due to livestock diseases	By 2045, there are no reports of transmission of diseases from livestock to wild ungulates.	Snow leopard Himalayan brown bear Associated wildlife species

Table 62 Threat Reduction Results in Results Chain Five.

Threat Reduction Results	**Details**	**Indicator**	**Objective**
Habitat disturbances, intrusion, and degradation are controlled.	With strict wildlife laws and policies in place, there would be regulations on uncontrolled tourism and other wildlife habitat encroachment. This will reduce wildlife species and habitat disturbances.	Number of illegal activities reported	By 2045, wildlife habitat disturbances will be regulated through strict wildlife laws and policies.

The prey species population is controlled and increasing.	With more strict policies, there would be regular checks on illegal wildlife hunting in the region.	Number of wild ungulates in the wild	By 2045, the wild ungulate population in the region is stable and increased by at least 15%

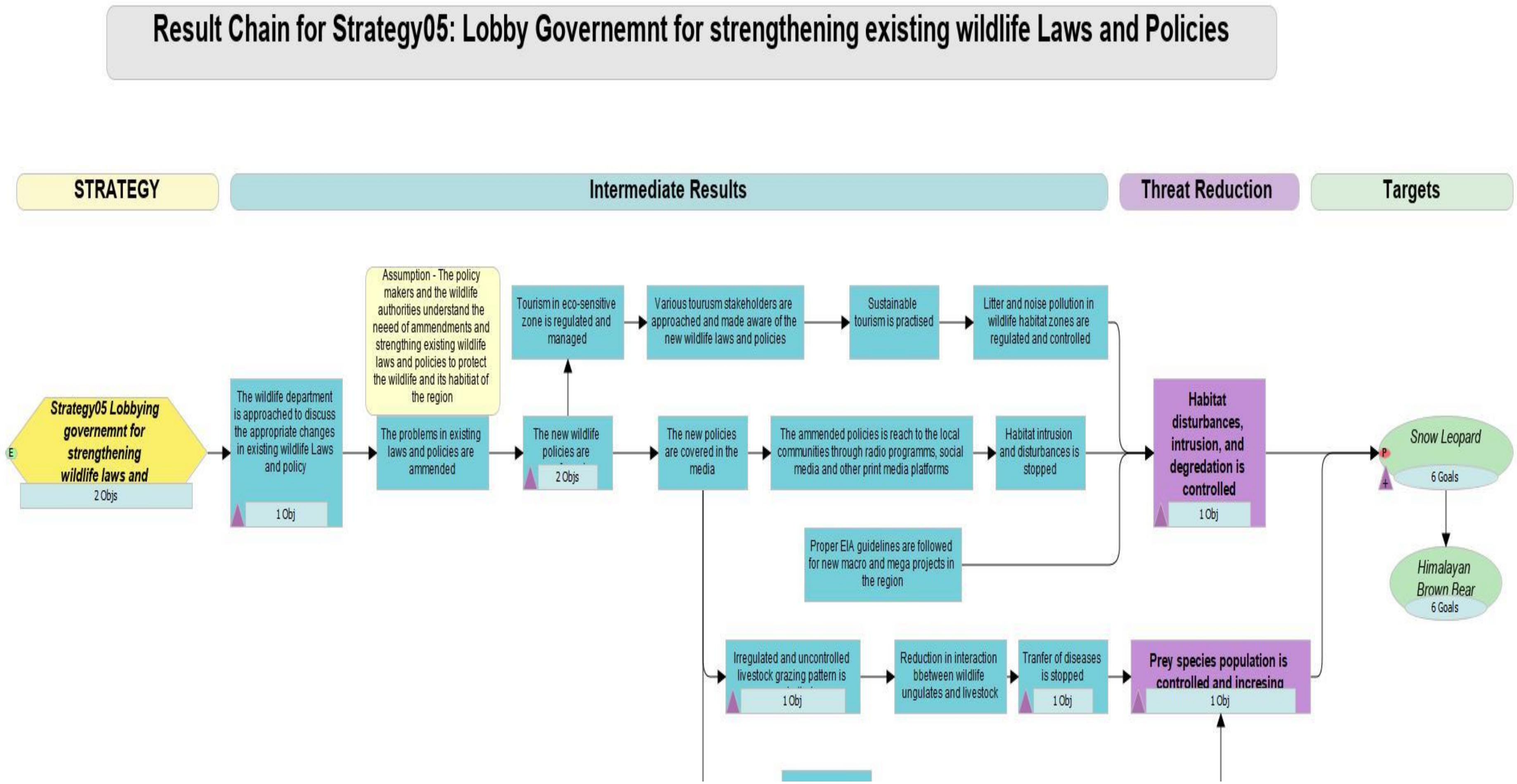


Figure 84 Results Chain for Strategy Five: Lobbying the Government for strengthening wildlife laws and policies.

Figure 85 Results Chain for Strategy Six: Wildlife Eco-Tourism.Figure 86 Results Chain for Strategy Five: Lobbying the Government for strengthening wildlife laws and policies.

Strategy Six: Wildlife Eco-Tourism

Wildlife-based tourism that gives jobs and monetary support to local people will increase the economic worth of the resource and provide incentives to maintain it (Buckley, 2009; Honey, 2008; Weaver, 2011; WWF, 2019). The main objective of this strategy will be to reduce the dependence on livestock rearing as the main source of livelihood and create an alternative source of eco-friendly income.

Standard classification: **Substitution**

Ratings-

Potential impact: **High**

Feasibility: High

Roll-up: Effective

Objectives

Objective 01- Linking People and Government

By 2030, the local government is persuaded to draft a scheme for eco-tourism in conflict-prone villages across Kargil

Objective 02- Extending eco-tourism

By 2045, at least a total of 15 wildlife conflict-prone villages are covered under the wildlife eco-tourism scheme to create an alternative source of income for the local human population.

Theory of Change for Result chain Six: Wildlife Eco-tourism

The main assumption followed for this strategy is that the eco-tourism is performed sustainably and with support from the local tourism authority as well as travel agencies. The main activities for this strategy will be to train the locals to be tour guides, encourage villagers in conflict-prone areas for homestay initiatives, and train locals on the production of handmade goods for sale. These strategies will help reduce the dependency of the local human population on livestock as the main source of livelihood, which will assist in the improvement of their financial condition. The majority of illegal activities surrounding wildlife are believed to be due to poverty. As an alternate source of income with eco-tourism, the locals will appreciate the wildlife and assist in the protection of the ecosystem. Once the tour guides are properly trained, and homestays are established, local, national, and international tour and travel agencies will be the approach for their assistance and marketing. Tourist influx will be regularly monitored in collaboration with the local authorities to check the influx to ensure low impact on the environment but high end ecotourism (i.e., high prices but small groups). The handmade crafts will be displayed in villages in community building spaces for sale. The products will be on sale online also, reaching the maximum number of interested buyers. Overall, the whole strategy is aimed at improving the economic stability of the local people, which will reduce illegal wildlife activities and conflicts in general. The intermediate results, human well-being targets, and threat reduction results in the result chain is detailed in Table 63, 64, and 65, respectively.

Table 63 Intermediate results in the result chain six.

Intermediate Results	Details	Indicator	Objectives	Target/s impacting
Support is provided by the organisation. Also, the local wildlife and handicraft authorities are approached to encourage	Assumption: The initiative is supported by the local wildlife and handicraft department of the District for full support.	-	-	Snow leopard Himalayan Brown bear Associated wildlife species

handmade products for sale.	The support is provided to the local community with the pledge to support the local wildlife of the region, protect wildlife habitat and also report any illegal wildlife activities to the coal concern departments.			
Eco-friendly products (souvenirs, gifts) are produced at the village level.	-	-	-	Snow leopard Himalayan Brown bear Associated wildlife species
The Sarpanch of the respected village is approached for providing a space at the local community building to display the products for sale. The products are made available online for sale.	As there is a community building in every village, the local head of the village will be approached to provide a space to showcase the products for sale.	Number of village heads agreed to provide space at community buildings	By 2045, at least 75% of the targeted village will agree to provide a space at a community building	Snow leopard Himalayan Brown bear Associated wildlife species
The profits are given back to the local community and the people involved in the manufacturing, sale, and other procedures.	-	-	-	Snow leopard Himalayan Brown bear Associated wildlife species

Locals are encouraged to establish homestay.	-	Number of homestays registered with the tourism authority	By 2045, at least 100 homestays are registered with local tourism authorities	Snow leopard Himalayan Brown bear Associated wildlife species
District tourism authority popular travel agencies are aware of the homestay initiative and is advertised on local media, social media platforms and with other national-level tour operators	Assumption: The government and other tour and travel agencies will support the initiatives	-	-	Snow leopard Himalayan Brown bear Associated wildlife species
Local people are trained in handling local tours.	-	-	-	Snow leopard Himalayan Brown bear Associated wildlife species
Major registered tour and travel agencies are approached to support the initiative at the village level.	-	Number of tour agencies agreeing in the initiative to support local tours	By 2045, at least 50% of the major tour agencies in the region will accept the initiative and agree to support local tour operators.	Snow leopard Himalayan Brown bear Associated wildlife species
Local residents are used as tour operators.	-	The number of locals registered as tour operators.	By 2045, at least 100 locals from conflict-prone villages will be registered as tour operators with the tourism authority.	Snow leopard Himalayan Brown bear Associated wildlife species

Table 64 Human Well-being Targets in Results Chain Six.

Human well-being target	Details
An alternate source of income is generated for the locals.	The wildlife eco-tourism will make the local population rely less on livestock as the main source of livelihood, generating an alternative source of income.
The economic condition of the local community is improved.	With the new initiatives of homestay, local handicrafts, and local tour operators, the residents will see an improvement in their income.

Table 65 Threat Reduction Results in Results Chain Six.

Threat reduction Results	Details	Indicator	Objectives
Persecution of wild carnivores in retaliation to livestock killing is reduced.	Wildlife eco-tourism generates income for the residents with support from the local authorities. The people will be more confident in reporting illegal wildlife activities.	The number of retribution killings of wild carnivores reported	By 2045, persecution of wild carnivores in retaliation will be stopped
Illegal hunting of wild ungulates is stopped.	The improvement of the income situation will help in the reduction of illegal wildlife hunting, and proper reports of hunting will be reported to the concerned authorities.	Number of illegal hunting reports	By 2045, no reports of illegal wild ungulate hunting will be reported.
Habitat disturbance is controlled.	With sustainable eco-tourism practices in place, there would be less pressure on the wildlife habitat of the region.	-	-

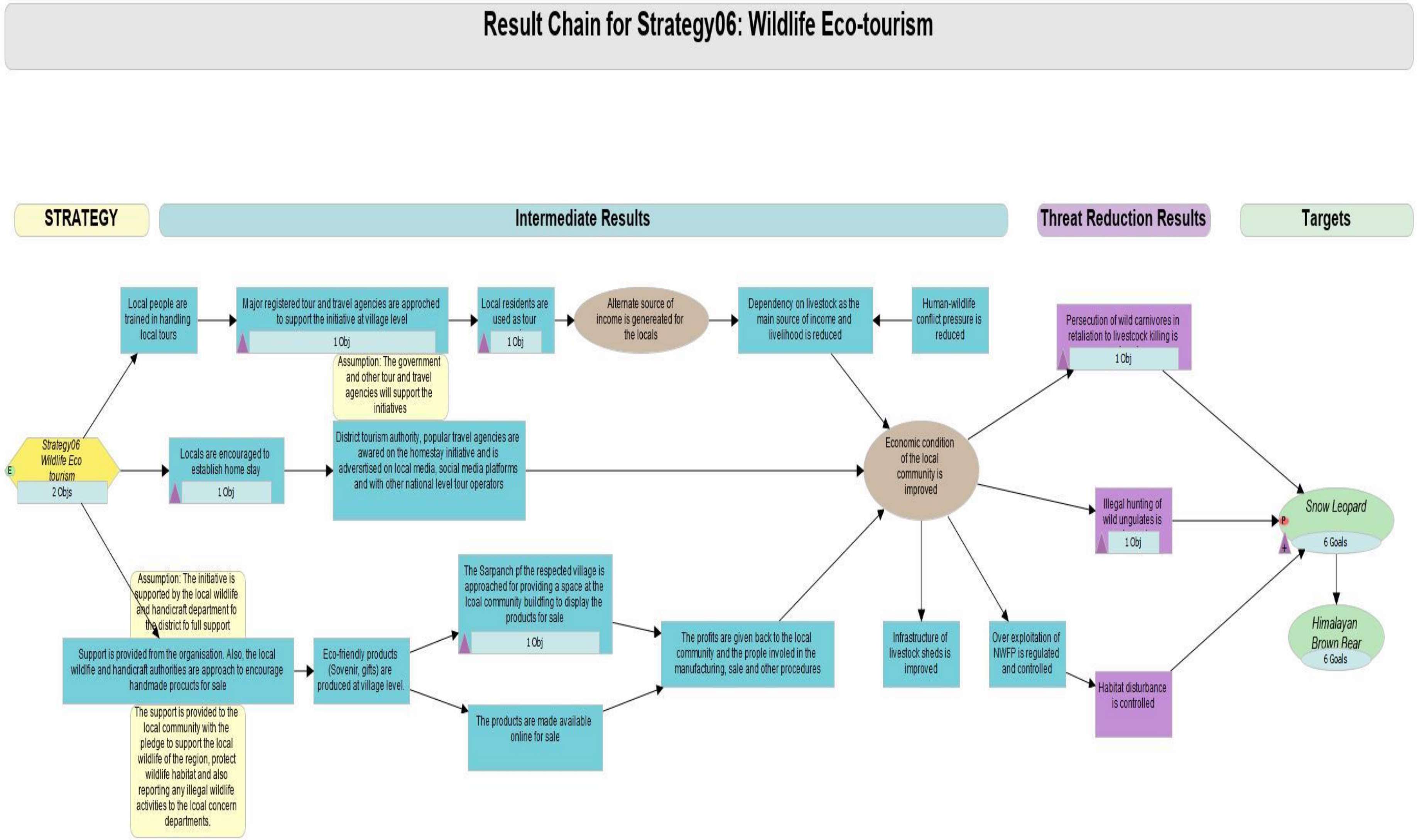


Figure 87 Results Chain for Strategy Six: Wildlife Eco-Tourism.

Appendix 1 Ethical Approval.Figure 88 Results Chain for Strategy Six: Wildlife Eco-Tourism.

Conclusion

In conclusion, this chapter outlines the strategic planning process for the conservation of the wild carnivore population in Kargil, spanning from 2025 to 2045. By utilising tools such as Miradi and adapting the Open Standards for the Conservation of Nature, a comprehensive Conservation Action Plan (CAP) has been conceptualised and designed, guided by the principles of the Conservation Measures Partnership (CMP).

The primary objectives of this CAP are to safeguard and sustain the populations of two keystone species in the region, the Snow leopard (*Panthera uncia*) and the Himalayan brown bear (*Ursus arctos isabellinus*). These species were chosen as theme conservation targets due to their critical roles in maintaining the ecological balance of the Kargil region, and due to their importance in HWC as indicated in previous chapters.

The CAP development process has thus far completed the initial two stages of the Open Standards, which involve the identification of key threats to wildlife and the formulation of strategies to mitigate these threats. It is important to note that at this stage, the project remains in a conceptual phase and has not yet been implemented on the ground.

The next crucial step in the conservation journey is to present and share this meticulously planned project with local wildlife authorities, non-governmental organisations, and various stakeholders invested in the welfare of Kargil's wildlife. Furthermore, efforts will be made to garner support and collaboration at the national level from the Indian government.

The successful execution of this ambitious twenty-year CAP hinges on securing the necessary logistical and financial resources. Once the project obtains the required support, it will transition from its concept phase to implementation, marking a significant step toward ensuring the long-term survival and well-being of the wild carnivore populations in the Kargil region. By adhering to the Open Standards and the principles of the CMP, this CAP offers a structured and strategic approach to conservation that is both adaptive and scientifically sound, with the ultimate aim of preserving the unique biodiversity of this ecologically valuable region.

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Appendices

Appendix 2 Ethical Approval.

Research, Innovation and Academic Engagement Ethical Approval Panel

Doctoral & Research Support
Research and Knowledge Exchange,
Room 827, Maxwell Building
University of Salford
Manchester
M5 4WT

T +44(0)161 295 5278

www.salford.ac.uk/

27 January 2020

Iftikar Ali

Dear Iftikar,

<u>RE: ETHICS APPLICATION STR1920-14 – Examining human wild-carnivore conflicts in Kargil trans-Himalaya</u>

Based on the information you provided, I am pleased to inform you that your application STR1920-14 has been approved.

If there are any changes to the project and/ or its methodology, please inform the Panel as soon as possible by contacting S&T-ResearchEthics@salford.ac.uk

Yours sincerely,

Dr Devi Prasad Tumula
Deputy Chair of the Science & Technology Research Ethics Panel

Appendix 5 Study Area permission letter.

GOVERNMENT OF JAMMU AND KASHMIR,
OFFICE OF THE DISTRICT MAGISTRATE KARGIL

Phone: 01985-232216 (O)
232644 (Fax)
Email: dckgl-jk@nic.in

TO WHOM IT MAY CONCERN

Shri Iftikar Ali PhD Researcher-University of Salford Manchester, United Kingdom, is hereby allowed to conduct PhD research in different blocks of the District on the topic titled 'Examining the Anthropogenic pressures on Carnivores (Vice-versa) in Kargil Trans-Himalaya, India in Kargil (Ladakh).

Addl. District Magistrate Kargil

Additional District Magistrate
Kargil
Addl. District Magistrate,
Kargil

No:- DMK/JC- permission/2019
Dated.23 . 07.2019
Copy to the:-
1. Shri Iftikar Ali PhD Researcher-University of Salford Manchester, United Kingdom for information and necessary action.

Appendix 8 Participation information cum invitation letter.

شرکاء کی معلومات شیٹ کے ساتھ دعوت نامے کا خط

ریسرچ پراجیکٹ عنوان

کارگل ہمالیہ ، ہندوستان میں انسانی جنگجوؤں سے متعلق

تنازعات کی جانچ پڑتال۔

Ethical Approval Reference Number – STR1920-14

1. دعوت نامہ

آپ کو اس تحقیقی منصوبے میں حصہ لینے کے لئے مدعو کیا جا رہا ہے .آپ ایسا کرنا کرنے سے پہلے، یہ ضروری ہے کہ آپ سمجھتے ہیں کہ تحقیق کیا جا رہا ہے اور اس میں کیا شامل ہوگا .اگر آپ چاہیں تو مندرجہ ذیل معلومات کو احتیاط سے پڑھنے اور دوسروں کے ساتھ اس پر بحث کرنے کا وقت لگائیں .ہم سے پوچھیں اگر کچھ بھی واضح نہیں ہے یا اگر آپ مزید معلومات چاہتے ہیں تو .یہ فیصلہ کرنے کا وقت لیں کہ آیا آپ حصہ لینے کے خواہاں ہیں .اس کو پڑھنے کے لئے شکریہ.

2. منصوبے کا مقصد کیا ہے؟

یہ تحقیقی منصوبے کا مقصد کارگول میں انسانوں اور کاروائوں کی تنازعہ کی سطح اور شدت کی تحقیقات اور مستقبل کے لئے مؤثر کمائی کی منصوبہ بندی کو فروغ دینا ہے.

3. میں نے کیوں منتخب کیا ہے؟

،آپ کو منتخب کیا گیا ہے کیونکہ مطالعہ کے علاقے کے رہائشی اور آپ کے گھر کے ایک سینئر ممبر کے طور پر آپ کا تجربہ اور علم اس خطے میں جنگلی زندگی اور انسانیت کے تنازعہ کے اثرات اور سطح کو سمجھنے میں مدد کرے گا.

4. مجھے حصہ لینے کی ضرورت ہے؟

یہ آپ کو یہ فیصلہ کرنے کا فیصلہ ہے کہ آیا حصہ لینے یا نہیں .اگر آپ حصہ لینے کا فیصلہ کرتے ہیں تو، آپ کو اس معلومات کا شیٹ کا ایک کاپی رکھنے کے قابل ہو جائے گا اور آپ کو رضامند رضامندی کے فارم سے اپنے معاہدے کا اشارہ ہونا چاہئے .آپ اب بھی کسی بھی وقت واپس لے سکتے ہیں .آپ کو ایک وجہ نہیں دینا ہے.

5. اگر میں حصہ لے تو میرے ساتھ کیا ہوگا؟

1. سوالنامہ -آپ سے اپنے انٹرویو لینے والے کے ذریعہ آپ کے آس پاس کے علاقوں میں جنگلی گوشت خوروں کے انسانی تناظر سے متعلق کچھ سوال پوچھا جائے گا جس کے بارے میں ہمارا تخمینہ ہے کہ آپ کو 45-50 منٹ لگیں گے۔ آپ اپنے نقطہ نظر کے بارے میں مزید معلومات کے فالو اپ انٹرویو پر راضی ہو سکتے ہیں۔

2. انٹرویو - آپ سے انٹرویو لینے والے کے ذریعہ کچھ سوال پوچھا جائے گا جو کارگل کے جنگلی گوشت خوروں اور اس کے انسانوں سے تنازعہ سے متعلق ہے ، جو آڈیو آلہ میں ریکارڈ کیا جائے گا۔

6. مجھے کیا کرنا ہے؟

برائے مہربانی سوالنامہ میں سوالات کا جواب دیں جیسا کہ آپ سے بہترین ہے .شرکت کے ساتھ منسلک کوئی دوسرے وعدے یا طرز زندگی کی پابندیاں نہیں ہیں.

7. حصہ لینے کے ممکنہ نقصانات اور خطرات کیا ہیں؟

/ تحقیق میں شرکت آپ کو کسی بھی نقصان یا مصیبت کا سبب بننے کی پیشکش نہیں کی جاتی ہے .ممکنہ جسمانی اور یا نفسیاتی نقصان یا مصیبت ہر روز روز مرہ کی زندگی میں تجربہ کار ہی ہو گی

8. حصہ لینے کے ممکنہ فوائد کیا ہیں؟

اس کے باوجود اس منصوبے میں شرکت کرنے والوں کے لئے کوئی فائدہ نہیں ہوتا، امید ہے کہ یہ کام مستقبل کے جنگلات کی حفاظت کے تحفظات اور جانوروں کے تحفظ کے منصوبوں پر فائدہ مند اثر پڑے گا .ان کے پیشہ ورانہ کام کو مطلع کرنے کے لئے شرکاء کے ساتھ نتائج کا اشتراک کیا جائے گا.

9. تحقیقاتی مطالعہ کی توقع سے قبل پہلے ہی کیا ہوتا ہے تو کیا ہوتا ہے؟

کیا تحقیق کی منصوبہ بندی کے مقابلے میں پہلے روکا جائے گا اور آپ کو متاثر کیا جاتا ہے کہ ہم کسی بھی طرح سے آپ کو بتائیں گے اور وضاحت کریں کہ کیوں.

10. اگر کچھ غلط ہو تو کیا ہوگا؟

اگر آپ کو پہلی مثال میں اس منصوبے کے بارے میں کوئی شکایت ہے تو آپ تحقیقاتی ٹیم کے کسی بھی رکن سے رابطہ کرسکتے ہیں .اگر آپ محسوس کرتے ہیں کہ آپ کی شکایت کو آپ کی اطمینان سے سنبھال نہیں دیا گیا ہے تو آپ کو مزید شکایت- نیچے ملاحظہ کریں- کے لئے سلففور کی انتظامی ٹیم سے رابطہ کرسکتے ہیں.

11. کیا میں اس منصوبے میں حصہ لوں گا خفیہ رکھا جائے؟

تحقیق کے دوران ہم آپ کے بارے میں تمام معلومات جمع کرائے جائیں گے .آپ کسی بھی رپورٹوں یا اشاعتوں کی شناخت یا شناخت نہیں کر سکیں گے .آپ کا ادارہ بھی شناخت یا شناخت نہیں کیا جائے گا .سوالنامہ میں آپ کے بارے میں جمع کردہ کسی بھی ڈیٹا پاس ورڈ کی طرف سے محفوظ کردہ کمپیوٹر میں ذخیرہ کیا جائے گا اور دیگر متعلقہ سیکیورٹی کے عمل اور ٹیکنالوجی .جمع کردہ اعداد و شمار تحقیق نامہ اور دیگر تیسری جماعتوں کے ذریعہ دوبارہ استعمال کی اجازت دینے کے لئے نامزد فارم میں شریک کیا جا سکتا ہے .ان نامزد کردہ اعداد و شمار کسی بھی فرد یا ان کے اداروں کی شناخت یا شناخت کرنے کی اجازت نہیں دے گی.

12. میں ریکارڈ کیا جائے گا، اور ریکارڈ میڈیا کیسے استعمال کیا جائے گا؟

1. سوالنامے کے سروے۔ آپ سے سوالنامے میں آپ کے ان پٹ کے سوا کسی اور طرح سے آپ سے علیحدہ اجازت حاصل کیے بغیر ریکارڈ نہیں کیا جائے گا۔
2. انٹرویو - انٹرویو آڈیو ڈیوائس میں ریکارڈ کیا جائے گا جو آپ کی طرف سے رضامندی حاصل کرنے کے بعد ہی ہوگا۔ اپنی شناخت ظاہر نہ رکھنے اور اسے خفیہ رکھنے کے ل device ، آلہ اور آڈیو فائلوں کی حفاظت کے لئے پوری احتیاط برتی جائے گی-

13. مجھ سے کیا قسم کی معلومات طلب کی جائے گی اور تحقیق کے منصوبے کے مقاصد کو حاصل کرنے کے لئے متعلقہ معلومات کی مجموعی کیوں ہے؟

سوالنامہ آپ کو آپ کی رائے اور موجودہ طرز عمل کے بارے میں لائبریری مینجمنٹ سے متعلق، جنگلی کاروائیوں اور کارنیوئ - انسانی تنازع کیس کی وجہ سے آپ کے علاقے میں تباہی کے بارے میں پوچھا جائے گا .آپ کے خیالات اور تجربے صرف وہی ہیں جو پراجیکٹ کی تلاش میں دلچسپی رکھتے ہیں.

14. تحقیق کے منصوبے کے نتائج کیا ہوگا؟

تحقیق کا نتائج شائع کیا جائے گا .آپ کو کسی بھی رپورٹ یا اشاعت میں شناخت نہیں کیا جائے گا .آپ کا ادارہ کسی بھی رپورٹ یا اشاعت میں نشاندہی نہیں کی جائے گی .اگر آپ تحقیق کے نتیجے میں کسی بھی رپورٹ کی ایک نقل دی جانی چاہئے، تو براہ مہربانی ہم سے پوچھیں کہ ہم آپ کی گردش کی فہرست میں ڈالیں.

15. کونسا تحقیق اور فنڈ کونسا ہے؟

یہ منصوبہ سلففور یونیورسٹی کی طرف سے منظم کیا جاتا ہے جس میں پروفیسر رابرٹ جوان (سپروائزر)، پروفیسر جین بولبل

شریک سپروائزر- اور افتخار علی (محقق)شامل تھے .یہ تحقیق وزارتی قبائلی امور، بھارت حکومت اور سلففور- یونیورسٹی کی طرف سے فنڈ ہے.

16. اخلاقی طور پر اس منصوبے کا جائزہ لیا ہے؟

یہ منصوبہ اخلاقی طور پر سلففور یونیورسٹی کے اخلاقی کمیٹی کی طرف سے منظور کیا گیا ہے.

17. مزید معلومات کے لئے رابطے

Iftikar Ali - Researcher

PhD Student/Researcher, University of Salford, Tel: +44 7341325170(UK), +91 9419015809(India),

email: i.ali19@edu.salford.ac.uk

Dr Robert Young (Professor) – Research Supervisor

Chair in Wildlife Conservation, University of Salford, UK. Tel: +44 (0)161 295 2058, email: r.j.young@salford.ac.uk

Dr Jean Boubli (Professor) – Research Co-Supervisor

Chair in Tropical Ecology and Conservation & Programme Leader for MSc Wildlife Conservation, University of Salford, UK. Tel: +44 (0)161 295 6825,

email: j.p.boubli@salford.ac.uk

اس تحقیق میں حصہ لینے کے لئے آپ کا شکریہ

University of Salford MANCHESTER

Participant Information sheet cum Invitation letter

Research Project Title

Examining human wild-carnivore conflicts in Kargil trans-Himalaya, India.

Ethical Approval Reference Number – STR1920-14

1. Invitation

You are being invited to take part in this research project. Before you decide to do so, it is important you understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part. Thank you for reading this.

2. What is the project's purpose?

This research project aims to investigate the level and magnitude of Humans and carnivores' conflict in Kargil and to develop an impactful mitigation plan.

3. Why have I been chosen?

You have been chosen because as a resident of the study area and an adult member of your household, your experience and knowledge would help us in understanding the impacts and level of human-carnivore conflicts in the region.

4. Do I have to take part?

It is up to you to decide whether to take part or not. If you do decide to take part, you will be able to keep a copy of this information sheet and you should indicate your agreement to the Participation consent form. You can still withdraw at any time without any reason.

5. What will happen to me if I take part?

1. For Questionnaire -You will be asked some question by an interviewer related to human perspective of wild carnivores in your surrounding areas which we estimate will take you

45-50 minutes. You may wish to agree to a follow-up interview to find out more about your approach.

2. For Interview – You would be asked some question by an interviewer relating the wild carnivores of Kargil and its conflict with humans, which would be recorded in an audio device.

6. What do I have to do?

Please answer the questions as best of your knowledge. There are no other commitments or lifestyle restrictions associated with participating.

7. What are the possible disadvantages and risks of taking part?

Participating in the research is not anticipated to cause you any disadvantages or discomfort. The potential physical and/or psychological harm or distress will be the same as any experienced in everyday life.

8. What are the possible benefits of taking part?

Whilst there are no immediate benefits for those people participating in the project, it is hoped that this work will have a beneficial impact on future wildlife conservation efforts and livestock protection plans. Results will be shared with participants in order to inform their professional work.

9. What happens if the research study stops earlier than expected?

Should the research stop earlier than planned and you are affected in any way we will tell you and explain why.

10. What if something goes wrong?

If you have any complaints about the project in the first instance you can contact any member of the research team. If you feel your complaint has not been handled to your satisfaction you can contact the University of Salford's Administration team to take your complaint further (see below).

11. Will my taking part in this project be kept confidential?

All the information that we collect about you during the course of the research will be kept anonymous and confidential. You will not be able to be identified or identifiable in any reports or publications. Your institution will also not be identified or identifiable. Any data collected about you in the questionnaire will be stored in a computer protected by passwords and other relevant security processes and technologies. Data collected may be shared in an anonymised form to allow reuse by the research team and other third parties. These anonymised data will not allow any individuals or their institutions to be identified or identifiable.

12. Will I be recorded, and how will the recorded media be used?

1. Questionnaire surveys -You will not be recorded in any way other than your input to the questionnaire without separate permission being gained from you.

2. Interviews – The interview would be recorded in an audio device which would be only after gaining consent from your side. Utmost care would be taken for the security of the device and audio files, in order to maintain your anonymity and keeping it confidential.

13. What type of information will be sought from me and why is the collection of this information relevant for achieving the research project’s objectives?

The questionnaire will ask you about your opinions and current practices in relation to Livestock management, depredation caused by wild carnivores and carnivore-human conflict case in your locality. Your views and experience are just what the project is interested in exploring.

14. What will happen to the results of the research project?

Results of the research will be published. You will not be identified in any report or publication. Your institution will not be identified in any report or publication. If you wish to be given a copy of any reports resulting from the research, please ask us to put you on our circulation list.

15. Who is organising and funding the research?

The project is organised by the University of Salford, involving Professor Robert young (Supervisor), Professor Jean Boubli (Co- Supervisor) and Iftikar Ali (PhD Scholar/Researcher). This Research is Funded by The Ministry of Tribal Affairs, Government of India and the University of Salford.

16. Who has ethically reviewed the project?

This project has been ethically approved by the Ethics committee of the University of Salford.

17. Contacts for further information

Iftikar Ali, Researcher

PhD Student, University of Salford,

Tel: +447341325170 (UK), +919419015809 (India),

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Dr Robert Young (Professor), Research Supervisor

Chair in Wildlife Conservation, University of Salford, UK.

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Dr Jean Boubli (Professor), Research Co-Supervisor

Chair in Tropical Ecology and Conservation & Programme Leader for MSc Wildlife Conservation, University of Salford, UK.

Tel: +44 (0)161 295 6825,

email: j.p.boubli@salford.ac.uk

Thank you for taking part in this research.

Appendix11 Participation Consent form.

کارگل ہمالیہ ، ہندوستان میں انسانی جنگجوؤں سے متعلق تنازعات کی جانچ پڑتال۔

تحقیق میں حصہ لینے کے لئے رضامندی (سوالنامہ سروے کے لئے)

Ethical Approval Reference Number – STR1920-14

- میں .... اس تحقیقی مطالعہ میں رضاکارانہ طور پر حصہ لینے پر راضی ہوں۔
- میں سمجھتا ہوں کہ اگر میں اب بھی اس میں حصہ لینے پر راضی ہوں تو بھی ، میں کسی بھی وقت پیچھے ہٹ سکتا ہوں یا کسی بھی سوال کے جواب دینے سے انکار کرسکتا ہوں بغیر کسی بھی قسم کے نتائج کے۔
- میں سمجھتا ہوں کہ میں انٹرویو کے بعد دو ہفتوں کے اندر اپنے انٹرویو سے ڈیٹا استعمال کرنے کی اجازت واپس لے سکتا ہوں ، ایسی صورت میں مواد کو حذف / خارج کردیا جائے گا۔
- میں نے مطالعے کا مقصد اور نوعیت مجھے تحریری طور پر سمجھا دی ہے اور مجھے مطالعہ کے بارے میں سوالات پوچھنے کا موقع ملا ہے۔
- میں سمجھتا ہوں کہ اس میں حصہ لینے میں ہمارے مقامی علاقے میں جنگلاتی زندگی کی غیر قانونی سرگرمیوں اور مویشیوں کی کمی کے معاملات کے بارے میں معلومات دینا شامل ہے۔
- میں سمجھتا ہوں کہ مجھے اس تحقیق میں حصہ لینے سے براہ راست فائدہ نہیں ہوگا۔
- میں جوابی شیٹوں میں اپنے انٹرویو کی آڈیو ریکارڈ شدہ یا دستاویزی دستاویز ہونے سے اتفاق کرتا ہوں۔
- میں سمجھتا ہوں کہ اس مطالعے کے لئے میں جو بھی معلومات فراہم کرتا ہوں اس کا خفیہ سلوک کیا جائے گا۔
- میں سمجھتا ہوں کہ اس تحقیق کے نتائج سے متعلق کسی بھی رپورٹ میں میری شناخت گمنام نہیں رہے گی۔ یہ میرے نام کو تبدیل کرنے اور میرے انٹرویو کی کسی بھی قسم کا بھیس بدل کر کیا جائے گا جس سے میری شناخت یا ان لوگوں کی شناخت ظاہر ہوسکتی ہے جن کے بارے میں میں بولتا ہوں۔
- میں سمجھتا ہوں کہ میرے انٹرویو سے چھپے ہوئے عرقوں کا حوالہ مقالہ ، کانفرنس پریزنٹیشنز ، اشاعت شدہ کاغذات وغیرہ میں دیا جاسکتا ہے۔
- میں سمجھتا ہوں کہ اگر میں محقق کو مطلع کرتا ہوں کہ مجھے یا کسی اور کو نقصان ہونے کا خطرہ ہے تو وہ متعلقہ حکام کو اس کی اطلاع دے سکتے ہیں - وہ پہلے مجھ سے اس پر تبادلہ خیال کریں گے لیکن میری اجازت یا اجازت کے بغیر اس کی اطلاع دینے کی ضرورت ہوگی۔
- میں سمجھتا ہوں کہ دستخط شدہ رضامندی کے فارم ، اصل آڈیو ریکارڈنگ ، اور جوابی ورق محققین اور اس کے سپروائزر صرف محقق کے ذریعہ پروجیکٹ / پی ایچ ڈی مقالہ کی تکمیل / پیش کرنے تک برقرار رکھیں گے۔
- میں سمجھتا ہوں کہ میرے انٹرویو کا ایک ٹرانسکرپٹ جس میں شناخت کرنے والی تمام معلومات کو محقق کی رضامندی کے مطابق وقت کی مقدار کے لئے برقرار رکھا جائے گا۔
- میں سمجھتا ہوں کہ معلومات کو قانونی حیثیت دینے کی آزادی کے تحت میں اس معلومات تک رسائی حاصل کرنے کا حقدار ہوں جو میں نے کسی بھی وقت فراہم کیا ہے جب یہ ذخیرہ اندوزی میں ہے جیسا کہ اوپر بیان کیا گیا ہے۔
- میں سمجھتا ہوں کہ میں تحقیق میں شامل شخص سے کسی بھی وقت مزید وضاحت اور معلومات حاصل کرنے ک

تحقیق میں حصہ لینے والے کے دستخط

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شریک کی تاریخ کے دستخط

محقق کے دستخط

مجھے یقین ہے کہ شریک اس مطالعے میں حصہ لینے کے لئے باخبر رضامندی دے رہا ہے

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محقق کی تاریخ کا دستخط

Examining human wild-carnivore conflicts in Kargil trans-Himalaya, India

Consent to take part in research (For questionnaire Survey)

Ethical Approval Reference Number – STR1920-14

- I……………………………………… voluntarily agree to participate in this research study.
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted/destroyed.
- I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.
- I understand that participation involves giving information on illegal wildlife activities and livestock depredation cases in our local area.
- I understand that I will not benefit directly from participating in this research.
- I agree to my interview being audio-recorded or documented in response sheets.
- I understand that all information I provide for this study will be treated confidentially.
- I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.
- I understand that disguised extracts from my interview may be quoted in thesis, conference presentations, published papers etc.
- I understand that if I inform the researcher that myself or someone else is at risk of harm they may have to report this to the relevant authorities - they will discuss this with me first but may be required to report with or without my permission.
- I understand that signed consent forms, original audio recordings, and response sheets will be retained by the researcher, and his supervisors only until completion/submission of the Project/PhD thesis by the researcher and in anonymous form after that.
- I understand that a transcript of my interview in which all identifying information has been removed will be retained for the amount of time as per the consent of the researcher.
- I understand that under freedom of information legalisation I am entitled to access the information I have provided at any time while it is in storage as specified above.

• I understand that I am free to contact the person involved in the research to seek further clarification and information at any time.

Signature of research participant

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Signature of participant Date

Signature of researcher

I believe the participant is giving informed consent to participate in this study

--- ----------------------

Signature of researcher Date

Appendix 14 Survey Documentation/ Schedule.

Living with Large Carnivores in Kargil

Living With Large Carnivore in Kargil

Dear Participant,

Thank you for taking the time to participate in the LIVING WITH LARGE CARNIVORES survey conducted as a part of my PhD in Environmental Sciences at the University of Salford, Manchester, supervised by Prof Robert John Young and Prof Jean Boubli. The aim of this research is to understand how people relate to wildlife in a livestock rearing situation, especially, when they incur heavy livestock loss, or threaten livelihood. It is hoped that this project will add to the knowledge base that will inform policies surrounding wildlife management.

Please do contact me if you have any questions.
Thank you in advance for your assistance in this research.

Sincerely
Iftikar Ali
G23 Peel building, University of Salford, Manchester -M5 4WT
United Kingdom
Email: i.ali19@edu.salford.ac.uk
Telephone: +44 7341325170

SECTION ONE: GENERAL INFORMATION

Please complete each question by clicking in the appropriate box or filling in the required information on the dotted lines.

Enumerator Code – KGL / B…….. / N……….

1.1 Village ……………………………

1.2 Are you a permanent residence of this village? ☐ YES: ………………☐NO: ....

If No, Name of your Village:…………………………….

1.3 Where did you grew up?

☐Village ☐small town ☐ big town ☐city

1.4 Age group: ☐20's ☐30's ☐40's ☐50s ☐60's ☐>70

1.5 GPS Village ……….N…………E

1.6 Highest level of education (and years attended at school) -

No education ☐ _______

Middle School ☐ _______

High School ☐ _______

Graduate ☐ _______

Above Graduation ☐ _______

1.7 Gender ☐Male ☐Female

1.8 Number of people in your household (above 18)– adults: …….

1.9 Number of people in your household – (below 18)children: ….

1.10 Religion/Belief:

Islam ☐

Buddhism ☐

Hinduism ☐

Others- ………..

1.11

Do your household rear livestock? ☐ Yes ☐ No

If yes, Is Livestock rearing your main source of income? ☐Yes ☐No
If yes,
How much is Livestock rearing part of your total income? ☐ 100% ☐ ~75% ☐ ~50% ☐ ~25% ☐ <25%

If you farm, which livestock do you farm?:

☐= Sheep
☐= Goat
☐= Cattles (Cows, Yak, Ox, Dzo, Dzomo etc.)
☐= Horses/Donkeys
☐= Poultry
☐= Cat/Dog
☐= Other: Please specify:…………………………………………………………………………………

………

If no, please indicate other sources of income:……………………………………………………….

1.12

Please indicate the number and value of each type of animal in your farm/shed/hosehold:

Animal	**Number**
Adult Sheep بھیڑ	
Young Sheep بھیڑ	
Adult Goat بکرا	
Young Goat بکرا	
Adult Cattle مویشی	
Cattle Calf مویشی	
Cat بلی	
Poultry مرغی	
Donkey گدھا	
Horse گھوڑا	
Other 1	
Other 2	
Others 3	
Othrs 4	
Total	

SECTION TWO: Livestock loss

2.1 How much **DAMAGE/Loss**, in animals lost, did your **livestock EXPERIENCE** due to wildlife, during the **LAST YEAR 2019-21?**

Snow Leopards

Animal	Number Lost
Adult Sheep بھیڑ	
Young Sheep بھیڑ	
Adult Goat بکرا	
Young Goat بکرا	
Adult Cattle مویشی	
Cattle Calf مویشی	
Cat بلی	
Poultry مرغی	
Donkey گدھا	
Horse گھوڑا	
Other Cost (i.e.:structures damages, etc)	
Others	

Bears

Animal	Number Lost
Adult Sheep بھیڑ	
Young Sheep بھیڑ	
Adult Goat بکرا	
Young Goat بکرا	
Adult Cattle مویشی	
Cattle Calf مویشی	
Cat بلی	
Poultry مرغی	
Donkey گدھا	
Horse گھوڑا	
Other Cost (i.e.:structures damages, etc)	
Others	

Wolves

Animal	Number Lost
Adult Sheep بھیڑ	
Young Sheep بھیڑ	
Adult Goat بکرا	
Young Goat بکرا	
Adult Cattle مویشی	
Cattle Calf مویشی	
Cat بلی	
Poultry مرغی	
Donkey گدھا	
Horse گھوڑا	
Other Cost (i.e.:structures damages, etc)	
Others	

Dogs:

Animal	Number Lost
Adult Sheep بھیڑ	
Young Sheep بھیڑ	
Adult Goat بکرا	
Young Goat بکرا	
Adult Cattle مویشی	
Cattle Calf مویشی	
Cat بلی	
Poultry مرغی	
Donkey گدھا	
Horse گھوڑا	
Other Cost (i.e.:structures damages, etc)	
Others	

Foxes:

Animal	Number Lost
Adult Sheep بھیڑ	
Young Sheep بھیڑ	
Adult Goat بکرا	
Young Goat بکرا	
Adult Cattle مویشی	
Cattle Calf مویشی	
Cat بلی	
Poultry مرغی	
Donkey گدھا	
Horse گھوڑا	
Other Cost (i.e.:structures damages, etc)	
Others	

2.2

What other, **NON WILDLIFE related LOSSES** (disease, etc.) did your **LIVESTOCK INCUR** durin? What losses were not accounted for?

Animal	**Number Lost**	**Monetary loss in Rupees (INR) as per market value**	**Cause of Loss (1- Disease, 2- Extreme weather, 3- Unknown/Other causes)**	**Unaccounted Losses**
Adult Sheep بھیڑ				
Young Sheep بھیڑ				
Adult Goat بکرا				
Young Goat بکرا				
Adult Cattle مویشی				
Cattle Calf مویشی				
Cat بلی				
Poultry مرغی				
Donkey گدھا				
Horse گھوڑا				
Others				
Others				
Others				
Others				

If **YES** in 2.1, then continue, else skip to 3.1

2.3

In what **Season** did the attack took place?

Snow Leopards

	Number Lost
Summer	
Winter	
Spring	
Autumn	

Bears

	Number Lost
Summer	
Winter	
Spring	
Autumn	

In what **Season** did the attack took place?

Wolves

	Number Lost
Summer	
Winter	
Spring	
Autumn	

Foxes

	Number Lost
Summer	
Winter	
Spring	
Autumn	

Feral dogs

	Number Lost
Summer	
Winter	
Spring	
Autumn	

2.4

Where (**Location**) did the attack took place?

Snow Leopards

	Number Lost
Livestock shed	
Open (in field)	
Pasture	

Bears

	Number Lost
Livestock shed	
Open (in field)	
Pasture	

Where (**Location**) did the attack took place?

Wolves

	Number Lost
Livestock shed	
Open (in field)	
Pasture	

Foxes

	Number Lost
Livestock shed	
Open (in field)	
Pasture	

Feral dogs

	Number Lost
Livestock shed	
Open (in field)	
Pasture	

2.5

When (**Time**) did the attack took place?

Snow Leopards

	Number Lost
Dawn	
Morning	
Afternoon	
Evening	
Dusk	
Night	

Bears

	Number Lost
Dawn	
Morning	
Afternoon	
Evening	
Dusk	
Night	

When (**Time**) did the attack took place?

Wolves

	Number Lost
Dawn	
Morning	
Afternoon	
Evening	
Dusk	
Night	

Foxes

	Number Lost
Dawn	
Morning	
Afternoon	
Evening	
Dusk	
Night	

Feral dogs

	Number Lost
Dawn	
Morning	
Afternoon	
Evening	
Dusk	
Night	

SECTION THREE: LIVING WITH LARGE CARNIVORES

3.1 How much of a **PROBLEM are the following WILDLIFE SPECIES for your Household?** Please indicate the appropriate number of the extent of the problem where **1 = not a problem at all and 7= a crisis**?

SNOW LEOPARD:

☐1 No Problem at all ☐2 Moderate Problem ☐3 Major Problem

BEARS:

☐1 No Problem at all ☐2 Moderate Problem ☐3 Major Problem

WOLVES:

☐1 No Problem at all ☐2 Moderate Problem ☐3 Major Problem

FOXES:

☐1 No Problem at all ☐2 Moderate Problem ☐3 Major Problem

FERAL DOGS:

☐1 No Problem at all ☐2 Moderate Problem ☐3 Major Problem

FURTHER COMMENTS:

Do you have any problems with **other species**? If yes please list the species name and extent of problem. (If you need more space, please use the comments section at the end of the survey)

3.2 What do you think the about the current population trend of the species in Kargil region?

SNOW LEOPARD:
☐1 Increasing ☐2 Decreasing ☐3 Constant

BEARS:
☐1 Increasing ☐2 Decreasing ☐3 Constant

WOLVES:
☐1 Increasing ☐2 Decreasing ☐3 Constant

FOXES:

☐1 Increasing ☐2 Decreasing ☐3 Constant

FERAL DOGS:

☐1 Increasing ☐2 Decreasing ☐3 Constant

FURTHER COMMENTS:

3.3 What do you prefer the population of the species in Kargil region in future?

SNOW LEOPARD:
☐1 Increase ☐2 Decrease ☐3 Remain the Same

BEARS:
☐1 Increase ☐2 Decrease ☐3 Remain the Same

WOLVES:
☐1 Increase ☐2 Decrease ☐3 Remain the Same

FOXES:

☐1 Increase ☐2 Decrease ☐3 Remain the Same

FERAL DOGS:

☐1 Increase ☐2 Decrease ☐3 Remain the Same

FURTHER COMMENTS:

3.4 What is the main threat to the wild carnivore population of Kargil?

☐1 Decline in Prey species population

☐2 Climate Change

☐3 Poaching and Hunting

☐4 Habitat loss and destruction

☐5 Human interference

☐6 Disease outbreaks

FURTHER COMMENTS:

3.4 What will be the best strategy to protect wildlife of the region?

☐1 Creation of Protected Areas

☐2 Strict laws

☐3 Education and awareness

☐4 Research and Monitoring

☐5 Livestock protection and better compensation schemes

FURTHER COMMENTS:

3.5 Are you satisfied with the current ongoing conservation efforts in the region?

☐1 Yes

☐2 No

FURTHER COMMENTS:

3.6 Are you aware about the compensation scheme for **wildlife related** damage in your area?

No ☐ Yes ☐ →Organization that manage the compensation: ……………..

If Yes, have you ever claimed compensation? Yes ☐ No ☐

If No, what are the reasons for this? ……………………………………………………………………………

What type of animals, how many animals did you lose, how much money did you claim and receive for the **last two year 2018-20?**

Type	Number lost to Snow Leopards	Value of loss in INR	No. animals claimed	No. successful animals claimed	Amount in INR received	How long long did it take to receive claimed money (In days)

If you were **NOT successful**, what were the reasons? ………………………………………………………

Overall, how would you **describe your experience of the COMPENSATION SCHEME** implemented in your area for **Snow Leopards**?

☐ 1= Extremely dissatisfied
☐ 2= Very dissatisfied
☐ 3= Moderately dissatisfied
☐ 4= Neutral
☐ 5= Moderately satisfied
☐ 6= Very satisfied
☐ 7= Extremely satisfied

ANY OTHER COMMENTS ABOUT THE COMPENSATION SCHEME?

THANK YOU VERY MUCH FOR YOUR TIME
And PARTICIPATION!

Please write your telephone number and email address if you wish to be further contacted for further updates

Tel:…………………………………………………..E-mail………………………………………………………………

Please feel free to add any comments you think may be helpful.

FURTHER COMMENTS

Appendix 17 Google form Questionnaire to study students in Higher Education.

Understanding the knowledge and attitude of students from Kargil (in higher education) towards Wildlife of Kargil - A short survey

You are being invited to take part in this research project. Before you decide to do so, it is important you understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish.Ask us if there is anything that is not clear or if you would like more information. Take timeto decide whether you wish to take part. Thank you for reading this.

You have been chosen because as a resident of the study area and an adult student inhigher education, your experience and knowledge will help us in understanding the students' perception of wildlife and will be informant and crucial in future wildlife conservation projects to be implemented in Kargil.

The Questionnaire- You are taking part in a short survey, mostly comprising of 'Yes' and 'No' question, is part of my PhD research and I will be highly obliged for your participation.The approximate estimated time for the completion of this survey is 5-10 minutes.

Research Ethics and confidentiality- The research has been approved by Ethical committeeof University of Salford. All the information that we collect about you during the course of the research will be kept anonymous and confidential. You will not be able to be identified or identifiable in any reports or publications. All data collected in the questionnaire will be stored in a computer protected by passwords and other relevant security processes and technologies. Data collected may be shared in an anonymized form to allow reuse by the research team and other third parties. These anonymized data will not allow any individuals or their institutions to be identified or identifiable. To maintain the anonymity of the respondents, there is no identifiable personal information questions included.

This survey is solely conducted for generalizing the knowledge and attitude of Students in higher education from Kargil (Ladakh) towards wild carnivores of the region.

PS- There is no 'right' or 'wrong' answers, please answer as per your best of knowledge.

Note- This survey is only for students from Kargil(Ladakh), and studying in graduation or above.

Thank you

Please feel free to contact me at the below details, for any question related to the research.

Iftikar Ali
PhD Researcher
University of Salford- Manchester
email- i.ali19@edu.salford.ac.uk
+447341325170

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1. I give my consent to participate in this short survey? *

- ◯ Yes
- ◯ No

* Required

SECTION1
General information

1. What is your gender? *

- Female
- Male
- Prefer not to say

2. What is your faith *

- Islam
- Buddhism
- *Bon-chos*
- Prefer not to say
- Others

3. What is your age? (In numbers) *

4. What administrative block of Kargil are you a resident of? (out of the 9 administrative blocks as per the past demarcation) *

- Drass
- Zanskar
- Shakar-Chiktan
- Sankoo
- Kargil
- Taisuru
- Lungnak
- Shargole
- Cha

5. What level of Education are you currently enrolled in? *

- Graduation
- Masters
- PhD
- Others (higher than 10+2)

6. Where are you currently studying? *

- Kargil
- Leh
- Srinagar
- Jammu
- Chandigarh
- Delhi
- Dehradun
- Other: ____________________

7. What were your subjects (stream) in 10+2? *

- Science
- Arts
- Commece
- Others

____

8. Was Environmental Science a subject or part of curriculum during your higher secondary school education? *

- Yes
- No

SECTION 2

Knowledge of Wildlife!

1. What is the name of the animal in the picture? (You can answer it in local, common or scientific name) PC-Iqbal *

2. What is the name of the animal in the picture? (You can answer it in local, common or scientific name) PC- Niaz *

3. What is the name of the animal in the picture? (You can answer it in local, common orscientific name) PC-Niaz *

4. What is the name of the animal in the picture? (you can answer it in local, common orscientific name) PC-Dhritiman Mukherjee

5. Kargil has a unique and rich biodiversity, owing to its special geographical characteristics *

- Yes
- No

6. There are many protected areas for wildlife in Kargil *

- Yes
- No

7. Wolves are omnivorous animals? *

- Yes
- No

8. Kargil (Ladakh) is sometimes referred to as 'cold desert' in scientific community *

- Yes
- No

9. Each wild carnivore plays an important role in the 'food web' *

- Yes
- No

10. The scientific name of fox is *

- *Vulpes vulpes*
- *Canis lupus*

11. Largest carnivore of Kargil is *

- Brown bear
- Snow leopard

12. Tigers (Panthera tigris) are also found in Kargil *

- YES
- NO

SECTION -3

Attitude towards wildlife

1. Do you think there should be more emphasis on wildlife related curriculum in school education? *

   Yes

   No

2. There should be more protected areas in Kargil to conserve and protect bio diversity? *

   Yes

   No

3. Local people living in adjacent to wild carnivore should be educated and aware about wild carnivores? *

   Yes

   No

4. Wild carnivores should be protected even if it incurs loss to some livestock? *

   Yes

   No

5. Will you be interested or thrilled to see a snow-leopard in wild? *

   Yes

   No

6. It is Important to protect wild carnivores of Kargil *

   Yes

   No

7. I feel relived and comfort when there are efforts to protect wildlife of Kargil *

   Yes

   No

8. Conservation of the wild carnivores is necessary for human survival. *

   Yes

   No

9. Curriculum/subjects focusing on local and global wildlife should be included in schoole education*
   - Yes
   - No

10. In geographically challenging regions, like Kargil, wise use of natural resources is necessary *
    - Yes
    - No

11. Every student especially in higher education must have good basic knowledgeof wildlife of his/her region *
    - Yes
    - No

12. We should respect and strive to protect all living being, including wild carnivoresas an integral part of the ecosystem *
    - Yes
    - No

13. Please, if you like to, share your views on wildlife of Kargil (any thing related to wildlife, eg., your local community approach, encounter experience,)

*Required

Thank you for your time and participation!