Navigating Human-wildlife Conflict: Key Species, Impacts, Mitigation andChallenges in Himachal Pradesh

Abstract

Human-wildlife conflict (HWC) in Himachal Pradesh is a critical issue arising from the intersection of human activities and wildlife habitats. Rapid deforestation, agricultural expansion, urbanization, and infrastructure development have all reduced natural habitats, pushing wildlife to live close to human settlements. Crop raiding, livestock predation, property damage, andon rare occasions human casualties are all forms of conflict. Leopards, black bears, monkeys, and wild boar are among the important animals involved in conflicts. The consequences of HWC are diverse, including economic losses for farmers, dangers to human safety, retaliatory wildlife fatalities, and disruptions to ecological equilibrium, despite current mitigation measures such as compensation schemes, fencing, wildlife transfer, awareness campaigns, sterilization program obstacles persist due to lack of funds, delays in policy implementation, and limited community participation, which complicates interventions.Studying human-wildlife conflicts is crucial to developing effective and sustainable solutions to mitigate negative impacts on humans and wildlife. This review helps in understanding the conflicts in Himachal Pradesh and developing strategies thatpromote coexistence. The state may effectively reduce human-wildlife conflicts while preserving its rich biodiversity by using an integrated approach that balances conservation goals with the socioeconomic requirements of local communities.

Keywords: Human-wildlife conflicts, wildlife,conflict management, coexistence, biodiversity, conservation implications

1.Introduction

Humans have long relied on wildlife for various resources and ecological benefits, which has fostered a coexistence between humans and wildlife. Humans and wildlife coexisted in ancient communities, where the natural world provided food, shelter, and cultural identity. Human-wildlife interactions have moved from coexistence to conflict, which is generally driven by socioeconomic shifts. Human-wildlife conflict a global issue is becoming more frequent over time. The primary cause of this is the world's population rise. According to recent UN estimates, the world's population may increase to about 8.5 billion people by 2030,

9.7 billion by 2050, and 10.4 billion by 2100. This growth in global population size coincides with a rise in urbanization. The vast human population and increasing rate of urbanization are damaging to biodiversity since the demand for natural resources rises proportionally, and these cities have taken over former natural habitats. The increasing global population as well as urbanization put strain on wildlife. These pressures frequently result in human-wildlife conflicts, which occur "when the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife"(Madden, 2004). HWC is a pervasive and ongoing conservation problem. The World Conservation Union defines it as when human populations intersect with wildlife requirements, causing costs for native residents and animals (Pradhan et al., 2012). Around the world, conservation efforts are becoming more and more conflicted with other human activities. They are frequently expensive, and damaging, and hinder not only successful conservation but also social equity, economic growth, and resource sustainability. Therefore, one of the most difficult issues facing conservation is probably conflict (Dickman, 2010; Redpath et al., 2013; Treves & Karanth, 2003; Young et al., 2010).

Wild animals' survival is seriously threatened by anthropogenic pressure in and around forested areas. Different wildlife species can be the source of human-wildlife conflicts, which can occur across international borders or within the same country varying in intensity and frequency (Pandey & Sharma, 2016). HWC is one of the biggest dangers to animal species and their habitats. It can impact the survival and conservation of animal species by causing injuries and deaths, population reduction or extinction, genetic erosion or inbreeding, and habitat degradation or loss (Dickman et al., 2011).Human encroachment and land clearance for communities and agriculture not only deplete wildlife habitats but also drive wild animals to live near people (Oman Zumo, 2024). HWC can impact the psychological health of both humans and wildlife, causing a decline in well-being and quality of life.HWCis a reciprocal process that harms humans as well as animals. Considering its significant implications for both human societies and wildlife populations, a human-wildlife conflict study is essential (Gogoi, 2020). We review human-wildlife conflict (HWC) in Himachal Pradesh, located in the Himalayan Mountain range. This review examines the existing literature and identifies knowledge gaps for future research related to HWC in the region. The study has significant value as it provides critical insights into the complex dynamics of human-wildlife conflicts in the state. Additionally, we analysed the challenges

associated with addressing these conflicts and proposed recommendations to mitigate them, with the ultimate goal of promoting coexistence between humans and wildlife.

1.1 Study area

Himachal Pradesh is located in the Western Himalayas and covers 55,673 km² approximately 1.69% of India's total area. The state is located between 30° 22'44" and 33^{0}12'40" N and 75^{0}45'55" to 79^{0}4'20" E. Himachal Pradesh has a semitropical to semi-arctic climate. The varying physiographic and climatic conditions have created numerous natural ecosystems, including forests, grasslands, pastures, rivers, lakes, wetlands, and glaciers. The total forest area is 37033 km^2 which is 66.52% of the total geographical area. The forest types range from dry scrub vegetation at lower altitudes to alpine meadows at higher altitudes. The state has 20 vegetation zones, generally synchronous with altitudinal stratification (Singh & Kumar, 2014). The state has a large variety of Flora and Fauna due to its diverse vegetation, climatic conditions, and terrains. About 8% of India's total faunal wealth is found in the State's diverse fauna. While the middle and lower hills and plains are home to barking deer, common leopard, sambar deer, and yellow-throated marten, the high mountains of Himachal Pradesh are home to rare wildlife like the snow leopard, Himalayan blue sheep, ibex, serow, western tragopan, musk deer, and Himalayan brown bear (HP Forest,2024).The State and its wild resources have coexisted sustainably for a long time.Although there have been reports of wild boar, black bears, and monkeys occasionally damaging standing crops, leopards have also been known to lift domestic animals. There have been isolated reports of black bears and leopards killing and injuring people. In order to properly address the growing number of conflicts between people and wild animals, wildlife managers are currently developing a long-term policy. Concerned about these conflicts, the State Government offers financial compensation for domestic animal losses as well as for human injuries or fatalities brought on by wild animals.

2. Cause of conflict

2.1 Habitat Encroachment and Fragmentation

Over the past 70 years, Himachal Pradesh's population has grown from 23.86 lakh in 1951 to an estimated 75.70 lakh in 2021. Wildlife habitats are progressively being encroached upon by agricultural land and settlements as human populations grow. This encroachment leads to habitat fragmentation and degradation and forces the animals to live near human settlements which increases the risk of conflict. With the increase in population natural habitats are

converted into agricultural lands, urban areas, and infrastructure which puts pressure on limited natural resources. This leads to increased competition for resources, which triggers conflicts between humans and wildlife (P. Kumar et al., 2017; V. Kumar, Sharief, et al., 2022; Pandey & Sharma, 2016).

2.2 Dependence on Forest Resources

Himachal Pradesh has 27.73% of its land covered in forest and is primarily inhabited by tribal communities. Tribals largely live on the upper and middle levels of the hills. Forest products, especially non-timber forest products (NTFPs) have the potential to deliver a long-term economic boost to millions of people, mainly tribals living close to and within forests by utilizing natural forest resources.NTFPs are a significant source of food and income for Indigenous populations (S. Kumar & Gupta, 2023). Many local communities in the state depend heavily on forest resources for their livelihoods. This dependency often results in increased interactions with wildlife, particularly in areas where livestock grazing occurs near forest edges. Such interactions can lead to crop damage and livestock predation, particularly from species like the Himalayan brown bear(V. Kumar, Sharief, et al., 2022).

2.3 Livestock Grazing Practices

Livestock grazing is an integral part of the livelihoods of many local communities in Himachal Pradesh. Over 100,000 members of the agropastoral Gaddi group move semi-annually with their sheep and goats between the summertime alpine meadows of the Himalayas and the wintertime scrub forests of the Siwalik, the foothills of the Himalayas (Saberwal, 1996). Improper grazing methods cause conflicts by allowing animals to graze in regions that overlap with wildlife habitats. This not only raises the danger of predation but also changes the behavior of wildlife, resulting in more frequent contact between humans and animals leading to conflicts between them as a study indicating the conflicts of locals with Himalayan Brown Bear in Lahaul Valley(V. Kumar, Sharief, et al., 2022).

2.4 Anthropogenic Food Source

Intentional or unintentional human food provisioning can draw wildlife into areas where humans predominate. Poor waste management can increase the probability of bears and other animals scavenging near villages which increases the risk of conflicts between humans and animals (V. Kumar, Sharief, et al., 2022). People frequently feed monkeys and other animals as part of their religious beliefs, which attracts these animals to live near them. Several

research conducted in Himachal Pradesh found that rhesus monkeys adapted to higher feeding from human resources. This also causes conflicts, because monkeys have been reported stealing and snatching food articles, tearing clothes, harming human property and home articles, and distracting individuals on roads (A. Chauhan & Pirta, 2010a; Sengupta & Radhakrishna, 2020).

3. Types of conflicts

3.1 Crop raiding

Wild animals causing damage to crops is a natural occurrence that most likely traces back to the beginning of agriculture. Even though animal damage is somewhat unavoidable, humans have traditionally tolerated and gone through (K. K. Karanth & Ranganathan, 2018). The relocation of wild animals from their native habitat onto agricultural land to consume the food that humans raise for their own sustenance is known as "crop raiding." Insects, plant diseases, and weeds were once thought to be the primary pests influencing agricultural crop productivity. The swarms of locusts that decimate massive tracts of crops in many regions of the world are among the more spectacular occurrences that frequently garner extensive media coverage(Sillero, 2001). Wildlife has been forced into fewer areas due to the recent shrinkage of natural habitats. Crop damage typically concentrates in the regions nearest to these pockets, and the ensuing damage can be extremely significant(K. K. Karanth et al., 2018). Many wildlife species now have significantly larger populations as a result of the country's Wildlife Protection Act of 1972, rendering some of them overabundant. These species have experienced ecological displacement as a result of inconsistent and frequently incompatible land-use practices(N. P. S. Chauhan, 2011). Factors such as farm distance from the herbivore density, forest border, cropping season, cropping patterns, and other landscape variables all have an impact on herbivore crop loss rates(Watve et al., 2016). Because of the state's steep terrain, most of the state's inhabited communities and agricultural areas are bordered by forests, rivulets, etc., which serve as animal hideouts. Crop raiding becomes more common as most of the farmlands are closer to forests (Mamo et al., 2021). Wild boars, monkeys, nilgai, sambar, and stray cattle are some of the principal animal species contributing to crop raids and losses in various sections of the state. Similarly, in agriculture, several studies showed the increasing problem of higher vertebrates such as monkeys, wild boar, and nilgai in different places across the country(V. Kumar, Attri, et al., 2022; Tripathi & Rao, 2016).

3.2 Livestock depredation

Livestock depredation is an important economic and conservation concern(Home et al., 2017). Killing or injury of domestic animals by wild animals is a serious problem for livestock holders in rural areas. It often leads to significant economic losses. According to the HP Forest Department's compensation system data, during the last 21 years (2000–2021), 10,229 livestock have been lost and 26,652 livestock have been killed as a result of wildlife assaults(M. Thakur et al., 2024). According to a recent wildlife census by ZSI, leopards are mainly responsible for attacking livestock in the state. Sheep represented the highest percentage of animals targeted by leopards, making up 21.31% of the predation events, followed by goats at 20.13%, cattle at 9.41%, dogs at 3.40%, and horses at 2.40%. Similarly, black bears mainly predated on sheep (22.48%) and goats (19.87%), with some impact on cattle (3.40%) and horses (2.35%), although no dog predation cases were documented.Conflict levels varied according to the season. Bilaspur had the highest livestock depredation rate for Leopards during the spring (32.653%), whereas trends varied in districts such as Chamba and Kangra, with maxima occurring at different times of the year. For black bears, Chamba saw the largest depredation in Summer (31.551%), whereas upper Kangra had the most incidences in Autumn (40.26%)(L. Sharma, 2024). Himalayan brown bears and snow leopards are responsible for livestock depredation in higher altitudes like Lahaul, Chamba, and Kinnaur. Wild boars and rhesus monkeys damage crops, reducing fodder availability for livestock, increasing farmer costs, and potentially transmitting diseases to livestock.; this can further increase the burden on rural livelihoods. Livestock depredation by wild animals is a serious problem but also cases of loss of livestock due to free-ranging dogs in various regions are reported which become a new challenge for the livestock holder (Home et al., 2017).

3.3 Human attacks

Wild animal attacks on humans can be intentional or unintentional. These attacks frequently occur when animals are protecting their young or territory. Animals may attack out of fear or confusion as a result of their unexpected encounters with people. According to compensation scheme data available with the HP Forest Department for attacks on humans by wildlife in the last 21 years (2000-2021), monkeys have the most cases with approximately 69%, followed by leopards and bears with 12% each and wild boar with 6%. Other species such as foxes and jackals have very few cases of human attacks. As per the data from the HP Forest Department's compensation schemes, 92 human deaths, 3617 human injuries, and 15 incidents of permanent disability have been reported as a result of wildlife assaults in the last

21 years (2000-2021). However, these are simply recorded cases, and the true number of cases may be far higher.According to the latest census report of ZSI, there have been 22 reported occurrences of bear attacks and 16 attacks by leopards on humans in different regions of the state(L. Sharma, 2024).

4. Key species involved in conflicts

4.1.Common Leopard (*Panthera pardus*)

The leopard (Panthera pardus) is the most widely distributed of all the wild cats in the world. *Panthera pardus* is listed as Vulnerable under criteria A2cd in *The IUCN Red List of Threatened Species* (2023). Leopard is adapted to live well in Savannah, rain forest, mountain elevation, dense vegetation, low scrub, and thickets, in some cases even quite close to human habitation. Leopards' can remarkably adapt to variations in prey availability, choosing smaller prey in areas where huge ungulates are uncommon. Leopards may survive by eating both large and small prey. They can scavenge well. Leopards usually hunt by tracking their prey and grabbing opportunitiesoften at night.(D. Kumar & Chauhan, 2011).

Attacks by leopards occur in 11 of the 12 districts, affecting over 75% of the state's land, and they are accountable for a significant number of human casualties throughout the state (Shivakumar et al., 2023). Human-leopard confrontations have escalated, especially in the Bilaspur, Hamirpur, Mandi, and Kangra districts. Because leopards hunt livestock and occasionally attack people, these conflicts have led to casualties and an unfavorable reputation among the local population (Pandey & Sharma, 2016). A total of 4,967 attacks 8,905 killings of livestock and 162 cases of human casualties in which leopards killed 13 people were reported in five different forest divisions of Mandi district during 1987-2007(D. Kumar, 2011). In district Hamirpur, 118 attacks were reported between 2001 and 2013 (P. Kumar et al., 2017). The state recorded an astounding average of 30 fatal and 287 non-lethal leopard attacks on people every year between 2004 and 2015 (Shivakumar et al., 2023).

4.2. Snow leopard (*Panthera uncia*)

The snow leopard is found in the Central Asian mountains, where it is widely but sparsely distributed. The US Endangered Species Act (1973), the 2002 IUCN Red List, and Appendix I of the Convention on International Trade in Endangered Species (CITES) all list the snow leopard as endangered, meaning that trade in the animal and its body is prohibited (Hussain, 2003).The first scientific survey of the Snow Leopard Population Assessment in India (SPAI)

program which took around 4 years (2019-2023) shows the country is home to 718 of the elusive cats. It is predicted that Ladakh has the highest number (477), followed by Uttarakhand (124), Himachal Pradesh (51), Arunachal Pradesh (36), Sikkim (21), and Jammu and Kashmir (9) (MoEFCC, 2023).The *Panthera uncia* is critical to the health of the high mountain ecosystem because it regulates prey populations and maintains plant community structure(Sharief et al., 2022). But also these endangered species are a problem for local communities in higher elevations of Himachal Pradesh because they prey on livestock. Surveys show that pastoral operations significantly overlap with snow leopard habitats, contributing to conflicts because these huge cats hunt on sheep and goats. Livestock depredation is the main reason behind the human and snow leopard conflicts in the western Himalayas because livestock contributes about 36% to snow leopard's diet(Maheshwari, 2013). In response to livestock losses, herders often resort to retaliatory killings of snow leopards, which exacerbates the conflict and threatens the species' survival (Sharief et al., 2022).

4.3. Asiatic Black Bears (*Ursus thibetanus*)

Asiatic Black bears are Found across southern and eastern Asia, including Afghanistan Pakistan, Korea, Iran, China, Japan, and India. The Himalayan region and the hills of northeastern India probably support one of the largest populations of Asiatic black bears in Asia (Charoo et al., 2009). Asiatic black bears live in forested mountain habitats (1,200–3,300 m) in the states of Jammu and Kashmir, Himachal Pradesh, Uttaranchal, Arunachal Pradesh, Sikkim, West Bengal, Mizoram, Meghalaya, and Tripura. Overlaps with sloth bears (*Melursus ursinus*) below 1,200 m and Himalayan brown (*Ursus arctos isabellinus*) bears above 3,000 m. In northeast India, overlaps with sloth and sun bears (*Ursus malayansis*) (Sathyakumar, 2001). The Asiatic Black Bear (*Ursus thibetanus)* is listed as Vulnerable under criteria A2cd in *The IUCN Red List of Threatened Species* in 2016.

Black bears are omnivorous in their food habits, foraging largely on fruits and to some extent on leaf material, grasses, insects, and other animal matter. The movement of bears for food outside these forest areas in search of cultivated crops leads to close encounters of man and bear, and sometimes to conflict. The black bear-human conflicts are in the form of crop damage, livestock predation, human attacks, and sometimes even the death of humans. Environmental degradation including overgrazing, deforestation, and forest fires, severely affects bear habitats. This degradation reduces the availability of essential resources for bears,

which can lead to increased human-bear conflicts as bears search for food in human-inhabited areas (U. Sharma & Sharma, 2022). According to the latest census report 2024, Chamba, Sirmour, Kangra, Mandi, Shimla, and Kullu have the highest number of bear assaults. The census counted roughly 529 black bears, with 307 being individually recorded. Black bear damages the crops and kills livestock causing serious economic damage to rural peoples of the state. Cases of human casualties are also reported in the state, leading to fatal injuries and death of individuals. Seasonal variation also occurs, with most attacks by bears being seen in the summer and autumn, and the least being observed in the winter and spring (L. Sharma, 2024).

4.4. Himalayan Brown Bear (*Ursus arctos isabellinus*)

The Himalayan brown bear (*Ursus arctos isabellinus*) is a top carnivore in the upper altitudes of the North and Western Himalayan landscapes. Brown bears are classified as 'Least Concern' on the IUCN Red List of Threatened Species due to their widespread distribution in the northern hemisphere. The Himalayan brown bear (HBB) lives in alpine meadows, sub-alpine, and scrub forests in Ladakh, Jammu and Kashmir, Himachal Pradesh, and Uttarakhand. The brown bear has received little attention in India and other Asian highlands because of its remote and high-altitude environment. In India, the species' population has not been quantified. According to a 2005 study, the approximate distribution range of brown bears in India is 36,800 km2, with only 10% distribution area under the protected areas.Brown bears have been detected in ten protected areas situated in the Great Himalayan and Trans-Himalayan ranges of Himachal Pradesh (Sharief et al., 2020). Brown bear conflicts mostly occur in summer and regions closer to forests or less than 500 meters from the forest. The upper lower socioeconomic class is most affected by these conflicts because they are highly dependent on forest resources for livelihood, which makes them more vulnerable to conflict with brown bears. Cases of conflict in the form of crop damage (30.6%), livestock depredation (6.2%), and both (28%) by brown bears have been reported by local communities in the Lahaul Valley of the state(V. Kumar, Sharief, et al., 2022).

4.5. Wild Boars (*Sus scrofa*)

The wild boar (*Sus scrofa*), native to much of North Africa and Eurasia is often referred to as the "wild swine," "common wild pig," or just "wild pig." During the Early Pleistocene, wild boars most likely originated in Southeast Asia and are now one of the most widely distributed large mammals which are distributed in Europe, North Africa, and Asia. (Vasudeva Rao et al.,

2015; Venkata Ramesh, 2019). *Sus scrofa* is listed as Least Concern in *The IUCN Red List of Threatened Species* in 2018.

Wild boar lives in diverse habitats and climates, possess few natural predators, and have high reproduction rates. In recent decades, Europe has experienced rapid population growth, leading to high population densities in many nations (Colomer et al., 2021). It has consistently been linked to humans and effectively makes use of the terrain that humans have shaped. Because it is a resilient and powerful breeder, it can spread and establish its population in new locations (N. Chauhan et al., 2009). Due to human overuse of forest resources, wild boars have been displaced from their native habitat and forced to rely on farmed crops such as maize, rice, sorghum, legumes, oil seeds, vegetables, and fruits. In addition to harming crops, it also damages forest plantations, orchards, and ground vegetation. It may also be a vector for certain infectious diseases (Vasudeva Rao et al., 2015; Venkata Ramesh, 2019). In many regions of the state wild boar poses a serious threat to crops and use the agroecosystem for shelter and food. A study on managing crop damage by wild animals in Himachal Pradesh revealed that the wild boar is the most problematic wild animal in the area (Piyush et al., 2018).

4.6. Rhesus Monkeys (*Macaca mulatta*) And Hanuman langur (*Semnopithecus entellus*)

The man-monkey association is as old as man's own existence and is a significant part of Indian culture and mythology, with some believing it to be a God. Nearly about 225 living species of non-human primates are present and 3 non-human primates—the Hanuman langur (*Semnopithecus entellus*), the bonnet macaque (*Macaca radiata*), and the rhesus macaque (*Macaca mulatta*)—have become urbanized in different parts of India as a result of increased agricultural activity, deforestation, and urbanization(Chaturvedi & Mishra, 2014; Singh Rajpurohit et al., 2011). In Himachal Pradesh, the rhesus monkey is associated with the monkey god Hanuman, and some believe langurs are Hanuman's incarnations. Due to their devotion, they are given food, which draws them closer to human settlements and increases their dependence on humans(Pirta et al., 1996; Reddy & Chander, 2016). According to behavioral research conducted in Shimla, the rhesus monkeys were more threatening toward people than the Hanuman langurs (A. Chauhan & Pirta, 2010a). Hanuman langurs are less abundant on state human property than rhesus monkeys, who are often seen in human settings. Unlike rhesus monkeys, even the Hanuman langur tribes that live in towns are not reliant on humans for food or space. As a result, opinions on Hanuman langurs and rhesus

monkeys are probably going to vary. Rhesus monkeys have been drawn to establish their niche near humans due to the combined influence of their dietary practices and religious convictions. These primates' eating habits and niches have now evolved, and they are now competing with humans (A. Chauhan & Pirta, 2010a; Das, 2017). The most commonly encountered animal in human settlements is the *monkey* also considered as pest. In 1980, Himachal Pradesh had 60,000 monkey population, but this rose to 3,17,112 in 2004 and there was a growth of 530% between 1908 and 2004. This is far greater than the carrying capacity of the state. There have been reports of the monkeys shredding and mutilating clothing, stealing and snatching food items, harming household items and human property, and harassing people on highways (A. Chauhan & Pirta, 2010b). The largest problem is damage to crops. According to the 2011 Agriculture Department Report on Crop Losses, monkeys alone affect roughly 1609 Panchayats in Himachal Pradesh, while other wild animals affect about 1169 Panchayats. An estimated 150 crores are lost annually due to the loss of food grains and vegetables. In a similar vein, the 2011 Horticulture Department Report suggests that horticultural crops evaluated for the 2006–10 period lost almost 105 crores due to the need to employ guards to secure their crops, farmers who dare to do so must spend more than they make (Dittus et al., 2019; Reddy & Chander, 2016).

5. Impacts

5.1. Economic Loss

Human-wildlife conflicts result in significant economic losses worldwide.Farmers may suffer large financial losses as a result of herbivore crop raiding and livestock predation, which exacerbates poverty and food insecurity (Gemeda & Meles, 2018).Particularly in rural communities where agriculture is the main source of income, wildlife raids on crops can result in significant financial losses and farmers are forced to stop growing crops (R. K. Thakur et al., 2022). Carnivore predation on cattle further strains household incomes and agricultural production (K. U. Karanth & Madhusudan, 2002).Although large carnivores are specialized in feeding on ungulates, they are ready to kill livestock when the chance presents itself.Domestication is thought to reduce livestock's anti-predatory qualities, leaving them more vulnerable to predation than wild ungulates. Other proximate factors for the increasing frequency of predator predation on livestock include the rise in local carnivore numbers, an increase in livestock populations, or a drop in wild prey populations(Bagchi & Mishra, 2006).Expenditure in fencing, guard animals, and other preventative efforts to reduce conflict

risks faces significant costs for communities and local governments.Despite being necessary, compensation plans for livestock and crop losses can put a burden on local budgets and postpone economic recovery (K. U. Karanth & Madhusudan, 2002). The Directorate of Agriculture, Himachal Pradesh, reports that farmers have been forced to stop growing crops on 19,563 hectares of land due to the threat posed by animals. According to the state's wildlife wing, crop raiding costs the horticultural and agricultural industries between 300 and 450 crore rupees per year. If the cost of fencing and watch and ward is also included, this estimate could increase to 1,500 crore rupees.

5.2 Threats to Human Safety

Wild animals pose a serious threat to human safety in various regions worldwide.Human casualties due to wildlife are a significant concern, overshadowing other types of losses such as crop and livestock damage. This issue is particularly pronounced in rural areas near wildlife reserves. Wild animals like leopards, bears, monkeys, and wild boars, are the main reported animals for human casualties in the state.Between 2004 and 2015, 356 occurrences of human injuries and fatalities linked to leopards were reported in HP Forest Department statistics, averaging three per year (Shivakumar et al., 2023). Although encounters with bears are rare, they are more likely to cause human injury than other species (Gulati et al., 2021). According to the latest population estimation and assessment of human-wildlife conflicts by ZSI 2024, 22 instances of black bear attacks on people and 16 leopard attacks have been documented (L. Sharma, 2024). Monkeys can display aggressive behavior when they feel threatened and will bite individuals who interfere with them. Since 2014, the annual average of monkey bites stands at 1,326, there are approximately 3.6 macaque bites reported each day in Shimla town (S. Thakur et al., 2020). Wild pig habitats interspersed with villages and crop fields result in frequent encounters with humans, although most of the attacks were accidental and occurred when these victims were visiting near or into the forest. Human casualties due to wild boars showed an increasing trend from 1990 to 2008 and a total of 100 cases were reported in HP, out of which 96 were of injury and 4 of Death(N. Chauhan et al., 2009). The increased closeness of wildlife and human settlements elevates the probability of zoonotic diseases because these animals might carry pathogens that may be transmitted to humans(Moore et al., 2023). For example, the bite of the Rhesus can transmit the Herpes virus which can cause potentially fatal swelling of the spinal cord and brain(Reddy & Chander, 2016).

5.3 Psychological and Social Stress

Local communities may experience dread and insecurity as a result of wildlife attacks, which may have an impact on their social dynamics and mental health(Raycraft, 2023) . Wildlife encounters can cause severe trauma, worry, and anxiety. For instance, long-term psychological problems like despair, PTSD, and anxiety can result from a family member being killed or injured by wildlife. The inability to execute customary death ceremonies owing to the loss of loved ones by wildlife can cause substantial emotional pain and cultural stigma (Barua et al., 2013). Chronic fear of wildlife assaults has an impact on day-to-day activity and mental health, particularly for vulnerable populations like elderly people and kids(M. Thakur et al., 2024).People's movements and activities may be restricted by the presence of harmful wildlife, which can result in a persistent sense of vigilance and worry. This may impact day-to-day activities, such as children's attendance at educational institutions and adults' capacity to work(Yeshey et al., 2022). The loss of crops or cattle to wildlife can cause financial strain, which has an impact on mental health. Persistent concern for food availability and financial stability can contribute to severe anxiety and stressful situations(Yeshey et al., 2022). Persistent wildlife confrontations can drive tribes to relocate, damaging social networks and cohesiveness within communities. Species-specific conflicts may endanger cultural activities and regional knowledge related to wildlife protection and traditional beliefs (K. U. Karanth & Madhusudan, 2002).

5.4 Ecological and Conservation Implications

Human-wildlife conflict has become a significant threat and most intractable challenge to the conservation of wildlife and causes the extinction of various abundant species across the world (Pradhan et al., 2012; Redpath et al., 2015; Sime et al., 2022). It is one of the main problems and challenges that policymakers and conservationists encounter while trying to find long-term solutions (Sime et al., 2022). Comprehensive data on a variety of species life history characteristics, such as population demographics, habitat use patterns, and species behavior, is necessary for conservation and management planning (Sharief et al., 2020).Chronic stress and decreased reproduction rates might occur from ongoing human-caused disruptions that interfere with vital natural behaviors including feeding, breeding, and migrating. The spread of agriculture and human settlements into wildlife habitats causes fragmentation, which reduces the amount of area accessible to wildlife and increases their vulnerability to conflicts. Wildlife populations may become isolated as a result of

infrastructural development or land use changes, which can also have an impact on resilience and genetic diversity. A decrease in natural prey can lead to increased predation on livestock, which may disturb the structure of predator-prey relationships in ecosystems. Local food webs and ecosystem processes may be impacted by changes in wildlife behavior and trends in population, which may compromise ecosystem stability and biodiversity.

Globally, A major cause of death for large carnivores is conflict with humans.The human-carnivore conflict and associated casualties (both humans and animals) cause fear and a negative impression of local communities toward the conservation of these species (Pandey & Sharma, 2016). For example, Brown bears caused extensive livestock depredation, and migratory graziers often found to kill them to reduce the predation on their cattle in upper areas of Himachal Pradesh (Rathore, 2008). It is well acknowledged that there is a strong correlation, specifically, between the illegal wildlife trade and human-animal conflict. Locals are more antagonistic toward wild animals in locations where there is a high level of violence (such as crop raiding, carnivores lifting cattle, man-killing, or, less frequently, man-eating). People become indifferent or even violently angry, which leads them to either directly or indirectly support or participate in illegal hunting and trapping for both the wildlife trade and human consumption. Even those who do not hunt or smuggle may be influenced to assist outside poachers or merchants in their illegal activities in these situations. There is a vicious cycle in which conflicts between humans and animals can be caused by a number of reasons including poverty, growing populations, and deforestation, which then stimulates wildlife trafficking and other dangers(Gureja et al., 2019).

6. Management and Mitigation Strategies

6.1. Preventive Measures / Physical Barriers:

Preventive measures play an important role in reducing human-wildlife conflict by limiting encounters between humans and wild animals. Physical barriers, whether man-made (stone walls, chain fences, electric fencing, and hedges) or natural (rivers and mountain ranges), are effective in geographically separating the wild population from nearby communities(Mishra, 1997). Farmers in the region construct different types of fences depending on animal species and closeness to forest habitats. Fencing might be expensive and never offers a suitable solution to the issue in many regions(Choudhury, 2004). Electronic fences are effective in lowering conflict, animals feel shocked when they touch the fence and develop a psychological fear thatkeeps them away from the fields(Gubbi, 2012). Electric fencing

requires maintenance for proper functioning otherwise it fails. The efficiency of different physical barriers is also debatable because sometimes one barrier is suitable for one species but it fails to stop other species for example wild animals like nilgai were able to jump over a 1.5-meter fence, while wild boar could burrow below stone walls (Sekhar, 1998). Still compared to farms without fencing, fencing offers some degree of crop protection. As a precaution, a variety of disrupting stimuli are also employed. It has been discovered that using electronic devices that emit stimuli like noises, chemicals, or light that annoy animals when they approach a protected resource, as well as using fire, torch lights, and noise-producing instruments like drums and shouting, can effectively stop animals from moving (Fernando et al., n.d.)**.** These devices scare the wild animals and help in the protection of livestock and crops.

6.2 Compensation Schemes for crop and livestock loss

People who live close to wildlife reserves regularly have to deal with wildlife, which can frequently lead to property damage, livestock losses, crop losses, and occasionally even human injury or death. People have a variety of strategies to deal with these encounters, such as constructing fences, keeping watch at night, and making noise to keep animals away, but most of these strategies don't last for very long (K. K. Karanth & Kudalkar, 2017).Insurance plans and ex-gratia compensation payments are also commonly utilized to mitigate potential financial losses caused by wildlife such as leopards, tigers, and elephants. The Indian government uses ex-gratia payments as a policy instrument to compensate people negatively affected by human-wildlife conflict (HWC). Payments are determined by each state government based on incident level. With human and wildlife concentrations differing greatly between states in India, compensation policies also fluctuate significantly (K. K. Karanth et al., 2018).

The government of Himachal Pradesh compensates those who have been injured or killed by wild animals. The state also compensates for domestic animal losses caused by wild animal attacks. To claim compensation, one can fill out the relevant forms. The forms are available on the Revenue Management System website of the government of Himachal Pradesh. These programs aim to create good attitudes towards wildlife conservation by lowering the financial load on impacted people. Compensating farmers and pastoralists for damage caused by wildlife decreases hunting pressure on wild animal populations (BULTE & RONDEAU, 2005). Compensation payments are seen as a safety net for communities facing economic

losses due to wildlife. However, the process of assessing compensation is complicated and bureaucratic, leading to additional costs for rural communities (Ogra & Badola, 2008). A study in Himachal Pradesh addresses these issues. It proposes the formation of a Compensation Task Force with three objectives: streamlining the compensation process, increasing awareness, and facilitating the application process. The task force should include representatives from various departments and local organizations. It suggests setting up additional centers for registering complaints in remote areas and developing synergies with other departments to provide immediate relief to affected communities. The goal is to ensure timely compensation and support for those facing significant economic losses due to wildlife conflicts (Kumar Sharma & Sripal, 2021).

6.3. Community-Based Initiatives

Human-wildlife conflict (HWC), in the context of crop raiding and attacks by wild animals, has evolved into a vital factor for communities living on the edges of protected areas (Pradhan et al., 2012). To deal with this threat, farmers in the region have developed and tested several unique, different methods at the village level based on indigenous knowledge. The most widely used traditional techniques include manual field guarding, ringing bells or drums in crop fields, using animal faeces, cow urine, using dogs to ward off animals, and other waste like rotten vegetable leaves that emit an unpleasant smell, as well as creating a fence out of shining tapes around the crop fields and using crackers (Bala, 2023). These traditional methods are modified effectively and are very useful in mitigating the conflict between humans and wildlife. Engaging local communities in mitigating efforts for conflicts and supporting the conservation of wild animals in their natural territories is necessary. Establishing village-level committees with residents, forest officials, and conservationists helps devise localized conflict mitigation strategies. Farmers should be encouraged to plant more crops less preferred by stray and wild animals, such as okra, garlic, ginger, turmeric, etc., to decrease financial losses. For individual farmers, watching and guarding their crops and livestock is very difficult. So, it should be done on a community basis(R. K. Thakur et al., 2022). Furthermore, incorporating traditional ecological knowledge into conservation plans enhances effectiveness and fosters community ownership. Capacity building through training programs on wildlife conservation, conflict resolution, and sustainable resource management equips communities with the necessary skills. Supporting community-driven crop protection measures, such as scare tactics, crop diversification, and

organic deterrents, minimizes crop damage by wildlife. These approaches collectively enhance conservation efforts and reduce human-wildlife conflicts.

6.4. Sterilization Programs

The state government has also implemented sterilization programs for certain wildlife species, particularly rhesus macaques.Since rhesus macaques are a wild population and non-surgical treatments like contraceptive tablets or implants are not practical, the Forest Department of Himachal Pradesh began the sterilization campaign for these animals after performing surgical tubectomy and vasectomy. Since 2006, the state has created seven sterilization centers, and between 2006 and 2021, 170169 macaques were sterilized. Despite the large number of macaques that were seized, some of them were either young or unsterilized pregnant females. There were 81982 females and 88187 males among these sterilized animals. After being sterilized, the macaques were returned to their native environment (Kumara & Venugopal, 2023).

7. Challenges in addressing human-wildlife conflicts

The challenges in addressing Human-Wildlife Conflict (HWC) in Himachal Pradesh are particularly pronounced due to the state's unique geography and biodiversity. The state has seen an increase in industrial and road development, an ongoing influx of tourists, and the construction of hydroelectric facilities along its rivers. The impact on the region's biodiversity has been greatly exacerbated by these factors. There is an immediate risk of extinction due to the increasing stress on the state's faunal life. As a result, immediate and efficient action must be taken to protect the wildlife, ensuring that it is not in serious risk of becoming extinct. Inadequate funding for conservation programs in the region further hampers effective wildlife management and protection efforts. Many mitigating strategies, such as constructing barriers, habitat restoration, or relocation programs, require a significant amount of funding, which is currently unavailable. Forest departments often lack technological tools such as drones, camera traps, and GPS collars for tracking wildlife activity, and the identification of the right animal that causes problemsbecomes difficult. Additionally, the lack of community involvement and awareness about the importance of preserving wildlife and coexisting with nature exacerbates the situation. Local communities may be hesitant to implement new mitigation strategies, such as transitioning to conflict-resistant crops or alternative livelihoods. Fencing, trenches, and other protective measures are costly and frequently beyond the means of local communities. Many local communities still

rely on traditional practices that may unintentionally harm wildlife or fail to adopt modern mitigation strategies. Moreover, the policies designed to address HWC in Himachal Pradesh are often poorly implemented and lack the necessary resources and coordination between government bodies and local stakeholders. The actual economic harm is frequently not covered by the compensation paid for losses to crops or livestock. Compensation delays brought on by bureaucratic inefficiencies might discourage communities from reporting occurrences. To address these challenges, we make recommendations for improving community-based conflict management, promoting coexistence through education and livelihood diversification, leveraging technology like GPS tracking and early warning systems, and ensuring timely compensation.

8. Conclusion

It is clear from the literature review that the state is a hotspot for HWC, a crucial component of wildlife conservation. To properly achieve conservation goals, we must approach human-animal conflicts from a socio-ecological perspective, including cultural, geographical, political, and wildlife aspects. Conservation and human welfare are like two sides of a coin; focusing on one without the other's assistance is useless. Determining the root causes of these conservation issues and developing scientific management plans to mitigate their impacts are therefore essential.Most research on HWC in the area has focused on large mammals; however, since small mammals and birds can harm crops and livestock their impact should be carefully investigated in future research.Most of the research focuses on wild animals such as monkeys, bears, and leopards. There is a significant knowledge void because there are few studies on conflicts involving herbivores (sambhar, nilgai, and wild goats) and small carnivores (wolves, jackals, and wild cats).Another area of inquiry that demands special attention is the connection that exists between climate change and the HWC, especially because the state is highly susceptible to the degradation of habitat and shifts in habitats of species as a result of climate change. The research seems to have disproportionately focused on areas surrounding PAs such as national parks and wildlife sanctuaries, leaving a substantial knowledge gap for future research.

In summing up this literature review on the Human-wildlife conflictsin Himachal Pradesh, It must be acknowledged that although research in this area has accelerated, more research is still necessary until we can be better prepared to lessen this threat. Future studies should focus on improving conflict mitigation strategies using innovative methods such as warning

systems for emergencies, GIS mapping, and behavioral studies of important species. More strict land-use laws, greater funding for conservation projects, and flexible management strategies that take traditional knowledge into account are merely some of the policy reforms that are required. Collaborative approaches are essential to addressing this complex challenge. To create comprehensive strategies, government organizations must collaborate with researchers, NGOs, and local communities. Initiatives including community-led conservation projects, compensation plans, awareness campaigns, and ecotourism marketing help in addressing regional problems and can also support sustainable development goals.

References:

1. Bagchi, S., & Mishra, C. (2006). Living with large carnivores: Predation on livestock by the snow leopard (Uncia uncia). *Journal of Zoology*, *268*(3), 217–224. https://doi.org/10.1111/j.1469-7998.2005.00030.x
2. Bala, J. (2023). Efficacy of Management Strategies against Animal Menace in District Una, Himachal Pradesh, India. *Environment and Ecology*, *41*(4), 2375–2380. https://doi.org/10.60151/envec/peus9422
3. Barua, M., Bhagwat, S. A., & Jadhav, S. (2013). The hidden dimensions of human-wildlife conflict: Health impacts, opportunity and transaction costs. In *Biological Conservation* (Vol. 157, pp. 309–316). https://doi.org/10.1016/j.biocon.2012.07.014
4. BULTE, E. H., & RONDEAU, D. (2005). RESEARCH AND MANAGEMENT VIEWPOINT: WHY COMPENSATING WILDLIFE DAMAGES MAY BE BAD FOR CONSERVATION. *Journal of Wildlife Management*, *69*(1), 14–19. https://doi.org/10.2193/0022-541X(2005)069<0014:WCWDMB>2.0.CO;2
5. Charoo, S. A., Sharma, L. K., & Sathyakumar, S. (2009). *Asiatic Black Bear-Human Conflicts around Dachigam National Park, Kashmir*.
6. Chaturvedi, S. K., & Mishra, M. K. (2014). Study of man-monkey conflict and its management in Chitrakoot, Madhya Pradesh, India. *International Journal of Global Science Research*, *1*(2), 107–110. www.ijgsr.com
7. Chauhan, A., & Pirta, R. S. (2010a). Agonistic Interactions between Humans and Two Species of Monkeys (Rhesus Monkey Macaca mulatta and Hanuman Langur Semnopithecus entellus) in Shimla, Himachal Pradesh. In *J Psychology* (Vol. 1, Issue 1).
8. Chauhan, A., & Pirta, R. S. (2010b). Public Opinion Regarding Human-Monkey Conflict in Shimla, Himachal Pradesh. In *J Hum Ecol* (Vol. 30, Issue 2).
9. Chauhan, N., BARWAL -Devender KUMAR, -Kuldeep S, -Barwal, N., & -Kumar, K. S. (2009). Human-Wild Pig Conflict in Selected States in India and Mitigation Strategies. In *Acta Silv. Lign. Hung* (Vol. 5).
10. Chauhan, N. P. S. (2011). *Agricultural crop depredation by nilgai antelope (Boselaphus tragocamelus) and mitigation strategies: challenges in India*. *432*, 190–191. https://doi.org/10.5073/jka.2011.432.104

11. Choudhury, A. (2004). Human–Elephant conflicts in northeast India. *Human Dimensions of Wildlife*, *9*(4), 261–270. https://doi.org/10.1080/10871200490505693

12. Colomer, J., Rosell, C., Rodriguez-Teijeiro, J. D., & Massei, G. (2021). 'Reserve effect': An opportunity to mitigate human-wild boar conflicts. *Science of the Total Environment*, *795*. https://doi.org/10.1016/j.scitotenv.2021.148721

13. Das, P. Kr. (2017). ECOLOGICAL AND SOCIAL PERSPECTIVES OF HUMAN-MONKEY CONFLICT: A CASE STUDY OF SHILLI BAGI VILLAGE, SHIMLA RURAL TEHSIL, HIMACHAL. *The Observer*, *54*, 104–108.

14. Dickman, A. J. (2010). Complexities of conflict: the importance of considering social factors for effectively resolving human–wildlife conflict. *Animal Conservation*, *13*(5), 458–466. https://doi.org/10.1111/j.1469-1795.2010.00368.x

15. Dickman, A. J., Macdonald, E. A., & Macdonald, D. W. (2011). A review of financial instruments to pay for predator conservation and encourage human–carnivore coexistence. *Proceedings of the National Academy of Sciences*, *108*(34), 13937–13944. https://doi.org/10.1073/pnas.1012972108

16. Dittus, W. P. J., Gunathilake, S., & Felder, M. (2019). Assessing Public Perceptions and Solutions to Human-Monkey Conflict from 50 Years in Sri Lanka. *Folia Primatologica*, *90*(2), 89–108. https://doi.org/10.1159/000496025

17. Fernando, P., Kumar, M. A., Williams, A. C., Wikramanayake, E., Aziz, T., & Singh, S. M. (n.d.). *Review of Human-Elephant Conflict Mitigation Measures Practiced in South Asia WORLD BANK-WWF ALLIANCE FOR FOREST CONSERVATION & SUSTAINABLE USE LIST OF TECHNIQUES CONTENTS*.

18. Gemeda, D. O., & Meles, S. K. (2018). Impacts of human-wildlife conflict in developing countries. *Journal of Applied Sciences and Environmental Management*, *22*(8), 1233. https://doi.org/10.4314/jasem.v22i8.14

19. Gogoi, M. (2020). Human–Wildlife Interactions: Turning Conflict into Coexistence edited by Beatrice Frank, Jenny A. Glikman & Silvio Marchini (2019) 476 pp., Cambridge University Press, Cambridge, UK. ISBN 978-1-108402583 (pbk), GBP 34.99. *Oryx*, *54*(5), 748–748. https://doi.org/10.1017/S0030605320000678

20. Gubbi, S. (2012). Patterns and correlates of human–elephant conflict around a south Indian reserve. *Biological Conservation*, *148*(1), 88–95. https://doi.org/10.1016/J.BIOCON.2012.01.046

21. Gulati, S., Karanth, K. K., Le, N. A., & Noack, F. (2021). Human casualties are the dominant cost of human-wildlife conflict in India. *PNAS*, *118*(8). https://doi.org/10.1073/pnas.1921338118/-/DCSupplemental.y

22. Gureja, N., Kumar, A., & Saigal, S. (2019). *HUMAN-WILDLIFE CONFLICT IN INDIA*.

23. Home, C., Pal, R., Sharma, R. K., Suryawanshi, K. R., Bhatnagar, Y. V., & Vanak, A. T. (2017). Commensal in conflict: Livestock depredation patterns by free-ranging domestic dogs in the Upper Spiti Landscape, Himachal Pradesh, India. *Ambio*, *46*(6), 655–666. https://doi.org/10.1007/s13280-016-0858-6

24. Hussain, S. (2003). The status of the snow leopard in Pakistan and its conflict with local farmers. *ORYX*, *37*(1), 26–33. https://doi.org/10.1017/S0030605303000085

25. Karanth, K. K., Gupta, S., & Vanamamalai, A. (2018). Compensation payments, procedures and policies towards human-wildlife conflict management: Insights from India. *Biological Conservation*, *227*, 383–389. https://doi.org/10.1016/j.biocon.2018.07.006

26. Karanth, K. K., & Kudalkar, S. (2017). History, Location, and Species Matter: Insights for Human–Wildlife Conflict Mitigation From India. *Human Dimensions of Wildlife*, *22*(4), 331–346. https://doi.org/10.1080/10871209.2017.1334106

27. Karanth, K. K., & Ranganathan, P. (2018). Assessing Human–Wildlife Interactions in a Forest Settlement in Sathyamangalam and Mudumalai Tiger Reserves. *Tropical Conservation Science*, *11*, 194008291880275. https://doi.org/10.1177/1940082918802758

28. Karanth, K. U., & Madhusudan, M. D. (2002). Mitigating human-wildlife conflicts in southern Asia. *Animal Conservation*, *5*(3), 217–222.

29. Kumar, D. (2011). *8 th European Vertebrate Pest Management Conference 180 Julius-Kühn-Archiv*. *432*. https://doi.org/10.5073/jka.2011.432.098

30. Kumar, D., & Chauhan, N. P. S. (2011). *STUDY OF LEOPARD MENACE, FOOD HABITS AND HABITAT PARAMETERS IN MANDI DISTRICT, HIMACHAL PRADESH. Under the supervision of Dr*.

31. Kumar, P., Chandel, S., Kumar, V., & Sankhyan, V. (2017). Leopard–Human Conflict Led Casualties and Conservation Awareness Campaign in Shivalik Hills of Northern India. *Proceedings of the National Academy of Sciences India Section B - Biological Sciences*, *87*(3), 893–898. https://doi.org/10.1007/s40011-015-0653-3

32. Kumar, S., & Gupta, D. (2023). Forest Biodiversity and Livelihood of Tribal People in North Western Himalaya with Special Reference to Himachal Pradesh, India. *International Journal of Plant & Soil Science*, *35*(19), 888–907. https://doi.org/10.9734/ijpss/2023/v35i193623

33. Kumar Sharma, R., & Sripal, R. (2021). *Human-Wildlife Conflict Management Strategy in Pangi, Lahaul and Kinnaur Landscapes, Himachal Pradesh*. https://doi.org/10.13140/RG.2.2.23605.81128

34. Kumar, V., Attri, V., Rana, D. S., & Chauhan, S. K. (2022). 'Crop Raiding': Farmers' Perspectives in Shiwalik Hills of North-Western Himalayas, India. *Journal of International Wildlife Law and Policy*, *25*(4), 301–313. https://doi.org/10.1080/13880292.2022.2146851

35. Kumar, V., Sharief, A., Dutta, R., Mukherjee, T., Joshi, B. D., Thakur, M., Chandra, K., Adhikari, B. S., & Sharma, L. K. (2022). Living with a large predator: Assessing the root causes of Human–brown bear conflict and their spatial patterns in Lahaul valley, Himachal Pradesh. *Ecology and Evolution*, *12*(7). https://doi.org/10.1002/ece3.9120

36. Kumara, H. N., & Venugopal, N. (2023). *Population status of rhesus macaque (Macaca mulatta) in Himachal Pradesh Technical Report*.

37. Madden, F. (2004). Creating Coexistence between Humans and Wildlife: Global Perspectives on Local Efforts to Address Human–Wildlife Conflict. *Human Dimensions of Wildlife*, *9*(4), 247–257. https://doi.org/10.1080/10871200490505675

38. Maheshwari, A. (2013). Snow leopard (Panthera uncia) surveys in the Western Himalayas, India. *Journal of Ecology and The Natural Environment*, *5*(10), 303–309. https://doi.org/10.5897/jene2013.0382

39. Mamo, A., Lemessa, D., Diriba, O. H., & Hunde, D. (2021). Pattern of crop raiding by wild large mammals and the resultant impacts vary with distances from forests in Southwest Ethiopia. *Ecology and Evolution*, *11*(7), 3203–3209. https://doi.org/10.1002/ece3.7268

40. Mishra, C. (1997). Livestock depredation by large carnivores in the Indian trans-Himalaya: Conflict perceptions and conservation prospects. *Environmental Conservation*, *24*(4), 338–343. https://doi.org/10.1017/S0376892997000441

41. MoEFCC. (2023). *Status of snow leopard in India (SPAI)*.

42. Moore, J. H., Gibson, L., Amir, Z., Chanthorn, W., Ahmad, A. H., Jansen, P. A., Mendes, C. P., Onuma, M., Peres, C. A., & Luskin, M. S. (2023). The rise of hyperabundant native generalists threatens both humans and nature. *Biological Reviews*, *98*(5), 1829–1844. https://doi.org/10.1111/brv.12985

43. Ogra, M., & Badola, R. (2008). Compensating Human–Wildlife Conflict in Protected Area Communities: Ground-Level Perspectives from Uttarakhand, India. *Human Ecology*, *36*(5), 717–729. https://doi.org/10.1007/s10745-008-9189-y

44. Oman Zumo, D. (2024). Human-Wildlife Conflicts in Africa: A Preliminary Review. *International Journal of Environnemental Sciences*, *13*(1), 6–14. https://doi.org/10.13140/RG.2.2.34271.23202

45. Pandey, P., & Sharma, V. (2016). Curtailing Human-Leopard Conflict Using Wildlife Forensics: A Case Study from Himachal Pradesh, India. *Journal of Forensic Research*, *7*(3). https://doi.org/10.4172/2157-7145.1000331

46. Pirta, R. S., Gadgil, M., & Kharshikar, A. V. (1996). MANAGEMENT OF THE RHESUS MONKEY Macaca mulatta AND HANUMAN LANGUR Presbytis entellus IN HIMACHAL PRADESH, INDIA. *Biological Conservation*, *79*, 97–106.

47. Piyush, M., Arun, N., Rashmi, C., Yasmin, J., & Pankaj, T. (2018). A Study on Managing Crop Damage by Wild Animals in Himachal Pradesh. *International Journal of Agriculture Sciences9107*, *10*(12), 6438–6442. https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

48. Pradhan, V., Dar, M. A., Maqbool Rather, M., Panwar, M., & Pala, N. A. (2012). *HUMAN-WILDLIFE CONFLICT IN KITAM BIRD SANCTUARY: PERCEPTIONS AND POSSIBLE SOLUTIONS*.

49. Rathore, B. chand. (2008). *Ecology of brown bear (Ursus arctos) with special reference to assessment of human-brown bear conflicts in Kugti Wildlife Sanctuary, Himachal Pradesh and mitigation strategies*. http://etheses.saurashtrauniversity.edu/id/eprint/597

50. Raycraft, J. (2023). Wildlife and human safety in the Tarangire ecosystem, Tanzania. *Trees, Forests and People*, *13*. https://doi.org/10.1016/j.tfp.2023.100418

51. Reddy, A. R. M., & Chander, J. (2016). *HUMAN-MONKEY CONFLICT IN INDIA: SOME AVAILABLE SOLUTIONS FOR CONFLICT MITIGATION WITH SPECIAL REFERENCE TO HIMACHAL PRADESH 1. 142*(10), 941–832. http://www.indianforester.co.in

52. Redpath, S. M., Bhatia, S., & Young, J. (2015). Tilting at wildlife: Reconsidering human-wildlife conflict. *ORYX*, *49*(2), 222–225. https://doi.org/10.1017/S0030605314000799

53. Redpath, S. M., Young, J., Evely, A., Adams, W. M., Sutherland, W. J., Whitehouse, A., Amar, A., Lambert, R. A., Linnell, J. D. C., Watt, A., & Gutiérrez, R. J. (2013). Understanding and managing conservation conflicts. *Trends in Ecology and Evolution*, *28*(2), 100–109. https://doi.org/10.1016/J.TREE.2012.08.021/ASSET/770336FE-78DA-4908-9B22-542D64DC521E/MAIN.ASSETS/GR1B4.JPG

54. Saberwal, V. K. (1996). *Pastoral Politics: Gaddi Grazing, Degradation, and Biodiversity Conservation in Himachal Pradesh, India.*

55. Sathyakumar, S. (2001). STATUS AND MANAGEMENT OF ASIATIC BLACK BEAR AND HIMALAYAN BROWN BEAR IN INDIA. *Ursus*, *12*, 21–29.

56. Sekhar, N. U. (1998). Crop and livestock depredation caused by wild animals in protected areas: the case of Sariska Tiger Reserve, Rajasthan, India. *Environmental Conservation*, *25*(2), 160–171. https://doi.org/10.1017/S0376892998000204

57. Sengupta, A., & Radhakrishna, S. (2020). Factors Predicting Provisioning of Macaques by Humans at Tourist Sites. *International Journal of Primatology*, *41*(3), 471–485. https://doi.org/10.1007/s10764-020-00148-5

58. Sharief, A., Joshi, B. D., Kumar, V., Kumar, M., Dutta, R., Sharma, C. M., Thapa, A., Rana, H. S., Mukherjee, T., Singh, A., Thakur, M., Sharma, L. K., & Chandra, K. (2020). Identifying Himalayan brown bear (Ursus arctos isabellinus) conservation areas in Lahaul Valley, Himachal Pradesh. *Global Ecology and Conservation*, *21*. https://doi.org/10.1016/j.gecco.2019.e00900

59. Sharief, A., Kumar, V., Singh, H., Mukherjee, T., Dutta, R., Joshi, B. D., Bhattacharjee, S., Ramesh, C., Chandra, K., Thakur, M., & Sharma, L. K. (2022). Landscape use and co-occurrence pattern of snow leopard (Panthera uncia) and its prey species in the fragile ecosystem of Spiti Valley, Himachal Pradesh. *PLoS ONE*, *17*(07). https://doi.org/10.1371/journal.pone.0271556

60. Sharma, L. (2024). *Population Estimation and Assessment of of Human-Wildlife conflicts for Conservation and Management Planning of Common Leopard and Asiatic Black Bear in Himachal Pradesh, 2024.*

61. Sharma, U., & Sharma, M. (2022). Bear Bite Injuries in the Hilly Areas of District Sirmaur, Himachal Pradesh. *International Academic Research Journal of Surgery*, *2*(01), 10–13. https://doi.org/10.47310/iarjs.2022.v02i01.003

62. Shivakumar, S., Carricondo-Sánchez, D., Athreya, V., Odden, M., Dhiman, S. P., Vaidyanathan, S., & Karanth, K. K. (2023). Examining leopard attacks: spatio-temporal clustering of human injuries and deaths in Western Himalayas, India.

Frontiers in Conservation Science, *4*, 1157067.
https://doi.org/10.3389/FCOSC.2023.1157067/BIBTEX

63. Sillero, C. (2001). *Crop raiding primates: Searching for alternative, humane ways to resolve conflict with farmers in Africa*.
www.peopleandwildlife.org.uk/crmanuals/CropRaidingPrimatesP&WManual

64. Sime, D., Siraj, Z., Teklemariam, A., & Tilahun, B. (2022). Human-Wild Animals Conflict in and around Amba Forest, Ezha District, Gurage Zone, Southern Ethiopia. *International Journal of Zoology*, *2022*.
https://doi.org/10.1155/2022/7002645

65. Singh, R. B., & Kumar, P. (2014). *Geographic and Socio-Economic Realities of Himachal Pradesh, Northwestern Himalaya* (pp. 11–26).
https://doi.org/10.1007/978-4-431-54868-3_2

66. Singh Rajpurohit, L., Sharma, G., Ram, C., & Rajpurohit, L. S. (2011). Study of man-monkey conflict and its management in Jodhpur, Rajasthan (India). In *Journal of Evolutionary Biology Research* (Vol. 3, Issue 1).
http://www.academicjournals.org/jebr

67. Thakur, M., Thakur, M. A., & Thakur, J. (2024). *HABITAT DEGRADATION AND INCREASING HUMAN-WILDLIFE CONFLICTS IN HIMACHAL PRADESH: A REVIEW "Habitat Degradation and Increasing Human-Wildlife Conflicts in Himachal Pradesh: A Review." XV*, 2455–054.
https://doi.org/10.31995/voyager.2024.v15.SI.006

68. Thakur, R. K., Walia, A., Mehta, K., Kumar, V., & Lal, H. (2022). Economic assessment of crop damages by animal menace in mid hill regions of Himachal Pradesh. *Indian Journal of Animal Sciences*, *92*(4), 484–491.
https://doi.org/10.56093/ijans.v92i4.124173

69. Thakur, S., Chauhan, V., Sharma, K., & Singh, M. (2020). Over 8000 macaque bites since 2014 but no herpes B virus infection reported from Shimla, India. *Journal of Global Infectious Diseases*, *12*(3), 163.
https://doi.org/10.4103/jgid.jgid_250_20

70. Treves, A., & Karanth, K. U. (2003). Human–Carnivore Conflict and Perspectives on Carnivore Management Worldwide. *Conservation Biology*, *17*(6), 1491–1499. https://doi.org/10.1111/j.1523-1739.2003.00059.x

71. Tripathi, R. S., & Rao, V. V. (2016). Vertebrate pest management in agriculture. In P. K. Agrawal, A. Verghese, S. R. Krishna, & K. Subaharan (Eds.), *Human Animal Conflict in Agro-Pastoral Context: Issues & Policies* (pp. 23–31). Assistant Director General / Director National Agricultural Science Fund Indian Council of Agricultural Research, New Delhi,.

72. Vasudeva Rao, V., Naresh, B., Ravinder Reddy, V., Sudhakar, C., Venkateswarlu, P., & Rama Rao, D. (2015). Impact factor: 3.762 Traditional management methods used to minimize wild boar (Sus scrofa) damage in different agricultural crops at Telangana state, India. *~ 32 ~ IJMRD*, *2*(2), 32–36.
www.allsubjectjournal.com

73. Venkata Ramesh, K. (2019). Damages Caused by Wild Boars and Strategies for their Management-Review. *Int.J.Curr.Microbiol.App.Sci*, *8*(2), 3480–3488.
https://doi.org/10.20546/ijcmas.2019.802.408

74. Watve, M., Patel, K., Bayani, A., & Patil, P. (2016). A theoretical model of community operated compensation scheme for crop damage by wild herbivores. *Global Ecology and Conservation*, *5*, 58–70. https://doi.org/10.1016/j.gecco.2015.11.012

75. Yeshey, Ford, R. M., Keenan, R. J., & Nitschke, C. R. (2022). Subsistence Farmers' Understanding of the Effects of Indirect Impacts of Human Wildlife Conflict on Their Psychosocial Well-Being in Bhutan. *Sustainability (Switzerland)*, *14*(21). https://doi.org/10.3390/su142114050

76. Young, J. C., Marzano, M., White, R. M., McCracken, D. I., Redpath, S. M., Carss, D. N., Quine, C. P., & Watt, A. D. (2010). The emergence of biodiversity conflicts from biodiversity impacts: Characteristics and management strategies. *Biodiversity and Conservation*, *19*(14), 3973–3990. https://doi.org/10.1007/S10531-010-9941-7/METRICS