

Livestock Depredation, Human Casualties, and Conservation Hostility: A Socio-Economic Analysis of Human-Common Leopard (*Panthera pardus*) Conflict in Community Forests of Arghakhanchi, Nepal

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ABSTRACT

Human-wildlife conflict inflicts serious socio-economic damage on rural communities living near forests. This study examined the socio-economic impact of human-common leopard (*Panthera pardus*) conflict in community forests of Arghakhanchi district, Nepal. A case-control design was used, with structured questionnaire surveys of 120 households (25 victim-family cases, 95 non-victim controls), key informant interviews, focus group discussions, and secondary data from the Divisional Forest Office (DFO) were used. Over nine years, 31 victims were recorded, of whom 25 were killed or wounded by leopard attacks. Goats (32%) were the most depredated livestock, followed by sheep (30%), chicken (25%), and buffalo (11%). Government compensation was reported as inadequate and procedurally complex, and 70% of respondents believed leopards should not be conserved. With 88% of households having no fencing, communities remain highly vulnerable. The study recommends revised compensation mechanisms, subsidized livestock protection measures, and stronger community involvement in conflict management.

KEYWORDS

Human-wildlife conflict, Livestock depredation, Common leopard, Compensation, Arghakhanchi, Socio-economic impact, Nepal

INTRODUCTION

Globally, the intensification of human-wildlife conflict (HWC) is considered one of the most critical conservation and rural livelihood challenges of the twenty-first century (Treves & Karanth, 2003). As natural habitats shrink and human populations expand, people and wild animals are increasingly coming into contact, resulting in loss of lives, livestock, crops, and property (Woodroffe et al., 2002). Among large carnivores, the common leopard (*Panthera pardus*) is particularly associated with conflict due to its wide distribution, opportunistic feeding behaviour, and ability to persist in human-dominated landscapes (Athreya & Belsare, 2007).

In Nepal, leopards are the principal predator responsible for 78% of livestock depredation incidents reported across 69 districts (DNPWC, 2017). Although the common leopard is listed under Schedule I of Nepal's National Parks and Wildlife Conservation Act 1973, compensation mechanisms for leopard-related losses remain less standardized and consistently implemented compared to those for tiger or elephant attacks, resulting in inequitable outcomes across districts. Communities living near community forests frequently suffer livestock losses and human casualties, yet receive limited institutional support (Inskip & Zimmermann, 2009).

Arghakhanchi district in Province No. 5 is one of the most severely affected areas in Nepal. Over nine years (2067–2075 BS; approximately 2010–2019), 31 victims were recorded in the district, of whom 25 were killed or wounded by leopard attacks, according to DFO Arghakhanchi records. Despite this, no study had specifically quantified the socio-economic damage to households, the pattern of livestock losses, or the adequacy of government compensation in Arghakhanchi. Understanding these dimensions is essential for

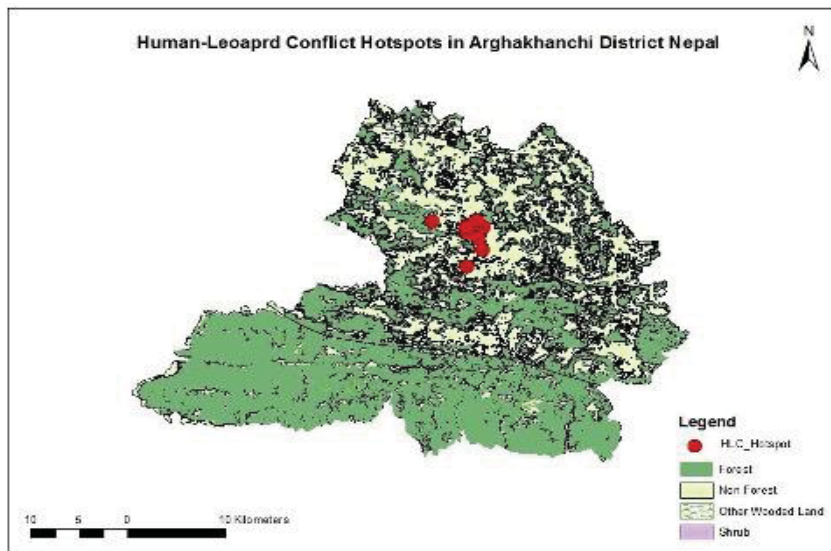
designing effective, community-centered mitigation strategies that protect human livelihoods while supporting leopard conservation.

This study addresses that gap by documenting the socio-economic impact of human-leopard conflict in community forests of Arghakhanchi district, focusing on livestock depredation, human casualties, compensation adequacy, and the economic vulnerability of affected households.

Study Area

Arghakhanchi is a district in Province No. 5 of Nepal, with its headquarters at Sandhikharka. The district covers 1,193 km² and had a population of 197,632 as of the 2011 national census (Central Bureau of Statistics, 2011). It lies between 27°45'N and 28°6'N latitude and 80°45'E to 83°23'E longitude, with altitude ranging from 305 to 2,515 meters above sea level. Approximately 40% of the district is forested, with 68% situated in the mountainous Mahabharat Range and the remainder in the Siwalik Hills. Seven conflict-affected wards of Sandhikharka municipality were selected as the study area based on historical attack records held at the Divisional Forest Office (DFO).

1:



Figure

Human-Leopard Conflict Hotspots in Arghakhanchi District, Nepal (Source: DFO Arghakhanchi, 2019)

METHODOLOGY

Data Collection Methods

A mixed-method research approach combining quantitative and qualitative methods was used. This study employed a case-control design: households with a documented leopard attack history served as cases ($n = 25$) and were selected through total enumeration, while households with no attack history served as controls ($n = 95$) and were selected through simple random sampling. The combined sample of 120 households was computed at 95% confidence level with 8.7% margin of error from a target population of 3,000 households using the formula: $n = \frac{NZ^2p(1-p)}{[Nd^2 + Z^2p(1-p)]}$, yielding $n = 120$. All findings are specific to the surveyed sample and should not be generalized to the broader district population.

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Key informant interviews were conducted with the community leader (Mr. Dhurba Prasad Chaulagain), the Assistant Divisional Forest Officer of Arghakhanchi (Ms. Shila Pokharel), and local government officials. A focus group discussion was held with representatives from governmental organizations, NGOs, police, journalists, and DFO staff. Secondary data were obtained from DFO Arghakhanchi, including records of attack incidents, victim ages, dates of attack, and compensation amounts disbursed.

Data Analysis

Descriptive statistics, including frequencies and percentages, were used to summarize socio-economic data. Livestock depredation data were organized by animal type and percentage of reported attacks. Compensation data from the DFO were compared against household-reported estimates of actual losses. Microsoft Excel was used for graphs and charts. All data collection instruments, including the household questionnaire in English and Nepali, an anonymized household-level dataset, and analysis files, are available from the corresponding author upon reasonable request.

Ethical Considerations: All participation was voluntary. Prior to each interview, respondents were informed of the study's purpose, assured of anonymity, and told they could withdraw at any time without consequence. Informed verbal consent was obtained from all 120 respondents before proceeding. Particular sensitivity was exercised during interviews with victim families given the traumatic nature of their experiences.

RESULTS

Human Casualties and Conflict Incidents

Secondary data from DFO Arghakhanchi showed that over nine years 2067-2075 BS, (approximately 2010-2019) 31 victims were recorded in the district, of whom 25 were killed or wounded by leopard attacks. The year-wise breakdown of victims and their condition is presented in Table 1. In addition, 20 leopards were killed in retaliation by communities during this period. Among the retaliatory leopard killings, 8 were female, 9 were male, and 3 were of unidentified sex. The dual toll of human casualties and retaliatory leopard killings reflects the severe and escalating nature of the conflict.

Table 1: Year-wise Number and Condition of Human Victims of Leopard Attacks, Arghakhanchi

Year (BS)	No. of Victims Attacked	Condition (Wounded / Killed / Both)
2067	2	Wounded
2068	1	Wounded
2070	3	Killed
2071	5	Both
2072	2	Wounded
2073	5	Both
2074	4	Both
2075	3	Both

Source: DFO Arghakhanchi, Sandhikharka, 2019

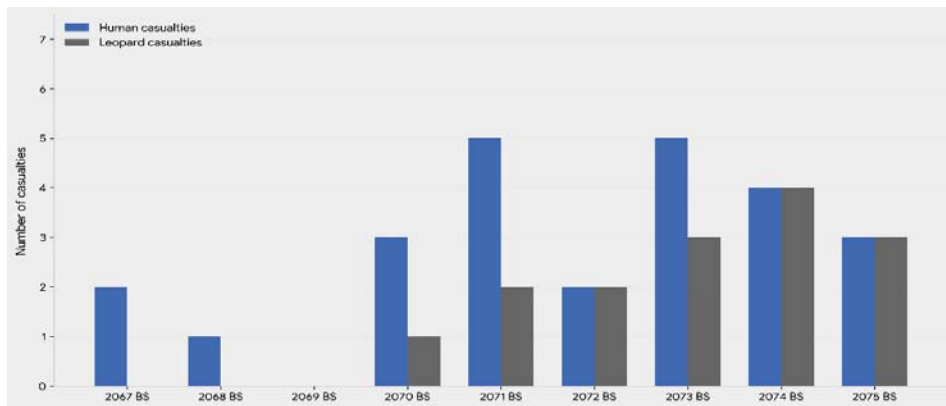


Figure 2: Annual frequency of human and leopard casualties in Arghakhanchi, 2010–2019 (Source: DFO Arghakhanchi, 2019)

Livestock Depredation

Livestock depredation was the most commonly reported socio-economic impact among surveyed households. Based on questionnaire data from 120 respondents, goats were the most frequently depredated livestock (32%), followed by sheep (30%), chicken (25%), and buffalo (11%). Many respondents reported multiple incidents of livestock loss over the past five years. The breakdown of livestock types depredated is presented in Table 2 and Figure 3.

Table 2: Livestock Depredated by Common Leopard in Arghakhanchi (n = 120 households)

Type of Livestock	98% of Reported Depredation	Rank
Goat	32%	1 (Highest)
Sheep	30%	2
Chicken	25%	3
Buffalo	11%	4 (Lowest)

Source: Household Survey, Arghakhanchi, 2019

Absolute counts of individual animals lost were not recorded at the household level during data collection; depredation is therefore reported as the proportion of respondents reporting loss of each animal type. Key informant interviews indicated that local market values for goats the most frequently depredated species ranged approximately NPR 5,000–15,000 per animal, substantially exceeding reported government compensation amounts. Future studies should systematically record total animal counts and market values to enable precise economic loss quantification.

Fencing and Livestock Protection

Among the 120 surveyed households, 88% had no fencing around their property, and only 12% used any form of fencing or enclosure. Households practicing shed feeding (keeping livestock in secure enclosures overnight) reported fewer depredation incidents compared to those relying on free grazing near community forests. The absence of protective measures, combined with the practice of grazing livestock adjacent to forest areas, was identified as the

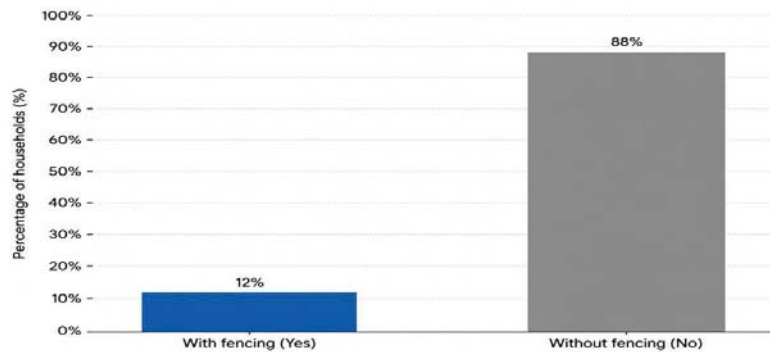


Figure 3: Percentage of households with and without fencing in Arghakhanchi study area ($n = 120$; Source: Household Survey, 2019)

Compensation Mechanisms and Adequacy

Government compensation for documented leopard attacks is administered through DFO Arghakhanchi; however, key informant interviews and focus group discussions identified three critical gaps in its implementation. Although the common leopard is afforded legal protection under Schedule I of Nepal's National Parks and Wildlife Conservation Act 1973, compensation mechanisms for leopard-related losses remain less standardized in practice compared to those for tiger or elephant attacks, complicating the response framework. Secondary data from DFO Arghakhanchi confirmed that compensation was formally disbursed to victim families in recorded cases. However, interview data revealed that the amounts provided were perceived by all victim households as insufficient to cover actual losses. Livestock market values in the study area, particularly for goats and sheep, which together accounted for 62% of depredated animals, significantly exceeded standard government compensation rates. Despite Schedule I listing under Nepal's National Parks and Wildlife Conservation Act 1973, no standardized compensation formula exists for leopard attacks comparable to those applied for tiger or elephant incidents. In practice, compensation amounts are determined on a case-by-case basis at the discretion of individual DFO offices, creating structural inequality between victims in different districts and undermining community trust in the formal system.

Socio-Economic Vulnerability of Affected Households

Of the 120 surveyed respondents, 67% were illiterate, 17% had completed the School Leaving Certificate (SLC), and 16% had attained higher literacy levels. Most affected households were subsistence-level farmers for whom livestock represented both food security and economic capital. The loss of even one goat, therefore, constituted a disproportionate financial setback for these families.

Among the 120 sampled households, 30% were located within 300 metres of the nearest community forest. A weak positive correlation was observed between household proximity to the community forest and conflict frequency ($R^2 = 0.09$); however, this was not statistically significant ($p = 0.607$), indicating no reliable association between distance from forest and conflict incidence in this sample. Land use change was also widely reported: 34% of respondents stated that land use in their area had changed in the past five years, primarily through the conversion of forests to agricultural land and settlements, pushing leopards closer to human habitation.

Children were disproportionately represented among attack victims. Attacks were most concentrated during Bhadra (August) when 9 of the recorded incidents occurred, coinciding with the maize cultivation season when children frequently played or worked near forest edges. In two documented cases in DFO records, the same child was attacked twice, with the second attack proving fatal.

Community Perceptions of Leopard Conservation

When asked whether conservation of leopard is important, 15% of respondents said yes (conservation is important), 70% said no (leopards should not be conserved due to threats to human and livestock safety), and 15% were unsure. "When asked what they would do upon encountering a leopard, 70% said they would kill it, 20% said they would call for help, 5% said they would report the incident to the DFO, and 5% said they would do nothing." These findings demonstrate that inadequate compensation and poor institutional response are directly eroding community willingness to support leopard conservation.

Figure 4: Community Perceptions Toward Leopard Conservation and Response Behaviour, Arghakhanchi (n = 120; Source: Household Survey, 2019)

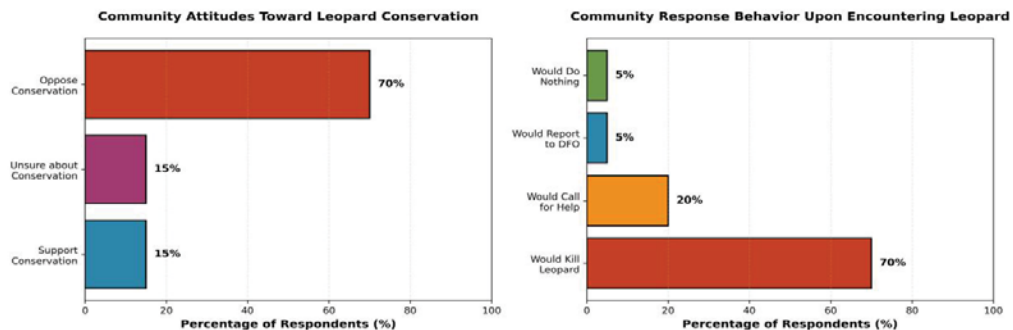


Figure 4: Community perceptions toward leopard conservation and response behaviour, Arghakhanchi (n = 120; Source: Household Survey, 2019)

DISCUSSION

This study documents, for the first time from Arghakhanchi district, the socio-economic burden that human-leopard conflict places on rural households in community forest areas. The findings are consistent with broader literature showing that livestock depredation constitutes one of the most significant economic threats to communities living near large carnivore habitat (Inskip & Zimmermann, 2009; Michalski et al., 2006). The predominance of illiterate, subsistence-level households make these losses especially severe, as families lack savings or insurance mechanisms to absorb them.

The livestock depredation pattern with goats (32%) and sheep (30%) most targeted reflects the vulnerability of small ruminants that are commonly kept with minimal protection in rural Nepal. This finding is consistent with Bagchi and Mishra (2006), who documented the preferential predation of small domestic animals in Himalayan communities. The high proportion of chicken (25%) among depredated livestock also indicates opportunistic attacks near homesteads, suggesting leopard habituation to human settlement areas.

The inadequacy of government compensation reported here mirrors findings from other South Asian contexts. Dar et al. (2009) observed that compensation commonly falls short not only in monetary value but also fails to address indirect costs such as psychological trauma and fear-driven changes in farming behaviour. The procedural complexity of the system further disadvantages marginalized communities, who lack the literacy and institutional access to navigate formal processes.

The near-universal absence of protective fencing (88% of households) is a major structural vulnerability. Globally, predator-proof livestock enclosures and night penning have demonstrated effectiveness in reducing depredation (Bagchi & Mishra, 2006). However, adoption requires both community awareness and initial capital investment, both of which are severely constrained in Arghakhanchi.

The killing of 19 leopards in retaliation over nine years is a serious conservation concern. Retaliatory killings are driven directly by inadequate compensation and the perception that the state fails to protect community livelihoods (Karanth & Madhusudan, 2002). This creates a harmful cycle: inadequate compensation encourages retaliation, retaliation depletes the leopard population, and reduced leopard prey may force surviving animals into greater contact with human settlements, intensifying conflict further. This retaliatory dynamic has been documented across Nepal. Thapa (2014) recorded 51 leopard deaths over six years nationally, with 65% caused directly by humans, but the rate of 19 retaliatory kills in a single district over nine years suggests that Arghakhanchi represents a localized crisis requiring district-specific intervention rather than reliance on national-level policy alone.

The concentration of attacks during the maize cultivation month of Bhadra (August) points to a clear and actionable window for seasonal intervention. Community forest management plans could incorporate targeted child safety protocols and community awareness campaigns during this high-risk period, without requiring permanent changes to livelihoods or land use patterns.

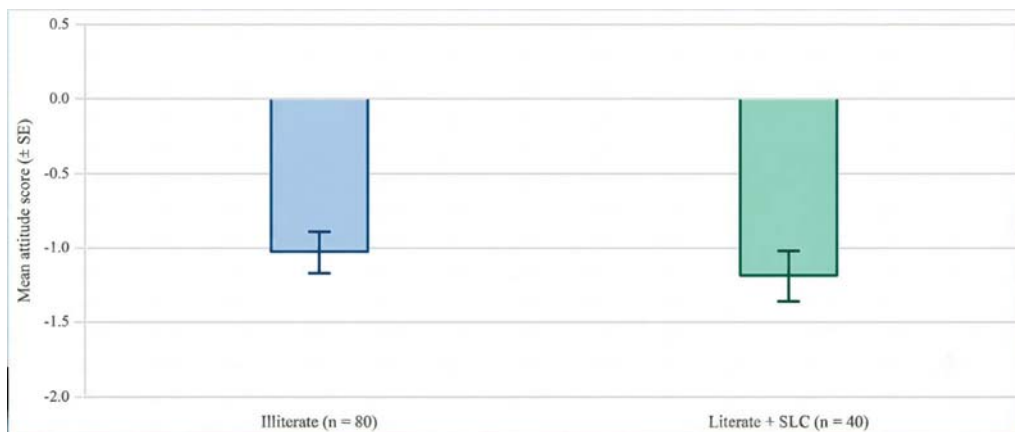


Figure 6: Mean attitude scores ($\pm$ SE) toward leopard conservation by literacy level, Arghakhanchi ($n = 120$). Scores range from -5 (most negative) to +5 (most positive). Scores below 1 indicate negative attitudes. Error bars represent standard error of the mean. ANOVA revealed no statistically significant difference between groups ($F = ns$, $p = 0.61$, 95% CI). No statistically significant difference in attitude scores was found between literacy groups (ANOVA, $p = 0.61$).

Source: Household Survey, Arghakhanchi, 2019.

Attitude scores toward leopard conservation did not differ significantly between literate and illiterate respondents (ANOVA, $p = 0.61$). The marginal difference observed (illiterate: -1.03 ± 0.14 SE; literate: -1.19 ± 0.17 SE) should be interpreted cautiously given the small sample size ($n = 120$) and lack of statistical significance. A larger, adequately powered study would be needed to determine whether literacy meaningfully predicts conservation attitudes in this context.

Limitations

Several limitations of this study should be acknowledged. First, the victim sample was small ($n = 25$ case households), limiting statistical power for comparative analyses between cases and controls. Second, the cross-sectional design prevents causal inference; it is not possible to determine from these data whether specific household characteristics caused greater conflict exposure or resulted from it. Third, findings are specific to seven wards of

Sandhikharka municipality and may not generalize to other conflict-affected areas of Arghakhanchi district or Nepal more broadly. Fourth, reliance on self-reported livestock losses and perceptions introduces potential recall and social desirability biases. These limitations should be addressed in future research through larger probability samples, longitudinal designs, and multi-district comparative frameworks. Fifth, the descriptive analytical approach used here does not control for confounding variables; future analyses should employ logistic regression to model depredation risk factors including livestock numbers, fencing status, household distance from forest, household size, and wealth proxies simultaneously.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that in Arghakhanchi district, human-leopard conflict imposes compounding socio-economic burdens, including livestock loss, human casualties, and institutional failure, that together produce active conservation hostility rather than passive indifference among affected communities. The following recommendations arise directly from the findings of this study. First, the Government of Nepal should establish a standardized, legally binding compensation formula for leopard attacks under the National Parks and Wildlife Conservation Act, eliminating the current district-level discretion that produces inequitable outcomes. Second, DFO Arghakhanchi should introduce a simplified oral or mobile-based compensation registration process specifically designed for illiterate claimants, given that 67% of respondents were illiterate; written documentation requirements effectively exclude the majority of victims from accessing the system. Third, CFUGs should be funded to provide community-level shed construction support, prioritizing the 88% of households currently without any livestock protection, with particular attention to goat and sheep owners who together account for 62% of all depredations. Fourth, seasonal child safety alerts should be issued through community radio and local government during Bhadra (August), when 36% of all recorded attacks in this study occurred, coinciding with the maize cultivation period when children's forest-edge exposure is highest. Fifth, future studies with larger samples should examine whether literacy level predicts conservation attitudes among conflict-affected communities in Nepal, as the present study lacked sufficient statistical power to detect a reliable effect, as this has significant implications for how awareness programmes are designed and targeted.

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