


Examining socio-ecological transitions and new human–wildlife relations in farming landscapes of the Nepal Himalaya

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Abstract

Wildlife invasion into farmlands is emerging as an acute problem in the Himalayas, threatening farm-based livelihood systems of smallholder rural communities. The problem is severe in the areas where successful forest restoration has been achieved by community forestry programmes alongside massive outmigration. Such evolving dynamics have created new conceptual and empirical discourses on conservation, nature-society relations and human-wildlife interactions, as some wild animals have become pests for farming communities. Consequently, the historical co-existence and relationships between subsistence communities and local ecosystems have been destabilized. By mobilizing the concepts of forest transition and agrarian transition, we explore these new and emerging relationships between the growing wildlife problem and deteriorating people's livelihood by examining the nature, extent and drivers of the new human-wildlife interactions and provide critical insights towards effectiveness of current policies and practical responses.

KEYWORDS

agrarian transition, community forestry, forest transition, Himalaya, human–wildlife conflict, livelihood, Nepal

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1 | INTRODUCTION

The Himalayan region is experiencing an unprecedented problem of human-wildlife conflict in the farmlands, creating a new set of livelihood challenges for the smallholder rural communities (Baral et al., 2021; Bista & Song, 2021; Sharma et al., 2021; Wangchuk et al., 2023). In Nepal, this problem has become acute in the mid-hill districts where community forestry programmes have contributed to restore the forest cover over the past decades. In this region, subsistence farming practices are substantially declining and the trend of abandoning farmlands increasing (Ojha et al., 2017; Poudel et al., 2024). This is partly due to the shortage of farm labourers induced by massive out-migration of youths from rural areas to the cities and abroad (Subedi et al., 2021; Sunam, 2020). Concurrently, with the growing human and wildlife interactions, rural communities are increasingly facing the devastation of crop damage, livestock depredation and human casualties. With such growing challenges, the smallholder practices are gradually disappearing, and rural people continue to explore livelihood alternatives away from subsistence agriculture. Such evolving dynamics have raised pertinent questions in biodiversity conservation discourse and practices, calling for a renewed discussion on human-wildlife relationships.

This new dynamic of growing conflict with wild animals is increasingly seen as a demotivating factor to the rural communities to continue smallholder agriculture and actively engage with community forest management and biodiversity conservation related activities. Such declining community interests in subsistence farming and eroding collective action towards the management of community forests and other commons have profound impacts on the local land use practices and historical forest-people relations in the Himalayan region. Therefore, the fundamental questions that merit attention are as follows: How the wild animals have become even more problematic in the mountain landscapes in recent years and what are the potential implications of this situation for the future of smallholder farming and the management of forest commons? Is this a new nature-society relationship emerging in the Himalayan farming landscapes? Examination of the nature, extent and drivers of growing human-wildlife conflicts allows us to engage in and contribute to more nuanced debates on farm-based rural livelihoods and conservation policies in the Himalayan region.

Historically, a 'protected area approach' dominated the discourses and practices of wildlife conservation. The conservation policies and practices that focus on the preservation of some emblematic wild animals (Adams & Hutton, 2007; Vaccaro et al., 2013) consider humans, particularly communities residing in and around forests, as a problem. Such an approach in a conceptual sense creates rigid boundaries between nature and society (Adams & Hutton, 2007; de Silva & Srinivasan, 2019). Biodiversity conservation policies and practices over the past five decades, in most of the cases in the Global South, have contributed to and even created intense human-wildlife conflicts (HWCs), jeopardizing livelihood opportunities of forest-dependent communities and exacerbating vulnerabilities of the marginalized and indigenous people (Adams & Hutton, 2007; Massé, 2016; West, 2006). Such conflicts are documented primarily in the context of protected areas involving larger animals (see Nuyus, 2016; Sharma et al., 2021). In recent years, this problem has been increasing outside the protected areas, and the smallholder farmlands have become the new sites of HWCs (Sharma et al., 2021). However, little attention has been paid to the everyday problems of such conflicts in the farming landscapes. Further, literature on the HWC is primarily centred around the immediate causes of conflict between wild animals and communities and tends to overlook the broader socio-ecological changes (Ullah et al., 2023) and political economic processes (Fletcher et al., 2023; Fletcher & Toncheva, 2021; Komi & Kröger, 2023) that are important underlying drivers behind the contemporary human-wildlife problem. This paper thus intends to fill this gap by developing an understanding of such evolving human-wildlife interactions in changing social and ecological contexts. However, the traditional model of agrarian transition appears to have not occurred in much of the global south.

We explore these processes in the mountain farming landscapes of Nepal where the harvest losses to wild animals and the killing of livestock by wild cats such as tigers and leopards are not a new phenomenon (Acharya et al., 2016; Sharma et al., 2021). The major concern presently is the gravity and intensity of the problem and its wider implications for future farming practices. Some farmers in Nepal have harvest losses of up to 80%

(Andersson & Hansson, 2022), and the farming communities are witnessing an increment in the number of wild animals in the areas where there used to be little or none in the past. This new situation does not imply an increase in the diversity of wild animals, rather indicates a selective growth of certain wild animals causing not only immediate negative impacts on the farming communities but also disrupting the balance of local biodiversity.

The Himalayan Mountain systems have undergone tremendous socio-economic and forest transition during the last four decades, and such transitions (see Gautam et al., 2003; Poudyal et al., 2023) have led to a new socio-ecological system or, more precisely, a new dynamic of forest-people relations. We argue that such recent and evolving human and wildlife relationships can provide important and new theoretical and policy insights related to biodiversity conservation and agrarian practices. We develop an analytical framework that combines concepts of forest transition and agrarian transition for understanding how farming communities are being further pushed away from subsistence agricultural practices. We argue that the entire ecosystem, that is, forest-people relations in the Himalayas is changing, where shifting roles of the local communities and the dynamics of community collective action are central to understanding why the trends of wildlife problems are emerging. In doing so, this analysis challenges the dominant biodiversity conservation policies and discourses and provides insights for reimagining policies and practices towards creating a conducive environment for conserving biodiversity with due consideration of the smallholders' livelihood.

2 | NEW HUMAN-WILDLIFE INTERACTIONS—AN EMERGING THEORETICAL FRAMEWORK

There is a growing realization that the current trends, patterns and dynamics of human-wildlife interactions in the Himalayan region cannot be explained using the conventional framework of human and wildlife conflicts that primarily focuses on the proximate causes of the conflict between wild animals in the protected areas and the communities living around the parks (see Fletcher et al., 2023). The dominant literature uses the rational economic logic of resource scarcity and competition to explain human needs and their conflicts with wildlife habitats (see McAfee, 2012). A substantially new conjuncture of socio-ecological conditions and forces has emerged in the Himalaya as a result of a combination of global political economic forces and local dynamics. As a result, a new dynamic of interactions between humans and wildlife is emerging, characterized by human-wildlife conflicts onto farmland outside protected areas, which is increasingly becoming a significant societal issue. To explain this emerging scenario, we aim to mobilize two interrelated concepts of agrarian transition and forest transition. By integrating these concepts, we intend to develop a new analytical framework for examining the dynamics, drivers and trends of human-wildlife interactions in the rural Himalaya.

First, the concept of agrarian transition is widely mobilized to understand the political-economic processes of change in the agrarian community primarily driven by the state and the market (Bernstein & Byres, 2001; Byres, 2016; Hammen, 1972; Lerche, 2013). For the purpose of explaining the Himalayan situation, we refer to agrarian transition as a process of socio-economic change in the production systems and social structure from an agrarian or peasant society where subsistence and farm-based productions are the dominant forms of economy, into an increasingly market-based production relations and consumption practices (Bernstein, 2010; Bryceson, 1996; Rigg & Nattapoolwat, 2001). This, simply, is not a predefined or unidirectional transition to the market economy and involves a combination of diverse socio-economic and day-to-day material transformations in agrarian lives where market relations become dominant. These agrarian transition processes are triggered by a variety of forces such as capital circulation (Borras, 2009; Harvey, 2003), financialization (Kay, 2008; Paudel et al., 2020), development modernization (Kumar, 2020; Rankin, 2004), environmental degradation and disaster responses (Camargo, 2022; Epstein et al., 2018; Muldavin, 1997) and market penetration (Bernstein, 2010). Agrarian transition sets the motion towards the process of deagrarianization (Poudel et al., 2024) resulting in primitive accumulation (Harvey, 2003; Paudel, 2016) as well as creating massive outmigration as a national or transnational labour force

(Blaikie et al., 2002; Pain et al., 2021; Sugden et al., 2022). Some argue that agrarian transition leads to market-led consumption practices (Brown & Waldron, 2013; Cavalcante, 2016) and focuses on restructuring family dynamics and sources of livelihoods (Kelly, 2011) by diversifying occupations and livelihoods (Chhetri et al., 2021; Rigg, 2006) that trigger cultural and social changes in the rural areas (Bernstein, 2010; Redman & Foster, 2008). However, the classical form of agrarian transition seems to have not happened in large parts of the global south (Lerche, 2013; McCarthy, 2020; Rigg, 2006). Neither farming has transitioned to market-oriented production nor has the surplus labour been entirely absorbed by the industrial sector (Li, 2017). Rather, the rural changes are characterized by the processes where rural households are not only exploited by the market, but livelihood activities are also diversified. For example, in Nepal, rural households combine subsistence production with commercial agriculture production and/or off-farm activities and supplement their income predominantly via remittance (McCarthy, 2020; Rigg et al., 2016). Agrarian transition therefore is an uneven, contested and complex process of change that can generate conditions of possibility for new economies, ecological systems and nature-society relations.

These analyses of agrarian transition offer insights into understanding the dynamic processes and outcomes of systemic changes in agrarian society and the impacts of these changes on the economic, social and cultural lives of the smallholder farmers especially in rural areas. However, the concept of agrarian transition has been mainly concentrated on the alterations in economic practices, labour flows and market relations and the variegated processes of commodification within agrarian systems. To fully understand the new nature-society relationships emerging in the Himalayas through the current human-wildlife interactions, we must move beyond these political-economic analyses alone and establish intertwined relationships between the agrarian transition processes and the changes happening in the biophysical features in the landscapes such as forests and ecosystems. Some scholars have explored the connections between growing changes in agrarian practices and shifting coverage and compositions of the forests explaining the positive correlation between rural outmigration and growing tree coverage in the community forest areas in Nepal (Chhetri et al., 2021; Fox, 2018). However, to develop a more comprehensive understanding of the contemporary human-wildlife interactions in the Himalayas, we must view the processes of agrarian transition in relation to the evolving dynamics of forest transition and ecosystem changes.

Second, the concept of forest transition provides an analytical framework to explain the trajectory of land use change in relation to the socio-economic changes in a specific context. Mather (1992) defined forest transition as referring to the dynamics of forest cover change in Europe where forest cover declined with the beginning of industrial development followed by the recovery of forests as a country undergoes economic development. As it evolved, the forest transition theory explores the drivers and processes of change in forest conditions, composition and overall dynamics due to large-scale forest regrowth, reforestation and afforestation (Barbier et al., 2010) as people move out of the rural areas. The concept of forest transition can be extended to explain the processes and dynamics of change in wildlife habitats in farming landscapes and their interlinkages with changes in agrarian practices.

Nepal's forest recovery since the 1970s has had a strong association with local collective action and the development of community forestry (Gautam et al., 2003; Poudyal et al., 2023). Whereas the current patterns in forest transition are linked to swift changes taking place in agrarian practices primarily due to rural outmigration, land use changes, commodification and increased off-farm livelihood opportunities (Chhetri et al., 2021; Fox, 2018) and marginalization of smallholder farmers (Poudel et al., 2024). Arguably, there is a strong connection between an ongoing forest transition and wildlife habitat changes resulting in the recent increment in human and wildlife interactions (see Ullah et al., 2023). However, the forest transition concept alone cannot explain this new situation as this concept is confined to ecological changes as an indicator of new human-wildlife interactions. The current wildlife dynamics are an outcome of evolving socio-economic changes and changes in biophysical systems creating a new socio-ecological system. This new socio-ecological system indicates different and new socio-economic practices and evolving changes in associated natural ecosystems such as forest dynamics, water systems and the material changes in the landscape.

We also draw attention to the dominant biodiversity conservation discourse that emphasizes the conservation of 'charismatic' animals and the protected area approach focusing on pristine and exclusive landscapes

(Adams & Hutton, 2007; Hutton et al., 2005). The consequences of the protected area approach have resulted in the displacement of local communities (Adams & Hutton, 2007; West, 2006), ushering negative social impacts and unequal distribution of costs and benefits (Adams & Hutton, 2007; Massé, 2016; West, 2006). Rights of the locals and indigenous communities, relationships between conservation and poverty and issues of social justice and exclusion (Adams & Hutton, 2007; West, 2006) have been a prime focus of political ecological studies for decades. Globally, policies and practices of conservation are influenced by the global discourses and agendas of international conservation organizations (Aryal et al., 2021; Dhakal et al., 2022). Such dominant discourses of conservation continue to influence national government policies and practices of handling wildlife problems inside and outside of the protected areas for a long period. As a result, traditional practices of hunting are criminalized (Paudel et al., 2020), which has led to an enormous growth in the population of some wild animals in the rural areas of Nepal (Baral et al., 2021; Bista & Song, 2021). Further, we maintain that the narrow focus of existing literature, the conflict between human and wild animals within and around protected areas and animals of conservation concerns, that is, protected animals¹ (see de Silva & Srinivasan, 2019; Nyhus, 2016), fails to adequately explain the broader processes of socio-ecological changes.

In recent years, the HWC outside protected areas has attracted attention in Nepal and outside to some extent (see Bista & Song, 2021; Goswami et al., 2014; Sharma et al., 2021). Such a small but emerging body of work on human–wildlife interaction outside of the protected areas draws attention to the problem farming communities face in the Himalayan regions where smallholder farming forms an important part of rural livelihoods, and these areas are going through remarkable socio-ecological transformations (Bachmann et al., 2019; Blaikie et al., 2002). Our analytical framework of socio-ecological transition that combines both forest transition and agrarian transition helps us to develop a better and more nuanced understanding of the changing forest–people relations and growing wildlife problems as an outcome of these overlapping and simultaneous processes of changes in forest and society.

An emerging body of literature highlights a gap in current research on HWC, suggesting that it overlooks the influence of broader political-economic processes on the growing conflicts between local communities and wild animals in protected areas (see Fletcher et al., 2023; Fletcher & Toncheva, 2021). We draw attention to this emerging body of work and argue that a comprehensive analysis of the shifting socio-ecological relations is crucial to deepen our understanding of the recent development of HWCs, and this problem should be understood situating it in the larger processes of transformation in the Himalayan ecosystem (involving changes in both the socio-economic and ecological systems) where both human and wild animals produce and reproduce landscapes and their relationships. We demonstrate these processes by analysing the nature and extent of the problems that pose enormous challenges to smallholder farmers and exploring the key drivers (primarily the factors driving socio-economic transformations) leading to changing socio-ecological systems. Through this analysis, we question the dominant approaches at the policy and discursive levels of biodiversity conservation and suggest a new understanding of the human–wildlife relationships in farming landscapes in Nepal and the Himalayan region.

3 | METHODOLOGY

This paper is based on qualitative fieldwork using a case study approach and also draws on several workshops/dialogues conducted at district, provincial and federal levels in Nepal. As the study was related to growing human–wildlife problems in the context of mountain farming, we focused our field study on three mid-hill districts of Ramechhap, Dhading and Sindhupalchok (see Figure 1).

Data were collected from purposively selected case study villages using in-depth household interviews and focused group discussions and district-level stakeholder workshops (see Table 1). We conducted 29 in-depth household interviews to capture the experience of local communities and their encounters with wild animals and the

¹As Torres et al. (2018) suggest, about 82% of literature on HWC concerned these conflicts in and around protected areas and mostly involving large carnivores and mega herbivores.

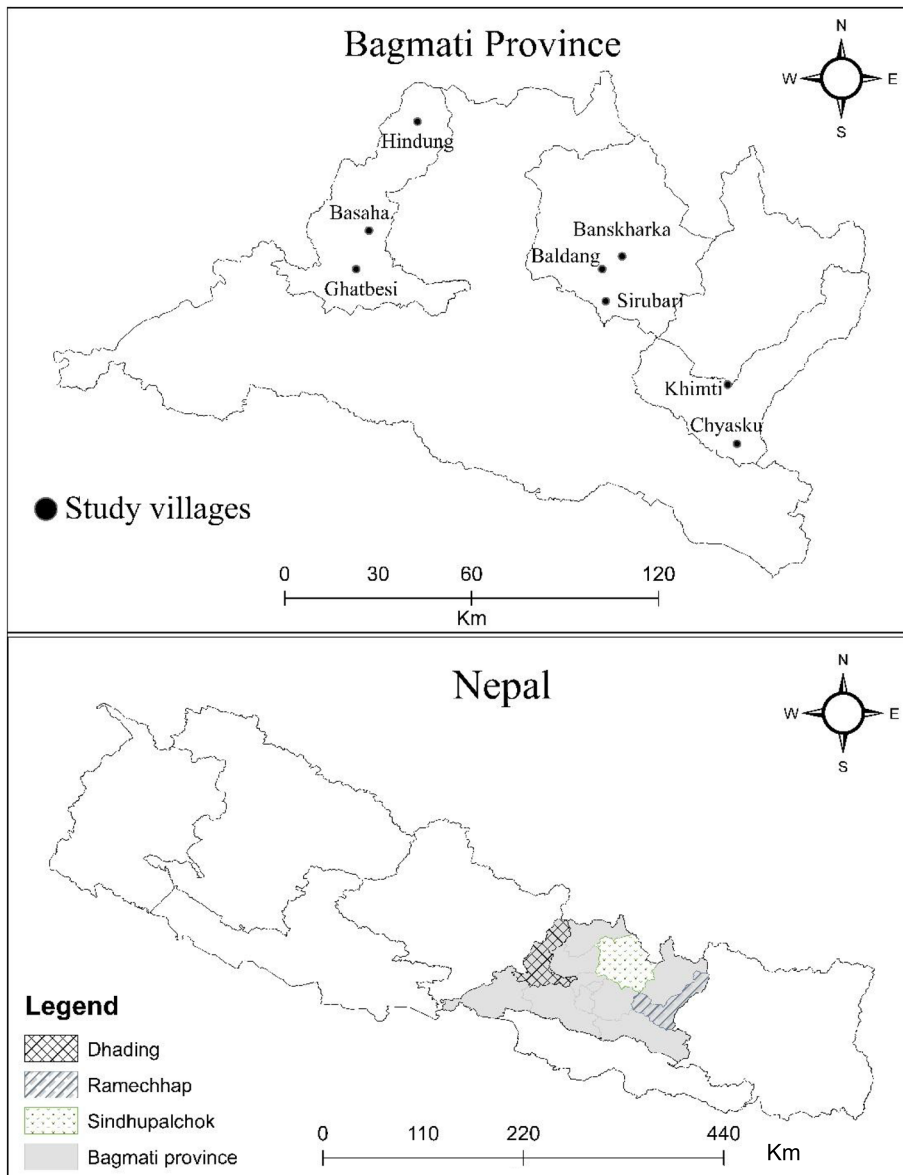


FIGURE 1 Map showing the study sites.

extent of problems they faced. We conducted eight focus group meetings in the case study villages to understand the extent of local responses to wildlife problems. The participants of the focused group meetings consisted of farmers and representatives of the local forest user groups. We also conducted transect walks with local key informants in each case study village to observe and explore the wildlife problems in the farming areas. Further, we conducted key informant interviews (14) with district-level informants who included forest officials and local government representatives. The district-level workshops were participated by representatives of key stakeholders such as forest offices, the federation of community forest user groups, agriculture knowledge centres, livestock development offices, local governments and forest user groups. These workshops were instrumental for the validation of our field-based findings as well as gathering insights on policy responses.

TABLE 1 Research methods and respondents.

SN	Research methods	Respondents/participants				Remarks
		Dhading	Sindhupalchok	Ramechhap	Total	
1	In-depth household interview (HH)	5 (2 from higher caste, 3 from ethnic groups; 2 females in total)	5 (1 from higher caste and 4 from ethnic groups; 1 female)	19 (5 + 14) (8 from higher caste, 10 from ethnic groups and 1 Dalit; 7 females)	29	In Ramechhap, 14 household interviews were conducted by master students. ²
2	Key informant interview (KII)	3	4	7 (3 + 4)	14	4 conducted by master students
3	Focused group discussions (FGDs)	2 (14 participants with 4 females)	2 (21 participants with 8 females)	4 (2 + 2) (with 24 participants including 7 females)	8	2 FDGs conducted by master students
4	District level workshop	1 (23 participants with 3 females)	1 (23 participants with 5 females)	1 (37 with 12 females)	3	

²In Ramechhap, we drew material from the work of two master students whom we supervised.

We also conducted provincial and national level dialogues to share our findings and insights and discuss policy responses. In the provincial level workshop held in Kathmandu, participation of senior officials from the provincial forest ministry and department, district (divisional) forest officers, representatives from the National Association of Rural Municipalities in Nepal (NARMIN) and representatives of grassroots organizations such as the Federation of Community Forest Users, Nepal (FECOFUN) was present. The workshop focused on the stakeholders' perception on growing wildlife problems outside the protected area and policy measures adopted, key policy gaps and potential policy responses. At the national level workshop (dialogue), the participants included heads of the federal departments of forestry and wildlife, officials from the federal ministry of forest and environment, representatives from FECOFUN and NARMIN and researchers. The workshop focused on unpacking the intensity of the growing wildlife problem, its effect on farming communities and provisions in the federal policy/legislation.

4 | CONTEXT OF AGRARIAN AND FOREST TRANSITIONS AND GROWING WILDLIFE PROBLEMS

Increasing human-wildlife conflicts in farming landscapes can be understood as an outcome of a new and emerging socio-ecological system (ecosystem) in the Himalaya. A shift from subsistence farming towards non-farm livelihood activities is well documented in recent years (Chhetri et al., 2021; Sugden et al., 2022). Such shifts are driven by two parallel processes. Firstly, smallholder farming in the mountain landscapes has been facing growing stresses involving shrinking per capita land holding size (Marquardt et al., 2016; Ojha et al., 2017), shortages of farm labour and increased wages (Maharjan et al., 2020, 2013; Ojha et al., 2017) and climate change related stressors (Adhikari, 2018; Karki & Gurung, 2012). Secondly, with the gradual marketization of the rural economy, rural households face increasing demand for cash to pay for daily consumption goods, health care and education among others (Rankin, 2004). These parallel processes of deteriorating farming conditions and increasing demand for cash push the households to diversify livelihood activities such as outmigration for labour work in cities and abroad (Maharjan et al., 2020; Sunam, 2020). In addition, a growing trend of human-wildlife conflicts has accelerated these processes of shifting towards off-farm activities and labour outmigration.

International labour migration has become a common phenomenon in rural farming villages in recent years. In the past, outmigration to India seeking jobs was a common practice. Since the 1990s, migration to the Gulf countries and Malaysia has increased drastically (see Table 2). Remittance sent by labourers has become an important source of rural livelihoods (Sunam, 2020). While migration has helped diversify rural livelihood portfolios and address growing poverty to some extent (Sunam & McCarthy, 2016), it has also created negative impacts on farming (Adhikari & Hobley, 2015; Maharjan et al., 2013). For instance, as a response to the shortages of farm labour, rural households have confined farming in the most productive and accessible areas (closer to the settlement) leaving other lands idle or letting the trees/forest grow (Marquardt et al., 2016; Ojha et al., 2017; Poudel et al., 2024). Such practices of leaving land fallow and declining farming and agriculture production which in turn have posed a challenge to food security (Ojha et al., 2017). These processes are largely driven by global political-economic factors such as labour demands in the countries with growing economy and Nepal's developmental shift towards modern consumerism and lifestyle transformation (Sugden et al., 2022; Sunam, 2020).

Over the last few decades, there has been notable progress in forest recovery by increasing forest cover in both community forests and private lands (see Table 2). In part, forest cover change in mountain landscapes is an outcome of the decline in subsistence uses of the forests such as the collection of fuelwoods, fodder and even timber in mountain areas (KC et al., 2021; Poudyal et al., 2023). Such decline in use of forests is also the outcome of improved access to alternative sources of energy such as petroleum gas, electricity and biogas in rural areas and a decline in livestock numbers. Yet, the main attribution for the unprecedented success of forest recovery reaching 44% of the total area has been the successful implementation of the community forestry programs (Gautam et al., 2003; Niraula et al., 2013; Oldekop et al., 2019). Arguably, the current changes in the uses and management of forests have led to a decline in human disturbance in forests and hence have induced a change in the ecological dynamics of the forest, creating new habitats for wildlife.

Further, the state's biodiversity conservation policies and practices are equally responsible for how these changes play out in producing new dynamics of human-wildlife interactions. Nepal's biodiversity conservation

TABLE 2 Demographic and forest cover change in the study districts.

District	Population change		Migration pattern		Forest types and management	Forest cover change ^a	
	2011 (NPHC 2011) ^b	2021 (NPHC 2021)	2001	2021		Ha in 2000	Ha in 2019
Ramechhap	202,646	170,302	6109	27,613	Sub-tropical pine and broadleaf mixed forest (in the study sites) and mostly managed by local communities	65,801	70,462
Sindhupalchok	287,798	262,624	6222	41,653	Sub-tropical to temperate forests with mix of pine and broadleaf species, high level of pine plantation, mostly managed by local communities	122,700	138,922
Dhading	336,067	325,710	13,949	66,667	Sub-tropical to temperate forest with dominant species of Hill Sal (<i>Shorea robusta</i>), pine and broadleaf. Mostly managed by local communities.	93,250	113,837

^aData source: <http://nepal.spatialapps.net/nlcm> ICIMOD.

^bNPHC stands for the Nepal Health Professional Council.

policies and practices are primarily focused on the conservation of emblematic animals such as tigers, rhinos and elephants by establishing protected areas of different kinds. However, the wildlife outside such protected areas is also governed by the same policy and institutional framework. As a result, Nepal's forest and wildlife-related policies hold a strict view of conservation of all kinds of wild animals, including those becoming pests. Traditionally, there existed practices of hunting wild animals for meat or to reduce damage to crops and domestic animals (Kharel, 1997). Such hunting practices have been forbidden by the wildlife laws initiated in the 70s (HMG, 1973), but such hunting has become difficult, if not impossible, in recent years because of increased government surveillance. While the patterns of change in agrarian practices (socio-economic dynamics) and forest transition are relatively known in Nepal, what remains unexplored is how these changes are linked to the new dynamic of human-wildlife interactions in farming landscapes. We argue that developing an understanding of these key processes and drivers behind growing wildlife problems provides an opportunity to rethink conservation policies and practices towards making them more responsive to local problems.

5 | FINDINGS

5.1 | Nature and intensity of the 'wildlife problem'

Some of our farmlands have been left uncultivated for years because of the monkeys. There are trees everywhere providing shelter for monkeys and other animals. We do not have enough laborers to work on farms and chase the monkeys away. Most of the adult men in the village are away to seek jobs in the city or abroad – a farmer in Sindhupalchok District.

This quote reflects the perspective of the local communities in the study sites about the growing wildlife problems that pose significant challenges to rural farming systems. Rural farming communities in the Himalayan mountains have been interacting with wild animals throughout the farming history as wild animals have been part of the farming ecosystem. They have been part of shaping how farming is practised, forests are managed and livelihoods are maintained. However, extensive socio-ecological transitions happening in rural mountains in recent decades have generated new and different forest–people relations that, in turn, are resulting in increased problems in farming caused by wildlife. From the field study, we found that there are two main ways that wildlife problems are expanding.

First, there has been a significant *increase in crop damage and livestock killings* by wild animals in recent years. The main animals involved in damaging crops include monkeys, wild boars, deer and porcupines, whereas the main animal involved in killing livestock is leopards. Farmers have frequently reported that the population size of animals, such as wild boars and deer, was not common in different areas of Ramechhap, Dhading and Sindhupalchoak in the past but been growing rapidly in recent years. Corns, wheat, potatoes, peas, mustards and vegetables are the major crops prone to damage by these pest animals. Monkeys damage most of the crops, whereas wild boars, deer and porcupines damage potatoes, peas and vegetables. A young man in Sindhupalchok said:

It has become extremely difficult for us to protect crops despite spending days and nights in the field guarding crops. Monkeys come during the day and wild boars, porcupines, and deer graze during nights. Often, we sleep only for a few hours in the early morning (around 4 am) every day. But still, we have not been able to protect the crops. It's just too much to handle (D5S2HH3).

Farmers residing in the forest margins particularly reported that they have been losing up to 80% of the maize crop because of damaged by the monkeys. In Ramechhap, a farmer shared that monkeys not only damage the crops in the field but also take away the maize stored in attics. Similarly, a woman from Baldang village in Sindhupalchok said, 'My family used to harvest about 45 *bhari* (a full back load consisting of about 30–40 kg) of maize crop from our

12 *ropanies*² (0.61 ha) of land prior to five years ago. In recent years, we have been harvesting barely 5 to 7 *bhari* only'. In a similar vein, a man from Neber village in Dhading said, 'in the past, my family could grow food (i.e., cereals) sufficient for more than six months for the family. Now, it has become hard to grow enough food for three months'. In Selang village in Sindhupalchok, a majority of the respondents reported that wild boars have damaged up to 70% of their potato crops. A man in his sixties said that his family used to grow potatoes as a main crop, an important source of food and cash income. During the last three years, he could, however, harvest only about 60% of the crop compared with the past years. For him, wild boars are the main threats to his family's livelihood.

In the mid-hills and higher mountain regions, smallholder farmers have been experiencing increasing threats of leopards and bears. Respondents from the Dhading district have been observing a dramatic increase in killings of livestock by leopards. Some households from higher mountain villages in the same district also reported human attacks by bears. People from the rural areas stated that in the past, there were only occasional killings of livestock by leopards and would happen inside the forest areas. However, in the last few years, they have been experiencing increasing attacks on goats and cattle by leopards in the agricultural fields as well as settlements.

In Dhading, there was a terrible incident of a bear attack on a teenage girl working in her farmland near the forest. During our fieldwork, the girl was still in the hospital in Kathmandu, and her family was struggling to manage expenses for medical treatment. Relatives of the victim were fretting about the hassles they were facing while applying for relief support for the girls' treatment as provisioned by the government, a point we will come back to later. While the incidents of human attacks are less frequent in comparison with the killing of domestic animals, fear of wild animal attacks on humans looms large.

In some villages, it seems like the dynamics of wildlife problems have undergone changes in recent years. For instance, a farmer of Ghatbesi village in Dhading who has been living in the village for five decades explained that there are decreasing trends of monkeys on her land whereas the numbers of deer and porcupines have been increasing in the last 5 years. A community member said, 'Monkeys are moving to upper mountain areas and there are new animals such as wild boars causing problems (in lower areas)' (D4S1HH1).

Second, *farmlands converting into forests are becoming animal corridors* in the landscape. For some farmers, the growing wildlife problem appears to be completely new. These farmlands become new forest margins as the neighbours who had farmlands in the previous forest margins abandoned farming creating new forest spaces. This is especially happening if the farmland in the forest margins requires massive labour involvement and high intensity of crop damage by the wild animals. Those farmers who can afford other means of livelihood abandon farming sooner than those incapable of affording non-farm activities. Surprisingly, the trend of farmers abandoning farming is more prevalent among financially stable ones rather than the ones unable to relocate from their regions. Such abandoned lands are gradually converted into forests (see Ojha et al., 2017), in turn, transition towards wildlife habitats and eventually act as ecological corridors connecting the settlements. A farmer from Sindhupalchok district mentioned, 'Many farmers have already left about 30% of their previously cultivated lands near the forest fallow which has now been converted into a new forest'. Many other farmers echoed that they have already left cultivating land in the forest fringes because of the wildlife problems and shortages of farm labour.

Guarding crops from wild animals has become even more difficult because of the increased number of trees in the farmland. As farmers reported, in the past, there used to be only a few trees (mostly fodder trees) in the farmland with a clear border between the forest and farmland. A farmer in Sindhupalchowk stated that 'the expansion of the forest has created a shelter for monkeys and chasing them is now difficult'.

These new forest corridors imply greater challenges for farmers in chasing away wild animals, and people have even experienced threats of physical attacks by some animals such as monkeys and wild boars when trying to scare them away. Some respondents were even of the view that monkeys have become more aggressive in comparison with the past. Women, children and elderly people feel increased difficulty to chase away monkeys from the farmland. A woman in Sindhupalchok shared the story of a physical attack by a monkey. She said, 'I was beaten by a

²1 ropani is equal to 0.05 ha.

monkey last year. I didn't have any tools with me at that time. The monkey came from the back and attacked me. I shouted and ran uphill and threw stones'.

These experiences point towards an increasing wildlife problem causing abandonment of cultivation practices. Some farmers reported that the growing wildlife problem has compelled them to abandon farmland and even to migrate. A farmer in Sindhupalchok reported, 'I and my two neighbors have moved uphill from the valley (*besi*). My neighbors' houses in the valley were next to the forest. We experienced intolerable sufferings from monkeys and leopards, and it made us leave the village' (D5S3HH5). The wildlife problem has led to a pressing challenge to food production and livelihood security in the mid-hills of Nepal, arguably further pushing rural households to seek alternative off-farm activities.

5.2 | Key drivers of the growing human-wildlife conflicts

Rapid socio-economic transformations in rural farming communities demand redefining the historical forest–people relations that have been contributing to a new form of human–wildlife interactions. As explained above, these socio-economic changes are also driving a forest transition creating a different type of forest ecosystem. The following are the key factors reshaping wildlife and farmers' interaction leading to intensifying wildlife problems in the farming landscapes.

First, *socio-economic drivers*: diversification of livelihoods and outmigration are important factors for forest transition in the mountain landscapes. However, forest increment has brought unintended negative consequences of wildlife problems to the farming communities. Further, with the shortage of labour force, tackling wildlife problems has become increasingly challenging. A man from Nilkantha municipality of Dhading said, 'In the past, a family used to have 10–12 members and there were plenty of hands for farming and guarding monkeys. But now many households have only women and elderly people at home. We hire labor from outside for agriculture work, but we have no one to guard crops against monkeys'. Further, a local government representative in the study sites claimed that increased wildlife problems pushed people to abandon farming and even outmigration. A local government representative from Sindhupalchok reported, 'My Ward has experienced a high level of wildlife problem and about 5 to 6 households from this Ward have out-migrated. Now you can see about 40 percent of households have abandoned part of their farmland primarily due to wildlife problems'.

Out-migration is a common phenomenon in Nepal (Blaikie et al., 1980; Kansakar, 1984). But in recent years, driven by the dual processes of increasing distress in farming in rural areas and the increasing opportunities of working abroad, the level of outmigration of adults (mostly men) as foreign labour has become phenomenal. Such an increase in outmigration has left indelible effects on the subsistence-based rural economy and farming. The migration has altered household demographic structure (Uematsu et al., 2016) and created an acute shortage of farm labour (Maharjan et al., 2020). Consequently, the abandonment of previously cultivated agricultural land has increased (Jaquet et al., 2015), further exacerbating wildlife problems. This explains the cyclical process of farming and outmigration and growing human-wildlife conflicts appears as an unintended outcome of this process.

Second, *changed forest ecology* (i.e. forest transition): most of the respondents highlighted that the increased forest coverage has created a favourable habitat and safe shelter for wild animals. This was mainly due to the restoration of degraded forest lands and increased tree coverage in the private land (Marquardt et al., 2016; Niraula et al., 2013). However, such views contradict somehow with the opinions of officials. During our field study, forestry officials favoured the view of forest regrowth and the creation of habitat that is not that favourable to wild animals, hence, pushing them into agriculture fields. They were convinced that denser forests do not necessarily provide food for wild animals.

For instance, a forest officer in Dhading district shared, 'Changing vegetation compositions with the dominance of bushy vegetation and reduced number of fruit tree species pushed wildlife out of the forests in a search for food'. As we will elaborate in the following section, some of the responses provided by district-level forest offices such as

planting fruit trees and construction of water ponds inside the forest are guided by this logic. This statement relates to some recent reports suggesting the abandonment of farmland and conversion into forests creating additional habitat for wild animals (see Baral et al., 2021). As Baral et al. (2021) argue, growing wildlife problems pushes farmers to abandon farming, following the cyclical process of growing wildlife problem and farmland abandonment in mid hills of Nepal.

It is worth noting that local collective action through CFUGs has played an important role in such forest transition. However, in recent years, there has been a gradual decline in forest utilization for subsistence purposes leading to reduced community participation in forest management (see also Poudyal et al., 2023; Sapkota et al., 2020). In the past, farming communities used forest for livestock grazing and to collect a wide range of products such as fodder, forage and fuelwood. However, in recent years, several changes such as declining population, declining livestock numbers and improved access to alternative sources of energy such as petroleum gas have generated a condition in which people are not using the forest as much. In community forestry practices, collective action is always correlated with the pattern of resource management and utilization. When communities start becoming indifferent to forest management and utilization, community collective action begins to weaken. Increased social inequality, individualism and commodification are contributing to the weakening of collective action, but the defining factor has been the socio-economic processes of delinking communities with common resources. Local communities were of the view that the decline in forest use in recent years has led to a change in forest density and hence increased wildlife habitats. An executive member of one of the community forest user groups in Sindhupalchok said 'With the decrease in regular cleaning and thinning activities in the forest in recent years, particularly after the 2015 earthquake, forests are turning into a bushy jungle. Forest provides shelter to monkeys but not food'. Further, one of the respondents in Ramechhap district said, 'We never expected that we were conserving forests for wildlife (specially the monkeys) to destroy our crops'. Such perception indicates the challenges faced by local collective action because of the growing wildlife problem.

Third, *fragmentation of habitats has intensified wildlife* problems. Habitat fragmentation indicates a process by which various infrastructure development, deforestation and new settlements divide the contiguous wildlife habitats into different fragments. In some cases, respondents reported that infrastructure development and urbanization have led to the fragmentation of forests into smaller patches and hence fragmented wildlife habitats. For instance, in Dhading district, road construction has fragmented large forest patches into smaller parcels. As a result, some communities experience more problems with herbivores such as monkeys and deer, and some communities have been experiencing growing problems of leopards killing domestic animals. Arguably, the fragmentation of forests has altered predator-prey relations and hence led to an increase in herbivore population in some areas and not enough prey animals for carnivores such as leopards in other areas. Local people in Dhading were of the view that leopards are without prey species (deer) in the jungle; therefore, they attack livestock. The growing problem of leopards entering settlements even in semi-urban and urban areas (Baral et al., 2021) has been attributed to habitat fragmentation.

Fourth, *policy and institutional drivers* are crucial in shaping forest transition. Community forestry policy and practices with an aim to regulate access and uses of forests, particularly by halting cattle grazing, have contributed towards forest recovery. While the community forestry regulations of forest use such as grazing control were important for achieving regrowth of the forest in the mountain areas; however, such rules alienated some marginalized groups from meeting their subsistence needs (Khatrī, 2018). We can see the growing wildlife problems as unintended consequences of the forest transition, primarily led by the community forestry policy and practices. Further, the conservation policy with a ban on hunting has impacted the dynamics of the common wildlife population. Some respondents have pointed out that the conservation policies that regard various traditional and indigenous practices as a crime have led to the increase in population of the key pest animals such as monkeys, wild boars and porcupines. Such blanket policies made for the conservation of emblematic animals via establishing protected areas appear as a major policy constraint for providing solutions to the growing wildlife problems in farming landscapes.

5.3 | Local innovations and policy responses

Amid rising problems, communities are not able to find better solutions to the growing human-wildlife conflicts in farming landscapes. This issue is widely discussed by the local media, and some rural municipalities have initiated discussions about possible responses. However, the policy response appears too little and too slow.

5.3.1 | Community responses

Communities have adopted three types of responses to deal with escalating wildlife problems: (1) continue guarding crops; (2) change in agriculture practices; and (3) abandoning farmlands.

As presented in Table 3, communities have adopted different techniques to scare animals away and guard the crops. Chasing monkeys away using Tibetan Mastiff dogs (*Bhote Kukur*) and making loud sounds using drums or even rifles is the most common and traditional practice farmers have continued for centuries. In recent years, a device has been developed with a loud sound akin to a rifle but produces an even louder sound to chase monkeys away. However, these techniques seem to have only short-term effects on monkeys. For the deer, people usually use

TABLE 3 Locals' response to deal with the wildlife problems in the study sites.

Response types and targeted animals	Examples
A more common practice of chasing monkeys was whistling, the use of Guleli (a locally made handheld weapon) and throwing stones. Some HHs keep Tibetan Mastiff dogs (<i>bhote Kukur</i>) and use them while chasing the monkeys	All of our three study sites practise these techniques.
Traditionally, people also used to use guns (rifles) to scare monkeys	Most of the respondents shared cautiously that people used to use rifles to scare the monkeys in the past. Even fake guns developed by the innovation centre target monkey control were used in Dhading (our site). However, it became ineffective as monkeys started getting accustomed to it.
Plantation of molasses grass that irritates monkeys because of stickiness and itchiness.	In Khimti, some households have planted molasses grass on the edges and boundary of <i>bari</i> land. The grass is sticky and disturbs monkeys. It worked for some time as monkeys would avoid visiting places where the grass was grown. However, they have grown accustomed.
Use of cage/wildlife trap	The cage is primarily aimed and used for the leopard. In Basaha village of Dhading, people made an iron cage to trap the leopard, but it has not been successful to trap even a single leopard. In Pharpu (Ramechhap), people have made two small traps for monkeys, and they caught a couple of monkeys too, but some people reported it to the police, so they have stopped using the trap now.
Guleli and pebbles (catapult)	Commonly used to chase away the wild animals such as monkeys, deer and even porcupines
Making the fences in some areas of <i>bari</i> land (for deer) (fencing for crop protection)	Particularly in Chyasku, farmers have made fences to protect vegetables from deer. Meshwire fencing has been used to protect the small area; however, it is too costly.
Guarding the crops at nighttime (mainly for Porcupine and wild boar)	In Selang and Baldang of Sindhupalchok, people have been guarding crops during the night but without much success.

fencing, and in the case of the nocturnal animals such as porcupine and wild boar, communities often guard crops during the night or use traps but with little effect.

Farmers have also adopted some collective guarding practices. For example, in Ramechhap, farmers guard crops from monkeys on a rotational basis involving several households. Similarly, in some cases, a number of households hire one individual to guard the monkey during the crop harvesting season and pay in kind (crop) as a wage (Onlinekhabar, 2022).

Farmers have also shifted cultivation patterns, that is, cultivate crops that are not easily damaged by animals. For example, in Ramechhap, people began to cultivate turmeric and lemon, which wild animals dislike, compared with the traditional cereals such as maize. In Dhading, farmers changed crop rotation expecting that wild boars would not damage certain crops such as millet. However, such rotation does not seem effective in many instances.

5.3.2 | Responses from the local governments (municipalities)

Municipal officials consulted during the district and provincial level workshops expressed that wildlife problems in their respective jurisdictions are one of the pressing issues. A representative of the NARMIN shared that almost 90% of the rural municipalities of the mid-hills are experiencing an increasing wildlife problem. The local governments have initiated some local responses, but the local government representatives see this as a major policy problem and need a response from the federal government.

Some municipalities have allocated budgets to support community responses, but such support has not been fully utilized in the absence of suitable solutions. A deputy mayor from Sindhupalchok mentioned, 'Although we have allocated budgets to tackle the wildlife problem for a couple of years, we don't know what could be done about it'. Another municipal member added, 'I am always puzzled about what I can say to the farmers regarding how to handle wildlife problems as they come to my office every day'.

Some municipality leaders also lobbied with the federal government for policy changes. The Ilam Municipality made decisions to request the federal government to amend the Forest Act 2019 responding to the control of monkeys (Dhakal, 2023) and allowing the hunting of pest animals. The municipal chair from Arghakhanchi, also an executive member of the NARMIN, has been leading a campaign to lobby with officials from the Ministry of Forest and Environment and the members of the federal parliament to make provision for hunting of pest animals. He shared his frustration with the inattentiveness of the officials in addressing the problem. The municipal chair from Arghakhanchi district made several efforts to address the monkey problem in his municipality, such as experimenting with several different techniques including the 'bang-gun' to produce loud sound, the use of artificial snakes and tigers to scare monkeys, requesting the Chief District Officer to allow hunting and hiring a monkey catcher from India and Western Nepal, but all the efforts went in vain.

Growing wildlife problems became an important political agenda in the recent local-level election held in May 2022. A mayoral candidate for the Rural Municipality in Bhojpur included the agenda to provide effective solutions to the problem of 'monkey terrorism' in his election manifesto (Onlinekhabar, 2022). Some of the provincial representatives have also raised this issue in the provincial parliament. For example, a member of the provincial parliamentarians of Bagmati Province in November 2022 raised the issue of wildlife problems highlighting the sufferings of people in Dolakha district.

The forest offices have also taken some initiatives focusing on containing wildlife in the forest through the promotion of fruit trees and managing water inside forests. For instance, at the district-level workshop in Ramechhap, an officer shared that his office has helped communities to construct a pond in the community forest area with the intent that wild animals will find water and reduce visits to farming areas. He also claimed that such interventions have reduced crop destruction by deer.

Farmers and other officials were of the view that such initiatives have limited effects in the long run, and there is a need for an effective policy response to control the population of pest animals. One of the forest officials of

Sindhupalchowk stated, 'growing wildlife problem in farming landscapes has become a policy problem [*ban byawasthapan nitigat samasya ho*]' . It is clear that the local-level efforts by community and local governments have remained inadequate, and thus, the farmers will suffer more if the federal government fails to provide an appropriate policy response.

5.3.3 | Responses at the national level

Growing problem of human-wildlife conflicts has started to draw the attention of policy makers. First, the mainstream national media have begun to cover stories of wildlife problems. For instance, Kantipur and Gorkhapatra, two major national daily newspapers, published cover stories of wildlife problems from various parts of the country in 2022 (Bhattarai, 2022). Such stories have not only highlighted the instances of crop damage, livestock killings and human casualties but also attempted to draw policy makers' attention highlighting the broader impacts to the rural livelihood. A story from far western Nepal presented a heart-wrenching story of how the growing problem of the monkeys has forced the villagers to out-migrate (Singh & Saud, 2023).

Second, the existing provisions of relief distribution are inadequate and can provide only short-term solutions. The guidelines are prepared to provide immediate relief for damage to the crops, livestock and human injuries.

Third, the alarming level of wild animal problems has also drawn the attention of researchers. In recent years, studies have started to document the growing wildlife problems and provide an analysis on the financial losses of the farmers. For example, a site-specific study of Baral et al. (2021) carried out in Kaski and Tanahu districts highlighted the increasing financial loss of rural farmers from increasing damage of the wildlife to crops and livestock. The findings of this study stated that 27% of the livestock numbers owned by their respondents were killed by wild animals within the last four years, incurring USD 142.61 per household, whereas overall crop damage was equivalent to USD 83,424. Similarly, Bista and Song (2021) found that 47% of the cropland parcels experienced crop-raiding, and 29% of the household lost livestock to wild animals. Yet, research in this field is sporadic and needs a more comprehensive understanding of the problems. However, the current policy measures are not only inadequate and inappropriate but also driven by the idea of managing HWC around protected areas. In a focus group meeting with the farmers in Banskharka Selang (Sindhupalchowk), participants mentioned that the government adopted and implemented conservation policies driven by international agendas of conserving diversity and wild animals, without a proper understanding of the ground reality of the farmers.

6 | CONCLUSION

The Himalayan ecosystems are changing rapidly and so are the socio-economic situations of the Himalayan communities. One of the major repercussions of these changes is the growing human-wildlife conflicts in farming landscapes and human settlements leading to disintegration of traditional subsistence farming-based livelihoods and displacement of people in an unprecedented way. By analysing the changing dynamics of interactions between day-to-day practices of subsistence farmers and wild animals in the mountain region, we have identified several theoretical and empirical insights that can help us better understand the complex socio-economic and ecological relationships emerging in the Himalayas and, subsequently, contribute to the growing scholarship on agrarian transition, political ecologies and biodiversity conservation in the new Himalayan socio-economic contexts of shifting population and environmental changes.

First, the growing wildlife problems in the farming and displacement of people from rural areas should be understood as a co-constitutive and conjunctural outcome of the two interrelated processes of agrarian transition and forest transition, both swiftly occurring in the Himalayan mountains. Community forestry restored the forest and the wildlife habitats shaping a new ecological condition in the Himalayas. Outmigration and the penetration of

market infrastructure have changed the rural economy and livelihood practices as a mode of new agrarian transition. Hence, the recent phenomenon of growing wildlife problems can be seen as an outcome of the forest transition fuelled by the change in agrarian practices and vice versa. These two processes of change are cyclical and self-reinforcing. On the one hand, labour outmigration and increasing move to off-farm livelihood options have contributed to forest transition process (including expansion of forest in private land); on the other hand, forest transition has led to a new human-wildlife relationships where some wild animals have become pests and causing more problems pushing people away from the subsistence farming practices. Second, these evolving interactions and dynamics between wildlife and people in the Himalayas can be explained as a new socio-ecological system where the material change in the forest and shifting day-to-day livelihoods activities led to a cyclical and conjunctural relationships creating the conditions of their own reproduction. Drawing from and contributing to various concepts of political ecology, socio-nature and agrarian political economy, the framework of socio-ecological system provides an angle to examine everyday practices and the earthly materiality of the landscape in defining particular human-wildlife interactions in the Himalayas. Third, community collective action is directly correlated with the access to, uses of and the materiality of the common resources. Communities are always heterogenous, and hierarchical but collective action continued to protect and manage community forestry in Nepal. But as the people are becoming less reliant on forest resources for day-to-day livelihoods, the intensity of collective action is degrading or disappearing. The functioning of community forestry institutions that played role for the restoration of degraded mountain landscapes is facing new challenges. There is a growing frustration among farmers about the negative consequences of recovery of the forest with their decades of efforts to conserve and manage. Hence, the theory of collective action needs further attention, and the case of Nepal demands revisiting its logics, institutions and incentives.

At the practical level, this new socio-ecological system results in a different form of forest-wildlife interactions with important implications for the future of farm-based livelihoods. The high level of wildlife problems will continue to displace smallholder farmers, and more farmers will abandon part of their cultivated land and seek alternative off-farm activities to sustain their livelihoods. Similarly, the growing wildlife problem as a result of declining management interventions in the community forests is noteworthy. Our findings suggest that there is a declining trend in management interventions in the community forests because of reduced utilization of forest products for subsistence needs (see Poudyal et al., 2023). Likewise, in the mountain region, over emphasis on conservation of the forests (Baral et al., 2019; Rutt et al., 2015) and cumbersome administrative procedures stands as an obstacle to promote people centred management practices, and this is done by Yadav et al. (2003), meaning limiting local autonomy of making decisions when it comes to harvesting of timber (Khatri et al., 2022). Hence, we see the need for further research towards developing a comprehensive understanding of the everyday dynamics and evolving relations between ecological changes in community forests and growing wildlife problems in the rural areas.

Our findings have resonance with the argument that the growing wildlife problem is, in part, an outcome of existing conservation policies and protected area approach excluding human interventions (Adams & Hutton, 2007; de Silva & Srinivasan, 2019). Therefore, reimagining current wildlife conservation policies is an urgent task, and the emerging new socio-ecological systems must be incorporated in developing policy measures.

The topic of new human and wildlife interactions in the Himalaya must be studied comprehensively to answer some of the lingering questions. First, we need a greater understanding on how the community heterogeneity and power differentiation play a role in this phenomenon and who are impacting more than others may provide us a better knowledge about differentiated impacts to smallholder farmers. Second, a deeper understanding of the relations between conservation and community forestry policies and the changing human-wildlife relations, particularly outside of protected areas, is important. Such understanding will help us rethink biodiversity conservation policies taking account of the changing forest-people relations so that our conservation policies and approaches can appreciate both biodiversity conservation needs and human wellbeing. With the understanding of these new trends in human-wildlife interaction, we will be better equipped to develop measures that incorporate what the growing wildlife problems means for the future of land-based livelihoods and how they overlay with other stressors such as climate change and market.

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CONFLICT OF INTEREST STATEMENT

There is no conflict of interest involved.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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