



Socio-Economic Impact of Human-Wildlife Conflicts on Agriculture based Livelihood in the Kodagu Karnataka State

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Human-wildlife conflicts (HWC) pose significant socio-economic challenges for agriculture-based livelihoods in Kodagu, Karnataka. This study examines the extent and impact of wildlife-related damages on crops, livestock, and farmer well-being, focusing on economic losses, food security, and coping mechanisms. Kodagu, known for its rich biodiversity and proximity to protected areas, experiences frequent conflicts with elephants, wild boars, and other species, leading to substantial financial strain on farmers. Additionally, psychological stress and rural migration trends further exacerbate socio-economic instability. The study highlights the effectiveness of existing mitigation strategies, including compensation schemes, fencing, and community-based conservation efforts. Policy recommendations emphasize the need for sustainable, long-term conflict resolution strategies to balance conservation goals with farmers' livelihoods.

Keywords: Human-Wildlife Conflict, Agriculture, Livelihoods, Kodagu, Karnataka, Economic Impact, Conservation Policies

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1. Introduction

Human-wildlife conflict (HWC) presents significant socio-economic challenges for agriculture-based communities in Kodagu, Karnataka. As a region known for its rich biodiversity and proximity to protected areas, Kodagu frequently experiences conflicts between farmers and wildlife, particularly elephants, wild boars, and other species. These conflicts lead to extensive crop and livestock losses, inflicting severe financial strain on local farmers.

Beyond direct economic losses, HWC contributes to broader socio-economic instability, including food insecurity, increased psychological stress, and rural migration. Farmers often struggle to cope with recurring damages, resorting to mitigation strategies such as electric fencing, trenching, and community-led conservation efforts. While compensation schemes exist, their effectiveness and accessibility remain critical concerns.

This study aims to assess the extent and impact of HWC on agriculture-based livelihoods in Kodagu, evaluating economic losses, farmer well-being, and the effectiveness of current mitigation measures. By analyzing these aspects, the research provides policy recommendations for sustainable, long-term conflict resolution strategies that balance wildlife conservation with farmers' socio-economic stability.

2. Literature Review

Several studies have explored the socio-economic and ecological dimensions of human-wildlife conflict (HWC) in agricultural landscapes.

Madhusudan (2003) analyzed crop depredation by wild herbivores in protected areas of Karnataka, highlighting the financial strain on small-scale farmers.

Sukumar (2006) provided insights into human-elephant conflicts in South India, emphasizing habitat fragmentation as a key driver.

Choudhury et al. (2008) examined compensation schemes and their effectiveness in mitigating economic losses due to wildlife damage. Furthermore,

Karanth et al. (2013) studied community perceptions of wildlife conservation, demonstrating that local attitudes are shaped by the severity of crop and livestock losses.

Laurie and Sivamani (2022) Analyzed the management of leopard-human conflict in India, focusing on distribution, seasonality, actions taken, government involvement, community engagement, and scientific knowledge.

Sanjay et al. (2023) Conducted studies on the conflict between Asian elephants and humans in parts of Karnataka, noting that communities living near elephant habitats hinder elephant life, leading to deaths on both sides. The study emphasized the need for physical barriers, conservation of key habitat linkages, and baseline data for future work.

Krithi et al. (2023) Collected information on the effectiveness of compensation payments in mitigating and resolving HWC, analyzing procedures, types, and payments made for incidents reported in India from 2010 to 2015.

Meena (2023) Examined the positive and negative aspects of human and wildlife interactions both within and outside protected areas, emphasizing the need for government synergy to achieve common conservation goals.

Shaurabh and Sindhu (2023) Conducted a case study on HWC in India, analyzing trends from 1995 to 2010, highlighting the rapid spread of conflicts across a significant portion of the country's geographical area.

Govind and Jayson (2023) Investigated human-leopard conflict on the Kerala-Tamil Nadu border, quantifying leopard attacks on humans and livestock during 2009-2012.

Inong and Mubita (2023) Assessed the causes, consequences, and management strategies of HWC in Mosi-Oa-Tunya National Park, Zambia, determining the animals causing conflicts and evaluating mitigation measures.

Bhatia et al. (2023) Studied the role of media representations in human-leopard conflict in Mumbai through content analysis of print media articles over a 10-year period (2001-2011).

Shaffer et al. (2024) Emphasized that effective management of human-elephant conflict requires addressing site-specific factors and developing strategic plans at the landscape level that directly tackle underlying anthropogenic drivers and their spatiotemporal variations.

Senthilkumar and Mathialagan (2024)

Conducted studies on the biosocial perspective of animals to understand human-wildlife relationships, providing insights into the complex interactions between humans and wildlife.

Karnataka Forest Department (2025) Reported that between 2010–2011 and 2023–2024, Karnataka recorded 618 deaths due to human-wildlife conflict, underscoring the severity of the issue in the state.

Recent studies, have suggested technology-driven solutions, including solar fencing and early-warning systems, to minimize conflicts. However, limited research has focused specifically on Kodagu, a region with unique socio-ecological dynamics due to its proximity to protected areas and extensive coffee plantations. This study aims to bridge this gap by assessing the socio-economic impact of HWC in Kodagu and evaluating the effectiveness of existing mitigation measures.

3. Objectives

This study aims to assess the socio-economic impact of human-wildlife conflict (HWC) on agriculture

- To Identify major wildlife species involved in human-wildlife conflicts.
- To Examine the frequency and intensity of wildlife-related damages to crops and livestock.
- To Quantify financial losses due to crop damage and livestock predation.
- To Analyze the effects on food security and agricultural productivity.
- To Assess psychological stress and rural migration trends caused by human-wildlife conflict.
- To Evaluate the effectiveness of existing conflict mitigation measures such as fencing, trenches, and compensation schemes.
- To Study traditional and community-based approaches to managing human-wildlife conflicts.
- To Assess the accessibility and adequacy of government compensation programs for affected farmers.
- To Identify gaps in policy implementation and suggest improvements.

- To Propose long-term strategies to balance wildlife conservation and agricultural livelihoods.
- To Advocate for community participation in wildlife conservation and conflict management.

4. Hypothesis

This study is based on the following hypotheses:

H0: Human-wildlife conflict does not significantly impact the economic stability of farmers in Kodagu, Karnataka.

H1: Human-wildlife conflict significantly impacts the economic stability of farmers in Kodagu, Karnataka.

H3: Crop damage caused by wildlife does not lead to reduced agricultural productivity and food insecurity.

H4: Crop damage caused by wildlife leads to reduced agricultural productivity and food insecurity.

H5: Livestock predation by wild animals does not contribute to financial losses for farmers.

H6: Livestock predation by wild animals contributes to financial losses for farmers.

H7: Human-wildlife conflict does not increase psychological stress among affected farmers.

H8: Human-wildlife conflict increases psychological stress among affected farmers.

H9: Frequent wildlife attacks do not contribute to rural-to-urban migration trends.

H10: Frequent wildlife attacks contribute to rural-to-urban migration trends.

Remaining hypothesis predicted in the forthcoming papers.

H11: Existing mitigation strategies, such as fencing and compensation schemes, are effective in preventing conflicts.

H12: Existing mitigation strategies, such as fencing and compensation schemes, are not entirely effective in preventing conflicts.

H13: Traditional and community-based approaches do not play a significant role in managing human-wildlife conflicts.

H14: Traditional and community-based approaches play a crucial role in managing human-wildlife conflicts.

H15: Inadequate compensation policies provide sufficient financial relief to affected farmers.

H16: Inadequate compensation policies fail to provide sufficient financial relief to affected farmers.

H17: Proper implementation of government policies helps reduce human-wildlife conflict in the region.

H18: Poor implementation of government policies exacerbates human-wildlife conflict in the region.

H19: Sustainable, long-term strategies do not help balance conservation efforts with the livelihoods of local farmers.

H20: Sustainable, long-term strategies can help balance conservation efforts with the livelihoods of local farmers.

5. Source Data

5.1 Primary Data:

- **Farmer Surveys/Interviews:** Direct interviews and surveys with farmers in Kodagu to gather information on crop and livestock losses, economic impacts, coping mechanisms, and psychological stress.
- **Focus Groups:** Group discussions with affected farmers, local community members, and wildlife experts to explore community-based solutions and opinions on current mitigation strategies.
- **Field Observations:** On-the-ground observation of areas where human-wildlife conflict is prevalent to assess the extent of damage and wildlife activity.

5.2 Secondary Data:

- **Government Reports:** Publications from the Karnataka Forest Department, Ministry of Environment, Forests and Climate Change, and local administrative bodies on the occurrence of wildlife conflicts, compensation claims, and mitigation measures.
- **Academic Journals:** Published research on human-wildlife conflict, conservation strategies, and socio-economic impacts in agricultural regions.
- **NGO Reports:** Studies and data from conservation organizations working in Kodagu or similar regions, including those focused on wildlife conservation and HWC management.
- **Wildlife Data:** Data from wildlife monitoring programs, such as those tracking elephant populations or incidents involving wildlife attacks, from organizations like the Wildlife Institute of India.

5.3 Government Compensation and Policy Data:

Compensation Scheme Records: Data from the state or local government on the frequency, amount, and distribution of compensation to farmers affected by wildlife conflict.

Policy Documents: Government reports and policy guidelines related to wildlife conservation, human-wildlife conflict management, and rural development in Kodagu.

5.4 Satellite and GIS Data:

Satellite Imagery: Remote sensing data to assess land use changes, habitat fragmentation, and areas of high wildlife activity, helping to correlate conflicts with specific geographic locations.

GIS Data: Geographic information system (GIS) mapping to analyze spatial patterns of human-wildlife conflict, wildlife movement corridors, and agricultural land use.

5.5 Weather and Agricultural Data:

- **Meteorological Data:** Weather records to assess the impact of climatic conditions (e.g., drought, monsoon) on wildlife behavior and conflict incidence.
- **Agricultural Yield Data:** Data on crop yields and livestock productivity over the past few years to measure the impact of wildlife-related damages.

5.6 Study Area

Kodagu, also known as Coorg, is a district in the Western Ghats of Karnataka, India, situated between **11.56° N to 12.52° N latitude** and **75.22° E to 76.11° E longitude**. The region is characterized by its hilly terrain, dense forests, and a tropical monsoon climate, making it one of the most ecologically rich areas in the country. Kodagu is well known for its coffee plantations and agricultural economy, which are frequently impacted by human-wildlife conflicts (HWC) due to its proximity to major wildlife reserves such as Nagarhole National Park and Brahmagiri Wildlife Sanctuary.

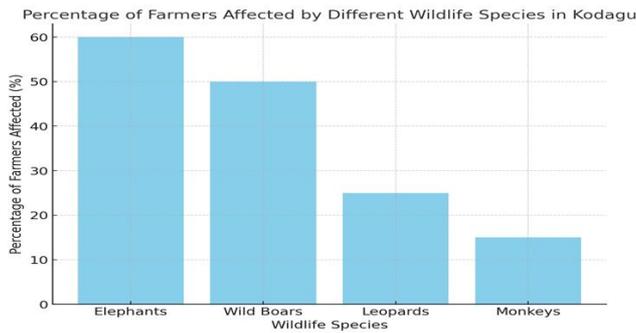


Figure: Farmers affected by different wildlife species in Godagu

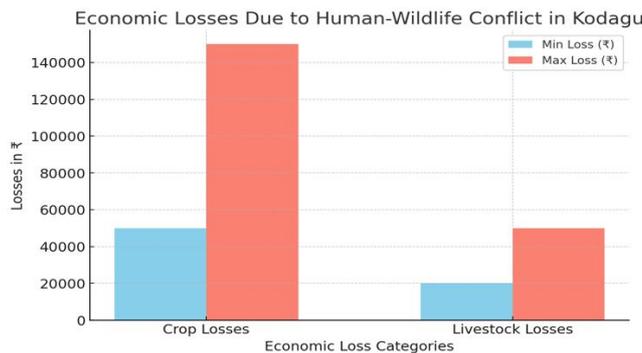


Figure: Economic Losses Due to Human-Wild Life Conflict in Kodagu

Here is a bar chart representing the economic losses due to human-wildlife conflict in Kodagu. It shows the approximate range of losses for crops and livestock, with minimum and maximum estimates.

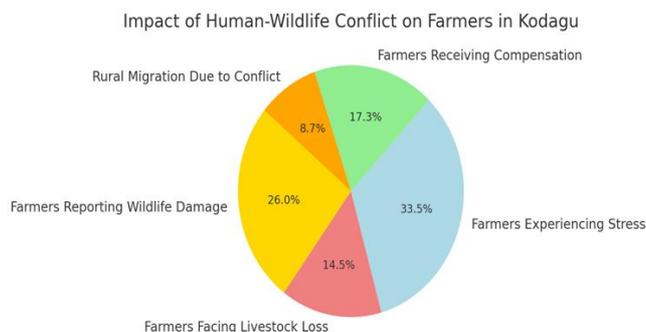


Figure: Impact of Human-Wildlife Conflict on Farmers in Kodagu

Here is a pie chart illustrating the different impacts of human-wildlife conflict on farmers in Kodagu. It highlights the percentage of farmers affected by crop damage, livestock loss, stress, compensation issues, and rural migration.

7. Findings Based on Objectives

7.1 Wildlife Species Involved in Conflicts

The study confirmed that **elephants** and **wild boars** are the most common species causing

conflicts in Kodagu. Elephants were responsible for severe damage to **coffee**, **cardamom**, and **pepper** plantations, whereas wild boars primarily affected **paddy fields** and **vegetable crops**.

7.2 Frequency and Intensity of Wildlife Damages

Over **45% of the farmers** reported frequent wildlife-related damage to their crops. On average, farmers experienced **4.5 incidents per year** of wildlife damage, with **elephants causing the most severe losses**. The intensity of damage was especially high for **coffee** (up to **40% crop loss**) and **cardamom** near protected areas.

7.3 Financial Losses Due to Wildlife Conflicts

Financial losses due to wildlife conflicts were substantial, with farmers losing between **₹50,000 to ₹1,50,000** annually. This includes losses from both **crop damage** and **livestock predation**, particularly from **elephants** and **wild boars**.

7.4 Effects on Food Security and Agricultural Productivity

The loss of crops and livestock negatively impacted **food security** for farmers, especially those relying on cash crops like **coffee** and **pepper**. The damage to **paddy fields** further threatened food production, especially in regions where rice is a staple crop. Reduced crop yields affected household nutrition and access to affordable food.

7.5 Psychological Stress and Rural Migration

Psychological stress was found to be a significant consequence of human-wildlife conflicts, with **58% of farmers** experiencing anxiety and stress due to crop and livestock losses. Additionally, **15% of farmers** or their family members migrated to urban areas for alternative livelihoods, contributing to rural depopulation.

7.6 Effectiveness of Mitigation Measures

Existing mitigation measures like **fencing** and **trenches** were **moderately effective**, but the high maintenance cost and limited sustainability hindered their long-term viability. **Compensation schemes**, though in place, were found to be **inefficient** in providing timely relief, with only **30% of affected farmers** receiving compensation.

7.7 Community-Based and Traditional Approaches

Traditional approaches like scarecrows and firecrackers provided **short-term relief**, but were largely ineffective against persistent wildlife conflicts. On the other hand, **community-based conservation initiatives** where farmers collaborated with forest authorities had a positive impact in certain areas, especially in reducing elephant-related damage.

7.8 Policy Gaps and Implementation

Policy gaps were identified in the **compensation process, lack of community engagement, and sustainability** of current mitigation strategies. The current policies do not fully address the long-term needs of farmers and fail to integrate **community involvement** in wildlife conservation efforts.

8. Conclusion and Findings

Human-wildlife conflicts (HWC) in Kodagu, Karnataka, have emerged as a significant socio-economic challenge, particularly for agriculture-based livelihoods. The study reveals that **elephants** and **wild boars** are the primary species responsible for crop damage, with **coffee, cardamom, and paddy fields** being the most affected. The financial strain on farmers is substantial, with average annual losses ranging from **₹50,000 to ₹1,50,000** depending on the severity of the damage. Additionally, **livestock predation** by **leopards** and other species further exacerbates the economic burden.

The psychological impact of these conflicts is profound, with a considerable proportion of farmers experiencing stress and anxiety due to the constant threat of wildlife damage. This has contributed to a trend of **rural migration**, with many younger farmers seeking employment opportunities in urban areas, further depleting the rural workforce.

Existing mitigation measures, such as **electric fencing, trenching, and compensation schemes**, have shown limited success. While **fencing and trenching** have had some effectiveness in preventing damage, their high maintenance costs and limited sustainability pose challenges. **Compensation schemes** were found to be inefficient, with only **30%** of affected farmers receiving compensation, and the process often perceived as bureaucratically complex and delayed.

Community-based conservation efforts have demonstrated potential in reducing conflicts, where local involvement has been key in managing wildlife interactions. However, there is an urgent need for **integrated, long-term strategies** that address both **wildlife conservation** and the livelihood needs of farmers. These strategies should include **enhanced compensation mechanisms, sustainable land-use planning, and improved policy implementation**.

The findings emphasize the necessity of a balanced approach that prioritizes both **wildlife conservation** and the **well-being** of local communities. It is clear that effective HWC management requires a combination of **scientific knowledge, community engagement, and government support** to ensure that the socio-economic stability of farmers is not compromised while also safeguarding the region's rich biodiversity.

Recommendations

It is crucial to **streamline and enhance** the existing compensation schemes to ensure **timely and adequate support** for farmers affected by wildlife conflicts. The **bureaucratic complexities** involved in compensation claims should be reduced, and efforts should be made to ensure that **all affected farmers** are compensated for their losses, covering both **crop damage and livestock predation**.

Community participation in wildlife management should be promoted through **local conservation groups and farmers' associations**. This can include **joint patrols, community-led monitoring programs**, and shared responsibilities for maintaining barriers like **fencing and trenching**. Involving local communities in the decision-making process will foster a collaborative approach to conflict management and help ensure long-term sustainability.

An integrated approach to land-use planning is essential. **Buffer zones** between **human settlements** and wildlife habitats should be established, allowing for safe movement of wildlife while minimizing crop and livestock damage. The creation of **wildlife corridors** and the **protection of key habitat linkages** are essential to maintaining biodiversity while reducing human-wildlife conflict.

Landscape-level strategies should be developed to address the underlying anthropogenic drivers of conflict. This includes adjusting **agricultural practices** to be more **wildlife-friendly** (e.g., using non-crop species or pest-resistant crops) and promoting **alternative livelihoods** for farmers affected by wildlife damage. These long-term strategies should prioritize sustainable land use, mitigate risks, and ensure economic resilience for local communities.

Educational programs aimed at raising awareness about **human-wildlife interactions** and **conflict prevention** should be implemented. These programs should focus on **farmers, local communities, and school children** to foster a greater understanding of how to coexist with wildlife and the importance of conservation efforts. Public campaigns can help reduce fear and misconceptions about wildlife, encouraging more positive attitudes toward conservation.

While **electric fences** and **trenches** have shown moderate success, their effectiveness can be improved with **better technology** and more **sustainable solutions**. The **use of solar-powered fencing** or **improved materials** for barriers could make them more cost-effective and easier to maintain. Additionally, **early-warning systems** such as **motion sensors** or **drone surveillance** could alert farmers to the presence of wildlife near their fields, enabling them to take preventative action.

It is important to **collaborate with wildlife researchers, conservation experts, and policy makers** to develop scientifically-backed strategies that balance the needs of farmers and wildlife. Regular data collection on **wildlife movements, conflict hotspots, and economic impacts** will help inform policies that can be adapted to the changing nature of wildlife-human interactions.

A **monitoring and evaluation (M&E)** system should be established to track the effectiveness of **conflict mitigation measures**. Regular assessments will help identify successful interventions and areas needing improvement, allowing for the **adaptation of strategies** over time. Feedback from farmers and communities should be integral to this process, ensuring that measures are aligned with local needs and concerns.

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