



Human-wildlife Conflict Management Conflict to Co-existence Strategy for Gakiling Gewog (2026-2030)



**Divisional Forest Office, Sarpang
Department of Forests and Park Services
Ministry of Energy and Natural Resources**

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Table of Contents

Acronyms	4
Acknowledgement	1
1. Introduction	2
2. Goal & Objectives.....	2
Goal	2
Objectives.....	3
3. Methodology	3
3.1 Description of Site.....	3
3.2 Method: C2C Framework	4
4. Result and Discussion	12
4.1 Demography and social information	12
4.2. Results at Gewog Level.....	12
4.2.1 Conflict species.....	13
4.2.2 Status of Outcomes at Gewog level.....	15
4.2.3. Status of Elements at Gewog level	16
4.3. Chiwog-wise Results	19
4.3.1. Gakiling Chiwog	19
4.3.2. Menchulam Chiwog	21
4.3.3. Rilangthang Chiwog.....	22
4.3.4. Sangkha Chiwog	24
4.3.5. Gaytemkha Chiwog.....	27
5. Conflict to Coexistence Strategy	29
6. Monitoring and Evaluation	35
6.1 Monitoring.....	35

6.2 Evaluation.....	35
7. Conclusion	38
References	38

Acronyms

Acronym	Full Form
C2C	Conflict to Co-existence
HWC	Human–Wildlife Conflict
DFO	Divisional Forest Office
DoFPS	Department of Forests and Park Services
WWF	World Wildlife Fund
IKI	International Climate Initiative
UNDP	United Nations Development Programme
NBC	National Biodiversity Centre
QRT	Quick Response Team
HEC	Human–Elephant Conflict
SoP	Standard Operating Procedures
SMART	Spatial Monitoring and Reporting Tool
RO	Range Officer
UI	Understanding Interactions
IUCN	International Union for Conservation of Nature
SSC	Species Survival Commission
FMID	Forest Monitoring and Information Division
NCD	Nature Conservation Division
NAAEE	North American Association for Environmental Education
NPDC	National Poultry Development Centre
DoST	Department of Surface Transport

Acknowledgement

The C2C Strategy for Gakiling gewog is the result of a collective and dedicated effort by the staff of the Divisional Forest Office, Sarpang. The Division sincerely acknowledges the commitment, professionalism, and teamwork demonstrated by all officers and staff who contributed their time, experience, and technical inputs toward the successful formulation of this strategy. Their sustained engagement throughout the process ensured that the document is comprehensive, practical, and grounded in field realities.

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The Division would like to extend special appreciation to Mr. Wangdi, Senior Forestry Officer of DFO-Sarpang, who played a crucial leadership role in guiding and coordinating the formulation of this strategy. His dedication, technical oversight, and leadership were instrumental in bringing the C2C planning process to completion. Finally, the Division extends its heartfelt thanks to all individuals, institutions, and stakeholders who, in various capacities, contributed to the development of this strategy. Their collective efforts have resulted in a key milestone that will guide Human Wildlife Conflict management and their co-existence in Gakiling Gewog in the years to come.

1. Introduction

Human-wildlife conflict (HWC) is a pressing issue in Bhutan, a country renowned for its commitment to conservation and environmental sustainability. Bhutan's forests cover approximately 69.71% (DoFPS, 2023) and it is rich in biodiversity with over 11,000 species officially documented within its borders (NBC, 2019). The country encounters the complex challenges that arise from coexistence with wildlife. As a subsistence farming society with over 54% of its population dependent on agriculture (UNDP, 2021), Bhutan faces significant conflicts, particularly in areas where human settlements and agricultural lands are in close proximity to wildlife habitats.

Sarpang Dzongkhag, located in the southern part of Bhutan, exemplifies these challenges. With extensive forest cover and diverse habitats, it is home to various wildlife species, including elephants, barking deer, peafowl and wild pigs, which frequently come into conflict with local communities. Incidents such as crop depredation, property damage and occasional human injury and death threaten both livelihoods and safety, posing obstacles to sustainable development goals like poverty eradication and environmental conservation.

Recognizing the need for a holistic and collaborative approach, the Conflict to Coexistence (C2C) strategy has been developed with support from WWF-IKI. The C2C approach emphasizes a process driven, inclusive effort involving local communities, service providers, and some local leaders, aiming to transform conflict scenarios into opportunities for coexistence. Through detailed assessments, stakeholder engagement, and adaptive management, this strategy seeks scalable solutions that ensure the protection of biodiversity while safeguarding the livelihoods of rural populations.

This document reflects the result of recent field assessments, community consultations, and strategic planning in Gakiling gewogs, emphasizing a pathway toward sustainable coexistence. By integrating scientific insights, local knowledge, and policy support, Bhutan aims to ensure that its rich biodiversity and thriving communities can coexist peacefully, setting an inspiring example for conflict management in shared landscapes.

2. Goal & Objectives

Goal

“To ensure harmonious co-existence between wildlife and people through holistic approach”.

Objectives

- Safeguard people and their livelihood/assets alongside wildlife presence.
- Secure wildlife and its habitat to sustain a healthy and resilient wildlife population.

3. Methodology

3.1 Description of Site

Gakiling Gewog is located in Sarpang Dzongkhag, covering an extensive area of 785 square kilometers (km), with forests making up 70% of its landscape and elevations ranging from 227 to 2361 meters (Figure 1). The Gewog is home to 539 households and a population of 2,036 people, with an almost equal number of males (n=1,045) and females (n=991). Residents enjoy full access to basic services such as drinking water, electricity, and mobile network coverage. Drinking water is supported by four Rural Water Supply Schemes.

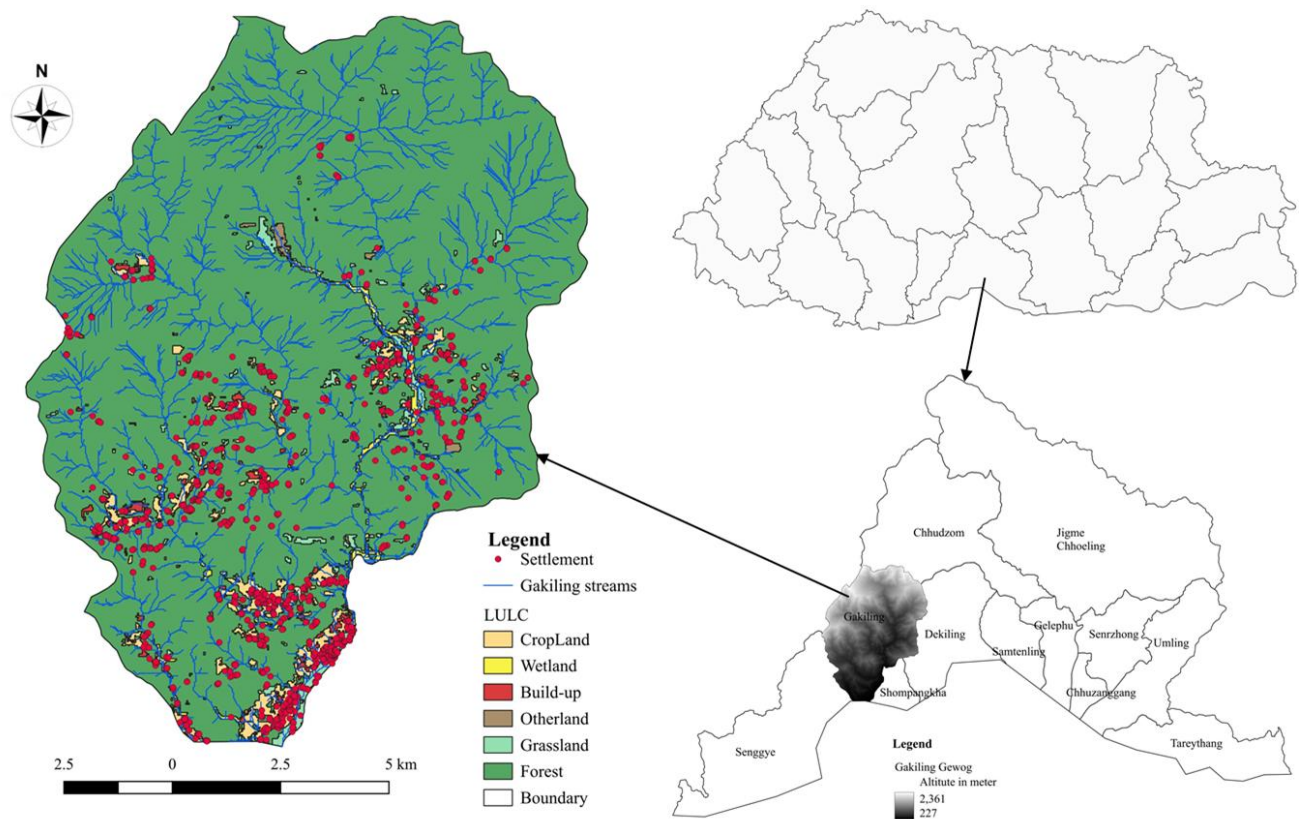


Figure 1: Location of C2C area

Agriculture plays a vital role in the local economy, with 338.54 acres of wetland and 1,122.21 acres of dryland, most of which is cultivated. This is supported by around 30 km of irrigation channels and 26 km of electric fencing (only 15% are functional). Several informal vegetable farming groups and five active cooperatives contribute to food production, while livestock farming includes informal poultry layers and broiler groups. There are no piggery groups but there are about 21 fishery ponds. Additionally, 154 households use biogas systems. Gewog actively manages its natural resources through six Community Forest Groups. Education is well supported with a Primary School with extended classroom, two Early Childhood Care and Development (ECCD) Centers, and three Non-Formal Education (NFE) Centers.

3.2 Method: C2C Framework

The C2C framework (Figure 2) presents a holistic and structured approach to transforming HWC into sustainable coexistence. It centers around four interconnected outcomes: safeguarding human well-being, conserving wildlife, protecting livelihoods and assets, and preserving natural habitats. These outcomes reflect the need for balanced, win-win solutions that benefit both people and wildlife. For example, preventing elephant raids not only secures crops but also aids in elephant conservation. To achieve this, the framework outlines six interdependent management elements: strong policy and governance, proactive prevention measures, rapid response to conflicts, understanding human wildlife interactions through research and local knowledge, mitigation of immediate impacts, and continuous monitoring. These elements function in a cyclical and adaptive manner, evolving with ecological and social conditions.

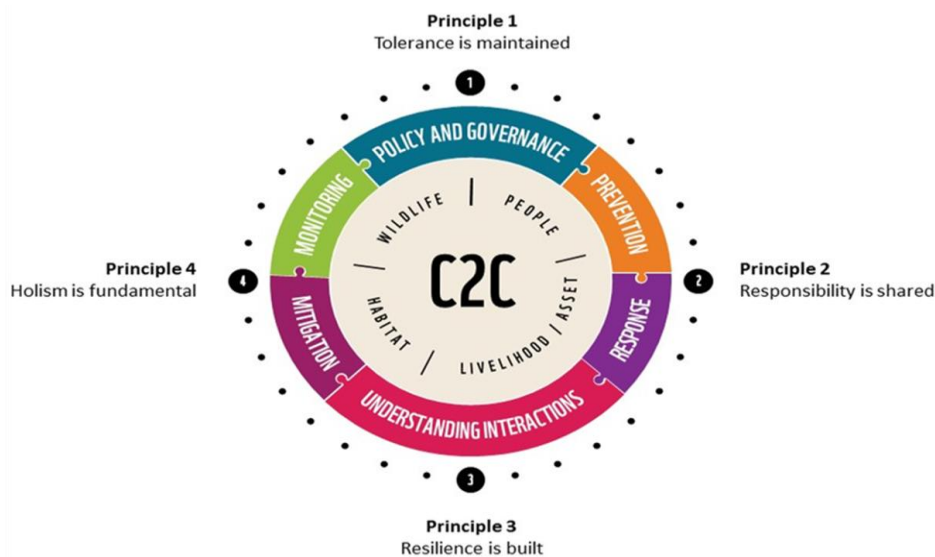


Figure 2: C2C: Conflict to Coexistence Framework

Primarily the framework are four guiding principles: tolerance, shared responsibility, resilience, and holism. Tolerance encourages communities to accept wildlife through education and cultural change, while shared responsibility ensures that governments, NGOs, and locals collaborate equitably in managing conflict. Resilience focuses on strengthening both ecosystems and human communities, and holism integrates conservation with broader socio-economic and cultural contexts. The C2C model fosters long-term change by building trust, leveraging local insights, and aligning conservation with community development. It serves as a comprehensive roadmap for turning conflict into coexistence, offering communities and conservationists the tools to create harmony between people and wildlife.

3.2.1 C2C Process

Step 1 Context Screening

The C2C Context Screening Form was used for assessing HWC in Gakiling gewog. This framework facilitates a comprehensive analysis of the landscape by integrating ecological, social, and policy dimensions. Prior to filling out the form, all available baseline information was collected from previous assessments, published literature, and social landscape mappings to ensure the accuracy of context screening. The screening process began with a detailed landscape description, capturing demographic data, land-use patterns, and the presence of protected areas within the site. Understanding the population density, community livelihoods, and tourism activities is crucial in determining how human settlements interact with wildlife and what factors contribute to conflict risks.

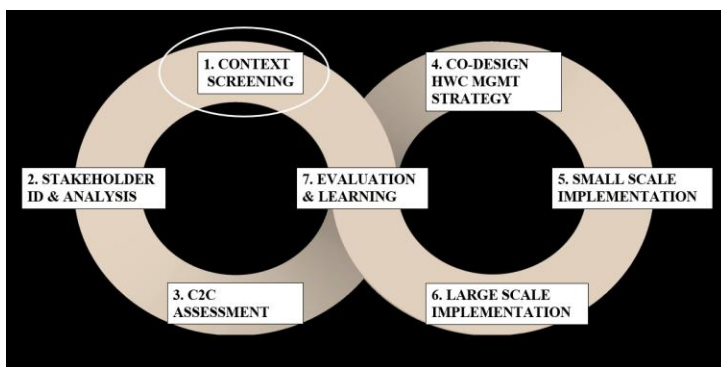


Figure 3: Step one context screening of HWC

A significant part of the screening focused on HWC trends, categorizing conflict species and assessing their impact on communities. The form documented the frequency and severity of encounters between humans and wildlife, analyzing incidents such as crop raids, livestock predation, and infrastructure damage. It also identified hotspots where such conflicts were prevalent and evaluated community

tolerance levels toward wildlife. Additionally, available conflict management methods, both past and present, were recorded to assess their effectiveness. The identification of drivers of conflict both anthropogenic (such as land-use changes and illegal hunting) and natural (such as climate change and food scarcity) provided insights into the root causes influencing human wildlife interactions. These underlying factors helped shape targeted mitigation strategies that addressed conflict at its source.

Beyond ecological factors, the screening also explored social dynamics, examining community heterogeneity, governance structures, and stakeholder power dynamics in managing HWC. This assessment ensured that coexistence strategies are inclusive and participatory, fostering community engagement in conservation efforts. The wildlife dynamics section investigated species population trends, movement patterns, and behavioral adaptations that contributed to conflict. Changes in wildlife behavior, dispersal routes, and learned habits provide essential information for developing species specific mitigation strategies. Finally, the screening reviewed policy frameworks, governance structures, and institutional support mechanisms that influence HWC management in Gakiling Gewog. Legal instruments, funding availability, and administrative capacity were analyzed to determine the feasibility of long-term coexistence strategies.

By systematically evaluating these categories, the C2C Context Screening Form provided a holistic foundation for designing adaptive and evidence-based conflict mitigation measures.

Step 2 Stakeholder identification and Analysis

Stakeholder identification and analysis (Figure 4) play a crucial role in the effective management of HWC, as different groups hold varying levels of interest, influence and availability in shaping mitigation strategies. In Gakiling Gewog, stakeholders were systematically assessed using the Stakeholder Analysis Matrix (C2C Tool 5) to determine their roles and collaborative potential in the C2C approach. This structured evaluation grouped stakeholders based on their involvement, categorizing them into directly affected parties, management contributors, and influential entities.

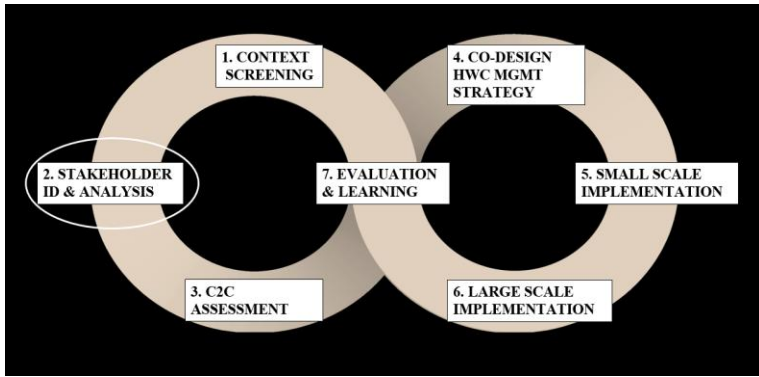


Figure 4: Step two stakeholder identification and analysis

The stakeholder identification process was carried out by a core team comprising the Deputy Chief Forestry Officer, IKI project focal, Division Section heads, Range Officer, HWC focal, local government officials, Gewog Agriculture and Livestock Extension Supervisors, and Tshogpas from five Chiwogs. This diverse team ensured a holistic assessment, capturing perspectives from both conservation authorities and local governance representatives. The stakeholder matrix employed a systematic ranking approach, answering a series of questions on a scale of 1 to 5 to evaluate four key aspects: their interest in HWC management, their influence on the long-term success of conservation strategies, and their availability for active participation in the co-design and implementation of interventions.

Analysis of stakeholder engagement revealed a diverse range of influences and interest levels. Groups with high interest, high influence, and high availability, such as the Gup, Tshogpa, concerned Range Officer (RO), and Quick Response Team (QRT) members, were identified as key actors in shaping and implementing management strategies. These stakeholders play a decisive role in mobilizing community support, ensuring policy implementation, and facilitating ground level interventions. Those with medium influence, such as Municipal Office, Integrated Check post, and Department of Surface Transport (DoST) are essential for information dissemination and resource coordination, supporting conflict resolution through awareness-building and institutional engagement.

Meanwhile, stakeholders with low influence such as farmers primarily contribute to ground level implementation, actively engaging in adaptive livelihood practices. On the other hand, stakeholders with low interest and limited influence, such as National Poultry Development Centre (NPDC) and Phubgyel Stationary Sawmill have minimal direct involvement in HWC initiatives, despite their presence in the region.

Step 3 HWC Assessment

Survey Design and Sample Size Determination

The C2C assessment for Gakiling Gewog, Sarpang Dzongkhag, covered all five chiwogs within the gewog. Primary data were collected through structured household surveys administered to a representative sample of community households, complemented by interviews with relevant service providers and duty bearers.

Sampling Frame

The total number of registered households across the five chiwogs of Gakiling Gewog was **1,001 households**, which constituted the sampling frame for the survey.

Sample Size Calculation

The required sample size was determined using **Yamane's (1967) formula** at a 95% confidence level with a margin of error of 5% ($e = 0.05$):

$$n = N / (1 + N \cdot e^2)$$

Where:

n = required sample size

N = total number of households in the gewog

e = margin of error (0.05 at 95% confidence level)

Substituting $N = 1,001$ and $e = 0.05$:

$$n = 1,001 / (1 + 1,001 \times 0.05^2)$$

$$n = 1,001 / (1 + 2.5025)$$

$$n = 1,001 / 3.5025$$

$$n \approx 285.8 \approx 286 \text{ households}$$

Applying Yamane's formula yielded a required sample size of **286 community households**.

Proportional Allocation across Chiwogs

The total sample of 286 households was distributed across the five chiwogs using **proportional allocation**, ensuring each chiwog's share of the sample reflected its relative size within the gewog. The allocation formula was:

$$n_i = (N_i / N) \times n$$

Where:

- n_i = sample size allocated to chiwog i
- N_i = total number of households in Chiwog i
- N = total number of households in the gewog (1,001)
- n = overall sample size (286)

Chiwog-level figures were rounded to the nearest whole number and adjusted where necessary to ensure the allocated samples summed to exactly 286. The resulting distribution is presented in **Table 1**.

Table 1: Distribution of Surveyed Households by Chiwog, Gakiling Gewog

Sl. No.	Chiwog	Total Households	Households Interviewed
1	Gakiling	200	57
2	Getemkha	92	26
3	Menchulam	139	40
4	Rilangthang	218	62
5	Sangkha	352	101
	Total	1,001	286

Note: Chiwog-level allocations were rounded to whole numbers and adjusted to maintain the total sample of 286.

This stratified proportional approach ensured that the sample distribution faithfully reflected the relative household population of each chiwog within Gakiling Gewog, thereby maintaining the representativeness and statistical validity of the survey findings.

The HWC assessment (Figure 5) was carried out with several key objectives. Its primary purpose was to determine the effectiveness of existing interventions that fell under the 6 elements (Understanding

interactions, Policy, Prevention, Response, Mitigation and Monitoring) of HWC management, evaluating them against the 4 established outcomes (Habitat, People, Assets/Livelihoods and Wildlife).

Furthermore, the assessment aimed to identify any gaps in the current scale of those interventions. It also sought to understand the diverse perspectives of various stakeholders regarding HWC and its management. Finally, the assessment worked to understand and clarify any discrepancies that existed between the perspectives, knowledge, and overall understanding among different stakeholder groups.

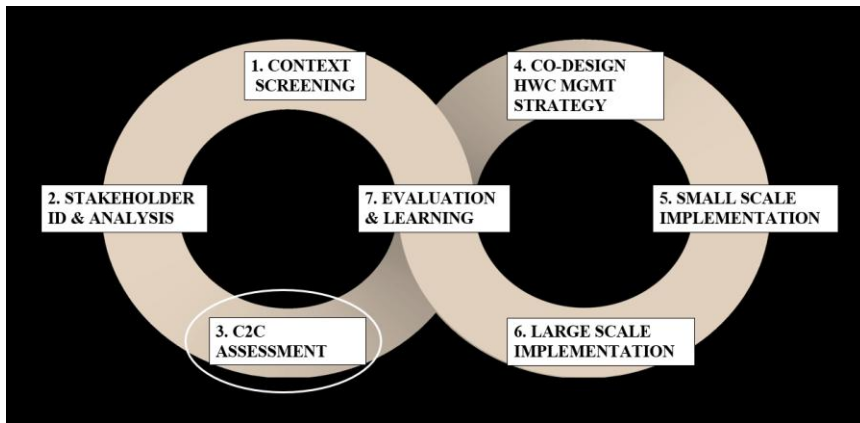


Figure 5: Step three HWC assessment

The assessment was carried out over seven days, engaging 16 Rangers across five Chiwogs. The survey utilized the SMART (Spatial Monitoring and Reporting Tool) App, in which the survey form was preloaded with questionnaires specifically developed for HWC assessment. These questionnaires were structured around a framework comprising six key elements and four intended outcomes. Interviews were conducted with two distinct groups: community members residing in Gewog and service providers working within the jurisdiction.

Prior to their engagement in data collection, the field staff under the Divisional Forest Office (DFO) Sarpang were trained to familiarize themselves with the survey form in SMART.

Step 4 Co-design

A total of 60 participants were involved in the co-design process in Gakiling Gewog. This included 10 representatives from each of the five chiwogs—Gakiling, Getemkha, Menchulam, Rilangthang, and Sangkha— along with 10 duty bearers and service providers, including the Gup, Mangmi, Gewog administration officials, Tshogpas, extension officers, and relevant sector representatives. The

participation of both community members and institutional stakeholders ensured that the strategy incorporated local experiences, governance perspectives, and technical expertise.

Table 2: List of Participants involved in Co-designing

Sl. No.	Chiwog	Total Households
1	Gakiling	10
2	Getemkha	10
3	Menchulam	10
4	Rilangthang	10
5	Sangkha	10
	Duty Bearers / Service Providers	10
	Total	60

Co-designing the HWC management strategy is a collaborative, multi-stakeholder effort, rooted in the principle of developing effective solutions with end-users (Figure 6). This approach recognizes that individuals with lived experiences are the true experts of their own circumstances. The co-design process itself is structured around a series of repetitive steps, beginning with engagement to foster mutual learning and define the core objective or challenge. This is followed by a crucial "understand" phase, where the focus shifts to discerning user needs, identifying assets, and gathering key insights.

The third stage, "ideate," is where creativity takes center stage, involving the generation and development of ideas, the design of concepts, and the creation of samples. Finally, the "validate" step ensures that the proposed solutions are presented, tested, and thoroughly evaluated. It builds upon the foundational insights gained from prior stages, including context screening, stakeholder analysis, and the comprehensive C2C assessment report. This integrated approach helps to determine the current situation, establish short, mid, and long-term goals, and collectively devise strategies to achieve those desired outcomes.

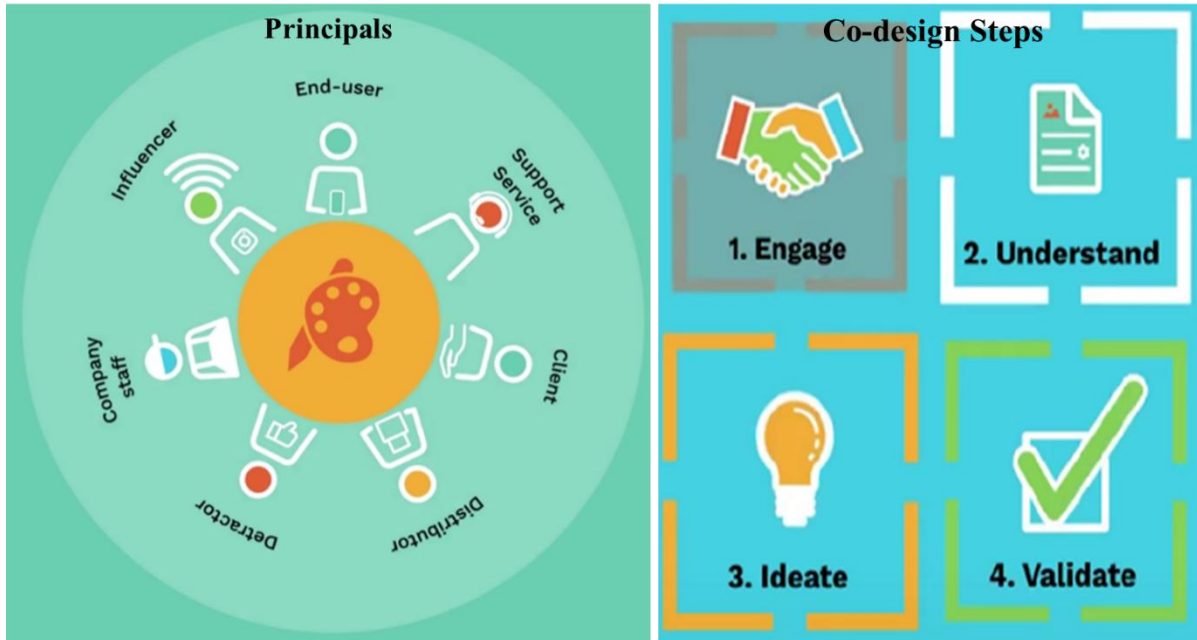


Figure 6: Co-design principals and steps

The C2C co-design process for this plan involved several distinct steps. It commenced with the meticulous preparation of the C2C assessment results. These key findings were then presented to both community members and service providers, ensuring broad dissemination of information. Subsequently, actions and interventions were collaboratively designed, directly informed by the assessment report. The participants were divided into groups (e.g., community members and duty bearers), each facilitated by a technical person such as forestry staff, to foster discussion and proposal of actions. The proposed actions from each group were then compiled and consolidated by the C2C core team. Finally, the compiled actions were validated leading to the drafting of the comprehensive C2C strategy.

4. Result and Discussion

4.1 Demography and social information

4.2. Results at Gewog Level

A total of 276 respondents participated in the household survey conducted across the five chiwogs of Gakiling, Getemkha, Menchulam, Rilangthang, and Sangkha in Gakiling Gewog. Among these respondents, 91 (33.0%) were male and 185 (67.0%) were female, indicating a relatively higher participation of female respondents during the survey. This higher representation of women is consistent with rural household surveys where women are often more available at home during the time of interviews.

With respect to age distribution, the majority of respondents belonged to the 41–59 years age group, followed by respondents aged above 60 years, while a comparatively smaller proportion fell within the

18–40 years age category. The dominance of middle-aged and elderly respondents reflects the demographic structure of rural communities and ensures that the survey captured views from individuals with substantial experience in farming, livestock management, and daily interactions with wildlife.

A considerable proportion of respondents (n = 216) reported residing in their respective communities for more than 20 years. This indicates a strong degree of local attachment and long-term familiarity with the surrounding environment and livelihood systems. Such long-term residents possess valuable historical knowledge of wildlife presence, land-use changes, and the effectiveness of past human–wildlife conflict (HWC) mitigation interventions, which is particularly important for community-based assessments and strategy development.

In addition to the household respondents, 23 participants represented service providers and duty bearers, of which 22 were male and one was female. These participants included government officials, local leaders, and sector representatives involved in wildlife management, agriculture, and community development. Their participation provided important institutional perspectives on the causes, impacts, and management responses related to human–wildlife conflict within the gewog.

Although the survey initially targeted 286 households based on the calculated sample size, the final number of completed household interviews was 276 respondents. The discrepancy occurred primarily because some households and duty bearers were not available during the survey period, often due to agricultural work, temporary absence from the village, or official engagements. Despite this limitation, the achieved sample size was considered sufficient to capture representative community perspectives across the five chiwogs and to support the analysis of socio-demographic conditions and human–wildlife conflict management strategies in the study area.

Agriculture was reported as the primary livelihood source for the majority of respondents, followed by livestock farming, while other households relied on family support, casual labour, business and trade, transport services, paid employment, and other income-generating activities. Respondents indicated that the most significant impact of human–wildlife conflict is crop loss, although some households also reported livestock predation, property damage, personal injuries, and disruptions to other livelihood activities.

4.2.1 Conflict species

Respondents identified elephants, porcupines, wild pigs, macaques, barking deer, birds, hares, and snakes as major conflict species. Among these, elephants, wild pigs, porcupines, macaques, and birds were reported to have the most severe impacts and were also regarded as the most frequently involved in conflicts. Additionally, golden langurs and dholes were identified as frequent conflict species. The details of conflict species are discussed at Chiwog level.

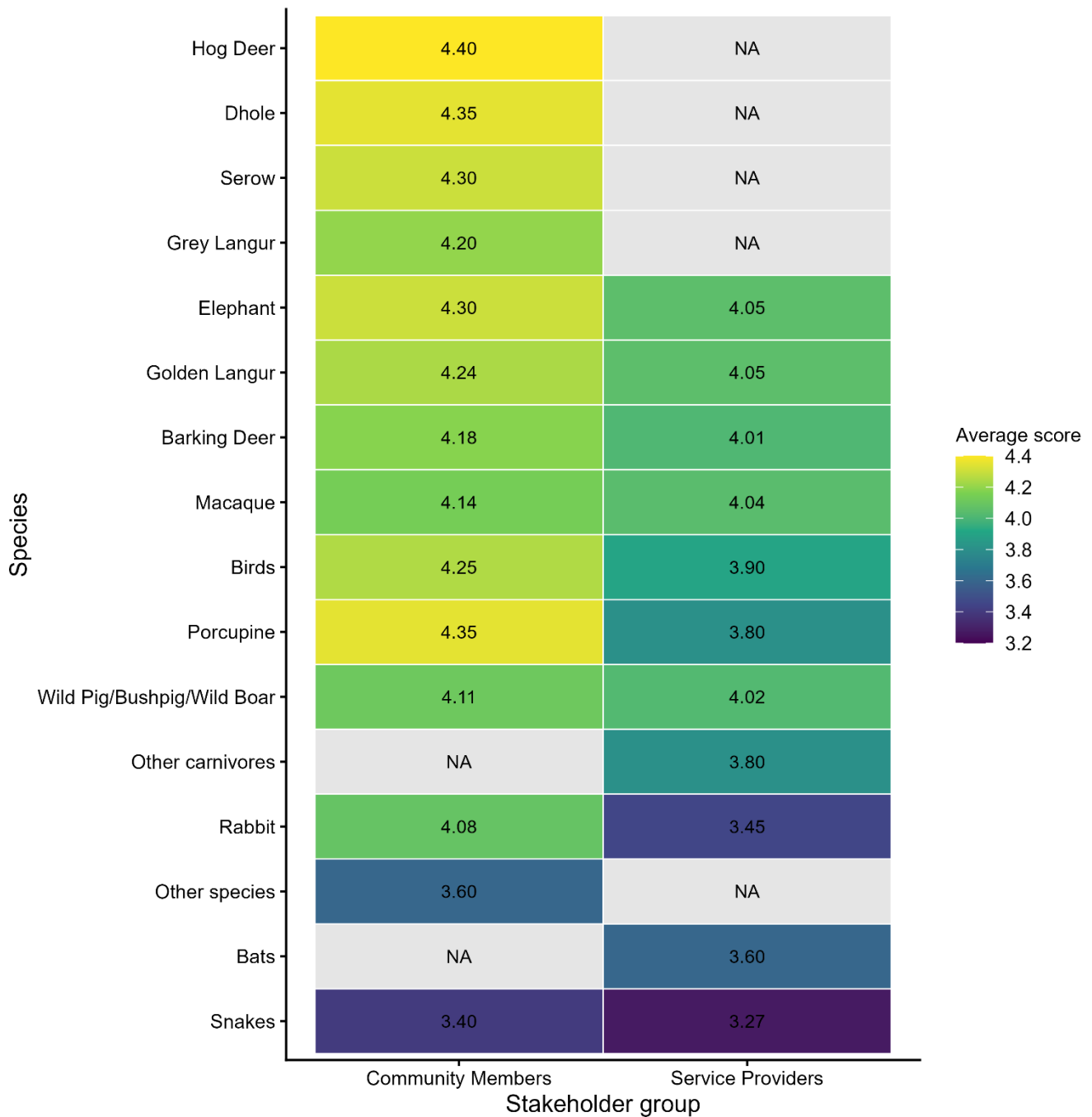


Figure 7. Species-specific human–wildlife conflict (HWC) scores by stakeholder group. Heatmap showing average scores for each species reported by Duty Bearers/Service Providers and Community Members/Rights Holders. Scores are means across five species-specific questions (people injured/killed in HWC, wildlife killed in HWC, knowledge of regulations, persecution, and restoration). Higher scores

indicate lower perceived HWC impact; lower scores indicate higher impact. “NA” denotes that a stakeholder group did not identify that species as a conflict species.

4.2.2 Status of Outcomes at Gewog level

The interconnected outcome ratings across four domains People, Livelihoods/Assets, Wildlife, and Habitat showed patterns of perceived vulnerability and disparity between stakeholder groups (Figure 7). Among duty bearers, the lowest mean score was recorded for Livelihoods/Assets (3.14), while the highest was for Habitat (3.91). A similar trend was observed among community members, who rated Livelihoods/Assets lowest (3.27) and People highest (3.90). The difference in the People outcome was statistically significant ($p < 0.01$), indicating a perceptual gap between groups regarding human-centric impacts of coexistence.

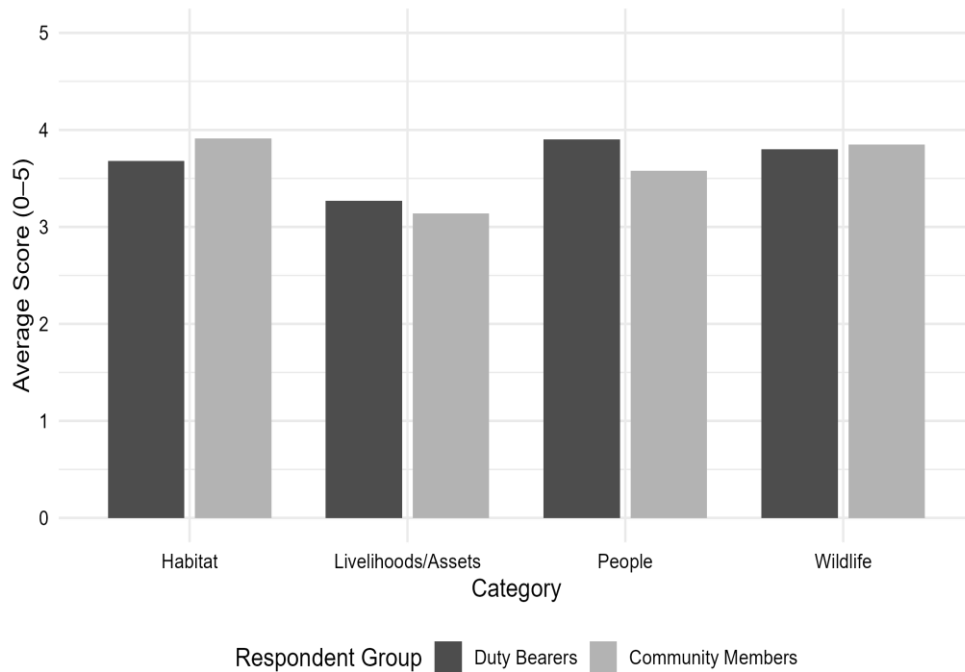


Figure 8: The interconnected outcome ratings across four domains

Both respondents’ groups showing the greatest concern for livelihood-related vulnerabilities and more favorable perceptions in habitat and wildlife (Figure 7). The consistently low scores for Livelihoods/Assets across both groups indicate a shared recognition of economic vulnerability arising from HWC. Thus, there is a need for enhanced intervention strategies focusing on community-based asset protection and livelihood diversification.

The results suggest that livelihoods and assets are perceived as the most adversely affected domains, requiring urgent attention in future human-wildlife coexistence planning. The convergence of perceptions

between service providers and community members in this domain underscores the importance of designing conflict mitigation interventions that prioritize livelihood resilience, compensation schemes, and sustainable land-use planning.

Differences in species impact reporting and outcome evaluations also highlight the need for integrated management approaches that account for both ecological and socio-economic dimensions of coexistence. Enhanced participation of local communities in conflict monitoring and response, coupled with capacity building for duty bearers, may improve alignment in perception and policy responses. Targeted efforts to mitigate high-impact species, particularly elephants and wild pigs, will be essential to reduce conflict frequency and severity, thereby improving human well-being while safeguarding biodiversity conservation objectives.

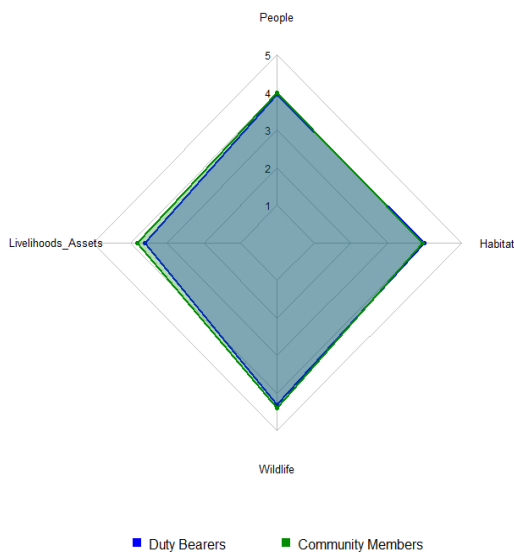


Figure 9: Radar Chart (People, Livelihood, Wildlife, Habitat Outcomes)

4.2.3. Status of Elements at Gewog level

The C2C approach outlines six foundational elements Understanding Interactions (UI), Policy, Prevention, Response, Mitigation, and Monitoring that collectively determine the effectiveness of human-wildlife coexistence strategies across four outcome domains. The disaggregated scores from stakeholders in Gakiling reveal insights into the perceived strengths and weaknesses of each element. These findings demonstrate both areas of convergence and divergence between duty bearers and community members.

I. Livelihoods/Assets secured against the HWC

Livelihoods and assets continue to represent the most vulnerable outcome domain in the Gakiling Gewog. Community members and duty bearers both rated this domain the lowest among the four outcomes, with particularly poor scores for Understanding Interactions (2.09 by duty bearers; 2.31 by community members) and Policy (2.91; 2.36, respectively). Mitigation also received low ratings (3.30; 2.94), reflecting perceived inadequacies in active prevention measures and compensation/Insurance schemes. Although slightly higher scores (Figure 9) were observed for Monitoring (3.61; 3.81) and Response (3.30; 3.34), the overall trend shows insufficient support systems and a lack of targeted livelihood protection mechanisms. There is an urgent need to implement scalable conflict mitigation tools, such as electric fencing, improved livestock enclosures, and crop insurance schemes. Community engagement in planning and executing these interventions will be essential for long-term efficacy.

II. People able and willing to live alongside wildlife

This outcome showed comparatively favorable perceptions, particularly among community members who rated Understanding Interactions (4.90) and Monitoring (3.95) the highest (Figure 9). This suggests a strong willingness to coexist and a relatively informed understanding of wildlife behaviors and risk factors.

Nonetheless, both stakeholder groups rated Mitigation low (1.74 by duty bearers; 1.55 by community members), indicating persistent safety concerns and a critical lack of effective protection measures. The Policy and Prevention elements also scored moderately (3.00–3.63 range), indicating room for strengthening risk education, communication protocols, and preventive interventions.

The disparity between high awareness and low safety scores underlines the need for targeted investments in community-based safety infrastructure and responsive early warning systems. Bridging this gap is vital for fostering long-term coexistence attitudes.

III. Habitat sufficient to maintain viable wildlife populations

Habitat related outcomes received some of the highest scores across all outcome domains, particularly from duty bearers (Figure 9). Remarkable the scores for Mitigation (4.04), Monitoring (3.96), and Response (4.26) were reflecting recognition of ongoing forest protection, habitat management, and enforcement efforts. Community members reported slightly lower scores across all elements, with Monitoring (3.44) and Response (3.61) showing a perceptual gap.

The difference in scores may reflect limited community involvement or communication in habitat stewardship initiatives. To address this, it is recommended that habitat management programs integrate participatory mapping, local surveillance schemes, and educational outreach to enhance shared ownership of conservation efforts

IV. Wildlife thrives alongside human presence

The wildlife outcome was perceived as relatively robust. Both service providers and community members reported high scores for Understanding Interactions (4.60; 4.81, respectively) and Response (4.35; 3.79). These scores demonstrate shared commitment to the protection and coexistence of wildlife populations. However, elements such as Prevention (3.17; 2.83) and Mitigation (3.58; 3.23) showed lower performance (Figure 9), suggesting weaknesses in proactive measures to deter conflict. Despite this, the relatively high scores across all other elements indicate an enabling environment for wildlife conservation.

Strategic efforts to strengthen preventive infrastructure, such as community awareness campaigns, improved land-use zoning, and reinforcement of anti-poaching patrols, will help sustain positive trends. Additionally, incentivizing conservation behaviors through community-based reward mechanisms may reinforce support for wildlife protection.

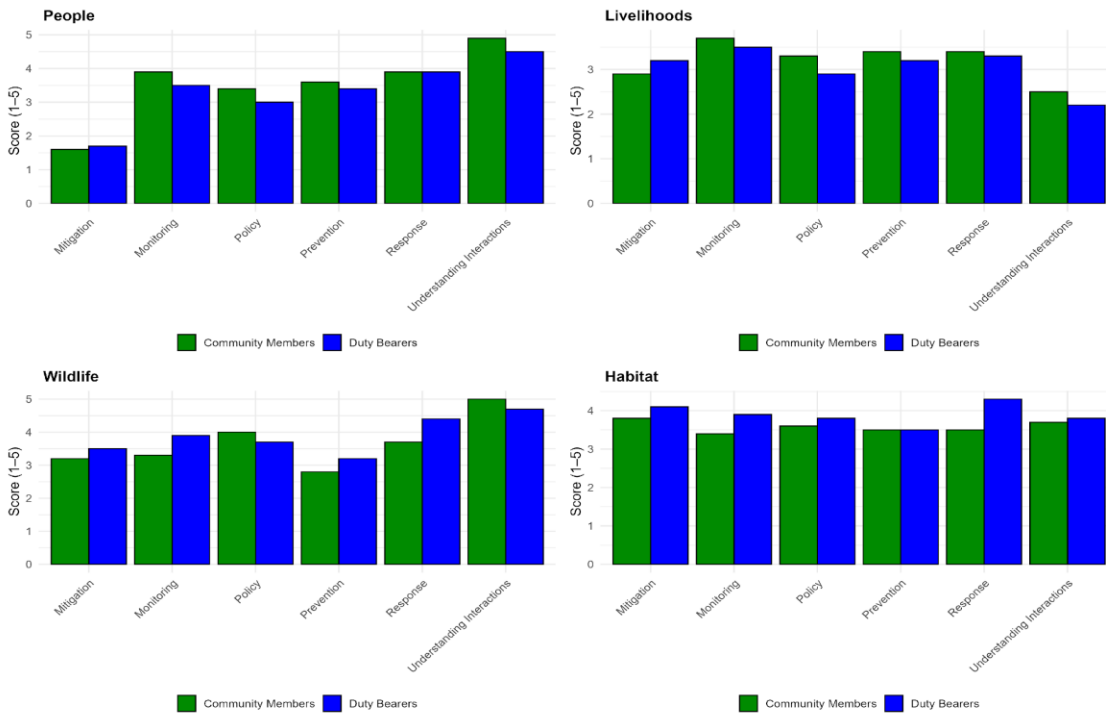


Figure 10: Grouped Bar Plots (Element-wise breakdown per outcome)

4.3. Chiwog-wise Results

4.3.1. Gakiling Chiwog

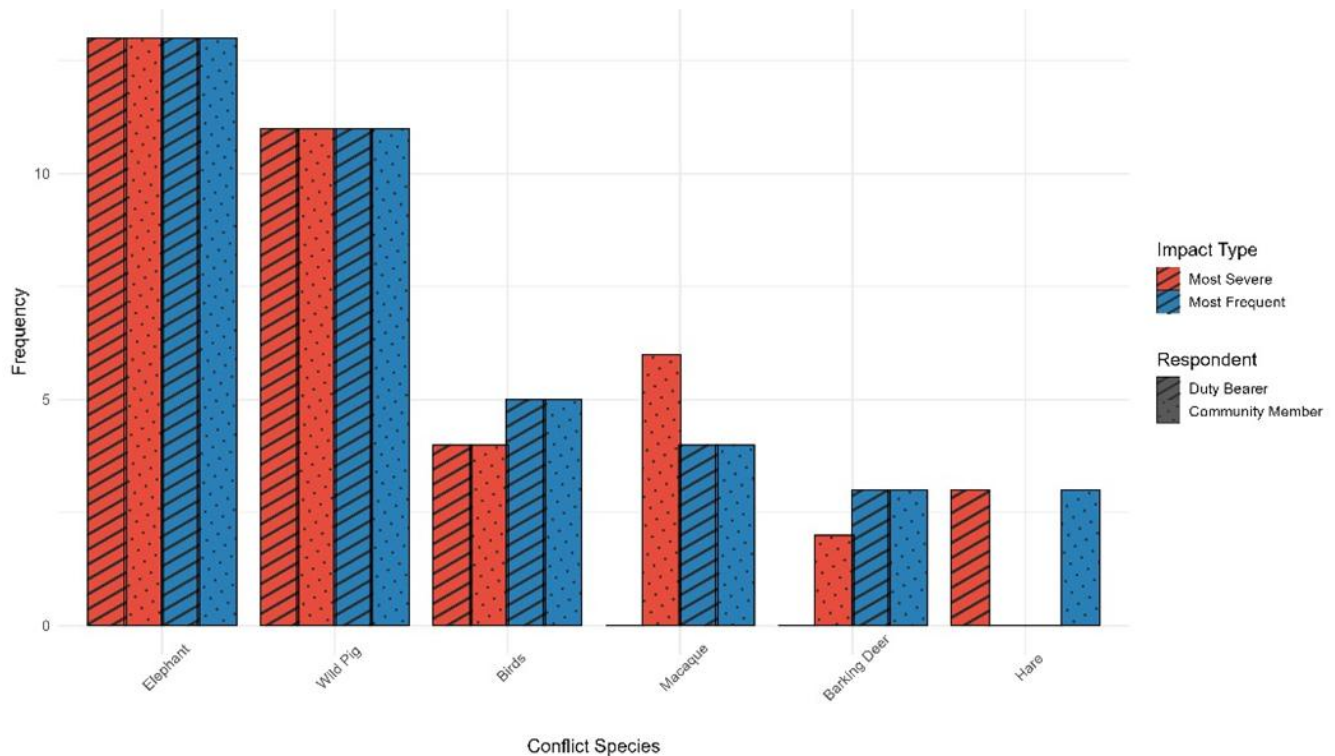


Figure 11: Graphical presentation of conflict species by stakeholder group

Respondents identified elephants and wild pigs as the most frequent and severe conflict species, with both species reported equally by duty bearers and community members ($f=13$). Birds and macaques followed, with macaques perceived as causing more severe conflicts by duty bearers, while community members reported higher frequency of bird conflicts. Barking deer were noted less frequently but still appeared consistently across respondent groups and impact types. Hares were reported only by community members and only under the most frequent impact category. Duty bearers reported higher severity of impacts, especially for macaques and elephants, whereas community members emphasized frequency, particularly for birds and hares. These differences in perception may reflect varying experiences, where community members face frequent but less severe encounters, and duty bearers focus on more critical incidents.

The variation highlights the need for integrated monitoring and communication strategies between community members and service providers to better capture the full scope of human-wildlife conflicts and develop balanced mitigation measures that address both frequent disturbances and severe damage.

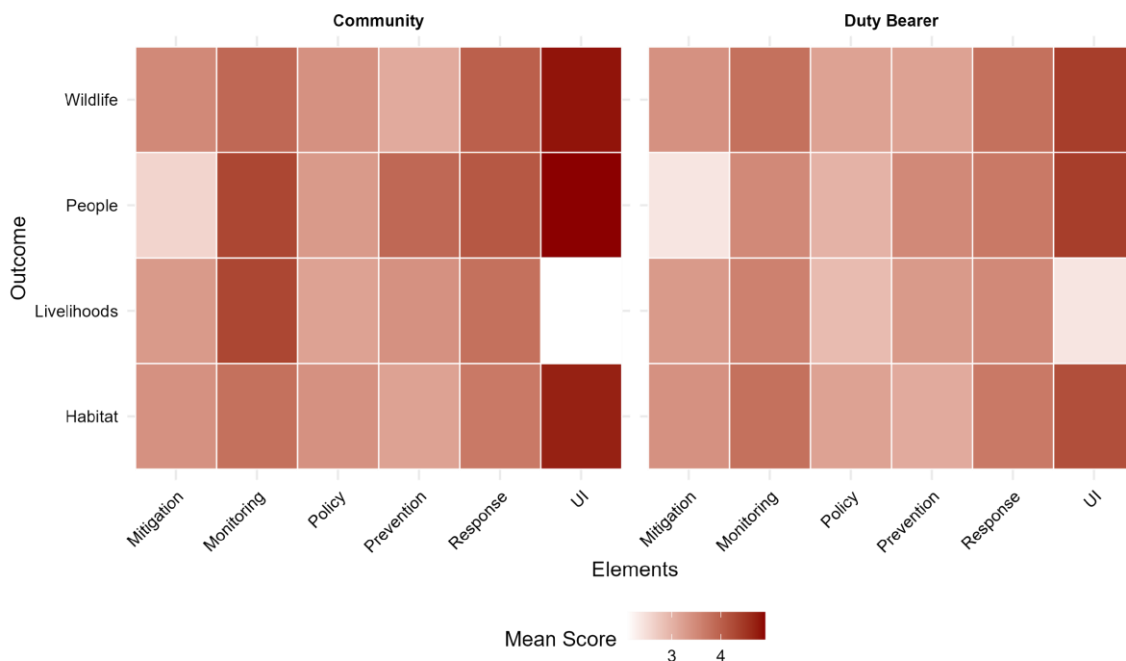


Figure 12: Graphical presentation of outcomes and element-wise perception

Both stakeholder groups scored highest under the wildlife and habitat outcomes, indicating relatively stable conservation conditions. This could be due to existing policies, enforcement, and habitat integrity. However, the livelihood/assets outcome received the lowest scores, particularly among community members, indicating a critical vulnerability in economic and food security linked to HWC.

Mitigation and policy were among the least performing elements across the livelihood and people outcomes, revealing a perceived gap in institutional response. While understanding interactions (UI) showed strong perception under the people outcome, its influence in livelihoods was limited, underscoring the need to contextualize awareness into actionable protection of assets. For future interventions in Gakiling Chiwog, emphasis should be placed on strengthening mitigation, livelihood support systems, and community engaged policy frameworks to address these disparities and move toward effective coexistence. The interventions at activity level is mentioned in strategies.

4.3.2. Menchulam Chiwog

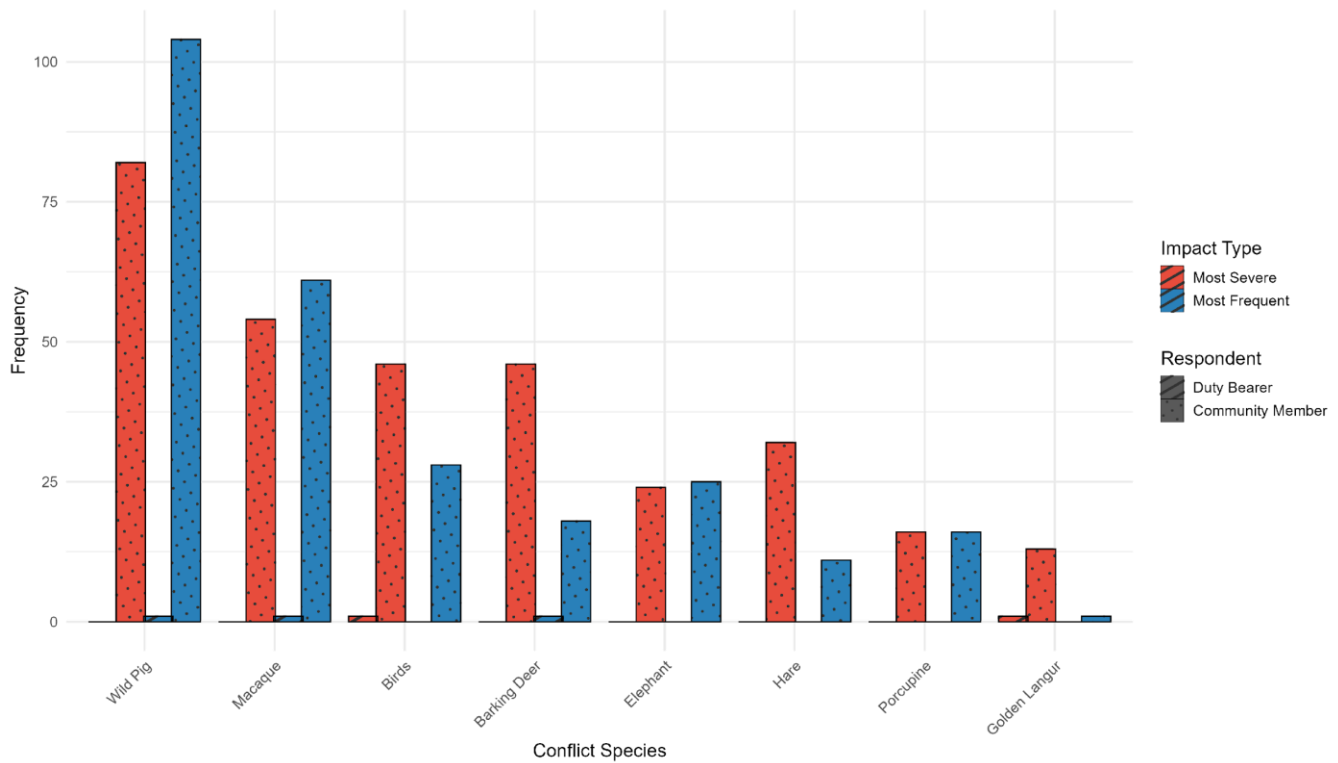


Figure 13: Conflict Species in Menchulam Chiwog

Respondents identified wild pigs, macaques, birds, and barking deer as the primary species involved in human-wildlife conflicts, with wild pigs reported by over 100 respondents as the most frequent conflict species. Macaques and birds also showed high frequencies, reported by approximately 60 and 30 respondents respectively. Barking deer were recognized for causing severe impacts, with over 50 respondents reporting this species under the “Most Severe” category. Elephants and pangolins were less frequently cited, while golden langurs were rarely reported. Duty bearers tended to report lower overall conflict frequencies but consistently noted high severity for barking deer, macaques, and wild pigs. Community members reported higher frequencies of conflict with wild pigs and macaques, reflecting their more frequent encounters. The low reporting of golden langurs suggests minimal conflict or lower awareness among respondents.

These contrasting perceptions underscore the need for improved coordination and data sharing between community members and duty bearers to ensure that both frequent and severe wildlife conflicts are accurately documented and addressed through targeted mitigation strategies.

In Menchulam Chiwog, livelihoods and assets recorded the lowest overall scores among the four coexistence outcomes, as assessed by both service providers and community members. This indicates that the local economy and resource security of households remain highly vulnerable to wildlife impacts. All six contributing elements to livelihood security performed weakly, with "Understanding Interactions" and "Mitigation" scoring especially low. This calls for targeted interventions that enhance mitigation strategies (e.g., fencing, deterrents), strengthen awareness, and improve policy responsiveness to ensure that livelihoods can coexist sustainably with wildlife presence. The habitat and wildlife outcomes were assessed more positively, particularly by duty bearers indicating that ecological systems remain intact, and conservation policies may be succeeding in preserving non-human components of the landscape. However, the continued imbalance where human well-being trails behind wildlife safety signals a pressing need to harmonize conservation with community resilience. Strategic investment in both technical (e.g., early-warning systems) and social (e.g., participatory planning) responses is essential to transform conflict into coexistence in Menchulam.

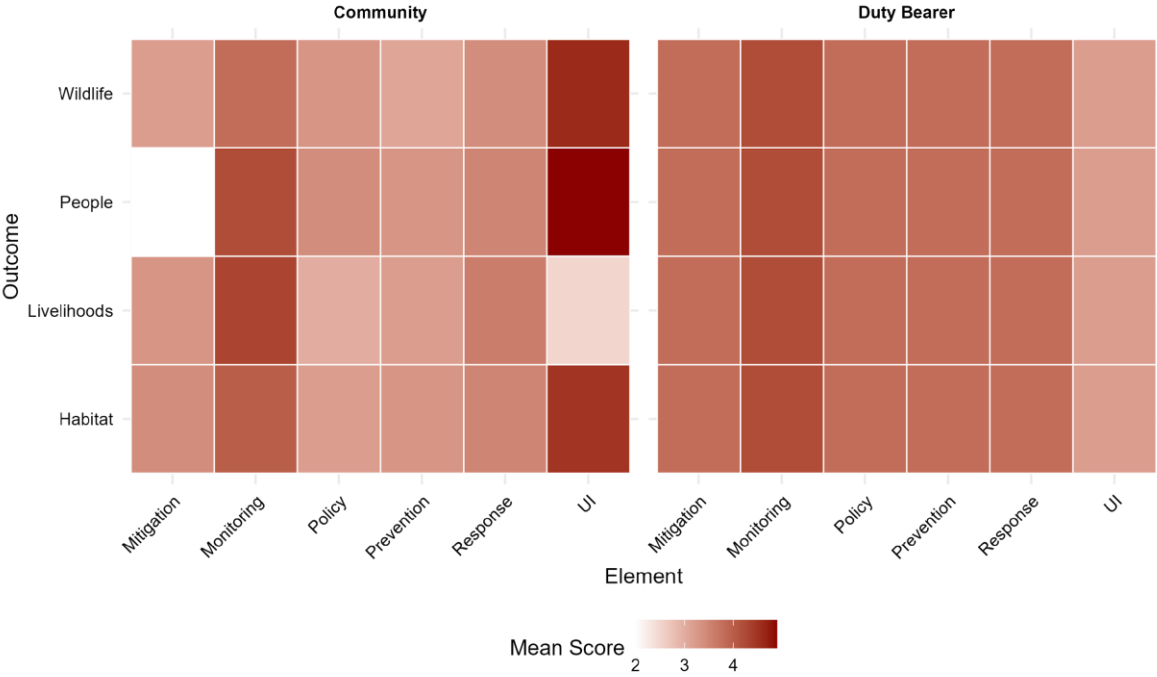


Figure 14: Graphical presentation of results by outcome and element

4.3.3. Rilangthang Chiwog

Respondents identified wild pigs, macaques, birds, and barking deer as the main species involved in human-wildlife conflicts. Wild pigs were reported by over 100 respondents as the most frequent conflict

species and by approximately 85 respondents as causing the most severe impacts. Macaques and birds followed, with macaques reported by 65 respondents for frequency and severity, and birds noted more frequently than severely. Barking deer were also frequently cited, with over 50 respondents reporting their severe impacts. Elephants and pangolins had moderate reporting, mostly for severity, while golden langurs were rarely noted. Duty bearers tended to report lower frequencies but highlighted the severity of impacts from barking deer, macaques, and wild pigs. Conversely, community members emphasized frequency, particularly for wild pigs and macaques, indicating more frequent encounters.

The divergence in perceptions between duty bearers and community members suggests a need for integrated monitoring and communication to capture both frequent and severe conflicts adequately, thereby improving mitigation efforts.

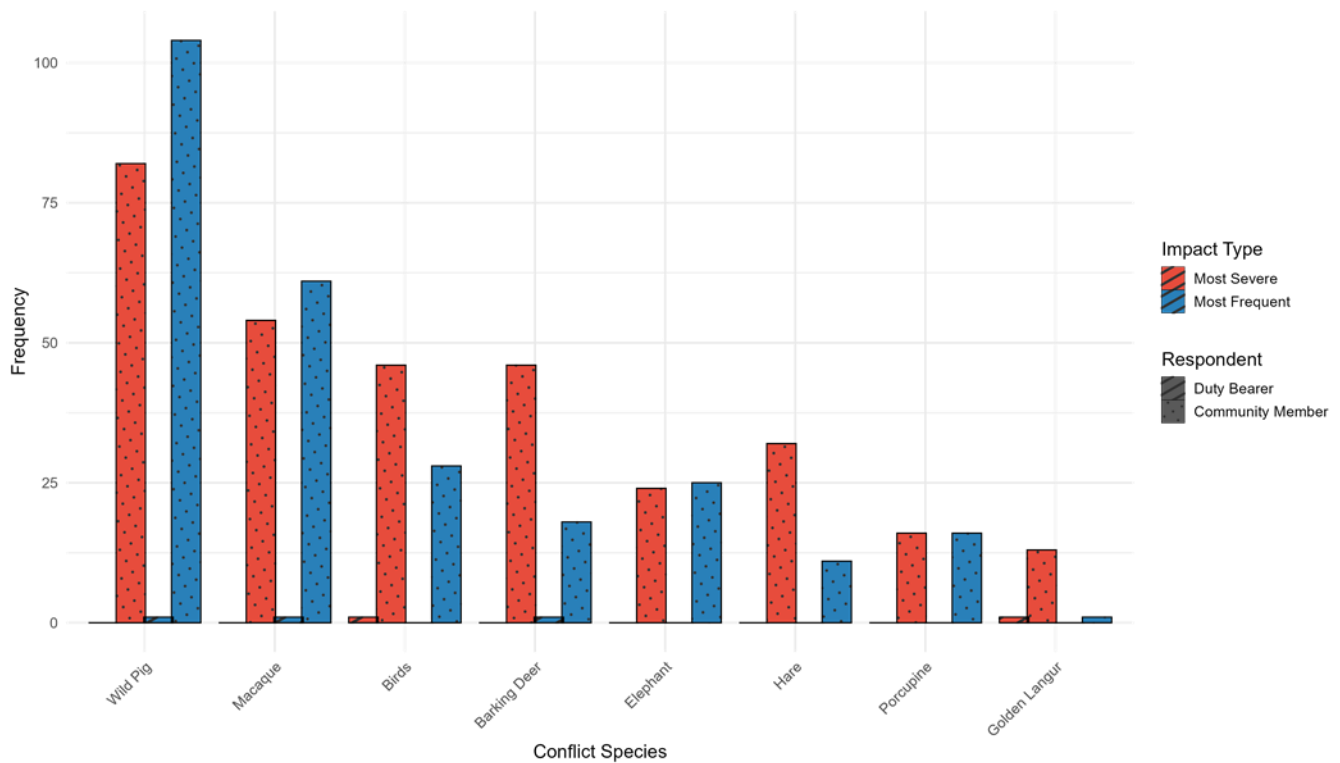


Figure 15: Conflict species in Rilangthang Chiwog

The livelihood/assets remain the most vulnerable outcome in Rilangthang Chiwog, as assessed by both community members and duty bearers (Figure 14). This indicates that there is a persistent challenge in protecting agricultural and livestock-based livelihoods from wildlife incursions. Among livelihood-related elements, UI scored the lowest, followed by policy and mitigation. This indicates that despite the presence

of strategies or plans, practical knowledge exchange and context-specific measures remain weakly implemented. For the outcome of people, elements like monitoring, response, and prevention showed moderate scores, but community members rated these consistently lower than duty bearers, implying a trust or effectiveness gap in institutional response.

Wildlife and habitat outcome scored higher across all elements for both groups, showing that conservation actions are more robustly implemented or perceived as more effective. To rebalance the coexistence framework in Rilangthang, targeted interventions should focus on strengthening livelihood-related elements particularly mitigation and understanding of interactions while maintaining the current momentum in habitat and wildlife conservation strategies.

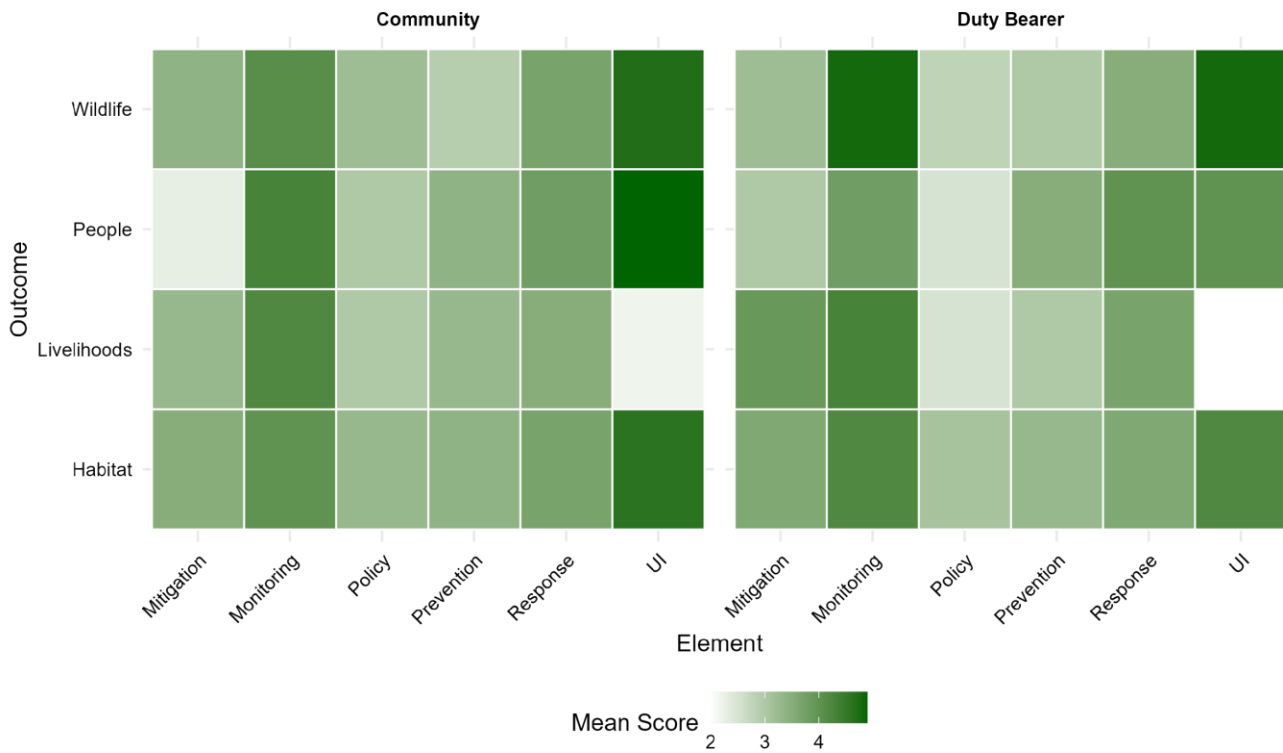


Figure 16: Graphical presentation of results by outcomes and elements for Rilangthang Chiwog

4.3.4. Sangkha Chiwog

Respondents identified wild pigs, macaques, birds, and barking deer as the principal species causing human-wildlife conflicts. Wild pigs were reported by over 100 respondents as the most frequent conflict

species and by approximately 85 respondents as causing the most severe impacts. Macaques and birds also ranked high, with macaques reported by around 65 respondents for both frequency and severity. Barking deer were noted predominantly for severe impacts by roughly 55 respondents. Elephants and pangolins were moderately reported, with elephants showing a slightly higher frequency than severity, while golden langurs were rarely mentioned, indicating limited conflict presence. Duty bearers tended to emphasize severity, particularly for barking deer and macaques, whereas community members reported more frequent encounters with wild pigs and macaques.

The differences between respondent groups highlight the importance of improved communication and data sharing to ensure comprehensive monitoring of both the frequency and severity of wildlife conflicts, thereby enhancing targeted mitigation strategies.

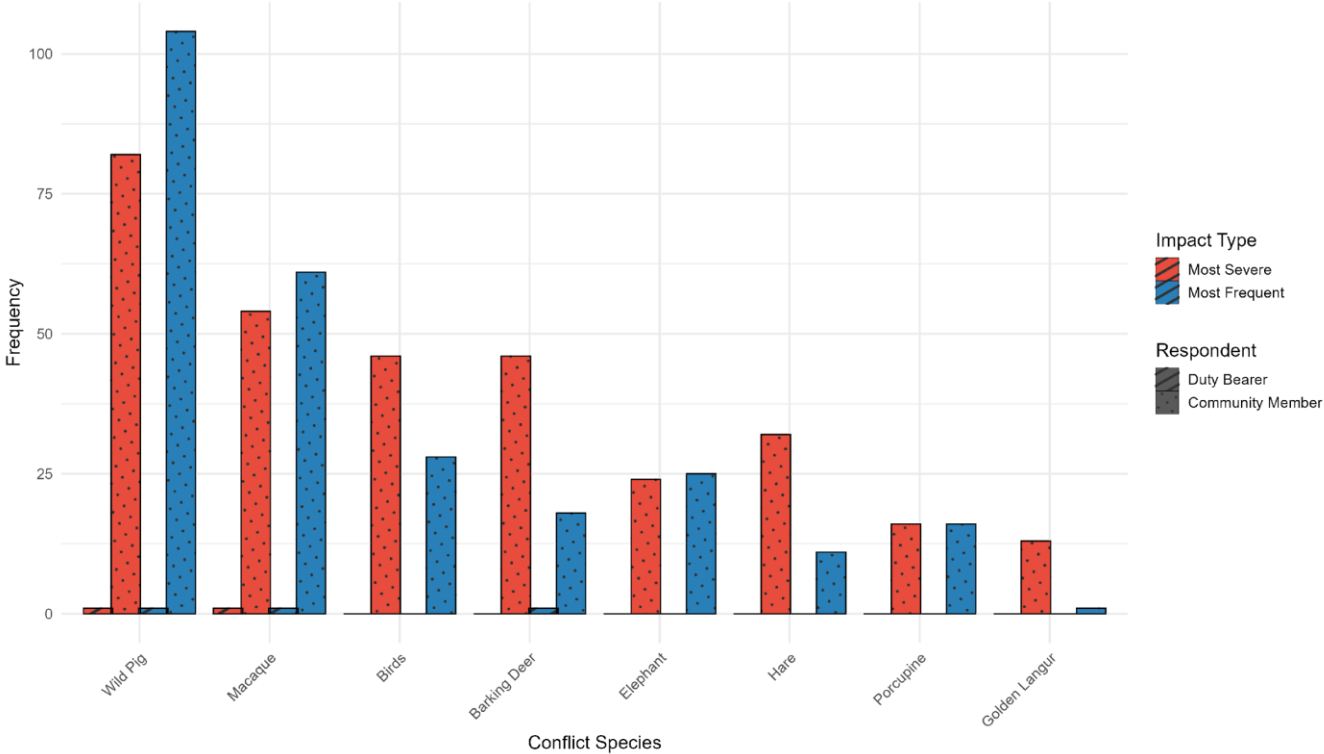


Figure 17: Frequency of reported conflict species by stakeholder group in Sangkha Chiwog

The livelihoods/assets outcome again scored the lowest among the four coexistence outcomes in Sangkha Chiwog, indicating greater vulnerability in this area. Both stakeholder groups emphasized this weakness, with slightly higher ratings provided by duty bearers than community members. The outcomes related to

wildlife and habitat scored relatively higher, suggesting better ecological conditions and lower perceived threats to wildlife from human activities in this Chiwog.

This outcome trend indicates that interventions should primarily aim at securing livelihoods—especially agriculture and livestock, through locally appropriate and sustainable strategies. Measures such as predator-proof livestock enclosures, crop protection fences, and compensation schemes could be prioritized. As shown in Figure 17, individual elements such as policy, monitoring, and prevention were moderately rated by both duty bearers and community members in Sangkha Chiwog. However, understanding interactions (UI) remained one of the weakest-rated elements, especially from the perspective of community members. This suggests a knowledge gap and limited engagement in understanding the dynamics of human-wildlife interactions.

In contrast, duty bearers rated elements like response and monitoring slightly higher, implying that structured institutional mechanisms exist but may not be effectively communicated or trusted by the local populace. Therefore, enhancing participatory monitoring, regular awareness programs, and inclusive planning are essential to strengthen these elements and improve overall coexistence.

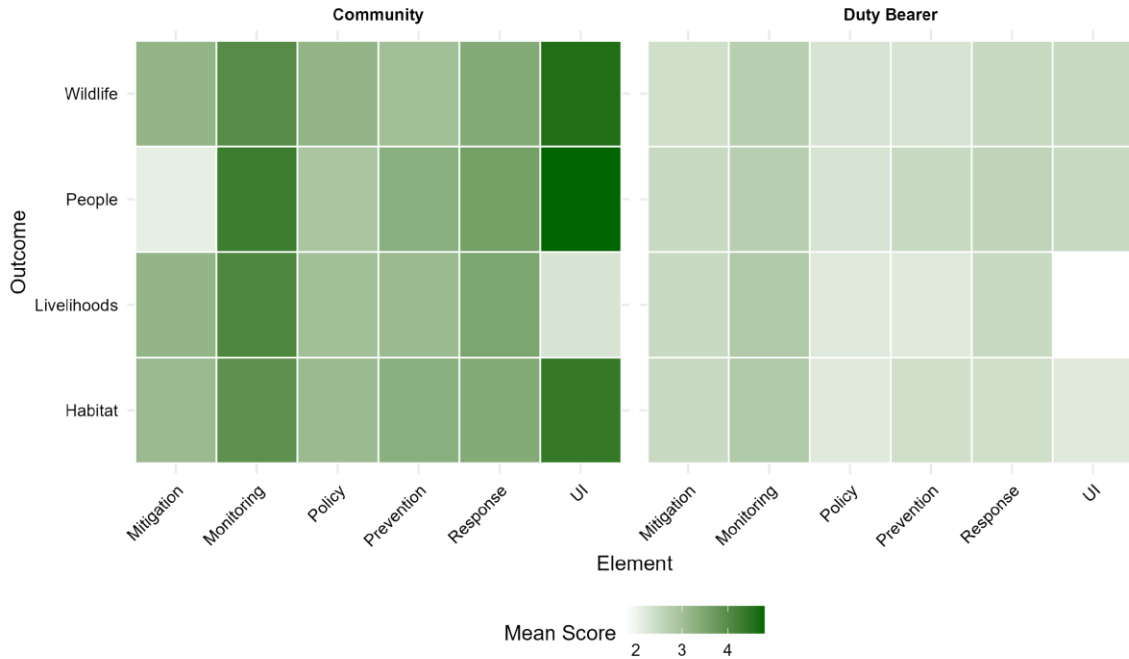


Figure 18: Element-wise contribution to outcomes for each stakeholder group in Sangkha Chiwog.

4.3.5. Gaytemkha Chiwog

Respondents identified wild pigs, macaques, birds, and barking deer as the main species involved in human-wildlife conflicts. Wild pigs were reported by over 100 respondents as the most frequent conflict species and by approximately 85 respondents as causing the most severe impacts. Macaques and birds also featured prominently, with macaques reported by about 65 respondents and birds by roughly 30 respondents for frequency. Barking deer were predominantly noted for severe impacts by around 55 respondents. Elephants and pangolins had moderate reporting levels, with elephants showing nearly equal frequency and severity responses, while golden langurs were rarely reported. Duty bearers focused more on severe impacts, especially from barking deer and macaques, whereas community members emphasized frequent encounters with wild pigs and macaques.

These differences in perception underscore the importance of coordinated monitoring and communication between communities and service providers to fully capture both frequent and severe human-wildlife conflicts and to inform effective mitigation strategies.

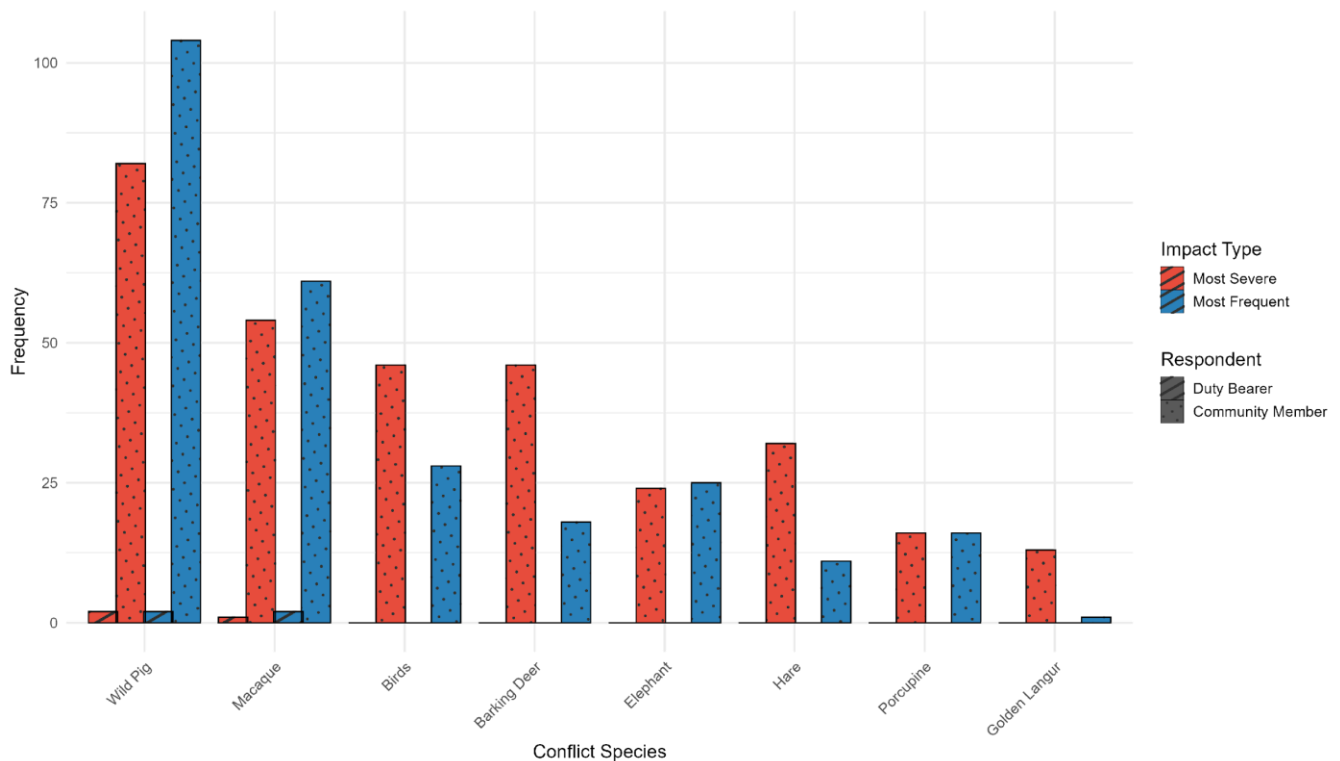


Figure 19: Conflict species in Gaytemkha Chiwog

The livelihoods/assets is the most vulnerable dimension of human-wildlife coexistence, with both community members and duty bearers consistently assigning it the lowest scores compared to people, wildlife, and habitat. This highlights the need for urgent and targeted interventions aimed at safeguarding rural livelihoods from wildlife-induced losses. An element-wise analysis further reinforces this vulnerability, showing particularly low scores in “understanding interactions” and “mitigation,” suggesting a lack of effective engagement and practical strategies to minimize livelihood impacts. In contrast, higher scores for monitoring and policy within the wildlife and habitat domains indicate stronger institutional focus on biodiversity conservation. However, to achieve balanced coexistence, further efforts must prioritize strengthening livelihood resilience through inclusive planning, improved communication between stakeholders, and expanded implementation of practical mitigation measures such as crop protection fencing, wildlife insurance schemes, and ecological compensation mechanisms such as habitat enrichment.

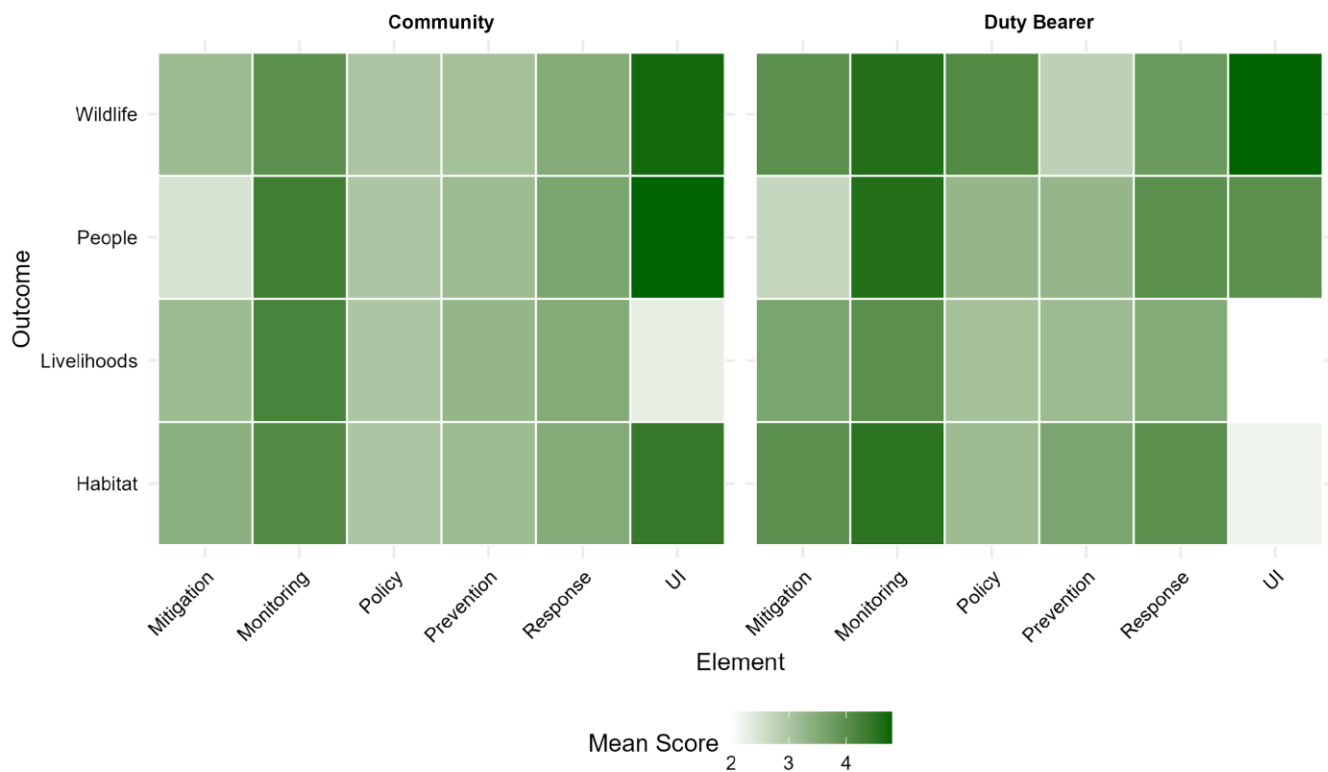


Figure 20: Element-wise contribution to outcomes for each stakeholder group in Gaytemkha Chiwog

5. Conflict to Coexistence Strategy

Human-Wildlife Conflict in Gakiling gewog varies by species, but elephants cause the most severe issues. Habitat loss and developmental activities on/along elephant migratory routes on Indian side are the main causes of human-elephant conflict in Gakiling chiwog. While other wildlife also contributes to conflicts, interventions focus primarily on elephants due to their significant impact.

This results in substantial crops and property damage and occasional human casualties. To address this, the C2C strategy offers a participatory, adaptive framework that balances human needs with wildlife conservation. It empowers communities through education, safeguards livelihoods via sustainable alternatives and barriers, and ensures safe wildlife movement and habitat enrichment. Built on a co-management model, C2C involves assessing conflict, designing and implementing targeted actions, and continuously monitoring and adapting strategies. Its long-term success hinges on deeper understanding of elephant behavior, mitigating habitat fragmentation, strengthening cross-border collaboration, leveraging technology, securing sustainable funding, and providing capacity building, and maintaining robust communication and compensation mechanisms— all aimed at fostering lasting human-wildlife coexistence.

The strategic interventions are designed to address outcomes which are perceived as most vulnerable. Out of four possible outcomes, the safety and livelihoods of people and the security of assets are prioritized, ensuring that welfare of wildlife and its habitat is not compromised. With a total budget of **Nu. 13.8 million**, the plan emphasizes infrastructure, preparedness, and habitat improvement. Key measures include:

- Nu. 7.5 million for enhancing chain-link-electric fencing (Hileykhola to Sarpangkhola, Gakiling) by 2027
- Development of SoP and awareness programs on HWC across all Chiwogs (Nu. 0.5 million total)
- Strengthening Quick Response Teams (QRTs) with gear (Nu. 0.9 million)
- Plantation of fodder trees and palatable species in Sangkha and Rilangthang (Nu. 1 million)

To support long-term coexistence and local economic growth, the plan also includes research, ecotourism, and monitoring activities:

- Study on gewog-level ecotourism potential (Nu. 0.1 million)
- Revival of Tsirang–Sarpang mule track for hiking and tourism (Nu. 3 million by 2030)
- Annual evaluation of electric fencing and by-law formulation (Nu. 0.55 million combined)

- Impact study of mitigation strategies (Nu. 0.2 million)

These integrated actions aim to reduce conflict, restore habitats, and offer sustainable livelihoods through community driven approaches.

Table 3: Implementation Plan and Financial Outlay

Sl. No	Outcome	Action / Activities	Chiwog	Responsibility	Budget (Nu in million)	Timeline	Remarks
1.	Livelihood / Assets	Maintenance and enhancement of combined chainlink-electric fencing (Hileykhola to Sarpangkhola)	Gakiling	Local Govt / Local Communities / DFO-Sarpang	10.5	By 2027	-Fence posts with spikes have been proposed for Gakiling Gewog. -In other areas experiencing high levels of human-elephant conflict (HEC), the implementation of electric fencing will be considered based on future assessments. -The inclusion of households for fencing support will likewise be determined on a case-by-case basis, depending on the severity of the situation and the vulnerability of the affected communities
2.	Livelihood / Assets	Periodic monitoring and evaluation of electric fencing	Gakiling	Local Govt / DFO-Sarpang	0.3	Every year	To monitor maintenance and functionality of electric fencing
3.	Livelihood / Assets	Formulate by-laws for management of electric fencing	Gakiling	Local Govt / Local Communities / DFO-Sarpang	0.3	By 2027	

4.	Livelihood / Assets	Study ecotourism potential in gewogs to boost local economy	All Chiwogs	Local Govt / Local Communities / DFO-Sarpang	0.1	By 2030	
5.	Livelihood / Assets	To revive the mule track from Tsirang to Sarpang to promote ecotourism and explore potential hiking opportunities	All Chiwogs	Local Govt / Local Communities / DFO-Sarpang	3	by 2030	
6.	People	Train QRT members and Forestry staff on HEC Response Techniques and Develop SoP for responding to HEC (Risk Management)	All Chiwogs	Local Govt / Local Communities / DFO-Sarpang	0.25	By 2026	For safety of people and elephants during elephant chasing
7.	Livelihood / Assets/Wil	Conduct awareness programs on	All Chiwogs	Local Govt / Local	0.25	By 2028	

	dlife/People	Human-Wildlife Conflict		Communities / DFO-Sarpang			
8.	People / Livelihood / Assets	Strengthening of Quick Response Team (QRT) and supply of field gear	All Chiwogs	Local Govt / Local Communities / DFO-Sarpang	0.9	By 2029	
9.	Habitat	Habitat Enrichment (Plantation of fodder trees and palatable species and control of invasive species, waterholes, etc.)	Sangkha and Rilangthang	Local Govt / Local Communities / DFO-Sarpang	1	By 2029	There has been a notable loss of valuable palatable plant species within key elephant habitats due to foraging pressure and habitat degradation. To address this, targeted plantation activities will be carried out in identified elephant habitat areas. The species selected for plantation will include native fruit-bearing trees that are not only palatable to elephants but also provide food sources for other wildlife species, particularly monkeys
10.	Livelihood / Assets/Wildlife/People	Study impact of mitigation strategies	All Chiwogs	Local Govt / Local Communities / DFO-Sarpang	0.2	By 2030	

			Total	13.8	
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6. Monitoring and Evaluation

Timely and systematic monitoring and evaluation are critical to ensuring the effective implementation and delivery of strategic actions. This section outlines the approach for tracking progress, assessing performance, and facilitating adaptive management throughout the implementation period. A comprehensive Monitoring and Evaluation Framework (see Table 4) has been developed in alignment with the broader implementation strategy. This framework includes clearly defined indicators to measure the performance of the strategy and evaluate its impact. Output indicators will primarily track the completion and effectiveness of the actions outlined in Section 6, supporting transparency, accountability, and continuous improvement.

6.1 Monitoring

Monitoring is a continuous process that provides stakeholders with regular updates on the progress, delays, or challenges encountered during implementation. For the five-year plan, the DFO Sarpang will conduct annual monitoring exercises. These assessments will help ensure that activities remain aligned with the intended outcomes, enabling timely course corrections and informed decision-making.

6.2 Evaluation

Evaluation serves as a periodic assessment to determine the overall relevance, effectiveness, and impact of the strategy. Two formal evaluations will be conducted during the planned period:

A midterm review in the last quarter of the second year, and

A final review for the last quarter of the fifth year.

Both evaluations will be carried out by a joint team comprising internal members from DFO, along with external evaluators, including representatives from the concerned Functional Division. This collaborative approach ensures a balanced and objective assessment of implementation performance and strategic outcome.

Table 4: Monitoring and Evaluation Framework

Sl. No	Outcome	Action / Activities	Indicator	Baseline	Unit	Yearly Target				
						2026	2027	2028	2029	2030
1.	Livelihood / Assets	Maintenance and enhancement of combined chain-link-electric fencing (Hileykhola to Sarpangkhola)	Length of fencing installed	4.5	Km		4.5			
2.	Livelihood / Assets	Study ecotourism potential in gewogs to boost local economy	No. of Report produced	1	Nos				1	
3.	Livelihood / Assets	Formulate by-laws for management of electric fencing	By-Laws formulated	0	Nos			1		
4.	Livelihood / Assets	To revive the mule track from Tsirang to Sarpang to promote ecotourism and explore potential hiking opportunities	Length of track revived	50	Km				50	
5.	Livelihood / Assets	Periodic monitoring and evaluation of electric fencing	No. of Monitoring conducted	0	Nos			4	4	4

Sl. No.	Outcome	Action / Activities	Indicator	Baseline	Unit	Yearly Target				
						2026	2027	2028	2029	2030
6.	People	Develop SoP for responding to HEC (Risk Management)	Brochures developed and shared with the public	0	Nos	200	200	200	200	200
7.	Livelihood / Assets/Wildlife/People	Conduct awareness programs on Human-Wildlife Conflict	No. of Awareness conducted	4	Nos	1	1	1	1	1
8.	People / Livelihood / Assets	Strengthening of Quick Response Team (QRT) and supply of field gear	No. of members equipped	0	Nos	50		50		50
9.	Habitat	Plantation of fodder trees and palatable species	Area (Ha)	0	Ha	2	2	2	2	2
10	Livelihood / Assets/Wildlife/People	Study impact of mitigation strategies	No. of Report produced	0	Nos					1

7. Conclusion

The C2C Strategy for Gakiling Gewog presents a comprehensive, participatory framework for addressing the persistent and complex challenges of HWC, with a particular focus on HEC. Rooted in robust field assessments, stakeholder consultations, and community engagement, this strategy seeks to harmonize biodiversity conservation with human well-being. By aligning ecological integrity with socio-economic needs, the C2C approach empowers local communities, enhances institutional coordination, and promotes sustainable coexistence.

With a total planned investment of Nu. 13.8 million, the strategy outlines targeted interventions across key outcomes: People, Livelihoods/Assets, Wildlife, and Habitat. Its success hinges on inclusive planning, adaptive management, and continuous learning. Through the integration of physical infrastructure, knowledge-based tools, responsive governance, and nature-based solutions, Gakiling Gewog can serve as a national model for coexistence. Effective implementation, backed by sustained funding, cross-sector collaboration, and consistent monitoring and evaluation, will be vital in achieving the vision of a resilient landscape where people and wildlife thrive together.

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