National Human-Wildlife Conflict Management Strategy of Bhutan (2018 – 2028)

Nature Conservation Division,
Department of Forests and Park Services,
Ministry of Agriculture and Forests

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MINISTER

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ROYAL GOVERNMENT OF BHUTAN

Ministry of Agriculture & Forests

Tashichhodzong, Thimphu: Bhutan

FOREWORD

Bhutan adopted the first national strategy document for Human-Wildlife Conflict Management in 2008. After the strategy document expired in 2013, a new document could not be formulated instantly. However, the ministry continued to pursue the strategies outlined in the first document in mitigating the human-wildlife conflict until the end of 2018. Looking back into the last ten years of implementing the National Human-Wildlife Conflict Management Strategy, the overall efforts had been progressive. Yet there is still more works that need to be done.

Built on the stocktaking of activities implemented through the first strategy and the assessment of the current scenario, I am pleased to learn that the Department of Forests and Park Services has revised the much needed national strategy document for human-wildlife conflict management in Bhutan. Every year, our farmers lose significant amounts of crops and livestock to wildlife, and on the other hand, anthropogenic threats are causing distress to the wildlife species. It is, therefore, vital that we identify the root causes of the problems, carefully analyze them and propose priority actions toward mitigating the issues for enabling a harmonious co-existence between human and wildlife.

Bhutan's strong commitment and conservation efforts have secured the habitats and species ranging from a smallest rodent to mega herbivore like elephant and top carnivores like tiger and snow leopard, which plays a vital role in the ecosystem. Yet all these species cause varying degree of conflict with our people. While conservation is equally important, we must seek an acceptable balance between conservation and livelihood. By addressing these issues, our collective efforts will take the Ministry of Agriculture and Forests a step closer towards achieving the primary concern and commitment of alleviating poverty in our rural villages besides securing ecological diversity.

In order for this strategy to become operational, sustained support and cooperation from the government and conservation partners will be required. I express my full support to the adoption and implementation of the strategy during the 12th Five Year Plan and beyond.

Lastly, I would like to extend my sincere thanks to UNDP Bhutan and Global Environment Facility for their keen interest in dealing with this pressing issue through their support in preparation of this strategy document. I also would like to congratulate the Nature Conservation Division and all the experts involved in the development of this strategy document.

Tashi Delek!

(Yeshey Penjor)

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ROYAL GOVERNMENT OF BHUTAN
Ministry of Agriculture & Forests
Tashichhodzong, Thimphu : Bhutan

སྒྲུང་ཆེན།
SECRETARY

FOREWORD

Human-wildlife conflict (HWC) is an emerging issue that requires the attention of both policy makers and academicians alike. Induced mainly by the strong interface between human and wildlife, the HWC incidences adversely impacts both humans and wildlife. Loss to both wildlife and their habitats and the people and their properties are not acceptable. It is, therefore, vital that this pressing issue of HWC is addressed with urgency. I am pleased to learn that Nature Conservation Division of the Department of Forests and Park Services has taken the much needed step in revising the much needed national strategy document for Human-wildlife Conflict management in Bhutan.

Traditionally, Bhutanese people derived most of their livelihoods from natural resources and there is a strong reverence for nature by the people. Such reverences supported by religious ethics have shaped an environmentally friendly lifestyle, which contributed towards conservation success of the country. However, the conservation success did not come without a cost, as our farmers continue to suffer increasing damages from wildlife. Many wildlife are also victimized due to human encroachment to nature. The first strategy document for HWC management (2008-2013) has helped address some of these issues and this aptly suited document is expected to further enhance our collective actions towards addressing the issues of evolved HWC incidences.

I am glad to learn that all the relevant stakeholders from both within the Ministry of Agriculture and Forests and beyond were actively engaged in developing this strategy document. As the ministry adopts this important strategy document and implement the actions as prioritized, I am optimistic that cordial support will be rendered by all the stakeholders involved as we implement the strategy during and beyod the 12th FYP. The strategies outlined here are expected to reduce the HWC incidences and help create safe habitats for wildlife and safe people and their property in the human domain.

In conclusion, I would like to join our Minister in extending our sincere gratitude to UNDP Bhutan and Global Environment Facility (GEF) for their their support in preparation of this strategy document. I also congratulate the Nature Conservation Division for leading the task in developing this strategy and all other experts involved in the development of this strategy and I wish success in implementing it.

Tashi Delek and best wishes!

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DIRECTOR

Royal Government of Bhutan
Ministry of Agriculture and Forests
Department of Forests and Park Services
Thimphu

PREFACE

With the establishment of protected area networks in the country where human communities are integral part of the protected areas, we perceive a harmonious co-existence between human and nature. However, new challenges have surfaced in managing wildlife in the human dominated landscape and vice versa and it have become more challenging with changing time. The issues of human-wildlife conflict (HWC) have become a daily phenomenon. Towards giving a facelift to the interventions that we put in addressing the HWC in the country, I am pleased to introduce the 2nd Human-Wildlife Conflict Management Strategy of Bhutan (2018-2028).

The document is an outcome of series of expert consultations, scientific symposium and exhaustive discussions with the field implementers. This strategy adopts the SAFE system approach which intends to create safe environment for both people and their assets and wildlife and their habitats in the landscape. As such SAFE system approach is a new holistic management approach and considers development of long-term solutions in a landscape.

This vital document comes at a time when we are at the early phase of 12th Five Year Plan which is aimed towards "enhancing food self-sufficiency and spurring RNR sector transformation while ensuring sustainable Natural Resource Management." With HWC regarded as serious challenges faced by our rural communities, this strategy document will provide clear directions in tracking the root causes and identifying mitigation measures of these issues.

To this end, I would like to express my sincere appreciation to Nature Conservation Division in bringing forth this extremely important strategy to address HWC in Bhutan. I also join in thanking the donors who supported in the development of this important document. I hope that the strategy will be successfully implemented during the 12th five year plan and beyond and create safe environment for people and their assets, wildlife and their habitats and live in harmony with nature and enhance gross national happiness.

My very best wishes!

(Lobzang Dorji)

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Royal Government of Bhutan
Ministry of Agriculture and Forests
Department of Forests & Park Services
NATURE CONSERVATION DIVISION
Thimphu

"Managing Bhutan's Natural Heritage"

ACKNOWLEDGEMENTS

The Nature Conservation Division, Department of Forests and Park Services would like to thank His Excellency Lyonpo Yeshey Penjor, Minister for Ministry of Agriculture & Forests for his support and directions in revising the much needed Human-Wildlife Conflict Management Strategy for Bhutan. I would also like to thank Dasho Rinzin Dorji, Secretary, Ministry of Agriculture & Forests for his guidance in the formulation of this important strategy and Mr. Lobzang Dorji, Director, Department of Forests & Park Services for his continued support and guidance. I am also thankful to Mr. Phento Tshering, former Director of DoFPS for his support during the initiation of the strategy revision works.

My special thanks goes to the core group members responsible for the preparation of this strategy and all other participants who attended the various workshops and consultations for developing this strategy document. The strategy document could not have materialized without their valuable contributions.

I would like to take this opportunity to specially thank and appreciate the team of experts specially; Mr. Jigme Wangchuk, Department of Livestock, Mr. Sangay Dorji, National Plant Protection Centre, Ms. Choney Yangzom, Mr. Jangchub Gyeltshen, Mr. Jigme T. Wangyel, Ms. Karma Choki, Mr. Kinley Rabgay, Mr. Kinga Norbu, Mr. Lhendup Tharchen, Mr. Namgay Wangchuk, Dr. Phuntsho Thinley, Ms. Tshering Pem, Mr. Tshewang Norbu, Mr. Ratu Wangchuk, Mr. Letro and Mr. Ugyen Tshering of the DoFPS who contributed a lot towards materialization of this strategy.

Lastly, I would like to acknowledge the support rendered by donors in revising this important strategy document. The revision of Human-Wildlife Conflict Management Strategy is funded through GEF financed NAPA 3 Project titled **"Enhancing Climate Resilience of Agriculture & Forest Landscape and Community Livelihoods"** implemented by RGoB with technical support from UNDP Bhutan. I also would like to thank the support rendered by all the stakeholders involved and look forward to your continuous support in implementing the strategy.

(Sonam Wangdi)
Chief Forestry Officer

LIST OF ACRONYMS AND ABBREVIATIONS

ABTO	Association of Bhutanese Tour Operators
ARDC	Agriculture Research Development Centre
BAFRA	Bhutan Agriculture and Food Regulatory Authority
BTFEC	Bhutan Trust Fund for Environmental Conservation
BES	Bhutan Ecological Society
CBS	Centre for Bhutan & GNH Studies
CFO	Chief Forestry Officer
CMB	Central Monastic Bodies
CST	College of Science & Technology
DAO	District Agriculture Officer
DoA	Department of Agriculture
DoFPS	Department of Forests and Park Services
DoL	Department of Livestock
DRC	Department of Revenue & Customs
DYT	Dzongkhag Yargay Tshogdhu
FYP	Five Year Plan
GECC	Gewog Environment Conservation Committee
GYT	Gewog Yargay Tshochung
GTC	Global Tiger Centre
ICDP	Integrated Conservation and Development Program
LG	Local Government
MoAF	Ministry of Agriculture and Forests
NCD	Nature Conservation Division
NPPC	National Plant Protection Centre
OAG	Office of Attorney General
RBA	Royal Bhutan Army
RBP	Royal Bhutan Police
RGoB	Royal Government of Bhutan
RICB	Royal Insurance Corporation of Bhutan
RNR	Renewable Natural Resources
RVL	Regional Veterinary Laboratory
SFD	Social Forestry Division
SWOT	Strength Weakness Opportunities Threats
TCB	Tourism Council of Bhutan
UNDP	United Nations Development Program
WMD	Watershed Management Division
WWF	World Wildlife Fund

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CHAPTER 1: INTRODUCTION

1.1. A brief country profile

The Himalayan Kingdom of Bhutan is one of the biodiversity-rich countries in the world. Despite its small size of only 38,394 km2 (NSB, 2018), the country is endowed with 129 species of terrestrial mammals, 736 species of birds, and 5,369 species of plants (NBC, 2014). Many of the globally threatened mammals, including the critically endangered white-bellied heron (*Ardea insignis*) and the endangered Bengal tiger (*Panthera tigris*), Asian elephant (*Elephas maximus*), snow leopard (*Panthera uncia*) thrive in Bhutan's forests. Every year, new species of insects, snails, and plants are being discovered from Bhutan. In addition, the rest of the world knows about Bhutan mostly for its sound environmental and conservation policies. Indeed, Bhutan may be the only country in Asia with the highest proportion of forest cover of 71% (FRMD, 2016) and the highest percentage of land under protection (51.44%; DoFPS 2016). The country's protected area network consists of five national parks, four wildlife sanctuaries and one strict nature reserve, interconnected by eight biological corridors (Fig. 1). The Constitution of the Kingdom of Bhutan mandates the government to preserve a minimum of 60% forest cover for eternity. Bhutan's success in biodiversity conservation is a result of wise leadership of our benevolent monarchs who have always placed environmental conservation at the forefront of national development.

More than half of the country's population live in the rural areas subsisting on agro-pastoralistic livelihood (Tshering and Thinley, 2017), which involves both rearing livestock and crop cultivation in the lower areas below 4,000 meters above sea level (m.a.s.l.) and mainly rearing livestock in the higher areas above 4,000 m.a.s.l. (Thinley and Lassoie, 2013). Mahayana Buddhism is the state religion, which is deeply intertwined with people's culture and livelihood, influencing their deep reverence for nature and wildlife.

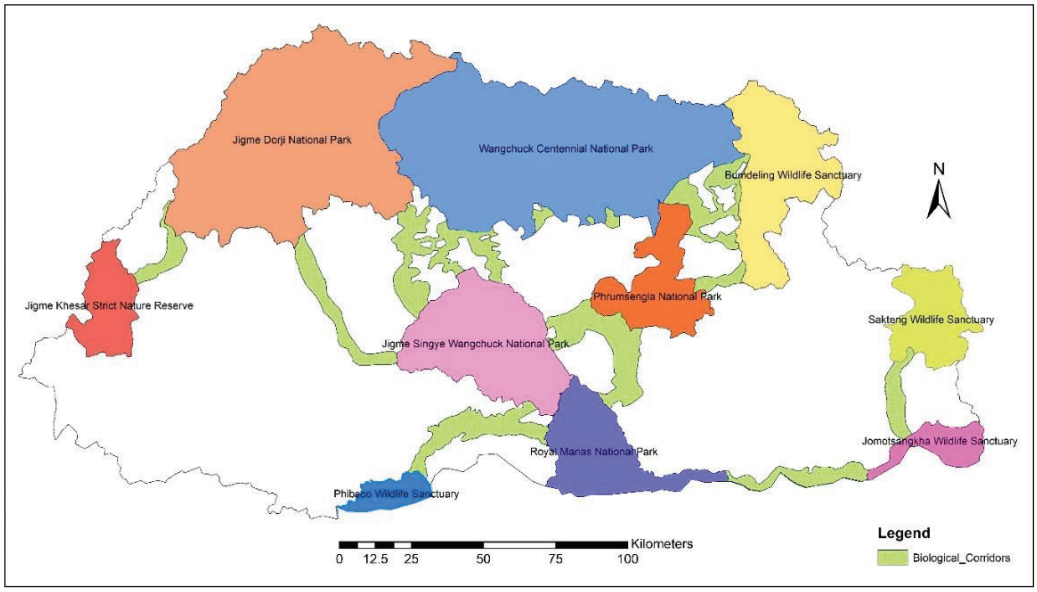

Figure 1. Protected Areas of Bhutan

1.2. Human-wildlife conflict situations in Bhutan

Human-wildlife conflict (HWC) is a global phenomenon wherein humans and wildlife negatively affect each other (Conover, 2002). HWCs are common in places where wildlife and human populations coexist and share limited resources (Schwerdtner and Bernd, 2007). Humans and wild animals are bound to conflict with one another whenever there are encroachments into each other's territory and consequent disturbance of livelihoods. Such incidences will exacerbate in the modern Anthropocene era with many human-dominated landscapes (Caro et al., 2012) and large human-wildlife interfaces, calling for continuous innovation and adaptation of the strategies to mitigate conflicts and to forge harmonious co-existence.

Bhutan being a predominantly agrarian society with about 60% of the population subsisting on forest-based agriculture and livestock production, human-wildlife conflicts will intensify and hence resolving such conflicts remains a huge challenge. Bhutan by virtue of its high forest cover and high biodiversity is naturally predisposed to human-wildlife conflicts due to large extent of human-wildlife interface. The expanding human settlements and their highly scattered nature and mostly located in the middle of forests pose a huge challenge to reducing human-wildlife interface. Dispersed human settlements also demand increased infrastructural developments, such as wide network of roads and power transmission lines, all of which result in increased habitat destruction and exacerbated human-wildlife conflicts. Further, some people continue to

reside inside the protected areas in due recognition of their traditional rights (NCD, 2004). This is contrary to the situations in other countries where human settlements have been relocated outside of the protected areas to minimize conflicts (Rao and Geisler, 1990; McLean and Straede, 2003). Expanding human settlements and resource utilizations inside the protected areas is also a huge challenge in resolving human-wildlife conflicts in Bhutan.

Figure 2. Nabji village in Trongsa

Two major reviews of HWC studies in Bhutan have been conducted so far by Thinley and Lassoie (2013) and Rajaratnam et al. (2016). Surmising from these reviews, human-wildlife conflicts in Bhutan can be broadly categorized into: a) crop damage by wild herbivores, and b) livestock predation by wild carnivores. Farmers' crops are lost to a suite of wild ungulates mainly wild pig (*Sus scrofa*), sambar (*Rusa unicolor*), barking deer (*Muntiacus muntjac*), hog deer (*Axis porcinus*), and elephants; wild primates mainly Assamese macaque (*Macaca assamensis*), gray langur (*Semnopithecus schistaceus*), capped langur (*Trachypithecus pileatus*) and (occasionally to) golden langur (*Trachypithecus geei*); and rodents, mostly to Indian porcupine (*Hystrix indica*). Although difficult to assess losses in terms of quantity and area lost, crop losses accounted for up to 18% of total household income loss in the early 1990's

(Choden and Namgay, 1996). There is no such assessment conducted in the recent years, and hence there is no current extent of crop losses to wild animals. Crop losses to wild animals vary from place to place with regard to principal crop raiders, which are the elephants in southern belts and the wild pigs in the east, west and central parts. Influenced by a species' distributional range, hog deer damage is reported only from Sarpang Dzongkhag and golden langur damage from Sarpang, Trongsa, Tsirang, and Zhemgang (Thinley et al., 2019). Massive population reduction measures cannot be pursued for any of these crop raiders, because they serve as the important prey species for numerous wild predators and also due to religious sentiments. Livestock are lost mostly to wild predators such as tiger, snow leopard, common leopard (*Panthera pardus*), dhole (*Cuon alpinus*), and Asiatic black bear (*Ursus thibetanus*). Yaks are mostly lost to snow leopards while bulls are commonly lost to tigers, and cattle and horses to dholes and leopards (Sangay and Vernes, 2008). Combined crop and livestock losses to wild animals could present a major setback to rural socio-economy (Sangay and Vernes, 2014; Thinley et al., 2018b). Incidences of bears damaging crops, raiding houses and monasteries, and mauling humans have been reported from some places. The other types of conflicts are transmission of diseases, poaching and retaliatory killings.

Apart from issues and challenges, the human-wildlife conflicts in Bhutan present several opportunities. Different stakeholders can convene to strengthen partnership and linkages in developing innovative strategies to mitigate conflicts. The conflicts also offer avenues to undertake in-depth ecological research to understand biology and behavior of the problem species. The tourism sector can benefit from increased wildlife sightings within the village vicinities. In attempting to resolve the conflicts, the relationship between wildlife conservationists and rural people can be improved.

1.3. Review of the past HWC strategy

The Nature Conservation Division (NCD) of the Department of Forests and Park Services (DoFPS) has developed the first-ever comprehensive HWC strategy called "Bhutan National Human-Wildlife Conflicts Management Strategy (2008 – 2013)" in 2008. The strategy had five themes viz., wild pig, elephant, carnivores, ungulates, and primates, and cross-cutting theme that was common to all. Under each theme (or chapter), objectives and strategies to mitigate conflicts were clearly listed. As stated in the last chapter, the strategy was to be implemented by the communities, local governments and field offices with technical backstopping from the NCD, National Plant Protection Center (NPPC) under Department of Agriculture (DoA), Department of Livestock (DoL), and the erstwhile Council of

RNR Research of Bhutan. The activities were to be monitored and evaluated by a core team from the Ministry of Agriculture.

The past strategy document expired in 2013 and could not be revised from thereafter, but the strategic action plans were assessed based on fulfillment of the objectives till the end of 2018. Overall, the past strategy has been satisfactorily implemented based on stocktaking of activities implemented so far. All six objectives for resolving human-carnivore conflicts were partially achieved, and there is still some more works to be done on improving livestock herd management, mapping the spatio-temporal distribution of human-carnivore conflicts in the country, and generating more information on the ecology of the carnivore species that are in conflict with humans. The first objective on mitigating human-wild pig conflicts (i.e., to reduce crop losses to wild pigs and lessen socio-economic burdens on farmers) has been partially fulfilled, as most of the strategies could not be pursued due to policy and cultural conflicts and some were technically unfeasible. None of the strategic actions under objective 2 (i.e., to conduct adaptive research to better understand wild pig ecology) of this theme were implemented, despite the fact that wild pig is the principal crop raider in many parts of the country. With regard to resolving human-ungulate conflicts all three objectives were achieved, except that the proposed strategic action of culling the problem species which is again not feasible due to legal and cultural limitations. Likewise, all objectives to resolve human-elephant conflicts and human-primate conflicts were fully achieved. Under the cross-cutting theme, all objectives for Integrated Conservation and Development Program (ICDP) and Environment Education components were achieved, but regarding the ecotourism component the regulated hunting of wild pigs by tourists could not be implemented due to legal and cultural restrictions.

1.4. Salient features of the current HWC strategy

The current HWC strategy differs from the past strategy in the following aspects.

1) **Follows the SAFE system** – The World Wildlife Fund (WWF) has recently developed a SAFE system to address human-wildlife conflicts such that the problem species, its habitat, humans, and human assets are safeguarded (NPPC and WWF-Bhutan, 2016). The new strategy has followed the SAFE approach by linking the objectives and strategies to all SAFE key components.

2) **Based on scientific data and field expertise** – The current strategy is an outcome of series of expert consultations, research symposium and exhaustive discussions with the field implementers. Several rounds

of consultative workshops were held with the stakeholders involved in mitigating HWCs to discuss and identify emerging issues and assess the strengths, weaknesses, opportunities and threats of some of the key strategies from the past strategy document. A two-day research symposium was held in Gelephu (20 to 21 November, 2018) to take stock of the HWC activities implemented and HWC studies conducted since 2008. The recommendations from the symposium proceedings were included to devise new strategies under different themes.

3) **Includes new themes to tackle new issues** – The current strategy has dedicated a new chapter on rodents in light of the emerging issue of rodents damaging agricultural crops in some pockets of the country. A separate chapter is also developed for the bears in recognition of its extent of conflicts with humans in terms of crop, livestock, and property damage and human casualties. The human-carnivore conflict chapter in the old strategy document is now split into two chapters (resolving human-canid conflicts and resolving human-felid conflicts) in order to derive specific focus on different taxonomic groups in view of their different nature of conflicts.

4) **Adaptive to changing environment** – The objectives of the new strategy document are kept broad to accommodate new strategies to tackle new issues. The strategies and actions are not prescriptive but simply proposed to provide guidance and reference framework.

5) **Includes practical monitoring and Evaluation** – The current strategy has a separate chapter on Monitoring and Evaluation (M&E) to periodically monitor implementation of the strategic actions and evaluate their impacts.

CHAPTER 2: HUMAN-FELID CONFLICT MANAGEMENT

2.1. Problem Statement

Human-felid conflict is one of the most urgent issues worldwide with regard to wildcat conservation (Karanth and Gopal, 2005) and efforts to synthesize knowledge about these conflicts have been few. The severity of conflict increases with a felid species' body mass (Inskip and Zimmermann, 2009). Human-felid conflict is mainly caused due to the predation of the livestock by the felids (Wang and Macdonald, 2006; Dalerum et al., 2009; Ripple et al., 2014; Rostro-Garcı´a et al., 2016). It is also common for the felids taking human lives elsewhere (Dalerum et al, 2009; Ripple et al., 2014). Moreover, due to the demand for wildlife parts in the international black market, poaching of felids is increasing (Corlett, 2007).

Among the nine species of wild felids confirmed present in Bhutan, the ones that come into conflict with the humans is the tiger, common leopard and snow leopard (Rostro-Garcı´a et al., 2016; Wangchuk and Tharchen, 2016). The human-felid conflict in Bhutan is dominated by felids taking livestock (Wang and Macdonald, 2006; Sangay and Vernes, 2008; Wangchuk and Tharchen, 2016; NCD, 2018) causing economic loss to the farmers (Wang and Macdonald, 2006). So far there is only one incidence of a tiger killing a man in Trongsa.

Wildlife poaching in general has never been considered as a significant threat for conservation in Bhutan, however, the current information indicates that it is increasing (NCD, 2018). In the recent years, the DoFPS recorded 19 cases of tiger poaching in Bhutan. Although there is no official record, retaliation against wild felids resulting from their livestock predation is potentially one of the major threats to their conservation in Bhutan (Rostro-Garcı´a et al., 2016). Aside from poaching and retaliation, tigers and leopards could face fatalities from being caught in the snares intended to trap other species (NCD, 2018). Some of them could be deliberately poisoned in retaliation (Wang, 2008). Some felids could be threatened by disease transmission from domestic animals, although there is only one recent case of a tiger dying from neurocysticercosis (migration of tapeworm larval cyst in the brain of an animal).

As livestock rearing is a significant source of rural livelihood and important part of the rural economy (Sangay and Vernes, 2008), livestock depredation by wild felids can cause major economic setbacks as well as threaten the survival of wild felids. Therefore, it is very important to meaningfully reduce livestock depredation by wild felid. This chapter addresses mitigation measures to address human-felid conflicts, mainly focusing on tiger, common leopard, and snow leopard.

2.2. Objectives, Strategies and Actions.

Objective 1. To understand the extent and distribution of human-felid conflicts in Bhutan

Strategy 1: Characterise human-felid conflict on spatio-temporal scale.

Actions:

1. Carry out hotspot mapping, highlighting spatio-temporal characteristics of human-felid conflict.
2. Assess the severity and impacts of human-felid conflicts to both humans and felids.

Objective 2: To reduce human-felid conflict

Strategy 1: Raise awareness of the livestock owners on the causes of human-felid conflicts

Actions:

1. Conduct mass education and awareness on the conflict scenario and preventive measure, policy, strategy and science of human-felid conflict in Bhutan.
2. Organize religious discourses on the spiritual linkage of flied conservation and human wellbeing.

Strategy 2: Reduce the scale of livestock predation through improved guarding practices.

Actions:

1. Install solar and electric fences around the cattle shed to minimize loss of cattle to felids.
2. Build corals for the cattle calves.

Strategy 3: Change perception of the livestock owners towards wild felids

Actions:

1. Initiate community-based ecotourism in the felid landscapes
2. Link and establish Payment for Ecosystem Services schemes in the felid landscapes.

Objective 3: To maintain healthy felid-friendly ecosystem

Strategy 1: Ensure adequate wild prey base to support wild felids

Actions:

1. Maintain and improve the existing cattle grazing lands (tsamdros) to provide more foraging areas for wild herbivores.

Strategy 2: Prevent spread of diseases to wild felids.

Action:

1. Assess threat of disease transmission to wild felids and their prey from livestock and feral animals.
2. Initiate measures to prevent disease transmission to and from wild felids.

Objective 4: To reduce poaching and illegal trade of wild felids

Strategy 1: Strengthen law enforcement**.**

Actions:

1. Strengthen and reinforce law enforcement with regard to poaching and illegal trade of wild felids.
2. Build capacity of the field staff and law enforcement agencies in wildlife crime detection, reporting and prosecution.

Strategy 2: Strengthen vigilance and intelligence networking

Actions:

1. Train field staff in patrolling, intelligence gathering, and information sharing.
2. Improve communication systems for field patrolling.
3. Strengthen and upscale SMART patrolling.
4. Build synergy, cooperation, and coordination among the law enforcement agencies.

2.3. Human- Felid Conflict Management Strategy Log Frame

Objective	Strategy	Actions	Key Performance Indicator	Implementing Agency		Priority (High, Medium, Low)	Cost Estimate (Mn. Nu.)
				Lead	Collaborator		
To understand the extent and distribution of human-felid conflicts in Bhutan	Characterise human-felid conflict on spatio-temporal scale.	Carry out hotspot mapping, highlighting spatio-temporal characteristics of human-felid conflict.	Hotspots mapped/ Conflict prediction map produced.	NCD/ UWICER	DoFPS Field Offices/ GTC	H	1
		Assess the severity and impacts of human-felid conflicts to both humans and felids.	Report on impact of felid conflict generated	NCD/ UWICER	DoFPS Field Offices/ GTC	M	1
To reduce human-felid conflict	Raise awareness of the livestock owners on the causes of human-felid conflicts	Conduct mass education and awareness on the conflict scenario and preventive measure, policy, strategy and science of human-felid conflict in Bhutan.	70% of the rural communities in conflict areas made aware on human-felid conflict.	NCD/ DoFPS Field Offices	LGs, RSPN, BES/ GTC	M	3
		Organize religious discourses on the spiritual linkage of flied conservation and human wellbeing	Religious discourses conducted	DoFPS Field Offices	LGs, CBS, Dratshang Lhentshog	M	2
	Reduce the scale of livestock predation through improved guarding practices.	Install solar and electric fences around the cattle shed to minimize loss of cattle to felids.	At least 20 units of electric installed	DoFPS Field Offices	LGs, DoL	M	5
		Build corals for the cattle calves	At least 40 corals built	DoFPS Field Offices	LGs, DoL	M	5

	Change perception of the livestock owners towards wild felids	Initiate community-based ecotourism in the felid landscapes	5 ecotourism products developed	NCD/ DoFPS Field Offices	LGs, TCB	M	5
		Explore Payment for Ecosystem Services schemes in the felid landscapes	PES schemes explored	WMD	NCD, LGs, DoFPS Field Offices	L	2.5
To maintain healthy felid-friendly ecosystem	Ensure adequate wild prey base to support wild felids	Maintain and improve the existing cattle grazing lands (tsamdros) for wild herbivores	30 tsamdro lands managed for herbivores	DoFPS Field Offices	LGs, DoL/ GTC	M	3
	Prevent spread of diseases to wild felids	Assess threat of disease transmission to wild felids and their prey from livestock and feral animals	Complete disease threat assessment undertaken.	NCD	LGs, DoFPS Field Offices, DoL (DVH, NCAH, RDCs)	M	1
		Initiate measures to prevent disease transmission to and from wild felids	Feral dog population managed in the high landscapes.	NCD	LGs, DoFPS Field Offices, DoL (DVH, NCAH, RDCs)	M	3
To reduce poaching and illegal trade of wild felids	Strengthen law enforcement	Strengthen and reinforce law enforcement with regard to poaching and illegal trade of wild felids.	SMART Patrolling implemented in field offices	FPED	DoFPS Field Offices, RBP, DRC, BAFRA, OAG, NCD	H	3
		Build capacity of the field staff and law enforcement agencies in wildlife crime detection, reporting and prosecution	50% of the Department staff trained in enforcement and prosecution.	FPED	Field Division & PAs, RBP, DRC, BAFRA, OAG, NCD	H	4

	Strengthen vigilance and intelligence networking	Train field staff in patrolling, intelligence gathering, and information sharing.	50% of the Department staff trained in intelligence gathering	FPED	DoFPS Field Offices, NCD	M	4
		Improve communication systems for field patrolling.	Proper communication system in place	FPED	DoFPS Field Offices, NCD	M	2
		Strengthen and upscale SMART patrolling.	SMART patrol upscale in all parks and Divisions.	FPED	DoFPS Field Offices, NCD	M	5
		Build synergy, cooperation, and coordination among the law enforcement agencies	Formal collaboration with RBP, Customs and DoFPS established.	FPED	DoFPS Field Offices, RBP, DRC, BAFRA, OAG, NCD	M	1

CHAPTER 3: HUMAN-CANID CONFLICT MANAGEMENT

3.1. Problem Statement

Bhutan has four wild canids, namely, Asiatic wild dog (*Cuon alpinus*), Tibetan wolf (*Canis lupus chanco*), Golden jackal (*Canis aureus*), and Red fox (*Vulpes vulpes*), as per the Field Guide to Mammals of Bhutan (Wangchuk et al., 2004). Only the Tibetan wolf and the wild dog (also commonly known as dhole) come into conflict with humans for predation of domestic livestock. The wolf occurrence has been recorded from Bji Gewog of Haa Dzongkhag (DoFPS, 2011), Nubri in Tsento Gewog of Paro Dzongkahg, Lunana Gewog of Gasa Dzongkhag (Thinley et al., 2015) and Chhoekortoe and Dhur in Chhoekor Gewog of Bumthang Dzongkhag (Norbu, 2014). The dhole is distributed throughout Bhutan, although its population has recovered from a mass poisoning campaign in the 1970s and 1980s as a result of persistent livestock losses (Wangchuck, 2004).

Wolves are known to predate on domestic yaks and horses. Cases of livestock depredation by wolves have been reported only from Lunana and upper Chhoekhor. In Bumthang, wolf predation on livestock has escalated since 2011, and has caused a total loss of about Ngultrum 1 million from 2009 to 2013 (Norbu, 2014). There is no such assessment in Lunana. Dholes are also known to predate on yaks and horses in addition to cattle and sheep (Wang and Macdonald, 2009; Thinley et al., 2011). The dhole is the principal livestock depredator in many places in Bhutan. For instance, people in Upper Chhoekor in Bumthang, cattle owners lost 177 yaks and 4 horses to dholes within a span of five years from 2009 – 2013, constituting 35% of the total livestock loss to predation by wild predators (Norbu, 2014).

Livestock losses to wild predators in Bhutan is generally attributed to lax herding (Rajaratnam et al., 2016; Tshering and Thinley, 2017) and low density of natural preys (Wang, 2010; Thinley et al., 2017). Tshering and Thinley (2017) reported highest number of livestock animals lost to dholes (49.9%) in western Bhutan, and the proportion of livestock lost to predation when not herded was significantly higher than losses when not herded.

In addition, there is very few studies on the dhole despite its endangered status and being a predominant livestock predator (Namgyal and Thinley, 2017). Similarly, little is known about the wolves in Bhutan (Norbu, 2014).

Figure 3. A dhole killed by farmers in Bumthang

Figure 4. A yak killed by dholes in Lingzhi

3.2. Objectives, Strategies and Actions

Objective 1: To reduce number of incidences of livestock depredation by wild canids

Strategy 1: Reduce the vulnerability of livestock to predation by wild canids

Actions:

1. Study livestock herding practices and recommend the best practices.
2. Carry out livestock intensification (or population reduction) programs in conflict hotspot areas.

Objective 2: To maintain viable populations of wild canids

Strategy 1: Improve understanding of the ecological aspects of wild canids

Actions:

1. Map the distribution of wild canids based on their current occurrences.
2. Assess the population status, home range, prey selection, and habitat selection by wild canids.

Strategy 2: Enhance prey populations for wild canids.

Actions:

1. Assess the abundance of prey species for wild canids.
2. Restore and enrich habitats for prey species.

Strategy 3: Develop comprehensive species-specific conservation plans for wild canids.

Actions:

1. Develop dhole and wolf conservation plan.

Objective 3: To increase the knowledge-base on human-canid conflicts

Strategy 1: Study the human dimensions of human-canid conflict.

Actions:

1. Study the nature and extent of human-canid conflict.
2. Study people's attitude, tolerance and acceptance capacity of wild canids.

Strategy 2: Study or document the extent of retaliatory killing of wild canids

Actions:

1. Conduct study on retaliatory killing of wild canids through social questionnaire survey

3.3. Human-Canid Conflict Management Strategy Log Frame

Objectives	Strategy	Actions	Key performance indicators	Implementer		Priority (High, Medium, Low)	Cost Estimate (Mn. Nu.)
				Lead	Collaborator		
To reduce number of incidences of livestock depredation by wild canids	Reduce the vulnerability of livestock to predation by wild canids	Study livestock herding practices and recommend the best practices	Study on livestock herding practices conducted	DoL/ UWICER	LG/ NCD/ DoFPS Field Offices	H	3.0
		Carry out livestock intensification programs in conflict hotspot areas	Livestock intensification programs conducted	DoL	LG/ DoFPS Field Offices	H	8.0
To maintain viable populations of wild canids	Improve understanding of the ecological aspects of wild canids	Map the distribution of wild canids based on their current occurrences.	Distribution map produced	NCD/ UWICER	DoFPS Field Offices	H	3.0
		Assess the population status, home range, prey selection and habitat selection by wild canids.	Canids-prey population dynamics study conducted	DoFPS	DoL	H	0.3
	Enhance prey populations for wild canids	Assess the abundance of prey species for wild canids.	Canid prey population assessed	NCD/ UWICER	DoFPS Field Offices	M	0.3
		Restore and enrich habitats for prey species.	Area of habitat enriched	DoFPS Field Offices	NCD/ UWICER	M	4.0
	Develop comprehensive species-specific conservation plans for wild canids.	Develop dhole and wolf conservation plan	Canid conservation plan developed	NCD	DoFPS Field Offices/ UWICER	M	1.5

To increase the knowledge-base on human-canid conflicts	Study the human dimensions of human-canid conflict	Study the nature and extent of human-canid conflict	Study conducted	UWICER	DoFPS Field Offices/ NCD	M	2.0
		Study people's attitude, tolerance and acceptance capacity of wild canids.	Study conducted	UWICER	DoFPS Field Offices/ NCD	M	4.0
	Study or document the extent of retaliatory killing of wild canids	Conduct study on retaliatory killing of wild canids through social questionnaire survey	Study conducted	UWICER	DoFPS Field Offices/ NCD	M	2.0

CHAPTER 4: HUMAN-BEAR CONFLICT MANAGEMENT

4.1. Problem statement

The Asiatic black bear (*Ursus thibetanus*) is the only bear species found in Bhutan. It is listed in Schedule I of the Forest and Nature Conservation Act of Bhutan 1995 which affords maximum protection to the listed species. Human-bear conflict is very common in almost all parts of Bhutan (NCD, 2008). The nature and intensity of conflicts with bears vary from places to places and conflicts with bears include livestock predation, crop damage, house raiding and even attacks on humans. As of 2015, 17 cases of bear mauling humans and 51 of livestock depredation by bears have been recorded (NCD, HWC database), although most of the cases go unreported. A case study in the buffer zone of Jigme Khesar Strict Nature Reserve, particularly in Sombaykha Gewog of Haa Dzongkhag, revealed that bears accounted for 58% of crop damage and 19% of livestock depredation (Wangchuk et al., 2018). Such incidences have caused annoyances, financial losses, injuries and even deaths to people living in close proximity to bear habitats. In most cases, farmers who have experienced negative interactions with bears harbour strong resentments and are thus more likely to lethally retaliate against the problem individuals. Hence, clandestine killings of bears could be happening and such killings in isolated areas with already small population could threaten bear populations and may cause local extinctions in such areas. Lately, bear-human conflicts have increased in many areas (Dorji, 2013) and have caused growing concerns among both wildlife conservationists and rural people. Such conflicts which if not resolved soon will severely affect bear conservation in the near future.

Not only that the bears face persecutions and retaliatory killings from human due to their nuisances, they also face direct elimination from poaching and indirect killings in snares and traps set for other wildlife species. Bears are mainly poached for bile, meat, and paws which are said to have medicinal properties.

Additionally, there is paucity of information on human-bear conflicts in Bhutan. So far, there are very few empirical studies related to this issue and hence there is limited understanding of the issue with regard to its nature and underlying causes. Drafting of a pragmatic human-bear conflict mitigation strategy is thus greatly hindered.

Figure 5. Figure 5. (L) A bear trapped in snare near agriculture field (R) Injured bear due to snaring in Haa

4.2. Objectives, Strategies and Actions

Objective 1: To prevent human-bear conflict

Strategy 1: Conduct education and awareness programs.

Actions:

1. Develop targeted Information, Education and Communication (IEC) materials on human-bear conflicts.
2. Educate the public on avoiding fatal encounters with bears.

Strategy 2: Carry out bear habitat management.

Actions:

1. Identify plant species preferred by bears.
2. Do habitat enrichment planting.

Strategy 3: To reduce supplemental food sources to bears.

Actions:

1. Advocate and support proper disposal of human wastes and livestock carcasses to avoid bears coming closer to human settlements.
2. Educate and support rural people on proper storage and guarding of food stocks in their houses.
3. Advocate and support monks and hermits on proper storage and disposal of ritual cakes, butter, flour and other items.

Strategy 4: Innovate and apply different bear deterrents and barriers.

Actions:

1. Support the installation of effective electric fences to keep away the bears from sensitive areas.
2. Support the construction of bear-proof sheds for poultry, juvenile yaks, cattle and sheep.
3. Encourage livestock owners to keep guard dogs to alert livestock owners of intruding bears.

Objective 2: To enhance understanding of the nature and pattern of human-bear conflict

Strategy 1: Promote research on the nature of human-bear conflicts.

Actions:

1. Document spatio-temporal characteristics of human-bear conflicts.
2. Assess the socio-economic characteristics and correlates of human-bear conflicts.
3. Assess the severity, extent, and impacts of human-bear conflicts.
4. Assess the behaviour of problematic bear individuals.

Strategy 2: Increase knowledge on the ecology of bears.

Actions:

1. Investigate the dietary selection, habitat use, and movement pattern of bears.
2. Assess the population abundance of bears.

4.3 Human-Bear Conflict Management Strategy Log frame

Objectives	Strategy	Actions	Key Performance Indicators	Implementer		Priority (High, Medium, Low)	Cost Estimate (Mn. Nu.)
				Lead	Collaborator		
To prevent and manage human-bear conflict	Conduct education and awareness programs	Develop targeted IEC (information, education and communication) materials on human-bear conflict	No. of IEC materials produced	NCD	DoFPS Field Offices/ ICTD	H	1.0
		Raise awareness of the policy makers and general public on human-bear conflicts	No. of awareness conducted	NCD	PPD MoAF/ LG	M	5.0
		Educate the public on avoiding fatal encounters with bears	No. of awareness conducted	NCD/ DoFPS Field Offices	LG	H	3.0
	Carry out bear habitat management	Identify plant species preferred by bears	Report on plant species preferred by bear	UWICER/ NCD	DoFPS Field Offices	M	2.0
		Do enrichment planting of preferred plant species.	No. and area of enrichment plantation	DoFPS Field Offices	Green Bhutan/ NCD	L	5.0
	To reduce supplemental food sources to bears	Advocate and support proper management of human wastes and disposal of livestock carcasses to avoid bears coming closer to human settlements.	No. of advocacy program conducted	NCD/ DoL	LG/ DoFPS Field Offices	H	5.0
		Educate and support rural people on proper storage and guarding of food stocks in their houses.	No. of households	DoFPS Field Offices	LG	H	7.0

		Advocate and support monks and hermits on proper storage and disposal of ritual cakes, butter, flour and other religious items	No. of support and advocacy program conducted	NCD/ DoFPS Field Offices	CMB	H	5.0
	Innovate and apply different bear deterrents and barriers	Support the installation of effective electric fences to keep away the bears	Km of electrical fencing; Numbers of HH benefited	LG/ DoFPS Field Offices	NCD, NPPC	M	7.0
		Support the construction of bear-proof sheds for juvenile cattle.	No. of beneficiaries	LG/ DoFPS Field Offices	NCD/ DoL	M	7.0
		Encourage livestock owners to keep guard dogs to alert livestock owners of intruding bears	No. HH raising and owning good breed of dog	DoL	LG	L	0.5
To enhance understanding of the nature and pattern of human-bear conflict	Promote research on the nature of human-bear conflicts	Document spatio-temporal characteristics of human-bear conflicts	No. of research conducted and Reports published	NCD/ UWICER	DoFPS Field Offices	H	5.0
		Assess the socio-economic characteristics and correlates of human-bear conflicts.	Reports published	UWICER/ NCD	DoFPS Field Offices	H	5.0
		Assess the severity, extent, and impacts of human-bear conflicts	Reports published	UWICER/ NCD	DoFPS Field Offices	H	5.0
		Assess the behaviour of problematic bear individuals.	No. of research conducted	UWICER/ NCD	DoFPS Field Offices	M	5.0
	Increase knowledge on the ecology of bears	Investigate the dietary selection, habitat use, and movement pattern of bears	No. of research conducted and Reports and map produced	UWICER/ NCD		M	5.0
		Assess the population abundance of bears	No. of survey conducted and abundance of bear known	NCD/ UWICER	DoFPS Field Offices	H	7.0

CHAPTER 5: HUMAN-ELEPHANT CONFLICT MANAGEMENT

5.1. Problem Statement

The Asian elephant is found only in the southern parts of Bhutan. Recent nationwide elephant survey estimated 678 individuals that are distributed within a total geographical area of 8,000 km^2, spanning six southern Dzongkhags of Samdrupjongkhar, Pemagatshel, Sarpang, Samtse, Dagana and Chukha. However, not all elephants in Bhutan are permanent residents. Some migrate frequently across the Indo-Bhutan border. Recent collaring of a few individuals by the NCD showed that the elephants spend most of their foraging times in the Indian territory and come to the Bhutanese side usually for salt intake at the natural saltlicks that are found inside Bhutan. According to Jigme and Williams (2011), elephants are mostly observed in Bhutan during the major cropping season.

Crop depredation and property damage by elephants continue to be a serious issue in the southern parts of Bhutan. Elephants have caused economic losses and social burden on farmers for many years. Approximately 42% of the households sharing space with elephants' experience crop losses to elephants, and maize is the major crop raided by the elephants (Tshering et al., 2017). The other crops raided are paddy, millet, banana, arecanut, coconut, and sugar cane. In the year 2018, three people were reported to be killed by elephants. Meanwhile, most cases of elephant damages do not get reported to government authorities and are thus undocumented. For example, about 40% of households in Sarpang Dzongkhag did not report crop damage by elephants to any authorities, and the top three reasons stated by farmers are 1) lack of reporting system, 2) absence of compensation for crop and property losses caused by wildlife, and 3) fewer damages to crops as compared to other personal effects (Tshering et al., 2017).

Until now, not much is known about the root cause of crop depredation by elephants. This is probably due to fewer studies on the causes of crop damages by elephant for which the answers may lie in the in-depth understanding of elephant ecology, migration routes and patterns, and elephant-human interactions. While information exists on the population and distribution of elephants, little is known about their migratory patterns. There is also lack of adequate data about spatial and temporal pattern of crop depredation in all areas affected by elephants.

5.2. Objectives, Strategies and Actions

Objective 1: To understand the nature and extent of human-elephant conflict

Strategy 1: Assess the extent of human-elephant conflicts in all elephant range areas.

Actions:

1. Study the spatial and temporal patterns of human-elephant conflicts.
2. Map human-elephant conflict hotspots.

Strategy 2: Identify and protect elephant migration routes.

Actions:

1. Study habitat use and migratory routes.
2. Delineate and protect migratory route.
3. Study land-use change in and around elephant migratory routes.

Objective 2: To reduce the number of incidences of human-elephant conflicts

Strategy 1: Pilot and upscale effective counter measures to deter elephants from encroaching into the agricultural crop fields.

Actions:

1. Pilot the use of live fences.
2. Upscale the construction of electric fences in the prone areas.
3. Experiment cultivating buffer (or non-palatable/non-preferred) crops.
4. Pilot constructing trenches around the vulnerable areas.
5. Upscale constituting Rapid Response Teams in other elephant affected areas.
6. Pilot raising beehives around the crop fields to keep away the elephants.

Strategy 2: Conduct mass awareness program on avoiding and mitigating human-elephant conflicts.

Actions:

1. Organize awareness programs on mitigating human-elephant conflicts for rural communities and schools.
2. Install informative signages at strategic locations.

Strategy 3: Strengthen anti-poaching, law enforcement, and networking to control poaching of elephants.

Actions:

1. Upscale SMART patrolling in all probable elephant poaching areas.
2. Institute community intelligence and vigilantes.

3. Strengthen coordination, information sharing, and joint patrolling with counterparts across the Indo-Bhutan border.

Strategy 4: Develop capacity of the local people and field staff to mitigate and deal with human-elephant conflicts.

Actions:

1. Train field staff and local people on installation and maintenance of electric and solar fences.
2. Organize regional and international study tours and field visits for field staff and local people to gain exposure on human-elephant conflict mitigation.
3. Organize national, regional and international seminars and symposiums on human-wildlife conflict mitigation to foster sharing of knowledge, lessons learned, and best practices.
4. Strengthen coordination, information sharing, and joint patrolling with counterparts across the Indo-Bhutan border.

Objective 3: Secure and improve elephant habitats and movement corridors

Strategy 1: Manage and restore elephant habitats.

Actions:

1. Implement habitat enrichment and improvement programs in the habitats and corridors.

5.3. Human-Elephant Conflict Management Strategy Log Frame

Objectives	Strategy	Actions	Key Performance Indicators	Implementer		Priority (High, Medium, Low)	Cost Estimate (Mn. Nu.)
				Lead	Collaborator		
To understand the nature and extent of human-elephant conflict	Assess the extent of human-elephant conflicts in all elephant range areas.	Study the spatial and temporal patterns of human-elephant conflicts	Study reports and maps	NCD	DoFPS Field Offices	H	1.8
		Map conflict hotspots	Hotspots mapped	NCD	DoFPS Field Offices	H	1.0
	Identify and protect elephant migration routes	Study habitat use and migratory routes.	Study reports and maps	NCD	DoFPS Field Offices	H	2.0
		Delineate and protect migratory route	No. of migratory routes demarcated	DoFPS Field Offices	NCD	H	0.8
		Study land-use change in and around elephant migratory routes	Study report	NCD/ UWICER	DoFPS Field Offices	M	1.0
To reduce the number of incidences of human-elephant conflicts	Pilot and upscale effective counter measures to deter elephants from encroaching into the agricultural crop fields.	Pilot the use of live fences.	No. of sites and length of live fence	DoFPS Field Offices	NCD	M	2.0
		Upscale the construction of electric fences in the conflict prone areas	No. of sites and length of electric fence	DoFPS Field Offices	NPPC	M	5.0
		Experiment cultivating buffer (or non-palatable/non-preferred) crops	No. and area of sites	DoFPS Field Offices	DoA	L	2.0
		Pilot constructing trenches around the vulnerable areas.	No. of sites and length of trenches	DoFPS Field Offices	NCD/ DoA	H	2.0
		Upscale constituting Rapid Response Teams in elephant affected areas.	No. of Rapid Response Team	DoFPS Field Offices	NCD	H	3.0

		Pilot raising beehives around the crop fields to keep away the elephants	No. of sites	DoFPS Field Offices	NCD/ DoL	L	1.5
	Conduct mass awareness program on avoiding and mitigating human-elephant conflicts.	Organize awareness programs on mitigating human-elephant conflicts for rural communities and schools	No. of awareness program conducted	DoFPS Field Offices	NCD/LG	M	2.0
		Install informative signage at strategic locations	No. of sites and signage installed	DoFPS Field Offices	LG	M	1.5
	Strengthen anti-poaching, law enforcement, and networking to control poaching of elephants.	Upscale SMART patrolling in all probable elephant poaching areas	No. of patrol conducted	DoFPS Field Offices	NCD/LG	M	5
		Institute community intelligence and vigilantes.	No. of community intelligence instituted	DoFPS Field Offices	Local communities	M	0.6
		Strengthen coordination, information sharing, and joint patrolling with counterparts across the Indo-Bhutan border	No. of meeting and joint patrolling	DoFPS Field Offices	NCD	M	1.0
	Develop capacity of the local people and field staff to mitigate and deal with human-elephant conflicts.	Train field staff and local people on installation and maintenance of electric and solar fences.	No. of frontline staff and local people trained	DoFPS Field Offices	NPPC/ NCD	M	8
		Organize regional and international study tours and field visits for field staff and local people to gain exposure on human-elephant conflict mitigation	No. of frontline staff sent on exposure/ study tour	NCD	DoFPS Field Offices	M	5
		Organize national, regional, and international seminars and symposiums on human-wildlife conflict mitigation to foster sharing of knowledge, lessons learned, and best practices	No. of seminars and symposium	NCD	DoFPS Field Offices	M	5

Secure and improve elephant habitats and movement corridors	Manage and restore elephant habitats	Implement habitat enrichment and improvement programs in the habitats and corridors.	Area of habitat under enrichment	DoFPS Field Offices	NCD/ Local communities	H	3.0

CHAPTER 6: HUMAN-WILD PIG CONFLICT MANAGEMENT

6.1. Problem Statement

Bhutan has two native species of wild pigs: Eurasian wild pig (*Sus scrofa*) and the critically endangered pygmy hog (*Porcula salvania*). The Eurasian wild pig (*herein after referred to as the wild pig*) is the one, which comes into constant conflict with humans in terms of crop damages. Unlike in the United States, the wild pig is part of the native landscape in Bhutan where it has co-evolved with the native ungulates and predators. Therefore, any measures to eradicate wild pigs from the local landscapes should be weighed in from the ecological perspective.

The wild pig is the predominant crop raider among the wild herbivores (Wang et al., 2006) in many districts of Bhutan because of which it has attracted a national attention. Gleaning from a five-year (2011-2015) data of annual crop damage reported by agriculture extension agents from eight dzongkhags (Bumthang, Chhukha, Dagana, Paro, Samtse, Trongsa, Tsirang, Wangduephodrang) to the Department of Agriculture, 839 households reported a total crop loss (potato, maize, paddy, buckwheat, barely, millet, and wheat) of 347 metric tons to wild pigs from a total affected area of 235 acres. In absence of a systematic (or uniform) reporting system for crop damage, it is hard to reliably quantify crop damages by wild animals in terms of quantity and area at both the local and national levels. As such, crop damage reports may be overestimated or underestimated while some incidences could even be unreported. Overestimation of losses could potentially lead to not only exaggerated figures but also result in demonization of wild animals, which could be counterproductive.

The most plausible scientific explanation to the principal cause of escalated wild pig damages to agriculture crops since the 1980s is the country-wide poisoning campaign of wild dogs in the 1980s due to their persistent livestock predation. This represents a classic example of an ecosystem backlash after a massive disruption in the natural balance. The other explanations to the problem, according to local farmers, are: 1) ineffectiveness of traditional crop guarding methods; 2) banning of slash and burn (or shifting) cultivation; 3) acute shortage of farm labour due to rural-urban migration (Wang et al., 2006); and 4) excessive collection of wild herbs and tubers which are also the foods for wild pigs. Another possible explanation is the hybridization between wild pigs and domestic pigs which is said to be happening in rural areas where domestic pigs are raised in open sheds and mating occurs in the night when farmers are asleep. The

hybrids, distinguished by an extra tooth on the lower jaw immediately behind the right canine, are said to be less fearful of humans and frequenting the crop fields and human settlements unlike the pure wild breeds. Majority of the wild pigs culled in 2004 during the wild pig management project were found to be hybrids (MoA, 2004).

Figure 6. A camera trap picture of wild pigs in central Bhutan

Mitigations and actions to resolve human-wild pig conflicts are few, except episodic project-based culling and electric fencing. Review of electric fences installed in few pockets highlighted effectiveness of locally fabricated electric fences in keeping away the wild pigs and other crop raiding animals (Penjor et al., 2014). Other innovative fencing and crop guarding methods are yet to be explored and tried. Simultaneously, ecological solutions to the wild pig problem can be explored (Thinley et al, 2018a), which at the moment is greatly hindered due to dearth of information on wild pig ecology, habitat selection, movement, and behavior. Contrary to the popular belief that the wild pig population has exploded, the overall density of wild herbivores are comparatively low in Bhutan (Wang, 2010), and the relative abundance of the wild pig is comparatively lower than other wild ungulates and domestic cattle in some areas (Thinley et al, 2017).

6.2. Objectives, Strategies and Actions

Objective 1: To reduce crop losses to wild pigs and improve overall food security

Strategy 1: Improve and innovate crop protection mechanism against wild pigs.

Actions:

1. Explore and provide alternatives to wooden fencing poles for electric/ solar fencing.
2. Pilot bio-fencing for sustainable and effective fencing.
3. Promote the use of stonewall fencing against wild pigs.
4. Pilot other crop protection measures other than electric/solar fencing.
5. Provide rust-resistant GI (Galvanized Iron) wires for electric fencing.
6. Support development of locally fabricated energizers and other fencing materials for electric fences to cut down the total cost.
7. Conduct nationwide assessment of the effectiveness of electric/solar fencing systems.

Strategy 2: Carry out crop diversification**.**

Actions:

1. Support alternative crops that are non-palatable to wild pigs in feasible areas.

Objective 2: To increase knowledge on wild pig ecology

Strategy 1: Estimate wild pig population abundance and density in the problem areas.

Actions:

1. Estimate wild pig population abundance using latest study methods and tools.

Strategy 2: Increase knowledge-base on the ecology and biology of wild pigs.

Actions:

1. Conduct field studies and research on wild pig ecology.

Objective 3: To improve knowledge-base on the human-wild pig conflicts

Strategy 1: Study spatial and temporal characteristics of crop damages caused by wild pigs.

Actions:

1. Assessment of crop damages using aerial and ground-based technology.
2. Map wild pig damage hotspots.

Strategy 2: Study the human dimensions of wild pig management with respect to people's perception and attitude.

Actions:

1. Conduct nation-wide survey to understand peoples' attitude and perception towards wild pig and associated damages.

6.3. Human-Wild Pig Conflict Management Strategy Log Frame

Objective	Strategy	Actions	Key Performance Indicators	Implementer		Priority (High, Medium, Low)	Cost Estimate (Mn. Nu.)
				Lead	Collaborator		
To reduce crop losses to wild pigs and improve overall food security	Improve and innovate crop protection mechanism against wild pigs.	Explore and provide alternatives to wooden fencing poles for electric/ solar fencing.	No. of alternative to wooden poles developed	NPPC/ NCD	ARDCs, LG, DoFPS Field Offices	H	2
		Pilot bio-fencing for sustainable and effective fencing	No. of pilot site carried out for bio fencing	NPPC/ NCD	DoFPS Field Offices, ARDCs, LG	M	1
		Promote the use of stonewall fencing against wild pigs.	No. of sites with stone wall fencing	NPPC	ARDCs, LG	L	2
		Pilot other crop protection measures other than electric/solar fencing.	No. of other protection measures piloted	NPPC/ NCD	ARDCs	H	3
		Provide rust-resistant GI (Galvanized Iron) wires for electric fencing.	Rust-resistant GI wire made available	NPPC	NCD, ARDCs	M	0.7
		Support development of locally fabricated energizers and other fencing materials for electric fences to cut down the total cost.	No. of locally developed energizer/fencing material supported	NPPC	CST, NCD,	M	1
		Conduct nationwide assessment of the effectiveness of electric/ solar fencing systems.	Carry out impact assessment	UWICER	NCD, NPPC, ARDCs, LGs	H	2
	Carry out crop diversification.	Support alternative crops that are non-palatable to wild pigs in feasible areas.	No. of pilots sites with non-palatable crops	NPPC	ARDCs, LGs	L	0.7

To increase knowledge on wild pig ecology	Estimate wild pig population abundance and density in the problem areas.	Estimate wild pig population abundance using latest study methods and tools.	Population estimate of wild pig carried out	NCD	DoFPS Field Offices, UWICER	H	3
	Increase knowledge-base on the ecology and biology of wild pigs.	Conduct field studies and research on wild pig ecology.	No. of studies carried out	UWICER/ NCD	DoFPS Field Offices	M	2
To improve knowledge-base on the human-wild pig conflicts	Study spatial and temporal characteristics of crop damages caused by wild pigs.	Assessment of crop damages using aerial and ground-based technology.	Assessment reports (No)	UWICER	NPPC, NCD, LGs	M	3
		Map wild pig damage hotspots.	Hotspot mapped	UWICER/ NCD	NPPC, DoFPS Field Offices	M	0.3
	Study the human dimensions of wild pig management with respect to people's perception and attitude.	Conduct nation-wide survey to understand peoples' attitude and perception towards wild pig and associated damages.	No. of studies carried out	NPPC/ UWICER	NCD, DoFPS Field Offices	L	1

CHAPTER 7: HUMAN-DEER CONFLICT MANAGEMENT

7.1. Problem Statement

There are five species of deer in Bhutan; four from Cervidae family, namely samber, barking deer hog deer, spotted deer (*Axis axis*), and one from Moshidae family which is the musk deer (*Moschus chrysogaster*). While sambar and barking deer are widely distributed across the country from the sub-tropical lowlands till mixed conifer forests, musk deer, hog deer and spotted deer are confined to certain ecological zones (Thinley et al., 2018b). Musk deer are found from the mixed conifer forests to sub-alpine forests in the higher Himalayas, spotted deer are limited to Phibsoo Wildlife Sanctuary, and the hog deer are distributed in the warm sub-tropical broadleaved forests in the southern foothills.

In Bhutan, there is no record of crop damage by musk deer and spotted deer. Rather, the musk deer is poached for its musk pod. The other deer species are known to damage agricultural crops. There exist many reports on deer damaging crops but devoid of reliable estimates of quantity damage. Due to poor understanding of the ecology and behaviour of problematic deer species, the appropriate counter measures have not been devised. Wang and Macdonald (2009) and Thinley et al. (2018) recommended applying ecology-based mitigation measures to understand the root causes of human-ungulate conflicts and to devise appropriate mitigation measures.

The proposition that the wild herbivores could be facing fodder competition from domestic cattle in Jigme Dorji National Park due to free-range cattle grazing in the forests (Tshering and Thinley, 2017) need further studies to validate if the phenomenon exists in other parts of the country. Frequent crop raiding by deer can annoy the farmers who may resort to retaliatory killings (Kharel, 1997). Therefore, it is vital to develop mitigation measures for crop damages by deer.

The existing fencing methods to deter crop damages by deer species need to be evaluated and better alternatives need to be explored. The use of cost-effective solar and electric fencings which have proven to be effective against some deer species (NPPC, 2015) need to be upscaled and expanded in the remaining affected areas. Feasibility of farmer appeasement programs such as insuring crops against wildlife damages need to be studied and implemented if deemed workable.

Figure 7. A sambar chased into human habitation by stray dogs

7.2. Objectives, Strategies and Action plan

Objective 1: To reduce human-deer conflicts

Strategy 1: Minimize crop losses to deer species.

Actions:

1. Innovate and improve crop-guarding mechanisms to keep away deer from the crop fields.
2. Explore the efficacy of change in cropping pattern to keep away the deer from the crop fields.

Objective 2: To ensure population viability of deer species

Strategy 1: Enhance knowledge on the ecology and behaviour of problem deer species.

Actions:

1. Carry out dietary selection of all problem deer species.
2. Determine the population abundance of problem deer species.
3. Study the crop raiding behavior of all problem deer species.

Strategy 2: Enhance protection of deer population.

Actions:

1. Conduct regular survey and monitoring of deer population.
2. Conduct regular SMART patrolling to control poaching of musk deer

Strategy 3: Improve deer habitat.

Actions:

1. Study the habitat preference by deer species.
2. Implement habitat enrichment programs for deer.
3. Conduct research to confirm if there is grazing competition between deer and livestock.

Objective 3: To increase understanding of the nature and extent of crop losses to deer species

Strategy 1: Generate knowledge on the nature and extent of crop damage by deer species.

Actions:

1. Conduct questionnaire surveys to understand the nature and extent of crop damage by deer species.
2. Generate a map showing deer damage hotspots in the country.

7.3. Human-Deer Conflict Management Strategy Log Frame

Objectives	Strategy	Actions	Key Performance Indicators	Implementer		Priority (High, Medium, Low)	Estimated Cost (Nu. in M)
				Lead	Collaborator		
To reduce human-deer conflicts	Minimize crop losses to deer species	Innovate and improve crop-guarding mechanisms to keep away deer from the crop fields.	Number of Innovative and improved crop guarding mechanism developed	DoFPS Field Offices/ NPPC	NCD, DoL, DoA, LG	M	10.5
		Explore the efficacy of change in cropping pattern to keep away the deer from the crop fields	Study on efficacy of cropping pattern change conducted.	DoA, UWICER	LG, DoL	M	1.0
To ensure population viability of deer species	Enhance knowledge on the ecology and behaviour of problem deer species	Carry out dietary selection of all problem deer species	Study on dietary pattern of problem deer species carried out.	UWICER, NCD	DoFPS Field Offices	M	2.0
		Determine the population abundance of problem deer species	Population estimated	UWICER, NCD	DoFPS Field Offices	H	4.0
		Study the crop raiding behavior of all problem deer species.	Study on crop raiding behavior carried out	UWICER	NCD, DoFPS Field Offices	M	5.0
	Enhance protection of musk deer population	Conduct regular survey and monitoring of musk deer population.	High risk poaching area identified	DoFPS Field Offices	NCD, UWICER	H	4.5
		Conduct regular SMART patrolling to control poaching of musk deer	SMART Patrol Reports	DoFPS Field Offices		H	6.5
	Improve deer habitat	Study the habitat preference by deer species.	Study on deer habitat conducted	UWICER	DoFPS Field Offices, NCD	H	4.5
		Implement habitat enrichment programs for deer	Habitat enrichment programs carried out(No./ Ha)	DoFPS Field Offices	NBC, NCD, UWICER	M	10.0

		Conduct research to assess grazing competition between deer and livestock	Research on grazing competition between deer and livestock conducted	UWICER	Donors, DoFPS	H	8.0
To increase understanding of the nature and extent of crop losses to deer species	Generate knowledge on the nature and extent of crop damage by deer species.	Conduct questionnaire surveys to understand the nature and extent of crop damage by deer species.	Survey on the extend of crop damage by deer species carried out	DoFPS Field Offices	NCD, UWICER, LG	H	9.5
		Generate a map showing deer damage hotspots in the country.	Deer hotspots mapped	NCD/ UWICER	DoL,	H	6.5

CHAPTER 8: HUMAN-PRIMATE CONFLICT MANAGEMENT

8.1. Problem statement

Bhutan has seven species of non-human primates (Wangchuk et al., 2003; Wangchuk et al. 2004; Choudhury, 2008) of which three are langurs: golden langur, capped langur, and gray langur, three are macaques: Assamese macaque, Rhesus macaque *Macaca mulata* and Munzala *Macaca munzala*) and one is a loris (Bengal slow loris *Nycticebus bengalensis*). Except for the slow loris, all primate groups are known to be conflicting with humans in terms of agricultural crop damage. By far the Assamese macaque is the most pervasive and notorious among the wild primates as per the opinions of the rural farmers during casual interviews. This is plausible because it is the most abundant and widely distributed primate in Bhutan (Choudhury, 2008), although its population density and structure are not known. The gray langur was not known to be problematic five to ten years ago, but nowadays it is known to cause both property and crop damage (Thinley et al., 2016). Similarly, the golden langur has recently joined the league of agricultural crop raiders but only in few pockets in Tsirang and Trongsa Dzongkhag (Thinley et al., 2019). The capped langur, rhesus macaque and munzala are also known to raid agricultural crops but there is no official documentation on the nature and extent of damage.

Though wild primates often come into conflicts with humans, there is very few empirical studies conducted on their behaviour and ecological aspects related to negative interactions with humans. So far studies on the ecology (Norbu et al., 2016b), morphological characteristics (Hamada et al., 2016), and genetic characteristics (Kawamoto et al., 2006; Kawamoto et al., 2016) have been carried out for the Assamese macaque which helped in devising locally fabricated electric fences as a counter measure (Norbu et al. 2016a). Population abundance and distribution mapping were carried out for the gray langur (Thinley et al., 2016) and the golden langur (Thinley et al., 2018b), but such information are lacking for the capped langur. There is also a dearth of information on the social aspects of primate management due to which appropriate counter measures could not be devised to resolve human-primate conflicts. Meanwhile, some golden langurs, gray langurs, capped langurs, and macaques have been reported dead due to electrocution on the power transmission lines and transformers. Some reports exist on their deaths due to collision with vehicles on the national highways.

Figure 8. A gray langur electrocuted

One of the main causes of human-primate conflict is the regular feeding of wild primates by humans along the national highways and at religious sites. Human provisioning of foods cause certain primate troops to become habituated to guaranteed source of foods and develop familiarity and closeness to humans and human settlements, thereby emboldening them to destroy human properties. For instance, regular feedings of gray langur at Dodeydra and Tango monasteries have resulted in langurs damaging the monastic sertos and roofs (Thinley et al., 2016). The other causes on conflicts are related to habitat destructions and fragmentations due to developmental activities such as hydropower dam constructions which displace certain troops towards the human settlements.

Figure 9. Macaques fed by humans along the highways

Electric fencing materials have been distributed to rural farmers by the government with proper installation manual (Penjor et al., 2013) and implementation guideline (NPPC, 2015). Electric fences were redesigned for primates based on the famers' feedback and pilot studies (Norbu et al., 2016a); however, further modifications and replications to other conflict sites are yet to be done. The combined effects of electric fences and bioacoustics can be explored based on the recent testing of bioacoustics in Japhu village in Rubisa Gewog of Wangduephodrang Dzongkhag by the Uygen Wangchuck Institute for Conservation and Environment Research (Department of Forests and Park Services) and the National Plant Protection Centre (Department of Agriculture).

8.2. Objectives, Strategies and Actions

Objective 1: To reduce the number of incidences of crop and property damage

Strategy 1: Upscale crop and asset protection mechanism against wild primates.
Actions:

1. Install effective fences and deterrents against the primates (e.g., electric fences, bioacoustics, and effective traditional fences).
2. Pilot and develop innovative crop protection mechanism against wild primates.

Strategy 2: Conduct mass awareness campaigns about feeding of primates.
Actions:

1. Conduct mass awareness program for the road commuters and tourists on the negative impacts of feeding primates along the highways.
2. Sensitize farmers about the importance of crop residue management after harvest seasons in order not to attract primates to the crop fields.
3. Conduct awareness programs to the monks to protect monastic properties.

Objective 2: To maintain viable population of wild primates

Strategy 1: Prevent primate deaths resulting from electrocution and road kills.
Actions:

1. Initiate dialogue with relevant organizations such as Bhutan Power Corporation Ltd., Royal Bhutan Police (Traffic Division) and Road Safety and Transport Authority.
2. Enforce Forest and Nature conservation rules 2017 to speeding vehicles and road commuters caught in killing and feeding of all wild primates.

Strategy 2: Enrich wild primate habitats in the problem hotspots.
Actions:

1. Conduct dietary analysis of wild primates to determine their food preferences.
2. Initiate community-based habitat enrichment programs in the human-primate conflict prone areas.

Strategy 3: Carry out ecological research on wild primates that are in conflict with humans.

Actions:

1. Carry out population and ecological research (home range, movement, behavior and feeding).

Objective 3: To increase understanding of human-primate interactions

Strategy 1: Enhance knowledge on human-Primate conflict

Actions:

1. Investigate different types of agricultural crops and properties damaged by different primate species.
2. Develop maps of human-primate conflict hotspots.
3. Document people's attitude and perception of wild primates.

8.3. Human-Primates Conflict Management Strategy Log Frame

Objectives	Strategy	Actions	Key Performance Indicators	Implementer		Priority (High, Medium, Low)	Expected cost (Nu. in million)
				Lead	Collaborator		
To reduce the number of incidences of crop and property damage.	Upscale crop and asset protection mechanism against wild primates	Install effective fences and deterrents against the primates (e.g., electric fences, bioacoustics, and effective traditional fences).	No./distance of counter measure developed	NPPC/ NCD/	DoFPS Field Offices & LG	M	3.0
		Pilot and develop innovative crop protection mechanism against wild primates	No. of pilot sites	NCD/ NPPC	DoFPS Field Offices & LG	M	1.0
	Conduct mass awareness campaigns about feeding of primates	Conduct mass awareness program for the road commuters and tourists on the negative impacts of feeding primates along the highways.	No. of awareness program conducted.	NCD	DoFPS Field Offices & LG	H	0.5
		Sensitize farmers about the importance of crop residue management after harvest seasons in order not to attract primates to the crop fields	No. of programs conducted	NCD	DoFPS Field Offices & LG	M	0.5
		Conduct awareness programs to the monks to protect monastic properties.	No. of awareness program conducted	NCD	DoFPS Field Offices, CMB	H	0.5
To maintain viable population of wild primates	Prevent primate deaths resulting from electrocution and road kills	Initiate dialogue with relevant organizations such as Bhutan Power Corporation Ltd., Royal Bhutan Police and Road Safety and Transport Authority	Minutes of the meetings.	NCD	BPC, BEA, BSB, RBP & RSTA	H	0.5
		Enforce Forest and Nature conservation rules 2017 to speeding vehicles and road commuters caught in killing wild primates	No. of case compounded.	NCD	Field Divisions & PAs	H	0.5

	Enrich wild primate habitats in the problem hotspots	Conduct dietary analysis of wild primates to determine their food preferences	No. of study conducted.	UWICER	NCD, Field Division & Parks	H	1.0
		Initiate community-based habitat enrichment programs in the human-primate conflict prone areas	Total area of plantation carried out.	DoFPS Field Offices	UWICER, NCD & LG	M	2.0
	Carry out ecological research on wild primates that are in conflict with humans.	Carry out population and ecological research (home range, movement, behavior and feeding)	No. of study conducted	UWICER	NCD, DoFPS Field Offices	M	2.0
To increase understanding of human-primate interactions	Enhance knowledge on human-Primate conflict	Investigate different types of agricultural crops and properties damaged by different primate species.	Assessment report (No.)	UWICER	NCD, DoFPS Field Offices	H	2.0
		Develop maps of human-primate conflict hotspots	No. of conflict area mapped	UWICER	NCD, DoFPS Field Offices	H	1.0
		Document people's attitude and perception of wild primates	No. of studies conducted.	UWICER	NCD, Field Division & Parks	H	3.0

CHAPTER 9: HUMAN-RODENT CONFLICT MANAGEMENT

9.1. Problem statement

There are 1,700 species of rodents known worldwide (Molur *et.al*. 2005) and they comprise 42% of mammalian species on the earth of which only less than 10% pose negative impacts on humans in agricultural or urban settings (Singleton *et al*. 2015; Dickman 1999; Werner et al. 2015). In Bhutan, there are 90 species of mammals of which 44 species are rodents (Wangchuk,*et al*. 2004; Gyeltshen,2013). Rodents are ecologically important for small cat conservation and seed dispersal. For instance, 12 species of rodents were found in the tiger scats collected from Nepal's Chitwan National Park (Dahal, 2012). At any rate, detailed information on the ecology of rodents in Bhutan is lacking.

Farmers in Bhutan consider rodents as one of the agricultural pests. Presently, porcupines, squirrels and rats are some of the rodents known to damage crops in Bhutan. Crop damage by rodents have been occurring in small quantities, but recently massive damage on maize have been reported from Dagana (BBS, 2018), Sarpang and Tsirang (Kuensel, 2018). Dagana Dzongkhag reported to have lost 31,700 kg of maize worth Nu.570340 and Sarpang Dzongkhag lost 50% of paddy to rodents from 4 acres of wetlands (Kuensel, 2018). Cardamom damage by rodents was also reported in Tsirang (Kuensel, 2018). Thus, crop damage by rodents has gained the attention of the national mainstream media. Increasing incidences of damages by rodents may pose severe threat to food security in the country, defeating national goal of achieving food self-reliance. Therefore, there is an urgent need to address this emerging issue to come up with appropriate strategies based on ecological approach to reduce human-rodent conflicts in the country.

9.2. Objectives, Strategies and Actions

Objective 1: To understand the extent of human-rodent conflicts

Strategy 1: Conduct species inventory

Actions:

1. Develop a checklist of rodent species that are known to cause crop damage.
2. Tabulate types of crops damaged by each problematic rodent in different seasons.

Objective 2: To understand the root causes of crop damage by rodents

Strategy 1: Study the ecological food chain

Actions:

1. Determine the natural principal predators of rodents causing crop damage.
2. Estimate the population abundance of natural predators.
3. Study the prey-predator dynamics.

Strategy 2: Study habitats utilization and dietary habitats of problem rodents

Actions:

1. Determine the habitats of problem rodents.
2. Understand food habits of problem rodents.

Objective 3: To reduce crop damages by rodents

Strategy 1: Explore and adopt ecologically sound control methods.

Actions:

1. Experiment the use of dummy predators and repellents.
2. Experiment on Conditioned Taste Aversion (CTA).

Strategy 2: Remove food sources of rodents after crop harvest.

Actions:

1. Advocate farmers not to leave crop residues after harvest.
2. Experiment flooding of fields after harvest.

9.3. Human-Rodents Conflict Management Strategy Log Frame

Objective	Strategy	Actions	Key Performance Indicators	Implementer		Priority (High, Medium, Low)	Estimated cost (Nu. million)
				Lead	Collaborator		
To understand the extent of human-rodent conflicts	Conduct species inventory	Develop a checklist of rodent species that are known to cause crop damage.	Checklist of rodent species produced	UWICER/ NCD	DoFPS Field Offices, NPPC	H	1.5
		Tabulate types of crops damaged by each problematic rodent in different seasons.	Studies on problematic rodent carried out	UWICER/ NCD/ NPPC	DoFPS Field Offices	M	2.5
To understand the root causes of crop damage by rodents	Study the ecological food chain	Determine the natural principal predators of rodents causing crop damage.	Predators of rodents known	UWICER	NCD/ DoFPS Field Offices	M	1.0
		Estimate the population abundance of natural predators	Population estimate of rodents predators known	UWICER	NCD, DoFPS Field Offices	L	2.0
		Study the prey-predator dynamics	Carry out Prey-predator dynamics	UWICER	DoFPS Field Offices,	M	1.0
	Study habitat utilization and dietary habits of problem rodents	Determine the habitats of problem rodents	Habitats identified	UWICER	DoFPS Field Offices,	M	1.5
		Understand food habits	Rodent food habit documented	UWICER	NCD, NPPC	M	1.5

To reduce crop damages by rodents	Explore and adopt ecologically sound control methods	Experiment the use of dummy predators and repellents	No. of sites piloted	NPPC	NCD, DoFPS Field Offices,	H	4.0
		Experiment on Conditioned Taste Aversion (CTA)	Type of taste aversion identified and put in practice	NPPC	NCD, DoFPS Field Offices,	L	1.0
	Remove food sources of rodents before and after crop harvest	Advocate farmers not to leave crop residues after harvest	No. of awareness campaign conducted	NPPC/ NCD	DoA	H	1.5
		Experiment flooding of fields after harvest	Flooding of field experimented	NPPC	NCD	M	0.5

CHAPTER 10: CROSS CUTTING STRATEGIES

10.1. Problem statement

Some of the human-wildlife conflict issues are common for several themes discussed in the previous chapters. The objectives and strategies to address these common issues can therefore cut across several themes. For instance, livestock depredation is common for both the canids and felids, and addressing some aspects of livestock management will resolve human-canid and human-felid conflicts. Similarly, addressing certain elements of crop damage by wild herbivores will resolve human-deer, human-elephant, and human-wild pig conflicts.

There are some issues relevant to all the HWC themes discussed previously. There is a lack of a dynamic database of all HWC incidences, action taken reports, and scientific studies conducted. There is also a dearth of capacity among the local people to deal with human-conflicts, and there is a need to explore innovative solutions and sharing of lessons learned and best practices from farmers in the neighbouring countries. In addition, there is general lack of awareness among the rural communities of the ecological roles and significance of the wildlife species that conflict with humans. Moreover, there is weak collaboration and coordination among the HWC stakeholders. This is mainly due to absence of a formally recognized central coordinating agency and focal agencies and focal persons from the key partner agencies. Further, emerging issues of wildlife diseases and transmission from and to humans and livestock is yet to be understood and addressed.

10.2. Objective, Strategies and Actions

Objective 1: To reduce livestock losses to wild predators

Strategy 1: Promote livestock intensification.

Actions:

1. Improve cattle breed.
2. Reduce the number of unproductive cattle.

Strategy 2: Reduce the number of free-ranging livestock in the forests.

Actions:

1. Restore rangelands and intensify improved pasture development.
2. Improve livestock herding practices to reduce livestock vulnerability to predation.
3. Encourage to grow fodder trees in unfertile and fallow lands.

Objective 2: To reduce crop losses to wild herbivores

Strategy 1: Improve crop protection mechanism.

Actions:

1. Up-scale and subsidize electric fencing.
2. Promote live fencing wherever relevant and possible.
3. Promote effective traditional fences such as stonewall fencing.

Strategy 2: Promote agriculture intensification.

Actions:

1. Promote high-yielding crop varieties.
2. Initiate changes in cropping pattern.

Objective 3: To reduce retaliatory killing of wild animals

Strategy 1: Offset crop and livestock losses to wild animals.

Actions:

1. Facilitate affected farmers on availing soft loans from financial institutions.
2. Study the feasibility of crop insurance scheme.
3. Study and replicate gewog environmental conservation committee (GECC) to compensate crop and livestock losses.
4. Implement the endowment fund for crop and livestock conservation.

Strategy 2: Provide alternative livelihood options to affected communities.

Actions:

1. Promote energy efficient technologies in the hotspots to reduce dependency on natural resources.
2. Initiate and promote ecotourism in HWC hotspots.
3. Form and train non-wood forest product (NWFP) user groups in the HWC hotspots.
4. Provide vocational trainings to rural people in the HWC hotspots.

Strategy 3: Pay compensation to wildlife victims.

Actions:

1. Facilitate ex-gratia payments to wildlife victims.

Strategy 4: Rescue, rehabilitate, translocate and remove problem animals.

Actions:

1. Establish wildlife rescue team and facilities at each division and park offices.
2. Train and equip wildlife rescue teams regularly.

3. Institute science-based removal of problem individuals.
4. Develop Standard Operation Procedure for rescue and rehabilitation of problematic and injured animals.

Objective 4: To raise awareness and promote local stewardship of wildlife and their habitats

Strategy 1: Initiate massive awareness and education programs.

Actions:

1. Organize national level expo on the impact of HWC and benefit of wildlife conservation.
2. Incorporate HWC module in the educational institutes.
3. Conduct public awareness and education programs.

Strategy 2: Promote local stewardship of wildlife and their habitats.

Actions:

1. Institute community-based human-wildlife conflict management group.
2. Institution of rapid response teams at both community level and forest division level

Objective 5: To strengthen collaboration among the stakeholders

Strategy 1: Foster strong institutional collaboration.

Actions:

1. Nominate a National HWC coordinating agency.
2. Formalize creation of HWC focal agencies in each department, division and field offices.
3. Nominate focal persons in each department, division and field offices.
4. Conduct annual HWC stakeholder coordination meeting.
5. Conduct regional and national conference and workshop.
6. Identify and build network with key external agencies.

Strategy 2: Mainstream HWC program in the sectoral plans

Actions:

1. Incorporate HWC program in the National, Ministerial, Departmental, Dzongkhag and Gewog plan.

Objective 6: To develop capacity of field implementers and local people

Strategy 1: Develop capacity of field staff and local people in HWC implementation.

Actions:

1. Organize exchange program and study visits for field staff and local communities.
2. Train stakeholders on HWC management and mitigation technologies.
3. Train wildlife researchers on research designing, data collection, analysis, and report writing.

Objective 7: To strengthen HWC information and database

Strategy 1: Enhance knowledge and information on HWC

Actions:

1. Conduct empirical research on HWC.
2. Document and disseminate findings with relevant agencies and policy makers
3. Conduct regional and national HWC symposium.

Strategy 2: Create a centralized database for HWC

Actions:

1. Develop a standard HWC incidences reporting system.
2. Develop an online portal for information sharing.

Objective 8: To prevent and control diseases transmission at human-livestock-wildlife interfaces

Strategy 1: Develop wildlife health and disease control mechanism.

Actions:

1. Develop a wildlife health and disease control strategy.
2. Strengthen the existing wildlife clinic and laboratory.
3. Conduct timely vaccination of free-ranging livestock.

Strategy 2: Generate information on wildlife health and disease issues.

Actions:

1. Conduct studies on wildlife health and disease issues.
2. Develop a database of wildlife health and diseases.

Objective 9. To reduce wildlife-Feral Dog conflict

Strategy 1: Manage feral dog population.

Actions:

1. Generate information on feral dog population and distribution.
2. Understand problems created by feral dogs to wild animals and humans.
3. Implement feral dog management guidelines and protocol.

10.3. Cross Cutting Theme Strategy Log Frame

Objective	Strategy	Actions	Key Performance Indicators	Implementer		Priority (High, Medium, Low)	Estimated cost in Nu. Million
				Lead	collaborator		
To reduce livestock losses to wild predators	Promote livestock in-tensification	Improve cattle breed	No. of improved cattle distributed, No. of hhs adopting stall feeding	DoL	LG	H	10.00
		Reduce the number of unproductive cattle	No. of bulls sterilized; No. of sex sorted semen used	DoL	LG	H	5.00
	Reduce the number of free-ranging livestock in the forest	Develop/Restore rangelands	Area of rangeland restored/ developed	DoL	LG/ DoFPS Field Offices	H	5.00
		Improve pasture development	Area of pasture developed	DoL	LG/ DoFPS Field Offices	H	10.00
		Improve livestock herding practices to reduce livestock vulnerability to predators	No. of hhs adopting stall feeding; No. of Biogas plants established	DoL	LG	H	5.00
		Encourage to grow fodder trees in unfertile and fallow lands	No. of fodder technologies adopted, Area of fallow land brought under fodder tree plantations	DoL	LG/ DoFPS Field Offices /NLCS	H	5.00
To reduce crop loss to wild herbivores	Improve crop protection mechanism	Up-scale and subsidize electric fencing	Km of electrical fencing; No. of hh trained	DoA	LG/ DoFPS Field Offices	H	10.00
		Promote live fencing wherever relevant and possible	Area of land under live fencing	DoA	LG/ DoFPS Field Offices	M	1.00
		Promote effective traditional fences such as stonewall fencing	Area of land fenced	DoA	LG	M	1.00
	Promote agriculture intensifica-tion	Promote high-yielding crop varieties (HYV)	No. of HYV crops promoted, No. of HYV adopted	DoA	LG	H	1.00
		Initiate changes in cropping pattern	Crops available in off season	DoA	LG	M	2.00

To reduce retaliatory killing of wild animals	Offset crop and livestock losses to wild animals	Facilitate affected farmer for availing soft loans from financial institutions	Numbers of HH facilitated & availed loans	DoA	LG	H	0.200
		Study the feasibility of crop insurance scheme	Published Reports on feasibility of Crop Insurance	DoA	LG	M	0.500
		Study and replicate gewog environmental conservation committee (GECC) to compensate crop and livestock losses.	Numbers of GECC established/ account opened	NCD	LG	H	5.00
		Implement the endowment fund for crop and livestock conservation	Numbers of households benefitted from endowment fund	NCD	LG	H	2.00
	Provide alternative livelihood options to affected communities	Promote energy efficient technologies in the hotspots to reduce dependency on natural resources	Numbers of biogas established; other energy (solar, electrical etc) efficient technologies used (Nos.)	DoL	LG/ DoFPS Field Offices	H	2.00
		Initiate and promote ecotourism in HWC hotspots	Numbers of home stay established; Numbers of youths involved/ employed in eco-tourism activities	DoFPS Field Offices	LG/ NCD	H	5.00
		Form and train non-wood forest product (NWFP) users' groups in HWC hotspots	Numbers of functional NWFP user groups formed	DoFPS Field Offices	LG, SFED	M	2.00
		Provide vocational training to rural people in the HWC hotspots	Numbers of farmers attended VET courses; Numbers of farmers/youth adopted off-farm activities	UWICER	LG/RDTC	H	5.00
	Pay com-pensation to wildlife victims	Facilitate ex-gratia payments to wildlife victims.	Numbers of HH compensated/ No. of ex-gratia payment give to wildlife victims	NCD	LG/ DoFPS Field Offices	M	5.00

	Rescue, rehabilitate, translocate and remove problem animals	Establish wildlife rescue team and facilities at each division and park offices	Numbers of wildlife rescue team formed/ Number of wildlife rescue facilities established	NCD	LG/ DoFPS Field Offices	H	1.00
		Train and equip wildlife rescue teams regularly	Numbers of wildlife rescue trainings conducted; sets of equipment supplied	NCD	LG/ DoFPS Field Offices	H	3.00
		Institute science-based removal of problem animals	Reports published; Numbers of problem animals removed/reduced	NCD/ DoFPS Field Offices	LG/ DoL/ DoA	M	1.50
		Develop Standard Operation Procedure for rescue and rehabilitation of problematic and injured animals	No. of SoPs developed and utilized implemented	NCD	LG/DoL/DoA	M	1.00
To raise aware-ness and promote local stew-ardship of wildlife and their habitats	Initiate mass awareness and education programs	Organize national level expo on the impact of HWC and benefit of wildlife conservation	No. of expo organized on HWC	NCD	DoL/DoA/LG	M	3.0
		Incorporate HWC module in the educational institutes	Course module on HWC incorporated in school's curriculum	NCD	MoE/SAP/LG	M	1.00
		Conduct public awareness and education programs on HWC	No. of awareness campaign organized; No. of participants attended	NCD/ DoFPS Field Offices	LG	M	1.50
	Promote local stewardship of wildlife and their habitats	Institute community-based human-wildlife conflict management group	No. of groups formed	DoFPS Field Offices	MoAF	M	1.00
		Institution of rapid response teams at both community and DoFPS Field Offices level	No. of RRT instituted	DoFPS Field Offices/ NCD	LG	M	1.0

To strengthen collaboration among the stakeholders	Foster strong institutional collaboration	Nominate a National HWC coordinating agency	Apex body for HWC established	NCD	DoL/DoA	H	1.0
		Formalize creation of HWC focal agencies in each department, division and field offices	Formalized HWC focal for each department/field office	NCD	DoL/DoA /LG	H	3.0
		Nominate focal person in each department, division and field offices	Formalized HWC focal for each department/field office	NCD	DoL/DoA/LG	M	
		Conduct annual HWC stakeholder coordination meeting	No. of meetings conducted	NCD	DoL/DoA/LG	H	1.00
		Conduct regional and national conference and workshop	No. of meetings/workshop/ conference conducted	NCD	DoL/DoA/LG	M	2.00
		Identify and build network with key external agencies	Networks established with no. of partners institutes/expertise	NCD	DoL/DoA/LG	M	0.500
	Mainstream HWC programs in the sectoral plans	Incorporate HWC program in the National, Ministerial, Departmental, Dzongkhag and Gewog plan	HWC mainstreamed into sectoral FYP/programme	NCD	DoL/DoA/LG	H	0.100
To develop capacity of field implementers and local people	Develop capacity of field staff and local people in HWC implementation	Organize exchange programs and study visits for field staff and local communities	No. of staffs/local communities exposed to HWC technologies; No. of new technologies adopted	NCD	DoL/DoA/LG	H	5.00
		Train stakeholders on HWC management and mitigation measures	No. of staffs trained	NCD/ UWICER	DoL/DoA/LG	M	2.00
		Train wildlife researchers on research designing, data collection, analysis, and report writing	No. of staff trained on wildlife research	UWICER	DoL/DoA/LG	M	2.00

To strengthen HWC information and database	Enhance knowledge and information on HWC	Conduct empirical research on HWC	Reports published/ No. research conducted	DoFPS	DoL/DoA/LG	M	2
		Document and disseminate findings with relevant agencies	Extension materials developed & distributed	UWICER	DoL/DoA/LG	M	1.0
		Conduct regional and national HWC symposium	No. of national and international symposium organized	UWICER/ NCD	DoL/DoA/LG	M	1.0
	Create centralized database for HWC	Develop a standard HWC incidences reporting system	Formalized standard reporting system on HWC	NCD	DoL/DoA/LG	H	2
		Develop an online portal for information sharing	Online portal on HWC developed	NCD	DoL/DoA/LG	M	1
To prevent and control diseases transmission at human-livestock-wildlife interface	Develop wildlife health and disease control mechanism	Develop a wildlife health and disease control strategy	Wildlife disease control strategy developed	NCD	DoL /LG	H	3
		Strengthen the existing wildlife clinic and laboratory	Wildlife health facilities strengthened	NCD	DoL/DoA/LG/	M	5
		Conduct timely vaccination of free-ranging livestock	No. of animal vaccinated against zoonotic diseases	DoL	LG	H	5
	Generate information on wildlife health and disease issues.	Conduct studies on wildlife health and disease issues.	Reports published/No. of studies on wildlife health and disease conducted	DoFPS	DoL	M	1
		Develop a database of wildlife health and diseases.	Functional database developed and adopted	DoFPS	DoL/DoA/LG	M	2
To reduce wildlife-feral dog conflict	Manage Feral dog population	Generate information on feral dog population and distribution	Published survey reports, Baseline for feral dog population established	DoL	NCD/LG	M	2
		Understand problem created by feral dogs to wild animals and humans	Reports published; policy intervened/ Study on impact of feral dogs to wildlife and humans conducted	DoL	UWICER/LG	H	1
		Implement feral dog management guidelines and protocol	Feral dog population (nos.) reduced	DoL	DoFPS Field Offices /LG	H	5

CHAPTER 11: FUND MOBILIZATION STRATEGY

11.1. Problem Statement

Despite the fact that human-wildlife conflict poses a serious threat to national food security, rural socio-economy and nature conservation, resolving HWCs is not featured as a national flagship program. Moreover, resolving HWCs are not listed as priority activities by various implementing agencies who propose funds as and when issues crop up. These are happening due to lack of a dedicated funding mechanism to resolve HWCs. Even the local governments do not prioritize on resolving HWCs thinking that it is the sole mandate of the central agencies such as the Ministry of Agriculture and Forests. Consequently, there is always shortage of funds to implement HWC mitigation strategies and action plans.

11.2. Objective, Strategies and Actions

Objective 1: To secure adequate funding for implementation of the strategic actions

Strategy 1: Allocate HWC budgets to local governments and field offices.
Actions:

1. Incorporate HWC specific budgets in the annual budgets by the local governments and field offices.
2. Incorporate HWC coordination budgets in the annual budget plan for the national coordination agency.

Strategy 2: Source HWC supplemental funding from external agencies.
Actions:

1. Develop HWC project proposals to be submitted to international and national donor agencies.
2. Liaise with national and international donors to develop joint project proposals.
3. Conduct annual write-shop to develop HWC project proposals.
4. Liaise with the business entities and corporate bodies to seek corporate social responsibility (CSR) funds.

11.3. Fund Mobilization Strategy Log Frame

Objective	Strategy	Actions	Key Performance Indicators	Implementer		Priority (High, Medium, Low)	Estimate cost in Nu. Million
				Lead	Collaborator		
To secure adequate funding for implementation of the strategic action	Allocate HWC budget to local governments and field offices	Incorporate HWC specific budget in the annual budgets by the local governments and field offices	Amount of budget sanctioned annually	LG/ DoFPS Field Offices	GNHC	H	
		Incorporate HWC coordination budgets in the annual budget plan for the national coordination agency	Annual budget sanctioned	NCD	GNHC	H	
	Source HWC supplemental funding from external agencies	Develop HWC project proposals to be submitted to international and national donor agencies	No. of project approved	NCD	GNHC	H	0.1
		Liaise with national and international donors to develop joint proposals	No. of project approved	NCD	WWF, BTFEC,	M	0.3
		Conduct annual write-shop to develop HWC project proposals	No. of write- shop conducted and No. of project approved	NCD	DoFPS Field Offices	H	0.3
		Liaise with the business entities and corporate bodies to seek corporate social responsibility (CSR)	Nos. of corporate funding	NCD	DoFPS Field Offices, DHI, LG	M	0.1

CHAPTER 12: MONITORING AND EVALUATION

12.1. Problem Statement

Monitoring and Evaluation (M & E) is the critical component of every project to monitor progress in project implementation and to assess project impacts. M & E was not strongly reflected in the past HWC strategy, and hence there was no detailed M & E strategy to monitor HWC implementation, particularly to monitor progress in implementation of strategic actions and to assess their impacts.

12.2. Objective, Strategies and Actions

Objective 1: To strengthen HWC monitoring and evaluation

Strategy 1: Develop a standard HWC monitoring and evaluation protocol.

Actions Points:

1. Develop standard protocol to monitor and evaluate implementation of HWC strategy.

Strategy 2: Develop an institutional mechanism to carry out HWC monitoring and evaluation.

Actions Points:

1. Mandate focal persons from the central coordinating agency and the field implementing agencies to carry out periodic monitoring.
2. Submit HWC monitoring reports to the heads of agencies.
3. Outsource HWC strategy evaluation to local consultants.

12.3. Monitor and evaluation Log Frame

Objective	Strategy	Actions	Key Performance Indicators	Implementer		Priority (High, Medium, Low)	Estimate cost in Nu. Million
				Lead	Collaborator		
To strengthen HWC monitoring and Evaluation	To develop a standard HWC monitoring and Evaluation protocol	Develop a standard protocol to monitor and evaluate implementation of HWC strategy	Monitoring and evaluation protocol developed	NCD	DoFPS Field Offices, DoA, DoL, PPD	H	0.5
	Develop an institutional mechanism to carry out HWC monitoring and evaluation	Mandate focal persons from the central coordinating agency and the field implementing agencies to carry out periodic monitoring	Monitoring report	NCD, DoA, DoL	DoFPS Field Offices, LG	H	2.4
		Submit HWC monitoring reports to the head of the agencies	Timely submission of monitoring report	NCD, DoA, DoL		H	0.1
		Outsource HWC strategy evaluation to local consultants	Evaluation report	NCD		H	1.0

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