Original Research Article

Assessment of Socio-Economic Impact of Human Wildlife Conflict on Agriculture:A Case of Smallholder and Subsistence Farmers in Eastern Bhutan

ABSTRACT

Human-wildlife conflicts are a great concern in where ecosystem services are shared between humans and wildlife animals. This paper examines the socio-economic impacts of human-wildlife conflicts. A descriptive survey design was employed in this study. Primary data were collected by using simple random sample from 120 households. Data were analyzed using descriptive statistics including frequency and percentages. The study results showed that there is a substantial social and economic impact on the smallholder and marginal farmers through loss of crops due to wild animals. Majority of farmers (23%) had incurred annual household economic loss ranging from US$49-US$59 per household.

Keywords:Human-Wildlife, farmers, implications, socio-economic.

1. INTRODUCTION

Human-wildlife conflict (HWC) is a growing concern globally and poses a risk to the livelihoods of the rural farming community. Human-wildlife conflict threatens the socioeconomic outcomes of the smallholder rural communities (Yang et al., 2020; Methorst et al., 2020; Sampson et al et al., 2021). Human-wildlife conflict occurs when lives and properties of human communities are threatened (Milupi et al., 2023; Kolinski et al., 2021; Matseketsa et al., 2019). Human and wildlife conflict can be also attributed mainly due to exploitation of natural resources and encroachment by human on wildlife habitats (Pant et al., 2023; Sharma et al., 2020; Nicole, 2019).

Bhutan is recognized as one of the top ten biodiversity hotspots in the world and has maintained an organized efforts in conserving and establishing an extensive network of protected areas in the country (Wangmo, 2019). However, there exists a tradeoff between country's conservation polices and human wildlife conflict in the country. Majority of the Bhutanese rural communities are residing adjacent to protected areas in the country. There has been a report of human-wildlife conflict cases every year in the country. The human and wildlife conflict varies spatially and with such factors as animal distribution patterns (Heinen &Youzen, 1994). The conflict between human and wildlife in the form of livestock predations, house raiding and even human attack has been reported every year in the country (Wangmo, 2019).

Crop raiding is a common challenge for farmers globally (Mukherjee et al., 2023; Manoa et al., 2020). A study by National Plant Protection Centre and World Wildlife Fund (2016) in Bhutan, revealed that crop raiding is far greater in scope and magnitude than livestock loss, indicating the significance loss due to crop raiding in the country. A similar kind of study by JICA (2012) also reported that about 30 percent of crop are loss due to crop raiding by wild animals in the country.

Empirical studies in Bhutan often fail to grasp the socio-economic implications of human-wildlife conflicts, and perceptions of this conflict often deviate from actual incidences of socio-economic impacts and its implications of the affected

smallholder and marginal farmers. Despite an increase in the regularity of human-wildlife conflict cases in Bhutan (Yeshey at al., 2022; Letro et al., 2021; Katel et al., 2014), it is still difficult to reliably assess the socio-economic inferences of human-wildlife conflicts on affected household livelihood. Therefore, the present paper attempts to gain intuitions of the smallholder and marginal farming and the effects of crop and/ livestock damage by wild animals.

Objectives of the study
The main objectives of this paper are:

- To assess household economic value of crop and livestock loss as caused by wildlife damage

2. METHODOLOGY

The main purpose of this study was to study the household economic value of crop or livestock loss cause due to wildlife damage. The study employed quantitative research approach. The study was based on primary data sources. Primary data (*n*=120) have been gathered from participants with the help of a survey questionnaire.For the purpose of this study, Bartsham Gewog under Trashigang district was selected. Trashigang district is located in the eastern region of Bhutan and is regarded as one of the biggest districts (3066 KM square) in the country. Electric fencing has been installed along 40 km of the boundary of five Chiwogs (sub-block) under Bartsham gewog in Trashigang. Trashigang district has one of the highest coverages in terms of electric fencing with 1170.32 acres in the country (NCD, 2019). A primary data was collected employing household questionnaire survey. Following the simple random sampling framework, we collected samples (*n=120*) from the five chiwogs. Data were cleaned and analyzed using Statistical Package for Social Science (SPSS). Data were analyzed using descriptive statistics in the form of frequency and percentages.

3. RESULTS AND DISCUSSION

In terms of livelihood activities 98.5% (n = 82%) of the study respondents households reported that crops and livestock are their main source of livelihood. Over 99% (n = 119) of study respondents reported incidences of crop and livestock damage by wild animals in the study area. Crop damage in terms of crop field estimated in land area in acre is shown in table 1.

Table 1: Estimates of the Crop Field Damage by Area (ac) of the Respondents' Households

Wild Animals	n	Sum	Mean	SD
Porcupine	112	60.3	0.79	0.47
Monkey	105	9.6	0.47	0.13
Wild Pig	116	36	0.30	0.31
Barking Deer	97	8.90	0.16	0.23
Birds	20	7.78	0.18	0.13
Samber	9	1.89	0.13	0.17

The result findings further shows that those respondents incurred economic and social costs as a consequence of conflicts between human and wildlife in the study area. Crop damage led to direct economic costs while smallholder farmers incurred a variety of additional costs as household living alongside wild animals had to implement various mitigation investment in the study area. though these indirect costs were not easy to estimate quantitively, but were found to be substantial for the study.

Table 2: Estimated Loss of Crops from Wild Animals (kg)

Crops	n	Sum	Mean
Paddy	5	649	134.03
Millet	2	461	49.18
Maize	47	16,734	320.48
Potato	9	473	210.37
Vegatable	7	659	163.26

Table 2 describes the estimated loss of crops due to wild animals measured in kilograms. Among the crop loss, maize and potato recorded the highest loss in terms of production loss due to wild animals in the study area. Crops namely maize and paddy and vegetable potato are the main major crops and vegetable grown and cultivated in the study area. however, it was found that severity of crop loss in maize and potato were recorded highest in the study area.

Table 3: Estimated Economic Loss of Crops in Values ($) from Wild Animals

HH Affected	Crop Loss Range Value in USD ($) *	Percentage (%)	Average Crop Loss Value in USD Value ($) *
22	39 - 49	18.6	41.21
28	49 - 59	23.3	50.33
11	59 - 69	9.1	62.05
26	69 - 79	21.6	71.97
17	79 – 89	14.1	83.06
16	89 and above	13.3	93.59

* Losses were reported in *Ngultrum* (Nu.), and were converted to USD. 1USD ~ Nu. 80.00.

Table 3 shows the estimated economic loss of crops due to wild animals in the study area. Majority of smallholding and marginal farmers incurred economic loss between 49-59 range (23.3%), followed by 69-79 range with an average of $71.97 in the study area. High percentage of economic loss in these ranges indicates not high severity of economic losses in the study area. This could be attributed to the electric fencing in the study area which hugely contributes towards mitigation on wildlife in the study area. On the other hand, only 9.1 percent of farmers in the study area suffers from economic loss range between 59-69 with an average of $62.05.

4. CONCLUSION

The study based on its findings concludes that smallholder and marginal farmers faced numerous results of human-wildlife conflicts and significantly impacted socio-economic impacts of those marginal farmers in the study area. Porcupine, monkey, and wild pigs were found to have huge economic loss in terms of crop field damages in the study area. On economic loss assessment, it was found that the severity of economic loss in terms of crop value is not that severe owing to various HWC mitigation implemented in the study area. However, government should adopt and implement various other permanent reliable mitigation measures other than just providing electric fencing.

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