# Assessment of Human-Wildlife Conflict in and Around Weyngus Forest, Dega Damot Woreda, West Gojjam Zone, Amhara Region, Ethiopia

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*Abstract*— *Human-Wildlife Conflict (HWC) is threatening the survival of wildlife and human livelihoods through worldwide; particularly in developing countries where their livelihood is depend mostly on agricultural activities. Although the problem is prominent, knowledge of looking for solution is scarce all over the world including Ethiopia. Hence the situation needs for research to contribute to mitigation measures in the study area. Therefore, this study was aimed to find the key crop raider and livestock depredation animals, to set up the nature and extent of conflicts experienced with wildlife, and to document techniques local people use to decrease HWCs. Data were collected through a household questionnaire survey, focus group discussion and direct field observation and analyzed using descriptive statistics and chi-square test. Habitat distraction 46(37.1%) increasing of wildlife population 38 (30.6%) and resource competition 27 (21.8%) were the major causes of conflict identified in the area. A total of nine (9) wildlife species were identified as causing severe crop and livestock damage. Vervet monkey (Chlorocebus aetiops) and Porcupine (Hystrix cristata) were reported as a top crop raider while, Bat-eared fox (Otocyon megalotis) and Common jackal (Canis aureus aureus) were suggested as principal livestock predator. The most challenging crops were potato and barley, while sheep and goat were the foremost problematic livestock in the area. Guarding day & night, keeping dogs, fencing, chasing, scarecrow, and limiting the animals in the house were the most practiced methods used to minimize the crop and livestock damage in the area. 67 (54.0%) and 80 (64.5%) of respondents had negative attitude, whereas 43 (34.7%) and 39 (31.5%) were have positive attitude towards crop raiders and livestock predators respectively. In conclusion, the study area demands for sustainable and culturally acceptable conservation solutions to mitigate human wildlife conflict.*

*Keywords*— *Community Attitude, Crop damage, HWCs, Livestock predation, Weyngus Forest.*

## I. INTRODUCTION

Human wildlife conflict (HWC) is interaction between humans and wild animals where there are costs accepted by humans (Blair, 2008). According to IUCN (2005) HWC as a conflict occurring "when wildlife requirements encroach on those of human population, with costs both to residents and wild animals." However, when their habitats are increasingly altered or managed by humans, certain wild species or individual animals may cause a significant problem to humans, other animals or the environment and resulted in HWC (Mesele *et al*., 2008). HWC is a common phenomenon throughout the world (Bibi *et al*., 2013; Shilongo *et al*., 2018). It becomes outward when wild animals cause damage to crops, kill livestock and humans and destroy properties and such conflicts are more widespread along the borderline of the protected area (Bibi *et al*., 2013; Hemson *et al*., 2009).

HWCs are most intense in the developing countries, because most of the peoples live in the rural area livelihoods are centered on livestock holdings and agriculture (Anand and Radhakrishna, 2017). Increasing HWCs are a cause for increasing failure of wildlife conservation practice in the world and also the most significant threats to the existence of many wildlife species (Madden, 2008). These conflicts are becoming more predominant as human populations increase and the resulting changes in land use related to development results in wildlife habitat loss or fragmentation (Waweru and Oleleboo 2013).

Ethiopia has a large number of wildlife species with diverse ecology and unique environmental conditions. However, wildlife habitats have been degraded, fragmented, and lost in most parts of the country due to an immediate contact between the wildlife species and the people and the wildlife species are largely restricted over few protected areas (Kumsa and Bekele, 2008). These HWCs disproportionally, negatively affect marginal communities through loss of access to livelihood resources such as crops and livestock and/or may lead to an increased negative impact on wildlife due to reciprocal killing by the people (Lockwood, 2006; West *et al*., 2006).

In Ethiopia, published HWC case studies (e.g. Mesele *et al*., 2008; Demeke and Afework, 2013; Leta *et al.,* 2016; Yigrem *et al*., 2016; Asebe, 2017; Hailemariam *et al*., 2017; Ayenew *et al*., 2019) are limited to some localities. Because wildlife diversity that are considered crop raiders and livestock depredators could vary from locality to locality. Other factors such as local community economic activity, wildlife habitat quality and stakeholder perceptions about HWC may vary from region to region and locality to locality (Rao *et al*., 2000). Traditional conflict management preferences could be unique among societies and localities due to exceptionality in wildlife species, economic activity, wildlife habitat conditions, and cultural conditions of a particular society (Hariohay and Røskaft 2015). To enhance the mitigation of HWC impacts, there is a need to compile case-specific studies at various localities around the world (Food and Agricultural Organization (FAO, 2009). For the effective mitigation of HWCS, there should be an accurate data (causes, types, distribution, impacts, stakeholder perceptions of these

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impacts, and possible solutions to the HWCs) regarding their magnitude and acceptable strategies that could promote coexistence through balancing both human and wildlife needs (Gemechu *et al*., 2014; Messmer, 2000).

In the present study area, agriculture and livestock production are the major sources of livelihood. Barely, potato, wheat, and bean, are major crops grown in the area while, sheep, goats and cattle are the main livestock production. Different wild animals are involved in crop raiding and livestock depredation however; there is no scientific investigation yet. Therefore, conducting research on HWC in the area would have a valuable means of solution to identify and minimize the existing problem and creating a better coexistence between human and wildlife and an improvement of wildlife conservation in the study area.

## II.    MATERIALS AND METHODS

### *Description of the Study Area*

Weyngus forest is located in Dega Damot District, Amhara Regional State, North western Ethiopia (Figure 1). The district is one of the fourteen districts of west Gojjam administrative zone of the Amhara region. It is 271 km far from Bahir Dar, the capital city of Amhara Regional state, and 401 km North of Addis Ababa, the capital city of Ethiopia. The total population of the district is 197,007, of which 98,740 are males and are 98,267are females. From these 3819 are living in the town while, the remaining, 19, 3188 are living in the rural areas (Liyew *et al*., 2017). Dega Damot Woreda has four major climatic zones. These are Dega 75%, Woina Dega 20% and Kola 5%. Most (85%) of the peoples are engaged in agriculture. The district is also characterized by good climate for most of the year with annual rainfall between 900 and 1200 ml. topographically; it consists of 35% mountainous, 30% ups and downs, 20% valleys and 15% plains (Dega Damot Woreda Agricultural Office (DWAO), 2017), as cited in Liyew *et al*., 2017).  The area is divided into six land use types such as farm land, grazing land, shrub land, forest and bare land. The major types of crops cultivate in the study area are potato (*Solanum tuberosum*), Barely (*Hordeum vulgare*), wheat (*Triticum* spp.), faba bean (*Vicia faba*) and maize (*Zea mays*) (DWAO, 2020).
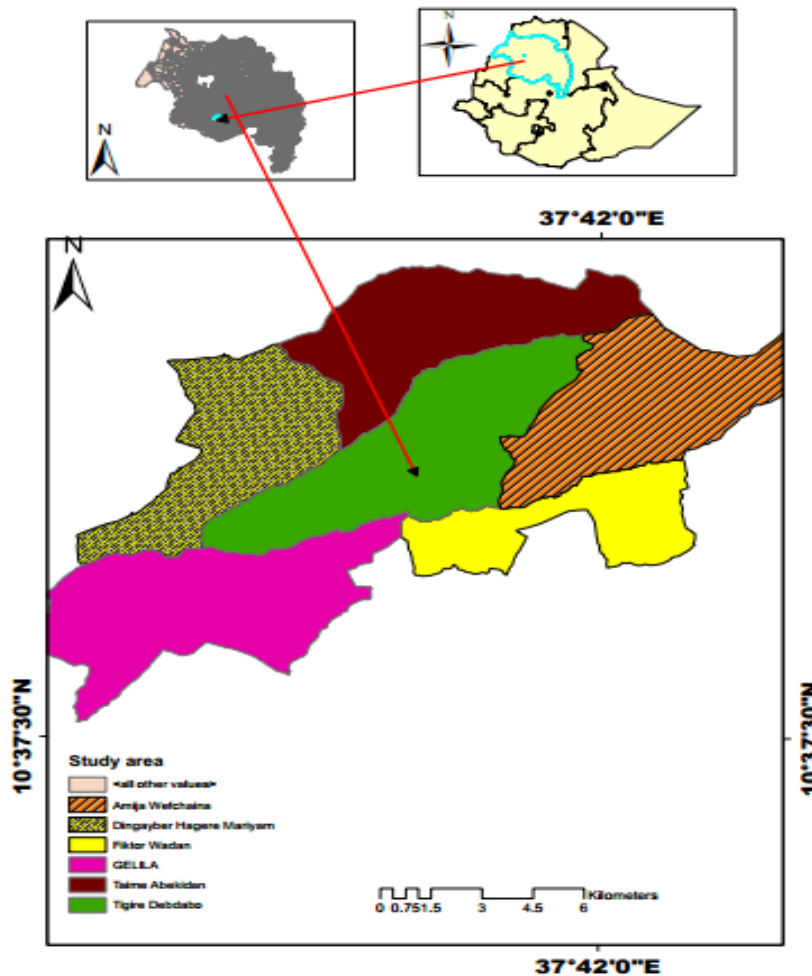


Figure 1: Map of the study area

### *Data Collection*

Data collections were conducted from December 2019 to May 2020 using three complementary data collection methods/tools (structured questionnaires; focus group discussion and direct field observation).

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*Sampling Design*

From the total of 4 villages in the study area, 3 villages (Meleya, Fuafuat and Guacha) with a total household population of 124, 110 and 180, respectively) were selected to conduct our study. These villages were selected purposively based on their proximity to the forest and existence of human–wildlife conflict. Following Gay (1996) and Amare and Serekebirhan (2019), a sampling technique for small populations, 30% of the total households (N = 414) were taken as a sample population (n = 124). Then, a proportional number of randomly selected households (37 from Meleya, 33 from Fuafuat and 54 from Guacha) were taken from each village using a systematic random sampling technique.

*Household Survey*

A questionnaire survey was used to acquire all relevant information about the different variables with questions being both open and close ended. It helps to get information from respondents regarding socio-demographic data, crops grown, causes of HWCs, damage caused to crops and livestock, species of wild animals more responsible for crop damage/livestock predation during the day and/or night time, crop type more damaged, population tendency of wild animals and community's attitudes and perceptions toward the existing conflict and the mitigation measures locally peoples used were incorporated. A structured questionnaire were prepared in English language and translated into Amharic because all the respondents are Amharic speakers.

*Focus Group Discussion*

This method was used to gather useful and detailed information on how local communities perceived wildlife, respondents' perception about wildlife tolerance; methods mostly used by farmers to protect their crops/livestock and suggestions on the severity of conflicts. This method was carried out to collect qualitative information from the selected three villages using the designed questioners. One group discussion (selected 5-7 respondents) was conducted in each village under the guidance of a mediator. Participants in the group discussion were selected systematical based on; year of residence in the area, traditional leaders, church leaders and both sexes with age of > 18 (eighteen years) were included.

*Direct Observation*

Direct assessment was conducted in the selected villages during the study period. It was used to obtain data on the damaged crops lost by crop raider, type, and animal species responsible for the damage through assessing foot marks and scats of the animals.

*Data Analysis*

SPSS version 22.0 computer software was used to analyze the data. We used descriptive statistic in a form of percentage and frequency to analyze socioeconomic profiles of the respondents. The respondent's responses about causes of HWCs and identification of crop raider and livestock predator were compared using a chi-square test.

## III. RESULTS

*Socio Demographic Data*

Of the total, 124 respondents, 88 (71%) were males whereas 36 (29%) were females. More than half of the respondents were in the age class 19- 40 (54.8%) age group and relatively few persons were older than 60 (7.3%) years, while, 37.9% of the respondents were included between the 41-60 age categories. Most 99 (79.8%) of the respondents were illiterate, whereas a few, 3 (2.4%), are high school and above. Both crop farming and livestock rearing (Mixed production) 112 (90.3%) was a common practice for resident's livelihood around study area. Some of the respondents have other income also 112 (90.3%) (bee rearing, trading and charcoal production).

In the study area, farmers have grown different types of crops, viz. potato, barley, wheat, maize, bean, cabbage and onion. According to respondent's responses and field observation, Potato (100%), Wheat (93.3%) and Barely (90.73%) were the top three crop types widely cultivated in all sampled villages (Table 1).

Table 1: Type of crops grown in the area (based on respondents response and field observation)

| Villages | Potato (%) | Barely (%) | Bean (%) | Wheat (%) | Maize (%) | Cabbage (%) | Onion (%) |
|----------|-----------|------------|----------|-----------|-----------|-------------|-----------|
| Meleya | 100 | 78.3 | 91.9 | 100 | 29.7 | 24.3 | 13.5 |
| Fuafuat | 100 | 93.9 | 87.9 | 93.9 | 9.1 | 39.4 | 21.2 |
| Guacha | 100 | 100 | 40.7 | 85.2 | 0 | 11.1 | 9.3 |
| Mean | 100 | 90.73 | 73.50 | 93.03 | 12.93 | 24.93 | 14.67 |

Most problematic wild animals' and nature of HWC in the study communities

All of the respondents 124 (100%) claimed that they had encountered conflicts with wildlife. A total of nine (9) wildlife species were perceived as causing severe crop and livestock damage in the study area. Ape (*Chlorocebus aetiops*), Porcupine (*Hystrix cristtata*), Rabbit (*Oryctolagus cuniculus*), Midako (*Sylvicapra grimmia*) and different avian species were reported as crop raider while**,** Bat-eared fox (*Otocyon megalotis*), Common jackal (*Canis aureus aureus*), Jib (*Crocuta crocuta*) and Aner (*Leptailurus serval*) were suggested as livestock predators.

*Causes and Effects of Human-Wildlife Conflict*

Of the total, 46 (37.1%) of the respondents mentioned that habitat distraction was the major cause of the conflict. Increasing of wildlife population and resource competition were also mentioned as causes by 38 (30.6%) and 27 (21.8%) of respondents respectively. Causes of human-wildlife conflict varied significantly in the study area ($\chi2 = 19.806$, df = 3, $p < 0.05$) (Table 2). Based on the response of the respondents and direct field observations, crop damage, livestock predation, human injuries (diseases/threats), destruction of property, were the main nature of conflict, effects of conflict, between human and wildlife. Most of the respondents, 102 (82.3%) reported the conflict happened due to both crop damage and livestock depredation was significant ($\chi2 = 80.327$, df= 1, $p < 0.05$ and $\chi2 = 90.604$, df= 1, $p < 0.05$) when compared with the crop damage and livestock predation respectively (Fig. 1).

Table 2: major causes of human-wildlife conflict in the study area

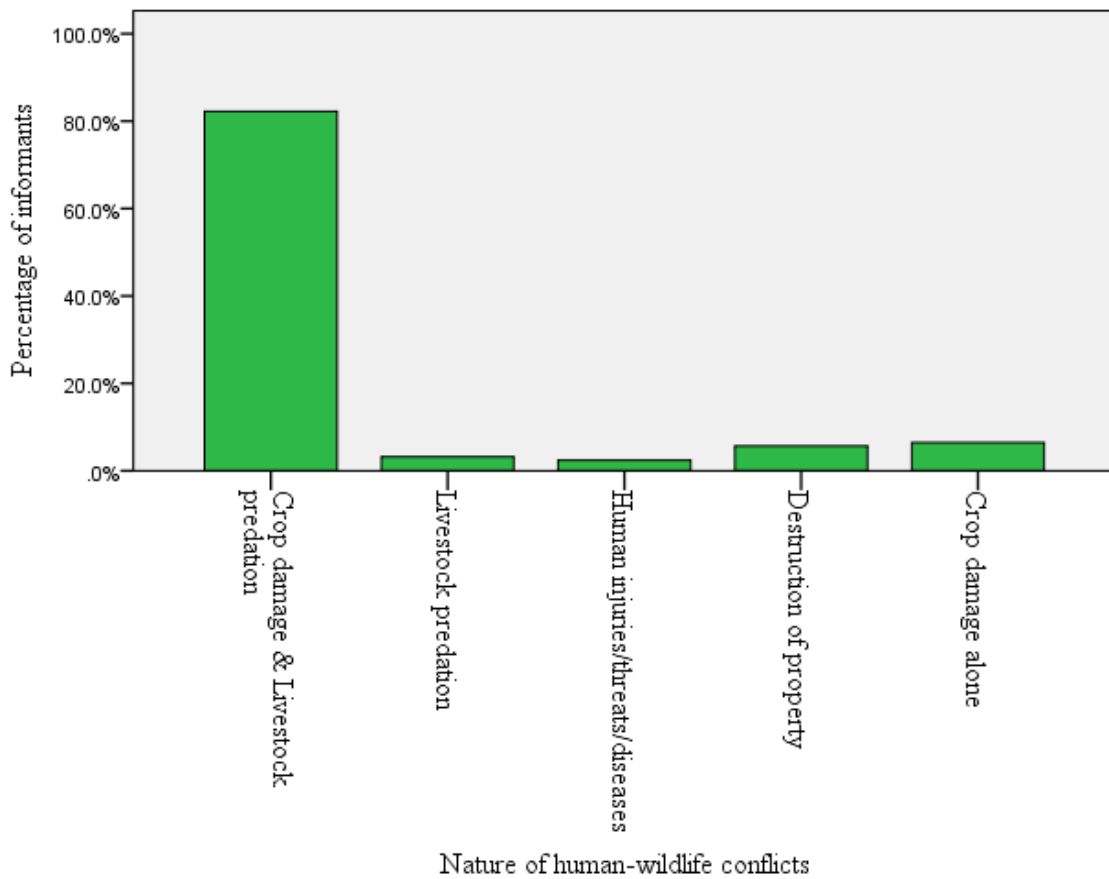| Cause of human wildlife conflict | Villages | | | |
|---|---|---|---|---|
| | Meleya | Fuafuat | Guacha | Total |
| Habitat distraction | 13 (35.1%) | 8 (24.2%) | 25 (46.3%) | 46 (37.1%) |
| Resource computation | 7(18.9%) | 6 (18.2%) | 14 (25.9%) | 27 (21.8%) |
| Increasing of wildlife population | 12 (32.5%) | 17 (51.5%) | 9 (16.7) | 38 (30.6%) |
| Human proximity to the forest | 5 (13.5%) | 2 (6.1%) | 6 (11.1%) | 13 (10.5%) |



Figure 2: Nature of conflicts in the study area

*Conflict Due To Crop Raiding*

The leading crop damage causing animals across the study area were ape 46 (37.1%) and porcupine 42 (33.9%) (During our fieldwork we also observed scats & the damaged crops by the porcupine) and Rabbits 19 (15.3%). The damages of ape and porcupines were significantly differed among villages ($\chi2 = 0.962$, df= 2, $p < 0.05$) and ($\chi2 = 17.706$, df= 2, $p < 0.05$) respectively. However, midako 11 (8.9%) and different bird 6 (4.8%) species were identified by some of the informants as less problematic crop pests (Table 3). The important crops grown in the study area like potato, wheat, barley and bean were damaged more frequently by wild animals. All of the respondents, 124 (100%) informed, as barely is the most damaged crops followed by potato 109 (87.9%). As result, there were significantly different ($\chi2 = 440.575$, df= 5, $p < 0.05$) among the severity of crops. However, cabbage and onion was damaged occasionally as they cultivate them rarely (Table 3).

Table 3: Response of informants on human-wildlife conflicts with reference to crop raider and crop damage

| Attribute | | Response | Villages | | | Overall (N=124) |
|---|---|---|---|---|---|---|
| | | | Meleya (n=37) | Fuafuat (n=33) | Guacha (n=54) | |
| Major Crop raider | Ape | Yes | 37 (100%) | 22 (66.7%) | 47(57.0%) | 106(85.5%) |
| | | No | 0 | 11(33.3%) | 7 (13.0%) | 18 (14.5%) |
| | Porcupine | Yes | 23 (62.2%) | 25(75.8%) | 54 (100%) | 102 (82.3%) |
| | | No | 14(37.8%) | 8 (24.2%) | 0 | 22 (17.7%) |
| Miner Crop raider | Rabbit | Yes | 31(83.8%) | 27 (81.8%) | 41(75.9%) | 99(79.8%) |
| | | No | 6(16.2%) | 6 (18.2%) | 13 (24.1%) | 25(20.2%) |
| | Midako | Yes | 21(56.8%) | 23 (69.7%) | 25 (46.3%) | 69(55.6%) |
| | | No | 16(43.2%) | 10 (29.3%) | 29 (53.7%) | 55(44.4%) |
| | Birds | Yes | 13(35.1%) | 5(15.2%) | 11(20.4%) | 29(23.4%) |
| | | No | 24 (64.9%) | 28(84.8%) | 43(79.6%) | 95 (76.6%) |
| Name of the crops damaged by crop raider | Potato | Yes | 29(78.4%) | 26(78.8%) | 54 (100%) | 109 (87.9%) |
| | | No | 8(21.6%) | 7(21.2%) | 0 | 15(22.1%) |
| | Barely | Yes | 37 (100%) | 33 (100%) | 54(100%) | 124(100%) |
| | | No | 0 | 0 | 0 | 0 |
| | Wheat | Yes | 21(56.8%) | 9(27.3%) | 6(11.1%) | 36 (29.0%) |
| | | No | 16(43.2%) | 24(72.7%) | 48(88.9%) | 88 (71.0%) |
| | Cabbage | Yes | 0 | 2(6.1%) | 3(5.6%) | 5 (4.0%) |
| | | No | 37 (100%) | 31(43.9%) | 51(94.4%) | 119 (96.0%) |
| | Bean | Yes | 19 (51.4%) | 21(63.6%) | 11(20.4%) | 51(41.1%) |
| | | No | 18 (48.6%) | 12(36.4%) | 43(79.6%) | 73(58.9%) |
| | Maize | Yes | 8(21.6%) | 0 | 0 | 8(6.5%) |
| | | No | 29(78.4%) | 33(100%) | 54(100%) | 116(93.5%) |
| | Onion | Yes | 1(2.7%) | 2(6.1%) | 0 | 3(2.4%) |
| | | No | 36(97.3%) | 31(93.9) | 54(100%) | 121 (97.6%) |

*Mitigation Measures Adopted by Local Farmers for Crop Damage*

Farmers utilized several methods to keep their farm from damage by crop raider in the study area. These measures taken to minimize crop damage were guarding day & night, using dogs, fencing, chasing, scarecrow, hunting and cattle dugs (dissolving of cattle dug in water and then, sprays/polish on the crops) (Figure 3 and Table 4). The techniques used to reduce crop damage were varying from village to village and to species to species. Most of the respondents 51 (41.1%) reported guarding day & night as an effective method of minimizing crop damage and a best option for all crop raider animals. On the other hand a considerable number of respondents, 22 (17.7%) also reported using dogs as a better and effective method in minimizing crop damage by Ape and Midako (Table 4).

Table 4: Response of informants on strategies used to cope crop raiding

| Techniques used to reduce crop damage | Villages | | | | Best option for |
|---|---|---|---|---|---|
| | Meleya (n=37) | Fuafuat (n=33) | Guacha (n=54) | Total (n=124) | |
| Guarding day & night | 18 (48.7%) | 11 (33.3%) | 22 (40.8%) | 51 (41.1%) | all crop raider |
| Using dogs | 6 (16.2%) | 7 (21.2%) | 9 (16.7%) | 22 (17.7%) | Ape & Midako |
| Fencing | 5 (13.5%) | 2 ( 6.1% ) | 9 (16.7%) | 16 (12.9%) | Porcupine |
| Chasing | 4 (10.8%) | 5 (15.2%) | 3 (5.5%) | 12 (9.7%) | Midako & Rabbit |
| Scarecrow (soaked in naphtha & Smoke, plastics & clothes) | 0 | 5 (15.1%) | 6 (11.1%) | 11 (8.9%) | Porcupine & birds |
| Hunting | 2 (5.4%) | 3 (9.1%) | 2 (3.7%) | 7 (5.7%) | Midako, Porcupine & rabbit |
| Cattle dugs | 2 (5.4%) | 0 | 3 (5.5%) | 5 (4.0%) | Birds |
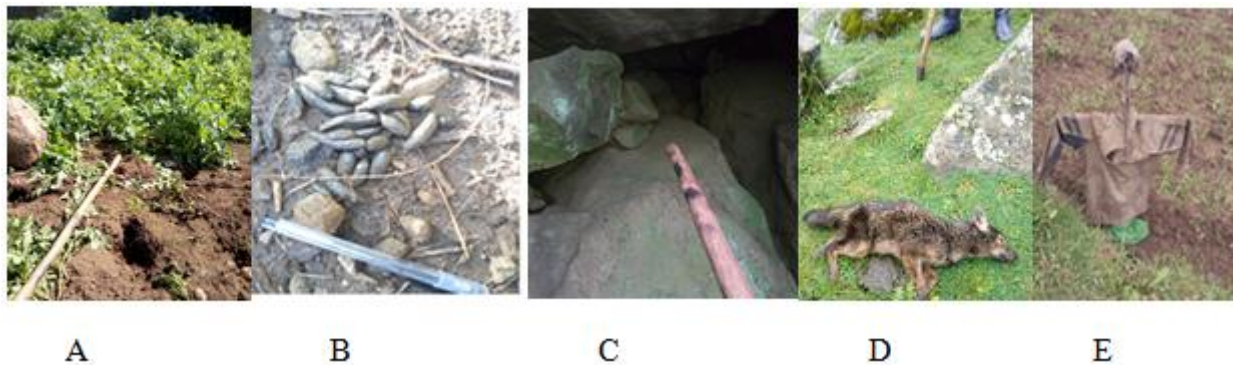


Figure 3: Damages of potato crops by porcupine (A), Scats of Porcupine (B), Common jackal killed by the community (C) and methods used to minimize the crop damage (E).

*Conflict Due To Livestock Depredation:*

Among the listed problematic wild animals, Bat-eared fox (Afine, አፊነ) were considered as the most serious animals 78 (62.9%) followed by common jackal 33 (26.6%) in the villages (Table 5). There was no livestock depredation reported in Meleya and Guacha villages by jib and aner respectively. The domestic animals attacked by the wild animals reported by the respondents were includes cattle, sheep, goats and hen/chickens. From those, sheep and goat were reported as the most problematic livestock among the villages (Table 5). From the most practiced techniques used to minimize livestock depredation, limiting the animals in the house 60 (48.4%) was the choicest option followed by active guarding 33 (26.6%) and Keeping dogs 31 (25.0%) (Table 5).

Table 5: Response of informants on human-wildlife conflicts with reference to livestock predation, techniques used for livestock protection

| Attribute | | | Villages | | | Total (n=124) |
|---|---|---|---|---|---|---|
| | | | Meleya (n=37) | Fuafuat (n=33) | Guacha (n=54) | |
| Livestock predation animals name | | Bat-eared fox | 28 | 17 | 33 | 78 (62.9%) |
| | | Common jackal | 8 | 11 | 14 | 33(26.6%) |
| | | Jib | - | 3 | 7 | 10(8.1%) |
| | | Aner | 1 | 2 | - | 3(2.4%) |
| The most prey animals | Sheep | Yes | 37 | 33 | 54 | 124 (100%) |
| | | No | 0 | 0 | 0 | 0 |
| | Goat | Yes | 32 | 27 | 46 | 105 (84.7%) |
| | | No | 5 | 6 | 8 | 19 (15.3%) |
| | Cattles | Yes | 0 | 0 | 2 | 2 (1.6%) |
| | | No | 37 | 33 | 52 | 122 (98.4%) |
| | Hen/ Chickens | Yes | 1 | 2 | 0 | 3(2.4%) |
| | | No | 36 | 33 | 54 | 121 (97.6%) |
| Techniques used For livestock protection | | Active guarding | 11 | 4 | 18 | 33(26.6%) |
| | | Keeping dogs | 7 | 13 | 11 | 31 (25.0%) |
| | | Limiting the animals in the house | 19 | 16 | 25 | 60 (48.4%) |

Community attitudes towards the wildlife and trends of conflict

Of all the informants, 67 (54.0%) had negative attitude and 43 (34.7%) were positive, whereas 14 (11.3%) were having no idea for crop raiders. Similarly, 80 (64.5%) of the respondents were negative to livestock depredators and 39 (31.5%) were positive, while 5 (4.0%) were having no idea. Hence, the proportions of respondents attitude was significant for both crop raiders ($\chi2 = 226.57$, df = 1, $p \leq 0.05$) and livestock predators ($\chi2 = 304.13$, df = 2, $p \leq 0.05$) (Table 6).

69 (55.6%) of respondents perceived increased trend of crop damage, 48 (38.7%) respondents estimated as under declining, whereas, 7(5.7%) of respondents had no idea about the trend of crop damages, while, regarding to livestock predation, 64 (51.6%) of respondents observed as there is an increased trends and 44 (35.5%), were reported as decreasing, contrariwise 16(12.9%) of the respondents had no idea. The increasing trends of damage were significant for both crop raiders (($\chi2 = 48.113$, df= 2, p < 0.05) and livestock predation ($\chi2 = 28.129$, df = 2, p < 0.05) (Table 6).

Table 6: Response of informant's attitudes towards crop raider/livestock predation and trends of crop damage/ livestock predation

| Attribute | | Villages | | | |
|---|---|---|---|---|---|
| | | Meleya (n=37) | Fuafuat (n=33) | Guacha (n=54) | Total (n=124) |
| Attitudes towards crop raider | Positive | 13 | 9 | 21 | 43 (34.7%) |
| | Negative | 19 | 22 | 26 | 67 (54.0%) |
| | No idea | 5 | 2 | 7 | 14 (11.3%) |
| Trends of crop damage | Increasing | 18 | 20 | 31 | 69 (55.6%) |
| | Decreasing | 14 | 13 | 21 | 48 (38.7%) |
| | No idea | 5 | 0 | 2 | 7 (5.7%) |
| Trends of livestock predation | Increasing | 24 | 15 | 25 | 64 (51.6%) |
| | Decreasing | 10 | 13 | 21 | 44(35.5%) |
| | No idea | 3 | 5 | 8 | 16(12.9%) |
| Attitudes towards livestock predation | Positive | 10 | 11 | 18 | 39 (31.5%) |
| | Negative | 24 | 22 | 34 | 80 (64.5%) |
| | No idea | 3 | 0 | 2 | 5 (4.0%) |

*Extent of HWCs*

Among the villages surveyed, Guacha was the severest from the other villages. There was a significant difference ($\chi2= 9.831$, df = 2, p<0.05) on respondent's rankings of HWC severity among the three villages (Table 7).

Most of the respondents reported that severe crop damage and/or livestock depredation occurred during the months of June – August 51 (41.1%) and from September – November 48 (38.7%). However, 14 (11.3%) and 11(8.9%) of the respondents mentioned that the damage also occurred on the months of December to February and March to May, respectively (Table 8). Hence, there was a significant variation ($\chi2= 44.452$, df = 3, p< 0.05) on severity conflict across months.

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Table 7: Respondent ranking of HWC severity across the three study sites

| Question | Response | Villages | | | |
|---|---|---|---|---|---|
| | | Meleya (n=37) | Fuafuat (n=33) | Guacha (n=54) | Total (n=124) |
| To what extent is HWC a problem? | Severe problem | 19 (51.4%) | 16 (48.5%) | 36 (66.7%) | 71 (57.3%) |
| | Moderate problem | 9 (24.3%) | 11 (33.3) | 16 (29.6%) | 36 (29.0%) |
| | No a problem | 6 (16.2%) | 5 (15.2%) | 2 (3.7%) | 13 (10.5%) |
| | Do not know | 3 (8.1%) | 1 (3.0%) | 0 | 4 (3.2%) |

**Note:** severe means that to a greater extent community members are affected by HWC, moderate means that community members are somewhat affected by HWC; do not know means there was no relevant information on the question

Table 8: Respondents response about months at which severe crop damage/livestock depredation occurred

| Villages | Months | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Sep – Nov | | Dec – Feb | | Mar- May | | Jun – Augt | |
| | Freq | % | Freq | % | Freq | % | Freq | % |
| Meleya | 15 | 40.5 | 3 | 8.1 | 0 | 0 | 19 | 51.4 |
| Fuafuat | 16 | 48.5 | 4 | 12.1% | 2 | 6.10% | 11 | 33.3 |
| Guacha | 17 | 31.4 | 7 | 13 | 9 | 16.7 | 21 | 38.9 |
| Total | 48 | | 14 | | 11 | | 51 | |

Crop raiding and/or livestock depredation were occurred both during daytime and at night. However, according to 81 (65.3%) of the respondents, day time is mostly preferred by the animals. On the other hand, 43 (34.7%) of respondents argued that night is the most preferred time for crop raiding and/or livestock depredation. There was a significant difference ($\chi2 = 11.645$, df = 1, p <0.05) between the time of the day that wild animals attack crops/livestock.

## IV. DISCUSSION

### Causes of Human wildlife conflict

The major cause of HWC in the study area identified were; habitat distraction, resource computation, increasing of wildlife population and human proximity to the forest. Among these; habitat distraction and increasing of wildlife population were the most severe cause. This result was similar with Joseline (2010) and Edward and Frank (2012) who reported increased habitat disturbance as major causes of HWC and similarly, Priston *et al*. (2012) who reported deforestation was the main causes of HWC. Studies elsewhere in the world have reported that, resource competition (Woodroffe *et al*. 2005; Yigrem *et al*. 2016), increased population density (Engeman *et al*., 2010), climate change (Mustafa *et al*., 2005) and habitat diminution (Matseketsa *et al*., 2019) has been the major causes of HWCs. On the other hand, Occasions of wildlife damage, loss of crops and livestock and injury or death of local people, are quite obvious with human settlements around protected areas (Karanth and Nepal, 2012). Similarly, crop damage, livestock predation, crop damage & livestock predation, human threats, and destruction of property were the major nature of conflict in the current study. Similar results were reported by Hailemariam *et al.* (2017) and Matseketsa *et al*. (2019).

### Most Problem causing Wild Animals' and Nature of HWC in the Study Communities

Hundred percent of the respondents were reported as there is problems of human- wildlife conflict, in and around Weyngus forest. Similar findings were observed from the study conducted on human – wildlife conflict in Tanzania (Edward, 2012) and Ethiopia (Leta *et al*., 2016; Mohammed *et al*., 2017). Ape, Porcupine, Rabbit, Midako and different bird species were reported as crop raider while, bat-eared fox, common jackal, hyena, and aner were suggested as livestock predator. Muluken (2014) reported in Wondo Genet district, the top six animals responsible for the most loss to crops are baboons, warthog, bush pig, vervet monkeys, porcupine and mole rat. Additionally, Amare and Serekebirhan (2019) stated that, ape, monkey, porcupine, warthog, fox, hyena, skunk and gazelle were the most eight pest animals in Midre-Kebid Abo Monastry.

The leading crop damage causing animals across the study area were ape and porcupine, while, the foremost livestock predation causing animals were bat-eared fox and common jackal. Primates had been widely cited in literature as infamous crop raiders (Abie and Bekele 2016, Alelign and Yonas, 2017; Mohammed *et al*., 2017). Similarly, Global Integrated Collection Assessment and Planning Workshop for Canids and Hyaenids (2016) reported as it is predators of small livestock. Common fox was predominant livestock predators followed by Hyena and Leopard in Ethiopia (Hailemariam *et al*., 2017).

### Conflict due to Crop Raiding

Ape, Porcupines and Rabbits were reported to be the most destructive wild animals in the study area (Table 3). The livelihood of the local community is mainly depending on agricultural practices; hence crop damages maybe viewed seriously in the communities. The people living in close proximity to the Weyngus forest overlap with the needs of wildlife that facilitated the conflict. Similar studies by Abie and Bekele (2016) and Leta *et al*. (2016) reported as crop losses are considerate for farmers who mainly depend on agricultural practices. On the other hand, Hariohay and Røskaft (2015) concluded as susceptibility of crop damage could increase in the absence of a buffer zone. During our field observation plants like kega (Rosa abyssinica), Koshim (Dovyalis abyssinica) and እንጆሪ (Fragaria spp.) were highly distracted by farmers due to these plants have a prickly surfaces which is suitable for fencing purpose, even though, these plant species are preferable food for primates in the study area. As well as, the presence of large trees especially Bahire Zafe (*Eucalyptus globulus*) and Ethiopian highland Bamboo (*Yushania alpina*) in

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the area helps for arboreal pathways and facilitates the conflict; as a result apes were the foremost crop raider wild animals in the area. Similarly, the most frequently identified crop pests are primates (Hailemariam *et al*., 2017; Mohammed *et al*., 2017). Primates are serious crop raiders due to their intelligence and adaptability (Strum, 1991). On the other hand, porcupines were the second known pest animals in the study area. Respondents identified that porcupines mostly damage potato crop in the area (damaged potato was observed in our filed observation too), especially in Guacha village. This is due to; the habitat towards this village has many hollows/caves which are favorable for them. In similar fashion, Amare and Serekebirhan (2017) noted that porcupines cause intensive damage to crops, and mainly on enset tubers and potatoes.

According to Demeke and Afework (2013) crops like, Maize, Teff and Sorghum attract crop raiders around Chebera Churchura National Park. But in the current study area, potato, barley and wheat were the most damaged crop types (Table 3). Probably, this is because of, these crops are widely grown by many households in the area as compared to the other crop types; and/or might be more preferred by irritant animals due to their deliciousness. Amare and Serekebirhan (2017) had also come to a similar conclusion that production of highly palatable and nutritious crops attracts primates and other wild animals. Similarly, Leta *et al*. (2016) reported that not all crops are equally damaged by crop raiders. Rabbit was the third most crop raider animals in the present study. However, Midako and different bird species were identified by some of the informants as less problematic crop pests. "Large and medium sized terrestrial mammal species are likely to traverse far away from the protected areas into human inhabited lands due to satisfy daily nutritive requirements which leads a significant contributors to HWC" (Matseketsa *et al*., 2019). Most respondents listed birds are commonly damage, from early matured to matured stage. Even though, Qura (*Corvus macrorhynchos*) and Qoq (*Perdix perdix*) were the most problematic birds on human property, hut, Gojo bet (local house) and crop raiding's respectively.

Farmers utilized different techniques for different wildlife. Guarding day & night, using dogs and fencing were widely practiced mediations to comprise HWCs in the study area. Most of the respondents 51 (41.1%) reported guarding day & night as an effective method of minimizing crop damage and a best option for all crop raider animals. On the other hand a considerable number of respondents, 22 (17.7%) also reported using dogs as a better and effective method in minimizing crop damage by ape and midako (Table 4). Dissolving of cattle dug using water and, sprays/polish on the crop seed is the choicest method keeping away crops from avian species. This might be due to the odor of cattle dugs repellent them, or else the dissolved solution sprayed on the crops might cover their seeds. In other studies, diverse safeguard methods are reported; for instance, Guarding (Asebe, 2017; Hailemariam *et al*., 2017), using dogs (Amare and Serekebirhan, 2019) and Fencing (Ogada *et al*., 2003; Mutinda *et al*., 2014).

*Conflict due to Livestock Depredation:*

Livestock are fundamentally vulnerable to depredation due to their reduced anti-predatory skills than the wild herbivores and due to scarcity of wild prey available in the area (Patterson *et al*. 2004; Jackson, 2012). Common fox, leopard and hyena were the main livestock predators in Ethiopia (Hailemariam *et al*., 2017). In the current study bat-eared fox was considered as the most serious livestock predator animals followed by common jackal in the study area (Table 5).

The domestic animals attacked by the wild animals reported by the respondents were includes; sheep, goats, cattle, and hen/chickens. Sheep and goats were reported as a most severe livestock by wild animals among the three villages. Medium sized livestock like goats and sheep are most vulnerable than cattle and pack animals to predation since medium sized can be killed and take to a safer place easier (Bibi *et al*., 2013). The depredation of cattle's were reported only in Guacha whereas, hens was reported in Meleya and Fuafuat. This might be due to the difference in village proximity to the forest and or the presence of many caves for predators to live there. Similarly, Miller *et al*. (2016) concluded, the more proximity to the forest, the highest existence of conflicts. Limiting the animals in the house, active guarding and keeping dogs are the most practiced methods to minimize livestock depredation in the study area. From these techniques, limiting the animals in the house was the choicest option followed by active guarding. This was in line with studies conducted by Ayenew *et al*. (2019). Though, in contrast to the present study, guarding was reported as the major measure taken to reduce livestock depredation by Demeke and Afework (2013). Building livestock enclosures (sheds) is a best option to keep livestock depredations (Angela *et al*., 2013). Guarding and keeping livestock in enclosures was a common method in minimizing livestock depredation (Hariohay and Røskaft 2015).

*Community Attitudes towards the Wildlife and Trends of Conflict*

Most of the informants had negative attitude for both crop raiders and livestock depredators (Table 6). Among informants, 69 (55.6%) of respondents were perceived increased trend of crop damage. This result was similar with the study conducted by Leta *et al*. (2014) who reported that the trend of crop damage by crop raider was increased in Gera district. While, regarding to livestock predation, 64 (51.6%) of respondents perceived as there is an increased trends. Rural populations in which their livelihoods are depending upon domestic animals have negative attitudes towards wild animals especially for carnivores (Hailemariam *et al.,* 2017) which are also true in the present study.

*Extent of HWCs*

The occurrences of crop damage/livestock depredation were differed with in each village. Among the villages Guacha was the severest village than the other villages (Table 7). This might be difference in the interaction level of surrounding peoples with wild animals. During our filed observation there was a high grazing intensity in Guacha, which leads competition of resources

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with the wild animals. In addition to this, most of the respondents reported that severe crop damage and/or livestock depredation occurred during the months of June – August and from September – November. This is due to these seasons are rainy season, as a result, the crops are mainly cultivating. On the other hand, the presence of cloud and fog creates a suitable condition for livestock predators especially for bat-eared fox, which is a diurnal in rainy season. Most of the respondents (65.3%), claimed that crop raiding and/or livestock depredation were occurred day time. This is due to most of the frequent attacking wildlife animals are diurnal/mostly active during the day time. Similar results were reported by Amare and Serekebirhan (2019).

## V. CONCLUSION

In conclusion, it is evident that the causes of human-wildlife conflict were habitat distraction, increasing of wildlife population and resource competition. From the result, the human wild animal's conflict in the current study area was due to crop damage, livestock predation , both crop damage & livestock predation, human injuries/threats/diseases and destruction of property. Farmers used different techniques in order to minimize crop damage and livestock depredation. However, these methods are requiring additional labor force and time consuming. Consequently, the result also implies that most of the local communities had negative attitude towards wildlife. As a result, human-wildlife conflict has increased alarmingly and in the absence of an appropriate management plan this problem, will be only going to get worse in the future. Therefore giving attention is mandatory to resolve such conflicts.

## VI. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are forwarded:
1. Working in collaboration with relevant stakeholders and responsible bodies including the local community to implement an integrated plan for better conservation is highly  recommended
2. The sustainable and culturally acceptable conservation solutions are necessary to find a balance between conservation priorities and the needs of people who live adjacent to wildlife which enables coexistence and sharing of resources at same level.
3. Continuous assessment for habitat change and taking management action is highly appreciable for the continuity of such wild life species.

*Conflicts of interest:* Nothing to declare.

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