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COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE

DEPARTMENT OF ZOOLOGICAL SCIENCES

Human-wildlife conflict in and around Anfarara Forest, Guji zone,
Oromia Regional State, Ethiopia

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Fulfillment of the Requirements for the Degree of Master of Science
in Biology

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Approval sheet form

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DEDICATION

This work has been dedicated to my wife Birkinsh Adela

Author's Statement

I, the undersigned, declare that this paper is my original work; prepared under the guidance of Advisor Misganaw Tamrat (PhD). Also the race of all materials used in the paper have been duly acknowledged.

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ACRONYMS

HWC: Human -Wildlife Conflict

IUCN: International Union for the Conservation of Nature and

NMA: National Meteorological Agency

NP: National Park.

WWF: World Wildlife Fund

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Abstract

*This study investigated human-wildlife conflict in and around Anfarara forest from December 2022 to January 2023. The aim of this study was to identify the main causes of human-wildlife conflict, estimate crop and livestock loss due to wildlife, identify crops and animals commonly killed by wildlife, and identify wildlife species affecting crops and agricultural products. Data were collected through questionnaire survey, focal group discussion and key informants. Data analysis was performed using SPSS version 16 and appropriate and descriptive tests. Therefore, descriptive statistics in the form of percentages are used to analyze the state of the economy. Participants and their responses were compared using the chi-square test. Wild animals were found in the following areas: Anubis baboons (*Papio anubis*), vervet monkeys (*Chlorocebus pygerythrus*), leopards (*Panthera pardus*), spotted hyenas (*Crocuta crocuta*), African wolves bush pig (*Potamochoerus larvatus*), warthogs (*Phacochoerus africanus*) and porcupines (*Hystrix cristata*). About 96.55% of the respondents said that the main wild animals causing crop damage are Anubis baboon, followed by vervet monkey (87.06%), and bush pig (70.68%). Participants reported domestic animals being killed by leopards, spotted hyenas, African wolves. Participants reported that competition for resources, crop loss, danger of poaching, increased destruction of land near the forest, and inadequate protection led to human-wildlife conflict around the Anfarara Forest. About 90.51% of the respondents responded that they protect crops by guarding, 83.62% they protect crops by using dogs, 81.03% by making scarecrows and 61.2% use smoke to protect crops. Therefore, awareness and mitigation strategies regarding human-wildlife conflict should be developed in the region.*

Keywords: conflict, crop raiding, livestock predation, predators

1. INTRODUCTION

1.1. Background of the Study

Human-wildlife conflict refers to conflicts between wild animals and humans when the needs and behaviors of wildlife interfere with human goals. It includes situations where wild animals threaten, attack, injure or kill humans and their livestock, crops or property, transmit disease or illness to animals, and use animals in the communities as food (Makindi et al., 2014). The impact on wildlife is still a major cause of human-wildlife conflict due to land expansion for agriculture, deforestation and coal, rapid human population growth, hunting and ranching of animals (Kumar, 2012). Human-wildlife conflict has adverse effects on both humans and wildlife (Makindi et al., 2014). In the world human wildlife conflict and coexist have been observed along the evolution of human beings (Eltringham, 1976). During earlier time when humans lived in caves, conflicts between wild animals and humans occurred due to disturbance in the habitat (Eltringham, 1978). As technology progressed, gradually in the Stone Age and Iron Age, people developed war tools such as hand axes to protect themselves from wild animals. Later, people began to hunt wild animals for food and protection (Eltringham, 1979). The large numbers reported by countries around the world demonstrate the seriousness of human-wildlife conflict and suggest deeper study to understand the problem and promote conservation confidence in threatened and endangered species (Hill, 2000).

Human-wildlife conflict is a common problem in Africa, including our country (Caro, TM, 1 et al. 998). It mainly damage happened due to crops raiding and livestock depredation caused by wildlife. It is becoming a major problem for land managers and conservationists because it leads to negative people's attitudes towards wildlife, which has consequences for conservation (Oikos 2002, Meingataki 2005).

Almost all protected areas in Ethiopia are surrounded by agricultural lands where wildlife has direct contact with humans (Kumsa and Bekele 2008). This increases human-wildlife conflict. These HWCs have a negative impact on marginalized communities because they lack access to livelihood resources such as crops and livestock (Colchester 2004; Lockwood 2006; West et al. 2006) and cause voluntary harm to wildlife through retaliatory killing. To effectively reduce HWC, a good understanding of its scale and strategies to promote cooperation by balancing the needs of humans and wildlife are needed (Newmark et al. 1993, Messmer,2000; Gemechu et al. 2000). 2014). this information; It should include formal information about cause, type, distribution, impact, how stakeholders understand the impact, and possible solutions. HWC survey data published in Ethiopia (Demeke 2010; Yirga and Bauer, 2010; Datiko and Bekele 2013) are limited to some regions. Because wildlife diversity varies across habitats (Yalden et al. 1984), the species considered crop predators and prey species may differ from habitat to habitat (Yirga and Bauer 2010). Ethiopia's natural ecosystems have been changing for thousands of years due to human and natural factors (Shibru, 1195). Most of the plateaus and some of the plains have been converted into agricultural and livestock land. Human activities often lead to conflicts between wildlife in our country due to the expansion of agricultural land, clearing of forests for wood and charcoal, burning of forest and destruction of wildlife. The plant is used as fuel wood, construction and other works. As a result, the nation's wildlife resources are now largely confined to a few protected areas (Hillman, 1993a).

One of the main objectives of this study is to investigate the human-wildlife conflicts, in the, Guji zone, Oromia regional state, southern Ethiopia, focusing on three selected villages of Belo aroji, Belo qilenso and Dandaloo gorofte. One of the activities carried out in this study is to monitor human-wildlife conflict and cooperation in our village. The scope of activities includes: explaining what is happening in the work area; understand the drivers of HWC and

identify areas where the risk of conflict is higher. Specifically, in three censuses from December 2022 to January 2023, these villages were monitored for crop and livestock killing. Benefits (Oromia Forest and Wildlife Enterprise Borena-Guj branch) and Malacca xibirro kebele Authority)

1.2. Statement of the problem

Human –wildlife conflict in around Anfarara forest a common problem. Because people and wildlife live together in the study area. Conflicts often occurs when wildlife cross line or boundary between livestock and wildlife and enter human territory. In the study area , the main cause of human –wildlife conflict due to deforestation for charcoal, timber,disturbance of wildlife habitat and expanding of agricultural land.

Therefore, the aim of this study is to fill the above-mentioned gap and provide suggestions for future communication solutions. This means that this research is designed to produce scientific data on human-wildlife conflict and coexistence.

Therefore, the main objective of this study is to identify wildlife-human conflicts by answering the following research questions, focusing on Anfarara Forest in, Guji zone, Oromia Region, Ethiopia:

- ❖ What are the causes and impacts of wildlife Conflict Anfarara forest?
- ❖ Which wild animals are controversial in Anfarara forest?
- ❖ What is the procedure of method of deterrent from crop raiding and livestock predation?
- ❖ Which species of crop and livestock highly damaged by wildlife?

1.3 Objectives of the Study

1.3.1 General Objectives

The objective of this study is to assess human-wildlife conflict in and around Guji zone of Anferara Forest, Oromia State, Ethiopia.

1.3.2 Specific Objectives

- To identify the causes of human-wildlife conflict.
- To identify of wild animals causes great controversy.
- To determines of method of deterrent from crop raiding and livestock predation.
- To identifies the major crop being raided and livestock predated

1.4 Limitations of This Study

There are different problems in the study area and around there. Some of these limitations include: there are insecurity around study area. There is no shortage of crops and forests, and animals also come to the forest for food. People living around forests planted less than most plants, charcoal, firewood and firewood to expand their agricultural areas. For these reasons, some animals migrate.

1.5 significance of the study

There are different specie of the wildlife and subspecies in our country. Many of wild animals are strong crop raider and livestock predator and - they create problems across different - parts of the country, especially in rural area where existence farmer living and farming near to the forest. The people have negative perception about wildlife animals; because wild animals damaged to their crops and livestock considerable from. In this study area, majority of the land is covered with forest and farmers who are near to the forest are the main victims of this crop damage as well as livestock predation. Most of their agricultural products are exposed to the damage by wild animal and their seasonal or yearly yields from their agriculture are less when compared with that of secured farmer.

The significance of the study is to maximize the understanding of people towards the wildlife conservation, to plan appropriate deterrence strategy of farmer's crop and livestock from raiding and predation, respectively.

Moreover, the data may be used as secondary data for researchers and any interested parties working in the study area. Hence, this study is paramount or has vital significant in identifying type of wildlife and method of minimizing the human –wildlife conflict in the study area.

2. LITERATURE REVIEW

2.1 Concept and definition of human-wildlife conflict

Human-wildlife conflict (HWC) is a term commonly used by conservationists to describe conflicts that happen between wild animals and people. It exists in different forms all over the world and is experienced more in developing countries (Blair, 2008). Various definitions about the term have been forwarded by different researchers and organizations working on the area.

Natural resources define it as any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment. According to the WWF human-wildlife conflict is a kind of conflict that can be triggered by humans or wildlife and have a negative repercussion on both parties that involved in the conflict (WWF, 2006).

Similarly, the United States Geological Survey (2003) in its review accentuates on the need to reckon the two contexts, i.e., actions by wildlife with human goals and human activities threaten the safety of wildlife in defining the term. Thus, they defined it as: human-wildlife conflict occurs when the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife. Human responses to the interaction are the most decisive factor for the outcomes of the conflicts between humans and wildlife (USGS 2003).

2.2. Causes of human-wildlife conflict

Many researchers at different times have investigated that the determinant factors that cause conflicts between human and wildlife in their respective research sites. The main causes of human-wildlife conflict are identified by different researchers across the globe in general and Ethiopia in particular.

Research conducted by Gobosho (2015) showed that habitat destruction, proximity to natural forest and increased subsistence utilization as the major causes of HWC in the study area.

The main cause of human-wildlife conflict worldwide is the competition between growing human populations and wildlife for the same declining living spaces and resource (Madden, 2008). The transformation of forests, savannah and other ecosystem in to agrarian areas or

urban agglomerates as a consequence of the increasing demands for land, food production, energy and raw materials has leads to dramatic decrease in wildlife habitat (Sillero-Zubiri and Switzer,2001).

The major causes of human-wild animals' conflict could be attributed to many factors ranging from wild animals' population increase to human population increase (Edward and Frank, 2012). The presence of many people needs cultivated land and hence a greater interface between people and wildlife. The world population is predicted to grow by over 50% in the next fifty years, from six billion in 2000 to over nine billion in 2050 and the increment in both wildlife and human population create competitions on fixed natural resource which leads to conflict (Sillero-Zubiri and Switzer, 2001).

The consequences of human-wildlife conflicts are cropping destruction, livestock predation, human death and injuries are sometimes recorded. Human-wild animals' conflicts were happened when the actions of humans or wild animals have an adverse impact upon the others. It recognized that humans have profoundly impacted wildlife and the environment in many ways, through habitat loss, pollution, introduction and spread of exotic and invasive species, overexploitation, and climate change. Human-wildlife conflicts vary according to geography, land use patterns, human behavior, and the habitat and behavior of wildlife species or individual animals within the species (IUCN, 2005). Crop raiding is not a new phenomenon and it has most likely been occurring since humans started practicing agriculture (Joseline, 2010).

2.3. The impacts of human-wild life conflict on humans

The outcomes of the conflict between humans and wildlife can have overwhelming impacts on the social, economic or cultural of humans. According to Gobosho (2015), the impacts range from clear-cut economic hardship to less tangible effects such as increased opportunity costs and decreased quality of life. Living alongside of wild animals can incur a variety of additional costs aside from the direct impact of depredation. According to Gobosho (2015), this event may even result in human's property damage, economic losses related to crop raiding, and harassment.

Mesele Yihune (2006) states that the conflict between humans and wildlife can cause many damages to the well-being of humans in diversified directions. It may cost humans in losses of life to drastically change of life patterns. He revealed that carnivores predated more

domestic animals and humans. Such encounter can cause danger to human and also increase economic loss. Similarly, Madden (2008) also stated that the conflict between human and wildlife may results in negative impact on people or their resources. The major types of wildlife damage on the human being are predation of domestic animals, crop damage and sometimes killing of humans.

2.3.1. Crop raiding wildlife conflict

This is the major types of human wildlife conflict large mammals cause crop loss near protected areas among agriculturalist in many parts of Africa and Asia. The extent of damage is almost significant when it is considered at the global level as compared to the damage caused by invertebrates and rodents. However, in the area where large number of animals occurs, the whole season production may be lost in a single night (Naughton- Treves, 1997).

Wildlife damage varies considerably from site to site and farmers have unequal capacity for preventing losses. Farmers themselves are sometimes, the cause for crop loss because they continuously change the vegetation structure of the land closer to the protected areas. This changed vegetation probably become attractive to wild herbivores (Messmer, 2000). Crop raiding and hunting may be closely linked. Crop raiding can reduce farmers' tolerance towards wildlife. Despite high population density in rural areas and more rapid conversion of forest to farmland, much less is known about crop raiding in Asia and Africa (Linkei, 2007). Damiba and Abes (1993) noted that production of highly palatable and nutritious seasonal crop such as maize, which attracts primates and other wild-animal involve heavily losses and therefore high guarding investments. Farmers' loss a whole garden particularly in areas highly infested with baboons, vervet monkeys, bush pig and porcupines, which inflict heavy and potentially catastrophic losses. Nchanji (1998) reported that crop raiding is a serious problem as crop raiding animals can have a devastating impact on the standard of living of peasants whose entire survival is dependent on subsistence agriculture. He estimated that in situation where farmers guarded their crops, the loss incurred was 30% and place where there was no guarding at all, the level of crop raiding was 90%. Consequently, there was severe food shortage, high food price, malnutrition and morbidity increased besides the rural agricultural society becoming poorer and poorer. Majority of children were not going to school and in situations where farmers guarded their crops, and forced to guard crops (Chambers 1992).

2.4. Factors affecting levels of crop raiding wildlife

2.4.1. Distance from the forest boundaries

Distance of crop field boundaries from the forest and other habitats is an important factor in determining the likelihood of incursion by wild animals (Hill, 1997, 2000, Hoare, 1999, Rugunda, 2004). Conflict between wildlife and people, particularly those who share the immediate boundaries with protected areas i.e., adjacent to crop fields, are common phenomenon all over the world (Musimbi, 2013, Eniang et al., 2011). However, close proximity between farms and the forest ecosystem resulting in high level of conflict and the forest edge were most frequently raided by wild animals that distantly located once (Hill, 2000).

2.4.2 Competition for resources between people and wildlife

The continuous decline and fragmenting of ecosystem through increased human pressure by human expansion often results in problems of ecosystem conservation that are small, isolated and fenced (Bissonette and Adair, 2008). This restricts wildlife populations and can result in local over population of a particular species, amongst other problems (Van Aarde and Jackson, 2007). The continuous loss of habitat emphasizes the importance of ecosystem conservation and the understanding of how wildlife uses ecosystem (Douglas-Hamilton et al., 2005). Many studies have shown that animals adapt their ranging and foraging behavior, or their daily movement rhythms, to avoid human induced disturbance and unexplored or unknown areas (Burke et al., 2008).

Once a conservation area is expanded, the response of wildlife can give wildlife managers and conservation planners' good insight into these animals' welfare and their perception of both the existing and new area. Crop raiding is increasing and people are competing with wildlife resources. The development of small-scale farming in areas that have historically been known be prime wildlife habitats or migration corridors, in Kenya. Most natural wildlife buffer zones have led to competition for food, water, habitats, and space for both humans and wildlife hence resulting in a conflict for survival (**Kagiri, 2000**).

2. 5 Methods of safeguarding crop damage

Farmers have evolved resourceful strategies to fight back against the animals responsible for damaging their crops (Butler, 1995). The methods that are employed by an individual farmer are deeply influenced by the resources at his disposal. In developed countries, farmers have considerable levels of capital and expertise to combat crop raiding. In developing countries such as Tanzania, Kenya and Ethiopia farmers have limited income and little access to

technology. A range of methods have not been evolved in such countries, relying on simple, manpower-based techniques to tackle crop raiders (Langbauer et al., 1991).

The most common method to prevent crop raiding is to simply chase the animals away from the crops. Once animals are spotted in a farm, people will run at them, yelling, banging drums and throwing objects to chase them away. This can be effective at times, but often the animals return to crops as soon as the people disappear. With animals such as elephants, hippopotamus and warthog, this can be a hazardous method, as the culprit instead of fleeing may attack and even kill the chaser (Taylor, 1982).

An extension of the chasing method is to permanently guard the fields. Guarding is undertaken throughout the year, but often increases in the harvest season when the risk from crop raiding is at its greatest. Children and women are often given the task of guarding their family's fields (Hill, 2000). A study on Budongo Forest Reserve in Uganda showed that children and women are responsible for 30% and 34% of the guarding, respectively (Hawthorne, 1980). In some areas, farmers employ guards to protect their fields, while others use dogs to frighten and chase away crop raiders. Co-operation between farmers often means that a guard will also help protect neighboring fields. Guarding can be costly in terms of time spent. It is almost impossible for farmers to guard their fields all the time. It is inevitable that some crop raiding will still occur (Seidensticker, 1984). Several methods are used to try and prevent crop raiding by scaring animals away through the use of brightly colored objects, and loud noises (Western & Lindsay, 1984)

3. MATERIAL AND METHOD

3.1 Study Area

The study was conducted in Adola Rede district of Oromia Regional states in southern part of Ethiopia located at 475 km south of Addis Ababa. It is situated between $5^{\circ}44'10'' - 6^{\circ}12'38''$ North latitude and $38^{\circ}45' 10'' - 6^{\circ}12' 37''$ East longitude (Fig. 1). Its elevation ranges from 1500-2000 meters above sea level. The mean annual maximum and minimum temperature of the district is 23°C and 16°C , respectively. The study district has bimodal rainy seasons (Oromia Forest And Wildlife Enterprises Borena- Guji Branch 2023) .

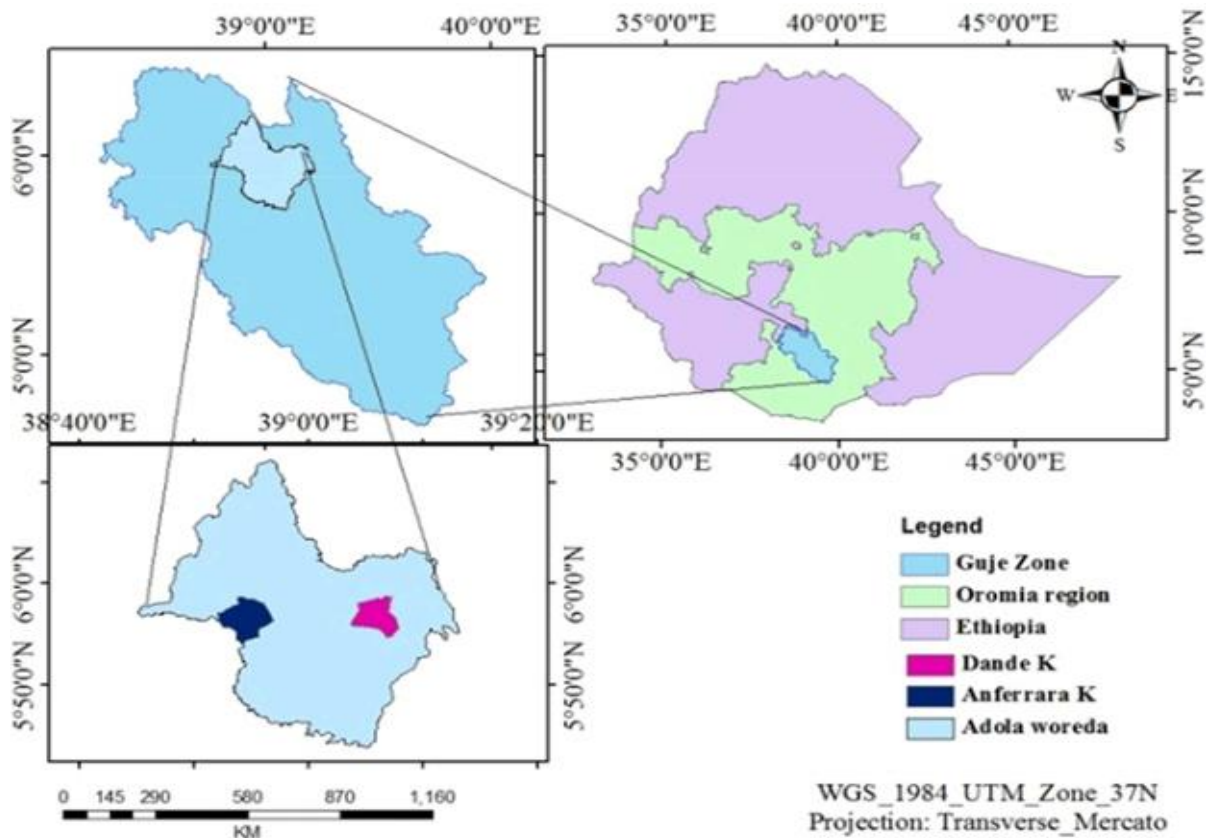


Figure 1. A map of Adola Rede district of Oromia Regional states in southern part of Ethiopia

The largest tree which is found in this forest is *podocarpus falcatus*, growing with a range of broadleaved species such as *Croton macrostachyus*, *Hagenia abyssinica*, *Ilex mitis*, *Olea capensis*, *Schefflera abyssinica* and *Syzygium guineese afromontanum* (Oromia Forest And Wildlife Enterprises Borena- Guji Branch 2023).

The forest is the habitat for different mammalian including leopard (*Panthera pardus*), spotted hyena (*Crocuta crocuta*), African wolves (*Canis lupaste*), Anubis baboon(*Papio anubis*), colobus monkey, vervet monkey (*Chlorocebus pygerythrus*), porcupine, (*Hystrix cristata*) warthog (*phacochoerus africanus*), and wild pig (*Potamocheirus larvatus*). Sometime Some wild animal migrates to Bale Mountain through Harana buluk forest into Anfarara forest which bounded to Girja. Before ten years ago there is some endemic wild animal found in this forest. However, currently those species are eliminated from the area due to deforestation and poaching (Oromia Forest And Wildlife Enterprises Borena- Guji Branch 2023).

3.2 Method

3.2.1 Preliminary survey

The preliminary survey was conducted from December 2022 to January 2023 for three days before the actual data collection. During this period field observation was made and basic information about the study area was obtained. The physical environment of the study area was observed with the support of Oromia Forest and Wildlife Enterprise Borena Guji Branch Office and local kebele leaders. The information was gathered from local people about the presence of wildlife in the Anfarara forest and conflict between human wild life conflicts around there.

3.2.2 Sampling design

The study area was purposely selected based as the area represents one of the highest cases in the human wildlife conflict. The selected kebeles were categorized in to three groups based on their proximity to ward the forest edge as near up to 3 km, 5km and 7km.

The total villages from the selected Kebeles were three and the study also covers a total of these three villages from Meleka Xibirro Kebele. Based on distance of farmland they have from forest egged households was selected from each village for formal interview.

Following this households' sample frames were established by collecting complete landholders list recorded from their respective kebele administration offices. The sample frames were all household head living in the Meleka Xibirro Kebele and finally the selections of sample household was based on farmland distance from forests to keep uniformity. Accordingly, the total numbers of household head living in this Kebele are **718** from (Meleka Xibirro Administration 2022).

After getting the total number of households living in the selected Kebele, From The target HHs a sample size of 116 (one hundred sixteen) HHs within Kebele were selected by using the formula given by Cochran,1977 cited in Bartlett et al., 2001).

$$No = \frac{Z^2 (P)(Q)}{d^2} \rightarrow n1 = \frac{no}{1 + no/N}$$

Where;

No = desired sample size (Cochran 1977) when population was >10,000

n₁ =finite population correction factor when population was <10,000

Z=Standard normal deviation which is 1.96 for 95% confidence level

P=proportion of people to be included in the sample that was 10%

Q=1-P (90%)

N = is total number of populations

d = is degree of accuracy desired (0.05)

Therefore, a total of 116 sample household heads were selected using simple random sampling techniques. Total population number of house hold in each village of Belo Aroji, Belo Qilenso and Dandalo Gorofte were 245,263 and 210 respectively. Allocations of the number of sample households to each village was proportional to the number of households living in each selected village, accordingly 39 households (hh) from Belo Aroji, 43 households (hh) from Belo Qilenso and 34 households (hh) from Dandalo Gorofte villages were selected for this study.

3.2.3. Data Collection Period

Data for this study was collected from December 2022 to January 2023. The data collection was obtained the permission from Oromia Forest and wildlife enterprise Borena Guj Branch and kebele administrative office to conduct this research.

3.2.4. Data Collection Methods

Household survey

This is a formal survey method where a semi- structured interview scheduled was employed with closed and open-ended questions. It helps to eliciting information from respondents regarding demographic data (such as age, sex, religion, marital status, family size and educational status), crops grown, damage caused to crops-; livestock, species of wild animals' responsible for damage, type of crop and livestock more affected, type of crop raiding wild animals, perceived wild animals' population trend, protection measures practiced, attitudes of local communities towards wild animals' management, and causes of

HWC. Three trained person and one researcher administered the interview. The interviews were conducted within the respondent's territory and in interviewing atmosphere by translating questionnaire to their local language.

Focus group discussion (FGD)

To complement the household surveys, basic descriptive information was collected. This technique was help to acquire useful and detailed information, which might be difficult to collect through the household survey regarding population trends, land holding and management system, population trends of top ranked damage causing wild animals and cause of HWC. Discussions were made with randomly selected 4-8 respondent in one Kebele under the guidance of a moderator. Checklists were prepared to guide topics for open-ended discussion with group of farmers.

Key informant interview

To strengthen the information collected using questionnaire and to have a detailed insight about HWC in the areas, in-depth interviews and discussion covering about cause, consequences, type, density and history of top ranked damage causing wild animals, farming system and cropping season of the study area were held

3.3. Direct Observation

3.3.1 Causes of Human- wildlife conflict

The current status of human-wildlife conflict in the study area was investigated through observations, FGD, and questionnaires following Anderson and Pariela (2005). To find out the causes that made wild animals forced to crop raiding and livestock depredation which create conflict between farmers and wild animals, variables such as nature of human habitat disturbance, distance of farmland from residence, cropping season and farm land expansion to forest area were assessed using interview as similarly used by Kivai (2010).

The presence / absence of human activities which creates forest disturbance or fragmentation were assessed. Human activities assessment included cutting of under stories, selective cutting of trees for charcoal, timber, woody, burning and complete clearing of forest mainly for expansion of cultivation. These activities were recorded using directly field observation methods.

3.3.2. Estimation of crop damage and livestock predation by wildlife

Agricultural crop losses and different livestock predation due to crop raiding wildlife and livestock predators were investigated through direct and indirect methods (Hill *et al.*, 2002). Independent assessment of the crop damage by the researcher was direct method of data collection. For direct observation on crop damage by wildlife, totally three study sites from each stratification used for formal interview were used. From each site, crop land having areas of 5,000 m² which have equal distance from forest edge were randomly selected from Belo Aroji, Belo Qilenso and Dandalo Gorofte villages. On the selected farm lands, the farmers were sowing their crop namely; bean, maize, barley and pea in the production season of 2021/2022. For each cultivated land, the type of crop grown, condition of the crop before raiding, area of being raided portion, part of the crop eaten and the type of crop species eaten were recorded three times in the day from December 2022 to January 2023 (Naught on-Treves, 1997).

Following Rugunda (2004) method, the area of the crops raided by wild animals was measured. After the yield harvested from one hectare were obtained from district Agricultural Office for each crop types, the amount of yield loss was estimated per hectare.

3.4 Method of Data Analysis

Data were analyzed using SPSS version 16.0 computer software. Accordingly, descriptive statistics in a form of percentage and frequency was used to analysis socioeconomic profile of the respondents and responses was compared using chi-square test. One-way ANOVA was used to analyze amount of crop lost, damage events registered between site and crop raiders and cause of HWC. Psion Correlation will be used to test the relation between distance of study village from edge of forest and the raiding occurrence. Chi-square test was used to analyze association of HWC, traditional methods used by the respondents.

4. RESULT

4.1 Demographic characteristics of Respondents

Among the respondents, 67 (57.8%) were males and 49 (42.2%) were females. Most 52(44.8%) of the respondents were in the age range of 36-45 followed by the age group 25-35, 46-55, above was 29 (25.0%), 21 (18.1%) and 14(12.1%) respectively. The marital status of the respondents was all are house holder. Regarding to educational background of the respondents, 66(56.9%) were uneducated and 50(43.2 %) were educated peoples (Table 1).

Table 1 Demographic characteristic of respondents

Demographic characteristics	Number of respondents	Frequency	Percentage
Sex	Male	67	57.8
	Female	49	42.2
	Total	116	100
Age	18-28	29	25.0
	29-39	52	44.8
	40-50	21	18.1
	Above 50	14	12.1
	Total	116	100
Educational background	literate	50	56.9
	illiterate	66	43.1
	Total	116	100
Marital status	Married	116	100
	Total	116	100

4.2 Economic activity and social interaction of respondents

About, 50(543.2%) of respondents reported that they have above more than nine family members whereas 44(37.9.2%) of respondents said that they have between five up to eight family and 22(18.9%) of respondents have between one up to four family members. (Table 2)

Table 2. The level farmland in the study area

Economic activity and social interaction	Number of respondents	Frequency	percentage
Family size	1-4	22	18.9
	5-8	44	37.9
	above 9	50	43.2
	Total	116	100

Farmland size	1 hectare	18	15.5
	2-4 hectare	39	33.6
	above 4 hectare	59	50.9
	Total	116	100

4.2. 1 Types of crops cultivated in the study area

Regarding to the economic activity of the household respondents, agriculture was the backbone activity that preferred in the study area. The main crop growing monthly was from April to November. Farmers in the study area were cultivating different types of crops such as, maize 48%, bean 25%, teff 18%, wheat 5%, and sorghum 4%

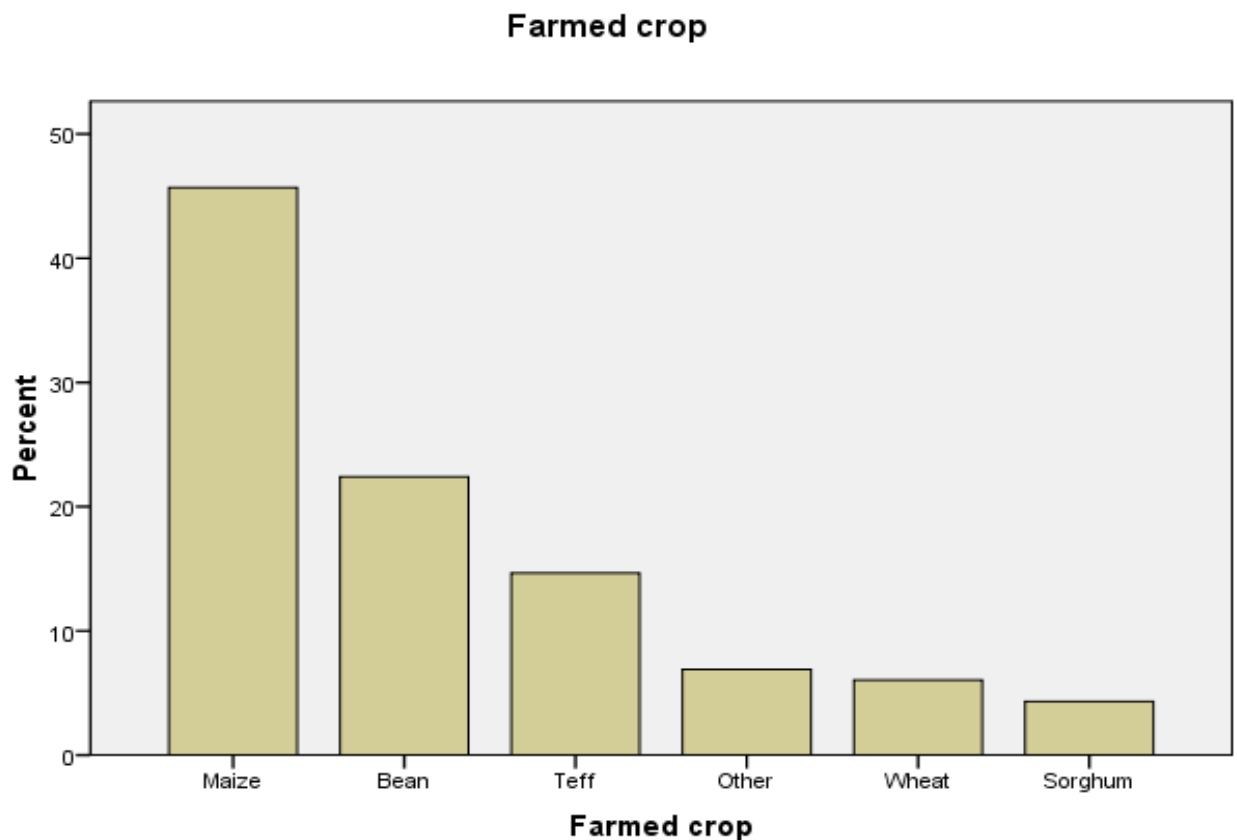


Figure 2. Different Types of crops cultivated by respondents in study area

4.3 Causes of human-wildlife conflict

The result of the study was suggested that deforestation was the main cause of the human wildlife conflict around the Anfarara forest. Another factor that causes if human wildlife conflict were expansion of agriculture land, disturbance of wildlife habitat and increments of wild animal.

Table 3. Respondents responses Cause of human wildlife conflict in the study area

Village	Number of respondents				Total
	Expansion of agriculture	Disturbance of wild habitat	Deforestation	Increment of wild animal	
Belo Qilenso	8	11	19	5	43
Belo Aroji	6	16	15	2	39
Dandalo Garofte	10	8	15	1	34
Total	24	35	49	8	116

4.3. 1 Distance from the forest boundaries

The result of this study was suggested that the distance of the farmland from the Anfarara forest was an important factor in determine extent of crop raiding and livestock damage by wild animal. Distance from the forest and trend in crop being raided and livestock predation were presented in the (Table 4). The respondents noted that, in all study villages crop raiding and domestic animal predation have been increased during the last 2022 years. A total of 90(77.58%) of the respondent had responded that the trend was increasing; (17)14.66% of the respondent had responded that the trend was decreasing, and (9)7.76% of the respondent reported that the trend of crop raiding and livestock predation were unknown. So, people who live close/near the forest generally have faced many problems than those living far from forest.

Table 4. Distance from forest and trend of the crop damage and livestock degradation by wild life last year

Village	Number of respondent	Distance from the forest(Km)	Increasing	decreasing	unknown
Belo Qilenso	13	0.5 km	13	0	0
	15	1-15 km	15		
	15	Above 2 km	14	0	0
				1	0
Belo Aroji	11	0.5 km	11	0	0
	22	1-15 km	10	12	0
	6	Above 2 km	6	0	0
Dandalo Garofte	9	0.5 km	9	0	0
	16	1-15 km	7	0	9
	9	Above 2 km	5	4	0
Total	116		90	17	9

4.3.2 Common damaged crop by wildlife around study area

The most common types of crop being raided by wildlife in the study area were maize, bean, teff and sorghum. The result showed that all crops were not equally affected by wild animal in the study area. During this study period, 59 (50.9%) of the respondent claimed that maize was the most susceptible crop to the crop raiders followed by bean 31 (26.7%), teff 17 (14.7%) and sorghum 6 (5.2%). Whereas only 3 (2.6%) respondents reported that absence of crop being raided (Table 5). Thus farmers, whose farmlands were located near to the forest boundary, were potentially at risk of losing maize year around.

Table 5. Crops raided by crop raiders around Anfarara forest

Types of crop	frequency	percentages	rank
Maize	59	50.9	1
Bean	31	26.7	2
Teff	17	14.7	3
Sorghum	6	5.2	4
Other damage	3	2.5	5
Total	116	100	

4.3.3 Major crop raiding wild animals around study area.

The respondent was perceived that 48(41.39%) of Anubis baboon, 30(25.86% of Vervet monkey, 14(12.07%) of wild pig, 13(11.2%) of warthog and 11(9.48%) of porcupine damaged crop. Farmers ranked crop raiding wildlife from one which causing most damage to one which causing least damage following in the below tables during in the study period. Anubis baboon, vervet monkey, bush pig, warthog and porcupine were taken of the first, second, third, fourth and fifth rank respectively. The most crop raiding wild animals were recorded in Belo Qilenso, Belo Aroji and Dandalo Garofte villages.

Table 6 . Crop being raided by wild animals around Anfarara forest

Wild animal	scientific name	local name	frequency	percentages	rank
Common names					
Anubis baboon	<i>Papio anubis</i>	Jaldeesa	48	41.39	1
Velvet monkey	<i>Chlorocebus pygerythr</i>	Qamalee	30	25.86	2
bush pig	<i>Potamochoerus larvatus</i>),	Booyyee	14	12.07	3
Warthog	<i>Phacochoerus africanus</i>	karkaroo	13	11.2	4
Porcupine	<i>Hystrix cristata</i>	Xaddee	11	9.48	5

4.3.4 The major livestock attacked by wild animal in the study area

The major types of livestock that were predated by wildlife were reported. A total of 31.9 % cattle followed by sheep (23.0%), goat (24.4%), horse (15.5%) and 5.2% other were predated. The most predated livestock in the three study villages were cattle followed by sheep, goat, horse and other domestic animal.

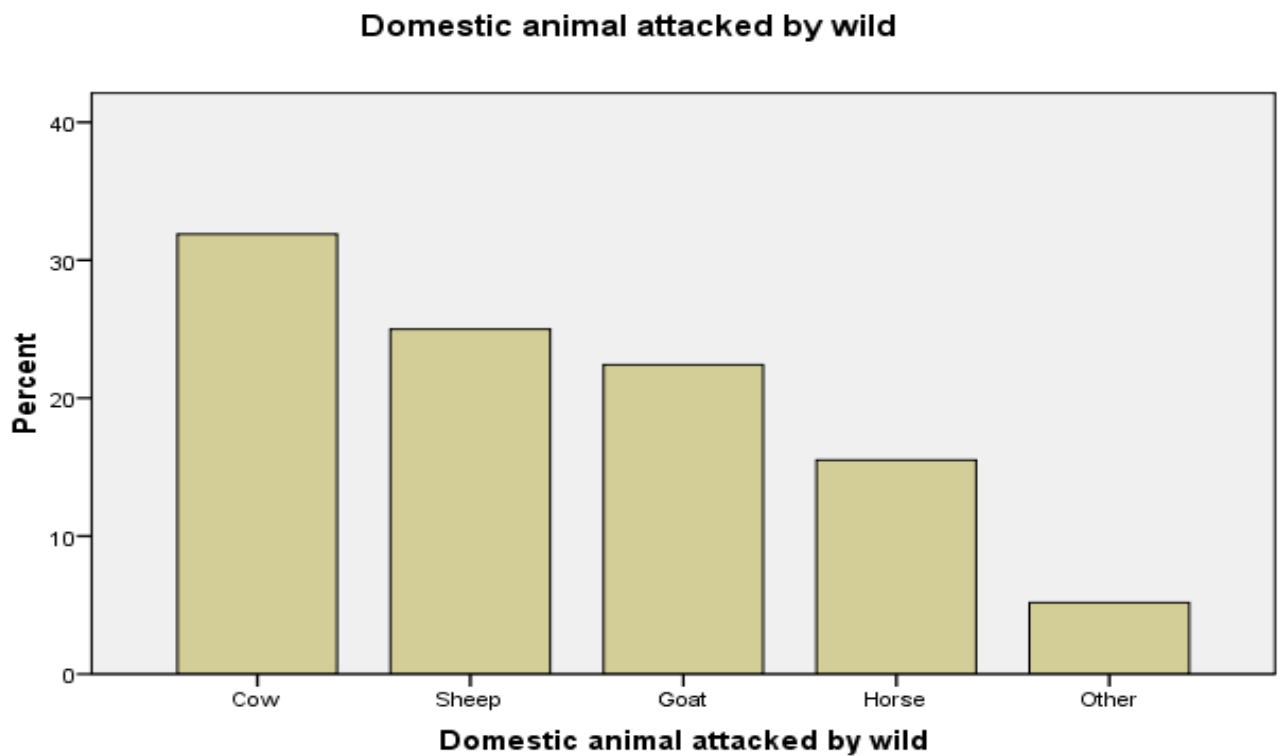


Figure 3. Proportion of livestock predated by wild around Anfarara forest for 2020_2023

The number of predated livestock cattle, goat and gorse damaged by the wildlife in Belo qilenso was higher than the other two villages. But the number of sheep predated damaged in the Belo aroji and Dandaloo garofte were the same (Table 7).

Table 7. livestock predated y wildlife

Site	Livestock predated by wild				
	Cattle	Sheep	Goat	Horse	other
Belo Qilenso	14	9	11	7	2
Belo Aroji	13	10	8	5	3
Dandaloo Garofte	10	10	7	6	1
Total	37	29	26	18	6

4.3.5 Livestock predators

In the study area, the respondents reported that the main livestock predators were spotted hyena (leopard and African wolf (*Canis luposter*)). Regarding to the percentage and frequency of livestock depredation by wildlife species were also investigated (Table 8). During the study period, the respondents reported that leopard were the major predator of livestock than the others in the three villages. Of all predation events, 50 (43.1 %) by leopard, 40 (34.5 %) by spotted hyena, 20 (17.2%) by African wolf and 6 (5.2%) by other predators (Table 8). Based on the result, in the Belo qilenso village the major predators that predated livestock were leopard and in Belo Aroji the most livestock attacker were spotted hyena. The other wildlife species were least predator of the livestock in all the three villages. The perception of the respondents toward leopard and spotted hyena was being among the most problematic wildlife due to its livestock depredation character. Both leopard and spotted hyena cause wide ranges of the human property as well as the top livestock predator wherever its ranges overlap with the livestock in the study area.

Tables 8. Types of livestock predators in and around study area

Village	Types of livestock predators				Total
	leopard <i>Panthera pardus</i>	Hyena (<i>Crocuta crocuta</i>)	African wolf (<i>Canis lupaster</i>)	Other	
Belo qilenso	21	10	10	2	43
Belo aroji	13	18	44	1	39
Dandalo garofte	16	12	6	0	34
Frequency	50	40	20	6	116
Percentage	43.1	34.5	17.2	5.2	100

4.3.6 Major wildlife damage vs season

In the study areas, the respondents reported that 42(36.2%) of wildlife caused severe damaged when there were scarce food in the forest during the dry season, 40(34.48%) was due to the scarcity of food during the wet season, 34(29.32%) of the presence of excess crop on the farm land during wet season in the study area. Thus, the season of sever caused of most crops raiding and livestock predation were during when wildlife species lack of sufficient food in the forest (Table 9). The second and third season of major damages of crops and domestic animal were during a presences of excess crop on the farm land and unfavorable of weather condition in the forest.

Table 9. The season of severe cause of crop raiding and livestock predation in and around Anfarara forest

Site	Scarce of food in the forest in dry	Scarce of food in the forest in wet	excess presence of crop on farm land in wet	total
Belo qilenso	16	14	13	
Belo aroji	15	16	8	
Dandola garofte	11	10	13	
Frequency	43	39	34	116
Percentages	36.2	34.48	29.32	100

4. 5 Methods of deterrence from crop raiding and livestock predation in and around Anfarara forest

The methods of deterring crop damage and livestock predation were also assessed (Table 10). The farmers, who are nearby to the forest, protect their crops from raiding by using different traditional methods. Permanent guarding their crops from raiding and livestock predation are taken the highest percentages 61(52.6%) followed by using guarding dog 23 (19.8%), modeling scarecrow 17 (14.7%) and smoking 15 (12.9%).

Table 10 Method of deterrent from crop raiding and livestock predation

Village	Method of safeguarding				Total
	Permanent guarding	using guarding dog	Scarecrow	Smoking	
Belo qilenso	23	9	6	5	43
Belo aroji	19	8	7	5	39
Dandola garofte	19	6	4	5	34
Frequency	61	23	17	15	116
Percentage	52.6	19.8	14.7	12.9	100

5. DISCUSSION

5.1 The major crop raid and livestock depredator of wildlife in the study

During the study period all of the respondents reported Anubis baboon, vervet monkey, bush pig, Warthog and Porcupine were the major crop raiding wild animals and cause raiding in different degree in the study area. Most samples respondent was said that Anubis baboon was the first crop raiding animals that damage the massive crop in the study area. The vervet monkey was the second ranked crop raiding animal in the study area. The bush pig , warthog and porcupine were ranked third, fourth and fifth crop raiding wildlife respectively. Similar results were revealed by Belay (2016) who reported that baboon was ranked as the top crop raiders around Gendo forest. Quirin (2005) also revealed that baboons and vervet monkeys are determined to be the most primate pests among other animals which were responsible for crop damage in Ilubabor Zone. The result also agrees with finding of Demeke Datiko and Afework Bekele (2013) who reported that Baboons are the most destructive crop raiding animals in Chebera Churchura National Park, Ethiopia, and Kate (2012) who reported that baboons were ranked as the top crop raiders in Uganda. Tweheyo (2011) also reported that baboons and bush pig were ranked as first and second. In the study area the respondent report those domestic animals were mostly depredated by leopard, spotted hyena and African wolf.

5.2 Causes of human-wildlife conflict

The main cause of human-wildlife conflict worldwide was the competition between growing human populations and wildlife species for the same declining living spaces and resource (Madden, 2008). This was also true in this study area; where most crop raiding wild animals visit agricultural land and damage crops as well as the predation of livestock cause due to decline in living space and resources (i.e. niche overlapping between human and wildlife species) in the study area. In line with this finding, humans have lived in close relationship with wildlife and have shared resources like space, habitat and food for a long time, which have stiffened to a nearly perfect competition (Knowledge Base Report, 2003). This result was also in agreement with Demeke D, Afework B.. (2013) who reported that habitat destruction and deforestation were the main causes of human-wildlife conflict in Indonesia. Priston *et al.*, (2013) reported that anthropogenic habitat alteration causes crop raiding in southeast Sulawesi, Indonesia by primates.

Crop loss and livestock depredation were the major impacts that trigger human-wildlife conflict around Anfarara protected forest. Most of the peoples live around the forest depend on agriculture and the forest holds variety of crop raiding large mammals. The result agrees

with the findings of Edward and Frank (2012), who reported that the causes of human-wildlife species conflicts were crop destruction, livestock predation, human death and injuries. In line with this finding, Boer and Baquete (1998) also proved that human wildlife conflict is more intense in developing countries, where agriculture is important components of the rural population even before two decades.

The study showed that, the majority of the farmland and/or settlements were more close to the forest, being near to the forest has its own contribution for crop damage by large mammals (Halake 2023). The result agreed with the finding of Gobosho (2015) who reported that increased habitat destruction, proximity to natural forest were the major causes of human and wildlife conflict. Furthermore, Newmark et al. (1994) reported that rural Africans generally did not want to see wildlife or have wildlife close to protected area due to crop damage and lack of benefits from the sector.

5.3 Common crops damaged in the study area

During this study maize was the most susceptible crop to crop raiders, followed by Bean, teff and sorghum. The agreed with the findings of Warren (2008), who reported that maize, bean, teff and sorghum were the most frequently damaged crop by crop raiding mammals in West Africa.

5.4 Trends of crop loss around study area

The trends of crop damage in the last years were relatively increasing in three villages (Belo qilenso, Belo aroji and Dandalo garofte). Because the villages were located near to the forest. In many parts of Africa, the conflict between local people and nonhuman primate is the most serious problem, if they are adjacent to nature reserves (Newmark et al., 1994). The same was true in the study area. This indicates that conflict between human and wildlife species

5.6 Preventing crop damage agent raiders

Farmers in the study area have developed different strategies to prevent wild animals from damaging their crops. Permanent guarding is one of the best methods many farmers use to protect crops from primates. Prevention can be done through guarding or even using a dog. (Sillero-Zubiri and Swetzer, 2001).

The second, third and fourth methods used by farmers are tracking, using guarding dogs, scarecrows and smoking, respectively. As the baboons chase Anubis, the baboons run in to the forest and often return; There vervet hides among the bushes and branches. A similar study was conducted by Ram and Kandel (2008), who reported that the most commonly used plant protection strategy in the study area, was to ensure constant vigilance in the field

throughout the growing season. The results of this study show that successful prevention requires people to stay in the field for long periods of time when crops are affected for many years. This study is similar to Kate (2012) who reported that people have other jobs such as going to school, doing house work, doing business at the local market, and working at home. Among these discoveries, it women and children who take care of crops to prevent damage from pests, primates and other animals. Similar studies were also conducted by Kate (2012) and Hill (2000) and reported that among adults in Hoima District (Uganda), at least two-thirds of crop cultivation by women and children was done by men. There are many guards, especially during the harvest season. During this time, farmers take care of their crops to their crops while driving wild animals away from their farms.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The results of the study showed that there was conflict around the Anfarara forest; this study made farmers believe that damage to crops by wild animals is a major problem for the development of farmers' agriculture. Different crops depending on investment period to avoid field and livestock damage. The main crops in the study area are corn, teff, sorghum and beans. The most affected animals are cattle, sheep, goats, horses and other domestic animals, while the most affected are wild animals. Since then, agriculture has been carried out near the forest and the original habitats of wild animals have been destroyed and destroyed. This can be verified through direct observation and interviews during data collection. The main causes of conflict are deforestation, crop damage, habitat loss, proximity to forests and inadequate protection, leading to conflicts between humans and wildlife in this study area. One way is through prevention. However, Anubis baboons are part of the wild game crop and leopards are the top predators in the study area. Human-wild life conflict has a negative impact on the Anfarara forest, non-human primates, and the livelihoods of farmers around the study area. On the other hand, farmers in the surrounding area face many problems due to human-wildlife conflict. They lost money from farming by confiscating crop and animals, preventing their children from going to school, and maintaining good relations with their neighbors because they were cared.

6.2 Recommendations

Based up on the finding of the present study, the following recommendations are made so as to mitigate the human wildlife conflict in the study area.

- The people in the study area depended on the forest for different resources such as fire wood, farmland, grazing land and fodder, such activities lead to the degradation of the natural habitat that may encourage wild animals to destroy crop. However to reduce the dependency of the local people on the forest, it is better to encourage the local people to plant trees for their different utilization and advise them to limit the number of cattle and have own grazing land.
- Most of landless youngster of the study area uses the forest as better sources of farmland. This activity is one of the causes for the distribution of the home of wildlife which push them to damage crops, so to solve this problems youngster should be given education not to be dependent on clearing forest for means of farmland, instead they should be organize with others and participate in activities like coffee plants and specie cultivation, which is dual benefits in the coming generation for youngster to engage on forest management.
- The government should encourage and organize youngsters in different organizations for creating job opportunities instead of damaging the forest for agricultural purposes.
- The government should control illegal settlements around the forest, expansion of farmland and cattle grazing in the forest.
- The government should discuss with farmers about the problem of crop damage and its solution.

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APPENDICES

APPENDIX-I

Questionnaire survey of data collection

A- Respondent's Demographic information

Respondent's demographic information for closed end questions encircles the letter of

1. Sex Male Female
2. Age _____
3. Marital status Married Unmarried
4. Educational background Educated Uneducated
5. Family size 1-4 5-8 above 9
6. Farmland size 1 hectare 2-4 hectare above 4 hectare
7. How many is the distance of your cultivation land from the forest?
 0.5 km 1-1.5 km above 2km
8. Level of property Rich Medium Poor

Information about Human wildlife conflict

9. Are there wild animals around your village? A, yes B, no
10. What type of crops you grow in your farm land 2021? Put in order to know
Which One is the most? A Maize B, Sorghum C. Teff , D Bean D,Wheat E, Other
11. Which type of crop is more attacked by wild animal? A, Maize B, Teff
C, Sorghum D, Bean , E No damage in general
12. Do wild animal cause damage to your crop? Yes/No
13. What the cause for the happening of HWC in your area?
A, crop damaging B, predation C, attacking human , all
14. What are the other causes of human wild life conflict?
A, Expansion of subsistence agriculture C, Deforestation
B, Disturbance of wild life habitat D, Increment of animal population
15. Which types of wild animal are more attackers to the domestic animal?
A, leopard B, fox C. Hyena C, other
16. Which of the following is the most domestic animal eaten by wild animal?

A, cow B. sheep C, Goat D, horse E, Other

17. Which types of wild animal mostly attack the crop? A. Anubis baboon
B. Vervet monkey C. wild pig D. porcupine E. Warthog F. Other

18. In what location of the crops damaged more by primate pest?

A. forest zone B. forest center C. other

Annual Crop Yield and domestic animal Damaged by wild animal and Its Severity

19. How many % of your annual crop yield was damaged by wild animal?

A.1-10% B. 11-20% C. 21-30% D. 31-40% E. 41-50% F. more than51%

20. How many % of your annual domestic animal was damaged by wild animal?

A.1-5% B.6-10% C.11-15% D.16-20% E. more than 21%

21. Which of the following ideas can be the reason why it is sever in specific season?

A. scarce of food in the forest C. unfavorable of the weather condition
B. the presence of excess crops on the farmland D. attractiveness of farm crops

Guarding Methods of Crop and domestic animal from wild animal

21. What is the method of guarding crop and domestic animal from wild animal?

A. Permanent guarding B. Chasing by dog C. Scarecrow D. Smoking

DATA COLLECTION SHEET FOR DIRECT OBSERVATION OF CROP AND DOMESTIC ANIMAL DAMAGE BY WILD LIFE.

Name of data collector _____

Place_____

Time of observation _____

Season _____

Distance of the field from the forest boundary _____

Species observed, type of crop and domestic damaged

Method used to control wildlife.

- Boqqoolloo Baqeela Garbuu Qamadii Ataraa
 Kan biroo

11. Bineensoonni irraa caalatti midhaan nyaatan eenyun fa'ii?

- Qamalee Jaldeessa Booyyee Weenni
 Xaaddee Karkarroo Kan biro

12. Bineensoonni irraa caalatti beladoota nyaataan isaan kam ?

- Qeerraansa Jeedala Worabeessa Kan biro

13. Beladoonni bineensoota nyaataman eenyu fa'ii?

- Saawwan Holoota Re'oota Fardeen

14. Bineensoonni bosonaa ni ajjeefamu

- Eyyeen Lakkii

15. Maloonni aadaa ittin miidha bineensoota ittisan maaliidha ?

- Eegduu Dallaa Aarsuu Fakki fakkeessan dhaabu



Picture 1. Species Of Anubis Monkey In The Study Area





Picture 2. Anfarara Forest



Picture 3. Maize Damaged Anubis Monkey