Jimma University

College of Natural Science

School of Graduate Studies

Department of Biology

Human-wildlife conflict in and around Yayu Biosphere Reserve, Southwest Ethiopia

By

Ewunet Ayana

Thesis submitted to the Department of Biology, College of Natural Sciences and School of Graduate Studies, Jimma University in partial fulfillment for the requirement of Master's degree of Science in Biology (Ecological & System Zoology)

October, 2014

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Advisor: Tsegaye Gadisa (PhD,Assist.professor)

Co-advisor: Tariku Mekonnen (PhD candidate)

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Dedication

This work is dedicated to my father Ayana Zewudie and my mother Bekelech Mekonnen.

DECLARATION

I hereby declare that the thesis entitled is my own original work. It has been done under the supervision of my thesis advisors. It has not been presented in any universities or institutions or colleges to obtain any academic awards. All the sources of materials used for this study have been duly acknowledged.

Name Ewunet Ayana

Signature ----------

Date ----------

Acknowledgement

I would like to express my deepest gratitude to my advisors, Dr. Tsegaye Gadisa and Mr. Tariku Mekonnin for their constructive criticism, guidance, invaluable advice, and helpful comments during the whole study period. Without their advices the accomplishment of thesis work would have been impossible.

I would like to express my deepest gratitude to my instructors and all members of Biology Department for their kind cooperation and assistance throughout my stay at the campus. I also thank the National Meteorological Agency, Jimma Branch for providing rainfall data of the study area. I would like to thank Yayu Woreda Administration, especially AtoKedirLubango for facilitating all things. And also I would like to express my appreciation for Dr. TadeseWoldemariam, Ethiopian Coffee Forest Forum for supporting me financially.

I would like to thank my assistant's and local guide, AtoTerarawKebede, AtoTeklehaimanotWeldegiorgis, AtoTakeleAlebachew and AtoLetaGobosho for their eagerness to help me.

My sincere gratitude to my father Ayana Zewudie,my mother Bekelech Mekonnin,my sister MisirachuAyana,my brothers Gelan Ayana and Segni Ayana and also to AddisuMesele whose words of encouragement,affection and prayer served me as a source of strength and inspiration through my study.

I would like to thank all my friends especially, SimagegnewMelaku, AlemnehAmare, John steelman, YibekalAsfaw and Kedir Kemal for their help, encouragement and support during the field work.

Last but not least, I would like to express my gratitude to all people who have helped in any way to make this thesis possible.

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ACRONYMS

EWCA	Ethiopian Wildlife Conservation Authority
FAO	Food and Agriculture Organization Environmental protection
FGD	Focus Group Discussion
GPS	Global positioning System
HWC	Human- Wildlife Conflict
NMSA	National Meteorological Service Agency
SPSS	Statistical Package for Social Sciences
UNEP	United Nations Environmental Program
YBR	Yayu Biosphere Reserve
a.s.l	Above Sea Level

Abstract

Human-wildlife conflict exists in different forms all over the world and experienced more in developing countries. Presently in Southwestern Ethiopia wild animals compete for resource with human being and in conflict with each other. This study on human-wildlife conflict was conducted in Yayu Biosphere Reserve, in Yayu Woreda, Ilubabor zone, Oromia National Regional State, Southwestern Ethiopia. The study was carried out from September 2013 to June 2014.Data were collected using semi-structured questionnaire, FGD and direct observation. Five wild animal species were identified, namely grivet monkey (Cercopithecusaethiops),anubis baboon(Papioanubis), bush pig(Potamochoeruslarvatus),colobus monkey (Colobus guereza) and blue monkey (Cercopithecusmitisboutourlinii).Among these wild animals, grivet monkey, anubis baboon and bush pig were the top ranked crop raiding wild animals respectively. Mean total count of wild animals in the selected study sites was 71.00±4.24 and 81.00±8.48 for grivet monkey, 61.00±4.24 and 60.50±4.94 for anubis baboon, 46.50±4.94 and 44.50±4.94 for bush pig in Hamuma and Bondewomegela site respectively. From the total planted maize crop, 12,240 (47.9%) was damaged. More damage occurred during the wet season than dry season. Large number of crops was damaged by wild animals during flowering and ripening stages. The respondents reported that, 97.4% cause of human-wildlife conflict was crop raiding. About 88.8% of the respondents in the study area explained that they use firewood and fodder wood for house construction together and 5.1% for firewood. The result showed that, 99% of the respondents reported increasing tendency of crop damage by wild animals. Respondents used guarding, chasing, fencing and scarecrow to defend crop raiding. There was strong conflict between wild animals and the surrounding people in the area. Therefore, possible solutions such asfarmers need to identify thecrops that are not mostly preferred to the pest wild animals should be met to alleviate the problem.

Key word: Crop damage, Human wildlife conflict, Yayu Woreda

1.INTRODUCTION

1.1.. Background

Ethiopia is one of the most physically and biologically diverse countries of the world, with a land area of 1,023,050 km^2. Ethiopia's diverse topography allows for an extensive range of ecological zones, from moist alpine highlands to hot, arid lowlands. The wide range of ecological zones support diverse wildlife habitats ranging from alpine moorlands to arid lowland savannas and arid lands, and extensive wetlands (Yalden, 1983;Leykun Abune,2000). Ethiopian highlands support many endemic plant and animal species, though with lower species diversity than lowland habitats. The presence of diverse wildlife and large numbers of endemic species in Ethiopia is due to the country's topographical variation. This variation helped to create isolated and varied ecological environments. The biological resources are distributed in different biomes, mainly the Afro Tropical Highlands, the Sudan-Guinean highland, the Sahel-Transitional Zone and the Somali-Masai Biome (Yalden*et al*., 1996). Diverse topography and regional weather patterns influence a diverse range of climates across Ethiopia; thus species have evolved and diversified correspondingly. Research has found that 31 mammals,17 birds,14 reptiles,30 amphibians, 7 arthropods,40 fishes and 12 percent of approximately seven thousand, roughly 840, plant species are endemic to Ethiopia.

Biodiversity in Ethiopia is not distributed evenly. For millennia, ecosystems of Ethiopia have been altered by human and environmental factors. Humans have converted most of the highlands and some of the lowlands into agricultural and pastoral lands by clearing vegetation and utilizing it for fuel and construction. As a result, wildlife habitat is now largely restricted to protected areas. National preserves include 21 national parks, 3 wildlife sanctuaries, 7 wildlife reserves, 3 community conservation areas and 18 controlled hunting areas (EWCA, 2013).

The trend in biodiversity conservation in Ethiopia is in decline as a result of multiple threats. The major threats to biodiversity conservation are unsustainable utilization of natural resources (over-exploitation), deforestation, conversion of natural vegetation to

farmland, forest fires, land degradation, habitat loss and fragmentation, extensive replacement of local crop varieties for improved stock, invasive species, illegal trafficking of domestic and wild animals, poaching, wetland destruction, climate change and human-wildlife conflict. Of these, expansion of subsistence agriculture, overgrazing, habitat fragmentation, wildlife disease and human–wildlife conflict are the major threats (Engidasew, 2010).

Human wildlife conflict (HWC) is a significant and critical threat to conservation across the world (Nyhus*et al.*, 2005). According to Eltringham (1979), HWCs have existed from the beginning of the human era. Conflict with wild animals and the environment caused human to seek shelter in caves for protection, hence the term "cave man". Slowly, humans progressed technologically harnessing fire and developing tools and weapons that allowed them to conquer their environment.

According to the World Conservation Union, HWC occurs when human populations overlap with wildlife requirements resulting in costs to both native residents and wildlife (Distefano,2004). Changes in agricultural techniques (such as the preference for monocultures, reduction of crop rotation and intensification of cropping) and an expansion of global trade in food and plant products have dramatically increased the impact of pests (Yudelman*et al.*, 1998). Various studies indicated that worldwide crop loss from pests ranges from 35% to 42% (Food and Agricultural Organization of the United Nations (FAO); 1975, Pimentel, 1992; Oerke*et al*., 1996; Yudelman*et al*., 1998). HWC is greater in tropical areas and developing nations in which livestock and agricultural land are an integral part of people's lives and income (Distefano, 2004).

1.2. Statement of the Problem

Human wildlife conflict is not restricted to a particular geographical region or climate, but is common to all areas where wildlife and human populations coexist and share limited resources (Brown and Jonker,2008). Because the human population continues to expand, there is an increasing demand for agricultural land and natural resources, which will lead to an increase in human-wildlife conflict.

According to Yayu Woreda Agricultural Office the major problem of HWC in the area was crop raiding by wild animals. The local people living in and around Yayu Biosphere Reserve area are facing to produce agricultural crops as a result of crop raiding by wild animals.Maize was the main crop cultivated in the area and highly damaged by anubis baboon, grivet monkey and bush pig. Moreover, the local communities destroy the forests for the purpose of timber production, construction and burnt by honey hunter. This leads to accelerated the habitat loss and wildlife depletion. Yayu Biosphere Reserve was recently established in Southwestern Ethiopia, Oromia National Regional State. To date, no systematic study has been undertaken on HWC in Yayu Biosphere Reserve. This study seeks to provide baseline information on HWC in and around Yayu Biosphere Reserve.

Questions intended to be answered by this study were:-

- What are the causes of HWC?
- What HWC prevention techniques are communities currently using, and which is the most effective?
- What is the extent of agricultural crop loss from wildlife?
- What are the populations of crop raiders' wildlife that visit crop field in different season?
- Which wildlife species contribute most to crop loss?

1.3. Objectives

1.3.1. General Objective

- To assess the causes and consequences of HWC in and around Yayu Biosphere Reserve.

1.3.2. Specific Objectives

- To identify major crop raiding wild animals and methods the local people use to protect their crops from crop raiders
- To identify the benefits of wild animals to the local community
- To determine the causes of HWC in and around Yayu Biosphere Reserve
- To estimate the amount of crop damage by wild animals

2. Literature review

2.1. Human-wildlife conflict

HWC has existed for as long as humans and wild animals have shared the same landscapes and resources. HWC, or negative interaction between people and wildlife, has recently become one of the fundamental aspects of wildlife management, as it represents the most widespread and complex challenge currently faced by conservationists around the world. It arises mainly because of the loss, degradation and fragmentation of habitats through human activities, such as logging, animal husbandry, agricultural expansion and development projects (Fernando *et al*., 2005). As habitat is fragmented, the length of edge for the interface between humans and wildlife increased, while the animal populations become compressed and separated in insular refuges. Consequently, it leads to greater contact and conflict with humans as wild animals seek to fulfill their nutritional, ecological and behavioral needs (Madden,2008; Lamarque*et al*., 2009).

HWC is increasing across Africa (Madden, 2004). As human populations and demand for land increase across the continent, HWC will continue to increase (Browne and Jonker, 2008). HWC occurs when wildlife requirements overlap with those of human populations, creating costs both to people and wildlife. It is a serious obstacle to wildlife conservation worldwide and is becoming more prevalent as human populations increase, development expands, the global climate changes and other human and environmental factors put people and wildlife in greater direct competition for a shrinking resource base.

Human wildlife conflict has been the cause of serious damage to both humans and wild animals for years (Raini, 2009). It occurs as a result of occurrence of both parties in close proximity. The conflict usually starts when wild animals consume resources claimed for human consumption: crops by herbivores and livestock by carnivores (Kissui, 2008). Large wild animals like elephants, rhinos, and hippos can cause structural damage to fences, electric posts and water pipes as they raid within settlement areas. Large animals may also cause significant damage to crops by tramping (Dudley *et al*., 2008).

Generally, a wide range of species, the principal culprits being insects, such as locusts and caterpillars, birds, such as seed-eaters and fruit-eaters, primates, such as baboons and vervet monkeys, rodents, such as rats, mice, springhares and porcupines, ungulates, such as antelope, bush pig, elephant, hippo, buffalo and zebra, large carnivores, such as lions, leopards, hyenas, wild dogs and wolves, small carnivores, like genets, servals and mongooses, are responsible for damage to human settlement, and thus conflict (Hill, 2000; O'Connell-Rodwell*et al*., 2000).HWC also occurs when human activities encroach into wildlife habitats, particularly grazing and settlement expansion. (Siex and Strhsaker, 1999; Michalski*et al*.,2006).

Proximity of wild animal populations to subsistence farming communities has long been recognized as a focal point for HWC around the world, with primates, ungulates, and elephants presenting problems for small-scale farmers across Africa (Madhusudan, 2003).At the same time, proximity to conservation areas can result in farm losses through livestock predation (Wang and Macdonald, 2006). These situations have become more common in the last decade as designations of conservation areas has increased, with new reserves typically being smaller, more fragmented, and closer to historic human populations (Treves and Karanth, 2003). Although the costs of HWC to people are clear, their differential effect on large and small landholders and households adjacent to reserves or protected areas is not fully known (Chhangani*et al*., 2008). More generally, the relationship between raiding by specific wildlife species and the relative success or failure of conservation missions for specific species remains understudied. Although it is possible to anticipate that the most marginal households and communities are victims of HWC, it may be the case that larger landholders and those who benefit themselves of forest resources are more vulnerable. In a broad sense, primary causes of HWC are demographic, economic, institutional and technological in nature (UNEP, 1995).

2.2.Human-herbivore conflict

Human-herbivore conflict is one of a major type of HWC. Humans and wildlife have been in conflict because agricultural crops generally offer a rich food source for people as well as wildlife. Large wild herbivores compete for pasture resources with livestock and can act as reservoirs of livestock diseases. As a result, humans have extirpated many native animal species from agricultural areas, either directly or indirectly through modifications in habitat availability or structure resulting from land use changes. As human populations have expanded in developing countries they have caused loss in biodiversity and species extinctions (Gordon, 2009).

Wild animal damage to agricultural crops is a serious concern affecting much of the world today (Singleton *et al*., 2005).The encroachment of wild habitats by subsistence farmers in Africa, as a result of increasing populations, is on the rise and this calls for concern. Crop raiding by wild animals is one of the major causes of HWC. According to Kimega (2003), in Kenya, food items such as maize, cassava, beans, potatoes, and fruit trees are targets for hungry wildlife such as elephants, baboons, zebra, buffalo and Bush pigs. Among common agricultural pests (primates, rodents, birds and insects), damage caused by elephants is often the most destructive (Hoare, 2000). This is because elephant raids are unpredictable and can cause more damage per raid than smaller wildlife. Almost all countries in Africa, including Ethiopia, reported problems with elephant crop raiding (YirmedDemeke, 1997).Crop damage affected farmers directly through loss of their primary food and cash resources and indirectly through a variety of social costs such as costs for education and health care. Due to these losses, rural people express their fear or even interfere with development projects that deal with wildlife conservation (Hill, 2000). Generally, it is difficult to alleviate the conflict between herbivores and humans, but it is possible to minimize the effects using different conservation measures.

2.3.Human - carnivore conflict

Species within the mammalian order Carnivora number around 226, almost all of which are predators (Treves and Karanths, 2003);and are declining in population worldwide, largely due to conflict with humans (Rodriguez, 2008). As a group, carnivores exert a profound influence on biological communities via predation and interspecies competition (Treves and Karanths, 2003). Human - carnivore conflicts pose an urgent challenge worldwide because these conflicts often pit human communities against carnivores, and human communities against conservationists who seek to preserve or restore wildlife populations (Bangs et al., 1998; Torres *et al*., 1996). Human - carnivore conflicts arise for several reasons (Michalski*et al*., 2006). Carnivores require a protein - rich diet, they often have large home ranges that draw them into recurrent competition with humans, most carnivores inhabit areas close to human habitations and many large carnivore species are specialized for ungulate predation (Polisar, 2000). Due to their large home ranges and diverse habitats, conservation of large carnivores is a challenging practice (Mech, 1995).

Conflict with humans is a major issue in large carnivore conservation (Jackson and Nowell, 1996). Conflict can have multiple implications ranging from fear evoked by the presence of the carnivore to fatal attacks on humans (Loe and Roskaft, 2004). Such conflict is seen with tigers in Indonesia and India (Nyhus and Tilson, 2004) and with lions in Africa and India (Patterson et al., 2004; Saberwal*et al*., 1994). Even in the absence of human attacks, livestock depredation by carnivores can slow down the livelihoods of people and affect their economic condition (Ogada*et al*., 2003). Human–carnivore conflict in terms of livestock depredation is perhaps more common and is seen in several reported cases across the world like pumas and jaguars in Brazil (Zimmermann *et al*., 2005), wolves and bears in North America and Europe (Jackson and Nowell, 1996; Kaczensky, 1999), lynx in Norway (Odden*et al*., 2002), lions, wild dogs and leopards in Africa (Patterson et al., 2004; Romanach*et al*., 2007), and leopards and tigers in Asia (Wang and Macdonald, 2006).

2.4. Human - primate conflict

Primates are one of the most frequently cited crop pests (Naughton-Treves, 1998; Hill, 2000), so primates and humans are often in potential conflict. The genera *Macaca, Papio* and *Cercopithicus* particularly baboons and vervet monkeys are one of the most serious crop raiders because of their high level of intelligence, adaptability, wide dietary range, complex social organization, aggression, etc (Sillero-Zubiri and Switzer, 2001). In most primate range countries, the major threats to populations are due to the extensive conversion of primate habitat into areas for human use as agriculture, forestry and plantations, trapping for biomedical trade, the effects of the bush meat trade and disease (Walsh *et al*., 2003).

According to Else (1991), the significant problem related to primates that are provisioned by people, when people seek contact with monkeys. The monkeys develop a taste for human foods, lose their fear of humans and then become proactive and aggressive in seeking human foods. This conflict is particularly interesting in that it arises from a positive desire to contact monkeys and then people discover that the contact poses risks from bites, theft of non-provisioned food or more general health issues such as exposure to *simian* viruses. In contrast to situations of direct conflict over goods, which produce negative perceptions of primates, here positive attitudes are responsible for the creation of a pest primate problem. Inadvertent opportunities for kitchen theft, garbage raiding, or from intentional human provisioning may result in population increases, exacerbating the existing problems; monkeys are then at risk of culling or complete removal (Fa and Lind, 1996).

A more general conservation issue for primate populations relates to the potential for indirect conflict between primates and livestock that forage on similar resources. Where people increase stocking rates in relation to natural vegetation availability, to enhance returns of meat, milk and other animal products, primates may be squeezed out or suffer reduced reproductive rates. While the human herders may not have a perception of monkeys as pests, the indirect competition can drive monkeys into habitats, such as forest plantations (Ciani*et al.,* 2001), where they cause significant damage and become pests.

2.5.Human impact on wildlife

Humans obtain many goods and services from nature to sustain their demand for food, water, fuel, construction, medicine, fiber and other needed materials. Development, including construction of roads, dams and utilities facilitate human activities and therefore advance human communities. However, development activities may weaken long-term sustainable development by propagating unintended environmental impacts. Development activities intended for simple industrial purposes often result in uncontrolled secondary human migration, illegal logging, hunting and various resource extraction activities (Anonymous, 2001). For example, various dams built to supply water for irrigation and hydroelectric power generation result in decreased downstream water supply, methane emission from some reservoirs, and draining of wetlands, which has enormous impacts on biodiversity and migratory species. The greatest human vulnerability to environmental degradation is related to effects on water resources, human health and agricultural productivity. Water pollution mostly occurs in industrialized countries, which also disproportionately consume large amounts of energy, contributing to global climate change. Human activities have many negative implications for wildlife, such as behavior modification and species distribution. The disruption of behavioral patterns can affect wildlife social structures, which are a key component for adaptation and evolution of species. This disruption by human disturbance can have a considerable effect on wildlife population performance even if the disturbance does not directly affect survival and reproduction (Manor and Saltz, 2003). Unintended consequences of human activities like noise, disruption of the physical environment, alteration of the chemical environment and introduction of exotic species, are responsible for disturbing the regularity of wildlife. The ecological impacts of habitat loss and redistribution of animals away from development areas may affect the foraging success or survival in areas beyond the initial zone of disturbance. This may result in overgrazing, erosion, changes in predation pressure and breeding (Sillero-Zubiri and Switzer, 2001).

Increasing human population and the associated impacts, such as habitat loss and hunting, are the underlying factors for the decline of mammalian species. These impacts threaten mammalian species and their effects on populations vary across the earth. Species that

inhabit more heavily impacted regions are expected to have a higher risk of extinction (Cardillo*et al*., 2004).

Illegal or traditional exploitation of wildlife within conservation areas for both subsistence and economic gain is common. For example, as reported by Leader-Williams et al. (1990), the decline of black rhinos (*Dicerosbicornis*) (Gray, 1821) and elephants (*Loxodontaafricana*) (Gray, 1821) in many countries within Africa is due to overexploitation. In Africa, the trend in core, protected areas like national parks is for populations to become ecologically isolated as adjacent human settlements increase. Through time, wildlife is lost from adjacent settlement areas and populations with in core areas are threatened by loss of biodiversity and local species extinction. Increasingly human dominated landscapes will restrict larger mammals to parks and reserves (Hackel, 1999). Human activities, both directly or indirectly, influence the survival of wildlife and therefore have the responsibility to recognize and reduce future anthropogenic extinctions.

2.6. Public attitude towards wildlife

Attitude can be defined as a predisposition to act in a favorable or unfavorable fashion towards some object. It is considered a precursor and an important predictor of willingness to act. For instance, a study on grey wolf restoration in Yellowstone National Park showed that positive attitudes towards grey wolves increased with distance from the wolves' home range (Bath and Buchanon, 1989). These days, the conflict between local residents and wildlife is seen as a major conservation issue (Newmark*et al*., 1993). The conservation attitude of communities living adjacent to protected areas is highly influenced by the problems associated with wildlife. Communities adjacent to protected areas that are unable to control the losses caused by wildlife are likely to develop negative attitude towards wildlife (Newmark*et al*., 1993, 1994).This is especially true in communities dominated by subsistence economies. Even small losses can generate strong negative attitudes towards wildlife (Oli*et al*., 1994). As reported by Newmark*et al*. (1994), in Tanzania, conservation attitude of communities living adjacent to protected area is strongly influenced by problems with wildlife. On the other hand, communities

that benefit from natural resources are likely to support wildlife conservation efforts and protected areas (ZelealemTefera, 2001).

Human attitudes and values concerning wildlife vary both within and among different sectors of the society. The views of rural residents about wildlife may not differ from urban residents except that they personally experience more of the benefits and/or problems caused by wildlife. However, farmers are one group whose attitudes about wildlife continue to differ from other stakeholders. They continue to view wildlife in terms of its importance and tend to be more concerned about how wildlife affects them economically (Messmer, 2000). Whatever the case, public understanding of the general environment and population related issues is critical for successful conservation efforts. For this, the perception natural resources and the interactions of local communities with their environment should continue to be studied.

3. Study area and methods

3.1.Description of the study area

3.1.1. Location

This study was conducted in Yayu Biosphere Reserve, which is located in Ilubabor Zone of Oromia National Regional State, 550 km southwest of Addis Ababa. Yayu Biosphere Reserve covers parts of the Yayu Forest along Geba and Saki rivers and an agricultural matrix adjacent to the forest area around Yayu Town (Figure1). The forest covers an area of approximately 167 km^2. Several forest blocks within the whole range have been designated as National Forest Protected Area (GebrecherkosWoldegeorgis, 2010). According to TadesseWoldemariam (2003), the study area is characterized by rolling topography; is highly dissected by small streams, gorges, and the Geba, Dogi and Saki Rivers. Yayu Biosphere Reserve is located between 8°21'S-8°26' N and 35°45'- 36°03' E. Yayu district has an elevational range of 1,200 m a.s.l.in lower river valleys to 2,000 m a.s.l. ridge tops.

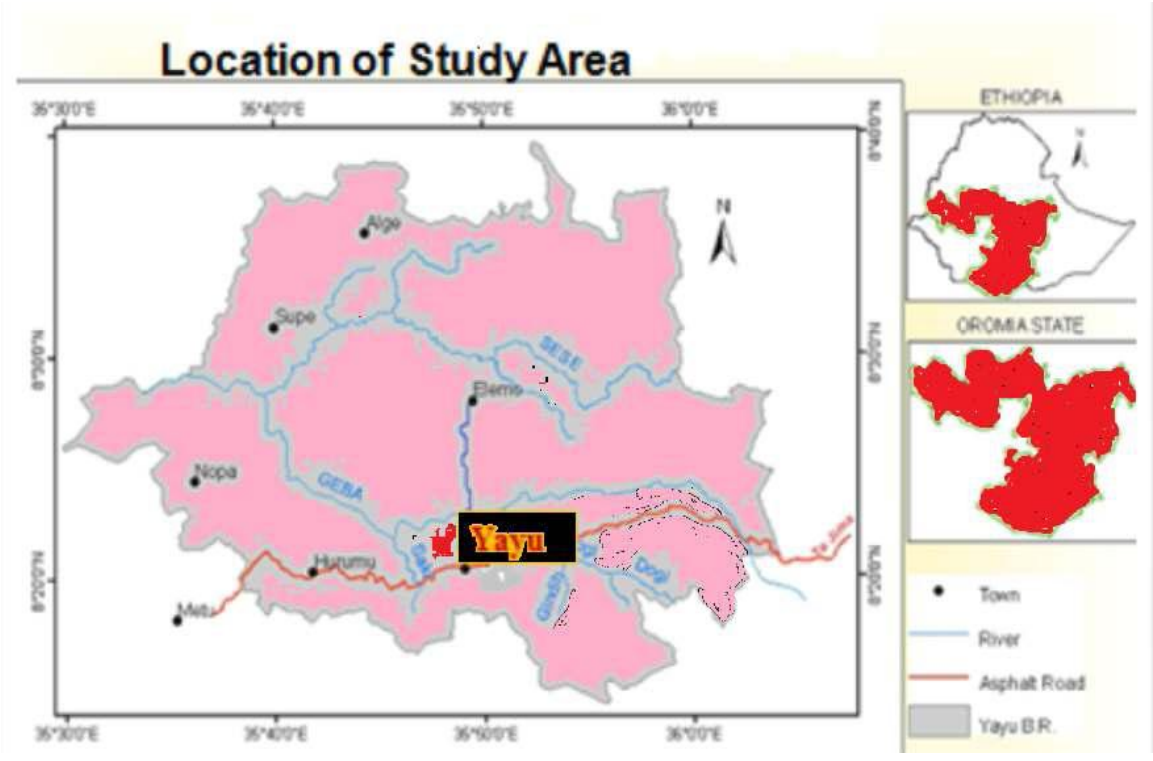

Figure 1 . Map of the study area(GebrecherkosWoldegiorgis, 2010)

3.1.2. Climate

According to the six years rainfall and temperature data obtained from the Ethiopian Meteorological Service Agency of Jimma branch Yayu Station, YBR is hot and humid. The mean minimum annual temperature is 14.13^{o}C, while the mean maximum annual temperature is 29.07^{o}C (Figure.2).Mean annual rainfall within the district is 1,563 mm/year, though there is high variation from year to year. The rainfall pattern is uni-modal, with low rainfall during January and February and the highest rainfall between June and August (Figure 3).

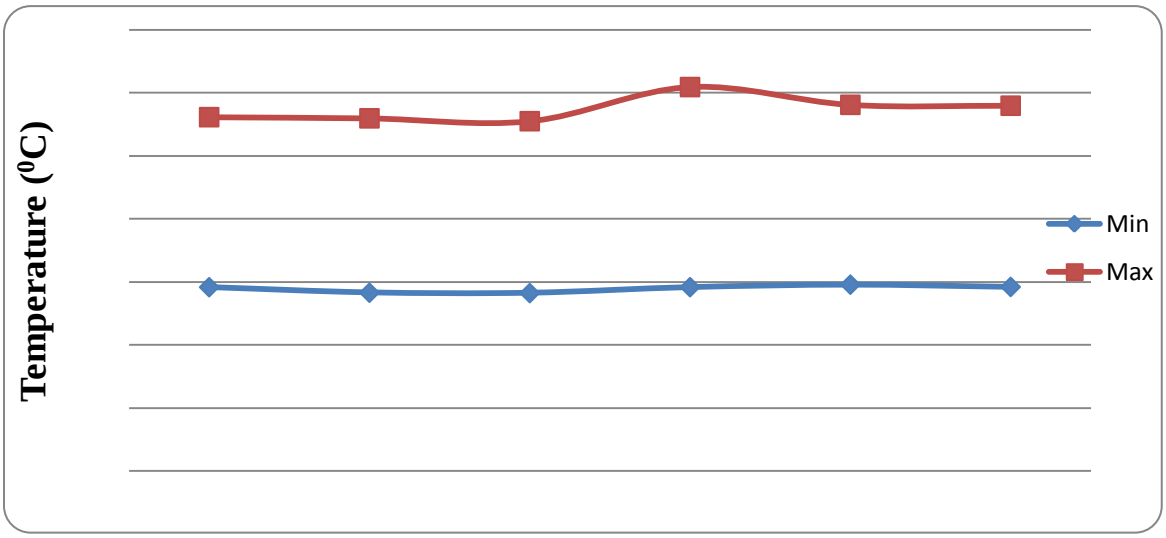

Figure 2.Mean annual minimum and maximum temperatures in Yayu,2006-2011 (National Meteorological Agency, Jimma Branch, 2013).

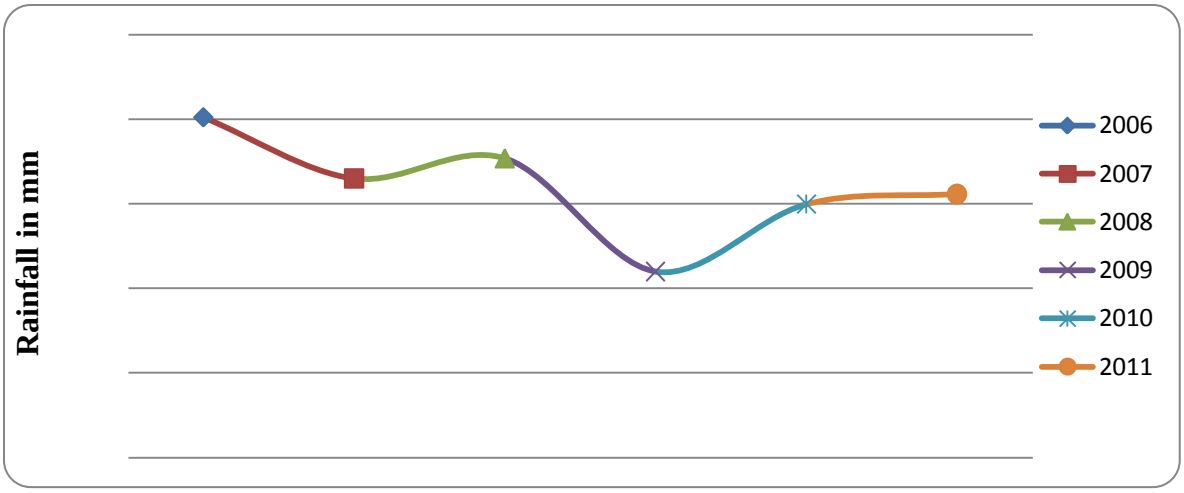

Figure 3. Mean annual rainfall in Yayu, 2006-2011 (National Meteorological Agency, Jimma Branch, 2013).

3.1.3. Forest type

Two major forest types are found with in Yayu district, namely, transitional rainforest and afromontane rainforest (Friis, 1992). *Ficus spp.*, C*offee arabica*, *Croton macrostachyus* and *Schefflera**abyssinica*are among the dominant tree species found within the study area. De Brazza's,colobus and vervet monkys, as well as African buffalo, bushbucks, warthogs, African civets, bats, thick-billed ravens, white necked ravens, African black Crows, fork-tailed drongos, glossy ibis, and many varieties of snakes, frogs, and aquatic and terrestrial insects are common in the study area (GebrecherkosWoldegeorgis, 2010).

Figure 4**.** Partial photograph of Yayu Biosphere Reserve

3.2.Methods

3.2.1. Site selection and sampling design

The study area was purposively selected as the area represents one of the highest case scenarios in HWC. Out of 20 Kebeles found in Yayu Woreda, two Kebeles namely Hamuma and Bondewomegela were selected by purposive sampling for this study. This is based on the severity of the HWC.

3.2.2. Sample size determination

After obtaining the total number of household heads living in each selected kebeles, the total sample size of the household was determined using the probability proportional to size-sampling technique (Cochran, 1977 cited in Bartlett *et al.*, 2001).

$$no = \frac{Z^2 * (P)(q)}{d^2} \quad n_1 = \frac{no}{(1 + no/N)}$$

Where:

$\mathbf{n_{0=}}$ desired sample size Cochran's (1977) when a population is greater than 10,000

$\mathbf{n_1}$= finite population correction factors (Cochran's formula, 1977) for a population less than 10,000

Z = standard normal deviation (1.96 for 95% confidence level)

P = 0.5 (proportion of population to be included in sample i.e. 10%)

q = 1-P i.e. (0.5)

N = total number of population (750)

d = degree of accuracy desired (0.06)

Based on Cochran (1977) population correction factors, a total of 196 sample household heads were selected using simple random sampling techniques from the total population of 750. The numbers of sample households within each kebeles were proportional to the number of household heads living in each sampled kebele.128 households from BondewoMagelakebele and 68 households from Hamumakebele were randomly selected for the study.

3.3. Data collection methods

Data was collected from September, 2013, to June, 2014.Three complementary data collection methods, namely household survey (questionnaire), focus group discussions, and physical observation were used. Direct observation was used to obtain data on number (frequency) of coming wild animals to farmlands and estimating crop loss by crop raider and the top ranked damage causing wild animals.

Questionnaires were distributed to selected households with in Yayu Woreda. This formal survey method employed a semi-structured interview composed of closed and open-ended questions. These household surveys involved were delivered and proctored by two native speakers. Proctors were provided training on how to fill out forms and how to approach sensitive questions of illegal hunting and encroachment in and around the biosphere reserve. To gain people's confidence, every household was visited prior to the interview and the purpose of the study was clearly presented. The questionnaires were administered to members of the household in a random manner based on a first come first serve basis. Each respondent was at least 18 years of age, and care was given to alternate male and female respondents.

Questions were included in the study to examine the conflict between local people and wildlife in the area. The questions were intended to gather demographic data such as age, sex, and educational status; crops grown by acreage, damage caused to crops (using categories ranging from no damage to severe damage), and species of wildlife responsible for damage, protection measures adopted, assessment of wildlife population numbers, and the attitudes of local communities towards wildlife and biosphere reserve management. (Appendix III)

Focal Group Discussion method was used to complement the questionnaires. Seven pre-designed open-ended questions were used for gathering information. Collected information included: how local communities perceive wildlife, how they access and use the biosphere reserve resources (forage and commercial products), and assessment of the co-existence of wildlife and human communities and how both benefit from the biosphere area. Two focus group discussions were conducted, one in each study site. Community leaders were approached 2 days in advance of the desired meeting time and requested to organize participants for the discussion. Group size in each site varied from 5 to 15 people. Participants were selected purposively based on their age and duration of residency in the area. Participants were invited to discuss issues important to their livelihoods and concerns. Information from group discussions was recorded and summarized using a text analysis method, and presented in a narrative fashion. (Appendix IV)

3.3.1. Estimation of population size of Wild animals

To estimate the population size of wild animals, count of the animal in the farmland and around the farmland was used. In the two selected farmland sites namely, Hamuma and Bondewomegela counting was carried out using unaided eyes while on foot, twice during the dry season and the wet season by researcher, guarder and two field workers. Training was given for two field workers and guards about counting of animal which enter and come around the farmland. During direct count all information such as species name, number of each individual species, age, sex and location of animal were recorded on the prepared data sheet. Their population was categorized into adult male, adult female, sub adult male, sub adult female, young and infants. Body size was used in age and sex determination (Mesele*et al*.,2008).Count was recorded when primates were most active and visible during morning and in the afternoon and the other wild animals such as bush pig counted during the night and more active in the early morning and late evening(Stuart and Stuart,1994). But, due to lack of instrument the behavior of nocturnal wild animals (complexity), counting was recorded, two days weekly and taken the average count in dry and wet season to avoid the redundancy of the bush pig entering and around the crop field during counting. This is only to estimate the number of wildlife that visit farmland and cause conflict with the community.

3.3.2. Estimate of crop damage by wild animals

To determine crop loss by pest wild animals, direct observation was carried out and helps to assure the information obtained from the questionnaire and FGD. The two sites namely Hamuma and Bondewomegela site were selected purposively based on the severity of human wild animal conflict. Each farmland measured by meter with an area of 30m by 30m and five plots with 4m width and 4m length were plotted at different directions to estimate total number of maize plants(Hill,2002). The maize crop was selected due to the main crop cultivated in the study site next to coffee. The area was covered by forest and a lot of wild animal were found and the crop was easily damaged. Direct observation was carried from the time of seedling up to harvesting time two days of observation in a week. Moreover, the guarder and the farm owner trained to record everyday loss of crop in all its developmental stages. During observation, the damage occurred such as species

name, number of each individual species, types of crop damage, parts of crop damage, amount of damage in standing, time of observation and location of animal was recorded in the data sheet and documented by photograph in the all stage of damage and pest species. Total damage was estimated by comparing with the estimated total number of the maize.

4. Data analysis

Statistical Package for Social Science (SPSS) version 16.0 was used to analyze collected data. Questionnaires and data from direct observation were coded and run through SPSS. Data were analyzed using descriptive statistics and responses from questionnaires and direct observation were compared using the chi-square test.

5. Result

5.1. Socio-demographic characteristics of respondents

From a total of 196 respondents,128 (65.3%) from Bondewomegela kebeles and 68(34.7%) from Hamumakebele. Among these,172(87.8%) were males. About 42(21.4%) of respondents were in the age range of 31-40. Regarding educational status of the respondents, many were non-educated 79(40.3%) (Table 1).About 143 (83.3%) of the respondents were residents in the study area for more than 20 years.

Table 1.Socio-demographic characteristics respondents

Socio-demographic characteristics		Frequency	Percent (%)
Sex	Male	172	87.8
	Female	24	12.2
	Total	196	100.0
Age	<20	2	1.0
	21-30	39	19.9
	31-40	42	21.4
	41-50	35	17.9
	51-60	31	15.8
	61-70	24	12.2
	>70	23	11.7
	Total	196	100.0
Kebele (site)	Hamuma	68	34.7
	Bondewomegela	128	65.3
	Total	196	100.0
Educational Background	Non educated	79	40.3
	primary school	76	38.8
	Secondary & preparatory school	32	16.3
	Certified	9	4.6
	Total	196	100.0
Duration of the respondents in the study area	below 5 years	5	2.6
	5-10 years	7	3.6
	11-15 years	15	7.7
	16-20 years	6	3.1
	above 20 years	163	83.2
	Total	196	100.0

About 192(98%) of the respondents have farmland and only 4(2%) have no farmland (Fig 5).

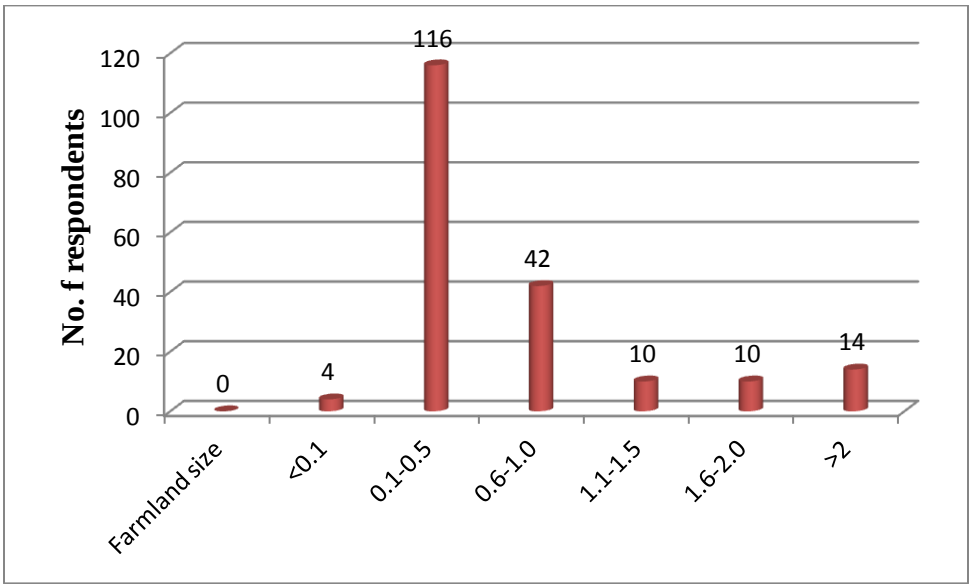

Figure 5. Size of farmland owned by respondents

5.2. Economic activity and social interaction of the respondents

In the study area farmers cultivate different types of crops, such as maize, teff, sorghum, bean, coffee and others (Table 2).190(96.9%) of the respondents cultivate maize, and 182(92.9%) cultivate coffee. Whereas 5(2.6%) cultivated teff, and 2 (1%) cultivated bean. But, crops such as peas, wheat and barley were not cultivated.

Table 2.Crop types cultivated in the study area

Crop cultivated	Yes		No	
	No of respondent	%	No of respondent	%
Maize	190	96.9	6	3.1
Teff	5	2.6	191	97.4
Sorghum	36	18.4	160	81.6
Bean	2	1.0	194	99.0
Peas	0	0	0	0
Wheat	0	0	0	0
Barley	0	0	0	0
Coffee	182	92.9	14	7.1
Others	2	1.0	194	99.0

5.3. Respondents knowledge and practice about Human wildlife Conflict

All of the respondents reported the presence of wild animals around their area. Among the respondents, 98% of them reported the presence of grivet monkey, 97.44% of them anubis baboon and 96.93% of them reported wild pig. The presence of lion was also reported by 27.04% of the respondents (Table 3).

Table 3. Response of participants about presence of animals around their areas

Common name of wild animals	No. of respondents	%
Grivet monkey	194	98.97
Blue monkey	167	85.20
Colobus monkey	187	95.40
Common Jackal	164	83.67
Bush pig	190	96.93
Bush buck	106	54.08
Anubis baboon	191	97.44
Leopard	141	73.46
Lion	53	27.04
Buffalo	125	63.77

Among the respondents 87(44.38%) reported grivet monkey, 86(43.87%) anubis baboon, 73(37.24%) bush pig,43(21.93%) of them Colobus monkey and 24(12.24%) blue monkeys as crop raiding animal in their locality(Table 4).

Table 4**.** List of crop raiding wild animals and their respective rank based on damage they caused as revealed by respondents

Common name of Wild animals	Scientific name	No.of respondents	Rank on damage they cause
Grivet monkey	*Cercopithecusaethiops*	87	1
Anubis baboon	*Papioanubis*	86	2
Bush pig	*Potamochoeruslarvatus*	73	3
Colobus monkey	*Colobus guereza*	43	4
Blue monkey	*Cercopithecusmitisboutourlinii*	24	5

In the present study, of the total respondents 191(97.4%) of them said that the cause of human wildlife conflict was crop raiding and 3 (1.5%) of them put raiding crop and predation as cause of HWC whereas 1(0.5%) and 1(0.5%) of them responded that the cause of HWC were raiding crop and attacking humans and crop raiding and disease transfer respectively (Table 5). There was no significance difference between the listed causes of HWC between the sites P>0.05(P=0.60).

Table 5.Response of the study participant about the cause of human wildlife conflict in the study area

Cause of the conflict	Frequency	Percent
Raiding crop	191	97.5
Raiding crop and predation	3	1.5
Raiding crop and attacking humans	1	0.5
Crop raiding and disease transfer	1	0.5
Total	196	100.0

Other than grivet monkey, anubis baboon, bush pig, colobus monkey and blue monkey there were other crop raider animals. Since the farmers don't know birds and rodents at species level, the general damage estimated at order level (Table 6).

Table 6.The response of the respondents about crop damage by other wild animals

Name of wild animal	No. of respondents	Percent
Porcupines	14	7.14
Rodent spp.	8	4.08
Birds spp.	12	6.12
African civets	6	3.06
Porcupine and civet	9	4.60

Rodent and bird spp.	10	5.10
All	97	49.48
Porcupine, bird and rodent spp.	19	9.70
Porcupine, civet and bird spp.	21	10.72

About 111(56.1%) of the respondents in the study site uses the resources, for firewood, 78(39.79) of the respondents as fodder wood for house construction and 7(3.6%) for others (Table 7).

Figure 6. Lianas used by the farmers from the Biosphere Reserves

Table 7.Respondent response about the types of resources used from forests by the communities

Resources used from forests	Frequency	Percent
Fire wood	111	56.61
Fodder wood for house construction	78	39.79
Others	7	3.6

In the study site 194(99%) of the respondents reported that the tendency of crop damage is increasing from time to time. And, there was no significant difference on the tendency of crop damage between the two sites, $p>0.05$($p=0.65$) (Table 8).

Table 8.The tendency of Crop damage by wild animals

Tendency of crop damage	No. of the respondents	Percent
Increasing	194	99.0
Decreasing	2	1.0
Total	196	100

From the total respondents 182(92.9%) reported that the crop damage was severe in wet season whereas only 14(7.1%) responded that it is severe during the dry season (Fig 7).

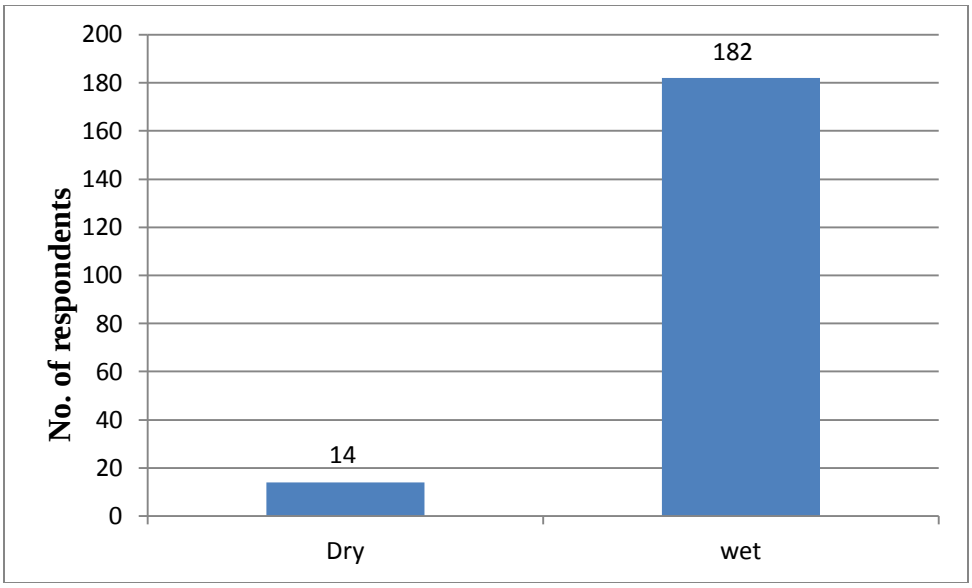

Figure 7. Crop damage in dry and wet season

Regarding reasons of conserving wildlife, 73(37.26%) of the respondents replied for tourism, 43(21.93%) for getting pleasure, 50(25.51%), (8.20%)for food value and 13(6.6%) followed by others small values (Table 9).

Table 9.The reasons for conserving wildlife by the respondents

Reason for conserving wild life	No of respondents	Percent
Tourism	73	37.26
Getting pleasure	43	21.93
Sale of body parts	50	25.51
Food values	16	8.20
Others	13	6.6
All	1	0.5
Total	196	100.0

The community in the study area uses different protection method of crop damage from the time of seedling up to maturation. For instance, 149 (76.02%) of respondents reported permanently guarding, 13(6.63%) using dogs to frighten and chase away crop raiders and placing a model of man in the crop field.(Table 10).

Table 10. Control method of crop damage

Crop damage control	Frequency	Percent
Permanently guarding	149	76.02
Digging hole around the crop	4	2.04
Using traps or snares	2	1.02
Fencing	3	1.53
Using unusual smell	4	2.04
Hunting wildlife in their fields	4	2.04
Using dogs to frighten and chase away	13	6.63
Placing a model of man in the crop field	13	6.63
Others	4	2.05
Total	196	100.0

5.4. Focus Group Discussion

The result here summarizes the views and interest of discussants with in each study site. The discussions showed that all the communities around Yayu Biosphere Reserve benefitted from the resources. The resources used from the Biosphere reserves are as fire wood, agricultural tools (materials), as a source of food, and fodder wood for house construction. Most of the discussants stated that "No life without the forest around the area (the current Biosphere reserves) which is our life and also our beauty."

Most discussants reported that the Biosphere resource benefits the local community but the utilization of the resources was not in a sustainable manner because of lack of knowledge of most people about how to use the natural resources.

Most of discussants had positive attitude towards wildlife for its importance to attract tourist, beauty, for scientific research, food, medicine and its value for the future generation, however they explained the serious impact of grivet monkey and anubis baboon on their development. Almost all participants agreed and reported that conserving wild life is important, managing the population of those serious crop raiders.

5.5. Population estimation of pest wild animals

In the study area five species of wild animals were identified during the wet and dry season. Among these anubis baboon (*Papioanubis)*, grivet monkey (*Cercopithecusaethiops*) and bush pig (*Potamochoeruslarvatus)* were wild animal that cause serious damage to crops in both study sites.

Table 11**.**Wild animals identified in the study sites

No.	Name of Wild animals	Local name (Afan Oromo)	Scientific name
1.	Anubis baboon	Jaldeessa	*Papioanubis*
2.	Grivet monkey	Qamalee	*Cercopithecusaethiops*
3.	Bush pig	Booyyee	*Potamochoeruslarvatus*
4.	Colobus Monkey	Weennii	*Colobus guereza*
5.	Blue monkey	Canaa	*Cercopithecusmitisboutourlinii*

5.5.1. Population estimate of anubis baboon

A total of 61.00±4.24 and 60.50±4.94 anubis baboons were counted from Hamuma and Bondewomegela sites respectively (Table 12).There was no significant difference in population size among sites $P>0.05$($P=0.33$). However, there was a significant difference among the age groups $P<0.05$(0.01).

Table 12. Population composition of Anubis baboon that regularly visit the crops in the two study sites

Age Group	Season	Hamuma	Bondewomegela
Adult male	Dry	7	8
	Wet	8	9
	Total	15	17
	Mean ± SD	7.50±0.70	8.50±0.70
Adult female	Dry	19	16
	Wet	22	17
	Total	41	33
	Mean ± SD	20.50±2.12	16.50±0.70
Sub adult male	Dry	4	2
	Wet	5	5
	Total	9	7
	Mean ± SD	4.50±0.70	3.50±2.12
Sub adult female	Dry	9	11
	Wet	11	12
	Total	20	23
	Mean ± SD	10.00±1.41	11.50±0.70
Young	Dry	14	16
	Wet	12	14
	Total	26	30
	Mean ± SD	13.00±1.41	15.00±1.41

Infant	Dry	5	4
	Wet	6	7
	Total	11	11
	Mean ± SD	5.50±0.70	5.50±2.12
Total	Dry	58	57
	Wet	64	64
	Total	122	121
	Mean ± SD	61.00±4.24	60.50±4.94

5.5.2. Population estimate of grivet monkey

In this study, a total of 71.00±4.24and81.00±8.48 grivet monkeys were counted in Hamuma and Bondewomegela sites respectively. There was no significant difference between the population of grivet monkey counted in the two sites $p>0.05$($p=0.35$). But,there was significant difference among the age groups of grivet monkey in the study site $p<0.05$(0.02).

Even though, there is no significant difference between dry and wet season, relatively large number of grivet monkey were recorded during the wet season (Table 13).

Table 13. Population composition of grivet monkey counted in the groups that regularly visit crops in the two study sites

Age group	Season	Hamuma	Bondewomegela
Adult male	Dry	9	10
	Wet	10	12
	Total	19	22
	Mean±SD	9.50±0.70	11.00±1.41
Adult female	Dry	19	23
	Wet	22	26
	Total	41	49
	Mean±SD	20.50±2.12	24.50±2.12
Sub adult male	Dry	6	4
	Wet	7	8
	Total	13	12
	Mean±SD	6.50±0.70	6.00±2.82
Sub adult female	Dry	11	13

	Wet	13	15
	Total	24	28
	Mean±SD	12.00± 1.41	14.00±1.41
Young	Dry	16	19
	Wet	14	17
	Total	30	36
	Mean±SD	15.00±1.41	18.00±1.41
Infant	Dry	7	6
	Wet	8	9
	Total	15	15
	Mean±SD	7.50±0.70	7.50±2.12
Total	Dry	68	75
	wet	74	87
	Total	122	162
	Mean±SD	71.00±4.24	81.00±8.48

Figure 8.Damage of crop by Grivet monkey in the flowering stage

5.5.3. Population estimate of bush pig

A total of 46.50±4.94and 44.50±4.94bush pigs were counted in Hamuma and Bondewomegela sites respectively (Table 14). There was no significant difference in the population of bush pig counted in the two seasons $p>0.05$($p=0.36$). In dry 43 and 50 in wet were counted in Hamuma and 41 in dry and 48 in wet were counted in Bondewomegela site. There was no significant difference in the number of bush pig counted among sites $P>0.05$($p=0.65$).

Relatively, the number of bush pig is higher in wet season in Hamuma and in Bondewomegela the number of bush pig in dry season were less (Table 14).

Table 14**.**Population composition of bush pig counted in the groups that regularly visit crops in the two study sites

Season	Hamuma	Bondewomegela
dry	43	41
wet	50	48
Total	93	89
Mean±SD	46.50±4.94	44.50±4.94

5.6. Estimation of crop damage by pest wild animals

From side to side all growth stages namely, seedling, flowering and ripening maize crop was damaged in to both study sites. The severity of damage varied depending upon the growth stage and type of animal raid crop. As table 15 shows that, large amount of damage occur in the flowering stage by grivet monkey and anubis baboon during ripening respectively. During seedling stage the damage by wild animals is less and no damage at all by bush pig.

Table 15.The amount of maize damaged by wild animals in each study site by maize stem

Stage	BondewoMegela						Hamuma						Total	
	Anubius baboon		Grivet monkey		Bush pig		Anubius baboon		Grivet monkey		Bush pig			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Seedling	98	8.76	101	8.88	0	0	74	7.30	89	6.53	0	0	362	6.17
Flowering	418	37.35	609	53.56	279	39.13	487	48.1	857	62.88	188	36.09	2838	48.38
Ripening	603	53.89	427	37.56	434	60.87	452	44.60	417	30.59	333	63.91	2666	45.45
Total	1119	100.0	1137	100.0	713	100.0	1013	100.0	1363	100.0	521	100.0	5866	100.0
Mean±	373.00± 255.48		379.00 ± 257.37		237.67± 219.93		337.66± 229.01		454.33± 385.35		173.67± 166.96		1985.33± 1382.54	

5.6.1. Estimation of crop damage by anubis baboon

From both study sites172 of seedling, 905 of flowering and 1055 of ripened maize plant stem were damaged by anubis baboon. There was a significant difference among different stages of maize damaged by anubis baboon $p<0.05(p=0.01)$.The total damage of

maize by anubis baboon was 1013 and 1119 in Hamuma and Bondewomegela sites respectively. Moreover, damage of maize in its stage in each site 98(8.76%), 418(37.35%) and 603(53.89%) during seedling, flowering and ripening in Bondewomegela site, whereas 74(7.30%),487(48.1%) and 452(44.60%) in Hamuma site were damaged during seedling, flowering and ripening stages respectively. There was no significant variation of crop damage by anubis baboon between site $p>0.05(p=0.86)$. Relatively, large amount of crop damage by anubis baboon was seen in Bondewomegela site (Figure 9).

From the total population of 12,240 estimated maize plants in both sites, anubis baboon damage 2,132(17.41%). The major damage was seen during ripening stage.(Fig 9). .

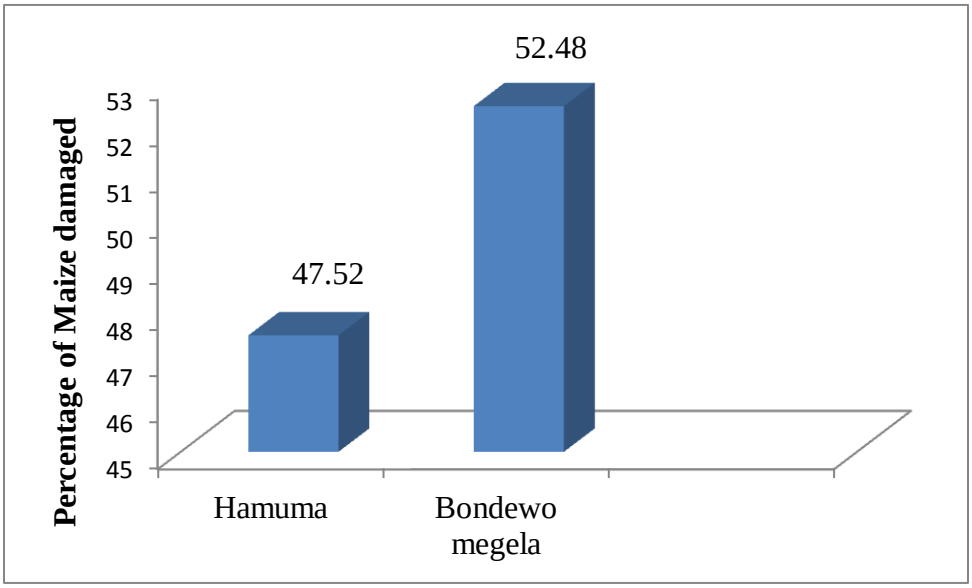

Figure 9. Percentage of maize damaged by anubis baboon in both sites

5.6.2. Estimation of crop damage by grivet monkey

The total damage of maize plant by grivet monkey was 1363 and 1137 in Hamuma and Bondewomegela sites respectively. There was no significant difference among the site $p>0.05(p=0.79)$. Damage on maize by grivet monkey was 101(8.88%), 609(53.56%) and 427(37.56%) and 89(6.53%), 857(62.88%) and 417(30.59%) during seedling, flowering and ripening stages in Bondewomegela and Hamuma sites respectively. There was significant difference among maize damaged between stages $p<0.05(p=0.01)$.

In Hamuma site large amount of maize crop were damaged by grivet monkey in the flowering stage (Figure 10).

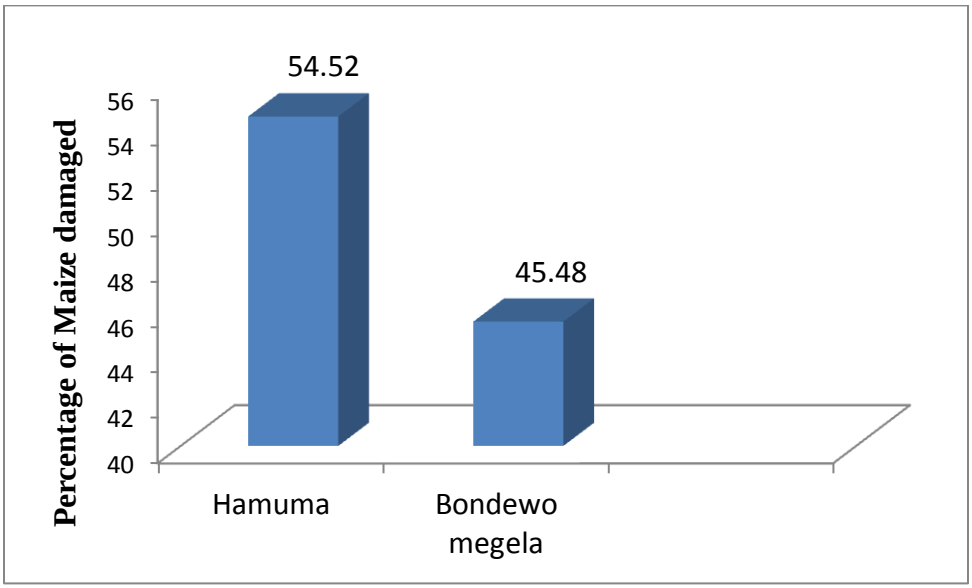

Figure 10**.** Percentage of maize damaged by grivet monkey in both sites

5.6.3. Estimation of crop damage by bush pig

In this study site, a total of 521 and 713 of maize crop were damaged by bush pig in HamumanandBondewomegela site respectively. There was no significant difference among the two sites $p>0.05$($p=070$).279(39.13%), and 434(60.87%) damaged during flowering and ripening stage in Bondewomegela site respectively. 188(36.09%) and 333(63.91%) maize was damaged during flowering and ripening stages in Hamuma sites. No damage occurred during the seedling stage. Among stages there was significant difference $p<0.05$($p=0.01$).(Fig 11).

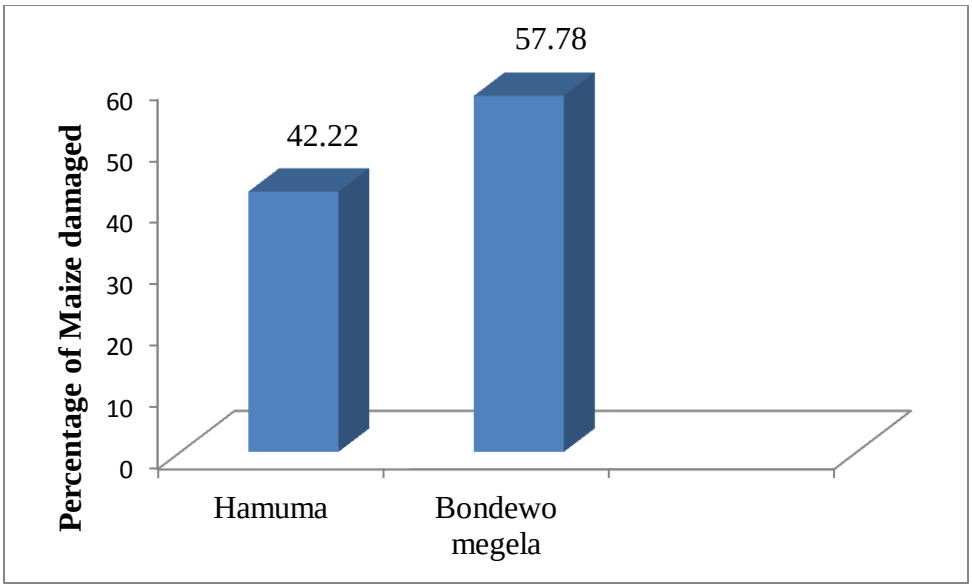

Figure 11**.** Percentage of maize damaged by bush pig in both sites

6. Discussion

During the present study, five wild animals were identified as top crop raider from the study site: namely, anubis baboon (*Papioanubis*), grivet monkey (*Chlorocebusaethiops*), bush pig *(Potamochoeruslarvatus)*, colobus monkey (*Colobus guereza*) and blue monkey (Cercopithecusmitisboutourlinii). Amongst these wild animals, anubis baboon, grivet monkey and bush pig were the most known pest of wild animals in the area.Similar results were observed from study conducted in Ilubabor Zone of Oromia region by Quirin(2005), anubisbaboon,grivate monkey and wild pig were the most crop raiding wild animals in the area.

In the present study, large numbers of wild animals were counted in all species of wild animals in wet season than dry season. For the reason that, during the wet season the farmland was attractive and also had adequate food source. Similarly, Mesele (2007)indicated that in Wonji-Shoa, Central Ethiopia, the number of grivet monkey in farmland was higher in wet season as compared to dry season.

The number of female count in the study sites was higher among age group of grivet and anubis baboon. This result in agreement with Mussa(2009) who reported that the number of female gelada baboon was significantly higher than the number of the corresponding male age groups in and around Denkoro forest(Ethiopia).

The result of this study showed that, the type of crop damaged by wild animals was maize crop. The main reason was due to that maize crop whether ripe or/and dried, it was the most frequently eaten crop by crop raiders (Warren, 2008). This result was in agreement with finding of Eniang*et al.* (2011) in Nigeria, Kivai (2010) in Kenya and Warren (2008) in Nigeria.

The study also revealed that grivet monkey, anubis baboon and bush pig raided maize crop in the study site. The result agrees with finding of Kate (2012) who reported that baboons were ranked number one crop raiders in Uganda. Aharikundira and Tweheyo (2011) also reported that baboons and bush Pig were ranked as first and second crop raiders in Uganda

respectively. Grivet monkey mainly causes damage during flowering, because the cob of maize was not matured (has less amount food content).Due to this, to get best cob they moves fastly from one to another and damage huge number of maize plant. Other reports also explained that worldwide primates and in East Africa bush pigs (*Potamochoeruslarvatus)* were among the species most frequently cited by farmers as notorious crop raiders, capable of causing heavy crop damage; Warthogs (*Phacochoerusafricanus*) are also involved (SilleroZubiri and Switzer, 2001).

In the present study, variation of crop damage by pest wild animals was seen in both sites. Relatively, the crop damaged by anubis baboon was higher in Bondewomegela site, due to the presence of high population of the pest wild animals in the area. The crop damage registered, by grivet monkey is larger in Hamumasite as compared toBondewomegela site. Comparatively, the crop damaged by bush pig is higher inBondewomegela site. From the listed wild animals the highest damage of crop was observed by grivet monkey. Because, around the farmland there were different trees such as Eucalyptus trees and used to hide them on it. From the total estimated yield ofmaize crops, 47.9% was damaged by wild animals. This result comparable with Kivai(2010) who reported land covered by maize is the most raided and incurred of crop losses due to crop raiding(47.19%) in Kenya.

In the present study, about 97.4% of respondents reported that the cause of human wildlife conflict were crop raiding and about 1.5% of them put raiding crop and predation as cause of HWC where as 0.5% and 0.5% of them respond about the cause of HWC were raiding crop and attacking humans and crop raiding and disease transfer respectively. Thisresult is in agreement with Engidasew (2010), who reported that almost half of the cause of HWC was both crop damage and loss of livestock to wildlife in Guassa Community Conservation Area,NorthShoa,Ethiopia.

The respondent in the study area uses firewood, fodder wood for house construction, grazing and others. This result is similar with the finding of Mesele (2006),who reported that the communities intheSemein Mountain National Park, of Ethiopia destroying the forests for the purpose of fire wood, cattle grazing and other benefits engages primates to ride crop.

The result showed that, 194(99%) of the respondents reported, the tendency of crop damage by wild animals was increasing from time to time,because of the increasing of pest wild animal population and resource competition with humans.Mesele (2006) reported that most of the respondents inAbergina, Mecheka-Tikurwuha, Kiflo and Jona-Daba sites expressed, there was an increased tendency of crop damage by Gelada baboon in and around the Semen Mountains National Park.

Most of the respondents reported that, crop damage was higher during wet season than during dry season. Because, the farmlands around the forest might provide many food sources for those wild animals and during the dry season scarcity of food may face. So, the wild animals can move to the forest to get food. Similarly, Mesele(2007) in Wonji-shoa, Central Ethiopia, revealed that the number of grivet monkey population in farmlands higher in wet season compared to dry season.

The responses from FGD showed that, most of discussants had positive attitude towards wildlife for its importance to attract tourist, beauty, for scientific research, food, medicine and its value for the future generation. But, due to lack of knowledge, most of the people didn't know how to use the natural resources practically and sustainably. Similarly Engidasew (2010)inGuassa Community Conservation Area, North Shoa Ethiopia, reported almost all participants agreed that conserving wild life is important.

According to the response from the respondents, permanently guarding was the most effective method of reducing crop damage. Local residents in the study area used different techniques like guarding, chasing and scare crow to minimize agricultural crop damage by wild animals. Sillero-Zubiriand Switzer (2001) also reported that chasing crop raiders, guarding, scarecrows, plastic flags, use of scents, fences, hunting, trapping and poisoning are some of the methods used in minimizing crop raiding. King and Lee (1987) also reported that the most effective short term prevention methods of crop damage by pest species is guarding together with chasing.

7. Conclusion and Recommendation

7.1. Conclusion

The present study has shown that a number of wild animals visiting crops daily have been increasing from time to time and likewise, the crop damage by those wild animals' increasing. Due to this, some farmers have converted from crop production to other activities. Farmers in the study area depends on the Biosphere Reserves use resources such as fire wood, grazing and fodder wood for house construction which revealed that the occurrence of resource competition between humans and wildlife.

In study sites, anubis baboon, grivet monkey, bush pig, colobus monkey and blue monkey were identified. The most commonly reported and ranked crop raiding wild animals were anubis baboon, grivet monkey and bush pig respectively. Other pest animals that raid crops include some rodents, porcupine and bird spp. Maize was the main crop cultivated by most farmers in the study area and the highest vulnerable crop to damage. From direct observation in the study area, 47.9% of maize crop was damaged. Most of the damage observed in flowering stage by grivet monkey and during ripening stage by anubis baboon. No damage was recorded by bush pig during seedling stage.

In the present study, the respondents reported that the cause of human wildlife conflict were crop raiding, predation, attacking humans and disease transfer.

The major strategies to protect crop raiders in the study area were permanently guarding, farmer's also used hunting of wildlife using dogs and chase and placing a model of man and other wild animals to protect crop raiders from their crop. Most of the people in the study site were farmer and also the conflict in the area was severe. Because of most of the land were covered by forest and habitat for those wild animals. In order to make and help the communities in the study area it is mandatory and timely issue to take responsibility.

7.2. Recommendation

Based on the finding of the present study, the following recommendations are suggested to minimize the problem of HWC:

- Encouraging farmers as they keep wild animal's habitat intact and should cooperatively keep their crop farm from crop raiders.

- Crops damaged by wild animals depend on the type of cultivated plants. The local communities should be encouraged to grow crops that are not easily damaged by wildlife, such as Enset, root plants.

- The forest and vegetation along the transitional zones are often burnt either by farmers, livestock keepers; honey and coffee collectors. This will accelerate the habitat loss and wildlife depletion. Therefore, awareness creation can be the possible solution for such problems.

- Further investigation should be conducted on the census of sex and age group for bush pig

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Appendixes

Appendix I

Data collection sheet for direct observation of crop damage by wild animals

Place_____

Site_____

Season_____

Stages of crop development_____

Distance of the field from the forest boundary_____

Name of data collector_____

S. .No.	Species observed	No. of individual.	Types of crop damaged	Parts of crop damaged	Amount of damaged	Time of observation	
						Diurnal	Nocturnal
1							
2							
3							
4							
5							
Total							

Appendix II

Data collection sheet for population estimate of Wild animals

Date_____

Species_____

Season_____

Place_____

Site_____

Name of data collector_____

S.No.	Group type	Age Structure						Remark
		AM	AF	SAM	SAF	Young	Infant	
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
Total								

AM=adult male, AF=adult female, SAM=sub adult male, SAF=sub adult female

Appendix III

A. Questionnaire

I. Household Questionnaires for local respondents around Yayu Forest Biosphere Area

A. Code _____

B. Age (>18) _____

C. Sex _____

D. Residence: village_____, Kebele _____ Woreda_____

E. Educational status: a) uneducated

b) Primary school

c) Secondary school

d) Beyond Secondary school

F / How long you have lived in this area?

a/ below 5 years b/5-10 years c/11-15 years d/16-20 years e/above 20 years

II. The crops cultivated in the study site and the estimate of the yield obtained

- **For the following questions give your answer by encircling the letter of your choice and fill the correct answer in the space provided. You can choose more than one answer.**

1. Do you have your own farm land? a/ yes b/no

2. If your response is yes for question no.1, for what purpose do you use it?

Please indicate the area

a. As farmland area in ha_____

b. Grazing land area in ha_____

c. Woodlot area in ha_____

3. which of the following crops do you cultivate on your farm land?

a/ maize b/ teff c/sorghum d/ barley e/ wheat f/ pea g/ bean h/ coffee i/others_____

4. How many kilograms (quintal) of yields did you get from each type of crop last year?

Type of crop	size of farm land in hec.	Yield obtained in quintal (Kg)
a)Maize	----------	----------
b)Teff	----------	----------
c) sorghum	----------	----------
d) Barley	----------	----------
e)Wheat	----------	----------
f) Pea	----------	----------
g) Bean	----------	----------
h)coffee	----------	----------

i) others ----------

III. Respondent's knowledge and practice about human Wild animal conflict

- **For the following questions give your answer by encircling the letter of the choice and fill the correct answer in the space provided. You can choose more than once answer.**

1/ Is there forest in your area? A/yes B/no

2/If your answer is yes for question 1 above what type of resources do you use from the forest?

a/ fire wood b/ grazing field c/ farm land d/ Fodder Wood for house construction e/others_____

3/ Are there wild animals around your area? A/yes B/no

4/ If your answer is yes for question 3 above, which of the following are they?

a/ vervet monkey b/ blue monkey c/*Colobus guereza*d/ fox

e/ bush pig f/ buffalo g/antelope h/ olive baboon

i/ tiger j/ Lion k/ rodents l/ others

5/which of the above mentioned wild life /wild animals/have conflict with humans? Please mention them.

6/which of the following is the cause of the conflict?

a/ raiding/damaging/ crop b/ predation. c/ attacking human's

d/ disease transmission e/all of the above

7/If your answer for the above question 6 is crop raiding which type of wildlife damages crop? a/primates b/rodents c/others(----------)

8/ which of the following Wild animal's damage crop?

a/ vervet monkey b/*Colobus guereza* c/Bush pig d/blue monkey

e/ olive baboon f/All of the above g/others----------

9/Rank the Wild animals in question no. 8 according to the severity of crop damage they cause? 1st_____2nd_____3rd_____4th_____5th_____

10/ List the main problematic wild animals cause damages your Crops and extent of damage?

NO	Animal type	Crop damage	Extent of damage last year (Least, Medium, Large)
1			
2			
3			
4			

11. At what stage do Wild animals attack your crops most?

stages	Crops																							
	Maize			Teff			barley			wheat			pea			Bean			Coffee			others		
Planting	s	m	l	s	m	l	s	m	l	s	m	l	s	m	l	s	m	l	s	m	l	s	m	l
Seedling																								
Vegetative																								
Harvesting																								

12. What is the tendency of the crop damage from time to time?

A. increasing (reason) _____

_____

B. decreasing (reason) _____

_____

13. At what time is the problem of crop damage more severe?

(Specify the season)_____

14. Do you think conserving wildlife is important? a. Yes b. No

15. If the answer for question number 15, is "Yes". Why?

a/ getting income through tourism b/getting pleasure by looking them

c/ getting income from the sale of their body part(skin, hide, meat, horn, fur etc…)

d/foodvalue/others_____

_____

16 /which of the following methods of crop damage control are common in your area.

a/ using traps or snares. b /hunting wildlife in their fields c/ Fencing

d/ using Strange or unusual smells e/ permanently guarding f/ using dogs to frighten and chase away crop raiders g/ placing a model of man in the crop field

h/ digging hole around the crop i/ if any more list down_____

_____

17/ what measures do you think should be taken by the following bodies in order to Prevent the crop damage?

a. by the government ----------

---

b. by non- governmental bodies

.....

---

c. by the farmer.....

.....

Appendix IV

Focus group discussion questions

1. Do you think the presence of the YBR close to your area benefited the community?
2. What benefits have been realized up until now?
3. Do you think local people and livestock affect wildlife?
4. How do local community and wildlife in the YBR could coexist in peace and harmony?
5. What is the importance of conserving wildlife?
6. To increase the local community benefit and at the same time securing the YBR, what should be done?

a. by the local community

b. by conservationists

7. In order to bring sustainable development for both the YBR and the local community, what do you suggest?