2019-09-20

THREATS AND CONSERVATION CHALLENGES OF WILDLIFE IN ARSI MOUNTAIN NATIONAL PARK: THE CASE OF GALAMA MOUNTAIN, SOUTHEASTERN ETHIOPIA

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M.Sc. Thesis

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Gosa Balcha

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE (MSc) IN WILDLIFE CONSERVATION AND ECOTOURISM MANAGEMENT

Major Advisor: Dr. Eshetu Moges

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June, 2019

Bahir Dar, Ethiopia

THESIS APPROVAL SHEET

As member of the Board of Examiners of the Master of Sciences (M.Sc.) thesis open defense examination, we have read and evaluated this thesis prepared by **Gosa Balcha Dame** entitled **Threats and conservation challenges of wildlife in Arsi Mountain National Park: The Case of Galama Mountain, Southeastern Ethiopia.** We hereby certify that; the thesis is accepted for fulfilling the requirements for the award of the degree of Master of Sciences (M.Sc.) in Wildlife Conservation and Ecotourism Management

Board of Examiners

_____   _____   _____

Name of External Examiner   Signature   Date

_____   _____   _____

Name of Internal Examiner   Signature   Date

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Name of Chair Person   Signature   Date

DECLARATION

This is to certify that this thesis entitled "**Threats and conservation challenges of wildlife in Arsi Mountain National Park: the case of Galama Mountain, Southeastern Ethiopia**" submitted in partial fulfillment of the requirements for the award of the degree of Master of Science in "**Wildlife conservation and ecotourism management**" to the Graduate Program of College of Agriculture and Environmental Sciences, Bahir Dar University by **Gosa Balcha Dame** (ID. No. BDU1018660PR) is an authentic work carried out by him under our guidance. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of our knowledge and belief.

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ACKNOWLEDGMENTS

ABBREVIATIONS/ACRONYMS

A.S.L   Above Sea Level

ABRDP   Arsi Bale Rural Development Project

AMNP   Arsi Mountain National Park

APEDO   Arsi Zone Planning and Economic Development Office

BMNP   Bale Mountain National Park

EBI   Ethiopian Biodiversity Institute

ENMA   Ethiopian National Meteorological Agency

FAO   Food and Agricultural Organization

FGD   Focus Group Discussion

HWC   Human Wildlife Conflict

SPSS   Statistical Package for Social Sciences

WWF   World Wide Fund

χ^2 Chi-square

ABSTRACT

Ethiopia is rich in wildlife resources with their valuable ecological, economic and social values. However, wildlife continues to be lost rapidly across the world in spite of the effort of conservationist organizations towards natural resources protection.The aim of this study is to assess the threats and conservation challenges of wildlife in Galama Mountain. This research was conducted in Galama Mountain, Southeastern Ethiopia. The data were collected from August 2018 to February 2019. Cross sectional and observational study design were applied. The data were collected using questionnaire, direct observation and focus group discussion. For direct observation six study sites were randomly selected from study area and for indirect method indirect evidences like feeding, digging, dung, foot prints, and spines were used. Wildlife in Galama Mountain mainly faced conservation threats and challenges due to habitat degradation, agricultural practice, settlement, fire, over grazing, human wildlife conflict, over utilization, lack of awareness and lack of effective managements. There was a significance difference ($\chi2=13.276$, df =5, p =0.021) on the knowledge of wildlife threats and conservation challenges in the study area among villages. Sex was not important in determining the knowledge of respondents on the threats and conservation challenges in the study area ($\chi2= 0.251$, df =1, p =0.617). There was no significance difference ($\chi2 =3.197$, df =5, p =0.067) among different age groups on their attitude about threats and conservation challenges. Educated respondents had better understanding about threats and conservation challenges ($\chi2 =12.660$, df =1, p ≤ 0.001). In the study area different crops were grown by local communities and the total loss was estimated about 10.9% (1560kg) of annual crop production in the study area. In another way out of total (3ha) cultivated land in the study area 0.325ha was lost. The maximum loss was registered on barley which covers 31%. Livestock depredation in the study village was not a big problem as the majority of (57.9%) of respondents replied. Wildlife in the study area were intensely challenged to survive due to different human activities in and around the mountain. Therefore, for sustainable utilization of wildlife resources in the study area the integrated wildlife conservation strategy measure should be needed.

Keywords/Phrases: Conservation challenges, Galama Mountain, human wildlife conflicts, threats, wildlife

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CHAPTER 1 INTRODUCTION

1.1 Background of the Study Area

Ethiopia is rich in biodiversity and its unique geographical features allows the country with high level of endemic species (Alemneh Amare, 2015). The country has diversified wildlife resources with their precious benefits. However, wildlife resources of Ethiopia fall under pressure from direct or indirect causes of human activities. Anthropogenic activities are directly influencing wildlife survival across different regions (Wilfred, 2010). Most of the major problems affecting wildlife and biodiversity are the direct or indirect human activities on the habitat. As the worldwide human population and demand for food production continue to grow, the intensity of our land-use increases (Donald and Evans, 2006). Wildlife in many national parks of Ethiopia is increasingly under threat from human encroachment, poaching for subsistence purpose, habitat degradation due to deforestation, encroachment of incompatible land uses and uncontrolled fire create ever increasing human wildlife conflicts (Tefera Melaku, 2011). As a result, the conservation of wildlife faced challenges because wildlife influence both people located near wildlife habitat and far from the areas (Bulte *et al*., 2003).

Whether for economic productivity or urban development, humans alter the landscape matrix in ways that effect the spatial density, diversity, and quality of wildlife habitat (Radeloff *et al*., 2005). Protected areas are important ecosystems of the earth which is essential for conservation of wildlife and other biological diversity. Over the past 25 years, the number of protected areas in developing countries has grown (Krausman and Harris, 2011). Currently, protected areas cover above 14% of the Earth's land surface (Marine Deguignet *et al*., 2014). The number of protected areas is increased between 1980 and 2005 because of the development of environmental policy which emerge agreement on the protected area as a tool for biodiversity conservation (Naughton *et al*., 2005). Protected areas are important nationally or internationally as conservation approaches of natural environment and wildlife (Dudley, 2008). However, these areas are exposed to severe pressure from anthropogenic activities that threaten their existence and sustainability (Wilfred, 2010; Reddy, 2014).

Human wildlife conflict is defined as any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife

population, or on the environment (Lamarque *et al*., 2009). Human-wildlife conflict is a universal problem and varies according to geography, land use patterns, human behavior and the habitat and behavior of wildlife species or individual animals within the species (WWF, 2005). Human-wildlife conflicts can take various forms, including carnivores attacking and killing livestock or humans, species raiding crops, competition for game and resources, disease exchange between livestock and wildlife, carcass poisoning, and retaliation killing (Thirgood *et al*., 2005; Madden, 2008). Crop raiding can be simply defined as wild animals moving from their natural habitat into agricultural land to feed on the crops that humans grow for their own consumption and trade (Sillero Zubiri and Switzer, 2001).

Galama Mountain has rich in wildlife resources including endemic wildlife species. However, due to lack of proper wildlife conservation measures they under-go threats which allow wildlife to become extinct and depleted. Despite the presence of its various wildlife resources, intensive area coverage, varied geographical features and ecological value which attract a number of researchers to the area, the issues related to threats and conservation challenges of wildlife in the area were not studied. However, wildlife species in Galama Mountain is encountering a number of threats and conservation challenges due to exhaustive human activities. Therefore, this study was designed to identify the major problems of the wildlife in Galama Mountain. Habitat degradation, loss and fragmentation, agricultural expansion, human wildlife conflict, livestock encroachment, fire, settlement are common threats for wildlife species in Galama Mountain.

1.2   Statement of the Problem

Wildlife has a various importance for the country and improves livelihood of the human beings. Wildlife has environmental, economic and social values. However, wildlife species encountered different problems from anthropogenic activities and others sources that affect their survivals and sustainability. Despite the presence of diversified wildlife and their invaluable benefits, wildlife resources of Ethiopia have been threatened due to habitat conversion, unsustainable utilization and invasive species, climate change and pollution. Added to these direct causes, demographic changes and lack of awareness and coordination, can become indirect causes of conservation threats (Daszak *et al*., 2000; Ho *et al*., 2007; IBC, 2014). Habitat alteration, agriculture practice, fire, livestock encroachment, settlement, human wildlife conflict, unsustainable utilization, lack of

awareness and ineffective management are the main threats and conservation challenges (Sefi Mekonen *et al.*, 2017; Kassegn Berhanu and Endalkachew Teshome, 2018).

Wildlife conservation poses a particular challenge to the global community because wildlife has an impact not only on people living in areas where wildlife is found, but also on people located considerable distances away from the habitats of wildlife (Bulte *et al.*, 2003). The conservation of wildlife species, their habitats and other natural habitats such as forest, wetlands and water bodies are intensively undergone pressure and this causes the extinction of wildlife species. The wildlife resources of Ethiopia are largely restricted to a few protected areas and inaccessible areas (Hillman, 1993). Therefore, wildlife management is crucial for conservation of biodiversity. Wildlife management focuses on increasing net benefit for society through purposeful intervention (Kassahun Abie and Afework Bekele, 2016).

One of the major sources of conflict of human- wildlife in Africa and in the world at large is crop raiding (Hill *et at*, 2002; Warren, 2003). Increasing resource use by humans at the human wildlife interface has resulted in intensification of human-wildlife conflict (Inskip and Zimmernna, 2009). Human-wildlife conflict is fast becoming a serious threat to the survival of wildlife and many endangered species in the world and a global problem that is experienced especially in areas where wildlife and human population exist together and share limited resources (Eniang *et al.*, 2011; Musimbi, 2013). Human-wildlife conflict causes various negative results both in human and wildlife. Human wildlife conflict was caused due to the overlap of human and wildlife requirements. The major outcomes of human-wildlife conflicts are crop damage, livestock depredation, damage to human property and collapse of wildlife population (Woodroffe, 2013). In Galama Mountain no researches have been done about issues related to threats and conservation challenges of wildlife to identify the problems of wildlife resources in the area. Therefore, this study was needed to be conducted in the study area to identify the threats and conservation challenges of wildlife in the study area Galama Mountains.

1.3 Research Objectives

1.3.1 General objectives

The general objective of this study was to assess the threats and conservation challenges of wildlife in Arsi Mountains National Park the case of Galama Mountain, Southeastern Ethiopia.

1.3.2 Specific objectives

➢ To identify anthropogenic caused threats and management related conservation problems in Galama Mountain

➢ To estimate crop and livestock loss by wildlife in the study area

➢ To evaluate the attitudes of local community towards wildlife in the study area

1.4 Research Questions

This research was answered the following questions.

➢ What are the threats and conservation challenges of wildlife in Galama Mountain?

➢ What types of conflict does the community encounter by wild animals and to what extent?

➢ What type of traditional method does the community use to alleviate the crop loss caused by wildlife in the study area?

➢ What are the attitudes of local communities to wards wildlife?

1.5 Significance of the Study

The results of this research were investigated threats and conservation challenges of wildlife in Galama Mountain which is the parts of Arsi Mountains National Park. Therefore, different stakeholders such as government bodies at different levels (national, regional, zonal and district), NGOs (such as Ethiopian Wolf conservation programme) and other local and non-local NGOs, national and international higher academic research institutions such as Bahir Dar university, Arsi University and other abroad universities concerned bodies will use the research findings of this study. Also, local communities, wildlife managers and community leaders will use the research findings. Additionally, the results and recommendations of this research will initiate researchers to do related or further researches in the study area.

1.6 Scope of the Study

The theoretical scope of this research is restricted to the threats and conservation challenges of wildlife. The geographical scope of the study is limited to Arsi Mountains National Park, specifically Galama Mountain which is the part of Chilalo-Galama block located in southeastern Oromia, Ethiopia. The research was conducted in the study area as per the designed study schedule.

CHAAPTER 2 LITERATURE REVIEW

2.1   Concept and definition of wildlife

The definition of wildlife is some time broader and contracted according to the users understanding or viewpoint. Occasionally it is used to include all wild animals, plants and microorganisms. Additionally, it is limited to terrestrial vertebrates. In wildlife management, it designates free-ranging birds and mammals. The management of such species is until now an integral part of wildlife management but progressively it embraces other aspects such as conservation of endangered species (Anthony *et al*., 2006). Traditionally, many people perceived wildlife as only to some game species exclusively birds, mammals, and fish that have been hunted. Currently, the term wildlife includes all living organisms that are not domesticated and found in the wild, even those that are not used for sport hunting (non-game species) (Sinha, 2001). Until recent year before the development of education and promotion some people define wildlife as only large mammals; such as elephants, lions, cheetah, hyena, leopard, buffalo and other related species. But wildlife refers to variety of all living organisms inhabiting in the wild (Alemneh Amare, 2015b).

In current situation wildlife conservation is a great challenge. It requires collaborative global efforts for success in modern changing world. There is a great need of different planning strategies for protection, conservation, and minimizing the loss of natural resources. Indication of conservation targets or endpoints and warning with site-specific greatly enhance the success rate of conservation (Romanach *et al*., 2016). Habitat conservation is the key solution to conserve wildlife. Currently, in Asia wildlife species being removed or else due to human persecution at alarming rate. Southeast Asia is recognized as one of the hottest of the world's hotspots of endangered biodiversity (Edwards *et al*., 2011). Main threat for Asian wildlife is Critical habitat loss and hunting. So, for protection conservation and management of wildlife, longitudinal research is very necessary especially in the case of illegal and legal trade, and to know about the basic population dynamics, related to long live species (De Silva, 2016).

The greatest threat to biodiversity is habitat loss (Segan *et al*., 2016). During the last two centuries human population increase rapidly so in order to meet their requirements land, farming and urbanization an important amount of natural vegetation was degraded which leads to deforestation around the world. For reducing the negative impact of human persecution on natural environment

many protected areas in the world are established for maintaining balance and conservation of wildlife (Dimobe *et al*., 2015).

For reducing the negative impact of human persecution on natural environment many protected areas in the world are established for maintaining balance and conservation of wildlife (Dimobe *et al*., 2015). According to IUCN in forest resource assessment area especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources and managed through legal and other effective means is known as protected area as well as forest area designed primarily for conservation of biological diversity that includes but is not limited to areas designated for biodiversity conservation within the protected areas is known as the area for conservation of biodiversity (Dimobe *et al*., 2015).

2.2 Threats on Wildlife conservation

2.2.1 Habitat loss and fragmentation

Wildlife is natural resources which have cultural, ecological and economic values. Wildlife is a renewable resource and their existence is dependent on habitat quality (Jafari *et al*., 2006). Wildlife obtain the special needs such as shelter, food, water and space from their environment (Salma and Mubashar, 2016). Wildlife habitat's threats are enormous in developing countries where the livelihood of many is highly dependent on subsistence use of natural resources and agriculture (Wiegand *et al*., 2005).

Habitat loss and fragmentation have a negative impact on wildlife. The fragmentation and destruction of natural habitat leads to reduction of population size, abundance, change of genetic diversity and extinction of wildlife (Salma and Mubashar, 2016). A factor that causes habitat destruction are poverty, population growth, land tenure system, land use change, improper development policies, economic incentives, inadequate conservation status (Jafari *et al.,* 2006).

Habitat loss and fragmentation are the main causes of changes in the distribution and abundance of organisms, and are usually considered to negatively affect the abundance and species richness of organisms in a landscape. One form of habitat loss is through fragmentation of continuous habitat into patches. Over time these patches become smaller and the gaps between them become larger. The ratio of edge to interior habitat of the patches becomes larger (Tania *et al*., 2007).

Habitat fragmentation describes changes in habitat configuration and can be independent of or in addition to the effect of habitat loss (Fahrig, 2003). Fragmentation of habitat has a number of consequences. For example, species that require interior forest habitats (many bird species), away from the edge, experience reduced habitat and hence population reductions (Saunders *et al*., 1993). In a long-term experiment where forest fragments of different sizes were constructed in the Amazon forest and the ecosystem showed aspects of degradation within the patches (Laurance *et al*., 2002).

Species that need to disperse through intact habitat (many reptiles, amphibians, ground dwelling insects) are prevented from doing so and their populations are reduced to isolated pockets with potential demographic and genetic consequences. For example, in fragmented parts of the northern boreal forests of North America, the foraging movements of the three-toed woodpecker (*Picoides tridactylus*) are highly constrained because this species strongly avoids open areas (Imbeau and Desroches, 2002). The greater length of habitat edge allows incursions of predators from outside the patch, increasing the predation rate on interior forest species.

In general, fragmentation results in the synergistic interaction of several deleterious factors, particularly habitat decay, reduced dispersal of animal populations, and increased risk of predation (Hobbs, 2001; Laurance and Cochrane, 2001). However, species respond differently to fragmentation of habitat. Species that do not move far (insects, reptiles, some forest birds) are more restricted than those of highly mobile taxa (many birds, mammals, long-lived species, generalist predators) (Debinski and Holt, 2000).

2.2.2 Livestock Encroachments

Grazing by free-range livestock has strong negative impacts on the wildlife populations, their habitats and overall ecosystem function and structure (Yosef Mamo *et al*., 2015). Livestock have been to intensively compete with population of wildlife for different habitat resources including forage, water sources and space. Livestock encroachment has been known to be the major driving forces for the degradation, fragmentation and loss of wildlife habitats, including protected areas (Solomon Tadesse and Kotler, 2016). For instance, livestock grazing and browsing can cause uprooting, trampling, and preying on fruits/seeds that strongly hamper recruitment and understory

vegetation regeneration reducing the cover and foraging opportunities of the mountain Nyala and Menelik's bushbuck (Demel Teketay, 1992).

2.2.3 Effects of roads on wildlife

Roads have negative effect on aquatic as well as terrestrial ecosystems. Roads are responsible for mortality of animals, overall environmental modification and introduction of exotic species. Construction of road is dangerous to invertebrate animals that are living near to road or beneath the road. Both vertebrates and invertebrate's species are affected by vehicle and vehicle accidents. One of the major effects of roads on animal behavior is hindrance in animal movement, home range alteration, loss of reproductive success, and change in physiological conditions. Due to construction of roads soil compactness as well as soil water content is changed. Roadside environmental changes result in change in light, temperature, sedimentation of heavy metals due to surface run-off. Hunting and fishing activities are also increased by construction of roads. Roads may not affect all ecosystems equally but it generally changes the species distribution and species richness (Trombulak and Frissell, 2000).

2.2.4 Pollution

Pollution includes air, water, soil and noise pollution. Air pollution decreases the native population of animals and has very bad effect on wild birds as well as wild mammals. The pollutants from industry cause diseases, mortality, bioaccumulation and physiological stress. For example, some pollutants such as heavy metals, noise, environmental xenobiotic changed the distribution of wildlife animals (Newman, 1979). Agricultural and urbanization are the major cause of water pollution. Phosphorus, nitrogen and many other nutrients are added to aquatic ecosystems continuously by agriculture and urban activities.

The major causes of soil pollution are human activities. Leakage of oil and chemicals also contaminate the soil. The overall soil contents and microorganisms in the soil are negatively affected by high level of contamination. Due to soil contamination crop yield is highly reduced and it affects the organism that depends upon the plants for their food, nutrition and habitat (Shayler *et al*., 2009). Noise pollution cause stress, loss of reproductive success, physiological disturbance, and limit the long-term survival of wild animals. Animal health and its survival are

greatly affected by noise pollution. So, it is our duty that we protect the wildlife and reduce the noise pollution in natural habitats of animals (Radle, 2007).

2.2.5 Human wildlife conflict

2.2.5.1 Concept and definitions of human wildlife conflict

Human-wildlife Conflict is defined as any interaction between humans and wildlife that results in negative impacts on social, economic or cultural life, on the conservation of Wildlife populations, or on the environment (WWF, 2005). Human wildlife conflict occurs when human requirements overlap with wildlife requirements creating costs to both wild animals and residents (Messmer, 2010). The loss of habitat, due to land degradation through anthropogenic activities like deforestation, agriculture and urbanization leads to an ever-increasing encroachment in wildlife habitats. This is the major cause of conflict between humans and wildlife in the tropical regions (Sharma, 2011). Such types of encroachment activities, into the natural habitat of wildlife brings more and more fragmented and then the habitat cramped into smaller pockets, where wildlife and humans come in contact frequently leading to conflict (Kumar, 2012). Human-Wildlife Conflict 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 challenges currently being faced by the conservationist 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 developmental projects (Mengistu Wale *et al*., 2017).

Human-wildlife conflicts are a global problem, and are occurring in many countries where human and wildlife requirements overlapping (Quirin, 2005; Dickman, 2010). Human wildlife conservation is also a growing problem for the communities located near the borders of protected areas. Such conflicts commonly take place as crop-raiding, livestock depredation, household damage and human casualties (Ogra, 2008). The extent of crop raiding by animals vary greatly among areas. This has direct relation with the crops cultivated, location of the cultivated land and the protection methods employed. Conflicts over natural resources between the communities living adjacent to protected area and tourism development have increased in recent years because of changes in land use and accompanying new ideas about wildlife resource management and utilization (Magige, 2012).

Human-wildlife conflict is a major concern of most people living next to protected areas in developing countries due to their subsistent live (Alemneh Amare, 2015). It arises when growing human populations needs overlap with protected areas and results scrambling for resource. As the Ethiopia's population increases, there is an increasing demand for space and resource utilization and affects wild animal's habitat on the protected areas. For example, in Simien Mountains National Park, the population of Walia Ibex has decreased due to agricultural expansion affects their habitat (Mesele Yihune *et al*., 2008). The endemic gelada baboon was the major causes of conflict with local communities because of their farmlands in these villages were located close to the habitat of gelada baboons (Mesele Yihune *et al*., 2008).

2.2.5.2   Causes of human wildlife conflict and its impact on wildlife

The causes of HWC are as diverse as the habitat of wildlife and it ranges from wild animals' population increase to human population increase (Edward and Frank, 2012). According to United Nation Census Bureau, the world population is about 7.7 billion, in 2019 and will be projected to over eleven billion in 2050 and the increment of both wildlife and human population creates competition on fixed natural resources which leads to conflict (Sillero-Zubiri and Switzer, 2001). In Africa, human population growth has led to encroachment into wildlife habitats, constriction of species into marginal habitat patches and direct competition with local communities. Most of the increasing demand for food in the developed world has been met through intensified agriculture and husbandry rather than increased production areas (Joseline, 2010). Continued expansion of agriculture and husbandry areas will have various impacts on habitats and biodiversity. Rural development in sub-Saharan Africa inevitably involves accelerated transformation of natural landscapes at the expense of wilderness that sustains biodiversity and finally resulted in HWC. The same fashion of wildlife destructions has been also practiced in Ethiopia. One of the major causes of HWC is habitat destruction or fragmentation. Wildlife habitat lost is due to habitat destruction by fragmentation (Sillero-zubiri and Switzer, 2001; Lamarque *et al.,* 2009). As the wildlife habitat becomes more and more fragmented the wildlife confined to a smaller pocket of unsuitable habitat. This fragmentation is accelerated by agricultural land expansion, the intensive harvest of wood for different purposes, overgrazing and animal husbandry.

Increasing human population and the associated impacts such as habitat loss and hunting are the underlying factors for the decline of mammalian species. They are considered as species

threatening factors and vary in intensity across the surface of 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.

2.2.5.3   Types of human wildlife conflict

Human-wildlife conflicts can be classified into three which includes psychological, economic conflicts, health and safety. Human wildlife conflicts can be real or perceived, economic or aesthetic, social or political (Messmer, 2000). Psychological conflicts involve the disruption of human behavior by annoyance wildlife, but the resulting economic costs of such conflicts generally are minimal (Decker *et al.,* 2002). Economic conflict occurs when damage caused by wildlife can be adversely affecting the income of the local communities (Decker *et al.,* 2002). Health and safety conflict occur when there is the transmission of diseases from wildlife to human beings and it also includes the collision of wildlife with vehicles (Conover *et al.,* 1995, Decker *et al.,* 2002).

2.2.6 Human population expansion

Human overpopulation occurs if the number of people in a group exceeds the carrying capacity of the region occupied by the group. The term often refers to the relationship between the entire human population and its environment, the Earth or to smaller geographical areas such as countries (Sam *et al*., 2014). Leadley (2010) opined that overpopulation can result from an increase in births, a decline in mortality rates, an increase in immigration, or an unsustainable biome and depletion of resources. Population is recognized as an indirect driver of biodiversity loss, as human demands for resources like food and fuel play a key role in driving biodiversity degradation. This happens primarily through the conversion of ecosystems to food production (Sam *et al*., 2014). Tropical rainforests often occur in developing regions and nations with rapid population growth, intense natural resource exploitation, and pressure for economic development (Laurance *et al*., 2009).

2.2.7 Agricultural expansion

Clearing of land for commercial production creates a drier climate and distorts the movement of water vapour passing from the Atlantic Ocean to the Andes. From an agricultural perspective, a drier climate might be more favorable and profitable; however, such a climate promotes and

facilitates fire (Fernside, 2007). Agricultural practices themselves also result in increased frequency of fire. Agricultural land expansion is the most dominant driver for habitat loss, which, combined with unsustainable forest management, contributes to the greatest cause of species moving closer towards (Sam *et al*., 2014). Agricultural expansion and intensification also threaten the benefit that biodiversity provides to crops, for instance, pest control and other environmental services (Sachs *et al*., 2009; Crowder *et al*., 2010). In addition to the loss of wild biodiversity, the present path of agricultural intensification, by relying on a few selected varieties, is displacing the large number of traditional cultured varieties of plants (FAO, 2010b).

2.2.8 Fire

Fires are used to clear regions of land and can drastically alter forest characteristics by reducing overall canopy cover, biomass and species richness. Following the abandonment of pastoral lands, rates of secondary forest regrowth were found to be negatively correlated with the number of fires during the pasture phase (Davidson *et al*., 2012). Frequent fires can lead to increases in plant species that are fire-adapted and flammable, thus resulting in more-savanna like ecosystems (Davidson *et al*., 2012). Fire may threaten a population that is already small if the species is limited in range and mobility or has specialized reproductive habits (Smith and Fischer, 1997). Most fires thus have the potential to injure or kill fauna, and large, intense fires are certainly dangerous to animals caught in their path (Singer and Schullery, 1989).

Animals with limited mobility living above ground appear to be most vulnerable to fire caused injury and mortality, but occasionally even large mammals are killed by fire. For example, the large fires of 1988 in the Greater Yellowstone Area killed about 1% of the area's elk population (Singer and Schullery, 1989). Fire has effects on habitat which influenced the species population much more dramatically than did direct mortality. Because of drought during the summer of 1988 and forage loss on burned winter range, elk mortality was high in the winter of 1988 to 1989, as high as 40% at one location (Vales and Peek, 1996).

2.3   Conservation and Management of Wildlife

Wildlife populations are found in areas where their basic needs such as shelter, reproduction, food and water, and movement are satisfied. This area is called habitat. Wildlife management is the art and science of manipulating populations and habitats for the animals and for human benefit (Anderson, 2002). Wildlife conservation is the effort to maintain and use wildlife resources wisely. A form of conservation ranges from active management efforts, such as the manipulation of habitats and the introduction of species, to a complete "let alone" attitude (preservation). But conservation in general means attempting to save resources for future generations (Anderson, 2002). The conservation of wildlife highlights three important aspects which are maintaining the habitat, maintaining the breeding stock, and prohibition of killing of any animal unless situation demands for (Santra, 2008).

Ethiopia is a signatory party of the Convention on Biological Diversity thereby, has been undertaking efforts in biodiversity conservation (EBI, 2014). Similarly, Ethiopia has developed a national biodiversity strategy and action plan with the objectives of conserving representative examples of remaining ecosystems through a network of effectively managed protected areas under sustainable use and management by 2020 (EBI, 2014). However, a significant biodiversity conservation challenge was evident in several protected areas (Alemneh Amare, 2015).

CHAPTER 3 MATERIALS AND METHODS

3.1 Description of Study Area

Arsi Mountains National Park is a recently recognized national park which is established in 2011. The national park located in southeastern part of Ethiopia. Approximately 200 km far from Addis Ababa, and 15 km from the town of Asella. The park consists of different blocks namely Chilalo-Galama (792 km^2), Dera (13 km^2), Hunkolo (22 km^2), Kaka (104 km^2) blocks. This study was conducted in Galama Mountain which is the part of Chilalo-Galama block of Arsi Mountains National Park. Galama Mountain is located between 7.48 to 7.88°N latitude and 39.27 to 39.51°E longitude which make up about two-thirds of the block (524 km2) and form a diverse landscape with elevations ranging from 2000 to more than 4000 masl and bounded by four districts; Tena, Degeluna-Tijo, Shirka, and Lemu-Bilbilo woreda.

Vegetation is primarily Afro-alpine at higher elevations (3276–4008 masl), Erica (heath dominated) at middle elevations (3202–3985 masl), dry evergreen Afromontane vegetation at elevations of 2843–3756 masl, and mixed-species tree plantations at lower elevations (3181–3340 masl) (Girma 2016). Galama Mountain has humid montane climate with bimodal rainfall pattern. The mean annual rainfall ranges from 778.7 to 1089.65mm. The study area has a mean monthly maximum temperature of 22.4° C and minimum temperature of 11.1° C (ENMA, 2015). The park is well known by its endemic and endangered large mammals like Mountain Nyala, Ethiopian wolf and Menelik's bushbuck. Agriculture and human settlement are dominant land uses around the Galama Mountains, often affecting the forest landscape. Local livelihoods rely on cultivation of crops, livestock rearing, and subsistence extraction of forest resources
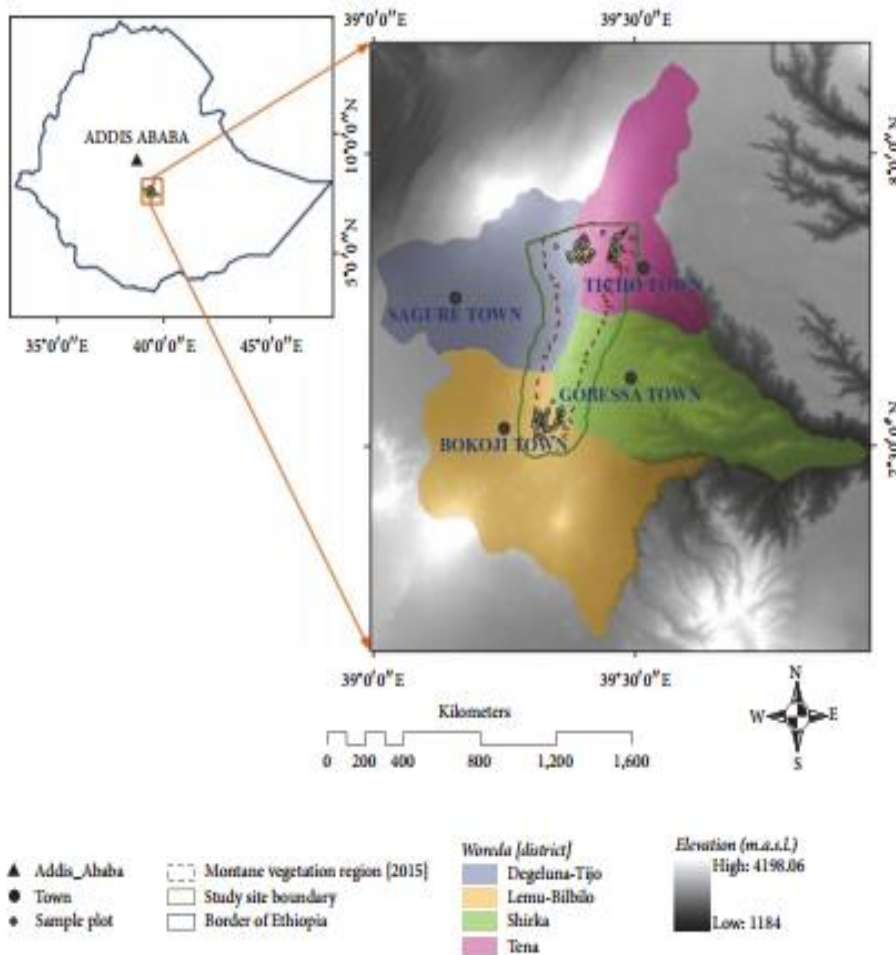
Figure 1 Location of the study map (Source: Zerihun Girma *et al*., 2018)

3.2 Research Design

To commence this research, mixed research approach i.e. qualitative and quantitative were used to provide more complete answer to research questions, to overcome the limitation arise due to employing single research approach (Kumar, 2005). Data were collected quantitatively and qualitatively from the sampled population of each district in which sample was drawn from local communities of the selected district. Cross-sectional and observational study which is suited to study the prevalence of a phenomenon, situation, problem and attitudes were employed.

3.3 Sampling Techniques and Sample Size

Galama Mountain is enclosed by four districts namely: Tena, Shirka, Lemu-Bilbilo and Degelu-Tijo. The Lemu-Bilbilo and Shirka district were purposely selected from the rest woreda because the two districts were at the opposite side of study area and threats on wildlife were intensive at these two districts. Therefore, the two districts were expected to be representative. Sample size determination is important to infer the results for the whole populations. Each respondent was selected randomly. The simplified formula for sample size is provided by Israel (1992) for 95% confidence level and 5% level of precision. In the same way, the sample size for this study is determined by using Israel formulae as follow:

$n = \frac{N}{1+N(e^2)}$, where, n is number of respondents drawn from total population; N is the target population size and e is the level of precision. From a total population of 52,818 in selected sites of districts the sample size was therefore calculated as 397. That is n = 52,818/1+52,818(0.05)^2 =397

For selection of informants from each Kebele, a proportional allocation formula was used (Kothari, 2004) and calculated as:

$$n = \frac{\text{Number of total population in each Kebele X Total sample size}}{\text{Total population of the study site}}$$

Accordingly, sample size for each kebele was determined in the following table.

Table 1 Total house hold and sample size per kebele in the study area

Name of kebele	Total HH	Sample size	Sex	
			Male	Female
Hella Waji Konne	9,638	72	54	18
Labuf Xijo	9,137	69	43	26
Hella Xijo Sero	9,963	75	46	29
Lemmo Michael	4,913	37	29	8
Ululle karra	12,822	96	72	24
Lemmo Dima	6,343	48	31	17
Total	**52,818**	**397**	**275**	**122**

NB: HH: House Holds

3.4 Data Collection Method

To achieve the objectives of the present study, three complementary data collection methods namely household survey, direct observation and focus group discussions were used during present study. The data were collected from August 2018 to February 2019. Secondary data, on the amount of crop obtained per hectare and price per kg were obtained from the district agricultural offices.

3.4.1 Questionnaire Survey

Questionnaire survey was used to acquire information on the various aspects of the study about the different variables with the question being both open and close ended. It helps to get information from respondents regarding socio-demographic data (such as age, sex and educational status), crops grown, damage caused to crops and livestock, species of wild animals responsible for damage, type of crop more damaged, type of crop raiding wild animals that causes more damaged, protection measures practiced, population tendency. The questionnaires questions were including a category with closed style items requiring the respondents to rank their rate of agreement with a particular item such as 'yes' or 'no'; 'increasing', 'decreasing' and 'no

estimation'; and a 5-point Likert scale (where 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; and 5=strongly agree) depending on a particular question.

3.4.2 Observation for identifying and describing conservation threats and challenges

Direct survey was another method used to collect primary data and carry out through systematic and purposeful observation. The observation was conducted in the selected sample Kebele of the district during the study. Recording of information about threats and conservation challenges was undertaken by using observation checklists. Digital photo camera was used to take the pictures of different threats and conservation challenges of wildlife in the observed area.

3.4.3 Focus Group Discussion

A focus group discussion (FGD) is a good way to gather together people from similar background or experiences to discuss on specific issue of interest. This method helps to acquire useful and detailed information. FGD was carried out to collect qualitative information from the selected Kebele. Focus groups provide insights into how people think and provide a deeper understanding of the phenomena or situations being studied. So, to have deep information about the conservation threats and challenges of wildlife in Galama Mountain three focus group discussions (students, farmers and government employees) were purposely selected. Discussions were made with randomly selected 5-12 respondent in each Kebele. The participants were selected purposively based on the responsibilities and experience they have and relevance to issues understudy.

3.4.4 Direct observation for estimating crop damage by wildlife

Agricultural crop losses due to crop raiding wild animals were achieved through direct and indirect methods (Madden, 2008). For direct observation on crop damage by wild animals, totally six study sites namely Hella Waji Konne, Labuf Xijo, Hella Xijo Sero, Lemo Michael, Uululle Karra and Lemo Dima were selected randomly and each has an area of 5,000 m2 covering cultivated land with equal distance from the mountain edge were selected randomly. Each study site was 0.5 km far from the mountain edge. The areas of the crops damaged by wild animals were measured following Rugunda (2004) method. After the yield obtained per one hectare was obtained from district agricultural office for each crop types, the amount of yield loss was estimated per hectare.

Some animals do not damage crops during the day time therefore, it requires using marks left by them such as dung, feeding, foot print diggings and other physical remains such as spines. Following the suggestions of Rugunda (2004) and Tweheyo *et al*. (2011), animal marks and signs were used to identify the type of crop raiding wild animals feeding on a particular crop. Local peoples and local farmers were useful in identifying the signs of crop raiding animals.

3.5   Data Analysis

The collected data was analyzed using the Statistical Package for Social Sciences (SPSS) version 22 Computer software program. The questionnaire was coded and run to SPSS. Chi-square test was used to see whether there is a significant difference among the knowledge of respondents about conservation threats and challenges of wildlife and sex, different age classes and educational background; distances of farm land and the extent of damage and traditional method used by respondents to defend wildlife. Descriptive statistics such as percentages and frequency were applied to organize, analyze and interpret the results. The data were also presented using tables, graphs and figures.

CHAPTER 4 RESULTS AND DISCUSSIO

4.1. Results

4.1.1. Background characteristics of the respondents in the study area

The general information about demographic data obtained from the respondents which includes gender, age, educational level, livelihood activities and marital status. The total number of the study subjects were 397. Out of them 275 (69.3%) were male and 122(30.7%) were female respondents.
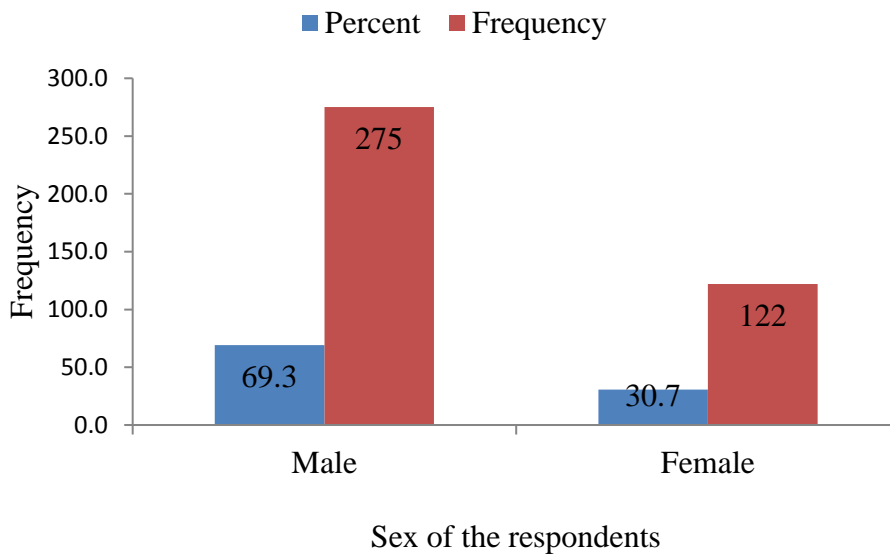
Figure 2 Sexes of the respondents by frequency and percent

The age of the respondents was ranges between 24 to 66 years. The mean age of the respondents was is 42.6297 indicating that the respondents are economically active population that best suited the problem under study. Even if the respondents were economically active population, the majority of the respondents (30%) were in the age category between 35 to 40 years followed by 41 to 46 years that accounts about 24.2%. In other ways about 54.2% (215) age was between 35 to 46 years (fig. 3).
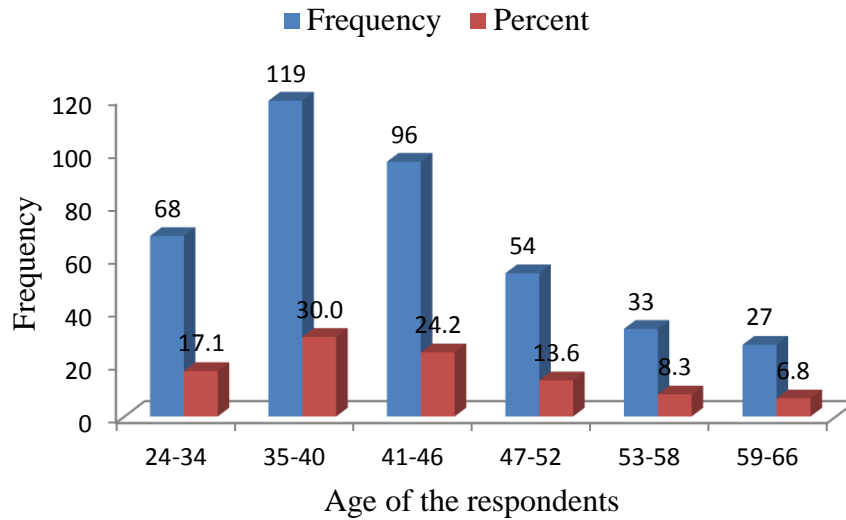
Figure 3 Age of the respondents in the study area

Regarding to the livelihoods of the respondents, most of the respondents were involved in mixed farming activities 305 (76.8%). About 46 (11.6%) of the respondents were engaged in crop production and other income whereas 27 (6.8%) and 19 (4.8%) of the respondents depends only on crop production and livestock farming, respectively as shown in the fig. 4.
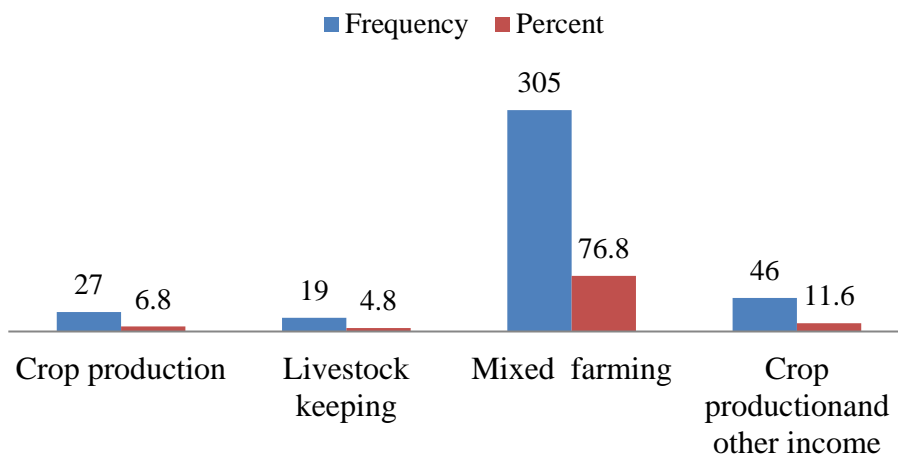
Figure 4 Livelihood Activities of the respondents

In the study areas, the majority of the respondents engaged in marriage which constitutes 283 (71.3%) of the total target respondents. Whereas 114 (28.7%) respondents were single (i.e. unmarried, widowed or divorced) who are not involved in marriage. In terms of sampled Kebele,

the larger number of married respondents were found in Ululle Karra, i.e., 67 followed by Hella Xijo Sero which is 57 were married (Table 2)

Table 2 Marital status of the respondents

Respondents Kebele	Marital status of the Respondents		Total
	Married	Unmarried	
Hella Waji Konne	49	23	72
Labuf Xijo	51	18	69
Hella Xijo Sero	57	18	75
Lemo Mikael	28	9	37
Ululle Karra	67	29	96
Lemo Dimo	31	17	48
Total	**283**	**114**	**397**

As respect to the educational status of the study subjects, among total number of respondents (397), about 67 (16.9%) of them were not read and write (illiterate) whereas 330 (83.1%) have formal or non-formal education (literate) but they read and write.
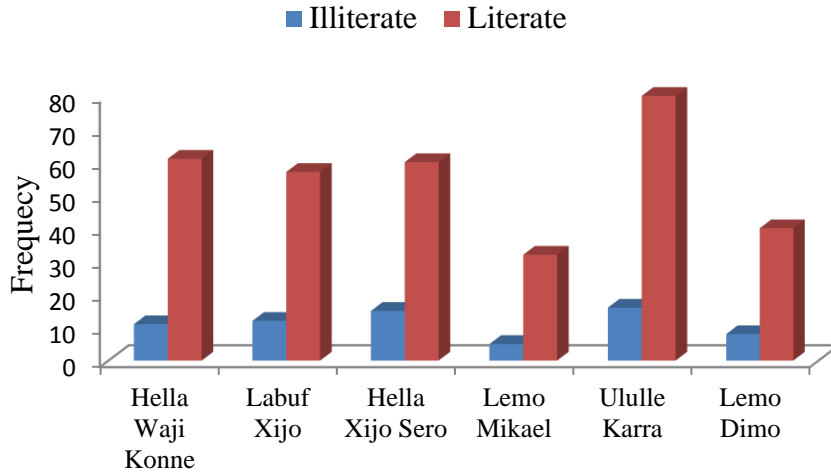
Educational background of respondents

Figure 5 Educational backgrounds of the respondents

The majority of the respondents 242 (61%) lived in the study areas for more than 25 years. About 80 (20.2%) of respondents lived between 16-25 years in the study areas. The rest 75 (18.8%) of the respondents lived in the study areas for less than 16 years. In general, about 322 (81.2%) of the respondents have been living in the study sites for more than 16 years. When the study sites were compared, the majority of the respondents lived in Ululle Karra Kebele for long time (fig. 6).
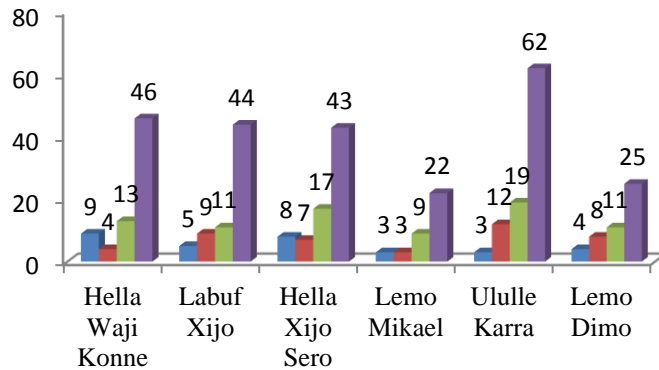
Respondents kebele

Figure 6 Duration of the respondents in the study area

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4.1.2. Respondents' knowledge on threats and conservation challenges of wildlife

The respondents were asked whether or not they knew the threats and conservation challenges of wildlife in their surrounding mountains. Accordingly, the majority of the respondents 356 (89.7%) knew threats and conservation challenges and few of respondents 41 (10.3%) have no information on these problems (Table 3).

Table 3 Knowledge of respondents on threats and conservation challenges

Did you know the threats and conservation challenges of wildlife?	No. of respondents	%
Yes	356	89.7
No	41	10.3
Total	397	100

Respondents who distinguish the threats and conservation challenges of wildlife were asked to point out their view based on Likert-scale (agree, strongly agree, neutral, disagree and strongly disagree) on each problems of wildlife. According to respondents who lived in the study area, the major threats and conservation challenges of wildlife were fire, habitat loss, fragmentation and degradation, expansion of agricultural practice, collection of fire wood/charcoal, over-grazing by free ranging livestock, human-wildlife conflict, lack of awareness, administration problem and lack of proper management of wildlife habitats (Table 4). The majority of the respondents (97.2%) were strongly agreed and agreed up on the effect of fire on wildlife. The other wildlife threats and conservation challenge was habitat loss, fragmentation and degradation. Accordingly, most (95.8%) of the respondents agreed and strongly agreed on it.

Table 4 Respondents agreement on threats of wildlife

Threats and conservation challenges of wildlife	Level of agreement									
	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
	F	%	F	%	F	%	F	%	F	%
Habitat loss, frag. and degradation	164	46.1	177	49.7	15	4.2	0	0	0	0
Agric. Practices	193	54.2	144	40.4	14	3.9	5	1.4	0	0
Pollution	14	3.9	60	16.9	6	1.7	209	58.7	67	18.8
Fire	151	42.4	195	54.8	10	2.8	0	0	0	0
Settlement	67	18.8	168	47.2	62	17.4	40	11.2	19	5.3
Overgrazing	156	43.8	153	43.0	29	8.1	18	5.1	0	0
HWC	129	36.2	180	50.6	26	7.3	15	4.2	6	1.7
Livestock Encroachment	129	36.2	186	52.2	28	7.9	8	2.2	5	1.4
Collection of fire wood/charcoal	128	36	197	55	23	6.5	6	1.7	2	0.6
Hunting	42	11.8	89	25.0	10	2.8	193	54.2	22	6.2
Invasive species	16	4.5	78	21.9	7	2	206	57.9	49	13.8
Over utilization of Resources	119	33.4	167	46.9	39	11	21	5.9	10	2.8
Invasive species	16	4.5	78	21.9	7	2	206	57.9	49	13.8
Adm. Problem	100	28.1	187	52.5	46	12.9	16	4.5	7	2
Lack of awareness	128	36	197	55	24	6.7	6	1.7	1	0.3
Lack of effective mgt.	160	44.9	157	44.1	28	7.9	8	2.2	3	0.8
Mean frequency	113.07		155.7		24.47		50.1		12.7	

Number of the respondents were strongly agreed and agreed that the expansion of agricultural practices (94.7%), settlement (66%), over grazing (86.6%), human wildlife conflict (86.6%), livestock encroachment (88.4%), collection of fire wood/charcoal production (91%), and over utilization of resources (80.3%) were the major threats of wildlife (Table 4). Whereas, out of total respondents, 60.4%, 77.5%, and 71.7% of respondents were replied disagree and strongly disagree to the threats and conservation problems of wildlife like hunting, pollution and invasive species respectively. Lack of awareness about wildlife (91%), lack of effective management (80.6%) and the administration problem (89%) including agricultural expansion, Human wildlife conflicts, unsustainable utilization of resources were the most conservation challenges which hamper wildlife the conservation in the study area. There was a significance difference (χ^2=13.276, df =5, p<0.05 (0.021) on the knowledge of wildlife problems in the study area among villages. Sex was not important in determining the knowledge of respondents on the threats and conservation challenges in the study area (χ^2= 0.251, df =1, p≥0.05 (0.617). There was no significance difference (χ^2=3.197, df =5, p≥0.05 (0.067) between respondent's knowledge on threats and conservation and different age classes in this research. Educated respondents had more understanding about threats and conservation challenges (χ^2 =12.660, df =1, p≤0.001).
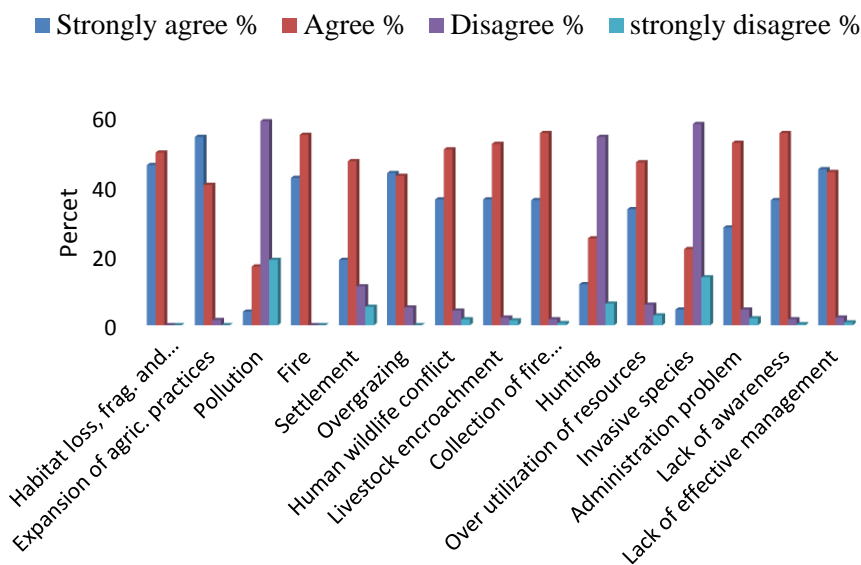
Figure 7 Threats and conservation challenges of wildlife

According to field observations the major threats and conservation challenges of wildlife in the study area were habitat loss, fragmentation and degradation, the expansion of agricultural practice, over grazing by free ranging livestock, illegal burning of charcoal, settlements, fire, human wildlife conflict due to its crop loss and livestock depredation, overutilization of resources, overgrazing. The findings of Focus Group Discussion revealed that wildlife in Galama Mountain were threatened due to different human caused conservation threats and challenges. The increment of human population, poverty, limited awareness of the local community about wildlife and their habitats, deforestation, and livestock encroachment were the main causes of wildlife conservation problems and challenged wildlife to survive in the study area. Also, the discussion with FGD showed that the causes of human wild animals' conflict were expansion of subsistence agriculture around mountain edge, wild animals habitat disturbance, over utilization of resources in the habitats, increment of human population, settlement, overgrazing by free ranging livestock.

4.1.3. Economic activity and vulnerability to human wildlife conflict

According to the response of the respondents, about the possession of own farmland in their study area, the majority of respondents were possessing their own farm land. Among these 344 (86.6%) reported that they have their own farmlands whereas 53 (13.4%) reported that they have no their own farmlands (Fig. 8). This research shows that respondents those who have not their own farm land cultivated crops by renting land or cooperating with others. From the total respondents 53 who did not have their own farm lands 14 (26.4%) cultivated crops by renting land whereas 39 (73.6%) was cultivating by cooperating with others.
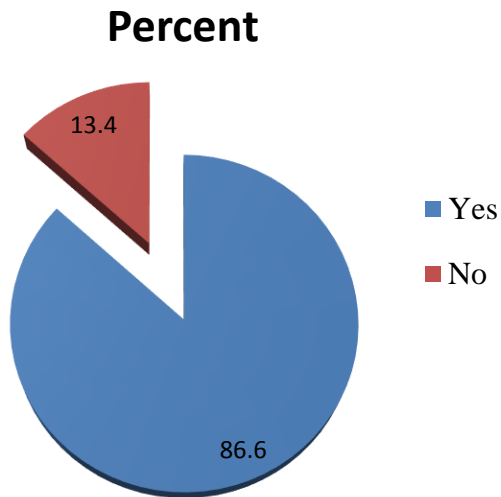
Percent

Figure 8 The percentage of farmland owned by respondents

As shown in fig. 9, that the respondents' own farmland with different size ranging from 0.5ha to more than 5ha. Accordingly, 154 (38.8%), 112 (28.2%), 58 (14.6%), 20(5%) of respondents owned farm land covering 1.1-2.99 ha, 3-4.99 ha, 0.5-1 ha and 5 ha and above farmland respectively.

Percent
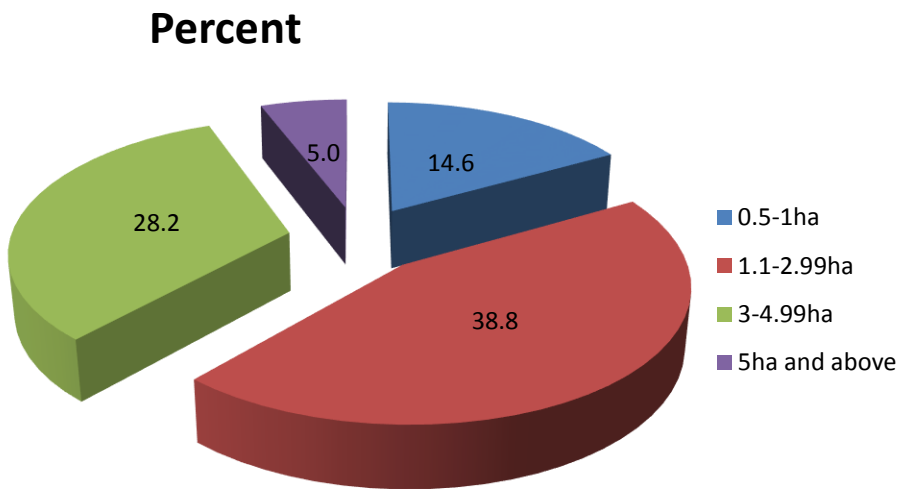
Figure 9 Size of farmland owned by respondents

On the bases of the respondent's response, the distance of their farmland to the mountain edge were 0-0.5 km (59.2%), 0.5-1 km (24.7%), 1-1.5 km (12.6%) and >1.5 km (3.5%) respectively.

The majority of respondent's farm land was not far from the mountain edge. This indicates that the damage of crop was the highest to those who live near to the mountains edge.
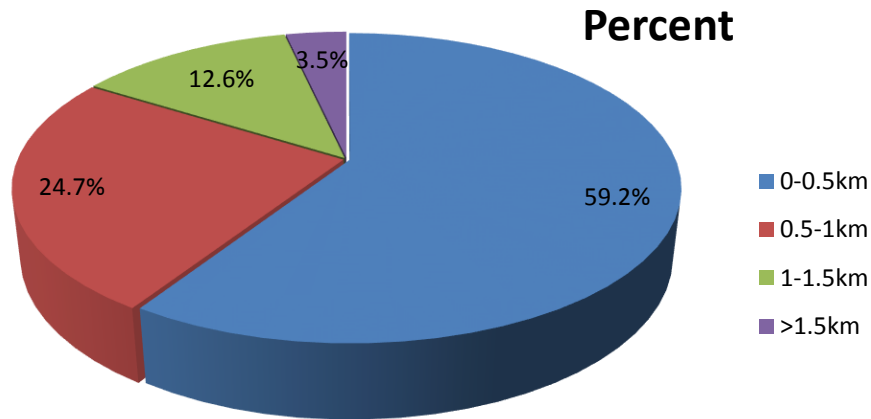
Figure 10 The distance of the farmland from the mountain edge

Depending on the respondent's response, most of the respondents encountered conflicts from wildlife in the study area (i.e. 88.4%) of them were encountered with conflicts; even though the majority of respondents' face conflicts certain respondents 11.6% did not encounter conflicts (fig. 11).
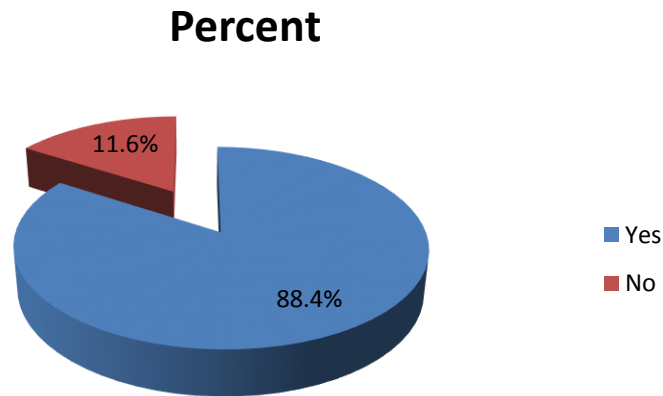
Figure 11 Percentages of the respondents encounter conflict

As the majority of the respondents 43.3% replied, they encountered with both crop damage and livestock loss whereas 26.2% were reported as they encountered with crop damage conflict only.

Others faced Livestock conflict only 18.9% and 11.6% of respondents did not encounter conflicts in the study area (fig.12).
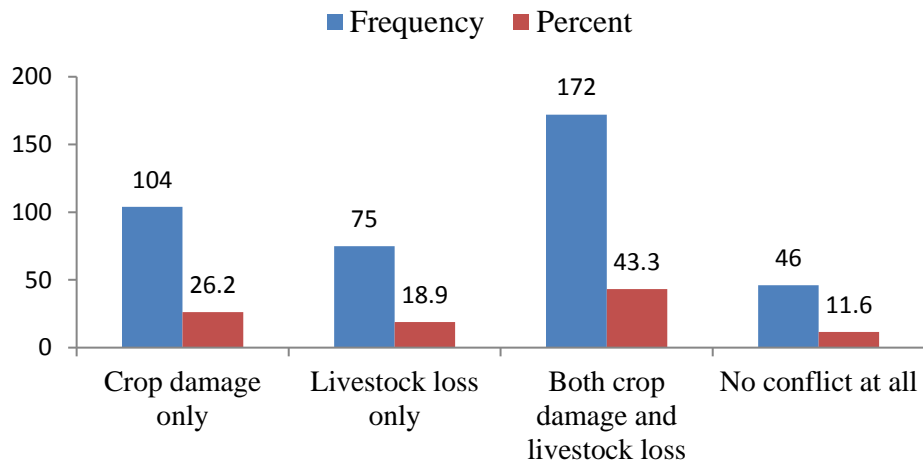
Figure 12 Types of conflict faced respondents

4.1.3.1. Types of crop production in the study area

As it was founded from the study, about 378 (95.2%) of the respondents grow crops on their farm land and 19 (4.8%) of them were not grow crops. Barely was the most cultivated crop in the study area more than any other crops. This shows that local communities mainly dependent on barley for their livelihood's activities in each study villages (Table 5). The highest number 194 (48.9%) of respondent's grow barley was found in Hella Waji Konne and Ululle karra kebele. This implies that any problem (damage) they faced on barley production will directly lead them into problems. The second principal crop produced in the study area was wheat as 27.7% of the respondents replied, which is important crops for food purposes. Bean and maize ranked third and fourth in production respectively; linseed, pea and tomato were the least produced in the study area respectively.

Table 5 Types of crop cultivated in the study area

Respondents	Types of crop cultivated							
Kebele	Barley	Wheat	Maize	Tomato	Linseed	Bean	Pea	Total
Hella Waji Konne	48	15	2	2	2	2	1	72

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Labuf Xijo	35	18	6	0	2	5	3	69
Hella Xijo Sero	22	31	6	0	7	8	1	75
Lemo Mikael	19	11	1	1	2	2	1	37
Ululle Karra	46	22	4	4	7	9	4	96
Lemo Dimo	24	13	4	0	2	2	3	48
Total	194	110	23	7	22	28	13	397

According to the response obtained from respondents; from the crops cultivated in the study area maize (22.7%) was the most affected one and ranked first. In the same way bean (16.9%) and wheat (15.6%) were the more affected crops next to maize ranked second and third respectively. But crops like tomato (15.4%), barley (14.9%) and pea (14.6%) were lesser affected as compared to the rest crops (Table 6). The crop damage faces at different stages of the growth. As shown in fig.12 the majority of the crops cultivated in the study area were exposed to damage at their early maturation and matured stage which accounted about 158 (39.8%) and 182 (45.8%) respectively. Other crops were damaged at their seedling 34(8.6%) and at all stages 23(5.8%). As the majority of the respondents replied most of the crops were affected at its maturity stages.

Table 6 More attached crop on the farm land

Crop type	Number	%	Rank
Maize	90	22.7	1.0
Barley	59	14.9	5.0
Tomato	61	15.4	4.0
Bean	67	16.9	2.0
Wheat	62	15.6	3.0
Pea	58	14.5	6.0
Total	397	100	21
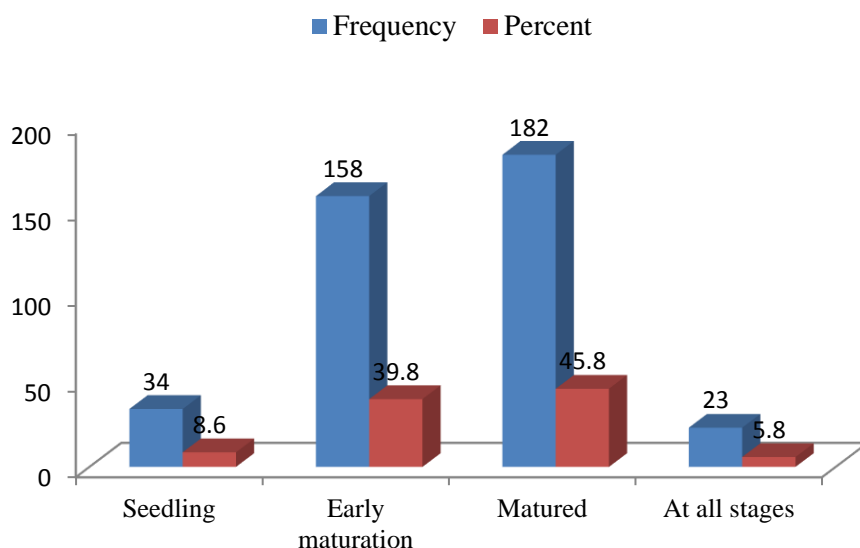
Figure 13 The stages of crop exposed to damage

Accordingly crops such as bean, maize, tomato and wheat were affected vastly at their maturity stages whereas barley and pea were attacked highly at their early maturity stages (Table 7). Regarding to the trend of crop damage the majority of respondents replied that the damage was increasing from time to time. Moreover, most of the respondents replied that the extent of crop damage by wildlife was high 159 (40.1%), medium 174 (43.8%) and 64 (16.1%) of the respondents considered the extent of crop damage by wildlife was low (Table 8). By using Chi-square to compare the data there was a significant difference (χ^2=88.846, df =6, p≤0.001) between village distance from the mountain and the extent of crop damage. As the distance of the farm land far from the mountain edge the crop damage was decreasing and vice versa. So, distance could be factor for crop damage.

Table 7 The stages of crop exposed to damage by crop types

The stage of crop attacked	More attacked crop						Total
	Maize	Barley	Tomato	Bean	Wheat	Pea	
Seedling	6	3	6	7	5	7	34
Early maturation	21	29	24	32	27	25	158
Matured	37	25	26	43	28	23	182
At all stages	6	2	5	5	2	3	23
Total	70	59	61	87	62	58	397

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Table 8 The percent of respondents about the extent of crop damage

	Level	Number	Percent
The extent of damage to the crop	High	159	40.1
	Medium	174	43.8
	Low	64	16.1
Total		397	100

Table 9 The extent of damage to the crop * Distance of farm land from mountain edge

The extent of damage to the crop	Distance of farm land from mountain edge				Total
	0-0.5km	0.5-1km	1-1.5km	>1.5km	
High	149	41	16	3	209
Medium	77	55	20	4	156
Low	9	2	14	7	32
Total	235	98	50	14	397

4.1.3.2. Common wildlife in the study area

As respondents revealed heyna 44 (11.1%), warthog 173 (43.6%), Jackal 32 (8.1%), porcupine 26 (6.5%) and antelops 122 (30.7%) were common wildlife occurred in the study area (fig.14). As 209 (52.6%) and 188 (47.4%) of respondents replied warthog and porcupine were the major crop raider in the study area respectively.

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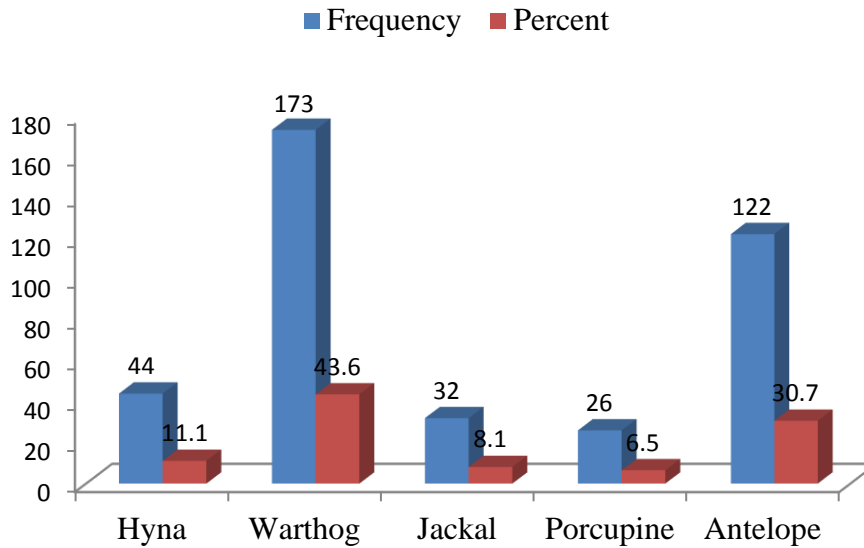
Figure 14 Common wildlife in the study area

4.1.3.3. Wildlife responsible for crop damage

According to the respondent's response indicated that two wild animals were identified from the study area namely warthogs and porcupines which were among the common wildlife in the study area and also, they were the more responsible wildlife for crop damage or loss in different degrees. Accordingly, the greater number 364 (91.7%) of respondents replied that warthog was the most responsible for crop damage and 33 (8.3%) of respondents replied that as porcupine was responsible for crop damage. Again about 390 (98.2%) of respondents said warthogs were cause crop damage during day time and 382 (96.2%) of respondents replied porcupine cause damage during night time.
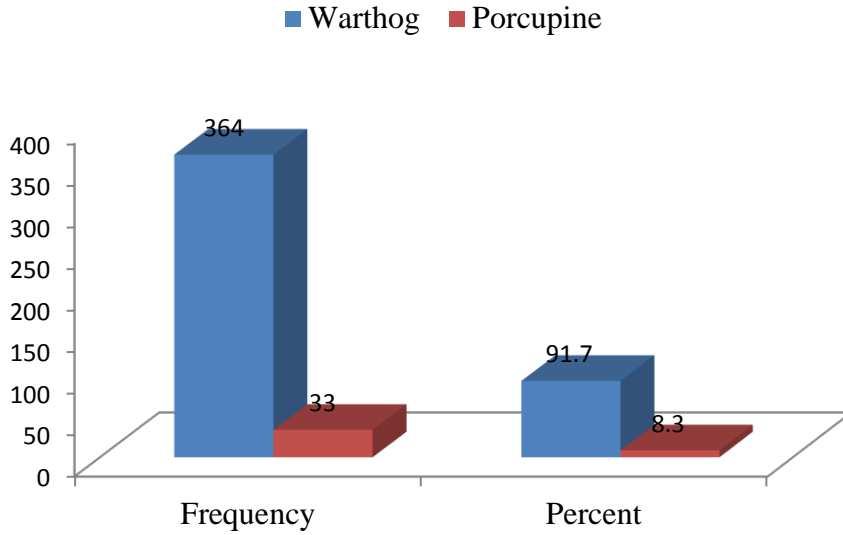
Figure 15 Responsible wild animals for crop damage

4.1.4. Estimated crop loss by wildlife animals

During the present study, different types of crops were grown in the study sites. But in terms of coverage on the farm land, barley, maize, wheat and bean were main cultivated in the study area respectively. In terms of area coverage barley covered $14,135m^2$ (47.12%), maize $8,450m^2$ (28.2%), wheat $4,035m^2$ (13.45%), and bean covered $3,380m^2$ (11.27%) of the of the total cultivated land $30,000m^2$ in all sites. Bean covered the smallest portion of cultivated lands $3,380m^2$ (11.27%) whereas barley covered the largest portion of the cultivated lands $14,135m^2$ (47.12%) in the study area.

Table 10 The extent of crop cultivated in sample site (m²)

Village	Crop cultivated in the area (in m²)			
	Barley	Maize	Wheat	Bean
Hella Waji Konne	2,310	1,200	790	700
Labuf Xijo	2,600	1,250	600	550
Hella Xijo Sero	2,225	1,300	865	610
Lemo Michael	2,050	1,700	500	750
Ululle Karra	2,500	1,550	550	400
Lemo Dima	2,450	1,450	730	370
Total	14,135	8,450	4,035	3,380

The damage extent of crop was varied depends on villages and crop types and even the animal that cause crop damage. From the total of 3,250m² damaged farm lands recorded during the time of direct observation of every damage event, 455m² was happened in Hella Waji Konne, 488m² in Labuf Xijo, 495m² in Hella Xijo Sero, 640m² in Lemo Michael, 548m² in Ululle Karra, 624m² takes place in Lemo Dima. The highest damage took place in Lemo Michael villages and when we compared the area of the crop damage area of the four types of crops the highest damage was on barley.

Table 11 Total damaged area (m²) recorded in four crop types

Villages	Extent of crop damage per unit area (in m²)				
	Barley	Maize	Wheat	Bean	Total
Hella Waji Konne	142	110	115	88	455
Labuf Xijo	105	154	164	65	488
Hella Xijo Sero	161	112	135	87	495
Lemo Mikael	212	183	140	105	640
Ululle Karra	222	105	119	102	548
Lemo Dima	280	123	132	89	624
Total	1,122	787	805	536	3,250

Out of total cultivated crops (3ha) in the study area about 0.325 ha was damaged. When we estimate the crop loss, it is calculated as; Total crop loss (Kg) = expected yield before crop raid – observed yield after crop raid.

Based on this formula the amount of crop loss in (Kg) as estimated through quadrat sample in fields of six randomly selected sites are summarized in the following table (Table 12).

Table 12 The expected amounts of crops in each sample site (Kg)

Crop types	Expected yield (in Kg)	Observed yield (in Kg)	Yield difference (in Kg)	Market value (birr/kg)	Annual monetary loss(birr/kg)
Barley	6,784.8	6,244.8	540	11	5,940
Maize	4,056	3,678	378	10.5	3,969
Wheat	1,936.8	1,547.8	389	13.5	5,251.5
Bean	1,622.4	1,362.4	260	15.5	4,030
Total	14,400	12,833	1,560		19,190.5

As calculated, from 14,135m^2 barley, 8,450m^2 maize, 4,035m^2 wheat and 3,380m^2 bean sample taken from farm land 6784.8kg barley, 4056kg maize, 1936.8kg wheat and 1622.4kg were expected respectively. As crops damaged in m^2 was compared for all sites no significant difference was found in the amount of crop lost between all site ($\chi2 = 181$, df =180, p = 0.465). The highest yield recorded was in barley while the lowest was on bean. Of all expected yield, 1560kg was lost by wild animals during the present study. The loss covers 10.9% of the total annual production of the sampled area of the four crops cultivated. In monetary term, the overall loss of farmers in the sampled area was estimated about 6,396.83ETB per hectare, which covered 3.8% of the monetary value of the annual production. The maximum loss was registered on barley crop which cover 31% of the total loss occurred.

4.1.5. Seasonal patterns of crop damage and trends of wildlife population in the study area

From the total respondents 320 (80.6%) revealed that crop damages were sever in dry season but 19.4% of respondents revealed crop damage was sever in wet season. As it was obtained from the

study wildlife population in the study area was decreased from time to time. As the trends of wildlife population in the study mountain indicate 336 (84.6%) of respondents said wildlife population in the study area was decreasing and 8(2%) of the respondents replied that wildlife population was increasing. However, 53(13.4%) of respondents reported they were not able to estimate the population either increasing or decreasing. There was no significant difference in trends of wildlife population among respondents (χ^2=3.729, df=10, p≥0.05 (0.959) (Table 12).

Table 13 Wildlife population trend in the study area

Respondents Kebele	The trends of wildlife population in the surrounding mountain			Total
	Increasing	Decreasing	No estimation	
Hella Waji Konne	2	61	9	72
Labuf Xijo	0	58	11	69
Hella Xijo Sero	1	64	10	75
Lemo Mikael	1	32	4	37
Ululle Karra	2	82	12	96
Lemo Dimo	2	39	7	48
Total	8	336	53	397

4.1.6. Traditional methods used by farmers to defend crop raiders from their crops

During the present study, respondents used different traditional control measure to defend crop raider from their crops. These methods include guarding, fencing, making scarecrow, fencing and guarding, and chasing. There was a significant difference between respondents (χ2=37.724, df =20, p<0.05 (0.01) in using different traditional methods. About 160 (40.3%) of respondents reported that they guard their crops during crop growing season, 152 (38.3%) of respondents were also defend crop raider by both fencing and guarding, 46 (11.6%) of the respondents used only fencing and 22 (5.5%) of the respondents chased by dogs or stones, and 17 (4.3%) of respondents were making scarecrow which was used as supplementary to defend the crop raiders from their

farm lands. Guarding was the most used and effective protective method to minimize the loss of their crops from crop raider followed by fencing and guarding (fig. 16).
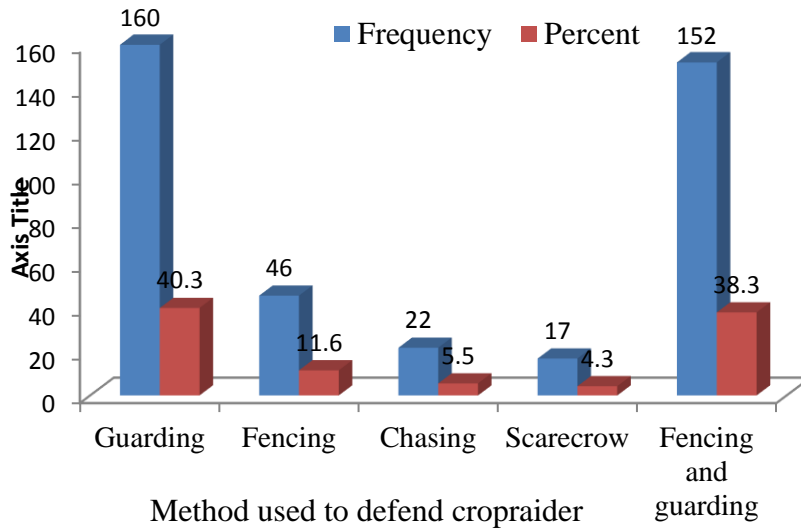
Figure 16 Traditional method used to defend crop raider

4.1.7. Livestock Depredation

Out of the total target sample population 318 (80.1%) have owned livestock and the rest 79 (19.9%) of the respondents have not owned livestock. The majority of respondents 57.9% said that livestock loss by carnivores was not as such a big problem in the study area. While 42.1% of the respondents were reported that livestock depredation was a problem in the study area. The most predators those hunt animals such as cattle, horse, donkey, goat and sheep during the present study were Hyena, Jackal and leopard. There was a significant different between (χ^2=21.782 df=8, p<0.05(0.005) more problematic wildlife and the more affected livestock. Based on respondent's response sheep were the most affected livestock. In another way Jackal was the most problematic wildlife in livestock predation (Table 14).

Table 14 Problematic wildlife in terms of livestock predation

More problematic wildlife in predation of livestock	More affected livestock by wildlife					Total	
	Cattle	Goat	Sheep	Horse	Donkey	Frequency	%
Hyena	11	3	105	26	14	159	40.1
Jackal	16	7	134	38	25	220	55.4
Leopard	4	3	11	0	0	18	4.5
Total	27	11	250	68	41	397	100

4.1.8. Wildlife animals killed during HWC and method used

Human wildlife conflict occurs when wildlife's requirements overlap with those of human populations, creating costs to residents and wild animals. On this basis the respondents were asked whether or not they have known wild animals harmed during the crop raiding and livestock depredation. Accordingly, the majority of the respondents 219 (55.2%) known wildlife killed during the damage whereas 178 (44.8%) of them were not. Residents were protecting their farms and livestock from any loss while the situation much of wildlife on the spot was killed and harmed; in a sense they were using different methods. Those methods include hunting, direct shooting, trapping, and poisoning. There was no a significant difference (χ^2 =12.823, df =16, p≥ 0.05(0.058) between wildlife killed during the crop loss and livestock depredation and the method used to kill them. The method used to kill wild animals was not selective rather any method used while the crop raider came to the farm land. The most used method by the local community was hunting 144 (36.3%). Also, direct shoot 107(27%), trapping 91(22.9%) and poisoning 50 (12.6%) was used but not as such used methods as compared to hunting.

Table 15 Wildlife killed during damage and method used

Method used to kill wildlife	Wildlife killed during damage					Total
	Jackal	Hyena	porcupine	Warthog	Leopard	
Hunting	84	6	22	32	0	144
Direct shoot	62	3	24	18	1	108
Trapping	52	4	16	19	0	91
Poisonings	25	1	11	12	0	49
Others	2	1	0	2	0	5
Total	225	15	73	83	1	397

4.1.9. Respondent's attitudes toward wildlife

Majority of respondents 217 (54.7%) replied they have negative attitudes toward wildlife in their surrounding mountains. Whereas out of total respondents 180 (45.3%) have positive attitudes toward wild animals in the study area. This indicates that the local communities have no enough knowledge on wild population values and importance.

4.2. Discussion

4.2.1. Threats and conservation challenges of wildlife

Historically throughout the African continent, wildlife populations have been rapidly declining due to logging, civil war, hunting, pollution, poaching and other human interferences. In the same way Ethiopian wildlife resources are declining by fast rate owing to various problems including habitat loss, fragmentation and degradation, agricultural expansion, human induced fire, poverty, over growth of population, lack of awareness, management problems and any others anthropogenic activities. Also, it is obvious that in Arsi Mountain National Park wildlife animals are decreasing from time to time due to habitat degradation, agricultural expansion, human induced fire and other related human activities (personal view). As identified by respondents in the study area, wildlife threats and conservation challenges were habitat loss, fragmentation and degradation, fire, expansion of agricultural practices, settlement, over grazing, human wildlife conflict, livestock encroachment, collection of fire wood/charcoal production, over utilization of resources, lack of awareness, lack of effective management and administration problems.

In Galama Mountain, demographic features and social changes places more people in direct contact with wildlife. As there were human population increment in and around the protected area it starts to create pressure on wildlife in the area by degrading species habitat and fragmenting through expanding agricultural practices. Habitat refers to an area with the resources and conditions present to provide occupancy by a given organism. These resources and conditions include food, water, cover and any special factors needed by a species for survival and reproductive success. So, as habitat of wildlife was lost, fragmented and decreased in its quality, wildlife lacking all mentioned resources and conditions and begins to decline and threatened. Similarly, Alemneh Amare (2015a) reported that many wildlife areas in Ethiopia are threatened due to over increasing population, habitat loss and degradation. Habitat degradation, fragmentation and loss affect the survival of wildlife populations through reducing the number of available habitats, reducing habitat quality, and creating edge effects (Evanglista, 2007; Anagaw Atickem *et al.,* 2011 and Anagaw Atickem and Loes, 2014).

Also, as the results of this research were indicated; habitat loss, fragmentation and degradation were the major threats to wildlife in the study area as 89.9% of respondents reported. 90.4% of

respondents said, human induced fire was the most and recurrent threats to wild animals in Galama Mountain. It was caused by herdsman who keeps cattle in the mountain and people who burn charcoal in mountain. At a time, fire destroyed a heap of resources and wildlife habitats since it is difficult to control automatically due to lack of modern fire extinguisher in the study area. The findings of the present study were in line with the findings of Kassegn Berhanu and Endalkachew Teshome (2018) who have stated fire as critical factor that devastates wildlife resources, once it is intense, it is difficult to extinguish manually since there are no modern fire extinguishers.

Most of the respondents agreed that human wildlife conflict was the main threats and conservation challenges of wildlife. Human-wildlife conflict is a major concern of most people living next to protected areas in developing countries due to their subsistent live (Alemneh Amare, 2015b). It occurs when the needs of human and wildlife overlap. Human wildlife conflict involves the raiding of crops or livestock loss by large animals and the retaliation by local peoples, who may encourage or engage in the killing of problematic wild animals. Human settlement took places in adjacent areas of the mountain. Following this there has been agricultural expansion towards the mountain edge and demand for grazing land and there was also need for livestock encroachment. The findings of the present study were consistent with the findings of Kassegn Berhanu and Endalkachew Teshome (2018) conducted in Alatish National Park, Northwest Shoa. As Mesele Yihune *et al*. (2008) have described, as Ethiopia's population increases, there is an increasing demand for space and resource utilization and effects on wild animal's habitat. In the same situation the wildlife resources in study area were decreased and challenging the conservation of wildlife as a result of over utilization of resources. This is because, the increasing demands for the basic needs to survive resulted in over utilization of resources in the mountain which influences wildlife and this harms their habitats.

Over grazing by livestock in the study area cause competition between wildlife those feeds on grass which directly affects wildlife survivals. Similarly, Sefi Mokonin *et al.* (2017) have reported that there was over grazing by livestock from nearby villages in Harena Forest. Over grazing harms, the quality of natural pasture and soil properties and also it causes soil erosion. According to Seth *et al.* (2017) livestock grazing affects over 60% of the world agricultural lands and influence ecosystem services and the quantity and quality of wildlife habitat, resulting in changes in biodiversity. Hunting is one of the threats of wildlife and it was purposeful activities of local

community for obtain their foods. However, 60.4% of respondents said hunting was not serious problem to wildlife in Galama Mountain. The results of this research contradicted with the findings of Kassegn Berhanu and Endalkachew Teshome (2018) who reported as 53.56% of the respondents were strongly in agreement and the rest were in the category 'agree' about illegal hunting in the Alatish National Park. This is because of the local communities in the present study area were not depends on wildlife for collecting their foods rather they depended on the other sources of foods like cultivation of cereals, vegetable and animal production. Fire wood collection/Charcoal production is one of the traditional fuels in Ethiopia. Charcoal production is the main economic activity (Dawit Diriba, 2012) and an important source of energy in developing country including Ethiopia (Solomon Chanie and Dereje Tesfaye, 2015). Beside its uses it affects wildlife population adversely and it is challenging for wildlife conservation. The same way in Galama Mountain the collection of fire wood/charcoal burning was the major threats to wildlife. Illegal charcoal burning and fire wood collection were some major causes of deforestation that might be directly influenced wildlife's habitat (Sefi Mokonin *et al.,* 2017) which is agreed with the present study. Invasive species is a global problem, where exotic species competes for resources and habitat, altering the physical environment in a way that sometimes causes competitive exclusion of native species with great economic and ecological consequences (Firew Bekele and Solomon Estifanos, 2018). The finding of this research is not in agreement with above findings due to that the alien species were not this much constraint to wildlife animals in the study area than the other threats and conservation challenges.

Awareness of local community settled in and around habitat of wildlife is essential in conservation and management of wildlife resources and their habitats. According to Temesgen Gashaw (2015), awareness creation should be the first action for any protected area conservation. This means the local communities should be aware of the environmental, social and economic importance of these areas before and after their establishment (Anteneh Gezahegn *et al.,* 2014). However, the national parks in Ethiopia are facing problems due to the reason that the society settled around the parks has low awareness (Sewunet Tesfaye, 2017). Limited awareness of the community about the importance of national parks is also a problem that affects the eastern Ethiopian protected areas (Mengistu Wale *et al.,* 2017) which is consistent with the present study. The lack of awareness about the wildlife is also the major conservation challenges of wildlife in the study area. Administrations at every level of regional or zonal and the district administration offices have a

responsibility in management and conservation of wildlife resources. However, administration problem and lack of effective management in the study area was the major conservation problems to wildlife resources and their habitats. An effective management practice of wildlife and their habitat resources is an essential conservation approaches to halt wildlife disturbance and loss. The results of this study were in agreement with (Alemneh Amare, 2015a) who reported that the district and zone administrator provided less attention to biodiversity conservation and provided only a limited budget and infrastructure for protected areas.

4.2.2. Human wildlife conflicts

Human-wildlife conflict is interactions between human and wildlife where negative consequence whether perceived or real, exist for one or both parties and occurred when the needs of humans and wild life is overlapping (Decker *et al.,* 2002). In many parts of Africa, the conflict between local people and wildlife is the most serious problem, if they are adjacent to nature reserves (Newmark *et al.,* 1994). As human population expanded and habitats of wildlife shrinks by local communities and wildlife are increasingly come into conflict over living space, food, shelter and other important resources. The results of this study have shown that there was a strong conflict exists between humans living around the Galama Mountain. Based on respondent's list five common wild animals namely hyena, warthog, Jackal, porcupine and antelope were identified in the study area. Warthog and porcupine were well known pest animals in the Galama Mountain. Warthog was identified as the major responsible pest animals for crop damage both during the day time and night time whereas porcupine was lesser responsible for crop loss and attacks farms during the night time. The conflict between wild animals and communities around Galama Mountain involved both in crop raiding and livestock predation of conflicts. This investigation improves the findings of Sullivan and Messmer (2003) who were reported human-wildlife conflicts have been increasing dramatically in recent years. This is because of human population increment and as a result agricultural activity expanded which goes to disrupt the habitat of wildlife. As most of the respondents (43.3%) reported that both crop damage and livestock loss conflict was higher than that of only crop damage (26.2%) and livestock loss (18.9%). Similar findings were observed from the study conducted in Tanzania by Joseline (2010) and in Ghana by Edward (2012) on the conflict between farmers and wildlife and Asebe Regasa (2017) who

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reported human-wildlife conflict with special emphasis on pest primates in and around Chato forest in western Ethiopia.

Different crops were cultivated in the study area including barley, maize, tomato, bean, wheat and pea. But all crops were not affected in the same way by crop raiders. Maize was the most susceptible crop to crop raiders, because it was easy to handle the cobs of the maize than other crops. Hence it was the most preferable crop by wild animals in the mountain. The study was agreed with the finding of Warren (2008) who reported the maize was the most frequently consumed crop by crop raiding in West Africa. Also, the present study was confirming the findings of Habtamu Dabalke (2016); Gizachew Girma (2016) and Asebe Regasa (2017), who were reported that as the maize was the most vulnerable crop to crop raider. Here in the present study the same thing was true in which maize was highly preferred by wild animals in the study area. Many crops are damaged by crop raiders at specific stage of development, for instance at seedling, early maturation, matured stage and also affected at all stages. As regard to the variation of damage in the developmental stages of maize, bean, wheat and tomato; the greater damage was recorded during their matured stage whereas barley and pea were more attacked at their early maturity development stage. This result was in agreement with the finding of Warren (2008) who reported that during seedling stage the farm land was clear and the guard can control the pest easily by watching them from farm distance in Nigeria.

The extent of crop damage by crop raider was increase as the distances between the farm land and the mountain edge increases. In a sense the extent of damage and distances of the farm land was inversely related. Similar findings were observed in the study of (Hill, 2000); Leta Gobosho *et al*. (2014) and Gizachew Girma (2016) whereas disagreed with the findings of (Gibbi, 2012) who reported farms far from the forest edge was affected more by elephants than the nearest one in south Indian reserve. As the present study revealed that the damage by pest wild animal in the study area was high during dry season than the wet season because the mountain was provided with grasses and other natural sources of foods during wet season but in dry season there was a scarcity of food sources in the mountain. This result was contradicted with the study conducted by Mesele Yihune (2007) who reported that more pest primate population was recorded during the wet season than the dry season in Wonji Shoa. As the trends of wildlife population in the study mountain indicates the wildlife in the study area was decreasing from time to time. This result was

in agreement with the findings of Sefi Mokonin *et al. (*2017) who reported as the majority of respondents (86.5%) acknowledged the status wildlife in Harena Forest were decreasing.

In the present study the livestock depredation in the study village was not a big problem as a larger number of 57.9% respondents replied. Even though, there were carnivores in the study area but there was no overblown damaged to livestock by wild animals in the study area. This is because most of the respondents in the study area secured their livestock every time. This result was in agreement with the findings of Habtamu Debalke (2016) who reported that 87% of respondents were said livestock depredation is not serious problem in the Gimbo wereda, Kafa Zone. Sheep were the most affected by jackal and hyena in the study area followed by horse and donkey. Goat and cattle were not affected like other livestock in the present research. A leopard had no much problem like hyena and jackal but sometimes tries to attack sheep, cattle and goat (Table 4.14).

 In the present study respondents were used different methods to defend crop raiders from their crops (guarding, fencing, chasing, scarecrow and both fencing and guarding). Most respondents used guarding and both fencing and guarding to repeal crop raider. Fencing also used as the third important method whereas chasing and scarecrow used as supplementary methods respectively. This result agrees with findings of Leta Gobosho *et al.* (2014) who found that guarding the farm land was the most important method used by the local peoples to protect the crop raider from their farms. During crop loss and livestock predation there was also a loss of wildlife by the local peoples on their farms by using different methods including hunting, direct shooting, trapping and poisoning. Hunting and direct shooting was the most used methods respectively in addition with trapping and poisoning. This research investigated that the majority of local communities have a negative attitude toward wildlife. This was because of wildlife causes damage to crops and livestock of the local peoples. The findings of the study were in agreement with the Gizachew Girma (2016) who report that as the greater of respondents have a negative and certain respondent have positive attitudes toward wild animals in Chebera Churchura National Park. This was because of the wild animal has damaging the crops on the continuous bases and there was no compensation way for the damage occurred. Hence, the results of the study tell us the local communities understand the wildlife as enemies to their well-being. Also, the findings of this study agreed with the findings of Hill (2002), the costs of destruction more often exceeded the benefit to community neighboring the park.

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS

5.1.   Conclusion

The study showed that Galama Mountain is indeed rich in wildlife resources and variety of geographical feature. It is therefore an ideal place for wildlife conservation, tourism development, scientific research, educational and recreational purposes. In conclusion, the present study revealed that wildlife in the study area were strongly challenged to survive as the condition they need by nature is changed. This is due to that wildlife of the study area were influenced by different human activities. This is not only the case for Galama Mountain but also, the major concerns for Ethiopian wildlife resources.

 The threats and conservation challenges of wildlife resources identified in the Galama Mountain were habitat loss, fragmentation and degradation, fire, overgrazing, agricultural expansion, human wildlife conflict, settlement, livestock encroachment, collection of fire wood/charcoal, unsustainable utilization of mountain resources, limited awareness of local people about wildlife, administration problem, and lack of effective managements along with little effects of hunting, pollution and invasive species to wildlife in the study area.

Human wildlife conflicts take place when there is the interaction between human and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment. Crop grown in the study area includes barley, wheat, maize, bean, linseed and pea. Barley covers a larger area and maize was the most affected crops by crop raider. Crop damage was a big problem to the local peoples and livestock depredation was not as such serious problems in the study area.

5.2.   Recommendations

Based on the findings of the present study, the following recommendations can be made to minimize the wildlife threats and conservation challenges in the study area.

- For sustainable utilization of wildlife resources, the concerning bodies at every level should have a responsible to minimize threats and conservation challenges of wildlife.
- Awareness raising for any concerned sector and local communities must be strengthen. The educated local community settled in and around the mountain are not trouble wildlife and not over use the resources of the habitat, even they use sustainably. This is because the community should be aware about wildlife values and their habitats significances.
- Pausing the illegal settlements with in the habitat of wildlife is integral part of wildlife resource conservation.
- Creating the effective management for wildlife in the study area should be encouraged.
- Community based conservation approach should be strengthened. This means giving the responsibility of conservation for local community. This leads the community the sense of owner ship. So, residents will use the resources in a sustainable way.

As the present study was indicated human wildlife conflict was the major conservation problems in the study area. So, based on the findings regarding HWC the following recommendations can be made to minimize the human wildlife conflict in the study mountain.

- To minimize HWC, reducing the dependency of local peoples on the mountains resource. When local community depends on the resources of the mountain there will be over utilization of resources. Hence, the overlap of human and wildlife requirements leads the conflict between human and wildlife.
- Palatable crops grown near the edge of mountain is not recommended because they are exposed to damage easily because such crops are highly preferable by many of wildlife.
- As much as possible the farmers should be defending their farm lands from crop raiders by using different traditional method which help them to reduce a big loss.
- The cooperation of farmers in protecting their farm is not promoting wildlife to raid farms in simple way.

CHAPTER 6 REFERENCES

Alemneh Amare. 2015a. Conservation Challenges of Gibe Sheleko National Park, Southwestern Ethiopia. *Natural Resources* **6**, 286-289.

Alemneh Amare. 2015b. Wildlife Resources of Ethiopia: Opportunities, Challenges and Future Directions: From Ecotourism Perspective: A Review Paper. *Natural Resource*. **6**:405-422.

Anagaw Atickem and L. E. Loe. 2014. Livestock-wildlife conflicts in the Ethiopian highlands: Assessing the dietary and spatial overlap between mountain Nyala and cattle. *African Journal of Ecology*, vol.**52**, no.3, pp.343–351.

Anagaw Atickem, L. E. Loe, O. Langangen, E. K. Rueness, and N. C. Stenseth. 2011. Estimating population size and habitat suitability for mountain Nyla in areas with different protection status. Animal Conservation, vol. **14**, no. 4, pp. 409–418.

Anderson Stanley H. 2002. Managing our wildlife resources; 4th edition, Wyoming Cooperative Fish and Wildlife Research Unit University of Wyoming.

Anteneh Gezahegn, Melaku Bekele, and Teshale Woldeamanuel. 2014. Natural resource use conflict in Bale Mountains National Park, Southeast Ethiopia. International Journal of Biodiversity and Conservation, **6**(12), 814-822.

Anthony R. E. Sinclair, John M. Fryxell and Graeme Caughley. 2006. Wildlife Ecology, Conservation, and Management (2ndedition). Biodiversity Research Centre, University of British Columbia, Vancouver, Canada

Arsi Zone Planning and Economic Development Office and Arsi Bale Rural Development Project. 2004. In Atlas of Arsi Zone, Asella, Ethiopia.

Asebe Regasa Workineh. 2017. Human-wildlife conflict with special emphasis on pest primates in and around Chato forest, Horro woreda, Western Ethiopia

Bhavana H. 2015. Human Wildlife Conflict: Need for Calm Coexistence, Parisara Envis Newsletter Issue 37, July-September 2015

Bulte E. H., van Kooten G. C., Swanson T. 2003. Economic Incentives and Wildlife Conservation.

Cardillo M., Purvis A., Sechrest W., Gittleman J. L., Bielby J. and Mace G.M. 2004. Human Population Density and Extinction Risk in the World's Carnivores. *Journal of Primate Biology* **2**(7):909-914.

Conover M. R., W. C. Pitt, K. K. Kessler, T. J. Dubow, and W. A. Sanborn. 1995. Review of human injuries, illnesses and economic losses caused by wildlife in the United States. Wildlife Society Bulletin **23**:407-414.

Daszak P, Cunningham A. A, Hyatt A. D. 2000. Emerging infectious diseases of wildlife Threats to biodiversity and human health Science **287**:443-449.

Davidson Eric A., de Araujo, Alessandro C., Artaxo Paulo; Balch, Jennifer K., Brown I. Foster; Bustamente, Mercedes M. C.; Coe Michael T.; DeFriess Ruth S.; Keller Michael; Longo, Marcos; Munger J. William; Schroeder Wilfrid; Soares-Filho, Britaldo S.; Souza, Jr., Carlos M.; Wofsy Steven C. 2012. The Amazon Basin transition. 481: 321-328.

Dawit Dirriba Guta. 2012. Assessment of biomass fuel resource potential and utilization in Ethiopia: Sourcing strategies for renewable energies. *International Journal of Renewable Energy Research*, **2**(1), 131-139.

De Silva S. 2016. Need for longitudinal studies of Asian wildlife in the face of crises. Global Ecology and Conservation. **6**:276-285.

Debinski D. M. and Holt, R.D. 2000. A survey and overview of habitat fragmentation experiments. Conservation Biology,**14**:342–355.

Decker D. J., T. B. Lauber and W. F. Siemer. 2002. Human-wildlife conflict management: A practitioner's guide. Northeastern Wildlife Damage, Management Research and Outreach Cooperative, Ithaca, New York, USA.

Demel Teketay. 1992. Human impact on a natural montane forest in southeastern Ethiopia, Mountain Research and Development, vol. **12**(4): 393–400.

Dickman A. 2010. Complexities of conflict: the importance of considering social factors for effectively resolving human-wildlife conflict. Animal Conservation. **13**:458-456.

Dimobe K, Ouédraogo A, Soma S, Goetze D, Porembski S, Thiombiano A. 2015. Identification of driving factors of land degradation and deforestation in the Wildlife Reserve of Bontioli (Burkina Faso, West Africa). Global Ecology and Conservation. **4**:559-571.

Donald P. F., and Evans, A. D. 2006. Habitat connectivity and matrix restoration: the wider implications of agri-environment schemes. *Journal of Applied Ecology* **43**:209–218.

Dudley N. (Editor). 2008. Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. 86pp.

Edward D. W and Frank, S. A. 2012. Victims perspectives of Lowes' Monkeys' (Cercopithecus campbelli lowei) crop raiding events in Ghana: A case of Boabeng-Fiema Monkey Sancturey. *Jornal of Biodiversity and Environmental Science* (JBES), ISSN:2220-6663 (print)2222-3045 (Online)Vol. **2**, P.1-8.

Edwards DP, Larsen TH, Docherty TD, Ansell FA, Hsu WW, Derhe MA. 2011. Degraded lands worth protecting: the biological importance of Southeast Asia's repeatedly logged forests. Proceedings of the Royal Society of London B: Biological Sciences. **278**(1702):82-90.

Eniang E., Ijeomah, H.M., Okeyoyin, G and Uwatt, A. E. 2011. Assessment of human wildlife conflict in Filinga of Gashaka Gumti National Park, Nigeria.

Ethiopian Biodiversity Institute. 2014. The Fifth Ethiopia's National Report to the Convention on Biological Diversity. Addis Ababa, Ethiopia. Pp. 18-23.

Ethiopian National Meteorological Agency. 2015. Meteorological data: Addis Ababa, Ethiopia.

Evangelista P., Swartzinski P. and Waltermire R. 2007. A Profile of the Mountain Nyala (*Tragelaphus buxtoni*).

Fahrig L. 2003. Effects of habitat fragmentation on biodiversity. Annual Review of Ecology, Evolution, and Systematics **34**: 487–515.

Fearnside P. M. 2007. Brazil's Cuiaba-Santarem (BR0163) highway: The environmental cost of paving a soybean corridor through the amazon. *Environmental Management* **39**: 601-614.

Firew Bekele and Solomon Estifanos. 2018. Challenges to National Park Conservation and Management in Ethiopia. *Journal of Agricultural Science*; Vol. **10**, No. 5; 2018 ISSN 1916-9752 E-ISSN 1916-9760

Food and Agriculture Organization. 2010b. The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture, Rome.

Gibbi S. 2012. Patterns and correlates of human–Elephant conflict around a south Indian reserve. *Biological Conservation*; doi: 10.1016/j.biocon. 2012.01.046.

Gizachew Girma. 2016. Human Wildlife Conflict and Its Implication for Conservation around Chebera Churchura National Park, Konta Special District in Southern Nations Nationalities and Peoples Region (SNNPR), Southern Ethiopia.

Habtamu Dabalke. 2016. Assessment of Human-Wildlife Conflict in Gimbo Woreda, Kafa Zone Southern Nations Nationalities and Peoples Region (SNNPR), MSc thesis Ethiopia

Hill M. 20002. Crop raiding by wild animals: The farmer's perspective in an agricultural community in western Uganda. *International Journal Pest Management* 43:77-84.

Hill M. C. 2000. Conflict of Interest between People and Baboons: Crop Raiding in Uganda. *International Journal of Primatology*, **21** (2): 23-39.

Hill M. C. 20002. Crop raiding by wild animals: The farmer's perspective in an agricultural community in western Uganda. *International Journal Pest Management* **43**:77-84.

Hillman J. C. 1993. Compendium of Wildlife Conservation Information. Volume I, NYZS and EWCO, Addis Ababa, Ethiopia.

Ho S. S, Brossard D., Scheufele D. A. 2007). Public reactions to global health threats and infectious diseases. Public Opinion Quarter, **71**:671-692.

Hobbs, R.J. 2001. Synergisms among habitat fragmentation, livestock grazing and biotic invasions in Southwestern Australia.; *Conservation Biology* **15**:1522–1528.

Imbeau L. and Desroches A. 2002. Area sensitivity and edge avoidance: the case of the Three Toed Woodpecker (*Picoides tridactylus*) in a managed forest. *Forest Ecology and Management* **164**:249–256.

Inskip C., Zimmernna. 2009. Human wildlife conflict; Areviw of patterns and prievities world wiae.wryx: 18-34

Israel G. D. 1992. Determining Sample Size; Fact Sheet PEOD-6: University of Florida.

Jafari R. Kideghesho, Julius W. Nyahongo, Shombe N. Hassan, Thadeo C.Tarimo and Nsajigwa E.. Mbije. 2006. Factors and Ecological Impacts of Wildlife Habitat Destruction in Serengeti Ecosystem in Northern Tanzania. Volume **11** pp. 917-32.

Joseline M. 2010. The impact of crop raiding by wild animals from Bugoma forest reserve on farmers' livelihoods.

Kassahun Abie and Afework Bekele. 2016. Threats to Gelada Baboon (*Theropithecus gelada*) around Debre Libanos, Northwest Shewa Zone, Ethiopia. *International Journal of Biodiversity*, Volume 2016, Article ID 3405717,7 pages http://dx.doi.org/10.1155/2016/3405717

Kassegn Berhanu and Endalkachew Teshome. 2018. Opportunities and Challenges for Wildlife Conservation: The Case of Alatish National Park, Northwest Ethiopia. African Journal of Hospitality, Tourism and Leisure, Volume **7** (1) - (2018) ISSN: 2223-814X

Kothari C. 2004. Research Methodology: methods and techniques, second revised edition, New Age International (P) Ltd., publishers, New Delhi, India.

Krausman P. R., and Harris L. K. 2011. Cumulative Effects in Wildlife Management: Impact Mitigation. CRC Press: 94.

Kumar H. 2012. Human-wildlife conflict in a degraded habitat of Lower Chambal Valley. *Asian Journal of Research in Social Science and Humanities*, **2**(4):1-13

Kumar R. 2005. Research methodology: A step by –step Guide for Beginners (2nd ed.), Singapore, Pearson publication.

Lamarque F., Anderson, J., Fergusson, R., Lagrange, M., Osei Owusu, Y and Bakker, L. 2009. Human wildlife conflict in Africa cause, consequences and management strategies.

Laurance W. F., Goosem M., Laurance S.G. 2009. Impacts of roads and linear clearings on tropical forests. *Trends in Ecology and Evolution* **24**: 659-669.

Laurance W. F., Lovejoy T. E., Vasconcelos, H. L *et al*. 2002. Ecosystem decay of Amazonian forest fragments: a 22-year investigation. *Conservation Biology,* **16**:605– 618.

Laurance, W. F. and Cochrane M.A. 2001. Synergistic effects in fragmented landscapes; *Conservation Biology* **15**:1488–1489.

Leadley P. H. M. 2010. Biodiversity Scenarios: Projections of 21st Century Change in Biodiversity and Associated Ecosystem Services. Montreal. Convention on Biological Diversity Technical Series No. 50. Montreal: Conservation of Biodiversity; Pereira.

Leta Gobosho, Debela Hunde Feyssa, Tariku Mekonnen Gutema. 2014. Identification of Crop Raiding Species and the Status of Their Impact on Farmer Resources in Gera, Southwestern Ethiopia: *International Journal of Sciences*: Basic and Applied Research (IJSBAR) (2015) Volume **22**, No 2, pp 66-82.

Lisa Naughton Treves, Margaret Buck Holland and Katrina Brandon. 2005. The Role of Protected Areas in Conserving Biodiversity and Sustaining Local Livelihoods; Annual Review of Environment and Resources.

Madden F. 2008. The growing conflict between humans and wildlife: law and policy as contributing and mitigating factors. *Journal of International Wildlife Law and Policy* **11**:189–206.

Magige F. J. 2012. Human-Wildlife Interaction in Serengeti and Ngorongoro Districts of Tanzania: A Case Study on Small Mammals. *Tanzania Journal of Science*, **38**, 95-105.

Marine Deguignet, Juffe-Bignoli, D., Burgess, N. D., Bingham, H., Belle, E.M.S., de Lima, M.G., Bertzky, B., Milam, A.N., Martinez-Lopez, J., Lewis, E., Eassom, A., Wicander, S., Geldmann, J., van Soesbergen, A., Arnell, A.P., O'Connor, B., Park, S., Shi, Y.N., Danks,

F.S., MacSharry, B., Kingston, N. 2014. Protected Planet Report 2014. UNEP-WCMC: Cambridge, UK.

Mengistu Wale, Abeje Kasie, Getachew Mulualem, Weldemariam Tesfahunegn, Abreham Aseffa. 2017. Wildlife threats and their relative severity of eastern Ethiopian protected area. Ecology and Evolutionary Biology; Vol. **2**, No.4, 42017, pp59-67.

Mesele Yihune, Afework Bekele and Zelealem, T. 2008. Human wildlife conflict in and around the Semien Mountains National Park. *International Journal of Ecology and Environmental Sciences* **34** (2): 149-155.

MeseleYihune. 2007. Human-wildlife (Gelada Baboon and Ethiopian Wolf) Conflict in and around Simien Mountain National Park M.Sc. Thesis Addis Ababa University, AddisAbaba.

Messmer T. A. 2000.The emergence of human-wildlife conflict management: turning challenges into opportunities. *International Bio deterioration and Biodegradation* 45:97-102.

Messmer T. A. 2010. The emergence of human–wildlife conflict management: turning challenges into opportunities: Wildlife Conflict Management, Jack H. Berryman Institute, Utah State University, 5210 Old Main Hill, Logan, UT 84322-5210, USA.

Musimbi M. 2013. Factors Influencing Human-Wildlife Conflict in Communities around the park. A case of Lake Nakuru National Park, Kenya, Masters' thesis, University of Nairobi, Kenya.

Newman R. J. 1979. Effects of industrial air pollution on wildlife. Biological Conservation; 3:181-190.

Newmark W. D., Manyaza D. N., Gamassa D. M. and Sariko H. I. 1994. The conflict between wildlife and local people living adjacent to protected areas in Tanzania, Human density as a predictor conservation Biology **8**: 249-255

Ogra M. V. 2008. Human–wildlife conflict and gender in protected area borderlands: A case study of costs, perceptions, and vulnerabilities from Uttarakhand (Uttaranchal), India. Geoforum, **39**(3): 1408-1422.

Quirin C. 2005: Crop Raiding by Wild Vertebrates in the Illubabor Zone, Ethiopia. BS.c, thesis, University of Otago, New Zealand. P57.

Radeloff V. C., Hammer R. B., Stewart S. I., Fried J. S., Holocomb S. S. and McKeefry, J. F. 2005. The wildland-urban interface in the United States. *Ecological Applications* **15**:799-805.

Radle L. A. 2007: The Effect of Noise on Wildlife: A Literature Review; pp1-16.

Reddy R.U. 2014. Conflicts between the Conservation of Elephant and Human Activities: In the Case of Babile Elephant Sanctuary (BES), Ethiopia. European Academic Research, 2, 1280-1292.

Romanach SS, Benscoter AM, Brandt LA. 2016. Value-focused framework for defining landscape-scale conservation targets. *Journal for Nature Conservation*. **32**:53-61.

Rugunda G. K. 2004. Crop raiding around lake Mburo National park, Uganda Department of Biology Mbrara university of science and technology Uganda; *African journal of ecology*.

Salma Batool and Mubashar Hussain. 2016. Wildlife in the perspective of environmental degradation: A review. *Journal of Entomology and Zoology Studies*; **4**(5): 508-511

Sam Ime Edet, Nnaji Emeka Samuel, Asuquo Edung Etim, Etefia Titus E. 2014. Impact of Overpopulation on the Biological Diversity Conservation in Boki Local Government Area of Cross River State, Nigeria. *American Journal of Environmental Engineering* 2014, **4**(5): 94-98

Santra Kumar Ajit. 2008. Handbook on Wild and Zoo Animals; Department of Livestock Production and Management College of Veterinary Science and Animal Husbandry Indira Gandhi Agricultural University Anjora, Durg, Chhattisgarh and Formerly Livestock Specialist, AFPRO, New Delhi.

Saunders D. A., Hobbs, R.J. and Arnold G.W. 1993. The Kellerberrin project on fragmented landscapes: a review of current information. Biological Conservation 64:185–192.

Sefi Mekonen, Alefu Chinasho, Kassegn Berhanu and Sewnet Tesfaye. 2017. Threats and conservation challenges of wildlife in Harenna Forest, Harenna Buluk District, South East Ethiopia. *International Journal of Biodiversity and Conservation* Vol. **9**(7), pp. 246-255, (2017), ISSN 2141-243X.

Segan DB, Murray KA, Watson JE. 2016. Global assessment of current and future biodiversity vulnerability to habitat loss-climate change interactions. Global Ecology and Conservation. **5**:12-21.

Seth J., Dettenmaier Terry A., Messmer Torre J., Hovick and David K. Dahlgren. 2017. Effects of livestock grazing on range meta- analysis of grouse populations. DOI: 10.1002/ece3.3287

Sewunet Tesfaye. 2017. Challenges and Opportunities for Community Based Ecotourism Development in Ethiopia. *African Journal of Hospitality*, Tourism, and Leisure, 6(3).

Sharma G., Ram C., Devi L. and Rajpurohit L.S. 2011. Study of Man-monkey conflict and its management in Jodhpur, Rajasthan (India). *Journal of Evolutionary Biology Research*, **3** (1): 1–3.

Shayler H, McBrid, M, and Cornell EH. 2009 Waste Management Institute: Department of Crop and Soil Sciences.

Sillero - Zubiri, C.and Switzer, D. 2000. Crop raiding primates: searching for alternatives, human Way to Solve conflict with farmers in Africa, People and wildlife initiative, Wildlife conservation research unit, Oxford University, oxford.123-134pp.

Singer, Francis J, Schullery and Paul. 1989. Yellowstone wildlife: populations in process Western Wildlands. **15**(2): 18-22.

Sinha, C. 2001. Wildlife Tourism: A Geographical Perspective. Conference Paper, 1-23.

Smith Jane Kapler, Fischer, William C. 1997. Fire ecology of the forest habitat types of northern Idaho; Ogden, UT: U.S. Department of Agriculture, Forest Service, Inter mountain Research Station.

Solomon Chanie and Dereje Tesfaye. 2015. Threats to biodiversity conservation and ecotourism activities in Nechsar National Park, Ethiopia. *International Journal of Biodiversity and Conservation,* **7**(2), 130-139.

Solomon Tadesse and Burt. P. Kotler. 2016. The impacts of humans and livestock encroachments on the habitats of mountain Nyala (*Tragelaphus buxtoni*) in Munessa, Ethiopia. *International Journal of Biodiversity and Conservation*, Vol. **5**(9), pp. 572-583, September 2013 DOI: 10.5897/IJBC12.103

Sullivan T. L. and Messmer A. T. 2003. Perceptions of deer-vehicle collision management by state wildlife agency and department of transportation administrators. Wildlife Society Bulletin 31:163-173.

Tania Zaviezo, Audrey A. Grez, Cristián F. Estades and Astrid Perez. 2007. Effects of habitat loss, habitat fragmentation, and isolation on the density, species richness, and distribution of ladybeetles in manipulated alfalfa landscapes. Universidad de Chile, Santiago, Chile.

Tefera Melaku. 2011. Wildlife in Ethiopia: endemic large mammals, *World Journal of Zoology*, **6** (2) College of Veterinary Medicine, Haramaya University, Ethiopia.

Temesgen Gashaw. 2015. Threats of Bale Mountains National Park and solutions, Ethiopia. *Journal of Physical Science and Environmental Studies*, **1**(2), 10-16.

Thirgood S., Woodrotte, R. and Rabinowitz, A. 2005. People and Wildlife: Conflict or coexistence. Cambridge University. Press London, Environmental Engineering. March 17-18, 2014 Dubai.

Trombulak C. S. and Frissell A. C. 2000. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities; Conservation Biology. Volume **14**, N0.1, page 18-30.

Tweheyo M., Tumusiime D., Turyahabwe N., Asiimwe A. and Orikiriza L. 2011. Wildlife damage and control methods around Lake Mburo National Park Uganda. *International Journal of Pest Management* **58**:1, 25-31.

Vales David J., Peek and James M. 1996. Responses of elk to the 1988 Yellowstone fires and drought. Yellowstone National Park, WY. Fair field, WA: *International Association of Wildland Fire*: 159-167.

Warren Y. 2003. Olive Baboon (Papio anubis): Behavior, Ecology and Human Conflict in Gashaka Gumti National Park, Nigeria. PhD, Thesis, University of Surrey.

Warren Y. 2008. Crop-raiding Baboons (Papio Anubis) and defensive farmers: A West African Perspective. *West African Journal of Applied Ecology*, V **14**.

Wiegand T., Revilla E. and K. A. 2005. Moloney, Effects of habitat loss and fragmentation on population dynamics, *Conservation Biology*, **19** (1): 108–121.

Wilfred P. 2010. Towards Sustainable Wildlife Management Areas in Tanzania. *Tropical Conservation Science,* **3**: 103-116.

Woodroffe, Rosie, Thurgood, Simon and Rabinowitz Alan. 2013. People and wildlife conflict or co-existence. Cambridge: University Press.

World Wide Fund. 2005. Human wildlife conflict manual 2005: Wildlife management series WWF World Wide Fund for Nature Southern African Regional Program Office (SARPO).

Yosef Mamo, Addisu Asefa and Girma Mengesha. 2015. Social organization in the mountain nyala (Tragelaphus buxtoni) population in the Bale Mountains National Park, Ethiopia, Biodiversity and Conservation, **7** (2):103–111,

Zarihun Girma, George Chuyong, P. Evangelista and Yosef Mamo. 2015. Habitat characterization and preferences of the mountain nyala (*Tragelaphus buxtoni*, Lydekker 1910) and Menelik's bushbuck (*Tragelaphus scriptus meneliki*) in Arsi Mountains National Park, south-eastern Ethiopia. International Journal of Current Research, vol. 7, pp. 23074–23082.

Zarihun Girma. 2016. Habitat use, Diet and conservation of the mountain Nyala and Meneliks bushbuck (Ph.D. thesis), University of Buea, Park.

Zerihun Girma, George Chuyong and Yosef Mamo. 2018. Impact of Livestock Encroachments and Tree Removal on Populations of Mountain Nyala and Menelik's Bushbuck in Arsi Mountains National Park, Ethiopia. *International Journal of Ecology*. Volume 2018, Article ID 5193460, 8 pages.

APPENDIX 1 Data collection sheet for direct observation of crop damage by wild animals

Name of data collector_____

Kebele_____

Village/got/_____

Stages of crop development_____

Distance of the field from the mountain boundary (proximity) _____

Month and Date	Species observed	Type of Crop Damaged	Size of damaged Area in (m^2)	Time of observation (day) or (night)	Traditional methods used to control wildlife

APPENDIX 2   Questionnaire for Local Communities

My name is Gosa Balcha; I am postgraduate student from University of Bahir Dar school of Fisheries and wildlife and carrying out a research study on threats and conservation challenges of wildlife in AMNP, the case of Galama Mountain. The questionnaires are designed only for this research. You are friendly requested to contribute and fill in the questionnaire which will be used in the study. I assure you that the information gathered will be only used for educational purpose and it will be treated with strict confidentiality. Thank you in advance for your contribution.

Part I: General Information about respondents

1.   Sex of the respondents: _____

2.   Age: _____

3.   For how long have you been living in the area?

  < 5 years [ ]   6-15 years [ ]   16-25 years [ ]   >25 years [ ]

4.   Marital status: Married [ ]   Unmarried [ ]

5.   Educational back ground: Illiterate [ ]   Literate [ ]

6.   Respondents Kebele: _____

Part II: Threats and Conservation Challenges of Wildlife in Galama Mountain

1. Do you know the threats and conservation challenges affect wildlife survival leading to decline in your surrounding mountain? Yes/No

 If your answer is yes, please put marks on likert-scale on the space provided for the following wildlife threats and conservation challenges listed in the table below.

No	Threats and conservation challenges of wildlife	Responses				
		Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1	Habitat loss, fragmentation and degradation					
2	Expansion of agricultural practices					
3	Pollution					
4	Fire					

5	Settlement					
6	Overgrazing					
7	Human wildlife conflict					
8	Livestock encroachment					
9	Collection of fire wood/charcoal burning					
10	Hunting					
11	Over utilization of resources					
12	Invasive species					
13	Administration problems					
14	Lack of awareness					
15	Lack of effective management					

Part III: The estimation of crop and livestock loss due to crop raider and predation respectively because of human wildlife conflict in the study area.

1. Do you have your own farm land?   Yes [ ] No [ ]

2. If your answer is yes for the above question, how much is its size.

   0.5-1h [ ]   1.1-2.99h [ ]   3.0-4.99h [ ] 5h and above [ ]

3. If your answer is no, how are you cultivate crops?

    By renting land [ ]   by cooperating with other [ ]

4. How much your cultivation land is far from the mountain edge?

   0-0.5km [ ] 0.5-1km [ ] 1-1.5km [ ] > 1.5km [ ]

5. What is/are your main livelihood activity/ies? Crop production [ ] livestock keeping [ ]

Mixed farming [ ] Crop production and other income [ ]

6. Did you encounter any conflicts with wildlife? Yes [ ] No [ ]

7. If your answer is yes for the question no. 6, which one? Crop damage only [ ] Livestock loss only [ ] Both predation of livestock and crop damage [ ]   No conflict at all [ ]

8. Do you grow crops? Yes/No

9. What type of crops did you grow more in your farm land in 2010/2011?

Barley____   Wheat_____   Maize__   Tomato_____   Linseed_____ Bean _____ Pea_____

10. Which type of crop is more attacked by wild animals? Maize__ Barley___ Tomato_____ Bean_____ Wheat____ Linseed____ Pea____

11. At which stages wild animals more attack crops?

Seedling [ ] early maturation [ ] matured [ ] at all stages [ ]

12. To what extent wild animals cause damage to your crops?

High [ ]   Medium [ ]   Low [ ]

13. Which wild animals are common in the study area?

Hyena [ ] Warthog [ ] Jackal [ ] Porcupine [ ] Antelope [ ]

14. Which wildlife species frequently attack your farm?

Hyena [ ] Warthog [ ] Jackal [ ] Porcupine [ ] Antelope [ ]

15. Which pest wild animals are more responsible for crop damage?

Hyena [ ]   Warthog [ ] Jackal [ ] Porcupine [ ] Antelope [ ]

16. Which wild animals are more responsible for crop damage during day time?

Hyena [ ]   Warthog [ ] Jackal [ ] Porcupine [ ] Antelope [ ]

17. Which pest wild animals are more responsible for crop damage during night time?

Hyena [ ]   Warthog [ ] Jackal [ ] Porcupine [ ] Antelope [ ]

18. In what season do you experience the most wildlife damage?

Dry season [ ] Wet season [ ]

19. What do you feel on the population trends of wildlife in your surrounding mountain?

Increasing [ ] decreasing [ ] No estimation [ ]

20. What control measures have been taken to safeguard your crops from pests?

Guarding [ ] Fencing [ ] Chasing [ ] Scarecrow [ ] Fencing and guarding [ ]

21. Which of the techniques are most effective?

Guarding [ ] Fencing [ ] Chasing [ ] Scarecrow [ ] Fencing and guarding [ ]

22. Do you have livestock? Yes /No If yes, how many?

23. Which one is more affected by wild animal's attack/predation?

   Cattle [ ] goat [ ] Sheep [ ]   Horse [ ] Donkey [ ]

24. Do you have lost livestock? Yes/No

25. If your answer is 'yes' for the above question which type of livestock you have lost?

   Cattle [ ] goat [ ] Sheep [ ] Horse [ ] Donkey [ ]

26. How many livestock you have lost (in number)? _____ _____

27. Which wild animals are the most problematic in terms of livestock predation?

Hyena [ ] Jackal [ ] Leopard [ ]

28.   Do you see wildlife killed during crop and livestock damage? Yes/ No

If yes fill the following table by listing killed wildlife and thick under the method by which it is killed

No.	Wild animal killed	Method used to kill				
		Hunting	Direct shoot	Trapping	Poisoning	Other (specify)
1						
2						
3						
4						
5						

29. What is your attitude toward wildlife? Positive [ ] Negative [ ]

APPENDIX 3 Check lists for Focus Group Discussion

Discuss in the following points in context to your locality

Is wildlife in your surrounding mountain (Galama) threatened?

Do you know the threats and conservation challenges of wildlife in the area?

What are the causes for threats and conservation challenges to wildlife?

How we are conserving and manage our wildlife population?

Are there any Human wildlife conflicts in your area?

Which pest wild animals cause more crop raiding?

What are the main causes of HWC in your area?

In which season the crop damage is serious and what is the reason behind?

How farmers protect pest wild animals from their property and how much it is effective?