JIMMA UNIVERSITY

COLLEGE OF NATURAL SCIENCES

DEPARTMENT OF BIOLOGY

ASSESSMENT OF HUMAN-PRIMATE CONFLICT IN SUNTU KEBELE OF LIMMU KOSSA WOREDA, SOUTH-WEST ETHIOPIA

A THESIS SUBMITTED TO THE DEPARTMENT OF BIOLOGY AND RESEACH AND POST GRADUATE COORDINATING OFFICES OF COLLEGE OF NATURAL SCIENCES, JIMMA UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN BIOLOGY

BY: TEKLEBIRHAN FIKRE

ADVISER: TSEGAYE GADISA (PhD)

AUGUST, 2015

JIMMA, ETHIOPIA

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AUGEST, 2015

JIMMA, ETHIOPIA

Declaration of Honor

The researcher hereby declares that this research on the title “Assessment of human-Primate conflict in Suntu kebele of Limmu Kossa Woreda, South-West Ethiopia" is my original work and all sources of materials used for the research have been fully indicated and acknowledged with complete references

Name: _____

Signature: _____

Date: _____

This research has been submitted for my approval as University advisor.

Main advisor name: _____

Signature: _____

Date: _____

Place: Jimma University College of Natural Sciences Department of Biology

Date of Submission: _____

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Abbreviations and acronyms

AWF: African Wildlife Foundation

CWP: Conservation Working Party

DA : Development Agency

EC : European Commission

EOLSS: Encyclopedia Of Life Support System

FAO : Food and Agricultural Organization of the United Nations

HGAC: Human Great Apes Conflict

HWC : Human Wildlife Conflict

IPS: International Primatological Society

IUCN: International Union for Conservation of Nature m : Meter

Kg : Kilogram

m : Mete

mm : Millimeter

PSG: Primate Specialist Group

SSS: Species Survival Commission

USAID: United States Agency for International Development

Abstract

Human-wildlife conflict is identified as one of the main threats to the continued survival of many species in different parts of the world. The present study was carried out in Suntu Kebele of Limmu Kossa Woreda, Jimma zone of Oromia National Regional State on "Assessment of human-monkey conflict in Suntu Kebele". The study included both the dry (February, 2016) and the wet season (May to end of August, 2016.). Three study sites were selected namely: Suntu, Jarso and Jato. Data were collected through self-administered questionnaire, face to face interviews, focus group discussions and field observations. For the questionnaire survey, 201 households or any family member ≥ 18 years of age were involved and the respondents were selected through random sampling method. Purposive sampling was employed for to select for focus group discussion. Sweep survey was used to estimate the population size of Anubis baboon (Papio anubis) and Vervet monkey (Chlorocebus pygerythrus). To estimate the amount of crop damaged by the pest monkeys, the grid system was used. For this purpose, 90,000m^2 of plots of land covered by maize crop were randomly selected and the magnitude of damage was recorded. The results of the questionnaire and interviews indicated that damage to crops by Anubis baboons and Vervet monkeys was the major problem. The result also showed depredation of goats & sheep by Anubis baboon, and poultry by Vervet monkeys. The finding from group discussion showed that the local people have developed negative attitudes towards these pest monkeys. The result of field observation to estimate crop damage indicated that the damage caused to maize crop by Anubis baboon at seedling. Tasseling and ripened stage together was 1.43% per a hectare and the damage caused to the same crop at different stages of its development by Vervet monkeys 1.42% per a hectare The field observation also showed the estimated population size of Anubis baboon in the dry season and the wet season was 67.00 ± 18.385 and 77.50 ± 20.51 respectively. The estimated population size of Vervet monkeys in the dry and wet season was 129.00 ± 26.87 and 138.50 ± 19.09. This study provides evidence with respect to crop damage by these monkey species. Therefore, human-monkey conflict issues must be resolved in the context of the local community.

Key words: Human-monkey conflict, Crop raiding, Mitigation strategy, Co-existenc

Chapter One: Introduction

1.1. Background of the study

Conflicts between humans and wildlife have occurred since the dawn of humanity. They occur on all continents, in developed as well as developing countries, yet the problems vary according to the particular environment and people's way of life. The problems are particularly common and pronounced in Africa. Rural and peri-urban communities are affected all over the continent (Lamarque *et al*., 2009). Human-wildlife conflict (HWC) is identified as one of the main threats to the continued survival of many species in different parts of the world. It is a serious obstacle to wildlife conservation and is becoming more prevalent as human population increase, development expands, the global climate changes and other human and environmental factors put people and wildlife in direct competition for a shrinking resource base (Laden, 2014).

Conflicts arise when the activities of wild animals coincide with those of people. Each year, thousands of people lose their lives and billions of dollars are lost in property because of HWC globally. Traditionally, people respond to wildlife threats by killing "problem" animals and eliminating wild habitat to prevent further losses. The biodiversity and economic costs is hard to estimate for developing countries, but data from developed nations are indicative. The US government responds to roughly $1 billion in agricultural damage nationwide by killing approximately 2.5 million wild animals annually (Treves, 2007).

HWC or negative interaction between people and wildlife has recently become one of the fundamental aspects of wildlife management as it represents the most widespread and complex challenge currently being faced by the conservationist around the world. The damage to human interests caused by contact with such animals can include loss of life or injury, threats to economic security, reduced food security and livelihood opportunities (Muluken Mekuyie, 2014). HWC is becoming a critical threat to survival of many globally endangered species, including the large and rare mammals (Ochala, *et.al*, 2013).

Non human primates are almost exclusively tropical radiation, and there are currently over 200 species of primates living in the tropics of Asia, Africa and Americas (Silva and Salazar, 2010). A set of global trends has contributed to the escalation of HWC worldwide. These can be grouped into human population growth, land use transformation, species habitat loss,

degradation and fragmentation, growing interest in ecotourism and increasing access to nature reserves, increasing livestock populations and competitive exclusion of wild herbivores, abundance and distribution of wild prey, increasing wildlife population as a result of conservation programmes, climatic factors and stochastic events (Distefano,2010).

Human Great Apes Conflict (HGAC) is a subset of HWC that can broadly be defined as ‘any human-great ape interaction which results in negative effects on human social, economic or cultural life, great ape social, ecological or cultural life or the conservation of great apes and their environment (Hocking and Humble, 2009). Conflict between people and wildlife today undoubtedly ranks amongst the main threats to conservation in Africa; alongside habitat destruction and commercially motivated hunting of wildlife to satisfy the demand for bush meat and represents a real challenge to local, national and regional governments, wildlife managers, conservation and development agencies and local communities (Muruthi, 2005). .

1.2. Statement of the problem

Conflicts arise between humans and wild animals when the wild animals prey on livestock and damage crops, or properties. A number of studies have shown that the problem is significant all over the world. HWC is a well-known phenomenon across Africa (Elizabeth, 2012). Similar problems are exhibited in many parts of Ethiopia. In Illubabor zone, in upland and wetland areas, maize is primarily predated by the baboon, followed by Vervet monkeys (Quirin, 2005). Reports showed that sheep loss by hamadryas baboon was 5.3% and goats 1.4% in and around the Simein Mountains National Park during the last ten years and hamadryas baboon is not only a predator but also a crop raider (Mesele Yihune *et al*., 2009).

Conflicts between humans and monkeys are seen in the rural kebele of Suntu of the Limmu Kossa Woreda. The inhabitants of the kebele reported that vervet monkeys and olive baboons are crop raiding pests in the area. In this rural kebele, the conflict between humans and monkeys is increasing from time to time because of expansion of human settlements and conversion of monkeys' habitats into farmlands. The conflict has become more intense because agriculture is an important part of the rural livelihoods. The human population growth rate of the Woreda is increasing. The average growth rate of the rural human population is 2.7% per annum while that of the urban population is 3.1% per annum (Limmu Kossa Woreda

Administration Office (2015).This situation brought about an increasing demand for land for agriculture and wood for furniture, construction and for firewood. This in turn has led to increased opportunities for humans and monkeys to come in to contact and ensured the conflict. The people in the kebele are small scale farmers who entirely depend on subsistence agriculture for their livelihood but the crops they grow are destroyed by crop raiding monkeys. This conflict may extend to other areas of the Woreda and will affect the ability of subsistence farmers to feed their families because of damage of their crops by these animals. The other potential threat due to the conflict is that children may miss schools and adults may miss their productive time to guard their crops.

1.3. Objectives

1.3.1. General Objectives

- To assess human-monkey conflict in Suntu Kebele of Limmu Kossa Woreda.

1.3.2. Specific Objectives

- To identify monkey species commonly found with respect to the study area**,**
- To assess crops that are most commonly raided by the primates ,
- To identify most serious monkey species that raid crops in the study area,
- To identify major causes of the conflict between humans and monkeys in the study area.

1.4. Significance of the study

This study helps to identify monkey species in the area, causes of the conflict, and perceptions of the local people towards the wildlife which are key information to devise mitigation strategies of the conflict in the area and it can be used as a source data for other researchers who conduct similar study in the area.

1.5. Scope of the study

This study covered three sites of Suntu Kebele of the Limmu Kossa Woreda: Jarso, Jato and Suntu. The study specifically examined the conflict between the local residents and monkeys in the area. In addition, the research concentrated on the most common crop raiding monkeys, the common type of crop raided and the impact that arise out of crop raiding and how these

impact can be mitigated to harmonize the co-existence between the monkey species and the local people.

Chapter Two: Literature Review

2.1. Evolutionary lines of primates

Humans belong to the same family as the anthropoid (human-like) apes, also known as the "great" apes. No other animals are as close to us: at the DNA level we are 98.4 % identical to chimpanzees and bonobos.

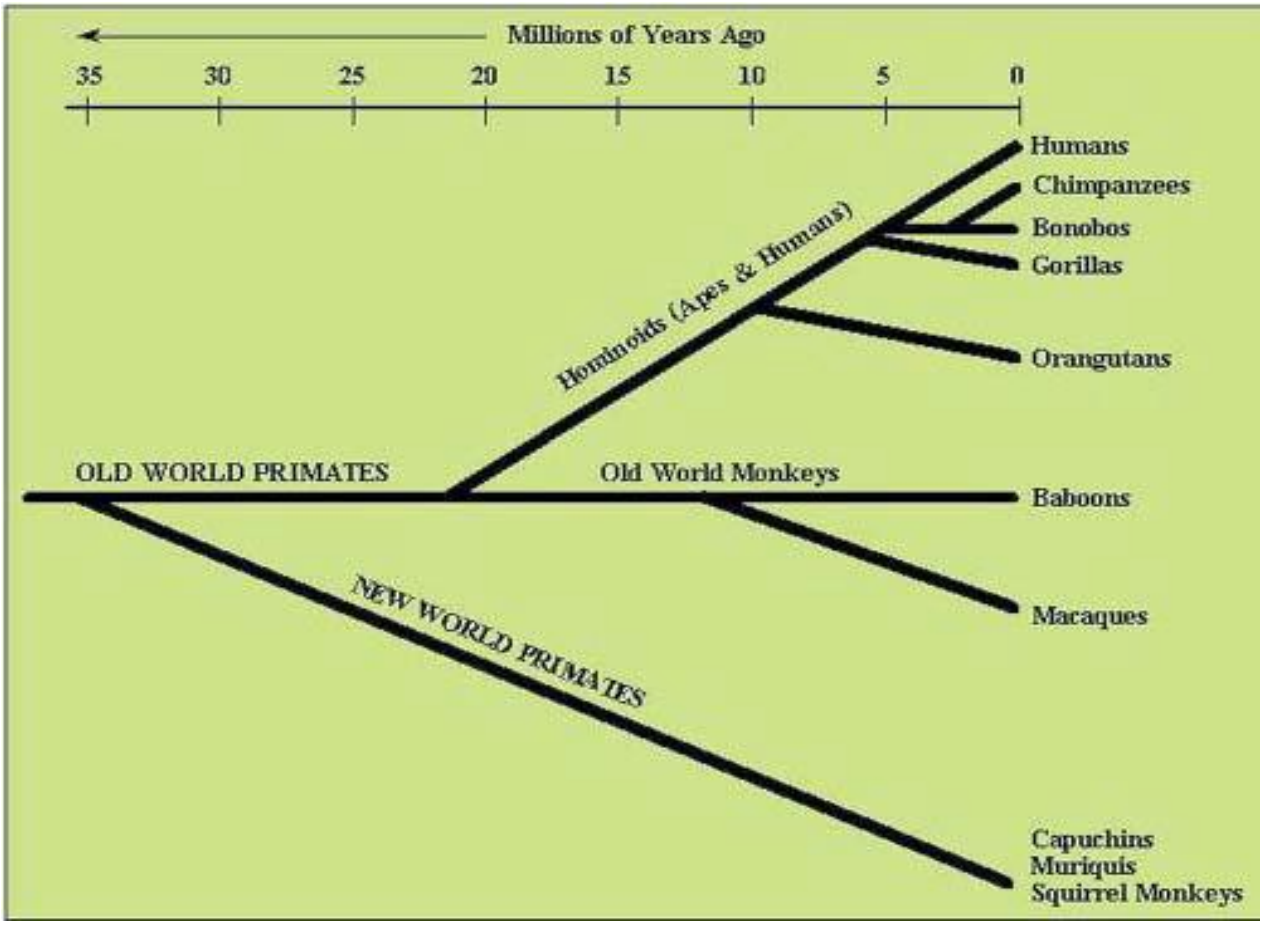

Figure 1 Evolutionary lines of primates

Source: MacDonald, 1984

There are nearly 300 primate species grouped in to about 80 genera most of which live in tropical or subtropical regions of the world. The majorities of living primate taxa are monkeys and are present in both the New and Old Worlds while Prosimians are found in Madagascar (George, 2002). Generally, primates are divided into (1) Prosimians, which are the primates least closely related to humans, having diverged from the lineage that led to humans approximately 80 million years ago (e.g., lemurs and sifaka), (2) New World

monkeys (Platyrrhines), which diverged approximately 40 million years ago (e.g., capuchins, howlers, marmosets, and tamarins), (3) Old World monkeys (Catarrhines), which diverged approximately 20 million years ago (e.g.,macaques, baboons, and columbine), Chimpanzees (Pantroglodytes), Baboons (P.pansicus), Gorillas (Gorilla gorilla , and G.beringei) and Orangutans (Pongo pygamaeus and P. abelii) (Brosnan *et al*., 2006).

2.2. Ecology of non-human primates

Hamadryas baboons inhabit the highlands of Ethiopia. Red or guinea baboons live in gallery forest and woodland savannas of West Africa. Chacma baboons reside in southern African woodland to semi-desert habitats. Home ranges of baboons may cover approximately 10,000 acres (Brent *et al*., 2001). Blue monkeys (*Cercopithecus mitis boutourlinii*), a subspecies is endemic to western Ethiopia, whose habitats had experienced different levels of disturbance at Jibat Forest. Forest Group occupied primarily continuous tree-dominated forest with little human disturbance whereas fragment Group inhabited a heavily degraded 2- to 3-km2 forest fragment (Dereje Tesfaye *et al.,* 2012). Olive baboons can be found in habitats ranging from desert to mountain forest. One reason why Olive baboons are able to adapt to these varying habitats could be their flexibility in foraging strategies and ability to extract food and nutrients from almost all strata of the environment (Whiten *et al.*, 1991).

Rainfall is directly correlated with food availability in many habitats. In savanna areas, the food availability is highest near the end of the rainy season and gradually decreases in abundance as the dry season continues (Barton et al., 1992). During the rainy season, fruit, young leaves, and flowers are abundant and important foods for olive baboons. As the dry season progresses, these foods become scarce and baboons must switch to other resources. The native range of vervet moneys is Sub-Saharan Africa from Senegal to Ethiopia (Durow, 2008).

Primates can be considered Tropical specialists. Their present and past distribution has been primarily within the tropics, although some generalist primates, such as macaques and humans have been able to successfully invade more temperate zones. There are six radiations of primates: The lemur, the Lories, the tarsiers, the New world or neo tropical primates, the Old world monkeys, and the apes (S-Silva *et al*., 2010).

2.3. Foraging behavior of non human of primates

Common examples of shared food among wild primates include insects, fruits and vertebrate meat (Jaeggi and Gurven, 2013). Primates (such as macaques) feeding on insect and/or other invertebrates for which the foraging time could be extremely important and the weight of food obtained is low-for instance, in a period of 10 minutes, either 50 to 100 g of fruit is eaten, or 1 or 2 g of small insects are obtained by active foraging-but insects provide fat and protein necessary for a balanced diet (Mac Clancy and Fuentes, 2009). In the wild, primates take in more grams of vegetable protein per day than seen necessarily based on body weight. This probably reflects the fact that vegetable protein, even if high quality protein, shows a lower digestibility than animal protein (Milton, 2000).

Early primates were not dedicated faunivores and lend further support to the emerging view that both insects and fruits were probably important components of the diet of basal primates, and that exploitation of fruits may account for other key primate traits (Nekaris, 2005). Although little is known about the nonrandom relationship of primates to their plant food resources, some evidence suggests that primates may select food for its palatability or digestibility, its caloric or nutritional value, or its degree of toxicity (Jones, 2005). A growing number of field studies have documented marked temporal variability in the diets of many animal species. Certainly, it is recognized that there are functional morphological constraints that limit the extent of dietary variability (Chapman and Chapman, 1990). Baboons are omnivores and consume a huge variety of items including roots, tubers, corms, fruits, leaves, flowers, buds, seeds, bark, exudates, cacti, grasses, insects, birds, bird eggs, and vertebrates (including other primates) up to the size of a small antelope (Whiten *et al*. , 1991). Olive baboons deal with the scarcity of food by utilizing subterranean food sources such as roots, tubers, and corms (Barton & Whiten, 1993). Olive baboons are good diggers and use their hands to unearth the roots of plants .Seeds are also an important food resource during the dryer times of the year (Barton et al. ,1992

2.4. Primates of Ethiopia

Africa supports a high diversity of primates, with 25 genera and 94 species (Thomas and de Jong, 2014). Although quite well represented in Africa, particularly in forest zones, only 12 to 13 species of primate are recorded in Ethiopia; namely *Galago senegalensis* (Senegal Bushbaby) , *Galago gallarum* (Somali Bushbaby) , *Anubis baboon* (Tera zinjero) , *Papio*

hamadryas (Nech Zinjero) , *Papio cynocephalus* (Bicha Zinjero) , *Theropithecs gelada* (Gelada, Chilada) , *Ceropithecus mitis* (Blue monkey,Cheno) , *Ceropithecus neglectus* (Debazza's Monkey,Debraza Tota) , *Chlorocebus patas* (Patas Monkey, Key Tota) , *Chlorocebus aetihops* (Grivet Monkey , Grivet Tota) ,*Chlorocebus pygerythrus*, (Vervet Monkey, Vervet Tota) , *Chlorocebus dijamdjamensis* , (Bale Monkey, Bale Tota) and *Colobus guereza* (Colobus Monkey, Guereza) (Afework Bekele and Yalden , 2013).

2.5. Causes of human non-human primates conflict

Habitat domination by humans and the concomitant compression, fragmentation and conversion of primate habitats are the driving forces behind human-primate conflict and one of the greatest threats to primate survival (Hoffman and O'Riain, 2012). Human wildlife conflict occurs when the needs and behavior of wildlife impact negatively on humans or when humans negatively affect the needs of wildlife. These conflicts may result when wild life damage crops, threaten, kill or injure people and domestic animals (Mesele Yihune *et al.,* 2009).

In many parts of the world people and non-human primates have lived side by side for thousands of years. Over the past 50 years or so there has been a growing concern that the changing needs of humans have endangered their ability to live in close association with nonhuman primates. In areas where humans and non-human primates live in close sympatry or where they live commensally, this mutual niche expansion may lead, and indeed has led, to conflicts between humans and nonhuman primates (Nekaris, 2013). Economic interests, such as logging and/or agriculture, are responsible for much of the habitat destruction that contributes to the decline of non-human primates throughout the world. In addition, such activities are significant threats to the survival of native species in habitats that are in close proximity with humans (Khatun *et al*,.2012).

Today, geladas are found only in a few areas throughout the northern Ethiopian highlands, and one isolated population south of the Rift Valley in Arsi province. It is estimated that only about 50,000– 60,000 geladas remain in the wild, and their numbers are thought to be declining. Increasingly, geladas are coming into contact with humans as local farmers expand their cultivation and livestock grazing to steep hillsides once inhabited only by wildlife (Beehner *et al*., 2012). Indirect threats (factors that contribute to the persistence of direct threats) were judged to be intimately interconnected and essentially linked to difficult socioeconomic and political contexts, and the problems of weak governance that result from

them. Indirect threats to bonobos include the bush meat trade, proliferation of weapons and ammunition, weak law enforcement, weak stakeholder commitment to conservation, human population growth, and expansion of slash-and-burn agriculture, insufficient subsistence alternatives, and industrial-scale commercial activities which have the potential for enormous negative impact: agriculture, logging, oil and mining, and associated infrastructure development (IUCN and ICCN, 2012).

As for other primates, many of the anthropogenic threats faced by Bale monkeys can be linked to the high rate of human population growth in the country where they occur. According to Ethiopia's Central Statistical Agency (2008), the population of Ethiopia nearly doubled between 1984 and 2007, from 40 million to 74 million. The resulting increasing human demand for natural resources in Ethiopia has led to an alarming rate of deforestation. While initially possessing 40% forest cover, the most recent estimates suggest that only 2.4% of Ethiopia remains forested today (Addisu Mekonnen *et al*.,2012).

2.6. Humans perceptions towards primates

In many regions of the world, where people and primates are found in close proximity, the attitudes of people towards primates impacts the latter's survival to a great extent**.** Human attitudes towards wildlife are influenced by fundamental values, interactions with as well as knowledge about the species. When interactions between humans and wildlife result in economic loss; due to crop and material damage or in physical injury and death, the presence of wildlife becomes intolerable for humans (Devi and Radahkrishna, 2013). The human perception of nonhuman primates is often one of contradiction, typified by extremes. In some cultures and contexts (e.g., Hindus of Bhutan, India, Nepal) primates are viewed as sacred, in others such as China or Japan, they are mythical creatures of cunning and deviousness, while for most of the world's subsistence farmers living in close proximity to monkeys and apes, they represent a significant crop pest. In many cultures these two views overlap resulting in both a love and loathing of the creatures such that they may be worshipped at a temple and killed on the farm next door (Lee and Preston, 2011).

Crop raiding is a form of human wildlife conflict which directly affects local people's perception of and support for conservation initiatives. Insects, rodents, birds and antelope are frequently cited culprits, due to their impact on cash crops However, in areas of high conservation concern primates are commonly significant pests perceived as the most serious

risk to subsistence farmers Crop-damage causes economic loss, opportunity cost and promotes negative perceptions towards species of conservation concern (Priston, 2008). About 55% of the respondents reported a high severity of crop damage, with monkeys alleged to be the greatest culprits. Respondents perceived that HWC have resulted in significant vegetation removal, shifts in crop production, food shortages, and poverty in the study area. Eighty-eight percent of farmers reported believing that wild animals significantly contributed to the shortages of food for their family (Mojo *et al*., 2014). If great apes and their habitat are to be effectively protected, it is imperative to work in cooperation with local communities who coexist with these animals. To facilitate such cooperation, it is necessary to gain an understanding of the perceptions and attitudes that local communities hold toward crop-raiding great apes. Given the high public profile of great apes and the potential threat they pose to human life and livelihoods, farmers may exaggerate the extent of crop-raiding in the hope of gaining compensation. If unsuccessful, this may in turn generate more negative attitudes and even lower tolerance toward great apes (Smith *et al*., 2010).

On the other hand, in many countries, non-human primates have received a degree of protection through religious context and cultural beliefs and are sometimes viewed as brethren. In northern India, Indonesia, and other areas in Asia, monkeys are worshipped, protected, and provisioned by villagers; in spite of this, people are still reluctant to share their crops with the monkeys (Khatun et al., 2012). When asked, most people stated that they believed that primate population had increased over the years, and many consider them to be agricultural pests due to the damage they inflict on crops. Due to religious believes, hunting and killing of primates were reported in low frequencies, but some eat the meat of purple faced langur for medicinal purposes (Nahallago *et al*., 2008).

2.7. Economic importance of non-human primates

Research with non human primates plays an important role in the advancement of human and animal health. Primates share 98 percent of human genes. For this reason, non- human primates are critical to biomedical research targeting the causes, progression, prevention, and treatment of a wide variety of diseases (California Biomedical Association, 2011). Non-human primates are maintained in Europe for a wide variety of purposes ranging from fundamental to highly applied research, and testing for regulatory purposes. Significant advances have been made in recent years in collating information on the use of animals in

research across Europe (European Commission, 2002). As a group, primates are mammals that travel daily, cover relatively large distances in social groups, ingest fruit from multiple species of trees epiphytes, and lianas each day, can transport large quantities of seeds, and often pass viable seeds through their gut. Their predominantly fruit-eating diets, in combination with arboreality, impact a wide variety of ecosystems ranging from evergreen to seasonal woodland and gallery forests to open habitats (Norkonk *et al*., 2011).

The relationship between humans and other primates has varied historically and culturally. Human and non-human primates overlap in a complex array of circumstances that range from forest, to rural village to urban environments and from prey, to pets, to vectors of serious pathogens (Weatheall, 2006). Wild primate populations may hold valuable clues to the origins and evolution of some important pathogens (Wolf *et al*., 2009).When kept as pets, primates act as surrogate infants, companions and/or entertainers (Mago and Chivers, 2010). Studies on primates can give clues about human nature and the nature of the species that led to humans. First, they are our closest relatives, so studying them should give us insight into what our ancestors looked. Second, they have similar basic design, and live in similar environments. So presumably, the living non human primates have been exposed to selection pressures that were similar to those our ancestors adapted. In most ways, they provide reasonable models for how those selection pressures might have affected early humans and our earlier ancestors (Own, 2008). Studying the mind and behavior of nonhuman primates that are closely related to man can potentially enhance the understanding of many human mental and behavioral processes for clear evolutionary reasons (Maestpieri, 2012).

Human and monkey brains show similar organization and structure, which helps in studying disease. National Primate Research Center describes the importance of non-human primates in studies of Alzheimer's disease, Parkinson's disease and neurological complications (Capitanio, 2008). Research with NHPs has identified the functional role of individual nerve cells and brain areas and then taught us that many cognitive functions rely on networks of such areas in the cerebral cortex and sub cortical structures (Roelfema and Treue, 2014).

2.8. Management Strategies for the Conservation of Primates

Efforts for conservation do not have to start with large sums of money. Instead, they should start with real commitment allied with voluntary efforts to work for the conservation of

primate species and their ecosystems (Carvajal *et al*., 2013). Some of the strategies to conserve primate species are: Strengthening institutional capacity -addressing the fundamental problem of weak capacity for law-enforcement and for ensuring conservation of the habitat, consultation and collaboration with local actors (peoples and their traditional and governmental representatives), public awareness and lobbying, research and monitoring activities (IUCN and ICCN,2012). Maintenance of the diversity of primates depends not only on the conservation of protected areas, but also on the conservation of areas that lack formal protection and are occupied by people, crops, and/or livestock. Livestock rangelands, when well-managed, can support viable populations of primates The persistence of biodiversity, including primates, depends not only on the conservation of official protected areas, but also on the conservation of vast tracts of land that lack formal protection, are privately or communally owned, and are occupied by people and their crops and/or livestock (Butynski *et al*,2014).

Of the approximately 276,000 rhesus macaques found in Himachal Pradesh, about 70,000 individuals abound in the rural and urban regions of the state .Mitigation measures proposed to control this major conflict include preventive management measures like surgical sterilization or immune contraception of macaques, garbage management and the prevention of provisioning in human populated sites as well as reactive methods such as the capture of identified problem troops/individuals, development of monkey sanctuaries and the establishment of insurance schemes/compensation for macaque-caused damage and injuries (Linnel *et al* 2014). There is a growing need for non human primate populations in captivity to be managed using techniques based on scientific principles, to be able to maintain self-sustaining populations, to educate our burgeoning human population about current conservation issues and for some zoological parks, to successfully reintroduce these populations into their wild habitats (Avanti, 2008). In general, there should be emphasis on the protection of the natural forest habitats of non human primates. This can be achieved through the establishment of reserve Forests, Sanctuaries, National Parks and Biosphere Reserves (Pitra *et al*1990).

Increasing understanding of the conservation status of primates and the role they play is important in developing viable conservation programmers.Where people are part of the problem faced by primates. people have also been part of the solution. Increasing awareness (e.g. of the often very limited distribution of many primates, their beneficial role in forest

maintenance through seed dispersal), understanding resource use by communities close to primate habitat, and optimizing the role captive primates can play in conservation are all issues that can be addressed under the broad topic of conservation education (Upadhyay,2009).

Chapter 3: Materials and Methods

3.1. Study area and period of study

3.1. 2. The study area

This study was conducted in Suntu Kebele, of Limmu Kossa Woreda, Jimma zone, Oromia National Regional State. The woreda is located 75 kilometers southwest of Jimma town. It is characterized by undulating plains, slopes, hills and valleys to the sides of Gibe River. According to Agricultural and Rural Development Office (ARDO) of Limu Kosa Woreda, the altitudinal range of the Woreda is 1250 to 2720 meter above sea level and the total area of the Woreda is estimated to be 250,000 hectares (ARDO, 2007). Its geographical location is between latitude of 8^0 4" to N to 80 7" N and longitude of 38^0 56" E to 37^0 0" E (figure 2). The three study sites represent the same Kebele.

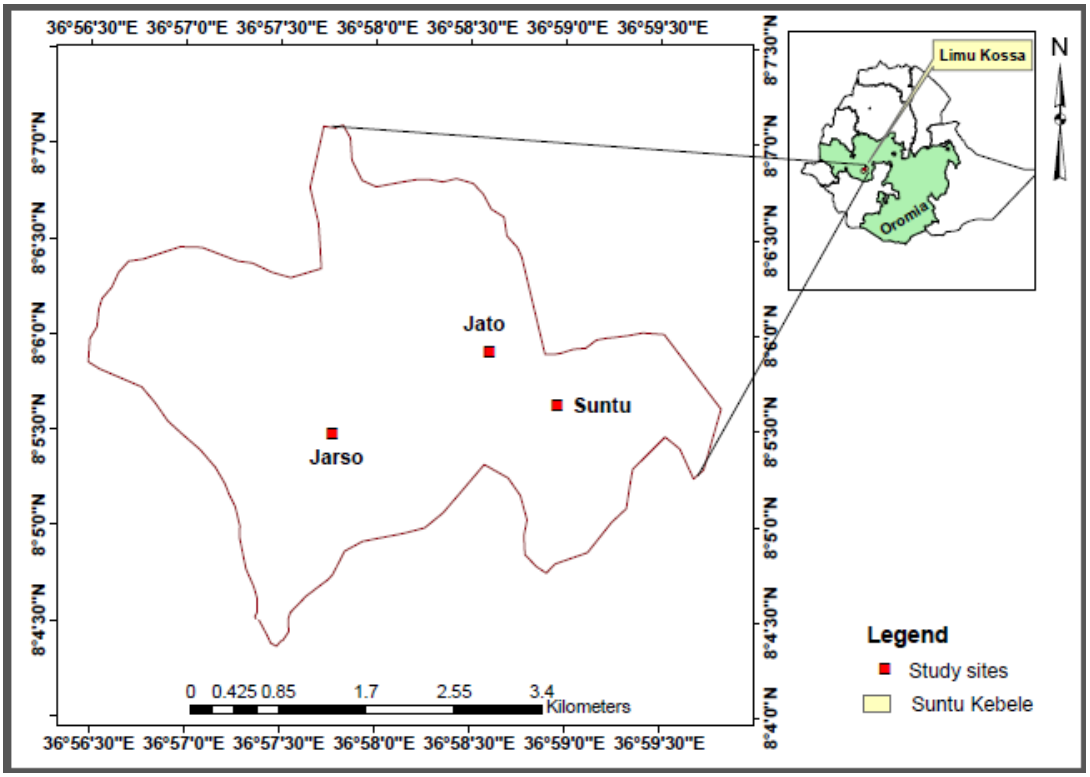

Figure 2 Map of the study area

3.1.3. Climate

The Woreda is divided in to three agro-ecological zones namely, Dega (25%), Woyina Dega (65%) and Kolla (10%) (ARDO, 2015)

3.1.4. Temperature and rainfall

The annual average temperature of the area is between 13^{O} to 30 ^{O}C (Dagim Alemayehu, 2016). The average annual rainfall is between 1600 to 2200 mm, and the area receives about 8 months of rainfall a year. The dry season includes from the mid of November to the end of February (Dagim Alemayehu, 2016).

3.1.5. Land cover and Population

The natural forest covers 23,149 hectares and that of man-made 10,169 hectares. Annual cereal crop covers 38,386 hectares and area of coffee coverage is about 40,059 hectares. The drainage of the Woreda consists of 78 small rivers and 2 big rivers, Ghibe and Dedesa (Limu Kosa woreda ARDO, 20015). The total population of the Woreda is reported to be 204,784 of which, 185,247 are rural residents while 19,501 are urban dwellers. Among these, 103,350 are males and 101,399 are females (Limu Kosa Woreda Administration Office, 2015). The total population of Suntu Kebele is 2679. Out of witch the number of households is 467. The number of households in Suntu, Jarso and Jato site is 132, 142 and 146 respectively. The Kebele covers an area of 1625.5 hectares of land which comprises 345 hectares of farmland where 121, 145 and 79 hectares are allocated to Suntu, Jarso and Jato site respectively.

The vegetation of the area is complex where the montane moist forest is common. The main species of plants are broad-leaved and ever green .The natural coverage of vegetation in the area is declining from year to year because of farm land expansion and logging of trees for timber production. Vegetation coverage in coffee plantation development of Suntu (currently called Horizon coffee plantation) is found in a very good condition because logging of trees is strictly forbidden (Limmu Kossa Woreda ARDO, 2015).

3.1.6. Soil Type

The soil of Limmu area is well drained, deep rich in humus content and characteristically suitable for coffee growth and other cereal crops. The pH of the soil ranges 5 to 7 (Agronomy Department of Suntu Coffee Plantation Development, 2013).

3.1.7. Wild animals

The study kebele consists a variety of amphibians, reptiles, avifauna, and mammal species including monkeys, buffalo *(Syncerus caffer*), hippotamus (*Hippopotamus amphibious*), wild boar (*Sus scrofa*), porcupine (*Histrix indica*),black buck (*Antelope cervicaora*), common jackal (*Canis aureus*),bush buck (*Tragelaphus scriptus*) and others (ARDO Natural Resource Conservation Department of Limmu Kossa Woreda, 2015).

3.2. Study design

A preliminary survey of field observation was undertaken to identify pest monkeys in the area. A cross-sectional survey was employed for the collection of data through questionnaire about current opinions and attitudes of human-monkey conflict in the study area. The study adopted the descriptive survey to reveal variables like, causes of human-monkey conflict, attitudes of the local communities towards monkeys, and magnitude of human-monkey conflict. Longitudinal surveys of field observation also conducted to estimate the population size of Anubis baboon and Vervet monkeys both during the dry and the wet seasons and to estimate damage of maize crop by pest monkeys from the seedling to ripening stage.

To complement information obtained from questionnaire survey, discussants were selected from both study sites based on their duration in the area and their ages. The discussion was on the pre-designed 15 questions (Appendix ii). Forwarded ideas were recorded and schematized. During the discussion, certain issues which were not agreed up on were recorded by counting their vote.

3.3. Sample size determination

From 420 households, 201 sample households were selected using the formula of Cochran (Cochran, 1977). Sample selection was done using of lottery method. To do this, names of households from each study site were listed on note book from a document of Suntu kebele office. Then the serial number of 420 households were listed on slip of papers , mixed them up thoroughly in a box, then drawn (without looking) slips one after the other without replacement. Accordingly, 63 households from Suntu, 68 from Jarso and 70 from Jato site were allocated as units of population.

3.4. Data collection method .

To achieve the objectives of the study, data were gathered through self- administered questionnaire, face-to-face interview, focus group discussions and field observations.

3.5.1.Questinnaire survey

Pilot survey was conducted from February 1 up to 14, 2016. During this survey, 18 closed-ended questionnaires were presented to 32 individuals from the local communities which were not included in the sample population. The main purpose of the pilot survey was to evaluate the questionnaire if there are certain ambiguities and to check whether it was applicable and reliable in the study area. Based on the result of the survey, certain rearrangements and modifications were made to the questionnaire.

The questionnaire was translated from English to the local language, Afan Oromo. The questionnaire was dispatched to the selected sample respondents in all three sites of the kebele to establish in depth information about crop raiding by monkeys, its consequences on the local farmers' livelihood and mitigation strategies towards crop damage by monkeys. Among the respondents, 146 filled the questionnaire by themselves while for 55 respondents who can't read and write, the questionnaire was delivered in the form of interview. Before dispatching the questionnaires, awareness was created to respondents about the purpose of the study and Developmental Agencies (DA) were also well oriented on how to administer the questionnaire. Questionnaires were administered together with three DAs who were familiar with the local language. Interviews were held together with two DAs who were well-versed in the local language (Afan Oromo). As was used by Ahshan and Uddin (2014), and Marshal and Hill (2009), the respondents were the house hold heads or other individuals (≥ 18 years of age) in the house who had willingness to answer the questions. These age groups were selected because they were expected to have well experience of conflict with monkeys and provide in depth information other than the rest of age groups (Appendix 1).

3.5.2 Focus group discussion

One focus group discussions were held at each site of the study from 13 to 15 of May 2016). For this activity, 10 to 12 key informants were selected from each study site based on their age and duration of residency in the area. To organize the meeting, group organizers were selected from the local community in advance. Then, interactive and participatory discussions

were held. Forwarded ideas in the discussions were registered regardless of their contributions positively or negatively to the sustainability of wildlife.

3.5.3. Direct Observation on Crop damage

Direct observations on crop damage by monkeys were conducted from March to end of August, 2016. Crop damage status in the three study sites was examined by direct observation on cultivated land and the affected types and parts of crops in the fields. Prior to data collection, discussions were under taken with key informants to locate the highest incidence of monkeys in the study sites. Three grids were established in the three study sites (one grid on each site). Each grid covered 30,000 m^2. Each grid was classified in to five cells where each cell had an area of 6,000 m^2. Three trials from each site were conducted to estimate average number of maize plants per $1m^2$ of plot and it was found to be 6. Parts and number of plants raided was recorded regularly (Naughton- Treves, 1977). Number of plants raided per plot was divided by the estimated number of plants per plot to get percentage loss.

3.6. Population estimation of primate speciespecies

Forest area at Jato site that covers 12.4 hectares (124,000 m^2) was divided in to 13 blocks (12 blocks each of which was 50m by 200m and 1block was 40 m by 100 m and the 9.3 hectare (93,000 $m^{2)}$ of the forest at Suntu was divided in to 10 blocks (9 blocks each of which was 50 by 200 m and 1 block was 30 by 100 m.

Population estimation of Anubis baboon and Vervet monkeys was not undertaken at Jarso site due to absence of forest at the site. Pest primates move from the neighboring Kebeles to this site to raid crops. To estimate the population of Anubis baboon and Vervet monkey, a sweep-survey (Barnett,1995) was used where several people spaced at regular intervals (50 to 100 m) and an observer walks across a forest area and recording the animals on both sides of the trails (20m on both sides). The observers were spaced at regular intervals of 100 m. During survey, a trail system was used by marking trees every 50m on straight line as much as possible (Pruetz, and Leasor, 2002). To separate each trail, differently colored markers were employed. Transect walks were employed twice both in the dry and wet season (Davenport *etal*., 2007).

During Census of monkeys, counting was made when the animals were most active and easily seen (Chapman, *et al*., 1988). Accordingly, the survey was undertaken before dawn

(7:00 to 8: 00 AM local time) .When the survey was going on, the observers walked at speed of approximately 5m/minute. Observers avoided shouting and to wear brightly colored cloths so that not to alert the animals. It was also tried to avoid eye contact with the monkeys during census because eye contact is regarded as threat to them (Chapman, *et al*., 1980). While census was under taken, some of the monkeys were bounding through the canopy while some of them were leaping from trees to trees and others were scratching hair of one another. In this census, 8 observers were involved: 5 from Natural Resource Department, 2 DAs from ARDO of the Woreda and the researcher. .

To identify primate species and their sexual dimorphism, a reference criteria (appendix iv) was given to each observer beforehand. Census of olive baboon and vervet monkey was undertaken on separate days. The primate population was categorized into six age groups : adult male, adult female, sub adult male, sub adult female, young and infant based on criteria for identification of sexual dimorphism and relative body size were used (Appendix v).

3.7. Data analysis

Raw data from the three study sites (Jato, Jarso and Suntu) , were organized and analyzed using IBM SPSS version 20. Data gathered through questionnaire, interview and field observations were analyzed through descriptive statistics whereas qualitative data obtained through focus group discussions were analyzed thematically. Correlation analysis test was employed to determine the relationship between the different variables. Independent sample t-test and one way ANOVA were used to see whether there was significant difference among the respondents in terms of their age, gender, educational background and access to information about general aspects of wildlife in relation to their negative or positive perception regarding conservation of monkeys in their area. .Paired T Test was used to compare the magnitude of damage to seedling, tasseling and ripened stage of maize crop. One sample T test was used to estimate Mean ± SD population size of primates counted during the dry and wet seasons and to estimate damage caused by primates at each developmental stage of maize crop. In addition to these, Chi-square test was used to see significant differences in non-parametric variables, like categorical data, and linear logistic regression model was also used determine factors for human-monkey conflicts.

3.2.8. Validity and reliability of data gathering instruments

3.2.8.1. Validity

The researcher identified data gathering instruments that more fit to the topic from various literatures which were tested previously at various levels and then refined or modified as required before administering the instruments since it is possible to use existing ones (Lodico *et al*., 2010) .

3..2. 8. 2. Reliability

Reliability is understood as a synonym for consistency and replicability overtime, over instruments and over groups of respondents (Cohen *et al*., 2007). This definition shows us that, the term reliability in research means "repeatability" or "consistency". A measure is considered to be reliable if it gives us the same result again and again. Coefficient alpha was used to estimate reliability for the instruments at 0.7 and above to be acceptable as Cronbach's alpha reliability coefficient normally ranging between 0 and 1 (Gliem, & Gliem, 2003). Based on this, 16 questionnaires were administered to 32 individuals during the pilot survey. The result was analyzed using SPSS and Cronbach's alpha result was 0.74.

Chapter 4: Results

4.1. Results of field observation

4.1.1. Population estimation of prevailing pest monkeys

In the present study, four species of primates have been identified from Jato and Suntu sites during both the dry and wet seasons. The identified monkey species were Colobus monkey (*Colobus guereza*),Vervet monkey (*Chlorocebus pygerythrus*), Blue monkey (*Ceropithecus mitis*) and Anubis baboon *(papio anubis*).

A

B

C

D

E

Plate A Adult male Anubis baboon (*Papio Anubis*) in Jato forest

Plate B Adult female Anubis baboon (*Papio anubis*) in Jato forest

Plate C Adult male Vervet monkey (*Chlorocebus pygerythrus*) at Suntu village

Plate D Adult female Blue monkey (*Ceropithecus mitis*) in Suntu forest

Sub-adult male Colobus monkey (*Colobus guereza*) in Suntu forest

Among these animal species, vervet monkey and Anubis baboon were crop raiders in the area. During field observation these animals were observed while they were raiding maize crop at seedling stage, tasseling and ripened stage and sorghum at the seedling stage. They were also observed while they were devastating fruits like mango, avocado, papaya, guava and banana.

A total of 86.00 ± 8.485Anubis baboons were counted at Jato site both during the dry and wet season and 58.50 ± 6.364 were counted at Suntu site both during the dry and wet season. In all age groups, there were no significant difference (x^2 = 0.000, df = 5, p =1.000) both in the dry and wet season at both sites in terms of number. The total count of males made both during the dry and wet seasons at both sites was 25.00 ± 9.899 and 29.00 ± 7.071 respectively and that of females at both sites during both the dry and the wet seasons was 52.50 ± 4.950 and 58.00 ± 2.828 respectively. The ratio of males to females was 1: 2. Young counted both during the dry and wet seasons at both sites were 26.50 ± 3.536 and 30.00 ± 4.243 respectively. Similarly, infants whose sex was not determined counted both during the dry and wet season at both sites were 21.00 ± 2.828 and 19.50 ± .121 respectively.

A total of 129.00 ± 26.87 and 138.50 ± 19.09 vervet monkeys were counted at both study sites both during the dry and wet seasons respectively. During the dry season, there were 24 adult males, 56 adult females, 26 sub adult males, 49 sub adult female, 53 young and 32 infants. During the wet season, there were 31 adult males, 63 adult females, 27 sub adult males, 53 sub adult females, 60 young and 39 infants. Chi-Square test revealed that there was no significant difference (x^2 = 0.000, df = 5, p= 1.000) in number both in the dry and the wet season in all age groups.

Table 1 Number of Anubis baboons and Vervet monkeys counted at Jato and Suntu site during the dry and wet seasons.

Primate species	Season	Total count at each site		Total	Mean ± SD
		Jato	Suntu		
Anubis baboon	Dry	80	54	134	67.00 ± 18.385
	Wet	92	63	155	77.50 ± 20.506
Vervet monkey	Dry	110	140	250	125.00 ± 21.213
	Wet	125	148	273	136.50 ± 16.263

4.1. 2. Estimation of the average number of maize plants per 1m^2 of plot

The number of maize plants per 1m^2 varied from 4 to 8 (Table 3). The estimated average number of maize plants per 1 m^2 was found to be 6. Accordingly, the estimated average number of maize plants per 30,000 m^2 per site was 180,000.

Table 2 Results obtained from trials conducted to estimate an average number of maize plants per 1m^2 of plot.

Trial number	Number of maize plants per 1m^2 of plot	Plot numbers randomly selected	Trial site
1	7	2	Suntu
2	5	4	Suntu
3	6	7	Suntu
4	6	4	Jato
5	7	5	Jato

6	8	6	Jato
7	5	1	Jarso
8	6	2	Jarso
9	4	4	Jarso
Average	6.0 maize plants/ m^2 of plot		

4.1.3. Estimation of maize crop damage by Anubis baboon

The damage caused by Anubis baboon on maize crop at each stage of its development in both study sites was recorded. The animals were observed to raid the crop rarely at seedling stage but frequently at tassel and ripened stage. Relatively, there was a high proportion of damage to the crop at Jato through all of its developmental stages As indicated in Table 4, the total proportion of loss to maize by the animals were 1.43 % per a hectare (or 1.15 quintal per a hectare). The total damage to seedlings, tassel and ripened part was 1105, 2891, and 3738 respectively. Paired-Sample T-Test revealed that there was a significant difference in magnitude of seedling damage and tassel damage ($t = -3.747$, $df = 2$, $p = 0.064$), but, there was no significant difference ($t = 2.012$, $df = 2$, $p = 0.182$) in the damage caused to tasseling and ripening stage of maize.

Plate 6 Raided maize crop at seedling Stage by Anubis baboon at Jato site

Plate7 Raided maize crop at harvest stage by Anubis baboon at Jarso site

4.1.4. Damage caused to maize crop by Vervet monkeys

The damage caused by Vervet monkeys to maize was also recorded. The damage caused to stage of seedling, tassel and ripened stage was 706.67 ± 353.6, 774.3 ± 389.7 and 1072.0 ± 424.3 respectively. Paired-Sampled T Test revealed that there was a significant difference between seedling stage and tassel stage of maize crop in their magnitude of damage by Vervet monkeys (t = -21.984, df = 2, p = 0.002). There was also a significant difference between tassel and ripened stage in magnitude of damage (t = -4.557, df = 2, p = 0.045). The severity of damage to the crop was relatively high during tassel stage than in seedling stage and ripened stage. From table 4 one can see that the estimated total proportion of crop loss because of Vervet monkeys was found to be 3.99 % per a hectare (or 3.19 quintal per a hectare).

At all the three study sites, maize (Zea *mays*) damage was seen by Vervet monkeys and Anubis baboon at all its growth stage i.e., Seedling, flowering and ripening stage. The magnitude of damage differed based on the growth stage of the crop and the type of pest monkeys that actually involved in raiding the crop. The severity of damage was relatively high during flowering stage (tasseling) by Vervet monkeys and during ripening stage by Anubis baboons. Seedling damage by Anubis baboon was relatively higher than that of the damage caused by Vervet monkeys.

Table 3 Damage caused by Anubis baboons and Vervet monkeys on maize at each study site

Developmental stage	Jato				Jarso				Suntu			
	Anubis baboon		Vervet monkey		Anubis baboon		Vervet monkey		Anubis baboon		Vervet monkey	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Seedling	548	0.31	325	0.18	240	0.13	329	0.18	317	0.18	594	0.33
Tassel	1456	0.81	1023	0.57	630	0.35	1053	0.59	805	0.45	1404	0.78

Ripened	2019	1.12	772	0.43	769	0.42	941	0.52	950	0.53	1218	0.68
Total	4023	2.24	2120	1.18	1639	0.91	2323	1.29	2072	1.15	3216	1.79

No. = Number of maize plant parts damaged

% = Proportion of the damaged parts per study site

4.1.5. Incidence of maize crop raided by pest primates and distance of plots to the nearest forest edge

As indicated in Table 5, incidence of crop raiding increases as the farm is nearer to the habitats of the pest monkeys.

Table 4 Incidence of maize crop damaged by Anubis baboon and Vervet monkeys and distance of plots away from the nearest forest edge at Jato site

Plot number	Sampled plots in m^2	Site	Number of maize plants raided at its various developmental stage			Distance from the edge of plots to the nearest forest edge in a meter
			Seedling	Tassel	Ripened	
1	4000.00	Jato	28	51	97	199.2
2	6000.00	Jato	42	147	335	148.6
3	6000.00	jato	93	170	433	113.3
4	8000.00	Jato	150	456	487	88.9
6	6000.00	Jato	235	632	667	72.4

Table 5 Average number of mango fruits raided per tree

Trials number	Number of mango fruits raided per tree	Trials number	Number of mango fruits raided Per tree
1	65	7	29

2	43	8	30
3	33	9	37
4	48	10	55
5	39	11	46
6	43	12	36
Average	42.0	Total	504.0

Plate 9 Mango fruits raided by Vervet monkeys at Jarso site

4.2. Results of the questionnaires survey

4.2. 1. Socio-demographic characteristics of the respondents

The age of respondents ranged from 18 to 78 years and the median of the class were 47 years. Many respondents (42%) in the age group of 44-56 and few respondents (2%) were in the age group of 70-82 years. Among the respondents, 69% were males and the remaining were females. Regarding their educational background, 59.7% were able to read and write, 11.4% of them had reached secondary level education, 1.5% had reached higher education and 27.3% were un educated. Regarding their marital status, about 73.1% of the respondents were married, 16.9 % of the respondents were unmarried, 7% of the respondents were divorced and 3% were widowed. The major economic activity of the respondents is farming and animal rearing (66%), only farming (26.1%) and others (6.9%) business activities like small scale trading, carpentry and charcoal production. Average farmland holding per household in the study area (excluding coffee farmlands, private and common grazing lands and other tree plantation farmlands owned by the respondents) was 1.74 ± 0.045.

Table 6 Socio-demographic characteristics of the respondents

	Character	Number	%
Age :	18-30	33	15.4
	31-43	45	23.4
	44-56	86	42.8
	57-69	33	16.4
	70-82	4	2.0
	Total	201	100.0
Sex :	Male	139	69.15
	Female	62	30.85
	Total	201	100.0
Educational background :	Un educated	55	27.36
	Read and write	120	59.71
	Secondary educated	23	11.44
	Higher educated (Diploma level)	3	1.49
	Total	201	100.0
Marital status:	Married	147	73.1
	Un married	34	16.9
	Divorced	14	7.0
	Widowed	6	3.0
	Total	201	100.0
Economic activities:	Only farming	53	26.1
	Farming and animal rearing	134	66.0
	Farming and other business activities	14	6.9
	Total	201	100.0
Farmland holding Per household	> 2 hectare	21	10.4
	1 up to 2 hectare	107	53.2
	< 1 hectare	73	36.3
	Total	201	100.0

All respondents (100%) indicated the presence of four species of monkey in Suntu kebele and all of them indicated that they have encountered conflicts with pest monkeys. The majority (73.6%) of the respondents encountered crop damage, 7.5% damage to property (like scratching farmers' hats and damaging certain crops as they steep on them), 5.5% to stealing food from kitchen, 8.0% to livestock predation and 5.5% to threatening people (Table 7). Olive baboons have been reported to threaten women and children. The respondents also reported that Anubis baboons were unmanageable to females and children

Table 7 Frequency of local responses regarding type of conflict

Type of conflict	Frequency	Percent
Crop damage	148	73.6
Livestock predation	16	8.0
Property damage	15	7.5
Stealing food	11	5.5
Threatening people	11	5.5
Total	201	100

4.2. 2. Primate species involved in the conflict

Regarding to monkey species involved in the conflict, respondents indicated that Vervet monkeys and Anubis baboons were the most problematic animals. Few respondents (12) also indicated that Colobus monkeys were rarely seen to raid berry of ripened coffee.

4.2. 3. Frequency of human-primates conflict

Concerning the frequency of human-primates conflict, none of the female respondents chose the scale, "annually", but rather approximately 73% of them indicated the presence of daily conflict. Chi-Square test showed the presence of significant difference between males' and females' responses in terms of the frequency of human-primates conflict. For males (*x2* = 241.230, df = 3, P = 0.001) and for females (x^2 = 44.161, df= 2, P = 0.001).

Table 8 Frequency of local conflicts regarding to responses of the local people

Gender	Response	Frequency
Male	Daily	114
	Weekly	10
	Seasonally	9
	Annually	6
Female	Daily	45
	Weekly	12
	Seasonally	5

4.2.4. Severity of the incidence of human-primates conflict

Regarding severity of the incidence of human-primates conflict, 52.75 % of the respondents revealed that there was very high severity of incidence, 37.8% high,5.5% medium and 3.0% of them indicated the presence of low incidence of severity.

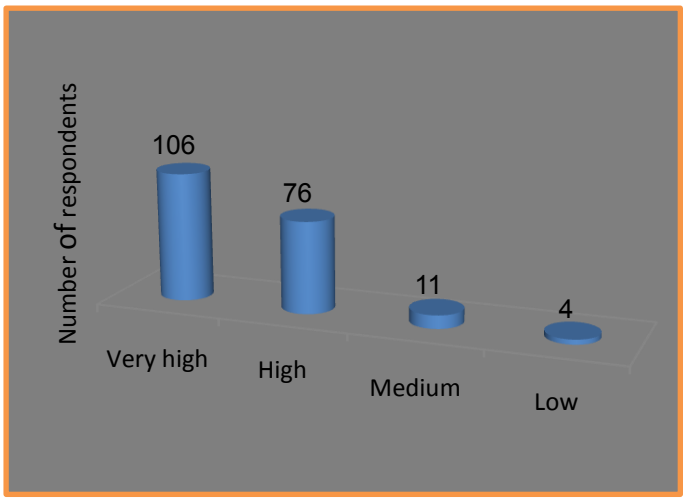

Figure 3 Frequency of local responses regarding severity of the conflict

4.2. 5. Primate species involved in the conflict in terms of their rank

Approximately 73.6% of the respondents reported that crop raiding by monkeys was the most important limit to their crop yields. The respondents ranked the primates based on their involvement in the conflict.

Table 9 Frequency of respondents about primate species involved in the conflict at all study sites in terms of their rank

Primate species involved in the conflict	Study sites		
	Jato	Jarso	Suntu
Vervet Monkey	24.3%	70.58%	69.81%
Anubis baboon	65.7%	12.10%	19.08%

4.2. 6. Crops grown in the area

The known cereal crops cultivated in the area are Maize (*Zea mays*), Sorghum (*Sorghum Spp.*), Finger millet (*Eleusine coracana*) and tef (*Eragrostis tef*) (Table 10). A significant difference was observed in terms of coverage especially among maize and the rest of other crops (x^2 = 433.110, df = 8, P = 0.001). Most tree crops were reported to have exposure to damage during their annual fruitening. However, some crops (banana and papaya) were raided throughout the year.

Table 10 .Response of the study participants about crop species in the study area

Crops	Number of farmers cultivated the crops	Percent	Rank
Maize (*Zea mays*)	201	100.0	1
Sorghum (Sorghum *Spp.*)	76	37.8	2
Avocado (*Persea americanus)*	47	23.38	3
Finger millet (*Eleusine coracana*)	38	18.90	4
Mango (*Mangifera indca*	36	17.91	5
Guava (*Psidium guajava*)	34	16.91	6
Banana (*Musa Spp.*)	31	15.42	7
Tef (*Eragrostis tef*)	29	14.42	8
Papaya *(Carica papaya*)	27	13.43	9

4.2.7. Estimated yield of crops

Average estimate of crop yield per crops per household in 2015 was 1572.0 Kg of Maize, 750.0 Kg of Sorghum, 235.0 Kg of Millet, 227.0 Kg of Tef, 25.38 kg of Avocado, 21.87 kg of Mango, 16.44 kg of Banana, 15.53 kg of Guava, and 9.92 kg of Papaya (Table 11).

Table11. The average yield of crops per household

Crop species	Frequency of households	Yield per household	Crop species	Frequency of households	Yield per household
Maize	122	1350.0 Kg	Sorghum	24	500.0 Kg
	45	1750.0 Kg		23	800.0 Kg
	10	950.0 Kg		22	750.0 Kg
	11	2150.0 Kg		7	150.Kg
	6	3350.0 Kg			
	4	295.0 Kg			
	3	260.0 Kg			
Average		1573.0 Kg	Average		750.0 Kg
Finger millet	28	400.0 Kg	Tef	11	300.0 Kg
	7	200.0 Kg		12	200.0 Kg
	3	650.0		4	150.0 Kg
				2	150.0 Kg
Average		416.66	Average		227.0 Kg
Avocado	18	26.0 Kg	Mango	13	20.0 Kg
	9	23.0 Kg		16	22.0 Kg
	16	25.0 Kg		4	19.0 Kg
	4	29.5 Kg		3	33.0 Kg
Average	25.38 Kg		Average		21.87 Kg
Banana	13	21.0 Kg	Guava	9	20.0 Kg
	15	13.0 Kg		17	13.0 Kg
	3	14.0 Kg		8	16 Kg
Average		16.44 Kg	Average		15.55 Kg
Papaya	5	25.0 Kg			

	4	16.0 Kg			
	2	21.0 Kg			
	Average	9.92 Kg			

4.2.8. Average loss of crops

As estimated by the respondents, the average crop loss per crop species per household over the last three years was 74.02 kg of maize, 45.27 kg of sorghum, 7.31 kg of avocado, 9.56 kg of mango, 7.03 kg of banana, 7.29 kg of guava and 3.22 kg of papaya (Table 12).

Table 12 Average loss of crops per household over the last three years (2013—2015)

Crop species	Frequency of households	Loss per household	Crop species	Frequency of households	Loss per house hold
Papaya	8	2.0 Kg	Sorghum	18	40.0 Kg
	7	3.0 Kg		17	45.0 Kg
	6	6.0 Kg		16	50.0 Kg
	4	2.0 Kg		11	48.0 Kg
	2	3.0 Kg		10	46.0 Kg
				4	42.0 Kg
Average	3.22 Kg			Average	45.27 Kg
Mango	15	11.0 Kg	Avocado	12	5.0 Kg
	9	8.0 Kg		11	6.0 Kg
	7	11.5 Kg		9	10.0 Kg
	5	7.0 Kg		8	7.0 Kg
				7	9.0 Kg
Average	9.56 Kg				7.31 Kg
Banana	10	7 .0Kg	Guava	9	8.0 Kg
	9	8.0 Kg		8	7 .0Kg
	8	6 .0 Kg		6	6 .0Kg
	4	7.0Kg		7	7.0Kg
Average	7.03 Kg			9	9.0 kg

			Average	7.29 Kg

The total loss of maize at seedling, tasseling and ripening stage was 2353, 6371 and 6709 respectively (Table 4). Yield of maize per a hectare was 80 quintal (Limuu Kossa Woreda ARDO). This 80 quintal could be obtained from 60,000 maize plants.

Table 13 Average loss of maize per household over the last three years (2013 –2015)

Frequency of households	Cultivated land in a hectare	Damage in Kg
56	28	8400.0Kg
21	21	5200.0 Kg
40	24	7200.0 Kg
11	7.7	2310.0 Kg
28	11.2	2800.0 Kg
25	7.5	1875.0 Kg
20	16	4800.0 Kg
Total	91.4 hectare	32585.0 Kg

4.2.9. Depredation of domestic animals

Few (5.97%) of the respondents agreed the presence of predation of domestic animals. Anubis baboons seemed to be a threat to young sheep and goats. In rare cases, Vervet monkeys seemed to predate young chicken. Respondents indicated that 9 young sheep, 7 young goats were predated by Anubis baboons and 7 small chicks were predated by Vervet monkeys over the past 3 years (Table 15).

Table 14 Trend of depredation of domestic animals

Domestic animals being predated	Primate species involved	Sites		
		Jato	Jarso	Suntu
Young goats	Anubis	4	2	1
Young sheep	baboon	3	2	4

Small Chicken	Vervet monkeys	0	2	5

4.2. 10.Attitudes of farmers to cultivate cash crops, or other plants which are less attractive to primate species.

Among the study participants, 53.7% of them need to cultivate cash crops in place of cereal crops if condition of the conflict continues in such a way. But 46.3% indicated that they don't need to replace cereal crops by other plants because the cereal crops grown in the area were major means of subsistence. A one way ANOVA revealed that there was no significant difference ($F = 0.060$, $df = 2$, $P= 0.942$) between the three villagers in response to cultivate cash crops instead of cereal crops.

4.2.11. Stages of crops susceptible to loss by primate species

The Majority (80.03%) of respondents confirmed that Anubis baboons damage maize at planting stage, 87.24% indicated that the animals raid maize at seedling stage, 97.51% of them revealed that the animals damage the crop at tasseling stage and all of the respondents indicated that the animals raid maize at ripening stage. The degree of raiding had increased from planting to ripening stage (Table 16). The animals also potentially raided sorghum at seedling, tasseling and harvesting stage. These animals raided all types of crops at harvesting stage, except tef. Vervet monkeys raided maize and sorghum at seedling, tasseling and ripening stage. They also raided papaya at seedling, vegetative and harvesting stage.

Table15 Frequency of locals' responses regarding stages of crops attributed to damage by monkeys

Stages	Raiders	Percent	Common Crops grown in the area							
			Maize	Sorghum	Millet	Tef	Mango	Avocado	Papaya	Guava
Planting	Ab	83.03	√	x	x	x	x	x	x	x
	Vm	63.18	x	x	x	x	x	x	x	x
Seedling	Ab	92.03	√	√	x	x	x	x	x	x
	Vm	87.24	√	√	x	x	x	x	√	x
Tasseling	Ab	97.51	√	√	x	x	x	x	x	x
	Vm	62.68	√	√	x	x	x	x	x	x
Ripening	Ab	100.00	√	√	√	x	√	√	√	√
	Vm	100.00	√	√	√	x	√	√	√	√
	Vm	3.93			√					

√ = Agree, x = Disagree, Ab = Anubis baboon, Vm = Vervet monkey, Percent = Percent of respondents

4.2.12. Feeding preference time of monkeys

Concerning feeding time, 68.65% of the respondents indicated that Olive baboons extended their raiding time from down to 1: PM and 65.17% of the respondents revealed that the preferable raiding time for Vervet monkeys was from down to 6: PM. (Table 17).

Table 16 Frequency of respondents regarding preferred raiding time of monkeys

Monkey species	Frequency	Preferred feeding time
Olive baboons	68.65%	From down to 6: 00 PM
vervet monkeys	65.17%	From down to 7: 00PM

Frequency = Frequency of respondents

During field observation for consecutive four days during the dry season and two days during the wet season, olive baboons were observed to extend their raiding time from down up to 6: 45 PM. In most cases, the animals return to their resting place in the late afternoon. Vervet monkeys were observed to raid crops actively in the early morning and in the late afternoon.

4.2.13. Strategies used to prevent crop damage by monkeys

Majority (77.1%) of the respondents indicated that guarding in field was the most effective means against crop raiding monkeys (Table 18). The respondents revealed that they scare the animals away from the fields by silently approaching them then throwing stones or spears at them or shouting at them. The respondents (23.88%) also mentioned that they faced certain challenges with guarding in the fields like; missing markets, social activities, business activities and from worshiping places. Similarly, they revealed that children were inhibited from attending their regular classes. Men and women were forced to disrupt their social life activities such as visiting relatives, sick and sorrow people. Some (22.38%) 0f the respondents also reported that they get tired guarding fields for long periods of days and nights throughout seasons when there were vulnerable crops in fields from both diurnal pest primates and others nocturnal pest mammals such as Warthogs and Bush pigs. All other strategies were described to be supplementary and less effective. Regarding to these methods, 8.95% of the respondents indicated that they use scarecrow, 7.96% trapping and 5.97% use smoking. It was noticed that when both men and women were guarding farms. In the absence Of parents children aggregate together and guard fields nearby their homes

Plate 8 when kids were guarding field around their home

Table17 Strategies used to prevent crop damage by monkeys

Preventive method	Description	Target animal	Priority
Guarding in fields	At least one person guards the plot for 12 hours (day)	Any monkey	Major
Scarecrow	Scarecrows are placed around farmlands	Any monkey	Supplementary
Smoking	Burning wood around farmlands	Any monkey	Supplementary
Trapping	Digging deep holes around farmlands & covering with grass	Any monkey	Supplementary

4.2.14. Major factors contributing to human-monkey conflicts in Suntu kebele

The majority (80.6%) of the respondents indicated habitat destructions in the area as major factors, human settlement adjacent to monkeys' habitat as a factor indicated by 75.1%. Human population growth (77.1%), poor guarding system of farm (69.7%) and lack of

governmental support in managing monkeys in the area (29.4%) were mentioned as contributing factors to HWC (Table 19).

Table 18 Factors that contribute to human-monkey conflict in Suntu kebele based on logistic regression analysis

variables	B	SE	df	Significance
Destruction of natural habitats of monkeys	-1.424	0.178	1	0.000**
Human settlement adjacent to Monkeys' habitat	-1.105	0.163	1	0.000**
Human population growth	-1.215	0.168	1	0.000**
Livestock population growth	0.311	0.143	1	0.029*
Lack of governmental support in managing monkeys in the area	0.878	0.155	1	0.000**
Poor guarding system of farmlands	-.831	0.153	1	0.000**

Level of significance shown with = $p < 0.001$ and $P < 0.05$

4.2.15. Discussion about the issue of human-monkey conflicts

The majority (62.2%) of the local inhabitants confirmed that they did not report the issue of human-monkey conflict in any public meetings to the concerned body of the Woreda by assuming they would not get response, but 49.3% of the local people indicated that they raised the issue to the concerned bodies of the Woreda. The respondents said that the concerned bodies of the Woreda spoke to them as they would look for strategies in which the local farmers and the monkeys would co-exist peacefully. Discussion to arrive at workable solution about the issue of human-monkey conflict among the local peoples differed (x^2 = 11.945, df = 1, $p < 0.001$) but trends of discussion between the local people and the concerned bodies of the Woreda was insignificant ($x^2 = 0.045$, df = 1, $p > 0.05$)..

4.2.16. Access to information about wildlife

Among the respondents, 77.6% are informed about the useful aspects of wildlife while 22.45% of the respondents had no access to information. A One way ANOVA revealed the presence of significant differences among different age groups in relation to access to information

about aspects of wildlife ($F = 26.434$, $df = 4$, $P < 0.05$). Respondents whose age ranged from 18 to 30 have more accessibility than those whose age ranged from 57 to 69 and 70 to 82.

4.2. 17. Perceptions of the local people regarding the primate species in the area

The local inhabitants differed in their responses about their perception regarding primate species in the area. About half (47.3%) of the respondents indicated that monkeys are very harmful, 40.3% harmful, 4.5% neutral, 5.5% useful and 2.5% very useful. Those who have positive attitudes about monkeys reported that primates are considered as natural heritages and they are also experimental animals. To the contrary, those who have negative attitudes towards them reported that monkeys are crop pests and also damage properties. There was a positive correlation between positive perceptions for primates and the need to conserve monkeys ($r = 0.152$, $p = 0.031$).

4.2.18. Management of primate species

The respondents indicated "Natural resource Conservation" sector of the Woreda to be the concerned body of the issue. The locals also reported that if something is not done against the problem animals, they will suffer because of losses of crops and damage to property.

4.2.19. Trend of forest destruction

The majority (86.1%) percent of the respondents indicated that they collect firewood from nearby forests, 5.5% from private woodlands and 8.4% of the respondents revealed that they collect some amount of firewood from a nearby forest and some amount from private woodlands. Many respondents (83.6%) also indicated the destruction of nearby forests by the local peoples for fire wood, timber production, charcoal, expansion of agriculture and for construction purposes.

4.2.20. Mitigation strategies proposed by the respondents

From Table 20, one can see that more than half (51.24%) of the respondents need to deal with the existing conflict through totally avoiding monkeys from the area. But 10.45% of the respondents need to plant fruit bearing trees in and around forests areas so that to serve as sources of food to monkeys, 9.95% need to translocate the animals, 9.45% chasing/ scaring monkeys away from farmlands, 7.96% planting spiny plants as a fence around farmlands, 6.96% compensation award from government to crop or property damage by monkeys and 3.98% need controlled shooting.

Table 19 Strategies proposed by the respondents to deal with human-monkey conflict in Suntu kebele.

Proposed strategies	Frequency of respondents	Percent
Planting fruit bearing trees in and around forests for monkeys	21	10.45
Planting spiny plants as a fence around farmlands	16	7.96
Chasing/ Scaring monkeys away from farmlands	19	9.45
Translocating pest monkeys	20	9.95
Controlled shooting	8	3.98
Compensation award from government to crop or property damage by monkeys	14	6.96
Totally avoiding monkeys from the area	103	51.24
Total	100.0	100.0

4.2.21. Locals' conservation attitude towards primate species

A one way ANOVA test revealed the presence of significant difference among respondents of different educational background in terms of their conservation attitude towards monkey species. The respondents differed ($F = 32.660$, $df = 3$, $p = .000$). Post Hoc Test revealed where the significant difference lie (Table 21)

Table 21 Post Hoc Test about locals' attitude towards conservation of monkey species in the area

Dependent variable	(1)Educational background	(j)Educational background	Sig.
Do you like to conserve monkey species in your area?	Uneducated	Read and write	.998
		Secondary level educated	.000
		Diploma level educated	.000

4.2. 22. Focus group discussion

All of the discussants had proven the prevalence of human- monkey conflict in the area. They indicated that monkeys were foraging sufficient food from the forest in which they were living. But by now the animals faced scarcity of forages in their habitats. They said that conditions became adverse in relation with the explosion of human population, and habitat destruction, in the area.

Among the responses concerning trends in population size of crop raiding monkeys, all of the discussants perceived the number of major crop raiders, particularly baboons and Vervet monkeys had increased over the past ten years. And hence, the tendency of conflict has increased from time to time .With regard to rating to the magnitude of damage to crops by baboon, 84.38% of the farmers expressed having suffered very high, 15.63% high and 15.62% and none of them preferred to tell very low, medium and no damage to crops. Concerning the extent of damage to crops by vervet monkeys, 78.13 % indicated that they had suffered very high and 21.88 % implied that they had suffered high. None of the discussants reported that Colobus monkeys and Blue monkeys caused very high and medium extent of damage. They also revealed that predation of livestock by the respected primate species was very low as to compared to crop damage. According to their opinion, the severity of crop damage varies from place to place within the kebele. They reported that areas like Jato, where there is high number of Anubis baboons, are prone to more severity than other areas of the Kebele. The majority (67%) of them told that they want to eliminate fruit trees from their farmlands. Because of these, most (65.63%) of the discussants revealed that they have developed negative attitudes towards these animals while 34.37% of them preferred to keep silent.

Table 21 Farmers' opinion about the extent of damage to crops by primate species

Primate species	Number of responses on extent of damage					
	No damage	Very low	low	Medium	High	Very high
Anubis baboon (*Papio anubis)*	0	0	0	0	5 (15.63 %	27(84.38 %)
Vervet monkey (*Chlorocebus) pygerythrus*)	0	0	0	0	7(21.88 %)	25(78.13 %)
Colobus monkey *(Colobus guereza)*	*19(59.37%)*	8(25%)	5(15.63%)	0	0	0

Blue monkeys *Ceropithecus mitis)*	28 (87.5%)	3(9.38 %)	1(3.13 %)	0	0	0

The discussants ranked maize and sorghum from cereal crops and Papaya, mango, avocado and guava from fruits from high to low severity by primate species. Regarding behavioral adaptations of monkeys to raid crops, the discussants reported that when baboons observe people guarding fields, few of them (2, or 3) approach to the field. When the field keeper tries to scare them away, the rest will enter the field in the other direction and raid crops. On the other hand, they reported that Vervet monkeys hide themselves behind crop stands when objects are thrown against them, or when they hear voice of people.

Finally, the discussants pointed out that the government should do something so that the wildlife in our area and the local community co-exist in a harmony. Continuing, they noticed that private sectors, like local investors and others who are interested in the initiative should co-operate with the government.

Chapter Five: Discussion, Conclusion and Recommendation

5.1. Discussion

In the present study, the four monkey species identified in the study area were Anubis baboon (*Papio anubis*), Vervet monkey (Chlorocebus *pygerythrus*), Colobus monkey (*Colobus guereza*) and Blue monkey (*Ceropithecus mitis*). Among these, Anubis baboon and vervet monkey were crop raiders in the area and the rest two were not considered as crop pests. During field survey, 9 respondents indicated that Colobus monkeys rarely used to raid berry of ripened coffee. Quirin (2005) also confirmed that Olive baboons and Vervet monkeys were dominant crop raiders in both uplands and wet lands in Ilubabor zone. He also mentioned that Colobus monkeys were used to raid berry of ripened coffee. A slight increment in population size of the two monkey species was observed during the wet season. This is because farmlands around the forest will provide sufficient foods for the monkeys. During the dry season, the animals will face shortage of food and hence will move to other areas to search food. Similar result was obtained by Mesele (2007) in Wonji-Shoa, Central Ethiopia that revealed the rise in population size of Grevet monkeys during the wet season than during the dry season.

In the study area, male to female ratio of Anubis baboon was 1: 2 and that of Vervet monkeys was also 1 male: 2 female. The result obtained in this study is in agreement with the result obtained by Melaku Haile (2013) in Kafa zone that indicated the sex ratio of Olive baboon was 1Male : 2 Female and that of Vervet monkeys was 1Male : 3 Females. The variation in sex ratio provided suitable condition for males to obtain more mates during their reproduction period.

Crop damage is the most prevalent form of human–monkey conflict in the study area. The majority (above 90%) of the local farmers grow maize in the area. The severity of maize (*Zea mays*) damage by monkeys is relatively higher than the rest of crops. Both baboons and vervet monkeys raid maize at its seedling, tasseling and ripening stage. The result of the present study is similar with the result mentioned by FAO (2009), that indicated the occurrence and frequency of crop-raiding is dependent up on conditions such as the availability, and type of food sources in the area, level of human activity on a farm and type and maturation of type of crops. The other causes for conflicts in Suntu kebele is destruction of farmers hut when monkeys scratch roofs in search of worms, and predation of domestic animals. A study undertaken in India (Sunanda and Saika, 2008) stated that monkeys not only

attack humans, but also properties. The human population growth rate in the area is also a key factor for the conflict. The annual growth rate of the rural Kebeles of the Woreda is 3.1%. Similarly, Lee and Priston (2001) indicated that the population growth rate of 3.1% is probably unsustainable in a country that is 80% depending on small-scale agriculture. (Siex and Struhsaker, 1999) also stated that in Africa, human population growth has led to encroachment into wildlife habitats, constriction of species into small areas and direct competition with local communities. The majority (83.6%) of the respondents indicated the presence of forest destruction for agriculture and for different purposes. Such types of activities will eliminate fruit-bearing plants in the forest areas which are used as sources of food for the monkeys. Therefore, the animals move to farmlands to raid crops. Mesele Yihune *et al* (2009) also mentioned that human wildlife conflict occurs when the needs and behavior of wildlife impact negatively on humans, or when humans negatively affect the needs of wildlife.

More than 52.75% of the respondents revealed that the incidence of sever conflict between humans and the two pest monkey species was very high. A study conducted in Wondo Genet, Southern Ethiopia (Muluken Mekuyie, 2014) reported that incidence of crop damage by Olive baboon and Vervet monkey was due to their social organization. The damage incidence is high because it is difficult to chase them away since they come to plantation fields in different directions in large number. Osborn and Hill (2005) also explained that primates can have a significant impact on crop yields due to the extreme agility of many primate species. The intensity of damage to crops varied from site to site within the Suntu kebele and even in the same farmlands. With regard to this situation, (Hill, 2004) stated that individual farming households can experience different crop losses even within the same village. Variation of crop damage by pest primates in each site was observed. Relatively high amount of damage was seen at Jato and Suntu site because the farmlands at Jato and Suntu are found around close to forest boundaries. But a relatively least amount of damage was observed at Jarso site because there are no forest areas at this site. Pest monkeys move to this site to raid crops from the neighboring Kebeles. Hill (2000) also revealed that distance between farm and the forest boundaries and the number of neighboring farms are highly likely to affect vulnerability to crop raiding by wildlife. Knight (2001) also stated that in tropical and subtropical regions, the extension of farming in to the forest interior makes wild animals become farm pests.

The damage to maize crop by Anubis baboons in the three study sites was 1.43% per hectare (or 1.15 quintal per hectare) and the damage to the same crop by Vervet monkeys was 1.42% per hectare (or1.3 quintal per hectare). Similar study was undertaken by Mesele Yihune (2006) in and around Semein Mountain National Park and he mentioned that average crop loss by Gelada baboon per hectare in the study area was 1.17 ± 0.1 quintal. The current result is comparable with this result. But it is not comparable with the study conducted in Nigeria which stated that up to 70 % crop loss occurred by monkeys moving in groups (Ofor *et al.,* 2009). Not only maize crop raided by the pest monkeys but also sorghum and various types of fruits (Table 12). The local farmers reported that if the existing conflict continuous in such a way they would likely to cultivate other cash crops instead of crops which are vulnerable to raiding by the animals. Fewer (12) respondents reported that they have already gave up cultivating sweet potatoes and pumpkin because of monkeys. A research conducted by Gerard and Ruf (2001) in the province of Sumatra (in Indonesia) indicated that primary rubber-producing area were converted to palm oil plantation because of primates.

Anubis baboons and Vervet monkeys raid maize plant at its all developmental stage. In this regard, (Hill, 2000) undertaken similar study in Uganda and confirmed that baboons raid maize throughout much of its growing cycle. Kate (2012) also conducted similar research in Hoima District of Uganda and reported that Vervet monkeys used to feed on roots, fruits and seeds of maize. The magnitude of damage to maize crop by pest monkeys varied in its all developmental stage at both study sites. Relatively a higher damage was observed during ripening stage by Anubis baboons whereas tasseling stage by vervet monkeys. The least amount of damage was observed during seedling stage by both animals at each study site.

In most cases, Vervet monkeys damage the top buds of maize plants during seedling stage while Olive baboons break the stems and then chew .There is no sufficient food content during the tasseling stage. For this reason, the monkeys move from one maize plant to the other to obtain better maize cob containing sufficient grains. In the process they waste a number of cobs within a short period of time. During matured stage, especially when the crop is going to dry, they are likely unable to chew the seeds. To the contrary of this, the damage to this crop is sever by Anubis baboons during ripening stage and damage continues until the crop is collected by the farmers because baboons can chew even dried maize seeds. Kate (2012) also described that Baboons have the potential to cause large amount of damage locally. They raid farms more frequently than other species. In addition to crop damage, these

animals also reported to have predated domestic animals (Table 15). Lambs and goats were raided by baboons and small chicken by adult male Vervet monkeys. Mussa (2009) also reported that Hamadryas baboon predated on sheep and goats in and around Denkoro forest. Similarly, (Eniang, *et al*, 2011) indicated that baboon preys on domestic chicken and sometimes attack women and children. The predation of Vervet monkeys on small domestic chicken reported by the local farmers. This situation might have been a new foraging behavior of Vervet monkey.

Farmers use various types of methods (Table 18) to prevent their crops from pest monkeys. The majority (77.1%) use guarding in the fields. In both study sites, guarding carried out by plot owner or by any member of the family. Very often, men are supposed to guard fields since they usually work in the fields. But in the absence of men, women also guard fields being two or more. If the field is nearer to home, kids also guard being two or more. People guard crops especially maize throughout its developmental stage. Hill (2000) in his survey in Uganda described that children of 6 to 12 years old carry out nearly a third of all guarding and just over a third is done by women and the remaining is carried out by men. In the current study it was observed that when adults carry out this activity, they were losing their productive time and children couldn't attend school regularly. Concerning this issue, Hill (2004) revealed that crop losses to wildlife may have various impacts on farming households. They include high guarding investment, disruption of schooling for children who have to help guard fields

The different approaches to reduce conflict between local communities and wild herbivores across Africa are documented in different studies (Osborn and Parket, 2003). The approaches can be divided into two groups, namely passive and active. Passive systems attempt to limit the movement of 'target species' into areas of agriculture. Barriers such as thorns, wooden or stone fences, trenches and electric fencing are among passive crop protective methods in many countries. Active systems are typically utilized in fields and some of these include 'drive them away', defense used by farmers (e.g. chasing animals by banging different objects like drums, or tin, shouting and throwing objects), and in some areas shots are fired into the air to scare animals.

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Most (62.2 %) of the respondents agreed that they did not report the issue of human monkey conflict to the concerned body of the Woreda by assuming they would not get solution. Smith *et al*., (2010) obtained similar result in Northern Sumatra that 89 % of the respondents who had experienced crop raiding by Orangutans claimed never to have reported such incidents because they did not know to whom to report, and in part (29 %) because they assumed that no one act even if the problem was reported.

About half (47.3 %) of the respondents claimed that monkeys are very harmful because they are crop pests and damage properties. On strategies proposed by the respondents to deal with human- monkey conflict, 51.24 % of the respondents showed a desire to totally eliminate the animals from the area. Similarly 65.63 % of the discussants told that they had developed negative attitudes towards the monkey species. The current result is not in line with the result obtained by Khatun *et al* (2012) in Keshabpur (Bangladesh) that described despite the anxiety regarding potential attacks and crop damage; many people enjoy seeing Langur as their ancestors used to do. Concerning attitudes towards conservation of monkey species in the area, 78.26 % of the respondents who reached secondary education and all those who reached higher level education (diploma level) have positive attitude towards conservation of monkey species in the area. This result is comparable with the result obtained by Nekaris *et al* (2013) stated that youngest respondents and those with the highest level of education had positive attitude towards primates. This may be attributed to the fact that the Sri Lankan Ministry of education is currently developing a new emphasis on education for sustainability and domestic conservation issue.

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5.2. Conclusion

The present study showed that demand is a factor driving human-monkey conflict in the area. When peoples' settlement and/ or activities is coincided with that of wildlife's habitat, competition will occur on limited available natural resources like food and space. And hence, this study provides information about the extent of human-monkey conflict in Suntu kebele of Limmu Kossa Woreda. The conflict between the local people and primate species (Anubis baboon and vervet monkey) is greatly pronounced in the area. Farmers perceived crop damage by these animals as a big challenge to agricultural development.

The severity of damage is high to cereal crops like maize, sorghum and fruits like mango, avocado banana, guava and papaya. Severity to papaya and banana is higher than those of other fruits because they have no definite fruiting time. Anubis baboon and Vervet monkeys were the known crop-raiders that damage substantial losses on crops in the three villages surveyed. Maize is a main crop which is cultivated in the area. The magnitude of threatening people, stealing kitchen food and animal predation by these animals is very low. To the present day, injury to human by the animals is not reported.

To prevent their crops from pest primates, the majority of people uses infield guarding and uses other supplementary methods. Farmers in the study area guard not only diurnal pests but also nocturnal pests like wild pigs. To guard their farms, people waste their productive time and energy. The farmers had no communal system of guarding their fields from pest wildlife. Due to this situation, pest monkeys and other wildlife obtain opportunity to damage crop easily.

There is destruction of natural forests in the area for the purpose of firewood, timber, charcoal, construction and for expansion of agriculture. This situation in turn has decreased availability food resources and niches for monkeys. Therefore, the animals are forced to move out of their area to raid farmers' crop. From linear logistic regression analysis, the most determinant factor for human-primates conflict in Suntu Kebele is destruction of natural habitats of primates.

The majority of the respondents have negative attitudes towards primates species while fewer of them have positive attitude towards these animals. There was a significant difference

between uneducated individuals and individuals who reached secondary and higher level of education in terms of their attitude towards the pest monkeys. This difference aroused because of the severity of damage to crops varies from village to village and from farm to farm. The other attitudinal difference between educated and uneducated people was created because of access to information about the benefit of wildlife to one's country.

5.3. Recommendation

For sustainable living of both humans and wildlife, the following recommendations are forwarded:

- Strengthening adult education in rural areas and mainstreaming the benefit of wildlife in the curriculum.
- The Woreda administrative bodies, Agricultural and Rural Development Bureau, the local investors in the Woreda, the local farmers and any individual person who is committed to the initiative of wildlife conservation should work cooperatively.
- Sharing best practices with other areas that are facing similar problems because of human-monkey conflict.
- Establishing Wildlife Conflicts Working Groups(WCWG) at a national level and to Woreda level (as was done by Biodiversity analysis and technical support for US Aid/ Africa)
- Establishing Environmental Institution independently in Oromia National State independently of ARDO
- Realization of the transformation (by the government) from agriculture-based economy to industry-based economy. This may let some rural peoples move to towns to be employed in industries. This will in turn minimize expansion of farmlands to forest areas.
- Establishing buffer zones between farmlands and forest areas to discourage monkeys from raiding crops
- Installation of electric power to rural areas (by the government). This will help people minimize destruction of forests.

References

Addisu Meknnen, Afework Bekele, Fashing P.J., Learnold, J.M., Atickom, A. and Stenseth,N,C.(2012). Newly discovered Bale monkey populations in forest fragments in South Ethiopia: Evidence of crop raiding, hybridization with Grivets and other conservation threats .American journal of primatology 00: 1-10

Afework Bekele and Yalden , D .W. (2013).The mammals of Ethiopia and Eritrea. Addis Ababa University press, Addis Ababa, Ethiopia .Pp.117- 130

Alerts. C., Altman, J., Brockman, D. K., and Fedigam, L. M. (2010). Reproductive aging patterns in primates reveal that humans are distinct. Pp.2

Anon (2011). http://primatology.net/2011/03/09/thesemantics-of-vervet-monkey-alarm-calls-part-i/). (Accessed January, 2015) Pp. 5

Antonio. (2011). Non-human primate's environmental enhancement national primate research center. Texas biomedical research institute, USA, Pp.5

Avanti, M. (2008). Animal welfare research and its implications to non-human primate breeding programs: A case study of the lion-tailed macaque conservation breeding program from India. **19** (10B) Mary land, USA. Pp40.

Barnett, A. (1995). Expedition field techniques primates. Royal geographical society, London. Pp.34

Barton RA, Whiten A, Strum SC, Byrne RW, Simpson AJ. (1992). Habitat use and resource availability in baboons. *Animal behavior* (5): 831-844

Brent, L., and Haven, C., (2001). A six booklet series on providing appropriate enrichment for baboons. South west foundation for biomedical research. Pp.3

Brosnan, S.F. , Neuton-Fisher , N.E., and Mark,V. (2001). Personality and social psychology review (in press) . Georgia state University, Atlanta .Pp.9.

Bruce, O.(2008).Introduction to biological anthropology.Notes9. Why anthropologists studynon-human primates, and an introduction to our relatives? Pp.2

Buckland, S.T., Anderson, K.P. , Burnham, J. L, Lake, D.L. , Borchers, L.T .(2001). Introduction to distance sampling: estimating abundance of biological populations. Oxford: Oxford University Press. Pp.13

Burnham, K. P., Andrew son, D. R. and Lake, J. L. (1980). Estimation of density from line transects sampling of biological populations. Wildlife society, Washington Dc. *Wildlife monograph* **72**

Butynnsky,T.M., and Jong Y. A. (2001). Eastern Africa primate diversity and conservation program, Lolldaiga Hills research program, sustainability centre Eastern Africa ,Nanuyiki , Kenya. Primate conservation **1**(28): 117-128

California Biomedical Research Association (un dated). Fact sheet: Primates in biomedical research. Available at: www.ca.biomed.org).(Accessed October, 2015). Pp.1

Capitanio, J. P. (2008). Monkey studies important in brain science. California National Primate Research Center. British medical journal, *The lancet*.Pp.1-2

Carvajal , P. M. , Bernard , I. R. , González , Y. , Sánchez, K., Franco, V., Silva ,S. and DeleÓn, G. (2013). Strategies for conservation of two critically endangered, endemic primates in Panama. FundaciÓn proconservacion de los-primates Panameňos (FCPP), Panama, Repoblica de Panamá. *Primate conservation*. Pp.4

Chapman, C. A. , and Chapman, L. J. (1990). Dietary variability in primate populations. Short communication. *Primates*, **3** (1):121-128

Cochran, W.G. (1977). *Sampling* techniques, Third Edition. John Willey andSon, USA. PP.47

Cohen, L. Lawrence Manion, Keith Morrison. (2007). Research Method in Education. Pp.24

Dagim Alemayehu (2016). A history of coffee production and marketing in Limu Awraja from 1990-1990. MA. Thesis, Jimma University, Ethiopia. Pp. 48

Dereje Tesfaye , Fashing, P. J. and Afewrk Bekele (2012). Ecological flexibility in Boutoulini's Blue Monkeys (Ceropithetecus mitis boutourlinii) in Jibat forest, Ethiopia: A comparison of habitat use, ranging behavior and diet in intact and fragmented forest. *Intact Jibat primatology* (34): 615-640.

Dagne Mojo, Rothschuh,J., and Alebachew Mehari(2014). Farmers' perceptions of the impacts of human –wildlife conflict on their livelihood and natural resource management efforts in Cheha Woreda of Gurage zone, Ethiopia. *Human- wildlife interactions* **8(**1): 67-77

Devi, S.N. and Radhakrishna, S. (2013). Attitudes towards primates and primate conservation in Manipur, North- east India. *Asian primate journal* **3** (1) .Pp.28

Distefano, E. (2010). Human wild-life conflict worldwide: Collection of case studies, analysis of management strategies and good practices. Kruger National Park, South Africa. Pp.2

Durow, E. (2008). Vervet monkeys-victims of human persecution. Save our planet network. Pp. 4

Elizabeth, S. (2012). A research project submitted in partial fulfillment of the requirement for the award of the degree of M.A. University of Nairobi, Kenya .Pp.4

Eniang, E., Ijeomah , H. , Okeyoyin , G. and Uwatt, A (2011). Assessment of human-wildlife conflicts in Filinga Range of Gashaka Gumti National Park, Nigeria. University of Port Harcourt Pp. 44

European Commission (2002 a). The welfare non-human primates in research. Report of the scientific committee on animal wealth and animal welfare .Pp.5

European Commission (2002 b).The need for non-human primates in biomedical research. Statement of the scientific steering committee adapted at its meeting of 4-5 April 2002. pp.1

George, R.M., (2002). Primate dentition. An introduction to the teeth of non-human primates. Cambridge University press, University of USA. Pp.1

Gerard, F. and Ruf, F. (eds). (2001). Agriculture in crisis: People, commodities and natural resources in Indonesia, 1996 to2000. Cirad, Montpellier.PP.21

Gliem, J. A. & Gliem, R. R. (2003). Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education

Gorden, A. D. , (2004). Evolution of body size and sexual dimorphism in the order primates: Rensch's rule, quantitative genetics, and phylogenetic effect. PhD thesis, University ofTexas at Austin. Pp. 14

Hill, C. (2000). Conflict of interest between people and baboons: Crop raiding in Uganda. Int. *J. primate*.**21**: 299-315

Hill, C. (2004). Farmers' perspective of conflict at the wildlife –agriculture boundary: Some lessons lesrned from African subsistence farmers. *Hum Dimen Wild* 9: 279-286

Hoar R. E. (1992). The present and future use of fencing in the management of large African mammals. *Environmental Conservation* **19**: 160-164.

Hockings, K. and Humble, T. (2009). Best practice guide lines for the prevention and mitigation of conflict between humans and great apes . Gland, Switzer land: IUCN/ SSC primate Specialist Group (PSG) .Pp.41

Hoffman, T. S. and Óriain, M. J.(2012). Land escape and requirements of primate population in a human dominated environment. University of Cape town, South Africa *Frontiers in zoology* **9** :(1), Pp. 1

IUCN and ICCN(2012). Bonobo (Pan paniscus) : Conservation strategy 2012 -2022 . Gland, Switzer land : ICCN/ SSC primate specialist group and institute Congolois Pour la conservation de la Nature .Pp. 65

Jaeggi, A. V., and Gurven, M.(2013). Natural cooperators: Food sharing in humans and other primates. *Evolutionary Anthropology* 22: 186-195.

Jones, C. B. (2005). Discriminating feeding on legumes by mantle Howler Monkeys (*Alouatta palliate)* may select for persistence. Pp.1

Joseline, N. (2010). The impact of crop raiding by wild animals from Bugoma forest resrve on farmers' livelihoods. MSc. Thesis, Maker ere University. Pp.15

Kate, K.(2012). Possible strategies/ practices in reducing wild animal (primates) crop raids in unprotected areas in Homina District

Khatun, U. H., Ahshan , M. F. and RØskaft , E. (2012). Attitudes of the local people towards the conservation of the common langur *(Semnopithecus entellus*) in Keshabpur, Bangladesh . *International journal of biodiversity conservation* 4 (11): 385-399

Knight,J.(2001). Introduction in Natural enemies: people-wildlife conflicts in anthropological perspective. Routtledge,London. Pp. 1-35

Laden, S.I., Anne, K., Boulton, A. and NIjamin, V. (2014). An ethno primatological approach to assessing levels of tolerance between human and commensal non-human primates in Sri Lanka. Primates in Sri Lanka. Oxford Brokers University. UK.. *Journal of anthropological sciences* **91** : 1-14

Lamarque, F., Andrew, J. , Fergusson, R. ,Lagrange,M. and Osci-Owasu, Y. (2009). Human -wildlife conflict in Africa – Causes, consequences, and management strategies. Food and Agriculture Organization of the United Nations. Rome, Italy. Pp.1

Lee, P. C. and Priston , N. E. C. (2001) .Human attitudes to primates: Perceptions of pests , conflict and consequences for primate conservation .University of Cambridge , UK.Pp.1

Linnel, J ., Sukumar, R., Shanker, K.(2014).Current conservation. Special*: Wildlife-human conflict*, **4** (4), Pp. 40

Lodico, M. G., Spaulding, D. T., & Voegtle, K. H. (2010). *Methods in educational research: From theory to practice (Vol. 28)* . John Wiley & Sons.

MacClancy , J. and Fuents, A. , (2009).Consideration on field methods used to asses non-human primates feeding behavior and human food intake interms of nutritional requirement. Oxford and New York, Berg Hahn. Pp.3

MacDonald.(1984).The encyclopedia of mammals. Facts on life publication, New York.Pp.1

Mago , N.C., and Chivers , D. (2010). Local knowledge and perceptions of pet primate and wild Margarita Capuchins on Isld de Margarita and Islade Cohe in Venezuela .Wild life Research Group , Cambridge, UK. *Endangered Species Research* 13: 63-72

Manfreda, E.,Mitteroecker,P., Bookstein,F.L., and Schaefer, K.(2006).Functional morphology of the first cervical vertebra in and non-human primates. The anatomical record (part B: New anatomy) 289B:184-194

Marchal, V. and Hill, C.(2009). Primate crop raiding: A study of local perceptions in four villages in North Sumatra, Indonesia.Anthropologycenter for conservation, environment and development, Oxford Brookes University, Oxford, UK. *Primate conservation*,(24): 107-116

Mcestripieri, D. (2012). Comparative primate psychology. The university of Chicago .IL, USA. Elsevier Inc, Pp.552

Meguerditchian , A. and Vauclair, J.(undated).Vocal and gestural communication in non-human primatesand the question of the origin of language. Center of primatology , CNRS,France. London: Psychology press. Pp.61-85.

Melaku Haile (20013). Assessment of human-wildlife conflict with special emphasis on pest primates in Saylem woreda, Kafa zone. MSC. Thesis, Jimma University, Ethiopia. Pp. 54

Mesele Yihune, Afework Bekele and Zelalem Tefera (2009). Human wildlife conflict in and around the Simein Mountain National Park, Ethiopia. Ethiopian journal of science, **32**(1): 57-64.

Messele Yihune (2006). Human wildlife (The Ethiopian Wolf and Gelada Baboon) Conflict in and around the Siemien Mountain National Park. MSC thesis, Addis Ababa University, Ethiopia.Pp.21

Messele Yihune, Afework Bekele and Zelalem Tefera(2009). Human-Wildlife conflict in and around the Simein Mountains National Park, Ethiopia. SINET: Ethiop. *Journal of Science* **32** (1) : 57-64

Milton, K. (2000). Back to basics. Why food of wild primates have relevance for modern human health. University of California, Berkley, USA, **16** (7/8), 2 .Pp 482

Muluken Mekuyie (2014). Human-wildlife conflict: Case study in Wondo Genet District, Southern Ethiopia. Agriculture Forestry and Fisheries **5**:352-362

Muruthi, P. (2005). Human-wildlife conflict: Lesson learned from AWF's African heart lands. AWF' working paper, Nairobi, Kenya.Pp.3

Mussa, A. (2009). Population status of Gelada baboonand human-wildlife conflict in and around Denkoro forest. MSC. Thesis, Addis Ababa University, Ethiopia. Pp. 44

Nahallago, C. A. D., Huffman, M. A., Kurppu, N. and Weerasingh, T. (2008). Diurnal primates in Sri Lanka and peoples' perceptions of them. *Primate conservation* **23**: 81-87

Naughton-Treves, L. (1997**).** Farming the Forest Edge: Vulnerable Places and People around Kibale National Park, Uganda. *Geographical Review* **87(**1**):** 27-46.

Naughton-Treves, L. (1998). Predicting Patterns of Crop Damage by Wildlife around Kibale National Park, Uganda. *Conservation Biology* **12(**1**):**156-168

Nekaris , I. ,Anne, K. , Boulton, A. and Njamn, V. (2013). An ethnoprimatological approach to assessing level of tolerance between human and non-human primates in Sri Lanka. Oxford Brookes University, UK, *Journal of anthropological sciences* **91**:.1-14

Nekaris, K. A. I. (2005). Foraging behavior of the slender Lories (Lories iydekker rianus) implications for the theories of primate origins. Washington University, USA.Pp.289.

Norkonk, M.A., Boinski,S., P .M . (2011). Does primate conservation promote ecosystem ? *American journal of primatology* 73: 3-8

Ochala, G. C., Koske, J., Asoka, G. W., Bunyasi, M. M., Pacha, O., Omondi , S. H. and Mireri , C. (2013).Assessment of traditional methods used by Samburu pastoral community in Human-wildlife conflict management. Kenyatta University, Nairobi, Kenya. *International journal of humanities and social* **3** (11) Pp.292

Ofor, O. , Ibeawuch, I. and Oparaeke, M.(2009). Crop protection problems in production of maize and Guinea corn in Northern Guinea Savannaof Nigeriaand control measures. Department of crop science and technology, Federal University of technology, Owerri. *Journal of nature and science* **7** (11) : 45-51

Osborn, F.V. (1998). The Ecology of Crop-raiding Elephants in Zimbabwe. *PhD thesis*, University of Cambridge, Cambridge. Pp 73-79.

Osborn, F. and Hill, C (2005). Techniques to reduce crop loss: Human and technical dimension in Africa. In: *People and wildlife: Conflict or coexistent?* Cambridge University press , Cambridge, UK. Pp. 72- 85

Osborn, F. V. and Parket, G. E. (2003). Towards an integrated approach for reducing the conflict between elephants and people: a review of current research. *Oryx* **37**: 80-84

Potter , S. (2009). Biology Student Text book Grade 12. Federal Democratic Republic of Ethiopia Ministry of Education. Pearson education, England, Pp.132

Pitra Rs, Gadgil M, Kharshikar AV. (1997). The management of the rhesus monkey *Maccaca mullatta* and human langur presbytis entellus in Himachal predesh, India. *Biol conserve 79: 97-106.*

Priston, N. E. C. (2008). Modeling primate crop-raiding perceptions of risk, actual risk and the implication for conservation final report. Oxford Brookes
University, UK. Pp.1

Quirin,C. (2005).Crop raiding by wild vertebrates in the Ilubabor zone, Ethiopia. A report submitted to university of Otago, New Zealand. Pp.23

Rabineau, J., (2009). Integrated non-invasive investigations of captive Abyssinian colobus monkey (*colobus guereza*): behavior, stress and parasitism. Doctoral thesis , University of Exeter. Pp. 5-6

Sekhar, N. U. (1998). Crop and livestock depredation caused wild animals in protected areas: The case Sariska Tiger Reserve, Rajasthan, India. *Environment Conservation* **5** (5) : 73-87

Silva,J.C., Alfaro, J. L., and Salazar, L. T. H.(2010).Ecology and behavior of tropical climates.*Tropical biology and conservation management* **8** (1). http:/www.eolss.net/ Eolss-sample All Chapter aspx, pp.1(Accessed March, 2016)

Sharma, G. , Ram, C . D. ,Rajpurhohiy ,L. S. (2011). Study of man- monkey conflict and its management in Jodhpur, Rajasthan (India). *Journal of Evolutionally Biology Research 3* (1):1-3

. Siex, K. S. and Struhsaker, T. T. (1999). Colobus monkey and coconutsia study of perceived human-wildlife conflicts. *Journal of Applied Ecology* **36**: 1009-1020.

Stuart, C., and Stuart, T. (1994). *Afield guide to the truck and signs of Southern and East African wildlife*. Southern Book Publisher Ltd, Singapore .Pp.64-165

Sunanda, O. and Saikia, P. (2008). Human –monkey conflict. A cause study Gauhati University campus Jalukbari Kamrup Assum zoos' print. 23 (2): 15-18

Sukumar, R. (1989). *The Asian Elephant.* Cambridge University Press, Cambridge. Pp.265

Teichroeb, A. , White, M. J. , and Chapman, C. A. (2014). Vervet (*Chlorocebus pygerythrus).* Intergroup spatial positioning: Dominants trade-off predation risk for increased food acquisition. *Int j primatol* . Springer science + Business media, New York. Pp.9

Thomas, M. B. and de jong , Y. A. (2014). Primate conservation in Rangeland Agro-ecosystem of Laikipia county , Central Kenya. Eastern Africa primate diversity and conservation program, sustainability centre East Africa.

Treves,A.(2007).Balancing the needs of people and wildlife: When wildlife damage crops and prey on livestock. An institute for research and education on social structure, rural institutions, resource use, and development. USAID NO.7

Upadhyay, M. (2009). Primate conservation awareness program in annapurna conservation area of Nepal. Projects and research supported by the CWP. Pp.3

US AID (2008). Ethiopia Biodiversity and Tropical Forest 118/119 Assessment. Pp.12

Weethalle, D. (2006). The use of non-human primates in research. A working group report. the academy of medical sciences. Oxford University and World Bank, New York and Washington.PP.119-138

Whitten, A., and Widdowson,E.M.(eds), (1992). Foraging strategies and natural diet of monkeys, apes and men. Oxford scientific publications, Oxford.

Wolf N. D. , Escalante A. A. , Karesh W.B. , Kilbourn, A. Speilman, A., and Lal , A. ((2009). Wild primates Population in Emerging Infectious disease research. The missing link? *Emerging infectious diseases* **4** (2): 149- 158. Harvard School of Public Health, Boston, Massachusetts, USA.

Working party for the preparation of the fourth multilateral and consultation 6th meeting (2003). Species- specific provision for non-human primates, Strasburg.Pp.4

Appendices

Jimma University

College of Natural science

Department of Biology (General Biology)

This questionnaire is prepared for a research entitled on "Assessment of human- primate conflict in Suntu kebele of Limu Kossa woreda, South-West of Ethiopia ". The questionnaires are designed for this research only. You are generously asked to

Respond to the questionnaire which will be used in the study. The information gathered will be used for the purpose of this research only and will be treated with strict confidentiality. Thank you in advance for your co-operation!!!

APPENDIX 1: Survey questionnaire on the back ground of the respondents and crop loss and/ or property damage by primates, and public perceptions about them

Direction one: Tick the appropriate answer to your level best, except for your age.

1. Respondents' back ground:

Your sex: Male [ ] Female [ ]

Your age in year----------

Your educational back ground: A) Uneducated [ ] B) Primary education [ ] C) [ ] D) secondary education E) Higher education [ ]

D) Secondary education [ ] E) If any other, please specify----------

Your marital status: A) Married [ ] B) Unmarried [ ] C) Divorced [ ] D) Widowed [ ]

2. What are your economic activities? A) Farming only [ ] B) Farming and livestock keeping [ ] D) If any other, please specify ----------

---

3. If your response to question no 2 is farming, what is the size of your farmland in a hectare? A) <1hectare [ ] B) 1 to 2 hectare C) > 2 hectare

4. Do monkeys occur in your locality? Yes [ ] , No [ ]

5. Do monkeys negatively affect your lives? Yes [ ] No [ ]

6. If your response to question no 5 is "yes", in what ways do they affect? A) Damaging crops [ ] B) damaging properties [ ] C) Stealing food in the house [ ] D) Livestock predation [ ] E)

Threatening people [ ] If any other, please specify----------
---

7. What is the frequency of human-primate conflict in your area? A) Annually [ ] B) Seasonally [ ] C) Weekly D) Daily [ ]

8. Can you rank the severity of the incident? A) Very high [ ] B) High [ ] C) Medium [ ] D) Low [ ] E) Very low [ ]

Direction two: Short answer

9. What types of primate species live in your area?

……...

10. What are the main monkey species involved in the conflict in your village? Please rank them

……...

11. What type of crops do you have in your farm land this year? Please, rank them in terms of their coverage…….

……...……

……..

12. How much quintals or kilos of crops did you get last year from each crop type?

……...

……...

13. In your opinion, how many kilogram or quintal of yields did you loose from each crop species by monkeys over the last three years?

14. How much hectare of land did you cultivate maize over the last three years?

15. Do you need to cultivate cash crops or other plants in place of cereal crops because of monkeys?

16. Have you ever lost any livestock by primates? If your response is "yes",

A) What livestock?

B) How many?

C) What is/are the monkey species involved?

17. At what stage do monkeys attack your crops most? Please respond in the table that follows. Tick "√" for agree and "x" for disagree.

Stages	Raiders	Common Crops grown in the area							
		Maize	Sorghum	Millet	tef	Mango	Avocado	Papaya	Guava
Planting									
Seedling									
Tassel									
Harvesting									

18. What time do the animals prefer to raid at day time? ----------
---

19. Do you think the following events (or activities) could be factors for human-monkey conflict in your area?

Variables	Respondents frequency	
	Yes	No
Habitat destruction		
Human settlements adjacent to monkeys habitat		
Human population growth		
livestock population growth		
Poor guarding system of farmlands		
Lack of governmental support in managing monkeys species in the area		

20. What is the trend of your discussion among your selves about the issue of crop-raiding by these animals in any public meetings? A) Yes B) No

21. Have you ever discussed with the concerned bodies of the Woreda about the destruction of your crops by these animals? A) Yes B) NO

22. If your response to question no 20 is “Yes”, what response did you get from them?

23. Describe the various techniques you use to control (minimize) your crop damage because of primates?

24. Which of the techniques you mentioned in question no 22 are:

A) Most effective? B) Least effective?

24. Do you have access to information about wild animals? A) Yes B) No

26. What is your perception towards monkey species found in your localities? Please rank them.

A) Very useful B) useful C) Very harmful D) harmful E) Somehow useful ,or harmful

27. For the response that you chose in question no 25, can you reason out?

……...

……...

……...

28. Who manages wildlife in your environment?

29. Where do you collect your fire wood?

30) Do people in your area clear forests A) Yes B) No)

31) If your response to question no 29 is "yes", for what purpose do they clear?

……...

32) Do you like to conserve monkey species in your area? A) Yes B) No

33) Can you mention some mitigation strategies to deal with human –monkey conflict in your area?

.

APPENDIX 11: Questions for focus group discussion

1. What monkey species live in your area?

2. Do you know the group sizes of monkey species in your area?

3. What is the tendency of crop-raiding by monkeys from time to time in your area?

4. Do you know if some areas in your kebele are more affected than others by these animals?

5. Do these animals have enough alternative food sources other than cultivated crops in the area?

6. If your response to question no 5 is "yes", please mention some of the alternative food sources available in the area

7. If your response to question no 5 is "no”, please mention some of the factors for lack of alternative food resources for these animals.

8. Do these animals show any specific behavioral adaptations to raid crops? If any, please mention some of them. ……..

…….....

.....

.....

9. What type of crops are seriously affected by these animals? Please mention them in terms of their order of being destructed.

……...……

…….

……..

……..

……

…….

10. Have you ever discussed with the concerned bodies of the woreda about the destruction of your crops by these animals?

11. If your response to question no 10 is "Yes", what response did you get from them

12 .Do you need if any governmental or non-governmental organization to help you compensate for your crop loss by these animals?

13. Do you have access to information about wildlife?

14...Do you need initiative activities to conserve these wildlife in your area?

15. What issues do you think to be addressed to:

A) The local community,

B) The private sectors and

C) The government for sustainable conservation of these animals without causing great damage to your crops and properties

APPENDIX III : Data collection sheet for direct observation of crop damage by monkey species

Place_____

Site_____

Season_____

Stages of crop development_____

Distance of the field from the forest boundary_____

Name of data collector_____

No	Monkey species involved	Type of crop damaged	Parts of crop damaged	Size damaged (m^2)	Time of observation: Year___ Month___ Date___
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Appendix IV: Data collection sheet for age structure of monkey species in the study area

Date_____

Species_____

Season_____

Place _____

Site_____

Name of data collector_____

Age structure	Seasons	Sites			Total	Mean ± SD
	Dry					
	Wet					
	Dry					
	Wet					
	Dry					
	Wet					
	Dry					
	Wet					
	Dry					
	Wet					
	Dry					
	Wet					
	Dry					
	Wet					

AM = Adult Male, AF= Adult Female, SAM=Sub-Adult Male, SAF=Sub-Adult Female

APPENDIX V: Data collection sheet to identify primate species and their sexual dimorphism

AM=Adult Male, SAM=Sub Adult Male, AF = Adult Female, SAF= Sub Adult Female

Monkey	Criteria for identification	AM	AF	SAM	SAF	Young	Infant
Olive baboon Source: (Burham *et al*,1980) , Lang(2006)	Body size	.About twice that of AF .Average weight up to 24 Kg	.Similar with SAM .Average weight up to 14.7 Kg	Similar with AF	Smaller than AF	Smaller than SAM &SAF	Smallest than all age groups
	Mane	Visible mane	No mane	Beginning of mane	No mane	No mane	No mane
Vervet monkey Source : Gorden (2004), (Teichroeb *et al*.,2014)	Body size and other related features	.Slightly larger than the female .Weigh from 3.9 to 8.0 Kg .Bright blue scrotal area .Red penis (Sexed).	.Similar with SAM . Weigh from 3.4 to5.3 Kg .Elongated nipples	.Similar size with AF .Testicles had yet to drop and .Bright blue scrotal area.	.Smaller than AF . Non-elongated nipples	.Smaller than SAM & SAF .	Smallest than all age groups

Univarsiitii JImmaatti

Kollejii Saayinsii Umamaa

Mummee Baayoloojii

Kaayoo qorannichaa: Sanyii qamalee minaan yokiin qabeenya qonnaan bultoota jiraattota ganda Sunxuu irratti rakkolee gessisaa jiran irratti qoranno gaggessuuf.

Gaafanno armaan gaditti eeraman deebisuu keessatti waan na'aatomtanif duraan dursee galata argdhaa jechuun barbaada.

Qajeelfama: Gaaffilee lakk.1-8tti eeramaniif yaada keessan mallattoo" √" tin agarsiisaa. Umrii kan keessan garuu barreffadhaa.

1. Haala wali-galaa hirmaattota: Umriin kan keessan (waggaadhan) meeqadha?

Sadarkaa barumsaa hirmaattota: Kan waa tokko hinbaranne [ ] , Barumsa al-idilee [ ] , Sadarkaa 1ffa [ ] ,Sadarkaa 2ffa [ ] , Kan biraa [ ]

Saala : Dhiira [ ] , Dubara [ ]

Haala fudhaaf heruuma : Kan infuune ykn kan inherumne [ ] , Kan fudhe ykn kan herumte [ ], kan adda bahe ykn kan adda baate [ ] , Abbaan warraa kan jalaa du'e ykn haati warraa kan jalaa dute [ ]

2. Hojiin idilee kan kessan maalidha? Qonna [ ] , Horsiise bula [ ] ,Qonna fi horii horsisuu [ ] , Kan biraa yoo jiraate haa ibsamu……...

……..

3. Gaaffii lakkofsa 2ffaa tif deebiin keessan" qonna " yoo ta'e, lafti qonnaa kan keessan hektaaraan meeqa ta'aa? Hektaara tokko gadi [ ], Hektaara tokko [ ] , Hektaara tokkof walakka [ ] Hektaara lama [ ]. Kan biraa yoo jiraate haaibsamu……

Waa'ee gosoota qamalee:

4. Gosootni qamalee naannoo kessan keessa nijiraatu? eyyen [ ] , Lakki [ ]

5. Gaaffii lakkofsa '4' irratti deebiin kan kessan "eyyen" yoo ta'e, bileensootni kun jireenyna keessan irratti miidhaa gessisaa jiru? Eyyen [ ] , Lakki [ ]

6. Lakkofsa 5ffaa irratti deebin kessan" eyyeen" yoo ta'e, akkaataa kamin miidhaa gessisaa jiru? Midhaan nyaachuudhan [ ] , Qabeenya barbaddessudhan [ ] , Namoota sossodaachiisuun [ ], Kan biraa yoo jiraate haa ibsamu……..

……..

7. Billensootni kun midhaan isaan gessisaa jiran sadarkaa maal irra jira jattani yaaddu ? Garmale guddaa [ ] , Guddaa [ ], Giddu gala [ ] , Xiqqaa [ ]

8. Sanyiin qamalee kunnin kan isaan miidhaa gessisaa jiran yoom yoomidha?

Waggaa waggaatti [ ] ,Waqtilee addaddaa keessatti [ ] , torban torbanin [ ] , guyyaa guyyaan [ ] , Kan biraa yoo jiraate haaibsamu……

……

Qajeelfama 2ffaa: Gafannoo armaan gadiitif deebii itti laadhaa.

9. Sanyii qamalee maalfaa'i naannoo keessan kessa kan jiraatanu?**.....**

……..

10. Sanyii qamale maalfaa'i hawaasa naannichaa irratti dhibbaa kan fidaa jiran?

……..

11. Gosa minnaan maalfaa'i oyiruu kessanirratti bara kana kan misoomsaa jirtan? Haaluma uwwisa gosa midhaanichaatin sadarkaa itti kennadhaa……...

……
…….

12. Bara dhengaddaa, tokkon tokko gosa minaanirra kilogiraama yokiin kuntaala meeqa argattan?

13. Waggottan sadan darban keessatti , tilmaamuaan kiliogiraama ykn quntaala meeqatu sababa sanyii qamaleetin midhaan isiin jala manca'e? (Gosa gosa minnaanitti terrefadhaa)

14. Waggottan sadan darban keessatti boqqollo heektara meeqa qottan?

15. Sababa bileensota kunnin midhaan nyaataa omishuu dhiftani biqiltuuwwan garaagaraa kan akka bunaa omishuu barbaaddu?.....

16. Bileensoota kunnin beeyiladootni kessan nyaatamaniru? Deebiin kan kessan "eyyen" yoo ta'e,

A) Maaltu isin jalaa nyaatame? …….....

B) Meeqatu isiin jalaa nyaatame?.....

C) Sanyii qamalee kamtu kana raawwate?.....

17 .Yeroo baay'e midhaan yookin kuduuraa fi muduraan bileensota kunnin kan manca'u sadarkaa maal irratti yommu jiraatu dha? Gabatee armaan gadii keessatti gutaa. Mallattoo "√" kan irratti wali-galuu kessanif, mallattoo " x" immo kan irratti wal-ingalle kessanif bakka duwwaa irratti gutaa.

Sadarkaa maal irratii akka midhamu	Goosa midhaan/Muduura						
	Boqqollo	Mishingaa	Daagussaa	Garbuu	Maangoo	Paappaayaa	Kan biraa yoo jiraate haa ibsamu
Yeroo faca'u ykn dhaabamu							
Sadarkaa biqiilturratti							
Oso inbilchaatin (yeroo daraaru)							
Erga bilchaate booda							

18. Sanyii qamalee nannoo keessan jiranu kan midhaan keessa mancaasu ganama dha moo, guyyaa dha moo, guyyaa gutu

19. Taatewwan (yokiin gochootni) armaan gaditti tarreffaman, walitti bu'insaa nama fi qamalee giddu uumameef sababoota ta'u nidanda'u

Sababa	Eyyeen	Lakki
Manca'insa bidollee kan umamaa		
Egumsi oyiruu laafaa ta'usaa		
Dabaluu lakkofsa beyiladaa		
Dabaluu lakkofsa ummataa		
Nannoo bilensoota kunninitti qubannaa namotaa		
Hoggansi fi to'aannon bileensoota bosanaa irrtti godhamu laafaa ta'usaa		

20. Miidhaa sanyii qamaleen tin isinirraan gahaa jiru ilaalchisee maal godhamu akka qabu marii waliin-walii gaggessitani beektu?

21. Bileensootni kuniin rakkoo akkasii yommu issinirraan ga'u, qaama dhimmichi isaa ilaallatu waliin marii gaggessitani beektu? A) Eyyeen B) Lakki

22. Debiin kan keessan "eeyyn" yoo ta'e, isaanirra debii maal argattan?

23. Midhaan kessan sanyii qamaleetin akkaa hinmancaane toftaawwan isiin ittin fayyyadamtanu maalidha?

……..

……..

24. Toftaawwan gaaffii lakkofsa "20" jalatti tarressitan keessaa

A) Isa kamtu caalmaatti nama fayyda?.....

25. Haala wali-galaa Lubbu qabeyyi bosona keessa kan naannoo kessa jiran ilaalchise carraa odeffanno ittin argattan jiraa? A) Eyyen B) Lakki

B) Isa kamtu bicuu nama fayyada?.....

26. Sanyii qamalee nannoo kessanitti argaman ilaalchise, sadarkaa armaan gaditti eraman kessaa isa kam kam itti laachuu barbaaddan? A) Haalaan faayidaa qabu B) Faayidaa qabu C) halaan midhaa qabu D) Midhaa qabu E) Haamma ta'e tokko faayidaas qabu midhaas qabu

27. Deebii lakkofsa '25" jalatti filattaniif sababa isaa ibsuu dandessu?

……
……

28 . Naannoo kessanitti bileensota bosanaa (gosoota qamalee dabalate) enyuutu hoggana?

29. Qoraan midhaan ittin bilcheffattan essadha funaantu?.....

30. Nannoo kessanitti namootni bosoona nimancaasuu? A) Eyyen B) Lakki

31. Gaaffii lakkofsa "26"tif deebiin kessan "eyyen" yoo ta'e sababiin manca'insaa maalidha?

……
……
……

32. Naannoo keessanitti sanyiin qamalee akkasaan kununfamanii jiraatan fedhii qabdaa? A) Eyyen B) Lakki

33. Wal-dhibdee namoota fi gosa qamalee giddu naannoo kessan kessa jiru kana gadi-busuuf tarsimoowwan maalfaatu hojiirra oluu qabu jattani yaaddu?----------

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Kutaa 2ffaa: Qabxiwwan ummata naannichaa waliin mariin irratti gaggeyfame.

1. Naanno kessanitti gosa qamalee maalfaa'i kan jiranu?

2.Bileensootni kunnin garee gareedhaan meeqa ta'aani deemu?

3. Naanno kessanitti haalli manca'insii midhaan billensoota kunnin raawwatu yeroodha gara yerootti akkam ta'aa jira?

4.Manca'insii midhaan bileensota kunnin araddaa keessan kessatti iddoo iddootti garaa-gartummaa qabaa?

5.Bileensootni kunnin midhaan malee waa biraa sorachuuf carraa qabu naannichaatti?

6. Lakkofsa 5 jalatti deebiin kessan "eyyen" yoo ta'e maalfaa'I sorrachuu danda'u?

7. Lakkofsuma 5 jalatti deebiin kessan "lakki" yoo ta'e dhabamuun sorata addadaa maal irra kan ka'e issinitti fakkaata?

8. Billensotni kunnin ala midhaan kessan nyaachuudhaf gafa jadhanu amaloota kanaan duura inturre ni agarssisuu? Yoo jiraate haa ibsamu.

9. Bileensoota kunnin midhaan gar-malee barbadaa'u tartibaan lafa kaa'aa.

10. Bileensoota kunnin midhaan isiinirraan ga'aa jirusaa ilaalchise namoota naannichaa dhimmichii isaanin ilaallatu waliin marii'aattani beektu? Lakki

11. Lakkofsa 10 gubbaatti deebiin kessan "eyyen" yoo ta'e deebii maal argattan?

12.Midhaan isin jalaa mancaa'aa jiruf benyaa argachuuf dhaabbileen motummaa yokiin miti-motummaan yoo jiraatan ni barbaaddu?

13. Faayidaa bileensotni bosonaa biyya tokkof qabanu ilaalchise oddeffanno wali-galaa qabdu?

14. Bileensotni bosonaa kunnin naanno kessanitti akkasaan kununfamani jiraatanu kesso kessanin kaka'umsa qabdu?

15. Sanyii qamalee naanno kessanitti midhaan fi wantoota addadaa irratti oso balaa guddaa ingessisiin akka saan kununfamani jiraatanu gama hawaasa naannichaatin, nammoota dhunfaatin fi gama motummaatin maaltu ta;u qaba jattani yaaddu?