HUMAN-ELEPHANT CONFLICT AND ITS ECONOMIC CONSEQUENCES AROUND CHEBERA-CHURCHURA NATIONAL PARK IN SOUTH-WESTERN ETHIOPIA

MSc. Thesis

BY

AREGAW ATINAFU DEDISO

NOVEMBER 2019

JIMMA, ETHIOPIA

Human-Elephant Conflict and its Economic Consequences around Chebera-Churchura National Park in South-Western Ethiopia

By

Aregaw Atinafu Dediso

A Thesis Submitted to
School of Graduate Studies, Jimma Universityin Partial Fulfillment of the Requirement forthe Degreeof Master of Science in Nnatural Resource Management (Wildlife and Ecotourism Management) (SOSC611)

Main advisor: Yoseph Melka (PhD)
Co-advisor: Debela Hunde (PhD, Professor)

November, 2019
Jimma, Ethiopia

DEDICATION

I dedicate this thesis to my Father, Ato Atinafu Dediso, he was pass away from this world at the beginning of my second semester class and this is heartbreaking me.

DECLERETION

I confirm that the work presented in this thesis is my own. Where information has been derived from other source, no part of this thesis has been submitted to any other university.

Name: Aregaw Atinafu Dediso

Place: Jimma, Ethiopia

Signature----------

Date of Submission----------

Email: aregawatinafu02@gmail.com

BIOGRAPHICAL SKETCH

The author, Aregaw Atinafu Dediso, was born on 6 Augest, 1988 in Aba Dahi kebele, Tercha Zuriya Woreda in Dawro Zone of Southern Nation Nationalities and People Regional State. He attended his elementary and junior secondary school at Aba Dahi and secondary school in Tocha Woreda Dawro zone. Following the completion of his Secondary education, he joined Arsi Bekoji ATVET College of Natural Resource in 2005 and graduated with Diploma in Natural resource on 23 July, 2008. After graduation, he was employed by Tocha werda Agricultural and rural development office. Later he joined Wolaita Sodo University College of agriculture on 3 September 2010 and graduated with BSc Degree in Natural Resources Management on December20, 2014.After graduation in Woliata Sodo University, he worked at Tocha Woreda Agricultural office, Land use planning coordinator until he joined the graduate studies program of Jimma University College of Agriculture and Veterinary Medicine to pursue a graduate study leading to a Master of Science degree in wildlife and Ecotourism management.

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my advisors, Dr.Yoseph Melka and Professor Debela Hunde for their initiation, encouragement, enthusiastic advice, assistance and unreserved support from the beginning to the end of this research work. I also appreciate their friendly approach, valuable comments and suggestions. In addition, their fast and urgent response to the problems and their love always persist in me. This helped me to finalize the thesis on time and boosted my confidence in my field of specialization. I would also like to express my special appreciation Mr. Obsu Herko helping me facilitates financial support from Jimma University College of agriculture and veterinary medicine and he also gave to me significant comment and suggestion on my thesis.

I wish to thank all members of the staff of Chebera-churchura National Park (CCNP), in particular the Warden of the Park, Ato Adane Tsegeye and expert Workine Wojuwho have devoted their time with me in all my work as well as for their concern in supporting my work in the Park and providing assistance during the research work.I am thankful to the Park scout and kebeles development agent, Ato Ashagire and Ato Eliyase Desta for helping me for household survey, field measurement data collection, translating the interviews and group discussions in their local languages with the local community, and for the time spent while I was in the field. They also saved my life from elephants and buffaloes attack. I am grateful to the staff of Keble Administration for their co-ordination by organizing the community I also sincerely acknowledge the Dawuro Zone (Kech Woreda) and Konta Special Woreda Agricultural Office for their unfailing cooperation, patience and willingness to give necessary evidence.

ACRONYM AND ABBREVIATIONS

CCNP	Chebera- Churchura National Park
CCS	Community Conservation Service
ETB	Ethiopia Birr
EWCO	Ethiopian Wildlife Conservation Organization
ha	hectare
HEC	Human -Elephant Conflict
HEI	Hman-elephant Intraction
HH	Household
HWC	Human−Wildlife Conflict
IUCN	International Union for the Conservation of Nature
SNNPRS	Southern Nations Nationality and People's Regional State
SPSS	Statistical Package for Social Science
WWF	World Wide Fund for Nature

TABLE OF CONTENTS

Pages

LIST OF TABLES

Page

LIST OF FIGURES

Page

ABSTRACT

Historically, humans and wildlife conflict coexist. However, due to the increased resource scarcity, lack of proper management and population growth, recent trends show that there is a growing conflict. In the context of Ethiopia, such conflicts are less researched and systematically recorded and thus it is not well understood and as a result is the problem was overlooked by experts and policy makers. An investigation on Economic-Cost of Human-Elephant conflict was carried out around Chebera-Churchura National Park in Dawuro Zone and Konta Special District Southern Ethiopia. The study followed a mixed method approach and data were collected both by qualitative (using questionnaire and observation) and quantitative method. Quantitative data were collected through household survey on four purposively selected villages (Serr, Yora, Maliga, and Damano) around the park from January to July, 2019. Focus group discussion, key informant interview and field observation were also used to collect qualitative data. From 1050population, 137sample respondents were randomly selected. Descriptive statistics, Pearson Chi Square test and ANOVA were used in data analysis. Results showed that, villages with a higher incidence of conflict were those proximate to the park and near to main water points. Crop damage was the most (78%) prominent reasons for human-elephant conflict. Others include property damage (3%), human injuries and deaths (3%), livestock attack (15%) and elephant death (1%). The most raided crops were maize (51%) followed by banana (28%). Results further revealed that, crop damage occurred more often during wet seasons than dry seasons. A total average economic value of crop loss per household per cropping season was accounted for ETB 9873.7, 7251.3, 5224.59 and 5305 in Serr, Yora, Maliga and Damano villages respectively. Most of the respondent (85%) had negative attitudes towards elephant conservation. Chasing with fire, loud noise and regularly guarding the fields were the most widely used local crop control methods in all four villages. This study revealed that rising incidence of human–elephant conflicts and significant economic loss and food insecurity as a result of crop damage around the CCNP.The establishment of buffer zone between park and villages, regulation of new settlements around the park, bee farming and growing non-palatable crops such as ginger, coffee, chill etc are recommended to lower human-elephant conflict

Keywords: Buffer-zone, Crop- raiding, Economic -losses, Human-elephant conflict

1. INTRODUCTION

1.1. Background

Human–wildlife conflict (HWC) is history as old as human civilization; yet currently the phenomenon poses a serious environmental challenge for human society. For bio-geographical and social characteristics, developing regions of the world such as South and Southeast Africa are particularly vulnerable to this problem. It's one of the fundamental challenges of wildlife management being faced by many conservation biologists in the world (Sillero- Zubiri & Laurenson, 2001). The conflict occurs because of competition between human and wildlife for shared and limited resources (Ocholla *et al.,* 2013).These conflict ranges from crop raiding to livestock raiding and human attack (Dickman, 2008). Human-wildlife interaction is a complex situation influenced by social, historical, cultural, political, environmental and economic factors. However, it is how the socio economic losses incurred by local communities are managed, that determines the perception and level of support for wildlife conservation by the local people (WWF, 2007).

Parker *et al.,* (2007) describe the human-elephant conflict as any interaction which results in adverse effects on human social, economic or cultural life, on elephant conservation or the environment. Human-Elephant Interactions (HEI) result in human deaths, elephant deaths, human injuries, elephant injuries, destruction of elephant habitat, secondary impacts and destruction of human property (Lamarque *et al*.,2009). However, people often confuse HEC with real forms of conflicts; HEC is just the interaction between human and elephant rather than actual conflict (Peterson *et al.,* 2010). Coexistence between humans and the elephants has a long history with HEI occurring over the entire evolution of our species (Ladan, 2014).According to Lamarque *et al.,* (2009) human and elephant have interacted since human started sharing the same habitat with elephants. Lee and Graham, (2006) described that HEI started since pre-colonial Africa. The most common feature of HEI is crop raiding (Mduma *et al.,* 2010).

Elephants are considered a keystone species; they can alter the landscape in a way that affects other species in the ecosystem. They can eat up to 300 kilograms plant material each day (Kingdon, 2004).That reduces tree densities and enables forest areas to be transformed into open woodlands (Hall and Ebenhard, 2014). They are mixed feeders that both browse and

graze; elephants rely on fruit as well as grass and shrubs for their diet and nutrition (McNaughton *et al*., 1988).

Geographical, political and climatic features influence occurrences and magnitude of HEC (Blanc *et al.,* 2007). Anthropogenic activities have blocked dispersal routes and genetic migratory corridors that usually provide alternative feeding patterns and an opportunity for exchanging genetic materials (Okello and D'amour, 2008: Lamarque *et al*., 2009: Mduma *et al.,* 2010).Conversion of elephant habitats significantly affects elephant foraging preference, feeding patterns and accessibility to other ecological resources (Mutanga and Adjorlolo, 2008: Leel *et al.*,2009). Anthropogenic activities, such as conversion of elephant areas into agriculture, settlements, or infrastructures are the fundamental causes of HEI (Granados, 2011; Ladan, 2014). Also, exponential human population growth amplifies the demand for land, water, food, energy and industrial raw materials, intensifying habitat fragmentation and increased resource competition between human and elephants (Osborn ,2004:Lamarque *et al.*,2009:Peterson *et al.,* 2010 and Kioko *et al.*,2013).

Size and structure of human populations usually influence the intensity and frequency of HEI (Sitati, 2003). It was stated that as human populations increase so, does the blocking of elephant migratory corridors (Yirmed *et al.,* 2006).Lee and Graham (2006) asserted that rapid increase in human populations and high conversion rate of elephant habitats into other forms are more significant threats to elephants than ivory trade. Due to the catastrophic elephant damage, local people label elephants as agricultural pests and merciless killers. People sustain extreme damage from elephants in the form of life, property, and crops. Crop raiding was reported as partial or complete loss of crops due to consumption, trampling and dung deposition (Kagwa, 2011).The uncompensated and uncontrollable damage from elephants undermines the local population's efforts and desire to participate in elephant conservation (Bandara and Tisdell, 2002). As a consequence, elephants become uncontrollable and unprotected outside protected areas (Granados *et al.,* 2012)

Ethiopia has currently more than 55 protected areas (including 21 national parks) (Amare, 2015), which implies more than 17.1% of its land, ranked third in African country next to Tanzania and Uganda. They protect and conserve the natural ecosystems and wildlife heritage

of the country (Murray and Admasu, 2013). Conversely, those protected areas are exposed to severe pressure, which threatens their existence and sustainability due to anthropogenic effects (Reddy and Workneh, 2014). Africa Elephant (*Loxodonta africana)* is one of a number of wildlife species being conserved in Ethiopia's protected areas. At present, elephants in Ethiopia are among the 37 mammal species that are threatened by extinction (Yirmed *et al.*, 2006).

The Southern Nation Nationality and Peoples Regional States has known to have actual potential wildlife resources. These wildlife resources, however, are mainly restricted to 7 national parks, two wildlife reserves and seven controlled hunting areas .These protected areas cover a total of about 35,000 km2 that is about 20% of the region (Amare, 2015). Among from these protected area elephants have only three National Parks and one Controlled Hunting area (Chebera-Churchura National Park, Mago National Park, Omo National park and Mizan Teferi Controlled Hunting Area (Sintayehu *et al*., 2014).The Chebera-Churchura National Park is one of the protected areas in the South-western Ethiopia, that contain good population of elephants (Girma, 2005).It is one of the best recently established protected areas in the region (South-western Ethiopia) and which is one of the highest wildlife densities in Ethiopia (Woldeyohans, 2006).

1.2. Research Problem

One of the major sources of conflict of human-elephant in Africa and in the world at large is crop raiding (Mduma *et al.,* 2010). Increasing resource use by humans at the human wildlife interface has results in intensification of human-elephant conflict (Inskip and Zimmernna, 2009).In Ethiopia elephants have been reported as crop raiders and given more attention (Kumssa and Bekele, 2013).Crop raiding as an alternative source of food for elephants creating conflict with communities living adjacent to protected areas (Yirmed, 2008).The problems of human-elephant conflicts are most common near protected areas like national parks, wildlife sanctuary and reserves (Harich *et al.,* 2013).

Chebera-Churchura National Park, the competition between local communities with elephant for the use of natural resource is particularly intense and direct.Therewere no demarcated boundaries between park and settlements. Most farming activity held in the buffer zone of the

park and extensive crop damage caused by elephants. Graham *et al.*, *(*2010) conclude that crop-raiding by elephants was significantly predicted by distance to the park.

Crop raiding by elephant cause food insecurity and loss of income to forest adjacent communities (Quirin, 2005).The overall problem is that there is no data on the magnitude of economic losses due to human-elephant conflict on study area. For that the present study was to assess human-elephant conflict and its economic consequences to households living around Chebera-churchura National Park in Dawro Zone and Konta Special District in south western Ethiopia.

1.3. Significant of Study

Analysis of costs at the human-elephant interface offers a means for objective measurement of the effects of wildlife, in particular elephants, on livelihood in Study Area. This information is expected to assist the managers of 3 National Parks and one controlling hunting area in South Nation Nationalities and Peoples Regional State, to develop strategies for co-management of human-elephant conflict and improved livelihoods, around study areas (Sintayehu *et al.*, 2014)

The study identified to human--elephant conflict around the Chebera-Churchura National park in southwestern Ethiopia. It is expected that results was assist in better understanding of the patterns, magnitude and cost of human-elephant conflict at the interface. A better understanding of the interaction between humans and elephants in study areas will assist in conflict mitigation measures and provide avenues for involving communities in conservation as a way of ensuring they benefit more from this important resource. The study will also be important in planning effective mitigation measures by guiding resource benefit allocation.

1.4. Objective of the study

1.4.1. General Objectives

The generally objective of this study was to assess the human-elephant conflict and the economic consequences on local communities living around Chebera-Churchura National between Dawuro Zone and Konta Special District South-western Ethiopia.

1.4.2. The Specific objectives

The specific objectives of this study were to:

- Identify the type of Human-elephant conflict around Chebera-Churchura National Park
- Identify the cause of human-elephant conflicts that established on Study Area
- Estimate the economic losses per household due to elephant caused damage
- Identify compensation scheme for those affected community due elephant caused damage
- Observe the range of mitigation strategies experienced by inhabitants for reduce the loss

1.5. Research Question

- What are the underlying causes of the problem of Human-elephant conflict in the study area?
- What type of conflict is the community encounter by Elephant and to what extent?
- How to estimate the losses as a result of elephant on study are?
- What measures are taken to compensate the losses and experienced by inhabitants

2. LITERATURE REVIEW

2.1.The African Savanna Elephants

With a length of up to 3-5 meters, Height of 2.5-4 meters and a weight of2, 500-7,000 kg elephants are the largest terrestrial animal in the world (WWF, 2014a). The most notable features of the African elephant are their trunk (used for communicating and gripping), their tusks (used for fighting, feeding and digging) and their large ears (used for radiating excess heat). The species can live up to 70 years and females are the most fertile from the age of 25 to 45.

After a 22 months long gestation one or sometimes two calves are born. The young wean after between 6 and 18 months but can keep nursing for up to 6 years and they are sometimes cared for by other members of the group. At puberty, males leave their herd to form temporary groups with other males and only join female herds again for mating. The diet of the African elephant consists mainly of leaves and branches, but also of a variety of grasses, plants, fruits and bark (WWF, 2014a). Since elephants can eat around 5 percent of their bodyweight (i.e. 300kilograms)per day (Kingdon, 2004), even a small herd can wipe out the annual crop of afa rmer in a single night (WWF, 2014c).

There are two subspecies of the African elephant, namely the savanna (or bush) elephant (*Loxodonta africana*) and the forest elephant (*Loxodonta africana cyclotis*) (WWF, 2014a). The savanna elephant is found throughout the bush lands and grassy plains of eastern and southern Africa, with highest densities in Tanzania among other countries (WWF, 2014c). It is larger and generally lighter in their skin tone than the forest elephant and it usually has four nails on its fore feet and three on its hind feet (Kingdon, 2004). The social structure of the savanna subspecies is built around family units consisting of around 10 females and their calves. These units are often joined together forming a clan of up to several hundred animals, led by a female matriarch (WWF, 2014b).When they feel threatened the elephants in a group form a circle around the young calves to protect them and the leader might go to attack (WWF, 2014a).

2.2.Elephant population in Ethiopian

Ethiopia is one of Sub-Saharan African countries that have elephants (Blanc *et al.,* 2003). Until the turn of this century, the African elephant had a very wide distribution and was more common in areas with altitudes ranging from sea level to 2500m (Yirmed, 1997).Elephant populations in Ethiopia are mostly small and scattered, primarily occurring in the peripheral low-lying parts of the country, or in remnant forests. The formal establishment and gazetting of protected areas in Ethiopia took place in 1966. Delays in this process were in part due to the devolution of authority to a regional level. In many instances boundaries have not been demarcated and people continue to live in protected areas. There is little active management or patrolling of protected areas. Large-scale agricultural developments are a threat to a number of Ethiopia's remaining elephant populations, particularly around Omo and Gambella National Parks in the west of the country (Milliken *et al.,* 2016).

In terms of diversity, Largen and Yalden (1987) recognized three races of Savanna or Bush Elephants in Ethiopia. These are *Loxodonta African knochenhaueri*, *Loxodonta African oxyotis* and *Loxodonta Africanorleansi*. Among these, *Loxodonta African knochenhaueri* used to occupy areas up to central Rift Valley. Currently, however, it is restricted to the Mago Valley, *Loxodonta African oxyotis* occupied parts of the country west of Omo River in the South up to the Valley of Takeze River in the North, with the largest concentration of this race in the vicinity of the southwestern border. *Loxodonta African orleansi* has been recorded from eastern Ethiopia, adjacent to the Somalia border. The only surviving representative of this race is found between Babile Elephant Sanctuary and the Environ of Webi-Shebeli (Milliken *et al*., 2016).

The estimated number of elephants in areas surveyed in the last ten years in Ethiopia is 1,017 at the time of the last survey for each area (Monico & Schapira, 2015). There may be an additional 1,160 elephants in areas not systematically surveyed. This guess probably represents a minimum number, and actual numbers could be higher than those reported. Together, this estimate and guess apply to 18,598 km² in Ethiopia, which is 84% of the estimated known and possible elephant range. There remains an additional 16% of the estimated range for which no elephant population estimates are available. However, during an

aerial total count in 2013, 337 elephants were seen (Grossmann et al., 2013). In 2015, 550 elephants were observed in the south-west of the park in an aerial total count, and another 56 were seen during the course of an aerial sample count of the wider ecosystem (Monico and Schapira, 2015).

While Mizan Teferi Controlled Hunting Area was previously considered to be the main area for elephants in the south-western forests, more recent reports suggest that Chebera-Churchura National Park, which was established in 2005, holds the largest remaining elephant population (Fig.1). Ground counts from 2012-14 in Chebera -Churchura indicated that there were 420 elephants (Ali *etal.*, 2016)

Figure1.Elephant herd in Chebera-Churchura National Park riverine forest (Source:-EWCA, 2018)

2.3. Human-Wildlife Conflict

Human-wildlife interaction is a complex situation influenced by social, historical, cultural, political, environmental and economic factors. All wildlife poses a threat to local people, but sever socio-economic losses are mainly inflicted by large carnivores and herbivores (WWF, 2007).

2.4. Human –Elephant Conflict

Human-elephant conflict is defined as an interaction between elephants and humans and/or their goods, livestock, land, or property that negatively impacts one or both parties (World Wildlife Fund, 2017). In serious instances it may lead to loss of human and/or elephant life (Warren *et al.,* 2007). HEC occurs internationally and negatively impacts both human and elephant populations. In Africa, dating back to the pre-colonial times, crop depredation by elephants caused settlements to be displaced and food shortages. Some believe that human elephant conflict is as old as agriculture in Africa (Naughton *et al.,* 1999).

Different researchers at different times have investigated the determinant factors that cause conflicts between human and wildlife. As human populations increase and development fragments habitats, human-elephant conflict (HEC) has become increasingly common (Thouless, 1994). Human elephant conflict is a key concern both in terms of conservation and socioeconomic significance. Elephants are mega-herbivores and commonly raid crops, causing economic losses, and death and injury to people (Fernando *et al.,* 2005).

Damage to crops especially around protected area vicinities is a serious problem that can potentially undermine conservation effort (Bayani *et al.,*2016). Crop raiding is the most common form of human-elephant conflict (Hoare, 2011). Crop raiding was reported as partial or complete loss of crops due to consumption, trampling and dung deposition (Kagwa, 2011).Gobosho (2015) reported that habitat destruction, proximity to natural forest and increased subsistence utilization as the major causes of HEC. The main cause of human-elephant conflict worldwide is the competition between growing human populations and wildlife for the same declining living spaces and resource (Madden, 2008).The transformation of forests, savannah and other ecosystem in to agrarian ecosystem or urban agglomerates as a consequence of the increasing demands for land, food production, energy and raw materials has leads to dramatic decrease in wildlife habitat (Sillero-Zubiri and Switzer, 2001).

The major causes of human-elephant conflict could be attributed to many factors ranging from Elephant population increase to human population increase (Edward and Frank, 2012).More peoples means more cultivated land and hence a greater interface between people and wildlife. Elephants capture the imagination and unswerving affection of people

worldwide but inspire animosity and fear among those sharing their land with these huge animals (Naughton *et al.,* 1999).Throughout Ethiopia, various types of HEC occur including: property destruction, poaching, resource competition, habitat fragmentation, and crop-raiding (Sitienei *et al.,* 2014).

2.5. Patterns of Human – Elephant conflict

The African elephant (*Loxodonta africana*) is an iconic species and its populations are currently found in thirty-seven Sub-Saharan African countries (Beaune *et al.,* 2013). African elephants are renowned not only for their large body size, but also for their ecological impacts and complex social structure. They are considered keystone specie because of their comparatively large individual body size and population biomass, which results in the consumption of more woody vegetation than by all other large herbivore species combined (Skarpe *et al.,* 2014). As a keystone species, elephants mold the landscapes in which they live and provide ecosystem services crucial to the survival of other species (Landman *et al.,* 2008). They are important seed dispersers and cause trophic cascades that impact community composition and nutrient cycling (Blake et al. 2009; Haynes 2012; Skarpe *et al*. 2014).

However, human activity threatens many African elephant populations despite their ecological importance and large body size. Poaching for the global ivory trade is one of the greatest threats elephants face. Wittemyer *et al.,*(2014) estimated that in 2011 alone approximately forty thousand African elephants, or 7.7% of the total elephant population, were killed for the global ivory trade. High levels of poaching coupled with a low overall population growth rate have led to a net population decline (Wittemyer *et al.,* 2014). In addition to poaching, African elephant populations are threatened by habitat fragmentation and land use change due to encroaching human settlements (Bouche *et al*., 2011).Bouche *et al.,* (2011) estimated that in the past forty years these combined factors have caused West African elephant populations to decline by ~33% and Central African elephant populations to decline by~76%. Without targeted conservation and anti-poaching efforts, it is likely these trends will continue and may lead to local extirpation.

Additionally, the African Elephant Status Report in2016 estimated that the number of African elephants has declined by 104,000-114,000 since the previous report in 2007 (Thouless *et*

al.,2016).A similar trend of decline was observed in Ethiopia the central Rift Valley and the valley of Awash River; elephants became extinct between 1900 and 1934(EWCO, 1991). The remnant herds pushed progressively further towards low altitude arid areas around the periphery of the country. The greatest portion of elephants inhabits these areas while only few of the elephant populations lives in the mid and high altitude forests of western Ethiopia as small fragmented populations (Allen-Rowlandson, 1990; EWCO, 1991).

The causes for the reduction in the number and home range of the African elephant in Ethiopia can be seen from two points, elephant killing, and habitat degradation and fragmentation (Blanc *et al.*, 2003). Habitat loss and degradation is the main factor responsible for the recent decline of elephant population size in the country (Demeke, 1997). Ethiopia is identified as having the largest unregulated ivory market in East Africa (Blanc *et al.*, 2003).However, the few surveys done at different times showed dramatic decline in the number and distribution of elephants (Demeke, 1997).

Human-elephant conflict is prevalent throughout Africa and occurs when elephants eat farmers' crops while foraging to meet their large caloric needs. As large herbivores,the average elephant consumes 250-300 pounds of foliage per day (International Elephant Foundation ,2018). They are mixed feeders that both browse and graze; elephants rely on fruit as well as grass and shrubs for their diet and nutrition (McNaughton *et al.*, 1988). Elephant cropraiding is especially serious for farmers living adjacent to protected areas; these farmers consider elephants to be one of the most serious causes of crop damage (Hoare, 2015; Megaze *et al*., 2017).

Elephant crop-raiding is problematic for farmers due to its severity rather than its frequency (Hoffmeier *et al*., 2015). This is because even if elephants do not crop raid a farm very often, one visit can compromise a farmer's successful harvest for that season.The severity of elephant crop damage creates epicenters of human-elephant conflict that most detrimentally impact subsistence farmers, that is, farmers whose production matches their consumption with little or no surplus (Sitati *et al.,* 2005).Poorly guarded farms are most susceptible to elephant crop-raiding (Sitati *et al.,* 2005).Gender is one of the factors that has been cited as having

significant influence on human wildlife conflict and conservation mechanisms (Gore and Kahler, 2012).

Lamarque *et al.,* (2009), asserted that men are killed more often than women, as they are exposed to greater perils. Men are involved in high risk activitiessuch as protecting crops at night, livestock herding, walking at night, poaching and drinking alcohol. All these activities expose them to elephant. However, both men and women have equal risks when working in their farm fields. Other studies have also shown that women perceive greater risk than men, especially when there is direct contact with elephant. However, women suffer to a greater extent due to socio economic impacts on their families (Gore and Kahler, 2012).

2.6. Magnitude of Human-Elephant Conflict

Human-Elephant conflict is multifaceted and can take any form, depending on theelephant species involved and circumstances. Crop damage and livestock depredationare common conflicts across the world. Other conflicts include human death andinjuries, elephant transmitted diseases and destruction of social infrastructures(Lamarque *et al.,* 2009).The impact of crop damage and livestock losses on localpeople who are already poor makes these two conflicts prominent, prevalent andsevere.

2.6.1. Crop damage

Elephants negatively impact subsistence farmers by damaging the crops they rely upon for their livelihoods and food security. In just one night, a family group, which averages nine elephants, can destroy a farmer's entire field (Wittemyer, 2001). Elephant crop-raiding behavior varies seasonally, and the period of most severe crop-raiding is often during peak ripening, just before crops are ready to harvest (Chiyo *et al.,* 2005; Sitienei *et al*., 2014). This poses a serious threat to subsistence farmers' economic stability and undermines their earning potential (Hedges and Gunaryadi 2010; Mackenzie and Ahabyona 2012; Sitienei *et al*., 2014).For example, research by Sitati and Ipara (2012) found that elephants preferentially ate mature maize.

Maize is the most widely-grown staple food crop in sub-Saharan Africa (SSA) occupying more than 33 million ha each year (FAOSTAT, 2014). Additionally, a study in Uganda found that household financial losses (from crop-raiding) averaged US $74 over the six-month

study, a substantial loss given the median household income was US $503 (Mackenzie and Ahabyona, 2012). These financial losses may render families unable to pay necessary expenses. Additionally, damages caused by wildlife crop-raiding cause greater food insecurity in communities adjacent to protected areas (Harich et al., 2013).Loss of income and food insecurity caused by elephant crop-raiding compromises farmers' abilities to meet their families' basic needs.

2.6.2.Children school absenteeism

In addition to directly undermining farmers' economic and food insecurity, successfully preventing crop-raiding often requires diligent field guarding to scare away elephants. The time and energy requirements for successfully protecting farms are especially high when proper fencing is not in place (Sitati et al., 2005). Unfortunately, children are often needed to protect these fields(Mackenzie and Ahabyona,2012). This family responsibility detrimentally impacts children's access to education.Mackenzie and Ahabyona, (2012) found that sixty percent of survey households reported children under the age of eighteen guarding crops.Human-elephantconflict limiting children's access to education and increase in resistance towards wildlife conservation (Hill, 2015).

The majority of children guarded crops two days a week (presumably on non-school days); however, other children guarded crops three to seven days a week during the peak-raiding season. In Tanzania, sixty-percent of students reported missing school to guard crops(Mackenzie and Ahabyona 2012). Regularschool absenteeism degrades children's academic performance. Studies showed that students living in communities that experienced regular elephant cropraiding scored worse on national exams than students living in communities not impacted bywildlife. (Mackenzie and Ahabyona, 2012; Sitati andIpara ,2012). Over time, poor academic performance may limit children's employment opportunities or their ability pursue highereducation(Smithand Kasik, 1999)

2.6.3. Resistance to conservation initiatives

Due to its negative impacts on farmers and their families, elephant crop-raiding often fosters animosity towards elephants and protected areas and can create resistance to elephant conservation initiatives (Sitati *et al.,* 2005). These feelings are intensified when farmers are

not compensated for crops lost to raiding by protected animals, such as elephants. A farmer quoted by Mackenzie and Ahabyona (2012) highlighted this sentiment, saying, If a thief pays for his sins, then animals should be speared and killed if there is no compensation (for crop raiding). In many places, community members bear the costs of protecting elephant populations without feeling they gain any direct benefits from conservation.

2.6.4.Human injuries and death

Human-Elephant Interactions (HEI) result in human deaths, elephant deaths, human injuries, elephant injuries, destruction of elephant habitat, secondary impacts and destruction of human property (Lamarque *et al*.,2009). The most common feature of HEI is crop raiding (Madden,2004).Human occupations in elephant habitats, increased human population, isolation of the crop field, proximity to protected areas and percentage of cultivation increase the frequency and magnitude of elephant damage and fatalities(Parker *et al*.,2007and Songhurst and Coulson , 2014).

A recent study carried out in Cameroon stated that there were few incidents of human attacks attributed to lions, elephants and hippopotami (Eyebe *et al*., 2012). However, a study carriedout in Zambia, showed that it was a serious problem, as 49 people per year were killed by crocodiles, elephants, hippopotami or lions (Chomba *et al.,* 2012). Deaths have also been reported in other countries. In Kenya, during a seven year period,200 people were killed by elephants. In Tanzania, which has the largest population of lions in Africa, lions killed 30 people between 1990 and 2004 and in Mozambique 70 people were killed by crocodiles over a period of 18 months between 2000 and 2002, mainly linked to severe rains and floods (Elisa, 2005).Elephants may also cause extensive damage to other property such as fencing,food stores during the dryer months following the main crop harvest and water installations (Elisa, 2005).

2.7. Costs of Human-Elephant Interaction

Elephant contributes directly or indirectly to both local and national economy through many ways that include wealth creation, employment and revenues. However, the individual cost for poor communities who are already poor and rarely compensated,is very high (Gillingham

and Phyllis, 2003). Because of their significant and uncompensated crop damage and nuisance,people residing in the boundaries of elephants' ranges consider elephants as agricultural pests (Bandara and, Tisdell , 2002). Parker *et al*.,(2007), found that elephant damage both stored crops and field crops. Such damages intimidate food security during drought season because of stealing grain from storage facilities(Lamarqueet al.,2009). Elephants attack subsistence peasants who are both economically and nutritionally poor (Hazarika and Saikia, 2013). Losing crops and family members means increased poverty, health constraints, malnutrition and illiteracy (Gadd, 2005).

The costs are visible and hidden cost.Visible costs include injuries, human death, crop and livestock losses, while hidden costs include increased family indebtedness due to the death of a bread winner, poor health, poor child development, lost schooling, lost work, additional labour and constant stress due to fear (Lamarque *et al*., 2009;Jadhar and Barua, 2012). Economic loss occurs when the costs of controlling pests exceed the crop loss (Hill, 2004 and Mayfield, 2015).

2.8. Compensation Systems

Compensation schemes often target the market price for victims' crops and livestock losses without recognition of opportunity costs of conflict mitigation and transaction costs of getting compensation, or the hidden costs of declined psychosocial and social well-being (Hoare, 2000; Ogra, 2008).HEC carries significant economic costs to humans and compensation is a measure which aims to alleviate conflict by reimbursing people for their losses. Compensation systems rely on giving out monetary payments or licenses to exploit natural resources, allowing the hunting of game or the collection of fuel wood, timber and fodder from inside protected areas. Of the two methods, financial compensation is a very contentious issue and the least popular due to its inefficiency and low rate of reimbursement. This is a reality in many developing countries, which face budget constraints and usually pay on an irregular basis and to a limited extent.

The second compensation scheme, also known as the settlement of rights to use natural resources, appears to be a more practical solution as the following case studies demonstrate. In India, in the state of Karnataka, financial compensation schemes are not

very effective. The process of claiming compensation and the verification and approval procedures are very bureaucratic and often result in only a small portion of the claims being paid. In a survey undertaken between 1996 and 1999 an overall 11% of the total claims for livestock depredation and 26% for crop losses were refunded. Secondly, the reimbursement can take up to 6 months to be released and usually undervalues the losses, covering an average of 5% of the total loss claimed for livestock kills and 14% for crop damage (Madhusudan, 2003).Compensation schemes have been constrained by lack of financial resources and the high transaction costs involved in verifying farmers' claims (Nyhus *et al*., 2005; Seifu and Beyene, 2014).

In Kenya, compensation schemes are very problematic. The government has not provided any reimbursement for crop and livestock losses since 1989 and it neither replaces nor repairs any installations that are destroyed by wild animals. Moreover, the compensation received for loss of human life or injury is not sufficient to cover funeral expenses or hospital bills. It also does not take into consideration the impact of such incidents on dependent children, who are often taken out of school because of the lack of funds to pay their fees (Kenya Wildlife Service, 1996).Exaggeration of the losses by affected communities has also been cited as a cause of non-payment of compensation (Wiladji and Tchamba, 2003; Linkie *et al*, 2006).

An alternative approach, the settlement of rights, appears to be a better strategy. It fixes a quota of commodities that can be exploited, it clearly demarcates reserve zones that are accessible to local villagers and it legitimizes their rights to those resources responsibility and awareness (Sekhar, 1998).

3. MATERIALS AND METHOD

3.1. Study Area

3.1.1. Location

Chebera-churchura National Park is one of the recently established 2005 wildlife protected areas in the country. It located in the $6^0$39'& 7^o09' N latitude and 36^o27'& 36^o57'E longitude, about 580 km south west of Addis Ababa(fig.2) and it covers an area of 1215km^2 lies within the western side of the Central Omo Give Basin (Grima,2005).The southern and eastern boundaries are Omo River. Esera and Kech (District) respectively. Both these Districts in Dawuro Zone. The west, North-West, North and small area in North east are bordered by Konta special Woreda. Five small creature lakes (Shisha, Keribela, Bahi, Koka and Cheferi) and four major Rivers (Shoshema, Zigina, Mensa and Tikurwuha rives) are located in different parts of this park (Datiko and Bekele, 2013).

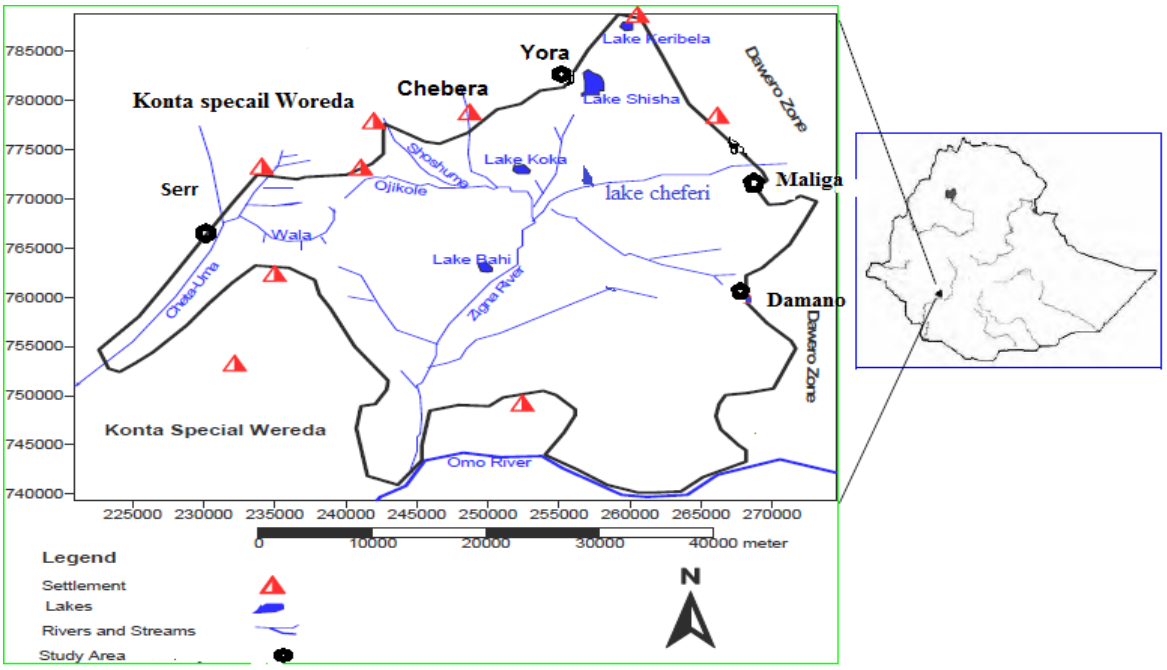


Figure 2: Map of study area

3.1.2. Topography

Chebera-churchura National Park is characterized by heterogeneous hilly terrain. The topography of the study area is highly undulating and rolling interspersed with different valley floors, purely drained bottomland punctuated by different hills. The general pattern of the topographic features of the area is of rolling to steep hills, interfluves between relatively narrow flat to undulating bottom land, which acts as collecting site for run-off water from the nearby uplands. Valleys and gorges generally characterize the area. The altitude of the area ranges from 950 to 2120 m a.s.l. at the volcano peaks in the western boundary (Timer, 2005).

3.1.3. Hydrology

The Shoshema, Zigina, Mensa, and Tikurwuha rivers and their tributaries drain the area. These rivers join the Dawuro Zone of the Park, then flow to Omo River, that bounds the Park southwards. However, during the dry season, most of the tributaries dry out before joining Omo River. There are five small and medium sized lakes (Shisha, Keribela, Bahi, Koka and Cheferi) located at the southeast, west, northwest and north of the Park. There are also several hot springs and waterfalls in deep gorges in different parts of CCNP.

3.1.4. Geology and Soil

Geologically the area is made up of tertiary Jima volcanic as described by Wood roof (1996).These Jima volcanic rocks are divided into lower basalt and upper rhyolites with minor basalts. The study area is mainly characterized by the rhyolite Jima volcanic parent rocks, which crop out in the northeastern parts forming the highlands. The lower basalt based on the Jima volcanic area is exposed in all areas around the Omo gorge, to the south of the study area. Ages of these Jima volcanic rocks are reported to range from the Eocene to Oligocene. Much of the original topography of the Oligocene lava outpourings, therefore, has been modified by 20 million years of water, wind and ice erosion, to produce the landscape of today (Hillman, 1993).The soil type of the north and eastern upland areas of the study area is dark brown dark reddish brown sandy clay loams to clay, though most area has clay loams. The soil structures are weak tending to be massive with friable topsoil over friable sub soils. They are non-calcareous. Shallow soil is more prevalent in the areas with steep slops in the southern parts and the Omo gorge (Damene, 2003).

3.1.5. Climate

As there are no temperature and rainfall records for the study area, the meteorological data used were collected from the Ethiopian National Meteorological Service Agency (ENMSA) station located about 14 km from the study area. Based on 10 years rainfall data (2005−2014), the rainfall in the area is uni-modal, having one long rainy season (between March and September, with a peak in July). The total annual rainfall in the area varies between 1000 and 3500 mm with the mean annual rainfall of 2154 mm. The dry season of the study area is from December to February, with mean maximum temperature varying between 27^{o}C and 29^{o}C. The hottest months are January and February while, the coldest months are July and August with the mean maximum and minimum temperatures of 28^{o}C and 12^{o}C, respectively so several hot springs and waterfalls in deep gorges in different parts of CCNP (Source: Ethiopian Metrological Authority, Hamaya branch office).

3.1.6. Vegetation and wildlife

Vegetation: The range of habitats in CCNP is diverse in altitude and vegetation cover .These can be categorized in to four major habitat types: Savannah grasslands with scattered trees, woodlands, montane forest and riverine forest (Datiko& Bekele, 2013). Savannah grasslands with scattered trees, Woodland, dominated by mixed species**;** montane forest and Riverine forest occurs along the different river sides in the study area and along the smaller perennial water courses.

Wildlife: Chebera-Churchura National Park supports a wide range of wildlife species. Thirty seven mammalian species were recorded by Girma (2005). These include African elephant (*L.africana*), African buffalo (*S.caffer*), hippopotamus (*Hippopotamus amphibious*), leopard(*Panther apardus*), lion (*Panther aleo*), Spotted hyena (*Crocuta crocuta*), African wild dog (*Lycaonpictus*), Warthog (*Phacochoerus africanus*), Bush pig (*Potamocherus larvatus*), Golden jackal (*Canis aureus*), Ground squirrel (*Xerusery thropus*), Porcupine (*Hystrix cristata)* and three species of primates; Anubis baboon (*Papio anubis*), Vervet monkey (*Ceropithecus aethiops*) and gureza (Colobus gureza). The Park is believed to possess a good diversity of birds, fish, reptiles and amphibians. A total of 137 bird species were recorded from the Park (Woldeyohans, 2006) and16 species of rodents and 2 species of insectivores were also recorded (Datiko and Bekele, 2013).

3.1.7. Economic activities

Agricultural practices and land-use system

Mixed agricultural practices are the sole livelihood of the majority of the inhabitants around the study area. They practice traditional agricultural system that combines perennial and annual cultivation with livestock rearing. Thus, the land-use practice is predominantly traditional shifting cultivation and livestock rearing. Shifting cultivation is common in the south and southwestern lowland on the undulating and rolling plains by residents around the study area.

3.1.8. Materials, Site selection, and sampling design

The materials used for this studies were Digital camera, Smart phone, Binocular, Tape meter, etc. Based on preliminary survey in November, 2018the information were gathered form Park management, local elders and village representatives. The study villages (Serr, Yora, Maliga and Damano) were park bordering villages purposefully selected for this study. The selection where based on the presence of serious HEC and vicinity to the park. The selected villages (Maliga and Damano) from Kech district in Dawuro Zone followed by Serr and Yora villages from Konta special district. Random sampling techniques where used to select 137 respondents from 1050 population in the villages (Yamane, 1967) (Table.1). and unbiased sample it would have been preferred to select the respondents randomly (Gardener, 2012).These were categorized into two groups based on their proximity towards to park edge as near (0-2 km) and far (2.5-3km) distance from the park were included in the questionnaire and field observation of which 106 (77.4%) and 31(22.6%) were male and female respectively.

Table 1. Sample size of study population

Four selected villages	Population size	Sample size	Yamane (1967:886) to determine this sample size
Serr	261	34	$n = \frac{N}{1 + N(e)^2}$
Yora	314	41	
Maliga	230	30	
Damano	245	32	
Total	1050	137	

Where,

n= the required sample size

N=the population size

e= is the level of precision with level of confidence is (95%), e ranges =±3% up to ±10%

To find out main cause of human-elephant conflict, conflict type and extent of damage, estimate economic losses, compensation scheme, their attitude toward elephant conservation and mitigation measure for the crop losses. The variables such as date and month when the conflict occurred, distance when rural community settlement vicinity to the park, year when the incidents was recorded, size of land where crops are destroyed and areas where incidents occurred. The dependent variable is the estimated amount of the cost of damage incurred bythe local communities. The cost classified under crop damage, human injuries,human deaths and property destruction using the questionnaire similarly used by Kivai (2010).

3.2 Methods

3.2.1. Source and methods of data collection

3.2.2. Source of data

Both primary and secondary source of data was used for this study.

The primary data was gathered through household survey, focus group discussion, key informant interview, and direct filed observation techniques on crop damaged by elephants. The survey was generated both quantitative and qualitative data for pertaining to their economic and demographic characteristics, aspects of participations and perception. Secondary data sources were obtained information from Chebera-Churchura National park office, Google, published and unpublished materials, books, journals, Kech and Konta Woreda Agricultural office extension report

3.2.3. Methods of data collection

The current status of HEC in the study area was investigated through Semi-structured interviews, focus group discussions; key informant interviews and direct observation were used following Anderson and Pariela (2005).

Pilot survey

During the pilot survey, 20 HHs were randomly selected individuals of varying ages, sex and the background among the local communities, thus not included in the main sample group. The main purpose of the pilot survey was to evaluate the questionnaire and to check whether it was applicable and suitable in the study area, to check whether the questionnaire can be understood by the respondents, to identify the period and the occurrence of human-elephant conflict and cause of HEC in the study area. Based on the pilot survey results, the questionnaire was revised and developed following Fairet *et al.,* (2012)

Semi -structured questioner

The semi structured questionnaire was administrated to members of households at random manner based on the first come first serve basis (Newmark *et al.*, 1994). The study was based mainly on sample village household cross sectional survey (Fig.3) using pre-tested structured questioner organized in logical order of presentation. Semi- structured open and closes ended questionnaires survey was conducted to gather information of demographic data, type of human-elephant conflict, to gather data on major crops raided, seasons more crop raided, size of farm to the park and to assess the range of conflict mitigation strategies. These data collected from January to July 2019.

Figure3.Household survey on Yora and Maliga villages in the communit yaroundCCN(Sour:field observation 2019) a=Yora, b =Maliga

Key Informant Interview

In-depth key informant interview washeled with 20 nuber (Fig.4) of inhabitants randemly selected from each village (village reprsentatives,local eledars and park mangement).to gather data conserving tocollect information regarding to more information on the majore cause of HEC,which human activties induce HEC,to reduce the conflict by socity and their atittude regarding to elephant conservation Lavrakas, (2008). (See App II, III&V).

Figure 4. Key informant interview was held by researcher and assisters on study villages around Chebera-churchura National Park (Source: field survey, 2019)

Focus group discussion

The group discussion was carried out by modifying the method described by (Bellet *et al.*, 2012). Focus group discussion is also another qualitative method of data collection instrument which was used in this study. Accordingly, four focus group discussions from four selected village household members were held. The participants were allowed to state their views and suggestions on human activities in CCNP, main cause of human-elephant conflict, type of conflict and their degree of damage, economic losses, their attitudes towards elephant conservation and what should be done to mitigate those conflicts (See App II, III&V. A total of 4 to 6 participants in each focus group are participated (Fig.5). And the general directions pursued in those 18 discussions were leave for the researcher to trigger issues for human-elephant conflict and its economic losses for discussion and promote active group perception

Information collected from group discussions were collated and summarized using text analysis method, and presented in a narrative fashion. Thus, the information acquired was triangulated through questionnaire interviews, focus group discussions and field observations.

Figure 5. Focus group discussion in Damano, Yora and Serr villages around CCNP (Source: Field survey 2019).

Field observation

To gather information of human activities that intensifies human-elephant conflict, to evaluate the degree of losses and proximity to the park, to quantify the crop losses and actual property damage, livestock depredation, human injury and death caused by elephants, to evaluate degree of conflict and crop damage by elephants were observed due to the presence of dung pile, footprint followed by remnant crop part on the field (Fig.6). To measure and estimate economic losses of crops due to elephants, sixteen (16) crop stand farmers were selected from four villages (Maliga, Damano, Serr and Yora) and in each village four (4) farmers were selected. The activities carried out in crop growth, maturity followed by harvesting season from Monday 12/3 to Friday 16/3/2019 and Monday 1/5to Friday 5/5/2019 in Serr followed by Yora villages in crop growth and maturity period and from Monday14/7 to Friday 18/7/2019 in Maliga followed by Damano villages in crop harvesting season at time different (early morning, day time and afternoon) (See AppIV). For calculate crop losses maximum and minimum losses in each village recorded and the average losses was taken in a given crops by average production to average market price in Ethiopia birr per quintal per hh per year.

Figure 6.Direct field observation for damaged crop by elephants (Source field survey Apr27 2019) a= elephant footprint size, b=remnant maize crop part,c=elephant dungpiles on farm field

3.3. Data analysis

In the first stage data was organized into different topics by following the objectives of the study and coding the data from interviews according to the topics. For these data descriptive statistics was used to summarize data by using SPSS version 20 computer software programs, Microsoft excel and the categorical responses were analyzed using Pearson chi-square ($\chi 2$) tests to explore the association among variables. One-way ANOVA for crop losses across the villages' comparisons was applied for all continuous data so as to obtain the quantitative information on similarities and differences of issues across the study villages. Estimating total economic loss of assets other than crop (i.e. livestock and property) may lead to biased conclusion, especially in the comparative studies as the economic value of such assets depend

on many site and species - specific factors (Studsord and Wegge 1995). Thus, in order to make my results comparable between the two districts in four villages by maintaining the consistency. It was focused on data analysis only on crop damage by elephants. As there is a general tendency of villagers to inflate the loss, indirect approach to calculate the loss (Upreti 1985, Sharma 1991).

Li = Ai×Yi x Mi Where,

Li = Loss of a given crop (Quintal/year) incurred by household i

Ai = Average Area damaged by elephant as reported by household i

Yi = Average yield in (Quintal/year/unit area) for a given crop as reported by household i

Mi. = Average market price in Ethiopia Birr/Quintal

4. RESULTS AND DISCUSSION

4.1.Demographic Information

The researcher begun by a general analysis on the demographic data got from the respondent which included; the gender, age, educational level, marital status, number of household, source of income and farmer land size. Among the respondents106 (77.37%) were male and most 84 (61%) age between 20 and 40 years. Among respondents about 80% were married and the long time settled in the area.Among the respondents 68 (50%) of the number of household ranges 4-6. Regarding the education status of the respondents, about 25% was illiterate, 67% read and write and only 5% of respondents had attained high school education. There was significant difference (x^2=20.39, df=9, p<0.01) in educational status of respondents and as one factor probability to contribute negative atitude on human-elephant conflict.The major economic activities of the sampled HH in the study area were subsistence agriculture, which includes crop farming, livestock rearing and/or a mixture of animal rearing and crop farming. About 78.8% of the respondents earn their income from mixed agriculture (crop farming belongs animal rearing).The remaining 10.2% depends, on both crop farming and other income sources such as daily labour works, 2.9% depends on government employee with animal rearing, 2.2% depends on shop owner and crop farming and 5.5% depends on bee farming with crop farming. The size of farmlands owned by sampled HH ranged from 1.5 to 5 ha with an overall mean of 2.25 ha. There was a significant difference among HH heads in sizes of farm land they hold ($\chi 2$ = 16.00, df = 5, P < 0.01).The probability of these were to contribute the rural community production matches thier cnsumption rathare than market surplus and thierlivelihooddepends on resource accese that increase human-elephant conflicts.

4.2. Types of Human-elephant conflict

Table 2. Shows that 41 (29.9%) of the respondents revealed as there was competition for resource between human and livestock with elephant, 59 (43.1%) of the respondents revealed habitat loss and fragmentation in protected area due to human and livestock, 21(15.3%) of the respondents revealed due to crop raiding and the last16 (11.7%) of respondent revealed huma n encroachment into the park. There was strongly significant difference

(x^2=70.763,df=9,p<0.001) in types of human-elephant conflict among the survey villages. This was in lined with Kioko *et al*., (2013) who described that human population growth amplifies the demand for land, water, food, energy and industrial raw materials, intensifying habitat fragmentation and increased resource competition between human and elephants. There were also similar finding by Liu etal,.(2017),they described that habitats shrink, elephants are progressively forced into closer contact with people, resulting in more frequent and severe conflict over space and resources with consequences ranging from crop raiding to reciprocal loss of life.

Table 2. The types of human-elephant conflict on Study Area

Types of HEC	Frequency	Percent
Resource competition	41	29.9
Habitat destruction and fragmentation	59	43.1
crop raiding	21	15.3
Human encroachment	16	11.7
Total	137	100.0

The following anthropogenic activities the protected area conservation related conflict that encourage human-elephant conflict were discussed with Park staffs, village representatives and local elders. These were resource access conflicts, livestock grazing, grass thatching, and Fire wood collection and Agriculture expansion and road construction in and around the buffer zone of the park.

Resource access conflict

Rural communities are highly dependent on a number of natural resources for their livelihoods (such as grazing land, firewood, wild honey, medicinal plants, farmlands and thatching grasses) but, without legal permits (Fig.7) hence conflicts have emerged around these resources.

Figure7. Different anthropogenic activities in and around the buffer zone of Chebera-Churchura National Park by rural community and other organization (Source: Fieldsurveyin February,152019), a=Wildfire and agriculture expansion in buffer zone, b=Road construction, c= Thatching grass collected from the Park, d= Livestock driveinto the park.

Livestock grazing

Majority of the livestock of the respondents (80.0%) grazed inside and around the Park, (35.20%) inside the Park (in Core zone) following (44.8%) in the buffer zone of the Park. Most of the respondents did not have their own private grazing land. Only (19.95%) of local people have own grazing land. livestock grazing significantly differed ($\chi 2 = 48.34$, df =8, $P<0.05$) in Villages across respondents on the study area (Table.3). The number of livestock inside the Park was both in during dry and wet season. This finding in lined with

Mariki *et al*., (2015), they reported that many rural communities move closer to more permanent water sources during dry periods to ensure stable water access for their household needs, crops, and livestock. Yet competition for increasingly scarce water sources and other resources during and/or after droughts increases the risk of conflict between elephants and humans in and around protected area.

Table 3. Grazing sites of villagers in Chebera- Churchura National Park

	Livestock grazing (%)			
Villages	n(137)	In the park	In the buffer zone	Own graze land
Serr	34	37.5	46.2	16.3
Yora	41	40.2	54.7	5.1
Maliga	30	29.4	37.3	33.3
Damano	32	33.7	41.2	25.1
Mean		35.2	44.8	19.95

Firewood collection

The main source of energy for the community around CCNP was firewood. Local people are heavily trusted on traditional mud stove, for cooking food using firewood. Among the respondent, (42.1%) depends on the Park for firewood and construction materials from park Core zone, (53.2%) of respondents depends collect fire wood and construction materials from park buffer zone and Only (4.7%)of respondents depends on their farm area use firewood and construction materials.

4.2.1. Trends of human-elephant conflict distance from the park and crop damage

About 48(35%) of the respondents farming lies 0-1km, 50(36.5%) of the respondents farming between 1.5-2km ranges followed by 39(28.5%) of the respondents farming in 2.5-3km ranges. These shows that almost all respondents farms in buffer zone of the park and from these Serr and half of Yora villagers under 0-1km range lies where as Maliga and Damano villagers under 1.5-3km range lies (Fig.8).Based on focus group discussions and key informant interview during the field studies, the villagers inhabited in this boundary before the park establishment. There was a significant difference (x^2=143.977, df=6, $p<0.001$) distance from the park to villages among the respondents settlements.

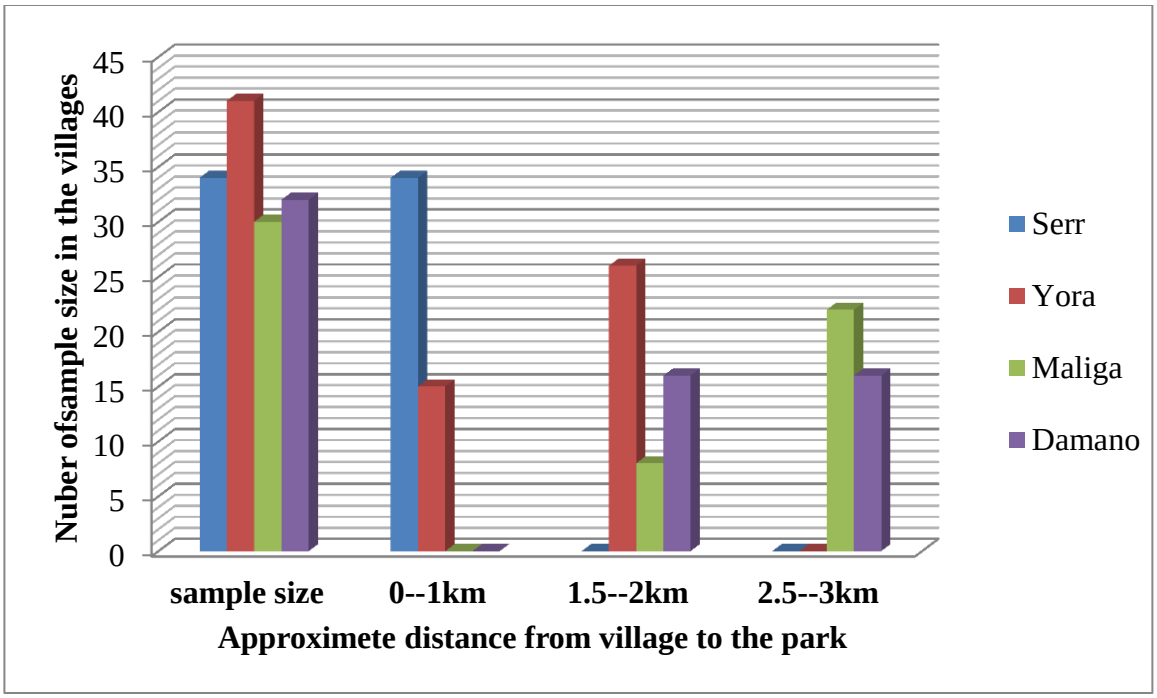


Figure 8. Distance from the park to the villages among respondents

The result revealed that Maize and Bananas were most severely affected crops by elephant in 0-1km to 1.5km distance range from the park followed by across the villages (Fig.9&10). There was significant association of(x^2=30.212, df=8, p<0.001) in distance of farming land to the park interms of crop damage by elephant. The farmers explained during focal group discussion following by key informant interview, elephant preferential crop raiding social animals as human it know that which crop easily palatable to them. This finding in lined with Leel *et al.*,(2009).He asserted that conversion of elephant habitats significantly affects elephant foraging preference, feeding patterns and accessibility to other ecological resources. The same was true in the study area that people are live near to the habitat of wildlife encounter high problem and frequent crop damage. Elephant cropraiding is especially serious for farmers living adjacent to protected areas, these farmers consider elephants to be one of the most serious causes of crop damage (Megaze *et al.*, 2017).

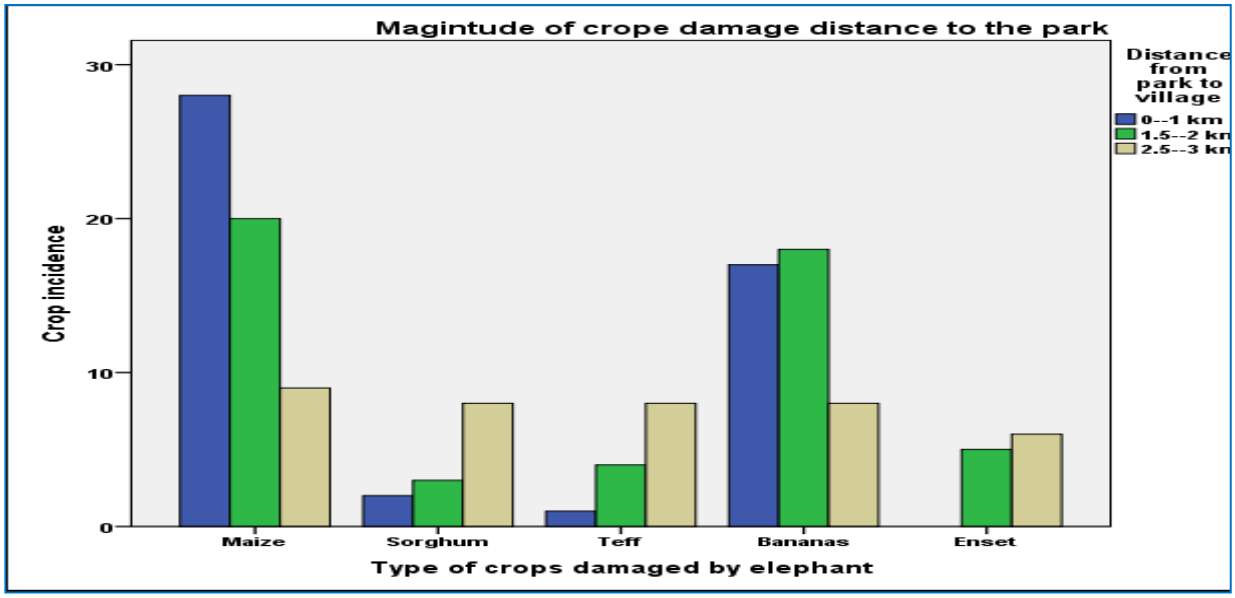


Figure 9.Crop damaged by elephants close to the park and far from the park

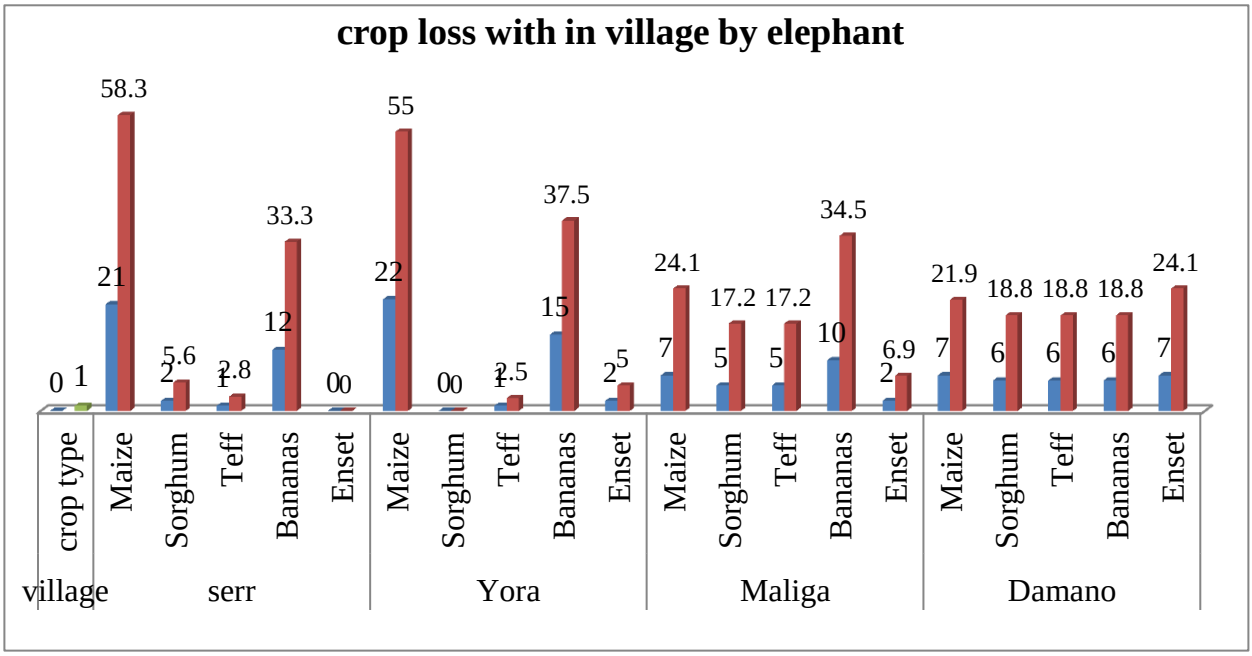


Figure 10.Crop incidence by elephants across the villages.

4.2.2. Trends of Elephant visit the farms to crop attack around the park

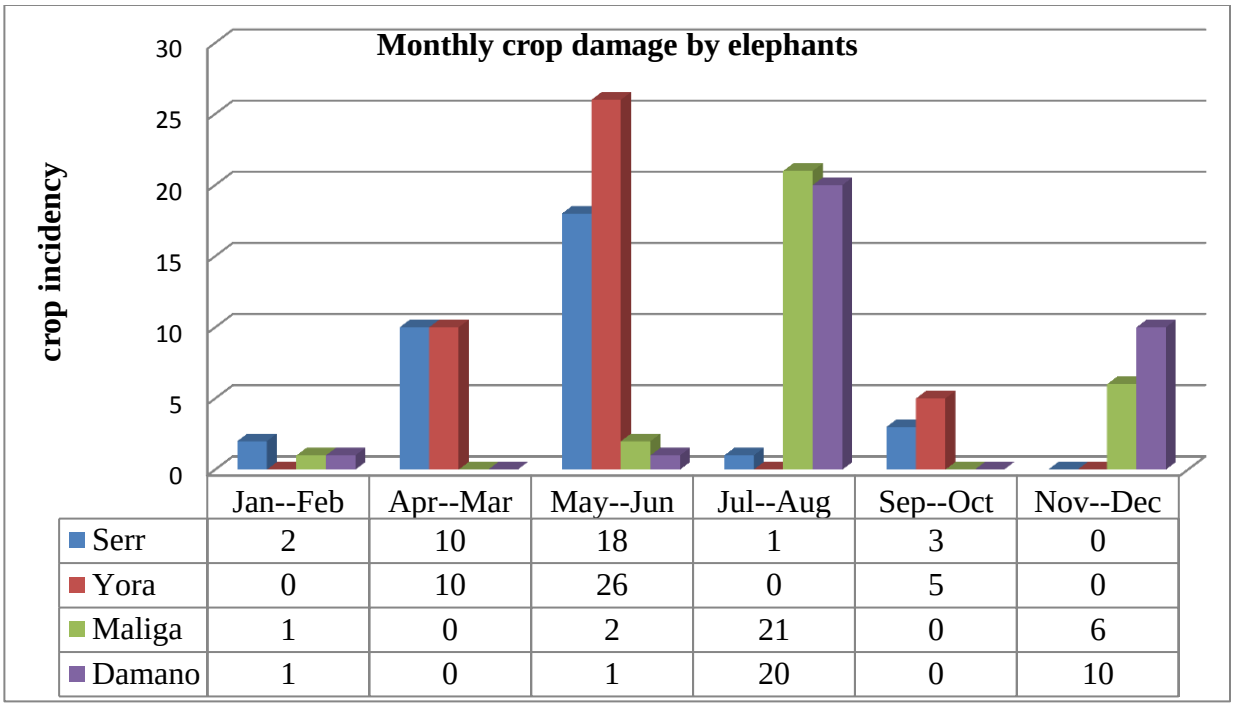
Table4 shows time of the day and months of the year when elephants frequently visit farms for crop damage. There were a significant difference (x^2 =40.93, df=9, p<0.001 and x^2=123.23 df=15, p<0.001) in time of a days and a year when elephants frequently visit the farm across

the villages. For Serr and Yora villages elephants frequently visit the farm through a year. This was due the villages were close to the park and the wetlands and in this wetland elephants cannot absent through a year where as in Maliga and Damano villages, elephants visit the farm through a year only two times (March and July)

Table 4.The day time and year elephants come to farming village to search crops

Time	n(137)	Freq.	Percent	village
Day time		3	2.2	Serr
Night time		118	86.1	Four villages
Early morning		4	2.9	Serr and Yora only
Evening		12	8.8	Serr and Yora only
Year				
All year round		36	27.0	Serr
6 times/year		33	24.1	Yora
2 times/year		53	38.7	Maliga and Damano
No fixed time		14	10.2	all

Figure11.Show that (53.9%) followed by (63.4%) of crop damage occurred from May to June in Serr and Yora villages together (70%) followed by (63.5%) of crop damage occurred from July to August in Maliga and Damano villages during the study period. This shows there was a significant(x^2=35.655, df=9, p<0.001, n=137) in month difference interms of crop damage by elephants within villages. The probability this due to different crop maturity and harvesting season across the districts between the villages. This finding consists by Sukumar (1989), further commented that protein content of wild food plants dropped far below the minimum level needed by elephant for maintenance during the late wet season. At this time, there was also the peak raiding season, the maturing finger millet and field crops, had much higher protein levels. Maize cobs, which are selectively plucked by elephants, had protein levels even higher than in fresh growth of tall grasses.



	Jan--Feb	Apr--Mar	May--Jun	Jul--Aug	Sep--Oct	Nov--Dec
Serr	2	10	18	1	3	0
Yora	0	10	26	0	5	0
Maliga	1	0	2	21	0	6
Damano	1	0	1	20	0	10

Figure 11.Monthly crop damage by elephant on study area

4.2.3. Types of wild animals involved in crop raiding

Elephants were reported to be the most destructive wild animals in the surveyed villages at near and far distances from the park (Table5). (54.7%) of the respondents cited elephants the 1st crop damage causing wildlife, (17.5%) of the respondents cited Africa buffalo the 2nd crop damage causing wildlife, (13.1%) of the respondents cited Vervet monkey 3rd crop damage causing wildlife, (8.8%) of the respondents cited Wild pig 4rth crop damage causing wildlife and the last (5.8%) of the respondents cited Warthog 5th crop damage causing wildlife. Wild animals involved in crop raiding significantly difference across the surveyed villages ($\chi 2$ =446.1 df = 12, n =137, $P < 0.05$). This finding consisting with Dkamela &Endamana, (2012), they verified Elephants have been caused serious damage in most of the studies to be responsible for the crop damage although other wildlife like Vervet monkey, warthogs, wild pig, Africa buffalo, and hippopotamus.

Table 5. Wild animals based on crop raiding on study area

Wildlife	Frequency	Percent	Rank	Damage
Elephant	75	54.7	1st	Very sever
Africa buffalo	24	17.5	2nd	Sever
Wild pig	12	8.8	4rth	Low
Warthogs	8	5.8	5th	Low
Vervet monkey	18	13.1	3rd	Medium

4.2.3.1. Comparisons between Elephant crop raiding with other wildlife

Figure12.Shows that crop raiding activity by elephant and other wildlife on study area, elephant prepare maize, bananas and enset crop and the part of crop raided by elephant maize all part, bananas fruit and stem part and enset both stem followed by leaf part. Their crop raiding behaviour uprooting system. But the other wild animals crop raiding behaviour mainly seed and fruit part only and their crop raiding behaviour on natural crop stand position (Fig.13a&b).For this the locally communities conclude that elephants is a messy eater ,uprooting and scattering as much as is eaten. This is due to its severity because of single elephant make light work of hectare of crop in a very short time.

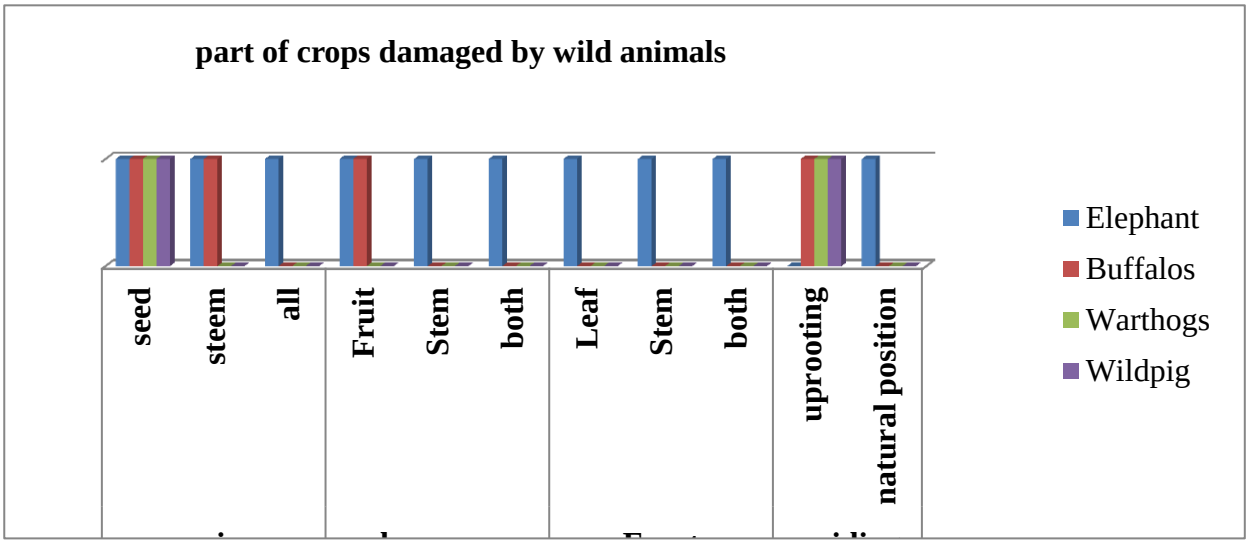


Figure 12.Crop raiding system by different wildlife on study area around CCNP

Crop raided by Elephants, b= maize crop raided by Warthog and Wild pigs

4.3.Cause and extent of adverse intraction of human-elephant conflict

The reason that respondents cited for having damage caused by elephant conflicts were shown by major reported reason by human- elephant cause damage were due to crop raiding, livestock depredation, humans injury and death, property destruction following elephant injury and death. Among the respondents (78.1%) reported crop damage, (15.3%) of reported livestock depredation, (2.9%) reported threat to humans (death and injuries), (2.9%) of reported as property destruction and (0.7%) of reported only elephant death (Fig.14). There was significant difference (x^2=70.763, df=9, p<0.001) in extent and adverse interaction of human-elephant conflict across the sites. Regarding the nature of HEC, crop damage was the most common problem in two districts within four villages followed by property damage and the threats to people. Also in this study, crop-raiding was cited as the most common type of human-wildlife conflict by men, women and village leaders. The injury to and killing of people and livestock were also mentioned. The cause of the human-wildlife conflicts was portrayed by village leaders to be the closeness of farmland to protected areas and the diminishing forests and reduced shrubs. (Cao *et al.*, 2010).

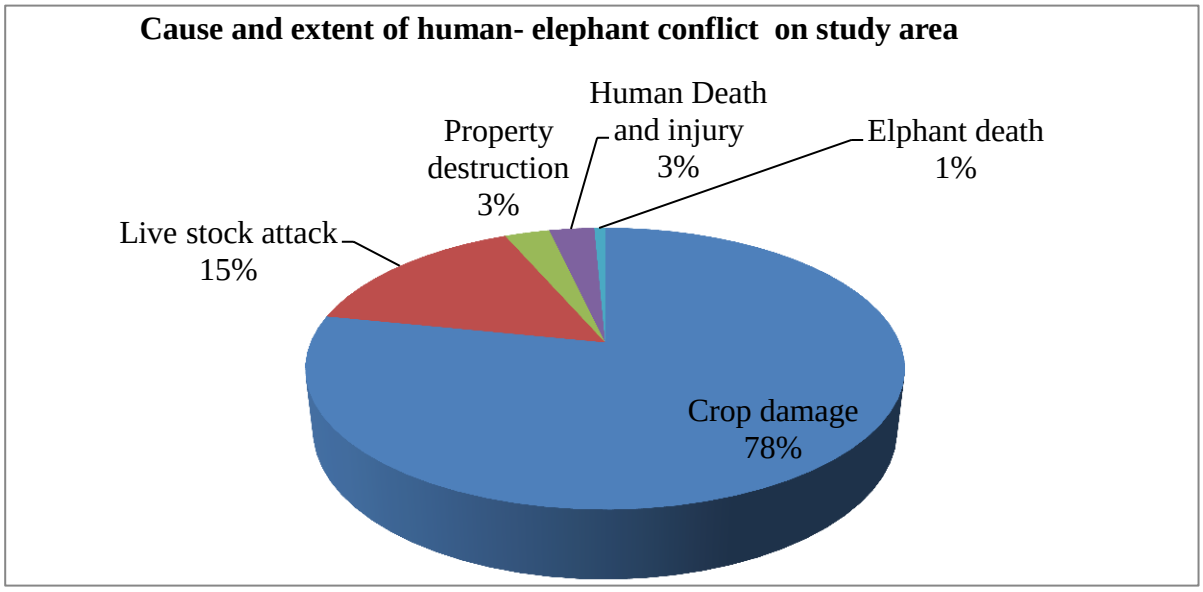


Figure 14.The incidence of human-elephant conflict around CCNP

4.3.1. Crop Damage

4.3.1.1. Degree of crop damaged by elephants

Table 6.Status of elephant's crop raiding incidence among the major crop

Major crops	Frequency=(137)	Percent	Rank	Farmer attitudes
Maize	70	51.1	1st	Negative
Sorghum	14	10.2	3rd	Negative
Teff	9	6.6	5th	>>
cassava	12	8.7	4rd	>>
Banana	27	19.7	2nd	>>
Enset	5	3.6	6th	>>

Table 6.Showsthat out of 137 respondent 70 (51.1%) of the respondents was verified elephant damage maize crops, 39 (28.5%) of the respondents verified bananas crop, 14(10.2%) of the respondents, verified that sorghum crops, 12(8.7%) of the respondents verifi ed cassava crop, 9(6.6%) of the respondents verified teff and the last one 5(3.6%) verified Ens et crops. The types of crops damaged by wild animals significantly difference among the surv eyed villages ($\chi 2=29.537$, df=15, P<0.001).From field observation point of view maize was the major crop types on survey area, for this the majority of farming area (85%) covered by maize (FAOSTAT, 2014).It was also discussed with focal group followed by key informant interview, they verified that elephant prepare maize crop at the first alternative food crop

among the other crop types. The probabilities of this elephants were social wild animals to us, so that maize and banana crops easily palatable to digest and sweet to elephants.

I also see repeated crop-raids by elephants (Fig.15&16) in certain farms suggesting that once the elephants know where there are crops available to eat; they will repeatedly visit those farms until the crops have been finished. Other farms only get one visit from elephants and are lucky to get away with minimal damage. When we visit a crop-raided farm our team of local field assistants, interns and participating farmers take various recordings including measurements of dung pile length of the various individual elephants; the pattern of movement around the farms, the crops present in the farm and the crops actually raided. Reddy and Workneh, (2014), asserted that Ethiopia elephants raid agricultural crops such as; vegetables, fruits and crop stores around house ranges and individual farmers suffer from damage by elephants risk their lives in defense of their crops.

Figure 15.Observe Elephants by using binocular and digital camera (Source: field observation February, 2019) **a)**=Observe elephants on farm field near Yora village, **b)**=elephant on maize crop, **c)**= Record damaged Bananas crop around homestead in Serr village ,**d)=**Elephant damage cassava crop

Figure 16.Magnitude of maize crop raided by elephants in Serr village. (Source:Field observation April 12,2019), a=before maize raided by elephants,b=maize raided by elephants

Table 7.Average market price of crops

Types of crops	Average Yield/ha		Average market price		Source of data collected from-
	kilogram	Quintal	ETB/Kg	ETB/qt	
Maize	1530	15.3	6.14	614.38	Kech and Konta district agricultural extension report 2018/2019
Bananas	9630	96.3	10.89=11	1089	Kech&Konta district agricultural office and local market value around CCNP
Enset	7540	75.4	27.77=28	2777.28	Kech and Konta district agricultural office and local market value around CCNP

(Source :Local market value assessment and Kech and Konta district agricultural extension report, 2019)

4.3.1.2. Estimations for average economic product of crops

Table 8. Average crop covered area (ha) by household in study villages

Crop product	village	N	M	SD	SE
Maize product	Serr	34	1.1285	0.38671	0.06445
	Yore	41	1.1406	0.40548	0.06411
	Maliga	30	1.0560	0.36533	0.06784
	Damano	32	0.4969	0.27394	0.04359
	Total	137	0.9555	0.357865	0.05997
Banana product	Serr	34	0.0790	0.04926	0.00821
	Yora	41	0.0820	0.04838	0.00765
	Maliga	30	0.0744	0.04900	0.00910
	Damano	32	0.0342	0.08780	0.01552
	Total	137	0.0684	0.06256	0.00535
Enset product	Serr	34	0.1007	0.08221	0.01370
	Yora	41	0.1001	0.09371	0.01482
	Maliga	30	0.1121	0.08899	0.01652
	Damano	32	0.0680	0.02534	0.00271
	Total	137	0.0953	0.09747	0.00747

N=respondents number , M=mean by hectare, SD=standard deviation ,SE=standard error

The result shows that average crop product (ha) by household in Serr, Yora, Maliga and Damano villages respectively 1.3 ha, 1.32 ha, 1.23 ha and 0.59 ha.There strongly significant mean difference (F=43.11,df=3,p=0.001,F=4.58,df=3,p=0.004 and F=12.76,df=3,p=0.001) between the villages interms of maize, bananas followed by enset crops. The economic value of average crop production (ETB) by household in Serr, Yora and Maliga followed by Damano villages respectively 39822.59ETB, 40255.4ETB, 40664.5ETB and22039.32 ETB.

4.3.1.3. Estimation average economic losses of crops

Table 9.The average yield losses (ha) by household on study villages

Losses		N=(137)	Mean	SD	SE
Maize losses	Serr	34	0.37	0.303	.052
	Yora	41	0.32	0.292	.046
	Maliga	30	0.24	0.213	.039
	Damano	32	0.26	0.233	.041
	Total	137	0.30	0.268	.023
Banana losses	Serr	34	0.034559	0.0390438	0.0066960
	Yora	41	0.024390	0.0279328	0.0043624
	Maliga	30	0.014333	0.0304770	0.0055643
	Damano	32	0.012305	0.0185652	0.0032819
	Total	137	0.021889	0.0308582	0.0026364
Enset losses	Serr	34	0.013235	0.0183766	0.0031516
	Yora	41	0.008049	0.0150365	0.0023483
	Maliga	30	0.007000	0.0129055	0.0023562
	Damano	32	0.007500	0.0152400	0.0026941
	Total	137	0.008978	0.0155906	0.0013320

Table9.Shows that there were statistically mean difference (F=4.317,df=3, p=0.006 & F=3.858, P=0.01) in maize following bananas crop losses by elephants in each household per hectare among the villages and there was no significant association of Enset crop losses in each household per hectare among the survey villages (F=1.154, df=3,P=0.33). The result shows that in Serr followed by Yora villages there were highest crop losses whereas in Maliga followed by Damano villages, low crop damage recorded. These were closeness to the park following human disturbance. Even though there was no crop on agricultural field around these villages, the elephant force to visit the home garden crops like Banana and Enset to raiding. The idea of focus group discussion and key informant view during the field study.

Elephants raided substantial amount of maize crop in all four villages. The total average crop loss in each household averagely in Serr village was 9871.8 ETB following by Yora7251.3 ETB and Damano 5305 ETB. The least loss was recorded Maliga 5224.59 ETB in one cropping season. The period of these economic losses crops at the crop growth up to harvesting from survey villages. This finding in lined with Mackenzie and Ahabyona (2012) they asserted in Uganda additionally, found that household financial losses (from crop-raiding) averaged US $74 over the six-month study, a substantial loss given the median

household income was US $503. These financial losses may render families unable to pay necessary expenses. These were only 88 respondents results out of 137 respondents because of 49 respondents reported they didn't encounter elephant damage and loss in the investigation period considered for this study. Among other crops, maize was lost in greatest quantities in Serr village while banana was in Yora village. In general, maize is reported to be a most prepared crop type to elephants following bananas and Enset crops. The quantity of average losses from average product were (32.3%), (26.7%), (20.8%) and (21.2%) respectively in Serr, Yora Maliga following Damano villages.

Table 10. Economic losses of crops due to Elephant damage

Crops	Serr			Yora			Maliga			Damano		
	ETB/qu/hh	SD	SE	ETB/qu/hh	SD	SE	ETB/qu/hh	SD	SE	ETB/qt/hh	SD	SE
maize	3478	0.303	0.052	3008	0.292	0.046	2256	0.213	0.039	2444	0.233	0.041
Banana	3624.2	0.0390438	0.0066960	2557.79	0.0279328	0.0043624	1502.7	0.0304770	0.0055643	1290.4	0.0185652	0.0032819
Enset	2771.5	0.0183766	0.0031516	1685.5	0.0150365	0.0023483	1465.89	0.0129055	0.0023562	1570.6	0.0152400	0.0026941
TCLB	9873.7			7251.3			5224.59			5305		
TCLQ	9.85			7.85			5.6			5.7		

TCLB=Total crop losses by Ethio_birr, TCLBQ=Total crop losses by quintal, ETB=Ethiopian birr, qt= quintal, hh= each households =standard devotions=standard error

Table10 shows that there was averagely 7.25 quintal crop in 6913.17 birr, losses annual from the given villages due to elephant damage.

4.4.Human injuries and deaths

Table 11. Incidents of human-elephant interaction

Year	Human injury		Human death		Elephant death	
	male	Female	male	female	male	female
2018	0	0	1	0	1	0
2019	1	0	2	0	0	0
Total	1	0	3	0	1	0

Table11 showed that there were 2 incidents of deaths and 1 injury due to elephant conflict reported in the study area over 2 years and 1 elephant death. Human injuries and death occurred in only males around the Chebera-churchura National Park. This happen due to the foreign visitor

4.5.Livestock depredation

Table 12.Livestock injury and death by elephant in and around Chebera-churchura national park of study villages.

Year	Livestock injury		Livestock death	
	ox	cow	ox	cow
2018	1	1	2	4
2019	2	0	3	5
total	3	1	5	9

Table12 showed that in 2018 and 2019, 4 livestock injury and 14 deaths reported by respondents, among from this (65%) of incident is occurred in Serr and Yora villages whereas (35%)in Maliga followed by villages.

4.6. Property Destruction

Table 13. Property destruction around Chebera-churchura national park on study village

Year	House	Stored grain	Fence
2018	3	5	7
2019	5	7	12
total	8	12	22

Table13revealed that a total of 54 households had their property destroyed by elephants in 2018/2019 on study area. There were averagely 2 injuries and 7 livestock death followed by 6 stored grain losses annual from study villages (Tab1e, 12&13) due to elephant caused damage.

4.7. The impacts of Human-elephant conflict

There was a number of human-elephant conflict exist on study sites based on focus group discussion and field observation during study period. These categorized as direct and indirect impact on rural communities around the parks .The direct impact observed as crop loses, human injury and death, property destruction and resource competition elephants with livestock and human whereas indirect impacts,(11.5%) of respondents cited absent from school , (25.2%) of respondents cited lack of sleep, (29.3%) of respondents cited steer and fear for night movement on their our farming area followed by (34%) of respondents cited loss of individual income and food insecurity. There was no significant difference (x^2=8.745, df=12, p>0.05) in indirect human-elephant impact among the villages. There were averagely from Serr and Yora villages 12 students absent from5^{th} and 6^{th}class under the age of 12 year and from Maliga and Damano8 students absent from 5^{th} class under the age of 14 years during 2018/2019 academic year. This was in lined with (Mackenzie and Ahabyona,2012), they verified thatunfortunately, children are often needed to protect the fields. This family responsibility detrimentally impacts children's access to education.This absenteeism from school degrades children's academic performance.

4.7.1. Duration and frequency of Human- elephant conflict

Figure17.Shows that conflicted between elephant and local community starting from 11 years ago reported (49.6%), started from 10 year ago reported that (22.5%) followed (24.8%) who reported it 7 years ago. This shows human settlement in the area started prior its establishment as a national park. With regards to the change in the frequency of the conflict, about (88.3%) of the respondents stated that such conflict is increasing from time to time. While none of the respondents perceive a decline in the conflict, about (11.7%) of them stated it remain more or less the same. In relation to damage reporting system to the concerned body, about (46%) of respondents stated that they report to park managers followed by Keble agricultural development agents (39.4%) and to the Woreda administration (14.6%) indicating that the majority of the respondents reported to park managers. This study lined with Hill ,(2015), he explains that this is because farmers are aggressively repot to direct their anger towards the conservationists or park officials managing elephant populations.

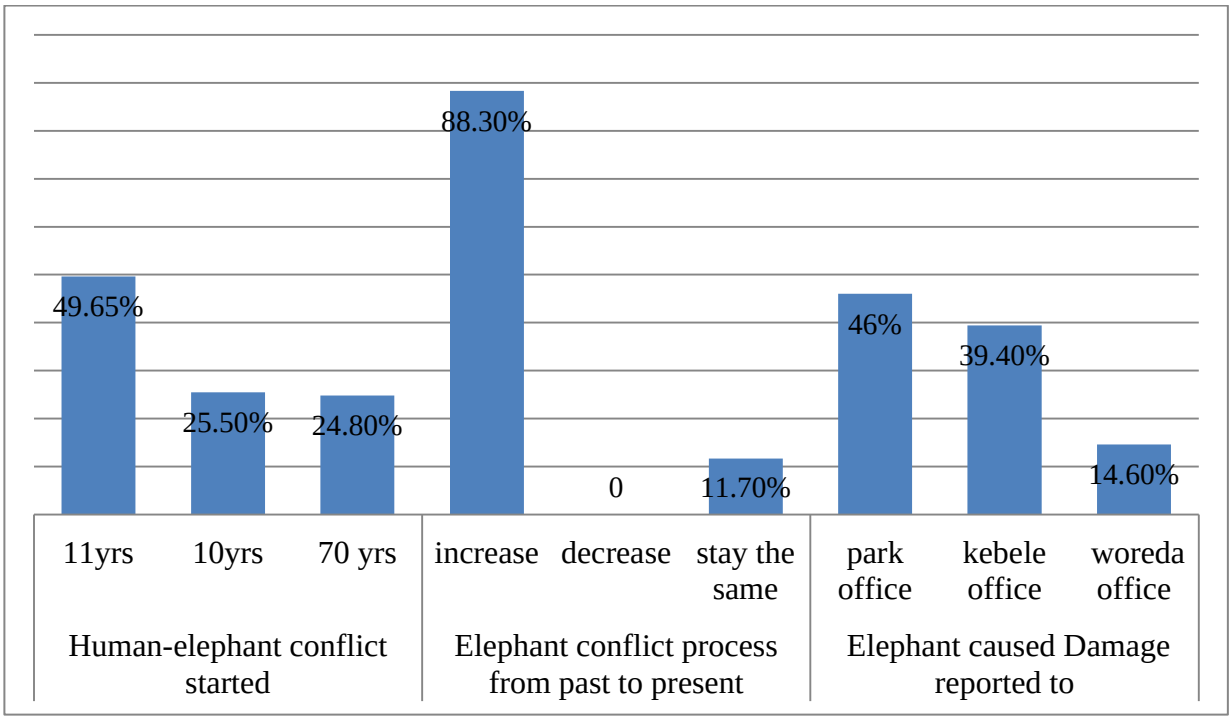


Figure 17.Duration of Human-elephant conflicts and frequency on study area.

5.8.Compensation system

It is a measure which aims to alleviate conflict by reimbursing people for their losses and giving out monetary payments or licenses to exploit natural resources, allowing the hunting of game or the collection of fuel wood, timber and fodder from inside protected areas. All of the respondents were noted that CCNP authority has not developed compensation scheme to those affected households by crop damage, human injury and death, livestock attack and property destruction giving in terms of cash, school bursary, project done by regional government, re settlement program etc. This finding was not consisting with Nyhus *et al.*, (20 05). He described that Compensation is a form of reimbursement given to people who have ex perienced wildlife damage to crops, livestock or property, experienced injury, death or are ph ysically threatened by wildlife.

5.8.1. Attitudes of respondents towards elephant conservation

The 85% of the respondents expressed negative attitude toward elephant conservation, (10%) of the respondents expressed positive attitude toward elephant conservation and (5 %.) of respondents explained elephant conservations is may be advantages for the future generation. There was no significant difference($x^2=23.456$, $df=15$, $p>0.05$) in attitude of respondents across the village towards elephant conservation. This was due to the elephant causes serious damage to crop, livestock, property and death and injury for human among the other wildlife on study area. For this damage there was no any compensation from concerned body. This finding in lined with Bandara and Tisdell (2002).They verified that the uncompensated and uncontrollable damage from elephants undermines the local population's efforts and desire to participate in elephant conservation. In addition to this elephant causes hidden cost or damage to household lik lack of sleep, fear and stress, children absent from school attending and emotional and mental disaster.

5.9.Local control measure to elephants induced damages

Table 14. Local mitigation measure of elephants on study area

Type of prevention	Frequency	Percent
chasing with fire	45	32.8
regularly guarding	35	25.5
Clearing trees from field boundary	22	16.1
Making loud noise	34	24.8

Table14 .Showed that (45%) of the respondents cited chasing with fire, (35%) of the respondents cited regularly guarding, (22%) of respondents cited clearing trees from field boundersfollowing (34%) respondents cited Making loud noise. There was significant differen ce (x^2=53.05.df=9, p<0.001) in local control methods to elephant caused damages among the villages. The severity of the problem was reflected by various methods undertaken at the community level to mitigate HEC in all four villages. Most people applied one or more measures to cope with HE Camong them, chasing with fire, making loud noise and regularly guarding the fields were the most widely used methods in all four villages. But in study villages Elephants are developed locally controlled measure. This show that Elephants are always one step ahead of us human beings in this arms race of offenses and defenses. They develop counter methods in no time in response to the techniques that we apply to drive them away chasing with fire, use of noise and explosives, and regularly guarding fields (Fig.18). These were not considered to be effective in mitigating HEC by the people of Serr, Yora, Maliga and Damano villages. However, all of them reported that these preventive measures are not effective. This study agrees with Sukumar (2003) whereby he observes that these techniques are merely effective to drive away inexperienced crops raiders, whereas veteran raiders, usually adult bulls or even some family groups are difficult to be fooled.

Figure 18.Local crop guarding methods on study villages. (Source: field observation)a = Boy watch the maize crop field in Serr village, b= site clearing and set fire on farm border in Yora villages,

5.9.1. Existence strategies practiced by CCNP Authority to mitigate the issue of HEC

Table15.Shows that CCNP have put poor measures to against the effects of human-wildlife conflict. All of the respondents were noted that CCNP authority has not developed compensation scheme and lethal control method. Almost (75%) of the respondents said the CCNP authority were not tried to create educational awareness for the local people about the importance of large wild animals, (70%) of the respondents noted no fence provided by the park managers following only (10%) of the respondents, noted the park manager provide guarding. Park or protected area can be a powerful tool for conservation of wildlife. Yet the full impact of these schemes requires a good understanding of their impact on local people livelihoods. The result indicates the CCNP authority does not put meaningful strategies to mitigate the problem of HEC.

Table 15.Strategies applied by park managements to mitigating human elephant conflict

Mitigation Strategies used by CCNP authority	Respondents response					
	Strongly Disagree	Disagree	Uncertain	Strongly agree	Agree	Total
Fencing	65%	5%	10%	5%	15%	100%
Education/awareness	52%	13%	10%	12%	13%	100%
Compensation	100%	0%	0%	0%	0%	100%
Lethal control program	100%	0%	0%	0%	0%	100%
Guarding	47%	24%	19%	3%	7%	100%

Limitation of the study

This research would be more effective and valuables if the research did not faced any obstacle, but the research encountered the following constraints.

- Lack of documented data based on damage caused human elephant- conflict.
- Lack of sufficient available and easily accessible material.
- Lack of sufficient time to conduct the research

6. CONCLUSION AND RECOMMENDATIN

6.1.Conclusion

Result of the present study provided information on some aspects of human-elephant conflict and its economic consequences around Chebera-churchura national park. It gives baseline information for further studies on economic losses of human-elephants conflict. The main cause of human -elephant conflict on study area were habitat destruction and resource competition of human and livestock with elephants the crucial one and crop raiding was the threat ones. This might be due to inhabitants farming area close to the park and absence buffer zone between the villages and the park.

Crop damage had a higher number of incidents than human injuries and deaths, livestock depredation and property destruction across the villages. This hinders significant impact on rural people lost of livelihoods income and disruption of food security.

Spent time and money, lack of sleep, fear and steers in night movement during crop guard, absenteeism children from school attained, crop loss, human injury and death, livestock attack were the impacts of human-elephant conflict. There was no compensation for direct and indirect impacts by elephants to rural communities' interms of cash or kinds and their attitudes for elephant conservation and management was negative.

The local crop mitigation measure such as regular guard, chasing with fire, clear site boundaries etc were ineffective measure of crops from elephant. There were no lethal mitigation measure and awareness creation regarding to the importance of elephant conservation provided by concerned body to rural communities. Research findings shows that although large number of farmers suffers crop raiding by elephants and other wildlife most affected communities not reported the problem any concerned bodies. This leads to hidden the existing problem due to lack communication among the suffered communities and responsive bodies.

6.1. Recommendation

To prevent human-elephant encounters in the first place, thereby reducing the risk of human-elephants conflicts, better land use planning can be used to avoid settlement and cultivation close to protected areas. Buffer zones can also be established around national parks to reduce the overlap between humans and wildlife. Another strategy for reducing human-elephant encounters, thereby preventing conflicts from arising, is to minimize human activity and livestock expansion into the elephant home range to compute water and food resources with elephants.

To further reduce crop loss to elephants, it was recommend that farmers dedicate part of their farmland to cultivating non-palatable crops instead of known elephant favorites like maize, sorghum, teff, and bananas. Shifting agricultural practices to cultivate crops that are non-palatable to elephants would reduce the attraction for elephants to enter that field. Growing both rapidly maturing non-palatable crops like sunflowers, chilies, and ginger as well as slow-maturing non-palatable trees including moringa would provide farmers with short-term income and long-term agro-ecological benefits (e.g. decreased soil erosion, nitrogen fixation)

Set up a bee-keeping association for the local people as beekeeping is a good income generating activity for resource-poor people, and is environmentally friendly and sustainable with no outside resources requirements. Skills trainings should be held by regional states, and park managers to introduce and encourage the adoption of alternative livelihoods such as poultry farming and beekeeping that are not as rainfall dependent as crop cultivation.

The park managements should work hard to increase the awareness creation to surrounding community about the importance of elephant conservation and management for ecologically, economically, environmentally and social benefits. It recommended that park surround community homey bee farming practice for scare away elephant from their farm and good environmental sustainability production.

It recommended that kebele development agents give awareness to inhabitants ‘for use of biogas plants and solar energy to reduce pressure on the Park resources and the concerned body should regulate new settlement schemes by allocating farming areas to communities away from the park and prevent further encroachment into the park.

REFERENCES

Acha, A.; Temesgen, M. (2015). *"Approaches to Human-Wildlife Conflict Management in and around Chebera-Churchura National Park, Southern Ethiopia" (PDF)*. Asian Journal of Conservation Biology. **4** (2): 136–142.

African Elephant Database (1998). IUCN/SSC African Elephant Specialist Group. IUCN, Gland and Cambridge

Ali, M.B., Lotz-Sisitka, H., Mphepo, G., Chaves, M., Macintyre, T., Pesanayi, T., Wals, A., Mukute, M., Kronlid, D., Tran, D.T. and Joon, D., (2016).Co-designing research on transgressive learning in times of climate change.Current Opinion in Environmental Sustainability, 20, pp.50-55.

Allen-Rowlandson, T. S. (1990). Aerial survey of wildlife resources in Ethiopia: January–February 1990. Unpublished report, Ethiopian Wildlife Conservation Organization. Addis Ababa.

Amare, A. (2015) Conservation Challenges of Gibe Sheleko National Park, Southwestern Ethiopia. Natural Resources, Areas of Ethiopia. A First Inventory, Ethiopian Wildlife and Natural History Society, Addis Ababa.

Anderson JL, Pariela F (2005). Strategies to mitigate human-wildlife conflicts Mozambique wildlife management working paper.

Bandara R, Tisdell C (2002) Asian elephants as agricultural pests: damages, economics of control and compensation in Sri Lanka. School of Economics. University of Queensland. Brisbane, Australia.

Barua, M., Bhagwart, S. &Jadhar,S (2012), The hidden dimension of Human Wildlife conflict: Health Impacts, opportunity and transaction Costs. *Biological Conservation*, Vol.157, no.0, pp. 309-316.

Barua, M., Bhagwat, S. A., &Jadhav, S. (2013). The hidden dimensions of human–wildlife conflict: Health impacts, opportunity and transaction costs. *Biological Conservation, 157*, 309-316.

Bati, C. Aseged G. and Chemere Z. (2002). Preliminary report on aerial Census of wild animals conducted in Nechisar, Mago and Omo National Parks and Mazie and Chebera Wildlife Reseve Areas. Unpublished report. EWCO, Addis Ababa.

Bayani, A., Tiwade, D., Dongre, A., Dongre, A.P., Phatak, R. and Watve, M.,(2016). Assessment of crop damage by protected wild mammalian herbivores on the western boundary of Tadoba-Andhari Tiger reserve (TATR), Central India.

Belayneh A. and Demissew S. (2011). Diversity and Population Structure of Woody Species Browsed by Elephants in Babile Elephant Sanctuary, eastern Ethiopia: an implication for conservation.

Bellet, C., Vergne, T., Grosbois, V., Holl, D., Roqer, F. and Goutard, F. (2012).Evaluating the Efficiency of Participatory Epidemiology to Estimate the Incidence andImpacts of Foot-and-Mouth Disease among Livestock Owners in Cambodia.

Bengis, R. G., Kock, R. A. & Fischer, J. (2002). Infectious animal diseases: the wildlife/livestock interface. Revue Scientifiqueet Technique, Vo.21, no.1, pp.53 65.

Biru Y. & Bekele A. (2012). Food habits of African elephant (Loxodonta africana) in Babile Elephant Sanctuary, Ethiopia Tropical Ecology 53(1): 43-52

Blake, Stephen, Sharon L. Deem, Eric Mossimbo, Fiona Maisels and Peter Walsh. 2009. "Forest Elephants: Tree Planters of the Congo." *Biotropica*41(4):459-468.

Blanc JJ, Barnes RFW, Craig GC, Dublin HC, Thouless CR, et al., (2007) African Elephant Status Report 2007: An update from the African Elephant Database. Gland, Switzerland: International Union for Conservation of Nature

Blanc, J.J., Thouless, C.R., Hart, J.A., Doublin, H.T., Douglas-Hamilton, I., Craig, G.C.and Barnes, R.F.W. (2003).African elephant status report. IUCN/SSC African Elephant Specialist Group, Gland, Switzerland and Cambridge

Bouché, Philippe, Iain Douglas-Hamilton, George Wittemyer, Aimé J. Nianogo, Jean-Louis Doucet, Philippe Lejeune and CédricVermeulen.(2011). "Will Elephants Soon Disappear from West African Savannahs?" *PloS One* 6(6):1-11

Brooks, C. &Maunda (2010), *Wildlife Resources and Human Wildlife Conflict,* in center for Applied Research and Department Affairs.

Cao, C., Anderson-Bowen, P., Hartwig, K., & James, S. (2010). *The Whole Village Project.Village Reports for Mandi, Gidas, Boay, Mwada, Sangaiwe, and VilimaVitatu in Babati District*. Minneapolis: University of Minnesota

Chaminuka, P., Groeneveld, R.A., Selomane, A.O. & Van lerland, E.C (2012). Tourist preferences for ecotourism in rural communities adjacent to Kruger National Park: A choice experiment aproach.*Tourism Management,* Vol. 33, no. 1, pp.168-176.

Chaminuka, P., Udo, H., Eiler, K. &Zijpp, A. (2008). Livestock systems and competing claims for land at the wildlife based tourism/livestock interface. Animal Production Systems Group, Wageningen University, Wageningen, the Netherlands.

Chiyo, Patrick I., Erica P. Cochrane, Lisa Naughton, and Gilbert I. Basuta. (2005). Temporal Patterns of Crop Raiding by Elephants: A Response to Changes in Forage Quality or Crop Availability? *African Journal of Ecology* 43(1):48-55.

Chomba, C., Senzota,R., Chabwela,H., Mwitwa,J. &Nyirenda,V.(2012). Patterns of Human Wildlife Conflict in Zambia; Causes, Consequences and Management Practices.*Journal of Ecological and* Natural *Environment*, Vol. 4, no.12, pp.303-313.

Darota, D., (2003). Yield Response of Bread Wheat (Triticum aestivum) to Applied Levels of N andP Fertilizers on Nitosol of Dawor Zone, Southwetern Ethiopia. M.Sc. Thesis,Alemaya University, Alemaya.

Datiko, D. and Bekele, A. (2013). Conservation challenge: Human-carnivore conflict in CheberaChurchura National Park, Ethiopia. Greener Journal of Bio-logical Science 3(3**)**: 108-11.

David, B., Fruth B., LoicBollache, Gottfried Hohmann and Francoise Bretagnolle.(2013). "Doom of the Elephant-Dependent Trees in a Congo Tropical Forest."*ForestEcology and Management* 295:109-117.

Dawuro Zone (Kech) and Konta Woreda Agriculture extension office (2018) .Agriculture extension report. Dawuro Zone Rural Development, Kech Woreda rural development.

Dickman, A. (2008). Key Determinants of Conflict be-tween People and Wildlife, Particularly Large Carnivores, around Ruaha National Park, Tanza-nia.PhD thesis, University College of London Institute of Zoology, London.

Dickman, A. (2010). Complexities of conflict; the importance of considering social factors for effective resolving human wildlife conflict. Animal Conservation, Vol.13,no. 5, pp. 458-466

Edward, D.W and Frank,S.A(2012) .Victims perspectives of Lowes' Monkeys' (Cercopithecuscampbellilowei) crop raiding events in Ghana: A case of BoabengFiema Monkey Sancturey .

Elisa, D. (2005). Human Wildlife Conflict Worldwide: Collection of case studies, analysis of managementstrategiesandgoodpractices.Rome,Italy.FAO.www.fao.org/world/regional /raf/workprog/forestry/magazine_en.htm

Emerton, L (2000).Economic incentives for biodiversity: countries are pmaking biodiversity attractive. Biodiversity for Secure Livelihoods in Africa, Vol.7, no. 1, p. 17-20. How Eastern Africa

EWCA, 2018 Chebera-Churchura National 14 Addis hereld in www.southtourism.gov.et

EWCO, (1991).Elephant Conservation Plan, Ethiopia.Unpublished document. Addis Ababa.

Eyebe, A., Dkamela, G. &Endamana, D (2012), Overview of Human Wildlife Conflict in Cameroon. Poverty and Conservation Learning Group Discussion Paper 5.Cameroon.

Fairet, Emilie, Maguy, Melanie (2012).Vulnerability to crop-raiding: an interdisciplinary investigation in Loango National Park, Gabon, Durham theses, Durham University. Available at Durham E-Theses Available at: http://etheses.dur.ac.uk/6399

FAOSTAT (2014).http://Faostat.fao.org

Fernando, P., E. Wikramayake, D. Weerakoon, L.K.A. Jayasinghe, M. Gunawardene, and H.K.Janaka. (2005). Perceptions and patterns of human–elephant conflict in old and new settlements in Sri Lanka: insights for mitigation and management. Biodiversity and Conservation 14:17

Gadd ME (2005) Conservation outside of parks: attitudes of local people in Laikipia, Kenya. Environmental Conservation 32: 50-63.

Gardener, M. (2012).Statistics for Ecologists Using R and Excel – Data Collection, Exploration Analysis and Presentation. Exeter: Pelagic Publishing.

Gillingham, S. & Phyllis, C (2003).People and protected areas; A study of local perceptions of Wildlife crop damage conflict in an area bordering the Selous Game Reserve, Tanzania. Fauna and Flora International, Oryx, Vol. 37, no. 3, pp. 316-325.

GoboshAmaja, (2015). Assessment of human wildlife conflict and Management Technique Ethiopia.MSc Thesis.

Gore, M. &Kahler, J. (2012). Gender Risk Perceptions associated with Human Wildlife Conflict: Implications for Participatory conservation.*PLOSONE.*Vol. 7, no. 3.e3290j.Doi:10.1371/Journal.pone.0032901.

Graham, A. D., Cherie Enawgaw and BereketNetserab (1998).Trends in LargeHerbivores of Omo and Mago National Parks.National Parks Rehabilitation in Southern Ethiopia Project.Ministry of Agriculture, Addis Ababa.

Graham, M. D., Notter, B., Adams, W. M., Lee, P. C., &Ochieng, T. N. (2010).Patterns of crop-raiding by elephants, Loxodonta africana, in Laikipia, Kenya, and the management of human–elephant conflict.*Systematics and Biodiversity, 8*(4), 435-445.

Granados A (2011) Local attitudes and elephant spatial distribution in theBenoue region, Cameroon: implications for human-elephant conflict and conservation.Concordia University, Montreal, Canada.

Granados, A., Weladji, R. B., & Loomis, M. R. (2012).Movement and occurrence of two elephant herds in a human-dominated landscape, the Benoue Wildlife Conservation Area, Cameroon.*TROPICAL CONSERVATION SCIENCE*, *5*(2), 150-162.

Gubbi, S. (2012) Patterns and correlates of human elephant conflict around a south Indian reserve. Biological Conservation, Vol.148, no.1, pp. 88 - 95.

Gusset, M., Swaarner, M., Mponwane, L.Ketetile, K. & McNutt, J (2009). Human Wildlife Conflict in Northern Botswana; Livestock predation by endangered African Wild dog LycaonPictus and other carnivores. *Fauna and Flora International, Oryx,*vol.43, no.1, pp.67-72

Hall, R. and Ebenhard, T. (2014). elefanter. National encykloped in. Available: <http://www.ne.se/elefanter> [2014-03-20]

Harich, F. K., Treydte, A. C., Sauerborn, J., &Owusu, E. H. (2013). People and wildlife: Conflicts arising around the Bia Conservation Area in Ghana. *Journal for Nature Conservation, 21*(5), 342-349.

Haynes, Gary. (2012). "Elephants (and Extinct Relatives) as Earth-Movers and Ecosystem Engineers."*Geomorphology*:99-107.

Hazarika R, Saikia A (2013) The pachyderm and the pixel: an assessment of elephant habitat suitability in Sonitpur, India. Int J Rem Sen 34:5317-5330.

Hedges, S., &Gunaryadi, D. (2010). Reducing human–elephant conflict: do chillies help deter elephants from entering crop fields? Oryx, 44(01), 139-146.

Hedges, Simon and Donny Gunaryadi. (2010). "Reducing Human–Elephant Conflict: Do Chillies Help Deter Elephants from Entering Crop Fields?" *Oryx* 44(1):139-146.

Hill, Catherine M. (2015). Perspectives of Conflict at the Wildlife–Agriculture Boundary: 10Years On. Human Dimensions of Wildlife 20(4):296 301.doi:10.1080/10871209.20 15.1004143.

Hill, CM. (2004) Farmers' perspectives of conflict at the wildlife agriculture boundary: Some lessons learned from African subsistence farmers. Human Dimensions of Wildlife 9: 279-286.

Hoare, R. (2012). Lessons from 15 years of human-elephant conflict mitigation: Management considerations involving biological, physical and governance issues in Africa. *Species Survival Commission*, 59.

Hoare, R. E. (2000). African elephants and humans in conflict: the outlook for coexistence. Oryx 34: 34-38.

Hoare, Richard.(2015). "Lessons from 20 Years of Human-Elephant Conflict Mitigation in Africa."*Human Dimensions of Wildlife* 20(4):289-295.

Hoffmeier-Karimi, Rebekah R. and Bruce A. Schulte. (2015). "Assessing Perceived and Documented Crop Damage in a Tanzanian Village Impacted by Human-Elephant Conflict (HEC)." *Pachyderm*(56):51-60.

Inskip, C. & Zimmermann, A. (2009). Human -elephant conflict; A review of patterns and priorities worldwide: *Fauna and Flora International, Oryx*, vol. 43, no. 1, pp.18-34.

International Elephant Foundation.(2018)."ElephantFacts."..(https://elephantconservation.org/ elephants/just-for-kids/).

Jack, H. (2009) Human wildlife conflicts emerging challenges and opportunities. Human Wildlife Conflicts, Vol. 3, no.1, pp.10-17.

Jadhar, S. &Barua, M (2012), The elephant vanishes: impact of human elephant conflict on people‟s wellbeing. Health and Place, Vol.18, no. 6, pp.1356 – 1365

Kagwa, S., 2011.Spatial distribution of human elephant conflict (HEC) and characterization of crop-raiding elephant in Kasigau region, Kenya. Master Thesis and Specialist project paper 1083. Western Kentucky University.

Kenya Wildlife Service.(1996). Wildlife-human Conflicts, Sources, Solutions and Issues. Available at: www.safariweb.com/kwild/wildlife.htm

Kikoti, A. P., Griffin, C. R., &Pamphil, L. (2010). Elephant use and conflict leads to Tanzania's first wildlife conservation corridor. *Pachyderm*, (48), 57-66.

Kingdon, J. (2004). *The Kingdon Pocket Guide to African Mammals*. London: A&C Black

Kioko J, Zink E, Sawdy M, Kiffner C (2013) Elephant (Loxodonta africana) demography and behavior in the Tarangire-Manyara Ecosystem, Tanzania. South African J Wildlife Res 43: 44-51.

Kivai S (2010). Are the Endemic and Endangered Tana River primate's culprits of crop raiding? Evaluating Human – Nonhuman primate conflict status around Tana River Primate Reserve

Krishnasamy, K., Milliken, T. and Savini, C., (2016). In Transition: Bangkok's Ivory Market. An 18-month survey of Bangkok's ivory market.TRAFFIC Southeast Asia.

Kumssa T. and Bekele A. (2013). Human-Wildlife Conflict in Senkele Swayne's Hartebeest Sanctuary, Ethiopia. Journal of Experimental Biology and Agricultural Sciences. 1(1): 32-38

Ladan SI (2014) Examining human wildlife conflict in Africa. International Conference on Biological, Civil and Environmental Engineering, Dubai, UAE.

Lamarque F, Anderson J, Fergusson R, Lagrange M, OseiOwusu Y, et al (2009) Human-Wildlife Conflict in Africa: Causes, Consequences and Strategies. Food and Agriculture Organisation, Rome, Italy 1: 157.

Landman, M., G. I. H. Kerley and D. S. Schoeman.(2008). "Relevance of Elephant Herbivory as a Threat to Important Plants in the Addo Elephant National Park, South Africa."*JournalofZoology*274:51-58.

Largen, M. J. and Yalden, D. W. (1987). The decline of elephant and black rhinoceros in Ethiopia.*Oryx***21**: 103-106.

Lavrakas, P. J. (2008).*Encyclopedia of survey research methods* Thousand Oaks, CA: Sage Publications,

Lee P Cand Graham MD (2006) African elephants Loxodonta africana and human-elephant interactions: implications for conservation. International Zoo Yearbook 40: 9-19.

Leel PD, Graham MD, and Douglass H, Adams WM (2009) The movement of African elephants in human-dominated land-use mosaic. Animal Conservation 12: 445-455.

Linkie, M., Dinata, Y., Nofriano, A. & Leader-Williams, N.(2006). Patterns and perception of wildlife crop raiding in and around KerichiSeblat National Park,Sumatra. Animal Conservation, Vol. 10, pp. 127-135.

Litoroh, M.W., (1997). Aerial census of the Gash-Setit elephant population of Eritrea and Ethiopia.*Pachyderm*, (23), pp.12-18.

Liu, P., Wen, H., Harich, F. K., He, C., Wang, L., Guo, X., et al. (2017). Conflict between conservation and development: cash forest encroachment in Asian elephant distributions. *Sci. Rep.* 7:6404. doi: 10.1038/s41598-017-06751-6

Mackenzie, Catrina and Peter Ahabyona.(2012). "Elephants in the Garden: Financial and Social Costs of Crop Raiding." *Ecological Economics* 75:72-82.

Madden F. (2004) Creating coexistence between humans and wildlife: global perspectives on local efforts to address human–wildlife conflict .Human Dimensions of Wildlife 9: 247-257.

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

Madhusudan, M.D.(2003).Living amidst Large Wildlife: Livestock and Crop Depredation by Large Mammals in the Interior Villages of Bhadra Tiger Reserve, South India. *Environmental Management*, 31(4): 466–475.

Mariki, S. B., Svarstad, H., and Benjaminsen, T. A. (2015). Elephants over the cliff: explaining wildlife killings in Tanzania. Land Use Policy 44, 19–30. doi: 10.1016/j.landusepol.2014.10.018

McNaughton, S. J., R. W. Ruess and S. W. Seagle.(1988). "Large Mammals and Process Dynamics in African Ecosystems."*Bioscience*38(11):794-800.

Mduma SR, Lobora AL, Foley C, Jones T (2010) Tanzania Elephant Management Plan 2010-2015.

Megaze, A., Gurja, B. and Balakrishnan, M. (2012). Population structure and ecology of the African buffalo (*Synceruscaffer*Sparrman, 1779) in CheberaChurchuraNationalPark, Ethiopia. *Afr. J. Ecol.* **51:** 393–401.

Megaze, Aberham, MundanthraBalakrishnan and Gurja Belay. (2017). "Human-Wildlife Conflictand Attitude of Local People Towards Conservation of Wildlife in CheberaChurchuraNational Park, Ethiopia." African Zoology 52(1):1-8.

Messmer, T.A (2000). The Emergence of Human wildlife conflict Management. Turning challenges into opportunities. International Biodeterioration 45:97-102.

Milliken, T., Krishnasamy, K., and Savini, C., (2016) Does legalization reduce black market activity? Evidence from a global ivory experiment and An 18-month survey of elephant poaching data (No. w22314). National Bureau of Economic Research.

Monico A., and Schapira T, (2015). Planning for Core areas of Wildlife Conservation at Gambella National Park Using Habitat Classification and Habitat Mapping (Doctoral dissertation, EiABC).

Munthali, S.M. & Soto, B (2002). *Overt and latent conflicts associated with the establishment of the Greater Limpopo Transfrontier Park.* Proceedings of theIUCN workshop on conflict resolutions in TBNRM development in southern Africa,Cape Town, South Africa

Murray, M. and Admasu, B. (2013) Development of a Marketing Strategy for Wildlife Tourism in Ethiopia. Unpublished Report, 65

Naughton, L., R. Rose, and A. Treves. (1999). The social dimensions of human-elephant conflict in Africa: A literature review and case studies from Uganda and Cameroon. Department of Geography, University of Wisconsin, Madison, 550 N. Park Street, Madison, WI 53706.

Newmark W.D Manyaza, D.N. Gamassa, D.M and sariko, H.I. (1994).The conflict betweenwildlife and local people living adjacent to protected areas in Tanzania. Human desity as predictor conservation Biology 8: 249-255

NYHUS, P.J., OSOFSKY, S.A., FERRARO, P., MADDEN, F. & FISCHER, H.(2005). Bearing the costs of human–wildlife conflict: the challenges of compensation schemes. In People and Wildlife: Conflict or Coexistence? (eds R. Woodroffe, S. Thirgood& A. Rabinowitz),pp. 107–121. Cambridge University Press, Cambridge, UK.

Ocholla, G.O., Koske, J., Asoka, G.W., Bunyasi, M.M., Pacha, O., Omondi, S.H. and mireri, C. (2013).As-sessment of Traditional Methods Used by the Samburu Pastoral Community in Human Wildlife Conflict Management. International Journal of Human and Social Science 3: 292-302.

Okello MM, D'amour DE (2008) Agricultural expansion within Kimana electric fences and implications for natural resource conservation aroundAmboseli National Park, Kenya. J Arid Env 72: 2179-2192.

Osborn FV (2004) Seasonal variation of feeding patterns and food selection by crop-raiding elephants in Zimbabwe.Afr J Ecol 42: 322-327.

Osborn, F. & Parker, G (2003).Towards an integrated approach for reducing the conflict between elephant and people; a review of current Research.Fauna and Flora International, Oryx .Vol. 37, no. 1, pp. 80-84.

Parker GE, Osborn FV, Hoare RE, Niskanen LS, (2007). Human-elephant conflict mitigation: a training course for community-based approaches in Africa (participants' manual) Nairobi, Kenya: IUCN.

Peterson MN, Birckhead JL, Leong K, Peterson MJ, Peterson TR (2010) Rearticulating the myth of human-wildlife conflict. Conservation Letters3: 74-82.

Poole, J. (1996). The African Elephant. In: Studying Elephants, pp. 1-9, (Kangwana, K.,ed.). AWF Handbook No.7. African Wildlife Foundation, Nairobi.

Quirin C. (2005). Crop Raiding by Wild Vertebrates/Elephant in the Illubabor Zone, Ethiopia. Report Submitted In Partial Fulfillment of The Post-Graduate Diploma in Wildlife Management. Pp 1-52

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

ReddyU.andWorknehS.(2014).Conflict between the conservation of elephant and human activities: In case of Babile Elephant sanctuary. Journal Geography and Regional Planning. 7(2): 25-29

SEIFU, M. & BEYENE, F. (2014). Local livelihoods and institutions in managing wildlife ecosystems: the case of Babile Elephant Sanctuary in Ethiopia. Journal for Nature Conservation, 22, 559–569.

Sekhar, N.U.(1998). Crop and Livestock Depredation caused by Wild Animals in Protected Areas: the case of Sariska Tiger Reserve, Rajasthan, India. *Environmental Conservation*, 25(2): 160–171.

Sharma, U. R. (1991).A study of Park - People interaction in Royal Chitawan National Park, Nepal.University of Arizona.

Sillero-zubiri, C. and Laurenson, M.K. (2001.) Interaction between carnivores and local communities: con-flict or coexistence? Pp. 282-312. In Carnivore Conservation. (edsGittleman, J.L., Funk, S.M., Macdonald, D.W. & Wayne, R.K. eds). Cam-bridge University Press, Cambridge, UK

Sillero-Zubiri, C. and Switzer, M. (2001). Interactions between herbivores and local communities: conflict or co-existence? Pages 282-312 in J. L. Gittleman, S. M. Funk,

D. W. Macdonald, and R. K. Wayne, editors. Carnivore Conservation. Cambridge University Press, Cambridge, U.K.

Sintayehu, W. *et al*., (2014). Report on Ecology and conservation of elephant in Ethiopia project report, Haramaya University, Ethiopia.

Sitati NW, Walpole NJ, Smith RJ, Leader WN (2003) Predicting spatial aspects of human-elephant conflict. J ApplEcol 40: 667-677.

Sitati, N., and Walpole, M. (2006).Assessing Farm-Based Measures for Mitigating Human-Elephant Conflict in Transmara District, Kenya. *Oryx* 40(3):279-286.

Sitati, Noah W. and HellenIpara.(2012). "Indigenous Ecological Knowledge of a Human-Elephant Interaction in Transmara District, Kenya: Implications for Research and Management." Advances in Anthropology 2(3):107-111.

Sitati, Noah W., Matthew J. Walpole, & Nigel Leader-Williams. (2005). "Factors Affectingn Susceptibility of Farms to Crop Raiding by African Elephants: Using a Predictive Model to Mitigate Conflict." Journal of Applied Ecology 42(6):1175-1182

Sitienei, Anne J., GeJiwen and Shadrack M. Ngene. (2014). "Assessing the Cost of Living with Elephants (Loxodonta Africana) in Areas Adjacent to Meru National Park, Kenya." European Journal of Wildlife Research 60:323-30.

Skarpe, Christina, Johan T. du Toit, and Stein R. Moe, eds. (2014). Elephants and Savanna Woodland Ecosystems: A Study from Chobe National Park, Botswana. Hoboken, NJ:John Wiley & Sons, Ltd.

Smith, Robert J. and SamuelKasiki. (1999). A Spatial Analysis of Human-Elephant Conflict in the Tsavo Ecosystem, Kenya. Gland, Switzerland.

Songhurst A, Coulson T (2014).Exploring the effects of spatial autocorrelation when identifying key drivers of wildlife crop-raiding.EcolEvol 4: 582-593.

STRUM, S.C. (2010) .The development of primate raiding: implications for management and conservation. International Journal of Primatology, 31, 133–156

Studsord, J. E., and P. Wegge. (1995). Park people relationships: A case study of damage caused by park animals around the Royal Bardia National Park, Nepal. Environmental Conservation **22**:132-142.

Sukumar, R. (2003).The living elephants: Evolutionary ecology, behaviour, and conservation. Oxford University Press, New York.

Tefera M (2011) Wildlife in Ethiopia: Endemic Large Mammals. World Journal of Zoology 6: 108-116.

Thouless, C. R., H. T. Dublin, J. J. Blanc, D. P. Skinner, T. E. Daniel, R. D. Taylor, F. Maisels,H. L. Frederick and P. Bouche. (2016). African Elephant Status Report 2016: An Update from the African Elephant Database. Gland, Switzerland: IUCN.

Thouless, Chris R. (1994). "Conflict between Humans and Elephants on Private Land in Northern Kenya." Oryx, 28(2), 119-127. doi:10.1017/S0030605300028428

TilahunNigusse, Edwards, S. and TewldeBerhan G/Egziabher (1996). Important Bird

Timer, G. (2005).Diversity, Abundance, Distribution and Habitat Association of Large Mammals in the Chebera-Churchura National Park, Ethiopia. Unpublished M.Sc. Thesis, Addis Ababa University, Addis Ababa.

Tweheyo, M., Hill, C. &Abua, J (2005), Patterns of crop raiding by primates around the Budongo Forest Reserve, Uganda. Wildlife Biology.Vol.11, no.3, pp. 237-247.

Upreti, B. N. (1985). The park-people interface in Nepal: problems and new direction. *in*A. Jeffrey, M. Neely, W. Thorell, and S. Chalise, editors. People and protected area in the Hindu Kush Himalaya, Proceeding of international workshop on the management of National Parks and protected areas in the Hindu Kush-Himalaya.

Warren, Ymke, Caroline Ross and Bobbo Buba(2007). "Patterns of Crop-Raiding by Wild and Domestic Animals Near Gashaka Gumti National Park, Nigeria." International Journal of Pest Management 53(3):207-216.

Whyte, (1996).Studying elephant movements. In: Studying Elephants, pp. 75-89,(Kangwana, K., ed.). AWF Handbook No.7. African Wildlife Foundation, Nairobi. 75-89 pp.

Wildaji, R. & Tchamba, M(2003).Conflict between people and protected areas within the Benoue Wildlife Conservation Area, North Cameroon. Fauna and Flora International.

Wittemyer, George, Joseph M. Northrup, Julian Blanc, Iain Douglas-Hamilton, Patrick Omondi and Kenneth P. Burnham.(2014). "Illegal Killing for Ivory Drives Global Decline in African Elephants." Proceedings of the National Academy of Sciences 111(36):13117-13121

Wittemyer, George. (2001). "The Elephant Population of Samburu and Buffalo Springs National Reserves, Kenya." African Journal of Ecology 39:357-365.

Woldeyohans D. (2006). *Diversity, distribution and relative abundance of Avian species of Chebera Churcura National Park, Ethiopia.* M. Sc. Thesis, Addis Ababa University, Addis Ababa.

Woodroffe, Rosie, Thirgood, Simon and Rabinowitz, Alan, ed. (2013).People and wildlife Conflict or co-existence. Cambridge: University Press.

WorldWildlifeFund.(2017)."Issues:HumanElephantConflict.".(http://wwf.panda.org/knowledge_hub/endangered_species/elephants/asian_elephants/areas/issues/elephant_human_conflic

WWF (2007).A case study on human wildlife conflict in Nepal. WWF International. Nepal.

WWF (2014c).Savanna Elephant. Available: <https://worldwildlife.org/species/savanna-elephant> [2014-04-15]

WWF(2014a).AfricanElephants.Available:<http://wwf.panda.org/what_we_do/endangered_species/elephants/african_elephants/> [2014-05-01]

WWF(2014b).*HumanElephantConflict*.Available:<http://wwf.panda.org/what_we_do/endangered_species/elephants/human_elephant_conflict.cfm> [2014-05-22]

Yamane, Taro. (1967:886). *Statistics, An Introductory Analysis,* 2nd Ed., New York: Harper and Row.

Yihune M, Bekele A, Tefera Z (2009).Human Gelada baboon conflict in and around the Semien Mountains National Park, Ethiopia. Afr. J. Ecol. 47(3):276-282

Yirmed D, (1997). The status of the African elephant (Loxodonta africana) in Ethiopia. Walia 15: 23-32.

Yirmed D, (2008). The ecology and conservation of the relice elephant population in horn Africa.Four year report. Addis Ababa, Ethiopia

Yirmed, D. and B. Afework, (2000).Population estimate and threat to elephants (Loxododonta *africana* Blumenbach, 1797) in Mago National Park, Ethiopia. Trop. Zool., 13: 227-237.

Yirmed, D. and B. Afework, (2000).Population estimate and threat to elephants (Loxododonta *africana* Blumenbach, 1797) in Mago National Park, Ethiopia. Trop. Zool., 13: 227-237.

Questioners to be filled by researcher from the respondents by face to face /household survey method the people who's living around Chebera-Churchura National Park in South West Ethiopia. The main purpose of this questionnaire is to gather relevant information about the conflict between Human and Elephants cause economic losses around Chebera Churchura National Park and to find out some solution to reduce the conflict.The response you provide will have a constructive and paramount important for the successful accomplishment of this study so, you are kindly requested to given by genuine response by translated the questioner in Dawuregna and kontegna language.

APPENDICIES

Human- Elephant Conflict Survey

Date:

Name of Interviewee:

Keble/ Village

AppendixI: - **Respondents Demographic information**

Number of village households:

1. Name of respondent: ----------

2. Age(Suntay): ----------

3. Sex (Layta): ----------

4. No of people in the Household (So Asapaydoy): ----------

5. Marital Status (Akwananne Gelwahanota): a. Single b. married c. widowed d. divorced

6. Education Background (Timirtee): a. Illiterate b. Read and Write c. Secondary

7. Size of farm land a. less than 1 hectare b.0.5-1 hectare c.1-2hectare d, greater than 2hectares

8. What are the main sources of income for the household? (More answers

Possible, rank in order of importance, double-check one by one**)**

Type of activity(Osoy)	High (1)	Medium (2)	Low (3)
Farming(gosha)			
Livestock rearing(Mehehenta			
Wage labour (Wolqaoso)			
Bee keeping(Mathahaaro)			
Government employees			
Shop owner			
Other (specify……..)			

Appendix II: - Focus group discussion with local people and Park officials on main Causes of human-elephant conflict

1. When were human- elephant conflict started your in village?

2. What are the main causes for human elephant conflict?

3. In your opinion, do you feel there are any competition other natural resources between

Human -elephant around the Chebera-Churchura National Park?

4. What would happen when human-elephant conflict occurs?

5. Do you know the difference between direct and indirect of conflict human-elephant?

6. What damage do human-elephant causes?

a) Croploss (Qumabayze) b) livestock attack c) human injury and death, property damage

e, Elephant death and injury(dangarsahayqo)

7. Which wild animals are more responsible for crop damage? Why?

a) Elephant (Dangarsa)b) Buffalo (Mentha) c) Wild pig (Gudunta) d) Warthogs (Gashuwa)

e) Verve monkey (Qare).

8. Ranks the common crop raiding wild animals that you mentioned in the question

Number 2 based on the severity of crop damage they cause?

A) 1st_____

B) 2nd _____

C) 3rd_____

D) 4th_____

E) 5th _____

9. Give a type of crop which is easily susceptible by elephant in your area

Appendix VIII: -Duration, frequency, season and days of crop damage by Elephant

1. When *did the village first experience crop losses from elephants?*

a, till today b,5 years ago c,0-5 years d, d,10 years ago f, last 2 years g. non

2. How many times do elephants come to the village per year?

a,3 times /yearb,2 times/year c,5times/year d, unknown

3. What *season do elephant crop-loss events occur?*

a) Harvesting season b) growth season c) development season

4. Give type of crops destroyed by elephant son ascending order: ----------

5. what about other wildlife cause crop damage?

6. During which season is the elephant seen in your village? (Please Specify the Months)

Jun	Feb	Mar	April	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec.

7. From the above question5 in what season is there a high frequency of elephant crop-loss events?

8. What time of the day is the elephant seen in your village?

Early morning(Guura)	
Daytime(Qanen)	
Evening(Omarsa)	
Night(Bilahe)	
No fixed timing (Eretena)	

9. How many hectare of your farm land on of the above crop destroyed by elephant in 2018?

9. What looks crop damage by elephant in the last three years?

a. Increasing b. decreasing. Unknown

10. Where was the problem reported?

Appendix IV: - estimation of crop losses by elephant in survey village from 16 respondents

Below is a list of all 16 respondents from four villages selected to measure their damaged cropping area due to elephant raiding and it cause economic losses in each household in one cropping

Respondent 1: Monday 15/7/2019 at 10:20 to 11:05 am (45 min). Male, 45 years old, 6 people in the household, land size following by cropped area 2.5ha and 1.35ha (of which 0.25ha are affected by elephants) in 2.5 km distance from the park to village. Grows maize, bananas and enset crop in Maliga village at a crop flowering, maturity and harvesting stage.

Respondent 2: Tuesday 16/7/2019 at 11:25 to 11:55 am (30 min). Female, 50 years old, 4 people in the household, land size following by cropped area3haand 1.13ha (of which 0.475 ha are affected by elephants) in 1.5 km distance from the park to village. Grows maize, bananas and enset crop in Maliga village at a crop flowering, maturity and harvesting stage.

Respondent 3: Thursday18/7/2019 at 1:25 to 1:55 pm (30 min). Male, 36 years old, 3 people in the household, land size following by cropped area 2haand 1.38ha (of which 0.31 ha are affected by elephants) in 2 km distance from the park to village. Grows maize, bananas and enset crop in Maliga village at a crop flowering, maturity and harvesting stage.

Respondent 4: Friday 18/7/2019 at 7:25 to 8:00 am (30 min). Male, 50 years old, 7 people in the household, land size following by cropped area 5ha and 2.35ha (of which 0.475 ha are affected by elephants) in 2,5 km distance from the park to village. Grows maize, bananas and enset crop in Maliga village at a crop flowering, maturity and harvesting stage.

Respondent 5: Monday 22/7/2019 at 8:20 to 9:05 am (45 min). Male, 30 years old, 3 people in the household, land size following by cropped area 2ha and 1.31ha (of which 0.5125ha are affected by elephants) in 2 km distance from the park to village. Grows maize, bananas and enset crop in Daman village at a crop flowering, maturity and harvesting stage.

Respondent 6: Monday 22/7/2019 at 4:25 to 5:05 am (50 min). Male, 45 years old, 5 people in the household, land size following by cropped area 4ha and 2ha (of which 0.53ha are affected by elephants) in 1.75 km distance from the park to village. Grows maize, bananas and enset crop in Damano village at a crop flowering, maturity and harvesting stage.

Respondent 7: Wednesday 23/7/2019 at 10:25 to 11:00 am (45 min). Female, 50 years old, 8 people in the household, land size following by cropped area 2ha and 0.875 ha (of which 0.25 ha are affected by elephants) in 2.5 km distance from the park to village. Grows maize, bananas and enset crop in Damano village at a crop flowering, maturity and harvesting stage.

Respondent 8: Friday 25/7/2019 at 3:25 to 3:55 am (30 min). Male, 40 years old, 3 people in the household, land size following by cropped area 2.5ha and 1.5ha (of which 0.31 ha are affected by elephants) in 2.5 km distance from the park to village. Grows maize, bananas and enset crop in Damano village at a crop flowering, maturity and harvesting stage

Respondent 9: Monday12/3/2019 at 12:25pm to 7:55 am (30 min). Male, 45 years old, 4 people in the household, land size following by cropped area 2ha and1.5ha (of which 0.84 ha are affected by elephants) in 0 .5 km distance from the park to village. Grows maize, bananas and enset crop in Serr village at a crop growth, stage.

Respondent 10: Monday12/3/2019 at 1:25pm to 2:00 am (35 min). Female, 55 years old, 7 people in the household, land size following by cropped area 3.5 ha and 2.2ha (of which 1.19 ha are affected by elephants) in <0.5 km distance from the park to village. Grows maize, bananas and enset crop in Serr village at a crop growth stage.

Respondent 11: Monday 1/5/2019 11:30 am to 12:10 am (40 min).Male, 35 years old, 2 people in the household, land size following by cropped area 2.5 ha and 2ha(of which 0.8578 ha are affected by elephants) in 0.5 km distance from the park to village. Grows maize, bananas andenset crop in Serr village at a crop maturity stage.

Respondent 12: Wednesday 3/5/2019 4:30 pm to 5:5 pm (45 min).Female , 50 years old, 5 people in the household, land size following by cropped area 3ha and 2ha (of which 1ha are

affected by elephants) in <0.5 km distance from the park to village. Grows maize, bananas and enset crop in Serr village at a crop maturity stage.

Respondent 13:Tuestday 13/3/2019 8:30 am to 9:5 am (35 min).Male , 45 years old, 4 people in the household, land size following by cropped area 2 ha and 1.625ha (of which 0.785 ha are affected by elephants) in 1.5 km distance from the park to village. Grows maize, bananas and enset crop in Yora village at a crop growth stage.

Respondent 14: Tuesday 13/3/2019 1:30 am to 2:00 am (30 min).Female, 55 years old, 7 people in the household, land size following by cropped area 2.5 ha and 2.28ha(of which 0 .6875ha are affected by elephants) in 1.75 km distance from the park to village. Grows maize, bananas and enset crop in Yora village at a crop growth stage.

Respondent 15: Thursday4/5/2019 4:30 am to 5:5 am (45 min).Male, 40 years old, 4 people in the household, land size following by cropped area 2 ha and 1.31ha (of which 0.45 ha are affected by elephants) in 1.5 km distance from the park to village. Grows, bananas and enset crop in Yora village at a crop maturity stage.

Respondent 16: Firday5/3/2019 7:30 am to 8:5 am (35 min).Male, 45 years old, 3 people in the household, land size following by cropped area 3haand 2ha (of which 0.875 ha are affected by elephants) in 1.25 km distance from the park to village. Grows maize, bananas and enset crop in Yora village at a crop maturity stage.

Appendix V: -compensation scheme

1. What benefit do you get from wildlife (elephant)?

a) Cash b) Project done with cash by Ethiopia wildlife conservation authority
c)School bursary d) Re-settlement program e) other specifies f) None

2. Attitude of the farmers to ward elephant conservation(Goshancha qopay)

a. Positive b. negative c. neither negative nor positive

Appendix VI: -The approximate distance of the park to the locally community

1.Is the Chebera –Churchura National Park near to you?

a. yes b.no

2. If yes give the approximate distance

a. below 1km b. 1-2km c. >2km d. unknown

Appendix VII: -mitigation measure for human-elephant conflict

1. What methods would *you like to try to prevent crop losses?*

a. field clearing with fire b. chasing with fire c. regularly guarding e. loud nosing

HEC mitigation strategies used by CCNP Authorities

Mitigation strategy	Strongly agree	Disagree	uncertain	Strongly agree	Agree
Educational awareness					
Compensation					
Fencing					
Lethal control program					
Regularly guarding					

Appendix VIII: -Elephant habitats and impacts

1. What would you like to see happen to the numbers of elephants from past to present day?
a. increase b. decrease c. disappear d. Stay the same

2. Do elephants impact you and your family in any of the following ways? Please respond yes or no for each potential

Impact	Impacted?
Crop trampling (Yedhe)	Yes No
Crop consumption (Mee)	Yes No
Lack of sleep (gimishodhayse)	Yes No
Destruction of property (golekole)	Yes No
Death & injury to humans (Asawodhe)	Yes No
Death & injury to livestock (MizaWodhe)	Yes No
Emotional & mental distress(Qophethe)	Yes No
Time spent guarding (Satiyaguude)	Yes No
Other(Haryka)	Yes No