ASSESSMENT OF HUMAN WILDLIFE CONFLICTS IN ENDUIMET WILDLIFE MANAGEMENT AREA, LONGIDO DISTRICT

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ENVIRONMENTAL STUDIES (MES) DEPARTMENT OF ENVIRONMENTAL STUDIES OF THE OPEN UNIVERSITY OF TANZANIA

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CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by the Open University of Tanzania a dissertation titled: **"Assessment of human-wildlife conflicts in Enduimet Wildlife Management Area, Longido District"** in partial fulfilment of the requirements for the award of the degree of Master of Environmental Studies (MES).

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DECLARATION

I, **Emanuel Michael Kivuyo,** do hereby declare that this dissertation is my original work and it has not been presented to any other University or Institution. Where other people's works have been used, references have been provided. It is in this regard that I declare this work as originally mine. It is hereby presented in partial fulfillment of the requirement for the Degree of Master of Environmental Studies (MES).

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Signature

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Date

DEDICATION

This work is dedicated to the Lord Almighty, who gave me the gift of life, health, time, strength, and guidance to accomplish this study. To HIM be the praise and honour. To my lovely wife, Linna, my daughters Abigail and Agape, and my son Aaron, for their tolerance, love, and moral encouragement during the study time. Moreover, it is dedicated to my beloved parents: my father, Mr. Michael Kivuyo, whose longing for good academic performance has always been my motivation and inspiration; My mother, Mrs. Rose Michael whose teachings, instructions, precepts, and principles have always been my life guidance.

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ABSTRACT

This study aimed to assess HWC in EWMA, Longido District. Household questionnaire surveys, key informant interviews, observation, and secondary sources were employed in data collection. Four types of HWC were established: livestock predation (30%), crop damages (26%), human harassment (23%,) and property damage. Underlying causes for HWC were Increased wildlife populations (32%), drought (28%), lack of water (20%), poor boma (5%), farm expansion (3%), inadequate pasture (5%), sharing of water sources (2%), dense vegetation (3%), and electric fence (1%). About 412.3 acres of maize (322) and beans (39.5) were damaged by wildlife, mostly at night and mainly during the wet season (82%) than the dry season (18%), but the Kruskal-Wallis test established no significant differences in time for crop raids (H (4) =4, P=.406). Additionally, 1596 livestock comprising goats (44%, 703), cattle (23%, 277), shoat (15%, 330), sheep (13%, 253), and donkeys (4%, 33) were attacked. Though there was no significant difference in the temporal pattern of predation (H (2) = 2, p = .406), interview results indicated that most predation species occurred at night (37%) than daytime (20%). It was recommended separate water sources for both wildlife and humans to avoid HWC occurring at shared watering points, grow alternative crops least preferable to wildlife, strengthen the livestock bomas with either live fence and use of chain link wire as well use of night guarding with the aid of watch tower equipped with powerful torches are some of the mitigation measures.

Keywords: *Eduimet WMA, Human-wildlife conflicts, livestock predation, seasonality in crop damages.*

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LIST OF ACRONYMS AND ABBREVIATIONS

AWF	African Wildlife Foundation
CARE	CARE International in Tanzania
EWMA	Enduimet Wildlife Management Area
FAO	Food and Agriculture Organization of the United Nations
HEC	Human - Elephant Conflict
HH	House hold
HWC	Human-Wildlife Conflict
KI	Key informant
KWS	Kenya Wildlife Service
NEP	National Environmental Policy, 1997
TANAPA	Tanzania National Parks
TAWIRI	Tanzania Wildlife Research Institute
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
USEPA	US Environmental Protection Agency
VGS	Village Game Scouts
WMA	Wildlife Management Area
WWF	World Wide Fund for Nature

CHAPTER ONE

INTRODUCTION

1.1 Overview

Human-wildlife conflict may well be expressed as any interface between humans and wildlife which ultimately leads to adverse effects on social, economic or cultural life, the conservation of wild animal populations, or the environment (WWF, 2005; Ladan, 2014). However, human-wildlife conflict (HWC) is said to occur once wildlife's needs intersect with the needs of human populations, generating expenses for inhabitants and wildlife. Human-wildlife conflict occurs when wild animals lead to mortal threat, injuries, and damage to crops and property and the wildlife is either killed, injured, captured or else harmed. As a result, humans and animals suffer from interacting with each other (World Park Congress, 2003).

1.2 Background to the Research Problem

In an actual situation, the overwhelming majority of what is termed human-wildlife conflicts are considered conservation conflicts since the wildlife species involved are typical of conservation concern (Redpath et al. 2015). Species-related conflicts are usually called human-wildlife conflicts (Conover, 2001). Direct contact with wildlife happens in both urban and rural areas; nonetheless, it is commonly inside and around protected areas, where wildlife density is higher, and animals regularly wander into cultivated fields or grazing areas adjacent to the protected areas.

A set of global trends has contributed to the escalation of HWC worldwide. According to Aharikundira (2011) and Redpath et al. (2015), human-wildlife conflict includes crop damage by herbivores, livestock predation by predators and the

destruction of the infrastructure as in the case of houses, water pipes and sources mainly by large animals, for instance, elephants. Also, where people practice small-holder agriculture and large-scale farming, clashes can occur between humans and wildlife. At the same time, they try to safeguard their livestock, crops, or family, resulting in injury or death (WWF, 2008).

According to Maden (2004), once the requirements and habits of wildlife cause a negative effect on human beings or once the activities of humans negatively affect wildlife, this is said to be HWC. Conflict also occurs when a person or community retaliates and slays wildlife contrary to the responsibility of protecting wildlife and their habitat. When protected area authorities fail to address the requirements of the local people or are inadequately addressed, it becomes a conflict between humans and wildlife and similarly between humans and wildlife (Maden, 2004).

Human-wildlife conflicts do not happen only in Africa but occur in different forms across the globe (Muruthi, 2005). For instance, the conflict between humans and crocodiles has been reported in 33 countries across the tropics and subtropics, and the problem undoubtedly exists in many more. Human-wildlife conflict is more extreme in the tropics and developing countries, where agriculture and livestock holdings are vital for the livelihoods and income of local communities living in rural areas (Maden, 2004; Lamarque et al., 2009).

Human-wildlife conflicts have intensified over the years due to human population growth, an extension of transportation routes, and the expansion of agricultural activities, which have exacerbated human encroachment on formerly wild and

unoccupied areas. Moreover, the effects of climate change are intensifying these conflicts (Lamarque et al. 2009). When wildlife access to their natural habitats and other sources such as food is interfered with, they can feed on crops and livestock, damage property, and injure or kill people, provoking humans to injure or kill wildlife in retaliation (WWF, 2008).

Usually, the large herbivores such as elephant (*Loxodonta africana*), buffalo (*Syncerus caffer*), hippopotamus (*Hippopotamus amphibius*) and large carnivores such as lion (*Panthera leo*), leopard (*Panthera pardus*), cheetah (*Acinonyx jubatus*), spotted hyena (*Crocuta crocuta*), wild dog (*Lycaon pictus*) and crocodile (*Crocodylus* sp.) are accountable for most of the HWC (Anon, 2005). A study by Packer et al. (2005) suggested that the impacts of HWC in Tanzania are human injury and death, crop damage and livestock predation and that between 1990 and 2004, lions attacked over 800 people. The impacts on the local community, mostly subsistence farmers, entail economic losses through crop damage, leading to a decline in their livelihoods (Muruthi, 2005).

The main human-wildlife conflicts in the Kilimanjaro Landscape (including the study area, EWMA) include crop damage and loss, competition for pasture and water, livestock depredation, disease transmission and human mortalities (Muruthi, 2005). Generally, livestock keeping is a primary activity of local communities in semi-arid areas. Due to predation, high conflict levels may occur among livestock owners (Muruthi, 2005). High livestock predation has created a perception in the community that many large carnivores exist in the Amboseli West Kilimanjaro Ecosystem (AWKE), especially the spotted hyenas.

Hyenas are said to pose the most significant problem to pastoralists. According to Kissui (2012), lions are the most problematic animals that mostly attack cattle, followed by hyenas. Generally, livestock predation has increased in recent years across all types of livestock, although sheep and goats have experienced the highest predation, mainly by hyenas (Kissui, 2012). In Enduimet WMA, the local communities complain about the crop damage caused by wildlife, especially elephants, eland, zebra, and buffaloes (Unpublished report, 2014).

Minwary (2009) studied the community members of Enduimet WMA and realised the benefits of wildlife and tourism, particularly at the community level. Over 50% of the household respondents perceived wildlife as causing more individual losses than gains. Studies conducted by Minwary (2009) and Kissui et al. (2012) pointed to the two most common damages indicated by the local communities as crop damage and livestock attacks. However, the intensity of these conflicts is not well known.

Furthermore, Minwary (2009) revealed incidences of human attack by wildlife, especially in Elerai village, where elephants have killed at least two people from the village since 2007, while in Tingatinga, two people reported that elephants have killed their family members. Similarly, the number of lions killed by the local people has dramatically declined, and the lion population in these areas has declined. However, none of the studies has pointed out the extent of damages inflicted by the wildlife upon the local communities, the causes and number, and the levels of incidences of human-wildlife conflicts in the area.

1.3 Statement of the Research Problem

Human-wildlife conflicts are manifesting in different forms globally (Muruthi,

2005). However, these conflicts are more extreme in the tropics and in developing countries (including Tanzania), where agriculture and livestock production are vital components for the livelihoods and income of local communities, particularly in rural areas adjacent to conservation areas (Maden, 2004; Lamarque et al. 2009).

Human-wildlife conflicts have both direct and indirect costs to humans. The direct costs of human-wildlife conflicts are crop damage, livestock predation and harassment. In contrast, the indirect costs are loss of time protecting property, harassment by wild animals and psychological torture due to the loss of family members. Wildlife crop damage affects a farmer's capacity to feed his family. It also reduces financial income and ultimately impairs the ability to provide health care, education, nutrition and development initiatives decline (Lamarque et al., 2009). Other damages include property and infrastructure destruction, such as water installation and pipes, fencing, livestock depredation, and transmission of animal diseases, such as foot and mouth. All these have financial implications for individuals and the community (Hoare, 1992) and generate a negative attitude of the local people towards wildlife conservation in the area.

Competition for natural resources between rural communities and wildlife is more intense in developing countries, where local communities suffer higher costs. Nonetheless, human-wildlife conflict is a growing global challenge and a main threat to conservation in Africa and EWM (Distefano, 2010). Given the current human population growth rate, increasing demand for resources and access to land, environmental damage and poaching (Kangwana 1993; Conover 2002; Treves; Karanth 2003 as quoted by AWF 2005).

Human-wildlife conflicts threaten the continued survival of many wildlife species. In Enduimet WMA, lions and other carnivore species were repeatedly speared and killed by the local communities, especially by the youth ''morans'' when found attacking livestock, which happens in Kitendeni and Sinya villages almost every year. Lions suffer most due to their behaviour; other carnivores, such as hyenas, are killed through poisoning. Elephants were also killed when they damaged crops or threatened the local communities. In the past three years, this happened in the instance when the elephant attacked humans, and the local communities demanded the wildlife management authorities to kill the elephant that caused the attack.

Another instance is when elephants seem persistent in causing crop damage and or roaming nearby communities, as in Tingatinga and Lerangwa villages. It has also been reported that during the wet season, when wildebeest are more abundant in the area, there has been a spread of diseases from wildlife to livestock, especially foot and mouth disease in Ngereyani and Sinya villages. Even though human-wildlife conflicts are evident in Enduimet, little is known regarding the underlying causes of the conflicts between humans and wildlife, the extent of damages inflicted upon the local communities by the wildlife, and the mitigation measures employed to reduce the conflicts. This prompts the need for a better understanding of the human-wildlife conflict dynamics to suggest and design better management options.

1.4 Objectives

1.4.1 General Objective

The overall objective of this study was to assess human-wildlife conflicts in Enduimet Wildlife Management Area.

1.4.2 Specific Objectives

Specifically, the study aimed at achieving the following specific objectives:

i. To determine the types and extent of human-wildlife conflicts in the study area.

ii. To determine the factors underlying human-wildlife conflicts in the study area

iii. To assess local communities' attitudes towards the establishment of WMA in the study area

iv. Examine the current mitigation measures employed in resolving human-wildlife conflicts in the study area.

1.5 Research Questions and Hypotheses

1.5.1 Research Questions

i. What are the types and extent of human-wildlife conflicts in the study area?

ii. What are the main causes of human-wildlife conflicts in the study area?

iii. What are the attitudes of the local communities towards establishing WMA in the study area?

iv. What are the current mitigation measures employed in resolving human-wildlife conflict?

1.5.2 Research Hypothesis

i. The underlying causes of human-wildlife conflict differ significantly in the villages under study.

ii. There is no significant temporal association of livestock predation in the study area.

iii.   There is no significant seasonal difference in crop raids by wildlife in the study area.

iv.   There is no any significant difference between crop raids and the crop growth stage.

1.6 Significance of the study

It has been a relatively long time since the local communities in Enduimet WMA started experiencing incidents of human-wildlife conflicts. They have frequently experienced crop damage and human attack (Minwary, 2009; Trench et al., 2009). For instance, local communities in Tinga Tinga village, predominantly agro-pastoralist, complained of being unable to cultivate due to prolonged drought and crop damage by wildlife (Trench et al. 2009). Also, AWF (2005) pointed out that crop damage, livestock predation, competition for water and grazing, the threat of disease transmission (such as foot and mouth disease) and human mortalities are significant problems in Kilimanjaro Heartland (including Enduimet WMA) that compromise humans-wildlife co-existence.

Furthermore, infrastructure damage, human attacks by wildlife and retaliatory killing of wildlife have been experienced (Unpublished field reports). However, although local communities bear all the consequences of HWC yet, there is no adequate solution to mitigate the human-wildlife problem in Enduimet, which made community members' complaints overlooked by their government again. The impacts caused are not yet ascertained or quantified in terms of monetary value. Hence this study aimed to assess human-wildlife conflict in Enduimet Widlife Management Area, in Longido district. The information generated from this study

was envisaged to help the local communities, the management of the EWMA, NGOs and Longido District Council with the current information on the situation of human-wildlife conflicts, hence enabling them to design effective human-wildlife conflict mitigation strategies to reduce human-wildlife conflicts so as to ensure a win-win situation between wildlife and humans.

1.7 Limitations

During the study, several challenges were encountered. The major one is the language barrier; this is because most of the indigenous communities speak the "Maa" language. However, this was overcome in several ways. First, the researcher had a background in the language. Secondly, the enumerators were picked from the local communities, which were village game scouts (VGS), for field data collection and also to aid in translation. Transportation from one area to another was also a limiting factor due to the remoteness of some areas and poor infrastructure, which caused difficulties in reaching some remote areas. It was also overcome through using motorbikes and starting working relatively early in the morning.

1.8 Organization of the Dissertation

This dissertation is organized into five chapters. Chapter One introduces the study by providing the context of the research problem, statement of the research problem, objectives and questions. Similarly, it presents the significance and limitations of the study. Chapter two presents the literature review by providing details and insight into; Concepts and Definitions, Theoretical Review, Empirical Review and research gap. Chapter three presents the research methodology adopted in the study. It provided details concerning the research approach, research design, study area,

sample size and frame, sampling techniques, data collection methods, validity and reliability of data collection instruments and ethical issues. Chapter Four comprises the research findings, results and discussion. Lastly, the fifth chapter includes the conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

This chapter reviews various literature concerning wildlife conservation conflicts, causes of human-wildlife conflict, consequences of human-wildlife conflicts, management of human-wildlife conflict, the emergence of wildlife management areas in Tanzania, the establishment of Enduimet Wildlife Management Area and the Research gap.

2.2 Concepts and Definitions

For this study, the following terms had the attached meaning:

Protected area- means an area of land or sea specifically protected for maintenance of biological diversity, natural or associated cultural resources and managed through legal or other effective means, an area declared to be a wildlife protected area under the Tanzania Wildlife Act No 5, 2009 (URT, 2009).

Human-Wildlife Conflict is any interaction between human beings and wildlife that results in undesirable effects on social, economic, or cultural life, the management of wildlife populations, and habitats.

Wildlife Management Area is an area declared by the Minister as a conservation area under section 30 of the Wildlife Act No.5 2009. (URT,2009)

2.3 Human-Wildlife Conflicts

Human-wildlife conflict (HWC) arises when the needs and behaviour of wildlife cause negative impacts on humans or when humans prevent wildlife from getting and accessing their needs. These conflicts may result when wildlife damages crops,

harasses, kills or injures people and domestic animals [Switzer et al. 2001). Human-wildlife conflict affects both humans and animals negatively and is the most complex issue facing wildlife management and conservation that requires urgent solutions. Conflict occurs when conservation, protection, and management of wildlife impede the livelihoods and welfare of the people (Redpath et al. 2013).

Human–wildlife conflict is one of the most critical threats facing numerous wildlife species currently, and this topic is getting growing concern from conservation biologists (Dickman, 2008). For instance, once people kill carnivores or destroy significant habitats that other people need to conserve, conservation conflicts ensue (Redpath et al., 2013, Dickman, 2008). Recently, conservation conflicts have been named differently amongst those whose interest is to preserve biodiversity and any specific wildlife or habitats, against those whose movements may impinge preservation actions (Young et al. 2010).

Conover (2002), cited in Frank (2014), explains that more of the investigation and studies on conservation and conflicts has been focused on human–wildlife conflicts, which happen when actions of either humans or wildlife have an antagonistic consequence on either of the two. Although this term is often used, it is slightly awkward as it deceitfully suggests that wildlife are significant opponents in conflict (Peterson et al. 2010). Additionally, human-wildlife conflicts stress the interactions between humans and wildlife. However, it represents only one side of the components as the term conceals the behind conflicts that arise amongst those humans who defend pro-wildlife purposes versus humans who are adversely affected by wildlife (Young, et al. 2010).

2.4 Typology of Human-Wildlife Conflicts

Human-wildlife conflicts can be classified based on their impact on human beings and property. These include human attacks that may result in deaths and injuries, crop damage and livestock predation (Lamarque et al., 2009). Large mammalian predators are accountable for many lethal attacks on humans (Lamarque et al. 2009). However, Large herbivores, as in the case of elephants and hippopotamus, are responsible for human fatalities yearly. Also, deaths happen accidentally during crop protection against hippos or elephants, mainly at night and or dusk, unintentional direct encounters with elephants or hippopotamus at adjacent residences, particularly on routes near water in darkness and contact with harmed large herbivores whose ordinary intelligence of caution is retaliatory.

Lion attack incidences are widely spread given that Tanzania is the home base that harbours the largest lion population. For instance, between 1990 and 2004, at least 563 people were killed and more than 308 injured by a lion (Packer et al. 2005). The problem has amplified intensely over the previous 15 years when many incidences of lion attacks have happened in southern Tanzania (Packer et al. 2005). The killing of livestock by wildlife is an additional consequence of Human-Wildlife conflict imposed on humans. The quantity and sort of livestock killed by wildlife depends on the types, period of year, and accessibility of natural prey species.

Livestock predation becomes an issue, especially in savannah and plains where pastoralism plays a significant role in the people's livelihoods. The damages are hardly substantial at the national level but can severely impact the individual stockholder. For a small-scale stockholder, damages due to depredation or crop

damage could mean a 100% loss, leading to household poverty (Lamarque et al. 2009). Crop destruction is the most prevailing type of human-wildlife conflict in Africa. According to Lamarque et al. (2009), the existence of crop damage is determined by various circumstances and conditions such as accessibility, variability and the kind of food sources in the natural ecosystem. Others are the extent of human activities on a farm, and crop type and maturing time as linked to natural food sources determine the existence and occurrence of crop damages (Lamarque et al. 2009).

2.5 Cause of Human-Wildlife Conflicts

Rising competition between wildlife and people for habitat and resources is the cause of human-wildlife conflict. This is particularly true for mega mammals, such as the African elephant *Loxodonta africana*, which significantly impact people (Sitati et al. 2005 cited in Ayadi, 2011). A considerable fraction of the African population depends entirely on nature for their basic needs. Clearance of the forest areas for fuel, settlement and crop cultivation damages the natural habitats of wildlife. Humans get attacked during clearances of the habitats as humans intrude on their grounds. Conflicts between humans and wildlife are increasing due to steady habitat loss. When wildlife's home range becomes more fragmented and is restricted to smaller patches of favourable habitats, the chance of humans and wildlife coming into contact with each other increases, as do the conflicts between them (Ladan, 2014).

According to Otieno (2003), socio-economic and political marginalization, insufficient land tenure policies, insecurity, cattle rustling, the spread of small

weapons and light weapons, debilitated outdated governance in pastoral areas, susceptibility to climatic unpredictability, and competition with wildlife were realised as the main aspects contribute conflict relating to pastoralists. Similarly, rising interest in ecological tourism and increasing human population in protected areas will likely cause conflicts between humans and wildlife. The residents' capabilities to manage and control public access and extensive usage of protected areas are feeble, coupled with inadequate awareness of the visitors concerning the risk and danger of wildlife, contributing to increased conflicts (Lamarque, et al. 2009).

According to WWF (2008), human-wildlife conflicts are increasing due to an increase in environmental calamities, human population growth and pressure caused by political and civil unrest that pushed people to live in the wild, occupying wildlife habitats and reducing their food sources and or their accessibility to food sources compel them to feed on cultivated crops and domesticated animals where they can also harm and kill people and cause property and infrastructure damage. In retaliation, humans capture or kill wildlife (WWF, 2008). Because natural places left for wildlife to move to are inadequate, this will further generate human-wildlife conflict, possibly because wildlife was brought into more dense areas occupied by humans (WWF, 2008).

Though human attacks occur rarely compared to crop damage and livestock predation incidents, they are the most upsetting and severe manifestations of human-wildlife conflicts (Lamarque et al., 2009; Baldus, 2004). Human attacks are likely significant catalysts of conflict with wildlife, predominantly wherever attacks arise with upsetting uniformity. In southern Tanzania, for instance, at least 36 people were

killed and ten injured. Several were drawn out of their shelters at night mainly by lions within an area of 350 km^2 between August and April in 2002 and 2004, respectively (Baldus, 2004). In Wildlife Management Areas, Human-wildlife conflict is intensified by habitat intrusion as local communities unlawfully expand their farms into constrained Wildlife Management Areas. This is brought by people immigrating from villages outside the Wildlife Management Areas and elsewhere looking for crop cultivation and livestock foraging areas (WWF, 2012).

2.6 Consequences of Human-Wildlife Conflict

Both crop damage by elephants and a single attack by dangerous wildlife elicit more hostility and anxiety than the cumulative damage of less immediately severe but chronic problems such as diseases (Maden, 2004; Muruthi, 2005; Lamarque et al., 2009). Human invasion and alteration of natural habitats led to fragmentation and loss of elephant habitat. Elephants invade crop farms and demolish houses in search of stored crops due to increased contact and reduction of elephant habitats.

Increased chance of encounters between elephants and people increases people's efforts to guard their property against elephant damage, though it may result in injury or death (WWF, 2008). When direct interaction happens between humans and wildlife, as in the case of elephants, hippos, buffalo, lions and crocodiles mostly along the tracks to and from residences and water sources during water collection or fetching and or bathing, it regularly results in death, and occasionally permanent injuries, nevertheless, numerous of those permanent injuries resulted into substantial sickness (2008).

Human life loss due to human–wildlife conflict at a national scale has slight significance, but at the household and community level, it can be disastrous and a very traumatic experience. Once human beings try to slay wildlife, mostly in retaliation occurrences; on the other hand, wildlife gets injured as a consequence of the conflict as some wildlife escape with injuries. Wildlife also gets harmed when humans attack them to protect wildlife from damage to crops and domestic animals and cause damage to possessions (Lamarque et al., 2009; Ladan, 2014). During dryer months, Elephants can also break and damage food stores while following the chief crop harvest (Hoare, 1992).

The damage to stored food is very upsetting to farmers compared to crop damage while still on the farms because more damage can be done to stored food resources quickly. Nonetheless, it isn't easy to replace the stored food until the subsequent planting season (Lamarque et al., 2009). The increase in wildlife (especially elephants, baboons, monkeys and wild pigs) has an undesirable effect on some of the WMAs on crops and livestock (IRA, 2007).

Crop damage by wildlife has been severe, and the district cannot compensate the local communities whose produce is damaged. Increased wildlife threatens the lives of humans surrounding the WMAs (IRA, 2007; WWF, 2012). Existing together with wildlife can impinge substantial costs at various weights, counting equally direct economic costs and indirect effects. Nevertheless, as soon as people sense that the cost of wildlife's existence is higher than the profits, they act in a manner that can have a significant negative impact on the wildlife (Dickman, 2008).

2.7 Management of Human - Conflicts

According to Ogada et al. (2003), mitigation strategies tend to decrease the level of impact and reduce the problem to a less detrimental effect. In contrast, a protection strategy is applied when the conflict is inevitable or has already happened. Although several socioeconomic and ecological aspects may exacerbate conflicts between humans and wildlife, various technical, institutional, and political ways exist to evade and alleviate human-wildlife conflicts. These possible resolutions are diverse and primarily rely on several factors, for example, the species of wildlife involved and the prevalent perception the local communities have towards wildlife (WWF, 2008).

Aharikundira et al. (2011) study around BINP advises the importance of considering local communities' involvement and participation in sharing the profit accrued from wildlife and natural resources utilisation as well as in the management of the protected areas (cooperative conservation management). A flourishing human-wildlife conflict mitigation strategy requires a participatory approach where the local community and stakeholders collaborate from the early stage/beginning in scheduling implementation and appraisal processes. This, in turn, enables the local people to resolve their particular problems rather than waiting on the Wildlife Management authority to solve the burning issues facing them (Aharikundira et al., 2011; Chong and Dayang Norwana, 2005; Mahalakshmi et al., 2018).

Local communities' information, awareness and thoughtful understanding of the dynamism of the human-wildlife interactions are essential in determining suitable approaches for specific circumstances because farming activities, cultures and

behaviour of wildlife, especially elephants, vary significantly (Hemson, 2004). Ongoing monitoring and adaptive management grounded on outcomes is crucial for positive and long-term effective human-wildlife conflict mitigation strategy is very vital since elephants are intelligent and highly adjustable animals to evade and withstand various mitigation measures employed, and some situation measures that were formerly effective might drop their efficiency from time to time (Mahalakshmi et al. 2018).

Although some conflict management activities involve translocation of wildlife and range confinement with fences (primarily targeting elephants) frequently practised, it may have a tremendously detrimental effect on their existence once misused; therefore, it is vital to not only monitor the success of activities in mitigating the conflict but also to study the direct and indirect impacts on the of elephant's survival (Dickman, 2008; WWF 2008). According to Chong and Dayang Norwana (2005), it is significant to comprehend that so long as humans and elephants share the same landscape, Human elephants' conflicts can only be reduced and never be eliminated; hence, the objective of any HEC management plan should be a focus on reducing the conflict to a tolerable level that ensures both parties directly affected can withstand any conflict that perseveres.

Proper land-use planning can help reduce human-wildlife conflict by ensuring humans and wildlife have ample space required, guaranteeing crucial habitats for wildlife in case of corridors and routes are safeguarded. This considerably increases the livelihoods of local people living with wildlife and, most notably, decreases the incidences of human damage and fatalities from wildlife (Chong & Dayang

Norwana, 2005; WWF, 2008). Nevertheless, human-wildlife co-existence can be enhanced through fine-designed human-wildlife conflict management strategies that integrate diverse practices grounded on the root of the problem (Muruthi, 2005).

It is suggested that effectiveness, cost, and human and social acceptability should be considered when selecting potential solutions. When human-wildlife conflicts are reduced, many communities' negative attitudes towards wildlife and conservation will likely also be reduced. Improving food safety by reducing effects caused by wildlife, especially crop damage and livestock predation, will also minimize the necessity of pursuing substitute food sources from protected areas, especially the hunting of wildlife (Muruthi, 2005).

According to Shemweta, *et al*., (2000), appropriately managing people and wildlife resources for sustainable co-existence is the excellent answer to human-wildlife complications. Suitable human-wildlife conflict management relies on thorough conclusions and proper communication built on realistic information on the conflict situation as well as biological and social research (Elsner, 2008; Shemweta *et al.,* 2000). The use of physical barriers, typically artificial and other natural barriers, for example, rivers, coastlines or highlands that happen naturally along a nature reserve boundary, can avert spatial overlying between wildlife and local communities.

Conversely, it was realised that spatial separation at all times is not a suitable human-wildlife conflict resolution, e.g., in India, on the eastern boundary of Gir National Park in the state of Gujarat, chain link fencing was anticipated to halt lions and leopards from wandering away out of the national park and simultaneously

avoid illegal grazing However, it was confirmed to be partly effective and un economically feasible. (Sethy & Mardaraj, 2015). Nyhus, *et al.,* (2005) suggested a compensation mechanism as another mitigation measure; compensation schemes involve reimbursing people or their relatives who have experienced crop damage by wildlife, livestock predation, property damage, or who have been wounded, killed, or endangered by wildlife. A farmer who experienced wildlife crop damage receives compensation in monetary form or in-kind support. Eligibility for reward relies upon where an attack occurs, for example, inside or outside a protected area, or based upon the officer on duty's valuation of the threat to farmers when driving away animals from their crops or livestock.

2.8 Empirical Review

The increasing agricultural practices will escalate wildlife-related conflicts due to crop raiding and other related damages. Damage to property by wildlife is a significant cause of disputes between wildlife management, and other land uses in the area. This generates an undesirable perception of the local people toward wildlife conservation and the wildlife management area (Trench, et al.*,* 2009). The state has hired its higher, productive lands for outdoor investors (Trench, et al. 2009). The creation of Ndarakwai Ranch, which lies next to Tingatinga, has amplified elephant movement since the elephants dwell on the Ranch and invade crops in TingaTinga during the night (Trench, et al., 2009).

Village associates reported that they no longer harvest crops as elephants finish their crops on their farms. Kitendeni, lying on the EWMA, is the only remaining opening providing for unrestricted wildlife movement on the Tanzanian side. The corridor

connects Mount Kilimanjaro National Park, the group ranches, and Amboseli National Reserve in Kenya across the border. The migrating wildlife passes through the group ranches before landing in the Amboseli National Park. Expanding agriculture and settlements have reduced the extent of this corridor from nearly 21 km^2 in 1952 to almost 5 km^2.

Shrinkage of the corridor has led to variations in the movement routes, wildlife figures and distribution in the corridor and elsewhere in the WMA. Land use incompatibility exacerbates human-wildlife conflict. Efforts are being made to secure the remaining little corridor on the Tanzanian side. Still, the activities of the group ranches on the Kenyan side are posing a threat to block the corridor. The blockage of this corridor, apart from the ecological consequences, will force animals to go through the villages and, therefore, exacerbate the already existing problem of property damage and killing of people. Conflicts in water sharing for domestic and irrigation between higher slope-position users and lower slope-position users in the low-lying plains are intense in the Enduimet division.

Human-elephant conflicts on water points within residential areas for water points, in particular, Tingatinga and Ngereiyani villages, are very high. There are two rivers in the area: Ngare Nairobi and Ngare Nanyuki. The rivers once flowed through the West Kilimanjaro basin all year round but are currently not flowing beyond Tingatinga and Ngereiyani villages during the dry season due to increased upstream irrigation. In Enduimet WMA, there is a good incorporation where pastoralist cattle foraging are with wildlife. Also, villagers are still allowed to graze their livestock inside the area set aside for the Wildlife Management Area, per pastoralist traditional

land management practices.

EWMA has improved by expanding its administrative structure, rendering it relatively well compared to other WMAs, for instance, there have employed officials at the Enduimet Authorized Association office. A university graduate serves as the Administrative Secretary for the WMA (Sulle et al. 2011). In Enduimet WMA, Livestock predation, primarily by leopards, lions and hyenas, is another problem that causes conflicts between pastoralists and wildlife. Major livestock species attacked comprise cows, goats, sheep and donkeys. These incidents become severe during dry seasons when most prey animals migrate to other areas (Kulindwa et al. (2003). Also, Tanzania is home to the world's largest population of lions, making lion attacks inevitable. For instance, at least 563 people were killed and more than 308 were injured by lions between 1990 and 2004. The situation has intensified over the past 15 years, and numerous cases have happened in southern Tanzania (Packer, et al., 2005).

2.9 Policies, Laws and Regulations Governing Wildlife Management Areas in Tanzania

When the Government of Tanzania faced the wildlife crisis in the 1980s, when the country lost more than half of the elephants and nearly all of the rhino population, the Government realized that sustainable resource conservation and rural development were closely interconnected. It also signified a failure of past centralized wildlife management policies and practices in Tanzania. Through support from development partners, for instance, the United States Agency for International Development (USAID), the Government of Tanzania began following a new model

of conservation based on the principles of community-based natural resource management (CBNRM), which originated from other nations in eastern and southern Africa.

This method is anticipated to involve local people in managing natural resources. It gradually became a critical complementary strategy to the traditional centralized command-and-control approach to promote sustainable biodiversity conservation and rural economic development (WWF, 2012). The Wildlife Policy of Tanzania of 1998 illustrated this new vision as it created room for local community involvement in wildlife conservation. The policy allows for the forming Wildlife Management Areas (WMAs) on community lands in Tanzania, an approach similar to CBNRM (Community Based Natural Resources Management) employed in other Southern African countries such as Mozambique and Zimbabwe.

Wildlife Management Areas Regulations were developed in 2002 and implemented in 2003 (WWF, 2012). A Wildlife Management Area (WMA) can be defined as a communal land set aside entirely as a habitat for wildlife by member villages. Following the principles of community-based natural resource management (CBNRM), the critical assumption of the WMA notion is that it provides local communities with economic benefits and involves them in the management to promote the long-term health of wildlife, habitat and rural economic development.

In 2003, the Government of Tanzania established a model stage of WMA development (WWF, 2012; Wildlife Policy, 2007). Capt.114 of the Wildlife Management Act, 2009 specify the criteria for the establishment of Wildlife

Management Areas that is it should have essential resources that can be accessed; its natural resources habitat should be of substantial economic value; it should be an ecologically feasible ecosystem part of an environmentally viable ecosystem and lastly, it should belong to single or several villages following the pertinent requirements of the law overriding village land, and other regulations relating to occupation and use of village land.

The government of Tanzania enacted the Wildlife Conservation (Wildlife Management Areas) Regulations of 2002 and the Guidelines for Designation and Management of Wildlife Management Areas of 2002 to support the operation of the Wildlife policy toward establishing the WMAs. The Regulations of 2002 require the aspiring WMA to prepare a General Management Plan (GMP) or a Resources Zone Management Plan (RMZP) before an area can legally declare a WMA. However, an RZMP is an interim measure in the circumstances of resources and time not providing for developing a GMP.

Developing a plan will ensure that wildlife resources are managed sustainably and that the interests of the communities are protected. A total of 33 WMAs had attained complete registration and covered about 29,000 km^2 of the total land area under protection for wildlife in Tanzania (more than 3% of the country's total land area). Also, 22 WMAs have not yet obtained complete registration (WWF, 2014). To ensure sustainable conservation and mitigation of HWCs in Tanzania, Wildlife Management Areas (WMAs) – areas set aside by village governments for conservation and livelihood have been established, and General Management Plans have been formulated and used.

The principal theory is to have General Management plans to guide the management and development of the resources and help mitigate HWC's in protected areas (WWF, 2007). Poor and non-transparent governance practices, feeble institutional and management arrangements, little revenue generation in several WMAs, and inadequate delegation of rights and responsibilities from the government to WMAs are the most shared problems; these also relate to the difficulties encountered in other community-based natural resources management (CBNRM) programs established in Africa and other places. As the wildlife population is expected to increase due to improved WMA management, human-wildlife conflict will be inevitable and even more intensified in areas without fences as the human population interacts directly with wildlife. Furthermore, human-wildlife conflicts are aggravated by habitat encroachment when villagers tend to expand their farming plots into constrained Wildlife Management Areas (WWF, 2014).

2.10 Establishment of Enduimet Wildlife Management Area

Eight villages form the Enduimet Authorized Association (EAA) from Enduimet Division, namely Sinya, Tingatinga, Ngereiyani (from TingaTinga Ward), and Elerai, OlMolog, Lerangwa, Kitendeni, and Irkaswa (from Olmolog Ward). EAA organized two participatory workshops in February and March 2005 to develop the first RZMP. The RZMP expired in 2010. Another workshop was organized in April 2011 to revise the first RZMP.

Local community properties, mostly crops, are being raided frequently by wildlife moving between EWMA and the surrounding protected areas. Elephants are the primary species causing most of the destruction. Elephants have also been reported

to kill human beings. Because of high land productivity, there is an influx of people in the villages constituting the EWMA. The population in the Enduimet division is currently estimated to be 35,881, a projection based on the 2012 Census.

2.11 Research Gap

Various studies have been conducted in Enduimet WMA on natural resources issues, including management and, to some extent, human-wildlife conflicts. Nonetheless, it has been realized that aspects such as social issues, root causes of conflicts, the extent of damage, the temporal pattern for human-wildlife conflict and the trend of human-wildlife conflicts were not or were slightly covered. Similarly, the annual agricultural yields and their contribution to the income of the local communities have been underestimated. So, this study sought to assess the human and wildlife conflicts that are the root causes of conflicts, the extent of damage inflicted upon the local communities, the pattern of attack and the mitigation techniques in place which may help the coexistence between people and wildlife in EWMA.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Overview

This chapter describes the research approach and design used in the study. The chapter describes the study area, the target population, sample size, sampling techniques and data collection methods. It also describes the study instruments, their validity and reliability, data collection procedures, data analysis techniques, presentation of findings, and the study's limitations (Kothari, 2009).

3. 2 Study Area

3.2.1 Geographical location

The study was conducted in Longido district at Enduimet WMA (Fig. 3.1), which lies between latitude: 2^0 49' 56.7'' Longitude: 36^0 55' 57.69''within AWF's Kilimanjaro Landscape, which includes the semi-arid savanna of the greater Amboseli ecosystem lying just north and West of Kilimanjaro (about 5,199 meters).
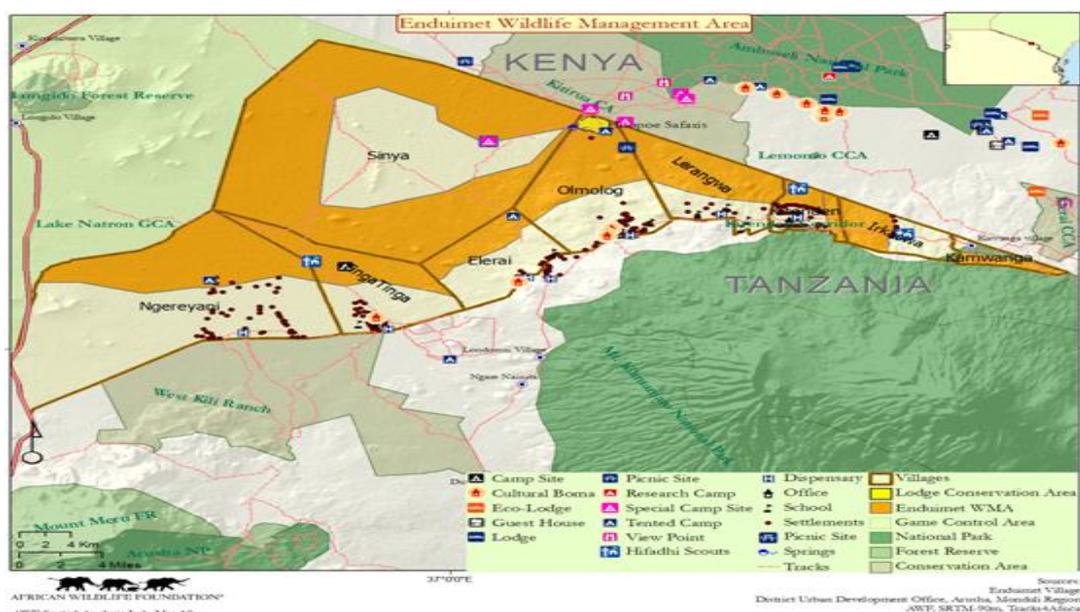
Figure 3.1: The Map of Enduimet Wildlife Management Area
Source: African Wildlife Foundation, 2010.

3.2.2 Climate

The semi-arid climate and scanty rainfall through the West-Kilimanjaro basin is the result of the Mountain's rain shadow. Though rain and temperatures vary in Enduimet Division, precipitation is restricted to 300-600 mm yearly (Poole and Reuling 1997). The region has two rainy seasons, which last from November to December and March to May, with the driest period from August to October (Muruthi, 2005; Frohardt, 2006).

3.2.3 Vegetation

Vegetation is predominantly of semi-arid East African Savannah (Minwary, 2009). They are primarily composed of mixed Acacia woodlands, *Acacia-Commiphora* brushland, *Acacia tortilis* savannah and *Sporobulus spp* short grass plains (Birdlife International, 2008).

3.2.5 Social Characteristics

Enduimet Division has a population of approximately 35,881 people and 5,679 households. At least 906 holds in Lerangwa, 971 in Sinya, 1221 in Irkaswa, 869 in Elerai, 512 in Tingatinga and 1200 in Ngereyani village (URT Census, 2012). The foremost ethnic group is the Ilkisongo Maasai, although on the more deeply cultivated lands, the area likewise comprises a significant number of WaArusha, WaChagga, WaPare and WaMeru (Trench et al. 2009; Kabiri, 2007). Most people in Enduimet practice a mixture of agriculture and livestock keeping.

3.2.6 Cultures of the Local People

The Maasai culture has withstood the wave of change that has swept most other cultural communities in East Africa. Commercial/subsistence cultivation and rural

settlement now threaten their pastoral way of life. The Trust Lands and wildlife management area can play a crucial role in supporting and perpetuating the culture of the Maasai people. The Orepejet, Olpul, and Maasai Bomas represent key cultural symbols of the Maasai people (EWMA RZMP, 2001).

3.3 Research Approach

The study employed the mixed-method approach concerned with the respondents' subjective attitudes, behaviours, and opinions (Kothari, 2009). It permitted the researcher to use the respondent's words to gain in-depth thoughts and knowledge and understand their feelings and experiences (Creswell, 1994). A qualitative approach was preferred to gain an in-depth understanding of the key informant's views, as each would have a different viewpoint on the phenomenon under study.

3.4 Research Design

Research design is the plan, structure, or situation for gathering and analysing data in a way that intends to combine significance to the research conducted (Kothari, 2009). In other ways, it entails the design of the assortment of measurements and analysis of facts. It is a set of rules that enables the researcher to hypothesize and see the problem understudy (Adams & Schveneldt, 1985). This study adopted the descriptive survey design.

3.5 Target Population

The target population for this study consisted of 5679 households in 6 villages located in Enduimet ward, specifically 906 holds in Lerangwa, 971 in Sinya, 1221 in Irkaswa, 869 in Elerai, 512 in Tingatinga and 1200 in Ngereyani village (URT Census, 2012).

3.6 Sample Size and Sample Frame

A sample is a fixed part of a statistical population whose characteristics are studied to gain information about the entire population (Webster, 1985). When dealing with people, it can be defined as a set of respondents (people) selected from a larger population for a survey. The study used purposive sampling to select six (6) villages out of nine available Villages in Enduimet Ward. The sampling unit for this study was the household heads above 18 years.

Names of household heads were randomly selected from the village registry provided by the respective Village Government Officers. If nobody was available for the interview in the selected household, the nearest house with a legible respondent was chosen. Likewise, with the help of village leaders, ten informants from each village were chosen deliberately for FGD and key informant interviews. This study's key informants were the District Game Officer, EWMA leaders, Village leaders, Village natural resources committee leaders, Local leaders, Councilors and Ward Executive Officers and other village members with knowledge of human-wildlife conflict and conversant with WMA and their villages.

3.7 Sampling Techniques

This study employed two sampling techniques, specifically simple random and purposive sampling.

3.7.1 Simple Random Sampling

The study used simple random sampling (SRS) to determine the sample size. The simple random sampling technique is where each element in the populace has an

equivalent chance and likelihood of being selected; hence, every household head in a population has an equal probability of getting into the sample (Kothari, 2004). Village log books the Village Executive Officers provided were used to draw a dependable household sampling frame.

Sample Size n = N * [Z2 * p * (1-p)/e2] / [N – 1 + (Z2 * p * (1-p)/e2]

$$\text{Sample size, n} = N * \frac{\frac{Z^2 * p * (1-p)}{e^2}}{[N - 1 + \frac{Z^2 * p * (1-p)}{e^2}]}$$

Where,

N = Population size,

Z = Critical value of the normal distribution at the required confidence level,

p = Sample proportion,

e = Margin of error

Table 3.1: Computation Table for Households Number Determination

Particular	Value
Population Size (N)	5679
Critical Value (95% confidence level) (Z)	1.95
Margin of Error (e)	0.02
a) Sample Proportion (uncertain) (p)	0.5
b) Sample Proportion (p)	0.05
Sample Size(n)	1054
Sample Size(n)	236

Source: Field Study (2017).

A list of names of all the heads of each household was written on a piece of paper, and the investigator assigned a number. Simple random sampling was deployed with a random mobile app installed on a smartphone, which is the number of households; numbers generated were matched with the names according to the sampled number for each village. The sampling frame of this study consisted of the total number of

5679 households of the six villages in Enduimet Ward. A calculator from Statistical

Service was employed to obtain the sample shown in Table 3.1.

Table 3.2: Households Sampling Intensity per Study Village

SN	Village	Total number of House holds	Number of House Hold sampled
1	Elerai	869	36
2	Tingatinga	512	21
3	Sinya	971	40
4	Irkaswa	1221	51
5	Lerangwa	906	38
6	Ngereyani	1200	50
	Total	**5679**	**236**

Source: Field Study (2017).

3.7.2 Purposive Sampling

Purposive sampling is the deliberate seeking or selecting of individuals or

circumstances likely to yield a better understanding of a phenomenon of interest

(Kothari, 2004). Enduimet WMA leaders, VGS, Village leaders, local leaders, and

District Game Officers located in Longido District Council were selected to obtain

the information, data and records related to Human and Wildlife Conflicts.

Furthermore, their opinions were also taken to improve the situation. Collect data on

various issues on human-wildlife conflicts. The key informants in this study included

the District Game Officer, EWMA leaders, Village leaders, Village natural resources

committee leaders, Local leaders, Councilors and Ward Executive Officers who

presented their understanding of the extent and intensity of human-wildlife conflicts.

Their opinions were recorded and later analyzed.

3.8 Methods of Data Collection

Data are facts, statistics, and pertinent past and present resources that are the basis

for the study and analysis (Krishnaswami, 2002). In this study, both secondary and

primary data were collected.

3.8.1 Secondary Data

A documentary review was used for secondary data collection. The documentary resources include the Researcher's field reports, Enduimet WMA Resources Zone Management Plan (RZMP), Wildlife Regulations and Act of Tanzania, the 2012 Census report and Endumeit WMA annual reports.

3.8.2 Primary Data Collection

Primary data were collected through direct observations, household surveys and Key informant interviews.

3.8.2.1 Direct Observation

Direct observation was used to confirm and check the respondents' answers to gather precise and consistent information, as most local communities tend to overstate the problem in expectation of immediate financial assistance. Observations were also crucial in discovering certain problem animal species responsible for crop damage, crops cultivated, the area's topography and other community activities that could be directly observed.

3.8.2.2 Key Informants Interviews

Face-to-face interviews with the key informants were also conducted, involving people thought to have the most relevant information. The key informants in this study comprised the District Game Officer, EWMA leaders, Village leaders, Village natural resources committee members, Local leaders, Councilors and Ward Executive Officers who presented their understanding of the extent and intensity of

human-wildlife conflicts.

3.8.2.3 Household Survey

Structured interviews were conducted by administering semi-structured questionnaires to the household heads (Appendix I). This method allowed the collection of information related to causes, extent, temporal pattern, seasonality of wildlife attacks, mitigation measures employed, types of human-wildlife conflicts and the local communities' attitudes towards WMA. Using a questionnaire for data collection allowed villagers with a minimum level of education to participate comfortably throughout the survey.

3.9 Validity and Reliability of Data Collection Instrument

3.9.1 Validity

Validity is the degree to which discrepancies within a measuring instrument echo actual differences amongst those being tested (Kothari, 2004). Structured questionnaires were deployed to 236 heads of households to ensure validity and obtain the relevant information. The validity of tools was confirmed by using the pilot study to pre-test the clarity of items administered. The enumerators and the researcher administered questionnaires to a few respondents, a total of 20, who were not included in subsequent questionnaire surveys. The approach enabled the estimation of time to issue a questionnaire and the necessary modifications, such as reframing questions to make them easily understood by the respondents.

3.9.2 Reliability

Reliability is a specified tool's consistency when measuring a particular phenomenon (Best and Kahn, 1998). This study ensured reliability by deploying various data

sources, including questionnaires, interviews, observations, and secondary data. International Business Machine (IBM)-SPSS software version 25.0 was employed to code and analyze the data and minimise errors and bias in the study.

3.10 Ethical Considerations

A clearance form was obtained from the Vice Chancellor of the Open University of Tanzania. The researcher introduced himself to the Ward Executive Officers, Village Chairmen, WMA leaders and the intended households. During the administration of questionnaires, interviews, and focus group discussions, the respondents were asked about their willingness to participate in the interview, and they were also guaranteed confidentiality on the information they provided. Respondents were permitted to discuss "Maasai" and or Kiswahili " in their local language for clarification. Finally, the notes were recorded using the operational language of English.

3.11 Data Analysis

Several procedures were used for the analyses and presentation of data. The raw data from the questionnaires were entered into MS. excel, cleaned, coded and analyzed for descriptive statistics and inferential statistical tests such as the Kruskal-Wallis test. Statistical analyses were performed using the IBM-Scientific Package for Social Scientists (SPSS) program version 25.0. Tables, bar graphs and charts presented descriptive statistics, giving frequencies and percentages. The chi-square test was to test for the correlation of some dependent and independent variables. A content structural analysis was used to analyze the constituents of verbal discussions with different respondents. In this method, dialogue with the recorded respondents was broken down into the slightest meaningful units of information, values, and attitudes

of respondents (Kajembe, 1994). On the other hand, data from focus group discussions were summarized by picking the vital points and conclusions reached by the group members themselves (Cooksey &Lokuji, 1995).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Overview

This chapter presents the analysis of data collected from the field, followed by a discussion of the research findings.

4.2. Socio-economic Characteristics of the Respondents

The study commenced with the analysis of the demographic characteristics of the respondents, which comprised gender, age, marital status, level of education, ethnicity, and occupation.

4.2.1 Gender of Respondents

The study results show that 96% of the respondents were males and 4% were females. Male respondents were many compared to females because males commonly headed households in the study area compared to females. Also, the males mostly responded to the questions, which is more common in many Tanzanian cultures. Gender is important to consider when it comes to human-wildlife conflicts.

4.2.2 Age of Respondents

From the result, most of the respondents' age ranged between 51 - 70 years (51%), followed by the respondents aged between 31- 50 years (41%), whereas respondents between the age group of 18-30 and 71-90 formed the minority groups of 7% and 1% respectively. So, most household heads (51%) were aged between 51 and 70 (Table 4.1). This was important because they clearly understood the historical trends of wildlife and the trends of human-wildlife conflicts in their areas. Additionally, the

group aged 31 to 50 years (41%) formed the second largest group of respondents; this was also important because many took care of the family's possessions and were actively involved in different socio-economic activities like crop cultivation, tending livestock and business. Hence, they clearly understood the current situation of damages to livestock and crops and threats to wildlife.

Table 4.1: Age of Respondents in the Study Area

Age (years)	Frequency	Percentage %
Age 18-30	17	7
Age 31-50	97	41
Age 51-70	120	51
Age 71-90	2	1
Total	**236**	**100**

Source: Field Study 2017

4.2.3 Marital Status

Table 4.2: Marital Status of Respondents in the Study Area

Marital status	Frequency	Percentage %
Single	13	6
Married	219	93
Widow	3	1
Total	**236**	**100**

Source: Field Study 2017

From the findings (table 4.2), 93% of the respondents were married, 6% were single, and 1% indicated that they were widows. This pattern means most of the respondents had established themselves and engaged in socio-economic activities to raise their families.

4.2.4 Level of Education

From the findings (Table 4.3), 55% of the respondents had attained primary education, and 38% had never attended formal education. 4% had secondary

education, 1% had university-level education, and 2% had vocational training.

Table 4.3: Level of Education of Respondents in the Study Area

Education level	Frequency	Percentage
None	90	38
Primary education	129	55
Secondary education	10	4
University/college	3	1
Vocational training	4	1
Total	**236**	**100**

Source: Field Study 2017

4.2.5 Ethnicity

The findings (Table 4.4) indicated that the majority of the respondents (97.0%) were

Maasai, and the minority remaining ethnic groups comprised Fyomi (1%), Waarusha

(1%), and Chagga (1%). Enduimet falls within Kilimanjaro Amboseli-Ecosystem,

where Maasai are the dominant tribe in northern Tanzania and southern Kenya.

Table 4.4: Ethnicity of the Respondents in the Study Area

Tribe	Frequency	Percentage %
Maasai	229	97.0
Mfyomi	2	1
Muarusha	3	1
Msafa	1	0
Mchaga	1	1
Total	**236**	**100**

Source: Field Study 2017

4.2.6 Main Occupation of the Respondents

The results (Table 4.6) show that most of the respondents were livestock keepers

(44%), whereas 31% were small-hold farmers, 19% were engaged in business, and

7% were employed.

Table 4.5: Occupation of the Respondents in the Study Area

Occupation	Frequency	Percentage
Employment	15	7
Business	45	19
Livestock	103	44
Agriculture	72	31
Total	**236**	**100.00**

Source: Field Study 2017

None of the respondents engaged in any activity apart from the four occupations (employment, agriculture, livestock keeping and business). The main reason for such occupation pattern is that the Maasai, the dominant tribe in the study area, is well known in Tanzania and East Africa, whose main economic activity is pastoralism.

4.3 Annual Agriculture Crop Yields in the Study Area

The study revealed that the total annual agricultural crop yield amounts to 411.4 tons per year (Fig. 4.1).
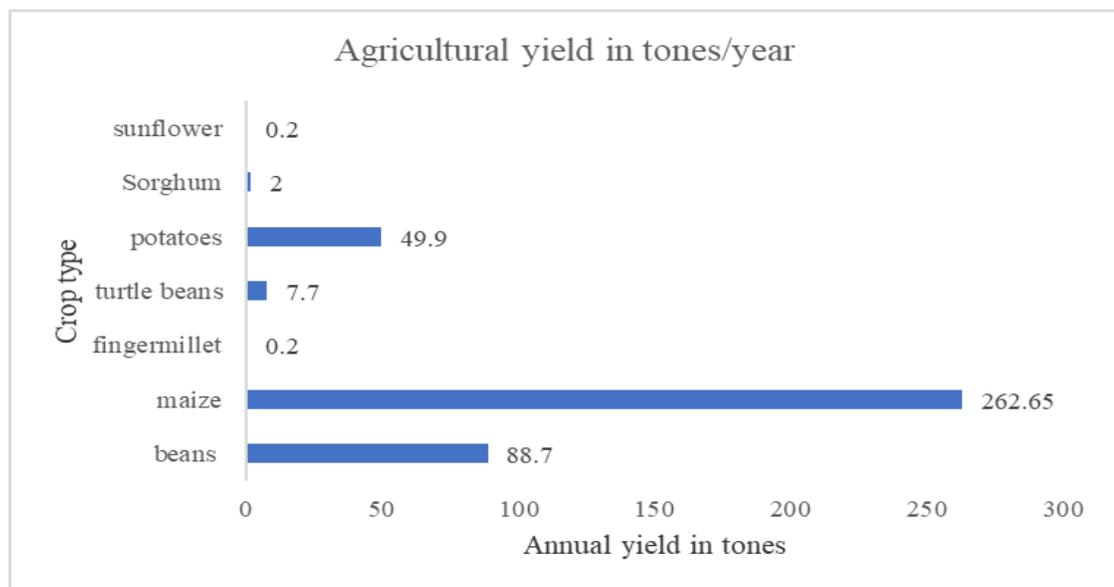
Figure 2.1: Annual Crop Yields in the Study Area

Source: Field Data (2017).

Maize accounted for the highest yield of 262.7 tons as it is the main crop cultivated by most local communities. Maize is also most Tanzanians' and East Africans' leading staple food. Beans and potatoes were the second most cultivated crops, and both amounted to 89 and 50 tons per annum, respectively, followed by turtle beans (8 tons). Sunflower and finger millet were the least cultivated crops in the study villages, and they both accounted for the most negligible yield of 0.2 tons each.

4.4. Annual Income from Crop Yields per Year in the Study Area

The study sought to determine the annual income from crop yields; it was revealed that the yearly agricultural income amounted to 235,685,006 million Tanzanian shillings per year. The income was contributed mainly by beans and maize, which accounted for 83,100,000 and 76,725,004 million TSh, respectively. Potatoes accounted for 56,700,000 million TSh, whereas finger millet and sunflower accounted for 700,000 and 200,000 TSh, respectively (Fig.4.3).
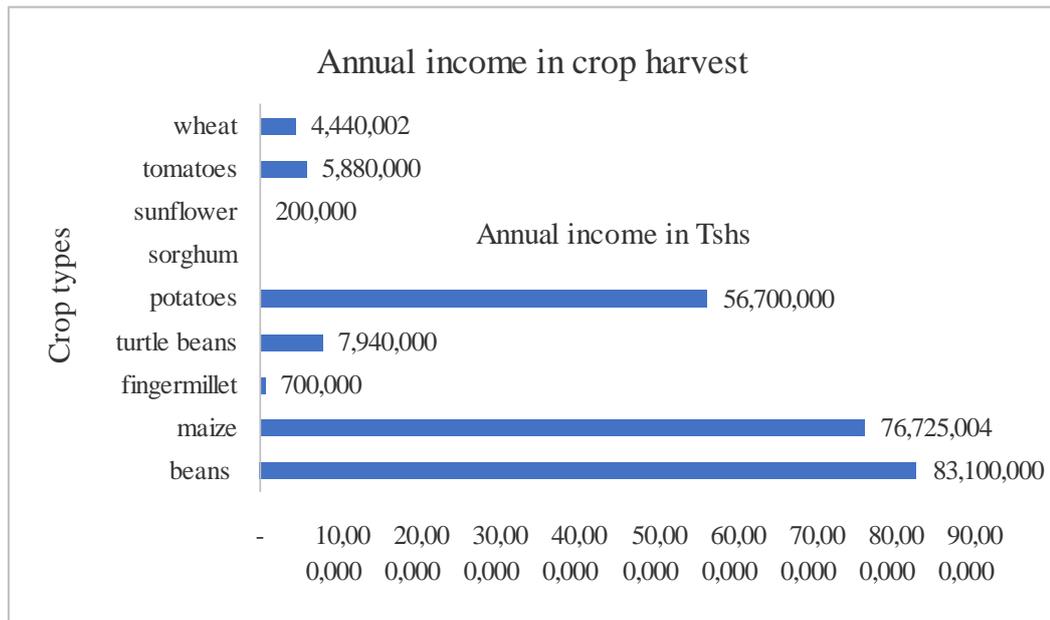
Figure 3.2: Annual Income from Crop Yields
Source: Field Data (2017).

4.5 Types of Human-Wildlife Conflicts

The study sought to determine the types of conflicts reported by the local communities. From the findings, the majority of respondents said that livestock predation was the main conflict (30%), followed by crop damages (26%), human harassment (23%), and property damage (21%). (Figure 4.4). The results concurred with a Key Informant at Lerangwa village who said,

> "*the main types of HWC were human attack, crop damage, property damages and most importantly the livestock predation*".

Another KI at Ngereyani village said that;

> "*most human attacks were caused by elephants, followed by buffalo and lions. Human attacks that resulted in death or injuries were sporadic, while incidences of crop damage were the most frequent in the study villages*".
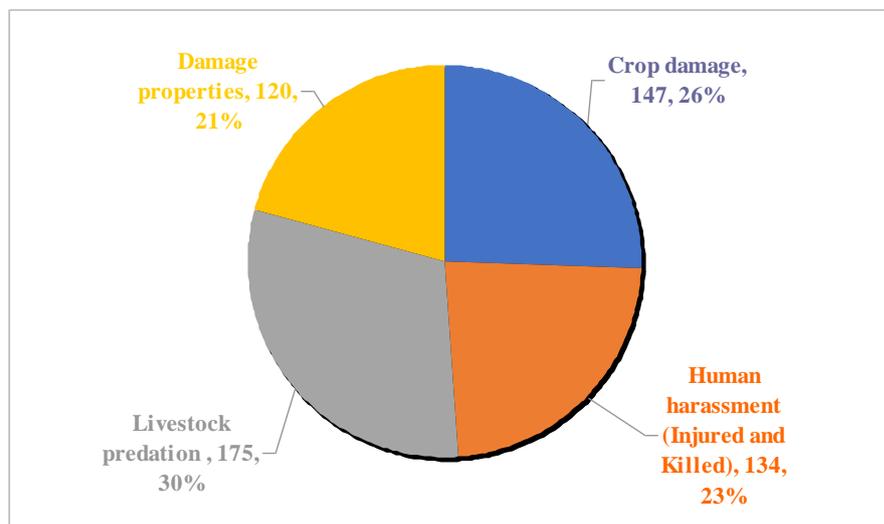
Figure 4.3: Types of Human-Wildlife Conflicts in the Study Area
Source: Field data, 2017.

Similar results were reported elsewhere by (Lamarque *et al*. (2009), Aharikundira and Tweheyo (2011); NACSO (2015); Sserwanga, 2018). Also, Muruthi (2005), Minwary (2009), and Kissui *et al.* (2012) reported that the two most common damages reported by the village members in Enduimet were crop damages (crop-

raiding) and livestock predation
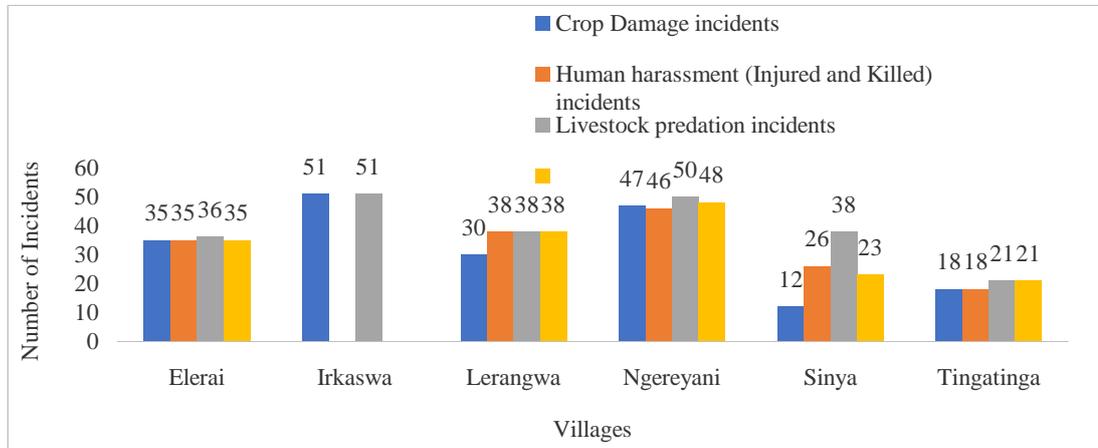
Figure 4.4: Types of Human-Wildlife Conflicts by Study Villages
Source: Field Data, 2017.

4.6 The Underlying Causes of Human-Wildlife Conflicts

The study intended to establish the main causes of human-wildlife conflicts in the study area. The respondents mentioned ten underlying causes for human-wildlife conflicts in the study area. They include: wildlife increase (32%), drought (28%), lack of water (20%), poorly constructed boma (5%), farm expansion (3%), inadequate pasture (5%), sharing of water sources (2%), dense vegetation (3%), and an electric fence blocking/hindering wildlife movement (1%). However, the Chi-square test showed no significant associations between the different causes for HWC as follows: high wildlife population (χ^2=37, df=9, p=1.78), droughts (χ^2=23, df=6, p=1.02) and lack of water (χ^2=19, df=7, p=0.90).

The dense vegetation provides concealment cover to the predators, increasing the likelihood of livestock predation. One KI said that;

> "*droughts, inadequate water, poor boma, inadequate pastures, sharing of water sources, and the presence of electric fence blocking stretched from Elerai to Kamwanga were the main causes for*

increasing HWC in these areas".
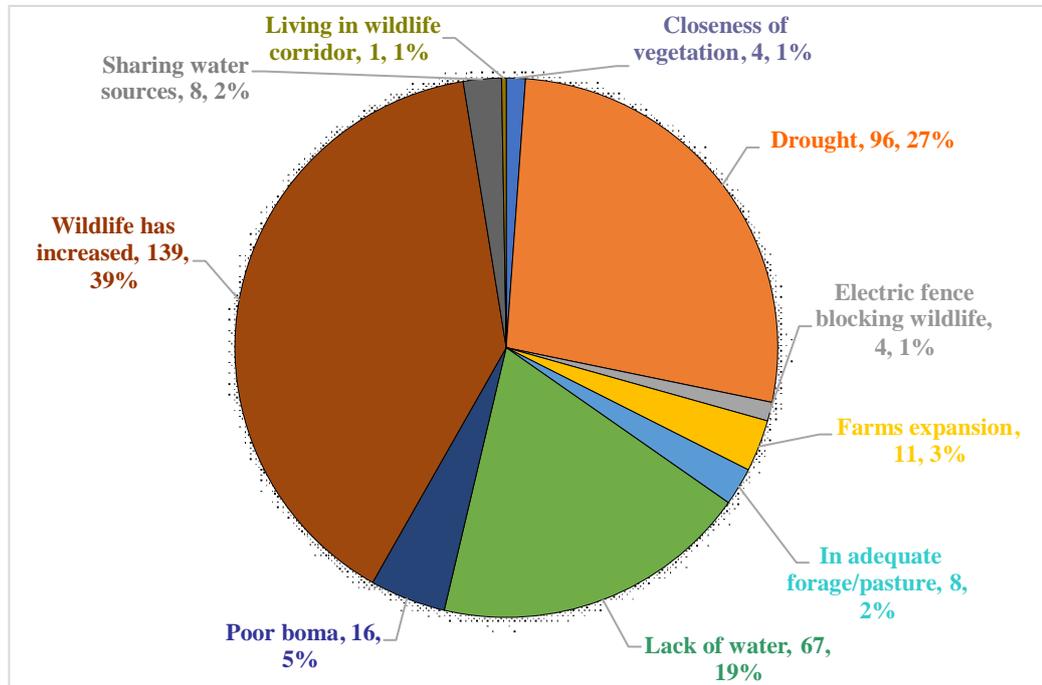
Figure 4.5: Underlying Causes of Human-Wildlife Conflicts in the Study Area
Source: Field data, 2017.

The results also concur with the study conducted in Serengeti National Park, where it has been established a close link between a dense vegetation cover and an increase in predator attack on livestock because they provide the habitats for both predators as well as grazing and browsing prey and concealment cover for lions (Hopcraft et al. 2005). Also, the results align with Muruthi's (2005) study, which reported that inadequate resources, including water and pasture, exacerbated human-wildlife conflicts. Similarly, in Imbaringoi, Kenya, conflicts, especially HEC, were reduced when AWF rehabilitated the water supply to help the livestock and local people in the Kitirua Concession Area. In so doing, livestock were prevented from moving to Amboseli National Park for water (Muruthi, 2005). It is recommended that farmers grow alternative crops, such as sesame, sunflower, and chilli, which are not palatable

or less preferred by elephants.

Additionally, Soto (2008) and Broekhuis, Cushman and Elliot (2017) suggested that households close to or within protected areas, forests, densely wooded areas and close rivers face a higher risk of livestock predation because dense vegetation provides cover for hiding carnivores. Again, weak bomas were more likely to experience depredation by carnivores (Gusset et al., 2009; Ogada *et al.,* 2003, as cited in Broekhuis, Cushman, & Elliot, 2017). Increased demand for land worldwide due to increasing human and wildlife populations and diminishing living places and resources was the main cause of human-wildlife conflict. (Struhsaker, 1999; Muruthi, 2005; Tjaronda, 2007; Lamarque, et al., 2009).

4.7 Wildlife Species Causing Conflicts

4.7.1 Crop Damage

Respondents pointed out that the principal wildlife causing crop damage were elephants (44%), followed by zebra (27%) and elands (17%). Others were dik-dik (3%), wildebeest (3), vervet monkey (2%), impala (1%) and hedgehog (1%) (Fig. 4.6). The damages caused by each wildlife species varies significantly. In Africa, elephants are the main cause of crop raiding and property destruction despite the declining population (Lee & Graham, 2006). On the contrary, other studies revealed bush pigs, baboons and buffaloes as the most damaging animals, feeding largely on maize, sorghum crops and sweet potatoes (Sarah and Phyllis, 2003; Aharikundira & Tweheyo, 2011; Sserwanga, 2018).
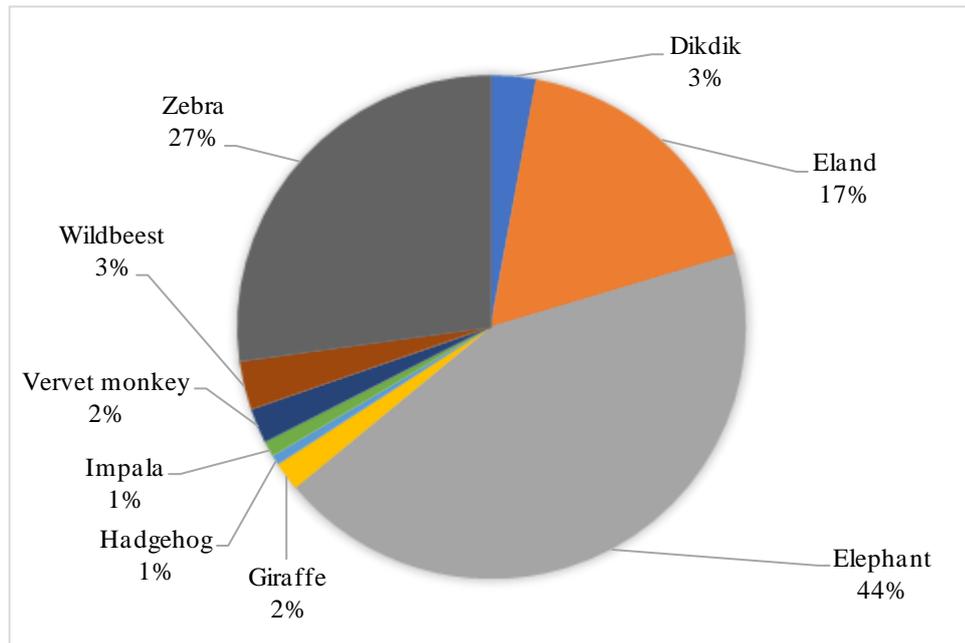
Figure 4.6: Major Crop-Raiding Animals Identified by Farmers in the Study Area
Source: Field Study, 2017.

4.7.2 Livestock Predation

With regards to livestock predation, respondents identified the following wildlife species as the main causes of livestock predation: hyenas (59%), lions (23%), leopards (16%), cheetahs (1%) and jackals (1%). Hyenas and lions were the principal predators causing most livestock losses, contributing to 59% and 23% of the losses, respectively (Fig 4.4). The results were collaborated by a KI at Irkaswa village who said,

> "*Hyenas and lions are principal predators for livestock predation followed by Leopard, Cheetah and Jackal*".

Similar results were reported from two arid-land ranches adjoining Tsavo East National Park in Kenya (Patterson et al. 2004). A comparable trend was also reported in the Samburu Heartland, where lions, leopards and hyenas were responsible for significant livestock killings (Ogada & Ogada, 2004, cited in Muruthi, 2005).

Also, a study conducted by NACSO (2015a) in Namibia in Kunene conservancies revealed that lions, cheetahs and hyenas were the top three most problematic animals. Okello (2014) study in Elerai and Oltiyiani conservancies, part of the Amboseli ecosystem, found three large carnivore species (lion, spotted hyena and leopard) to be involved in conflicts with the local communities, which concur with the findings of this study. On the contrary, a study in Gokwe communal land area in Zimbabwe revealed that a large per cent of livestock was killed mainly by baboons. In contrast, lions and leopards killed a relatively small percentage of livestock (Lamarque, *et al*., 2009).
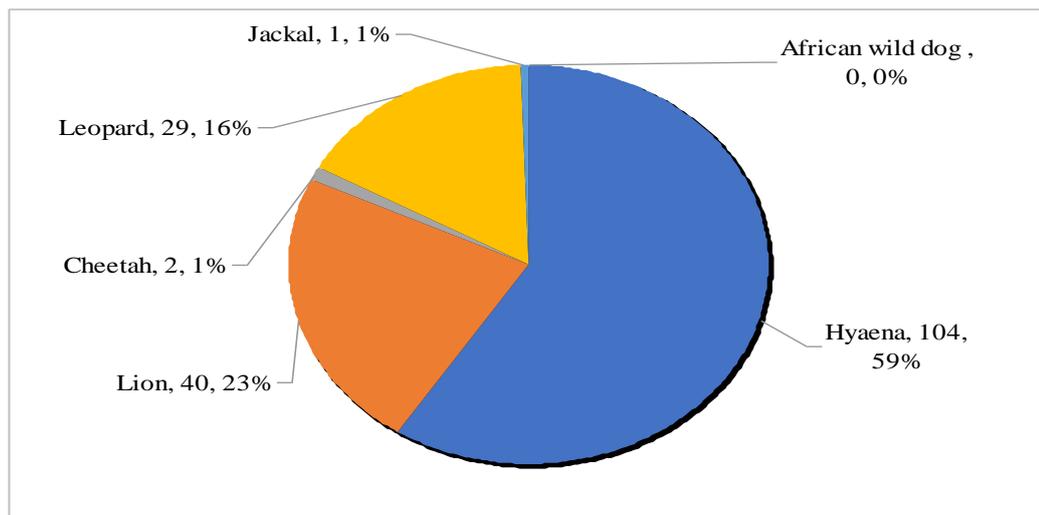
Figure 4.7: Major Livestock Predator Carnivore Species in the Study Area
Source: Field Study, 2017.

4.8 The Extent of Losses Suffered by Local Communities

4.8.1   Crop Damage

The findings indicated that maize was the most attacked crop (56%), followed by beans (18%), banana (6%), tomatoes and wheat (both accounted for 5%), sorghum (4%), turtle beans (3%) peas and finger millet both accounted for 1% respectively (Table 4.6).

Table 4.6: Crops damaged by acreage in the Study Area

Crop types	Frequency	Percentage	Acres
Banana	18	6%	8.8
Beans	59	18%	39.5
Black turtle bean	13	4%	10.4
Finger millet	4	1%	6
Maize	181	56%	321.8
Beans	9	3%	12.5
Peas	2	1%	2
Sorghum	13	4%	2.8
Sunflower	5	2%	3.1
Tomatoes	17	5%	3.9
Wheat	5	2%	1.5
Total	**326**	**100%**	**412.13**

Source: Field Study, 2017.

Approximately 412.1 acres of crops, mainly maize (322 acres), beans (40 acres), sorghum (3 acres), turtle beans (10.4 acres), finger millet (6 acres), sunflower (3 acres), tomatoes (4 acres), wheat (1.5 acres), banana (9 acres) and peas (2acres) were damaged by wildlife. High frequencies of crop damage were recorded in Irkaswa village (27%), followed by Lerangwa (21%), Elerai (18%), Ngereyani (18%), Tingatinga (13%) and Sinya villages (13%). Whereby about 172.5 acres of crops were damaged in Ngereyani village, 60 acres in Tingatinga village, 57.8 and 55.8 acres in Elerai and Irkaswa villages, respectively and 10.4 acres in Sinya village (Figure 4.9).
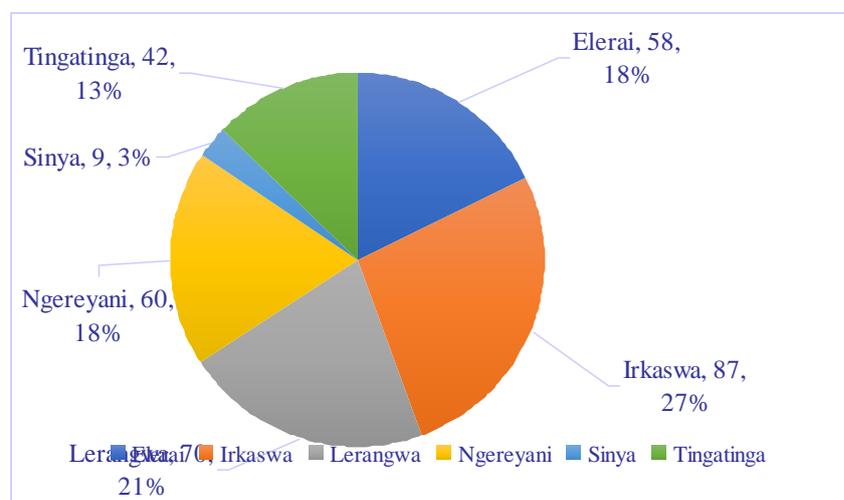
Figure 4.8: Frequency of Crop damages by Wildlife in the Villages
Source: Field Study, 2017.
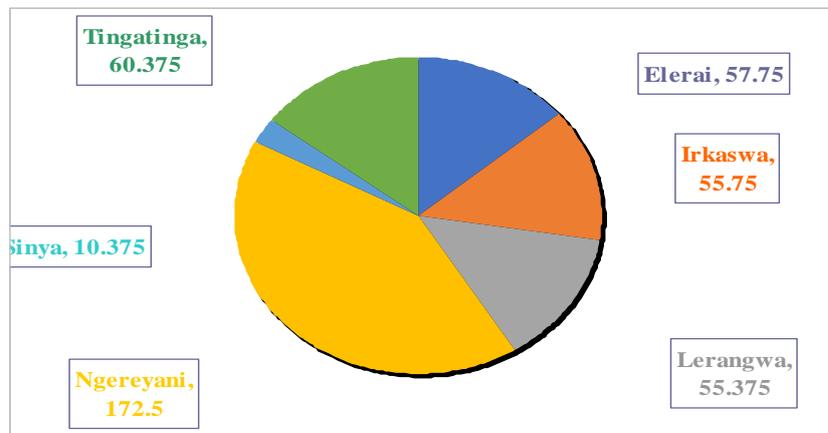
Figure 4.9: Acres of Crops Damaged By Wildlife in the Study Villages
Source: Field study, 2017.

Maize was the most damaged crop because it is the most preferable owing to its palatability and or because it is a widely cultivated crop as almost all farmers in the study villages` grow it. Similar results were reported by Aharikundira & Tweheyo (2011), Sarah & Phyllis (2003) and Distefano (2010); they concluded that maize, rice, sweet potatoes, and sorghum were the most preferred and hence commonly damaged crops by wild animals. Botey (2017) noted that maize and rice suffer the most crop damage, probably because most farmers cultivated one or both cereals, Maize, millet, and rice, as the main staple food. Lamarque et al. (2009) argue that multiple conditions determine the occurrence and frequency of crop raiding in farms by wildlife, such as food availability, variability and types, and type and age of crops.

4.8.2 Livestock Losses

The findings (Table 4.7) indicated that goats were the most attacked livestock (44%), followed by cattle (23%), sheep (13%) and donkeys (4%). About 1,596 livestock, composed of goats (703), cattle (277), sheep (253), and donkeys (21), were attacked by wildlife.

Table 4.7: Livestock Predation in the Study Area

Livestock	Frequency	Percentage	Numbers livestock killed
Cattle	63	23%	277
Goat	118	44%	703
Sheep	36	13%	253
Donkey	12	4%	33
Shoat	42	15%	330
Total	**271**	**100%**	**1596**

Source: Field Study, 2017.

Incidences of livestock predation were recorded in Irkaswa 18%, Ngereyani 18%, Sinya (18%), Elerai (15%), Tingatinga (15%) and Lerangwa village (14%). More livestock was attacked in Lerangwa village (345) (Table 4.11).
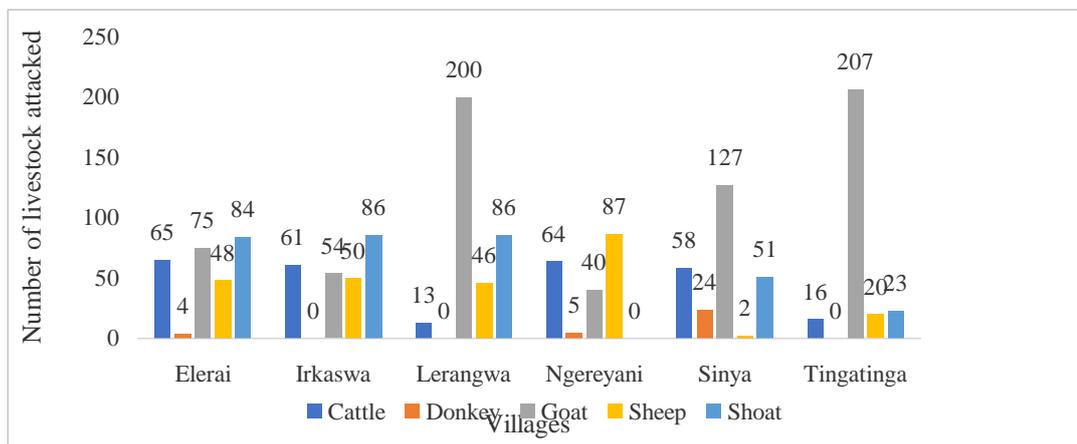
Figure 4.10: Number of Livestock predated by Study Villages
Source: Field Study, 2017.

Meanwhile, 276, 266, and 251 livestock were attacked in Elerai, Tingatinga and Sinya villages. Also, 251 and 196 livestock were attacked in Irkaswa and Ngereyani villages, respectively. The number and types of livestock killed by wildlife differ with the species, the time of year, and the accessibility of usual prey (Mwakatobe et al. 2014). In terms of the number of livestock attacked, goats (542) ranked the highest, followed by sheep (240) and cattle (103). The results imply that as the number of livestock types increased, the carnivores attacked more of that livestock type and *vice versa* (Okello, 2014).

4.9 Seasonality in Human-Wildlife Conflicts

4.9.1 Season for Crop Damage

Respondents pointed out that incidents of crop damage were higher during the wet season (75%) compared to the dry season (25%) (Figure 4.12). Although the Chi-square test shows no significant seasonality in crop raids (χ^2=39, df=1, p=3.93), but the observations and interview results suggest otherwise. Nevertheless, the apparent seasonality was probably because the crops are more abundant during the rainy season and close to protected areas, migratory routes, or dispersal areas.

Correspondingly, a study conducted in Selous-Niassa Western wildlife corridor indicated that most human-elephant conflicts peaked either during the wet season or at the beginning of the dry season, between January and June, compared to the dry season, between July to November (Botey, 2017). Furthermore, it was noticed that during dry seasons, elephants could attack food storage facilities and feed on grain, causing considerable consequences for food security (Lamarque, et al. 2009). Again, Muruthi (2005), reported increased human-elephant conflicts in conservancies surrounding Amboseli National Park in Kenya due to water scarcity
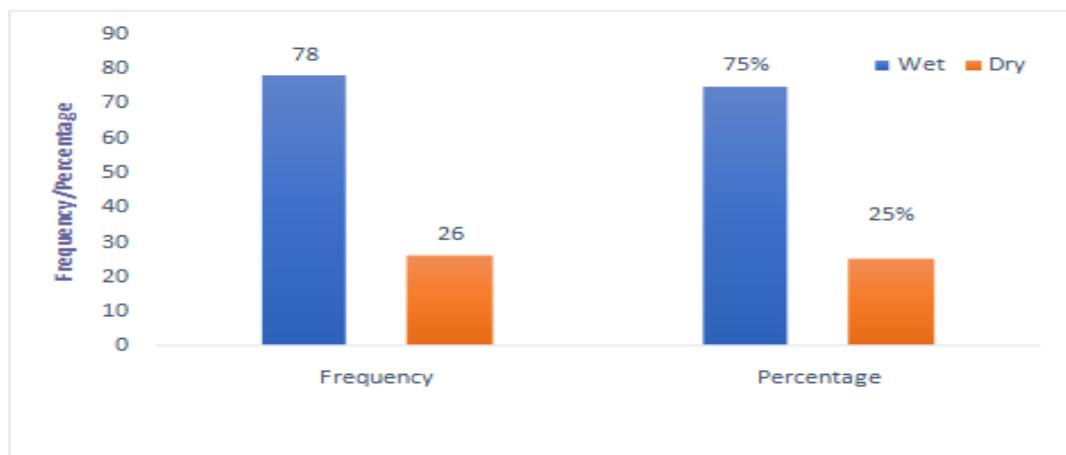
Figure 4.11: Seasonal Crop Damage in the Study Area
Source: Field Study, 2017.

4.9.2 Season for Livestock Predation

Livestock predation intensified during the wet season. For instance, more livestock predation incidences (75%) occurred during the rainy season as compared to the dry season (25%) (Figure 4.13). It might be the case because, during the wet season, the vegetation is thick and closed; hence, predators easily conceal themselves and, therefore, are not easily noticeable, enabling them to move close to the villages and attack livestock. A study conducted in the Peten District, Guatemala, by Soto (2008), corroborates these results, where livestock attacks intensified during the rainy season and peaked during the wet months. Likewise, Broekhuis *et al.* (2017), found more depredation events reported by the respondents during the wet season compared to the dry season.
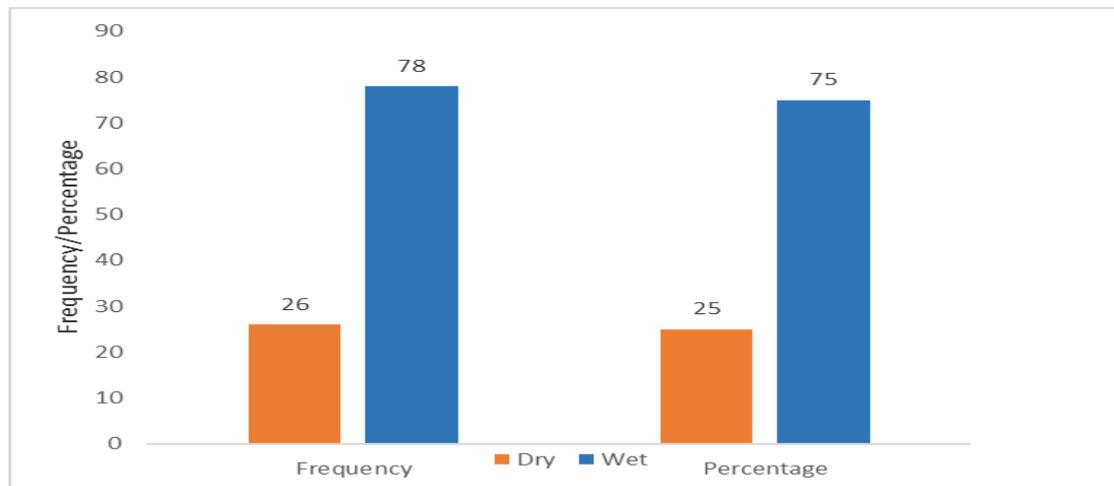
Figure 4.12: Seasonal Livestock Predation in the Study Area
Source: Field Study, 2017.

4.10 Temporal Pattern for Human-Wildlife Conflicts in the Study Area

The study sought to find the time for the occurrence of animal attacks. The findings indicated that more livestock predation occurred at night (37%) than in daytime (20%), Dawn (19%) and Dusk (17%) (Table 4.9). Although the Kruskal-Wallis H test showed no significant difference (H (2) = 2, P = .368) in temporal predation, the

interview results suggest otherwise.

Table 4.8: Time for Livestock Predation in the Study Area

Times of the day	Frequency	Percentage
Day time	26	26%
Night time	75	74%
Anytime	0	0%
Total	101	100%

Source: Field Study, 2017.

Correspondingly, Patterson *et al*. (2004) study in two neighbouring arid-land ranches connecting Tsavo East National Park in Kenya analyzed livestock predation occurrences over a four-year period where cattle were attacked by lions and hyenas mainly at night. The same scenario was observed by Enzerink (2017) and Soto (2008) in Namibia conservancies and Guatemala, respectively, where most of the livestock predation attacks occurred at night and a few during the daytime, which is similar to the results of this study.

Regarding crop damage, incidents mainly occurred at night (37%). Other incidents occurred either during the day (20%), dawn (19%), dusk (17%), and a few anytime (8%), (Table 4.10). Kruskal-Wallis H test indicated no significant difference in time of predation in the study area (H (4) = 4, P = .406), contrary to interview results. Similar studies in Namibia and Kenya revealed that wildlife crop damage mainly occurred at night. (Lamarque, et al. (2009); Lee & Graham, (2006); Soto, (2008) & Enzerink, (2017)).

Table 4.9: Time for Crop Raids in the Study Area

Time of the day	Frequency	Percentage
Dawn	41	19%
Day	43	20%
Dusk	38	17%
Night	81	37%
Anytime	17	8%
Total	220	100%

Source: Field Study, 2017.

4.11 Stages of Crop Damage by Wildlife in the Study Area

The results (Figure 4.14) show that crop damage occurred at all stages. However, most crops were more susceptible, mainly at the medium stage (46%) and maturity stage (38%) and less during the seedling or germination stage (16%). A Kruskal Wallis test shows no significant difference in the stage of crop damage by wildlife (H (2) = 2, P = .368), contrary to field observation and interview results.
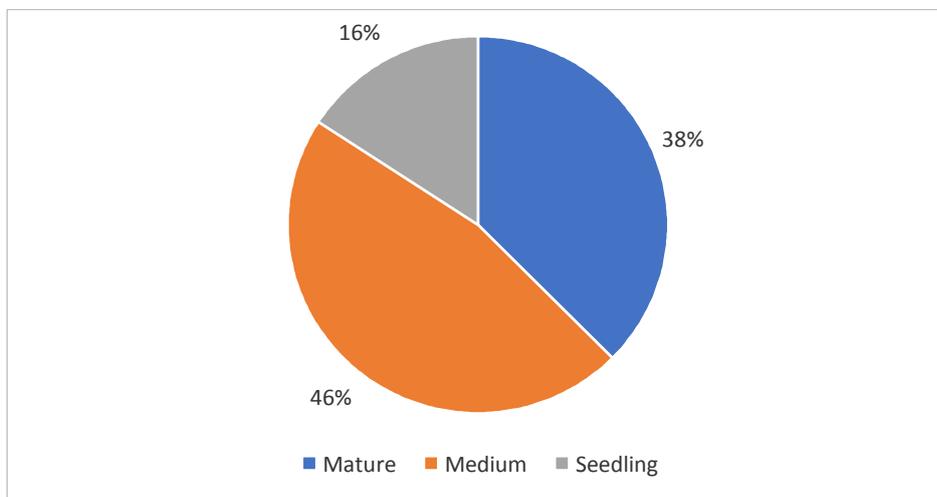
Figure 4.13: Stage of Crop Damage by Wildlife in the Study Area

Source: Field Study, 2017.

However, the observed variations could be attributed to the susceptible crop stage coinciding with wildlife animals' spatial and temporal movement. Alternatively, it could be attributed to the fact that different wildlife species prefer crops such as maize when mature. Also, at the medium stage, crops have high stock and nutritive contents and are relatively soft; therefore, they have a high preference for animals.

4.12 Sites of Livestock Predation

The study found that 58% of the livestock predation occurred in "bomas" or "kraals" compared to in the field (42%) (Figure 4.15).
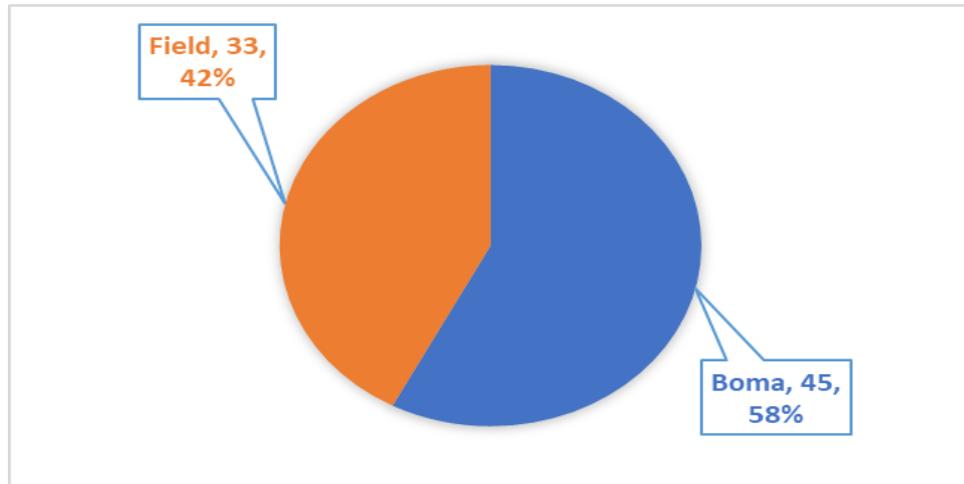
Figure 4.14: Sites of Livestock Predation in the Study Area

Source: Field Study, 2017.

The results imply that livestock predation occurred relatively equally in the bomas and the field. However, most field attacks happen when livestock gets lost during the daytime and preyed upon. Also, it could be due to large herds being herded by young boys, "laiyoni", as commonly referred to by the Maasai. The attack on bomas might have been due to poor construction of "bomas' or "kraals". In contrast to this finding, in Namibia conservancies and Maasai Mara Wildlife Conservancies Association (MMWCA) Kenya, it was reported that livestock attacks happen frequently and regularly outside of the kraals or "bomas", especially when the livestock were alone in the field (Broekhuis, Cushman, and Elliot, 2017; Enzerink, 2017) grazing outside the kraals compared to when they were inside.

4.13 Mitigation Measures for Wildlife Damages

The study results (figure 4.15) show the local community's perceptions of the effectiveness of mitigation measures against HWC.
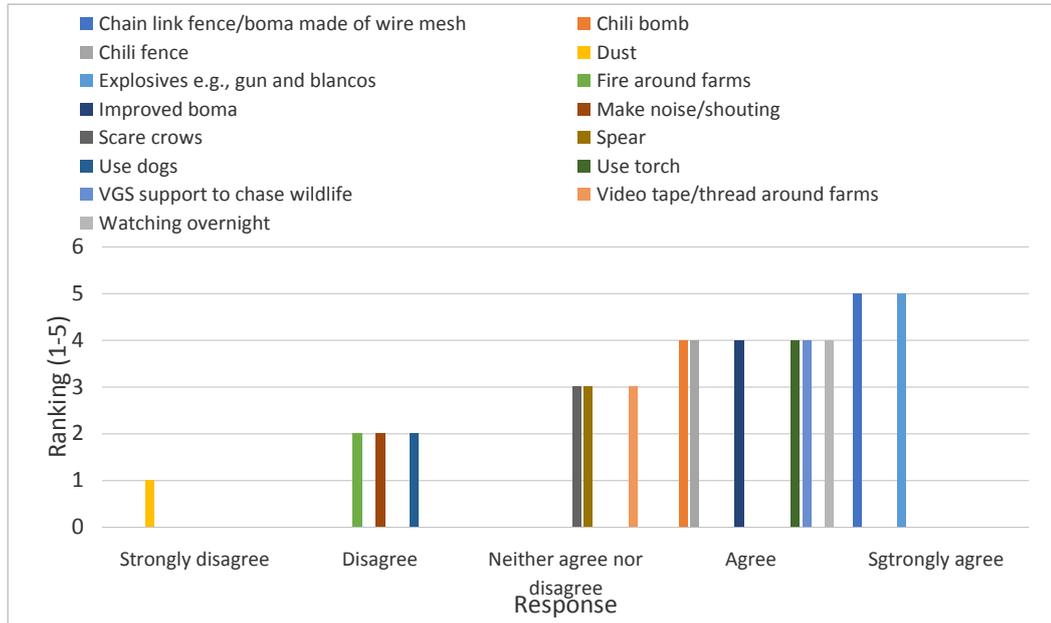
Figure 4.15: Occurrence of Livestock Predation in the Study Area
Source: Field Study, 2017.

The mitigation measures considered the most effective were using VGS support to chase away problematic animals, powerful torches, chain link fence/boma made of wire mesh, night watching (vigilant) and using explosives, e.g. blancos. The second-rated effective mitigation measures were chilli bombs, fences and improved boma. The mitigation measures in which local communities expressed uncertainty on their effectiveness were scarecrows, Videotape threads around farms, and spearing problem animals. The measures considered ineffectual were making fire around the farms, making noise and using dogs to scare away problematic animals.

The use of fires, noise, chilli fences, and powerful light, as in the case of big torches, was also reported to be commonly used in Laikipia (Graham & Ochieng, 2008). Although chain link fence/boma made of wire mesh seems effective in Enduimet, this was not always the case in reducing losses as in Zimbabwe, in the areas neighbouring Sengwa Wildlife Research Area, even though the reserve was fenced.

Livestock were confined in fortified enclosures; livestock were still attacked at night until reinforced with an additional roof like chain link ceilings) (Butler, 2000; Lamarque, et al., 2009).

Using chilli seems an effective mitigation measure; a sisal rope is tied from tree to tree or set up on 3-metre-long poles placed 30 metres apart, and pieces of white cloth are hung to thread at intervals of 5 metres. Then grease, hot pepper and oil were mixed to make a paste, which was applied to the thread and white cloths. The oil is waterproof, and the chilli irritates any animal (for instance, elephants) whenever it makes contact or approaches the fence (WWF SARPO, 2005, cited in Lamarque et al. 2009). Likewise, acoustic deterrents that produce sudden loud noises frighten wildlife, deterring them from crops. Also, other traditional acoustic methods such as beating drums or empty tins (in Zimbabwe), shouting and whistling scare away problem animals. Other methods include the use of explosive devices such as "bamboo blasters" using calcium carbide or fertilizers, pipe bombs, and home-based gunpowder, which are extensively employed by farmers in Zambia.

Similarly, overhead gunshots were used to scare off elephants that raid crops and threaten human life. It is a common preventive measure, but skilled personnel are needed to execute it to control problem animals. Nevertheless, human-wildlife conflicts could never be eliminated but only minimized (Redpath et al. 2011).

4.14 Trend of Human-Wildlife Conflicts

From the findings, 55% of the respondents indicated that human-wildlife conflict incidences were increasing. In comparison, 29% of the respondents stated that they

were decreasing, and 16% said there was no change (Fig.4.17).

Same
29
16%

Increasing
99
55%
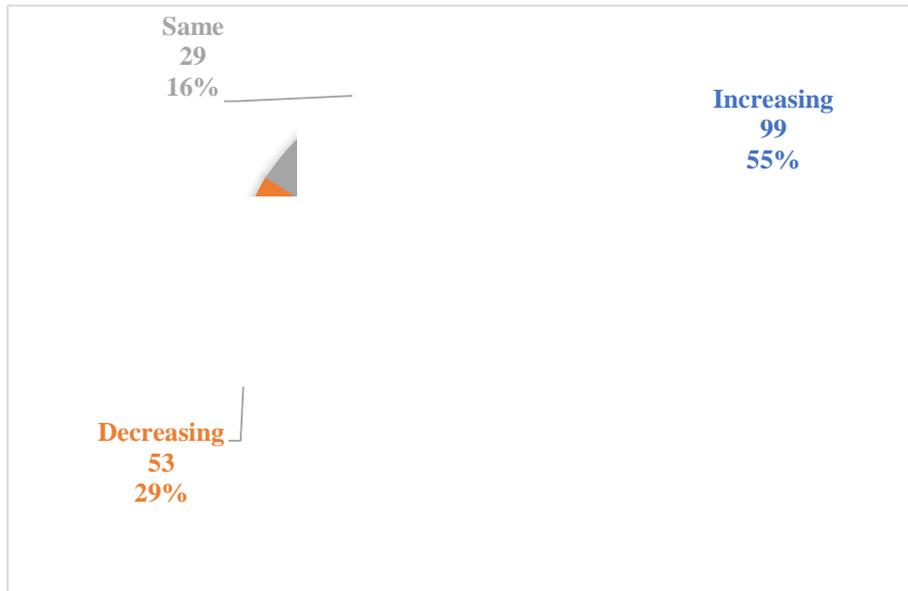
Decreasing
53
29%

Figure 4.16: Trend of Human-Wildlife Conflicts in the Study Area

Source: Field Study, 2017.

Similar global trends of increasing human-wildlife conflicts have been reported (Redpath et al. 2013). This trend could partly be attributed to climate change impacts leading to increased pressure on biodiversity, dwindling water accessibility, and increased competition for scarce resources between humans and wildlife (Vira et al., 2015; WWF, 2017; John & Richard, 2019).

4.15 Attitudes of the Local Communities towards Establishment of WMA

The study found that most of the 187 respondents recorded during the interview had relatively high awareness of the WMA; a majority of the respondents, 33%, considered WMA as an area set by communities for wildlife conservation; 22% and 20% believe it is suitable for income generation to support education for students from low-income families, sources of employment, and help in protecting wildlife and environment respectively. A minority (3%) of the respondents said that WMA

construct wells and boreholes to ensure water supply for wildlife to reduce Human-wildlife conflicts (Table 4.11).

Table 4.10: Local Communities' Attitudes towards Establishment of WMA in the Study Area

Attitudes	Frequency	Percentage
The area set by the local community for WMA	78	33%
I don't know	17	7%
It helps protect wildlife and the environment	46	20%
It is suitable as the income generated supports education for poor students and sources of employment	52	22%
We are happy to see the benefit of conservation	6	3%
It supports livestock projects for low-income families	14	6%
They should conserve wildlife but should seek compensation,	5	2%
It provides awareness of wildlife values to the community	7	3%
They should find a way of digging up wells for wildlife to reduce cases of Human-wildlife conflict	7	3%
WMA to have a fund for compensation to livestock keeper	5	2%
Total	**236**	**100%**

Source: Field Data, 2017.

A relatively small percent (2%) of the respondents expressed a negative attitude. It argued that the WMA should focus on conserving wildlife and compensating for crop damages and livestock killed. The negative attitudes that most communities have towards wildlife and conservation could be minimized when human-wildlife conflicts are minimized. Some of the conflicts occurred at the water points. For instance, Kangwana (1993, 1995. cited in Muruthi (2005) found that elephants habitually invade Maasai and their cattle during the dry season. Again, AWF financed a water project in Samburu Heartland in 2004 to supply water to communal areas and separate water sources for livestock and wildlife to reduce competition. The competition for water intensified human-wildlife conflicts (Muruthi, 2005).

Furthermore, a compensation mechanism can provide remuneration for wildlife damages sustained by local people (Muruthi, 2005); however, this has some

complications during implementation, and another question is reliability and sustainability. Economic damages from crop damage deserve close attention since suitable and appropriate compensation might increase tolerance toward wildlife, especially elephants (Gross et al. 2017, as cited in Nelson, et al., (2003).

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

The chapter presents the conclusion and recommendations of the study findings and suggestions for further studies.

5.1 Conclusion

The study assessed Human-wildlife conflicts in Enduimet Wildlife Management Area. The following is the conclusion drawn from the study results. Subsistence agriculture was the main economic activity in the study area, with a relatively low agriculture yield of 411.4 tons, valued at 235,685,000 million Tanzania shillings per year. So, any crop damage by wildlife would lead to substantial losses to the community in monetary terms and livelihood, thus engendering human-wildlife conflicts.

Four types of human-wildlife conflicts were prevalent in the study area: livestock predation, crop damage, human attack and property damage. The root causes of human-wildlife conflict were increased wildlife population, droughts, lack of water, poorly constructed boma, and farm expansion. The main problem animals were elephants, zebras, and elands, which were identified to cause crop damage. Hyenas, lions, and leopards were the main species involved in livestock predation, and to a smaller extent, cheetahs and jackals. Maize and beans were the most damaged crops, with the highest frequency of crop damage recorded at Irkaswa village, followed by Lerangwa, Elerai, Ngereyani, and Tingatinga villages. Concerning livestock predation, goats were the most attacked livestock, followed by cattle, shoat, sheep and donkeys.

Crop damage incidents were common at the harvesting stage, followed by the fruiting/rooting stage compared to germination and less during seedling. Crop raids were prevalent during the wet season compared to the dry season, corresponding to livestock predation incidents. On the other hand, findings indicated that livestock predation occurred mainly at night rather than in the daytime, corresponding with crop raids. It has been noted that most incidents happened during the night, with a few at dawn, morning, evening, and less in the afternoon.

Maize and beans were the most vulnerable crops, whereas goats, cattle, and sheep were the most attacked livestock regarding livestock predation. Use of explosives, particularly guns and blancos, videotape/thread around farms, throwing stones using a sling, making noise using empty tins or shouting, scarecrows, making fire around farms, and powerful torches, were the common mitigation methods used in the study area to chase problem animals.

5.3 Recommendations

Based on the findings from the study and conclusions, the following recommendations are suggested to minimize the human-wildlife conflict problem; since the most vulnerable crops to animal damage were maize, beans and wheat, it was recommended that mitigation measures should be put in place immediately when crops are still young, and once matured crops should be harvested directly rather than left to dry in farms. Also, alternative crops that are less preferred by wildlife but economically profitable, like sesame, sunflower and chilli, were recommended in the study area.

On livestock predation, it was recommended that local communities strengthen their livestock bomas with either live fence, especially the use of thorns, preferably rapidly regenerating tree species such as *Commiphora africana,* the "Esilalei" when planted around the boma it gets reinforced as the trees grow. When grazing livestock away from home, the livestock should be attended by adult herders, "Moran", accompanied by dogs which warn of approaching predators; this will alert the herders before predators cause any harm to livestock. Furthermore, local communities should be sensitized to a proper and more profitable and sustainable livestock-keeping system, particularly keeping improved livestock breeds produced by zero grazing,

Provision of water sources for both wildlife and human use through constructing water wells and dams in village areas for human use and in WMA areas for wildlife to minimize conflicts around shared water sources. The use of a night watch equipped with powerful torches was recommended. The EWMA management should continue sensitizing the local communities and raising awareness of the importance of conserving natural resources amid wildlife so that they appreciate the economic and ecological values of conservation areas, which is vital for their survival.

There is a need to build the capacity of the local communities on various income diversification activities, which are more compatible with natural resource conservation, such as beekeeping and cultural tourism, and reduce too much reliance on crop cultivation. Further studies are recommended to ascertain the economic impacts of human-wildlife conflicts and determine the area's capacity to accommodate humans, wildlife and livestock.

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APPENDICES

APPENDIX I: House hold questionnaire

Open University of Tanzania

Department of Environmental Studies, Faculty of Science Technology and Environmental Studies.

Human wildlife conflict in Enduimet Wildlife Management Areas

I am, _____, conducting academic research as a prerequisite requirement for the award of a Master's of Science degree in Environment studies. The research theme covers the type of human wildlife conflict, the extent of damage exerted upon the local communities by wildlifes, undelaying causes of human wildlife conflict, the attitudes of the local communities towards establishment of WMA and strategies adopted by the local communities in Enduimet WMA.

Research Questionnaire [Not Self-Administered]

[For Farmers, or Households Only]

Section A: Background information

Questionnaire No. _____ Date of interview: _____

District: _____ Division: _____ Ward: _____

GPS Location.   S_____   E_____

Code. _____

Results Code 1.Complete 2. Refused 3.Postponed 4.Incomplete

Section B: Demographic background and socio-economic characteristics of the respondent

1.Name: _____(*optional*) 2.Age:___3.Gender/Sex:____4.Ethnic group._____

5. Marital status: Single. (   ) Married.(   ) Divorced.(   )

Other._____(specify)

6. Village. _____ 7. Sub Village. _____

8. Education: Illiterate (   )   Primary education ( )   Secondary education ( )

Vocation ( )   University/College ( )

9. Are you, a permanent resident of this area or migrated from elsewhere?

If migrated from where? _____ and when? _____

10. What is the reason for your migration?

Low income. (   ) for Education.(   ) Natural calamity in earlier place.(   )

other._____

11. Do you have your own land? If yes, how much land do you have? In terms of

acres. _____

12. What are the major sources of your income? (Preferences)

SN	1	2	3	4	5
Sources	Employment	Agriculture	Livestock	Business	Others (please specify)
Rank					

Give score: 1- 5, where 5=the most and 1 to the least,

13. What major crops do you grow?

SN	Major crops (priority wise)	Agricultural Yield (Per year)	Annual income (in NRs.)	Contribution (%) to total crop production
1				
2				
3				

14. Which livestock do you possess?

SN	Livestock/bird (priority wise)	Number of livestock
1		
2		
3		
4		

Section C: The History of the establishment of CBC and Enduimet WMA

15. Are you aware of Enduimet WMA? Yes (   ) No (   ) Don't know: (   )

16. What is your concern about the establishment of Enduimet WMA?

_____

_____

_____

17. In your opinion, do you think Enduimet WMA is part of the community?

Yes. ( ) No.(   ) I don't.(   )

If Yes/No give your opinion_____

Section D: Human wildlife conflict

18. Have you encountered any wildlife in your area? Yes ( ) No (   )

If yes, which wild animals? _____

19. When did the animal reach to your house or crop land?

During daytime……………. At night ………………………Any time………………

20. How often do they visit?

Time	Anytime	Daily	Once a Week	After 2 weeks	Monthly	After 3 months
Put tick						

21. What kind of problems do wild animals create?

Crop Damage …………   Human harassment (Injured and Killed) ………..

Livestock predation …………   Damage properties ………….

Others (Specify)……………….

22. Which wild animals reach your house or crop land?

SN	Wild Animal	Season	Crop loss/damage in a year		Livestock loss in a year	
			Types of crops	Damage in Rs	Types of livestock	Damage in Rs
1						
2						
3						

23. Which animals destroy your crops (start with the most to the least)?

1._____   2._____   3._____

4._____

24. What crops are mostly destroyed by the animals or birds mentioned above (start

with the most to the least)?

1._____ 2._____ 3._____

5._____

25. At what stages in the growing cycle are crops mostly damaged? [Tick as

applicable]

SN	Types of crops	Stage				
		Germination	seedling	Flowering	Harvesting	Fruiting/Rooting
1						
2						
3						
4						

26. What time do animals mostly raid and destroy crops

At dawn. ( ) Afternoon ( ) Morning. (   ) Evening. ( ) Night.( ). Any time. ( )

27. Suggest possible ways how crop-raiding should be controlled

28. Can you sort these pictures into animals that are a big problem, small problem or

no problem around this household, and explain why? *(Show picture cards):*

S N	Type of wildlife	Problem			
		Big	Small	No problem	Don't know
1	Lion				
2	Cheetah				
3	Leopard				
4	Spotted hyaena				
5	African wild dog				
6	Jackal				

29. When was the last attack on your livestock by……………..?

		Predator involved
30. When (year and month if possible)		
31. Season of attack (dry/wet)		
32. Location of attack		
33. At/around this boma or elsewhere?		
34. Time of day of attack		
35. Livestock type attacked		
36. No livestock killed in attack		
37. No. injured but not killed		
38. Who was with the livestock?		
39. Was there a dog with the stock at the time of the attack?		
40. Were any adults present at the time of the attack?		
41. Did anyone actually see the attack (If not, find out how it was identified as a predator attack)		

Predators: Hyaena, Lion, Cheetah, African wild dog, Jackal

42. Do you chase or repel wild animals approaching your house or cropland? Yes:

___ No:___

If Yes, what is the effective method applied to chase or repel animals?

S N	Method	Very good (5)	Good	Fair	Low	Very Low
1						
2						
3						
4						
5						
6						

Ranking of the effectiveness: Very good (5), Good (4), Fair (3), Low (2), Very low

(1).

43. Have you noticed any wild animal killed during encounter with local people?

Yes: (   ) No: (   )

If yes, name the species and number (how many?) _____

44. Was anybody in your family harassed by wild animals? Yes: (   ) No: (   ) If

Yes, when did it happens,

This Year …..... Last year…....... Two years ago…........ Three years ago…........

Others specify …………………….

How was he/she attacked? …......................…….

45. Have you complained about the crop or animals' loss due to wildlife? Yes (   ),

No (   )

If yes, where did you complain …………….….............................

46. Did your complaint properly heard and reciprocated?

Yes ………….. No ……………..

47. Have you received any compensation of your crop or domestic animal loss?

A. If your answer is "yes" who provided you the compensation? ………………….

B. Are you satisfied with the compensation? Yes……. No…... .. Please explain.

48. In your opinion, who should provide the compensation………..

49. In your observation, what do you think are the causes of human wildlife conflict?

1._____

2._____

3._____

4._____

50. In your observation, do you think that the incident of human wildlife conflict is?

TICK

A. Increasing _____   B. Decreasing _____ C. Same as before ___

51. Could you suggest how this problem can be solved?

52. Do you think Human Wildlife conflict will increase in the near future?

Yes (……………….) No (…………………)

Thank you for your participation!

APPENDIX II: Focus group discussion

1. Is there any Human wildlife conflict in your area?

2. What are the types of human and wildlife conflicts?

3. How is the Human wildlife conflict situation in the community?

4. Which species pose as problem animals in this area?

5. What do you think are the underlying causes of human wildlife conflict in your area?

6. Which season incidences of human wildlife conflicts occur most, and can you tell the reason behind this?

7. What is the extent of damage inflicted by wildlife upon the local communities in your area?

8. What are the attitudes of the local communities towards the establishment of WMA?

9. What are measures employed to reduce human wildlife conflicts in your community?

_____

_____

_____

_____

_____

THANK YOU FOR YOUR TIME