HUMAN-WILDLIFE CONFLICTS: IMPLICATIONS ON WILDLIFE CONSERVATION AND MANAGEMENT AT CHYULU HILLS NATIONAL PARK AND ITS SURROUNDINGS, KENYA

WELLINGTON KIGWA GATHUNGU

A THESIS SUBMITTED TO THE DEPARTMENT OF WILDLIFE MANAGEMENT IN PARTIAL FULFILLMENT FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN PROTECTED AREA MANAGEMENT, UNIVERSITY OF ELDORET, KENYA

2015

DECLARATION

DECLARATION BY STUDENT

I hereby declare that this thesis is my original work and has not been submitted for an award of any degree or diploma in any other university or institution.

Signature…………………………… Date………………

Wellington Kigwa Gathungu

 FRW/ PGW/04/2003

DECLARATION BY SUPERVISORS

This Thesis has been submitted with our approval as university supervisors.

Signature……………………....... Date……………………………

Prof. Geoffrey Wahungu

National Environmental Management Authority

Nairobi

Signature………………………….. Date…………………………….

Prof. Hellen Ipara

Department of Wildlife Management

University of Eldoret

DEDICATION

To my wife, Rebecca, and son, Ian I thank you for believing in me even when I faltered. And to my parents; I will always be grateful to you for this achievement which is all because of you.

ABSTRACT

Although human - wildlife conflicts are a common phenomenon in different parts of the world, they have become a major challenge for conservationists in the 21st century. Major causes of conflicts include human population increases leading to encroachment on wildlife habitats and dispersal areas and development of land for agriculture and other activities that are in competition with conservation. This study assessed types, nature and causes of human - wildlife conflict as well as their impact on wildlife conservation and management within and around Chyulu Hills National Park. The study used the descriptive study design. The target population consisted of the local community living around the park and staff from Kenya Wildlife Service and other conservation organisations. A sample of 169 respondents were interviewed. Of this, 149 respondents were randomly selected from the local community living around the park and 20 purposively selected from among the key informants. A sample of 169 was appropriate for this study and was able to cater for possible dropouts occasioned by experimental mortality which is a threat to internal validity or refusal by respondents to participate. Data was collected using questionnaires, key informant interviews, focused group discussions and review of secondary data. Data was analyzed using descriptive statistics including frequencies and percentages while hypotheses' testing was done using the chi square test and results tested at the 0.05 level of significance. Results identified elephants as the most problematic wild animal in the study as reported by 70% of the respondents. Types and nature of human-wildlife conflicts experienced include crop damage (89.3%) and livestock predation (73.2%). Human deaths and injuries were the least mentioned. Lack of proper mitigation measures to mitigate was reported by 63.8% of the respondents as the main cause of increased human wildlife conflicts outside the park. Communities suggested mitigation measure such as erection of electric fences (76.5%), translocation of animals (17.4%), revenue sharing (15.4%) and frequent patrols among others. The study concluded that HWC impacted negatively to both people and wildlife and called for empowering local communities in order to improve their attitudes towards conservation. Land use planning and environmental education was also recommended to reduce conflicts in the study area.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

ACC   African Conservation Centre

ASALS   Arid and Semi- Arid Lands

AWF   African Wildlife Fund

CBC   Community based conservation

CBNRM   Community based natural resource management

CBS   Central Bureau of Statistics

CBO   Community based organization

CHNP   Chyulu Hills National Park

DAO   District Agricultural Officer

FAO   Food and Agriculture Organization

GD   Game Department

GIS   Geographical information system

GDP   Gross Domestic Product

GoK   Government of Kenya

GPS   Global positioning system

HWC   Human - Wildlife Conflict

IUCN   International Union for Conservation of Nature

KFS   Kenya Forest Service

KWS   Kenya Wildlife Service

MDGs   Millennium   Development Goals

NALEP   National Agriculture and Livestock Extension Programme

PAC   Problem Animal control

PAMU   Problem Animal Management

SSA   Sub- Saharan Africa

USD   United States Dollar

WCMD   Wildlife Conservation and Management Department

WWF   World Wide Fund

VBN   Value Belief Norm

ACKNOWLEDGMENT

CHAPTER ONE

INTRODUCTION

1.1. Background to the Study

Human - wildlife conflicts have always occurred in different parts of the world in a spatial and temporal context. Despite this, they have however; become a critical issue for conservation in the 21st century (KWS, 1994; FAO, 2007; Dickman, 2010). The conflicts have in recent years been caused by human population increases and the subsequent settlement on lands that are either wildlife habitats or dispersal areas, improved technology and development of land for agriculture and other activities that are in competition with conservation.

Human-wildlife conflict is an issue of global concern particularly in Africa, Asia and Latin America, and arises due to the interaction between people and wildlife which causes negative consequences to one or both parties (Mutinda ,1995; Madden, 2004; Dublin ,2004; Elsne, 2008;). The effects can be social, economic or cultural (Hoare, 2001). Human-wildlife conflicts (HWCs) occur where people and wildlife share common boundaries particularly around protected areas (Shemwetta *et al.,* 2000). FAO (2007) and Okello (2005) have pointed out that in the recent past, human-wildlife conflicts have escalated due to increase in human population and the subsequent encroachment on wildlife habitats. As a result, people and wildlife compete for space and other resources mainly due to changes in the use of land which more often are characterized by activities that are incompatible to conservation (Ngene, 2010). People often look at wildlife as a liability due to the costs arising from wildlife conflicts through crop damage, loss of human lives and injuries, loss of access to legitimate and traditional rights, damage to

properties, livestock depredation and threats to livelihoods through disease transmission (Haore, 1999a; Waithaka, 1995); Otuoma, 2004; Elsen,, 2008; FAO, 2007; Ngene, 2010; Sillero and Sukumar 2007).

Although human-wildlife conflicts occur worldwide, there are differences in the level of conflict and vulnerability between developed nations and developing countries (FAO, 2007), with conflicts being more prevalent and intense in developing countries. In Africa various studies have shown that human-wildlife conflicts occur in all habitats in west and central Africa, as well as in Eastern and Southern Africa (Barnes, 1996; Thouless, 1994; Treves, (2006).. The problem is severe in areas where agriculture is practiced, and also in pastoralists' areas where water is scarce. Human-wildlife conflicts have escalated in these areas mainly due to encroachment of human activities on wildlife lands and other areas previously occupied by wildlife (Ngene, 1998; Haore, 1999; Ngure, 1995; Sitati, 2004). Although the degree and intensity of conflicts are high near protected areas, they are intensifying in other areas too, mainly due to clearing of land for agriculture and poaching among others thus threatening conservation. As a result, different management strategies are required in specific areas and at specific times (Sitati and Walpole, 2006; Sitati, 2008).

According to Hoare (1999b), the occurrence of human-wildlife conflicts largely depends on the kind of human activities as well as the type of wild animals found in an area and their population. Many protected areas are unable to support the existing wildlife populations, and therefore the future success of conservation in protected areas largely

depends on the support of local communities and in particular their willingness to share their land with wildlife. This however, may not happen if the current level of conflict intensity persists or increases.

In Kenya, the origin of human-wildlife conflicts dates back to the establishment of parks and reserves and other wildlife protected areas amidst human settlements Lusigi, (1990); Wells *et al.,*1995; Graham, 2010).The establishment of parks and other protected areas was realized by removing local communities either forcefully or by treaty. Following this, communities lost their land rights. For example in the Amboseli ecosystem, the pastoral Maasai communities were never compensated for loss of grazing land and source of water as a result of the designation of Amboseli as a National Park (Ngene, 2010). The same scenario was observed during the establishment of Tsavo and Nairobi National Parks as well as Masai Mara National Reserve among others (Ngene, 2010).The loss of land caused those communities to develop negative attitudes towards wildlife protection. The increase of human activities such as agriculture in areas adjacent to the parks and other protected areas that are believed to be wildlife areas has complicated the issue of human-wildlife conflicts as people and wildlife increasingly compete for space. Regular wildlife invasions have led to some people abandoning their activities in many areas; and, people's tolerance towards wildlife is declining as evidenced when, wild animals are killed through poisoning or poaching for bush meat, hide or even trophies.(Ogada and Ogada,2004; Woodroffe,2005; Patterson and Kasiki,2004)

Besides the foregoing, it has been argued that people's perception is that the government values wildlife more than human life and their livelihood compared to other economic activities (Campbel *et al;* 2003, Okello: 2005, FAO, 2010). Lack of compensation through losses caused through wildlife damage except for human injury and death, government bureaucracy in compensation procedures, and inadequate compensation below market value has further aggravated an already bad situation making it worse (Campbell, 1999; Ngene, 2010; Nyhus *et al.,2004*).

On the other hand, lack of adequate mitigation measures by park management authorities coupled with their inability to protect people is also escalating the conflicts. This is because most parks are not protected by fences mainly due to poor planning and implementation of mitigation measures as well as inadequate funds. As a result people often enter into discordant relations with wildlife management institutions because first, despite the growing awareness of the potential threats of having wildlife outside parks, they are not allowed to control the wildlife conflicts. Secondly they are against the methods used by the government to mitigate and resolve conflicts because animals are not killed and therefore people perceive the government as incompetent. In most cases large mammals cause the greatest impacts and they are responsible for losses that amount to millions of shillings.

Apart from the losses that animals like elephants, buffaloes, and carnivores such as lions cause, the greatest threat to people living adjacent to parks and other protected areas is damage to property, human injury and death. More often the intensity of conflicts varies

in different seasons of the year. Further, land use changes have escalated human-wildlife conflicts mainly due to the blockage of migratory corridors and loss of habitats (Okello, 2010; Western and Waithaka (2000). As a result, migrating animals cause conflicts to settled areas due to unrestricted wildlife movements (Campbell *et al.,* 2003; Sillitoe *et al.,* 2010; Hoare, 2012; Rodriguez, 2012). The extent and magnitude of these problems varies considerably in different areas overtime, thus calling for different management strategies in specific area and specific times (Sitati and Walpole, 2008).

Chyulu National Park (CHNP)was established to protect the unique wildlife resources of the area where it is located. Okello (2005) has documented that about two thirds of the park is surrounded by human settlements and, individuals own small portions of land that were subdivided from group ranches and so changes in land use activities are causing conflicts. Further, land in Makueni County is more productive and densely populated compared to that in Kajiado County. As a result, agricultural activities are threatening wildlife conservation since the former are more profitable than pastoralism (Okello, 2005).

Unlike some parks in Kenya CHNP is not surrounded by a fence to protect and prevent conflicts. Methods used by KWS to control conflicts are neither sufficient nor effective to stop animals from causing damage. Further, the government does not allocate enough resources to hire enough personnel that could protect people and their property, and only few rangers are employed. Furthermore the rangers are not well equipped to enforce conservation regulations. As a consequence, this problem was compounded by the fact at

the time of this study most laws on wildlife conservation were outdated and had not been reviewed. The government needs to plan for the management of wildlife outside parks in order to devolve ownership and control rights to the communities living adjacent to parks. The government should support communities adjacent to the park with finances to install fences and other barriers to protect their properties and reduce conflict. (Ngure, 1995)

1.2 Statement of the Problem

The presence of wildlife outside Chyulu Hills National Park like other protected areas has resulted in competition over land resources such as pasture and water by people and wildlife. As a result, wildlife has continued to move outside the park thus destroying crops and other properties posing a threat to human life. The level of damage has caused people to abandon their activities because of damages and losses caused by different animals in different seasons. On the other hand, wildlife habitats are also reducing areas surrounding the park due to land sub-division and fragmentation. In addition, people are not compensated for the losses incurred in terms of crop damage because there is a lot of bureaucracy as well as insufficient funds given by the government. At the time of this study in 2011, there was only compensation for human injury (Ksh 50,000) and death (Ksh 200,000). Although these figures have been reviewed upwards; local communities bordering CHNP like other protected areas in Kenya abhor wild animals due to the foregoing conflicts and because of the fact that there are no direct benefits accruing from the park and its wildlife. Likewise, the ineffectiveness by Kenya Wildlife Service to control wild animals has compounded the problem.

Although various studies among them Okello's (2005) have been conducted in the study area to address various aspects of human-wildlife interactions as well as land use changes, no study has been carried out to examine the nature, types and causes of conflicts in the study area and the implications they have had on wildlife conservation and management. The current study was therefore necessary and aimed at assessing the issue of human-wildlife conflicts with a view of understanding their effects, as well as the mitigation measures put in place to mitigate them.

1.3 Purpose of the Study

The purpose of this study was to investigate the effects of human-wildlife conflicts and their implications on wildlife conservation and management in Chyulu Hills National Park and its surrounding.

1.4 Objectives of the Study

1.4.1 Broad objective

To assess the types, nature and causes of human-wildlife conflicts and their impact on wildlife conservation and management in CHNP and its surroundings.

1.4.2 Specific objectives

1. To establish the types and nature of human-wildlife conflicts experienced in CHNP and its surroundings.

2. To establish the causes of human-wildlife conflicts in CHNP and its surroundings.

3. To assess the impacts of human-wildlife conflicts on wildlife conservation and management in CHNP and its surroundings.

4. To assess the measures put in place to mitigate human-wildlife conflicts in CHNP.

1.5 Research Questions

This study was guided by the following questions:

1. What types of conflicts are experienced in areas bordering Chyulu Hills National Park?

2. What are the causes of human-wildlife conflicts in areas surrounding Chyulu Hills National Park?

3. What are the impacts of human-wildlife conflicts experienced on conservation and management of wildlife in Chyulu Hills National Park and its surroundings

4. What mitigation measures have been put in place to mitigate human-wildlife conflicts in CHNP and its surroundings?

1.6 Research Hypotheses

H_{O1}: there is no significant relationship between impacts of human-wildlife conflicts experienced and the level of support for wildlife conservation in the study area.

1.7 Justification and Significance of the Study

This study will help policy makers to put in place programmes to educate people on how to co-exist with wildlife and resolve conflicts. Policy makers will have a basis for formulating and implementing policies, programs and projects pertaining to wildlife conservation and management in order to respond to challenges associated with increases in human population, land sub-division and changes in land use. Results will be of benefit to scholars, researchers and other people keen on conducting similar studies.

1.8 Scope of the Study

This study was conducted in areas surrounding CHNP in Makueni and Kajiado Counties of Kenya. The study investigated human-wildlife conflicts and their implications on wildlife conservation and management. The study generated information from communities living adjacent to the park as well as KWS staff in charge of the park and personnel from KFS and other conservation organizations operating in the study area.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of the Concept of Human-Wildlife Conflicts

Human-wildlife conflict is a growing problem in areas surrounding protected areas worldwide, and has significant impacts on both people and wildlife populations. A global overview of this problem reveals that human-wildlife conflicts have been widely documented in India and other parts of Asia, Latin America, and Africa in particular east Africa, West Africa, central Africa and various parts of southern Africa. In all these areas reports of both human and wildlife casualties are well documented (Hoare,2001; Elsne,2008) Given the heavy losses and costs humans incur, the perception of people who live around protected areas is that they are alienated from parks and do not receive any benefits from conservation. As a result, people outside parks have continued to transform the use of their land to other uses such as expansion of agriculture and settlements. In Kenya, the effect is that the remaining wildlife is restricted to small patches of forests that are fragmented in areas dominated by people. Human population has more than doubled since independence thus intensifying conflicts as both people and wildlife populations compete for space and resources within and around protected areas.

According to Ngene, (2010) human- wildlife conflicts occur when the activities of people are in competition with those of wildlife because of limited resources. Following this interaction, people more often develop negative attitudes towards parks. Further, people are against conservation because they incur a lot of losses either through livestock predation and crop destruction among others which are caused by different species in

different seasons. Factors that contribute to the increase of human wildlife conflict in the world can be categorized as human population increase, land use changes, loss of habitats, degradation and fragmentation, the growing interest in ecotourism, competition for resources, increase of wildlife population and climatic factors among others.

2.2 The Concept of Protected Areas and its implications on wildlife conservation and management

Parks in Kenya just like in other parts of the world were established to promote the conservation and management of wildlife and other natural resources. Lusigi, (1991) alludes that protected areas were established based on the U.S Yellowstone model that lay emphasis on establishing protected areas with large populations of wildlife for tourism purposes. The model had no regards for local communities, their conservation methods, as well as ecological processes such as migratory species that were maintained in such areas throughout the year. As a result, conservation methods used by indigenous communities were affected because their requirements of land were never considered. This is evidenced in most areas where people were either forcefully evicted or relocated to other areas to create room to establish parks and other protected areas. Further, people whose land was alienated have always been against wildlife and wildlife conservation efforts, and this has over the years resulted into conflict following wildlife destructions (Sitati, 2008).

According to Ipara *et al.* (2008), most parks in Kenya are not complete ecosystems because they are unable to accommodate the ever increasing numbers of wildlife. Okello, (2005) further notes that most of the wildlife is found on private lands outside parks due to their seasonal behavior. The animals migrate from protected areas due to the seasonal

variability of resources that are available in isolated habitats which are fragmented and thus cause the conflicts with people outside parks (KWS, 1994; Ipara, 2007; Okello, 2005). These problems also threatens the survival of wildlife outside parks and is compounded by poaching activities. This has been compounded by conflicts which have accelerated in recent years, coupled by the fact that people do not benefit from wildlife found on their lands.

Literature reviewed revealed that Chyulu Hills National Park (CHNP) is surrounded by residents who feel alienated from the park because it was gazetted without consulting or compensating them for loss of their livelihood, and therefore the people have developed negative attitude towards wildlife conservation and management. As a result, CHNP like other protected areas in Kenya has become like an ecological island in a sea of land that is settled by people. Besides this, there is need to address the inequalities attributed to historical injustices in order to guarantee the future of protected areas and that of wildlife resources that they hold. On the other hand changes in land ownership and the methods for management have affected conservation of wildlife. The situation is compounded by human population increase outside the park and subsequent changes in culture which have led to development of land among other activities that are incompatible with conservation (Okello and Kioko, 2010).

2.3 Types, Nature and Causes of Human-wildlife Conflicts

2.3.1 Types and nature of conflicts

The type and nature of conflicts experienced vary with animal species that causes damage, and mainly comprise of predation of livestock, attack on humans, crop raiding

and disease transmission. An overview of the main types of HWCs experienced is given in subsequent sections.

2.3.2 Livestock predation

Large scale livestock keeping is practiced mainly by pastoral communities. It is valued for cultural, social and economic reasons. However, livestock predation is a common conflict in many parts of the world and causes a lot of losses which are varied in different areas. In France, Dickman (2008) reported that livestock predation is caused by the lynx, while in Norway by brown bears. In Brazil it is by Pumas, golden jackals in Israel and tigers in India.

In Kenya Ogada *et al.,* (2003) reported that livestock predation is caused by carnivores such as lions, leopards and hyenas, among others, This problem is severe in areas bordering protected areas and causes a lot of economic losses to the owners Kolowski and Holekamp, (2006). Studies conducted elsewhere by Kissui and Packer (2004) indicated that the movement of livestock closer to parks contributed to predation during the rainy seasons when wildlife migrates from the parks. Patterson and Kasiki (2004) reported that in areas around Tsavo National Park in Kenya, predators invade all the year round but there are more attacks during certain seasons and durations of the day. The attacks vary with different wild animals because predators attack due to preference and availability of livestock (Bruce *et al*, 2003). However, apart from predation, predators also destroy fences erected around livestock enclosures (Bomas) by making holes. This has more often resulted in hostility and negative attitudes towards carnivores. Woodroffe *et al.,* (2005) reported that such tensions have led to the killing of predators such as lions and hyenas among others leading to major declines globally of endangered species.

2.3.3 Attacks on humans

Attacks on people are not very common like livestock, but are important because of intensity of conflict they cause. Dickman (2008) reported that the number of people killed by wild animals is not very clear due to lack of clear records in many countries, although the number is small when compared to other causes of human death such as diseases or accidents. However, attacks on people causes significant threats in many areas. For instance in Sudarban region of eastern India, Tigers kill around 100 people per year while the Asian elephants kill between 100-200 people in India. In Kenya, Smith and Kasiki 1999) reported that between 1989 and 1994 wild animals killed or injured 448 people of which elephants were responsible for 173 cases. Other animals such as, buffaloes, lions, snakes among others also kill people whom they encounter during the day or night when people are herding livestock, guarding crops, collecting firewood in the forests or while walking in the village (Smith *et al.,* 2000 and Walpole *et al* 2003). This study investigated wildlife attacks on people with a view of proposing mitigation measures and co-existence of people with wildlife.

2.3.4 Crop raiding

Crop-raiding is a common type of human-wildlife conflict because many farms are destroyed outside parks and cause a lot of economic losses to farmers (Treves, 2008; Osborn and Parker, 2003). In Uganda, Naughton and Treves (1999) reported crop raiding was caused by many species of animals such as elephants, bush pigs, and monkeys among others, and destroyed crops at different maturity levels. Dickman (2008) reported that in Latin America birds and monkeys destroyed 77% of crops. In Africa and in particular Cameroon and Tanzania the Quelea quaele birds were reported to destroy up to 80% of crops and cause a lot of damage to farmers.

Expansion of agricultural activities outside parks accelerates conflicts as many farms are invaded by animals. Most studies indicate that many parks and forests in Kenya are surrounded by farming communities (Sitati, 2003). This is because farming activities have replaced the nomadic ways of life. Sukumar, (1989) and Dublin *et al.* (2004) reported that conflicts between wildlife and rural farmers in both Africa and Asian continent have led to fatal clashes between people and wild animals. In most cases farmers kill wild animals to protect crops, though at times they do it to obtain meat or trophies. In other cases people face starvation because of regular invasion or crop damage by wildlife that have forced farmers to abandon agriculture. Dickman (2008) reported that in India farmers are restricted from irrigating their fields at night due to threats of tiger attacks, while in Madagascar people living adjacent to Mantadic National Park are restricted by wild animals to access to their farms.

The types of crops grown determine the type of animal species that cause attacks and their frequencies for different preference in crop raiding since different animals have preference for different crops depending on their palatability. Sitati (2003) reported that in Transmara, Kenya, crop damage by elephants occurred throughout the seasons, but they were more severe in the months when crops are almost ready for harvesting. In Uganda, small animals such as primates and rodents cause more damage than larger animals (Naughton and Treves, 2005). However larger animals such as elephants cause intense conflicts as they not only trample on crops but are also bulky feeders thus causing a lot of damage.

2.3.5 Disease transmission

The risk of disease transmission to the people or their livestock has led to a lot of hostility towards wildlife conservation. Dickman (2008) reported that in the United Kingdom for instance farmers are concerned about badgers which are believed to be transmitters of tuberculosis to cattle while in east Africa, animals such as buffaloes act as reservoirs for diseases like East coast fever and also harbor disease bearing ticks. The other major threats to people are for example primates which are thought to be carriers of Simian immunodeficiency virus (SIV) that is implicated as the original source of Human Immunodeficiency Virus (HIV) that has infected and caused deaths to many people.

Carnivores on the other hand, act as reservoirs for diseases such as rabies that is responsible for a lot of human deaths worldwide each year (Woodroffe *et al,* 2006; Kissui, (2008). Kidegesho *et al,* (2005) observed that domestic dogs were believed to cause outbreak of canine distemper virus and rabies diseases in Serengeti and Masai Mara National Parks. Other than the diseases problem, wild animals such as herbivores compete for water, pasture and space with livestock. Competition occurs during the dry season and is attributed to the large number of migrating animals in search of water and pastures thus causing human-wildlife conflicts in areas adjacent to parks.

2.3.6 Property Destruction

Ngene, (2010) reported that cases of property destruction by wild animals was a major type of conflict outside Tsavo National parks and other protected areas in Kenya. In most cases, elephants were the most destructive as they destroyed water troughs and tanks as well as water pans or dams when searching for water. They also broke fences and trees

when roaming outside the park. In addition, elephants destroyed grain stores throughout the year calling for their control outside parks. Thouless and Sakwa (1995) suggested that in Laikipia District, Kenya, elephants were responsible for most destruction than other animals because they could move for long distance outside the park during all seasons. Their movement was accompanied by extensive trampling and destruction of local people's farms and structure.

Kidegesho *et al* (2005) observed that in Serengeti National Park, Tanzania, wet season elephant tracks and foot prints could be observed on the black cotton soil in and around the park. He further reported that predators such as hyenas and lions destroyed thorny fences of livestock bomas outside the park causing conflicts with people. According to KWS (1995) property damage by wildlife was not compensated by law and that compounded conflicts with people due to heavy losses incurred outside the park hence communities' lack of support to conservation.

2.4 Causes of human-wildlife conflicts

2.4.1 Human population growth and human wildlife conflicts

Kenya's population has been increasing at 3.6 % per annum and is among the highest recorded birth rate in the world (Swallow, 2005). Rapid population increases has caused competition between people with wildlife on the use of land. This has occurred due to activities of people such as settlements, sub-division of land, infrastructure development; expansion of agricultural activities as well as other factors thus destroying habitats (KWS, 1990; Muruthi, 2005). In the case of CHNP the issue of human population increase is a major factor that has led to encroachment by people on wildlife habitats leading to habitat fragmentation, destruction and degradation.

The Maasais and Kambas who inhabit CHNP were traditionally pastoralists and hunters and gatherers respectively. However, the rapid increase in human population, urbanization and improved technology has exerted enormous pressure on CHNP and its environs. Vast areas have been opened up for crop cultivation by farmers who continue to migrate to the area, and they are engage in unsustainable methods of farming as well as grazing systems. All these activities have led to loss of wildlife habitats. The situation has been worsened by the increase in the development of infrastructural facilities particularly roads which have led to the opening up of more areas and in turn destroyed the habitats through degradation, fragmentation as well as pollution of wildlife habitats.

According to Okello and Kioko (2010) land outside parks is privately owned by people and its fencing and fragmentation have affected the migration and movement of animals. The situation has been compounded by the sub-division of land, through installations such as fencing, deforestation and expansion of agriculture and settlements. As a consequence, these activities have affected the environment, natural habitats and wildlife population. Further, the increase of population outside CHNP and other protected areas has led to changes in land tenure. Around CHNP land tenure has over the years changed from communal land ownership of group ranches to individual or privately owned land. This trend is posing a serious threat and challenge to the maintenance of migratory routes and dispersal areas used by wildlife game due to the expansion of agricultural activities on the land.

Studies by Okello (2005) and Patterson *et al* (2004) reported that Tsavo ecosystem is regarded as one of the human - wildlife conflict hotspot areas in Kenya. Efforts to conserve and manage large wildlife populations outside protected areas and wildlife habitats has proved difficult mainly due to increasing human –wildlife conflicts (Sitati 2003; Hoare 2000). Land outside protected areas such as CHNP was meant to act as the dispersal areas for free ranging animals since parks and other protected areas are not complete ecosystems. Currently, these lands are now settled by people.

2.4.2 Land use changes and their implications on human-wildlife interactions

Land is used by people for various activities which include agriculture, forestry, urban development and conservation among others (Omondi, 1994). The increase in land use activities blocks migratory corridors thus forcing animals into smaller areas because of fragmented habitats. Many parks and protected areas have increasingly become isolated because of the blockage or disappearance of migratory corridors. As a result human-wildlife conflicts have intensified in those areas because of sharing common resources and boundary. This problem poses major challenges to wildlife managers and local communities. In areas outside CHNP   the change from pastoralism to crop farming and agropastoralism has increased the conflicts between people and wildlife. Smith (1999) and Sitati (2003) argued that wildlife conservation as a kind of land use cannot be implemented in isolation from other activities. They further allude that conservation as a land use has a lot of social and political challenges because it only supports livestock keeping and not any other activities such as crop farming. These findings are also supported by Kangwana, (1995); Kangwana, (1996); Ngure, (1993) and Omondi (1994),. In CHNP environs land is used mainly for crop farming and livestock keeping while, conservation is done mainly in CHNP. Other land use activities undertaken include

development, settlements and road construction among others. The later have had varied

impacts on human-wildlife co-existence as well as wildlife habitats.

2.4.3 Blockage of wildlife migratory routes

Human activities outside parks and other protected areas have blocked migratory

corridors used by wildlife. Smith and Kasiki, (1999) reported that many parks in Kenya

were established without considering migration routes used by wild animals across

protected area boundaries. Sitati *et al* (2003) reported that human-wildlife conflicts in

Transmara District arose due to blockage of migratory routes from Masai Mara National

Reserve by migrant agricultural communities and acquisition of land for agricultural

purposes. In Laikipia, Thouless and Sakwa, (1995) reported similar findings and alluded

that blockage of wildlife corridors has intensified human-wildlife conflicts mainly due to

development of land acquisition for other activities that do not support conservation. As a

result, wildlife are forced into smaller areas that are isolated or fragmented due to

changes in land use. In the study area the blockage of migratory routes has affected the

availability of water and pastures as people compete with wildlife for these resources.

Further, Patterson *et al* (2004) reported that Tsavo National Park among others in Kenya

are not complete ecosystems or habitats and animals migrate due to their seasonal

behaviors thus causing conflicts with activities people undertake outside parks. As a

result conflicts between people and wildlife have intensified in recent years leading to

losses in wildlife and humans, as well as the later property.

2.4.4 Change in cultures and lifestyles of people

Changes in the culture of people as well as lifestyles are transforming land ownership

from communal land tenure to private or individual ownership. Walpole *et al,* (2003)

observed that in Transmara District, Kenya an increase in human population resulted in

increased demand for land and change of land tenure patterns from communal group ranch system to individual holdings. The traditional management systems of land or methods of ownership have changed from joint properties to individuals. People have abandoned communal activities such as farming and hunting because of the new economic order of individualism to become rich or capitalism.

Education on the other hand has raised the level of awareness on the need of people to improve their economic activities by changing their activities on land as well as the methods on use of technology for prosperity. Further people have become enlightened on their rights on human-wildlife conflicts and want the government to review laws on wildlife conservation and management (Cap 376) by starting compensation for wildlife damage. Changing land use activities coupled with change in hunting methods, and technology and attitudes and perceptions towards wildlife have led people to specifically target large animals because of the extent of damages caused to crops, properties and loss of human life. All these factors reflect a change in human values or attitudes and have impacted negatively on wildlife conservation as many people outside protected areas are against conservation (KWS, 1995).

2.4.5 Introduction of agriculture

Sitati (2003) and Hoare, 2000) allude that the expansion of agriculture outside parks and other protected areas has led to the decline in wildlife populations. They further allude that sub-division of community group ranches into smaller farm units and the activities of farming have fragmented wildlife habitats and subsequently led to conflicts with wildlife as they compete for space. As a consequence, farmers loose a lot of crops to wildlife and

this is a major concern because on one hand the government is trying to promote food security by encouraging pastoralists to settle and start farming while on the other hand concerted efforts are being made to promote conservation. The end result is that farmers directly compete for space with wildlife because the management of parks does not plan for agricultural activities outside parks other than conflicts mitigation measures or initiatives.

On the other hand, people continue to use modern technologies to boost their produce. The later has however led to profound impacts on wildlife, wildlife habitats and people. Ceyhan (2011) reported that advancement in use of modern technology in Turkey destroyed the environment through pollution from organic and inorganic waste, unintended usage of agricultural lands, wrong agricultural application, erroneous using of pesticides and chemical fertilizer, irrigation among other practices lead to soil salinity, rising of ground water level, soil erosion due to wrong applications. As a result, they destroyed the environment by clearing the forest to open agricultural land, loss of species through pollution by use of chemicals and other pesticides as well as draining of wetlands among others.

Although the Government of Kenya has developed policies to guide both commercial and subsistence farming in order to protect wildlife, these have not been fully implemented. Further, farmers are not protected by the laws to clear vegetation on their farms and therefore they require training through extension services to mitigate conflicts and adopt the best practices because in most cases, farming or cultivation is more beneficial than

conservation and majority of the people cannot tolerate the presence of wildlife in their farms. This is evidenced by the intensity of conflicts in many farms near parks and has affected conservation since land is privately owned by individuals (Hoare, 2001).Like in other protected areas, the encroachment by people who start farming has transformed the use of land for commercial or subsistence purpose, and is thus changing the livelihoods of indigenous communities who were traditionally pastoralists. These changes have, however had varied impacts on wildlife and wildlife habitats.

In addition, the population of animals invading farms near parks and other protected areas due to poor management manifested through poor protection against poaching and financial capabilities of the government. Waithaka *et al,.*(1995); Kangwana, (1996), Tchamba, (1996) and Treves *et al* (2006) argued that the animals move in large numbers and have either become habituated or have lost fear of people. In other cases most problem animals had been re- introduced to other parks after being driven to extinction through poaching (Omondi, 1994). Although the migratory routes are increasingly becoming smaller in size, there is lack of active management to control the conflicts. Migration of animals outside Parks and other protected areas is important for their survival and the habitat to recover. Wildlife concentrates in the parks during dry seasons and migrates outside during wet seasons in search of water and pasture. These seasonal migrations have led to varied intensities in impacts to both people and wildlife causing negative effects to one or both parties.

According to KWS (1996) farming outside parks and other protected areas is the main cause of human-wildlife conflicts mainly because of the increase in settlement by people and the subsequent increase in the number of farms near parks (Ottichilo, 2000; Ipara e*t al,.* 2007). However, people have developed negative attitude towards conservation because animals are not eliminated from conflict areas either by translocation or killing, and therefore continue to cause a lot of losses and will not be tolerated to support conservation.

2.5 Impacts of Human-wildlife Conflicts

The interaction between people and wildlife often leads to varied impacts on the level of income as well as the quality of life of the people affected. Kidegesho, (2006) reported that impacts of HWC in Tanzania range from economic hardship to increased opportunity costs to the people. Dickman, (2008) reported that farmers in USA incur huge costs as they spend over 5.5 billion Dollars per year to manage wildlife problems while in Nepal, India livestock depredation by snow leopards has significant economic impacts on the owners and costs around 50% of their income per capita. The loss of agricultural crops, livestock predation and destruction of properties often leads to economic losses yet people are not compensated. People incur indirect additional costs as they spend a lot of time and money planning how to protect their property against wildlife damage.

Thirgood *et al.,*(2005) reported that people invest heavily in strategies such as livestock herding, guarding and predatory control. Other costs are incurred when constructing electric fences or other barriers on their properties or even when guarding farms or crops at night against wild animals. In addition, people are forced to abandon their activities on land and migrate to other areas when wildlife becomes a threat to their lives. Sitati *et al*

(2012) gave the example of Transmara District in Kenya, where perceived dangers from wild animals prevent children from going to and from school, this leading to fear among children and parents and consequently high rates of school drop outs. Other impacts have been reported include human injury and death, destruction of houses and crop stores among others (Sitati, 2003a)

2.6 Measures taken to mitigate human-wildlife conflicts

To minimize human-wildlife conflicts, many governments in collaboration with conservation organizations and local people are implementing various measures to mitigate, manage and resolve the conflicts (Sitati and Walpole, 2006). The success of measures implemented has been documented in various studies among them (Sitati,2003b; Sitati and Walpole,2006), In order to identify the spatial distribution of conflicts, trends as well as the causes so that researchers and wildlife managers plan for mitigation measures or management strategies that can succeed, a lot of financial and human resources are required. Despite this, it is important to empower the local community in resolving conflicts. This is mainly done by training communities to select methods that can be adopted in a specific area for example separating people from human-wildlife conflicts which is viewed as a permanent solution to the problem. However, resources are required to implement these measures. Apart from preventive measures used to mitigate human-wildlife conflicts. Other methods may include discussing with communities to change their attitudes towards conservation because they can benefit from the wildlife. A discussion of measures adopted is given in subsequent sections.

2.6.1 Traditional conflict mitigation measures

Human-wildlife conflict is still wide spread outside parks and other protected areas, and various strategies to protect people have been adopted (KWS, 1994). Bell (1984) and Sukumar, (1991) reported that African communities use different traditional methods to mitigate human-wildlife conflicts. However it has been documented that traditional methods of protecting wild animals from farms such as drums, lighting fires, using scare crows, scaring, making noise/shouting, shining torches and throwing stones are not very effective since animals become habituated to them (Sitati, 2003a). Further, the use of fire unless controlled is both destructive to environment and expensive to maintain throughout the night. In addition, throwing stones to animals endangers the lives of people because it involves moving closer to the animals. Despite this, various studies indicate that the most effective methods used to prevent human-wildlife conflicts encompass completely separating people and the wild animals from each other using physical barriers

Management of human-wildlife conflict has been researched and documented throughout Africa and Asia and other parts of the world, and there are many methods that are used to control damages. Traditional methods have been used by local people to minimize wildlife damage for many centuries (Hoare, 2001). Methods used vary from throwing stones, use of fire, scare crows and magic among others (Thouless 1994,). Guarding of crops is done in order to alert people when wild animals have invaded farms. The animals are scared away by beating drums or tins of any kind to make noise. Although the use of these methods is fairly effective, animals eventually become used to them (Hoare, 2001; Nyhus *et al.,* (2003). Fire is set along the boundaries of the farms to protect wildlife and

requires firewood throughout the night. Occasionally, people burn seeds or elephant dung mixed with chillies to increase the effects of the fire though this can be destructive to habitats (Ngene 2009; Hoare 2001).

Other methods used include clearing bushes around farms to enhance visibility of people to see animals before they can invade the farms and surrounding farms with strings or ropes smeared with chilly powder, tied with tins or clothes to scare animals (Thouless and Sakwa 1995),or planting unpalatable crops such as chilies. All these measures together with traps, spikes, sharpened stones, stakes and nails are sometimes placed on elephant paths approaching farms while pit traps are also known to be used (Hoare 2001) The use of these methods is not however, a long term solution because animals are driven to neighboring farms and may return back to the area (Barnes, 1996; Hoare, 1999c; Nyhus, *et al.,* 2000; Dublin and Hoare2004).

The use of traditional methods is done by combining several methods in order to enhance success. People for example clear the bushes around farms while guarding is done from watch towers and the guards use whistles or cowbells tied on the string along the fences to scare the animals. In addition fires are set along elephant's entry point to the farms. The effectiveness of these methods can be enhanced by combining many methods since they are not expensive and could be easily applied using locally available materials.

2.6.2 Conventional Mitigation Measures
2.6.2.1 Controlled shooting
Conventional or nobel measures adopted to prevent, mitigate, and manage HWC's are diverse and range from fencing, to controlled shooting, translocation and use of repelling

methods. The Problem Animal Control (PAC) or control shooting is done by park officials to assist local communities as a short term solution and makes wildlife authorities popular as communities benefit by obtaining meat (Hoare, 1999d; Graham,, 2010). However, it is difficult to identify the responsible animal and therefore a token of animals are killed to appease the communities despite the inability to solve the problem (Jillo *et al*., 2008).

Excessive killing of animals can lead to the extinction of some species because sometimes local people exaggerate the number of animals causing damage in order to obtain bush meat. Although KWS has trained personnel to identify animals causing damage and protect people, they are few and also unable to cover large areas due to lack of enough personnel and equipments. At the same time, policies are required in order to protect excessive killing of animals and this should be guided by scientific studies to monitor effects and the number of animals that can be killed in a certain area to benefit people. However, the control of endangered or the threatened species such as black rhinos, elephants and carnivorous such as lions and leopards should be prohibited to avoid their extinction.

Studies conducted in other areas have shown that PAC can generate revenue when combined with safari hunting quotas for specific animals. However, this requires monitoring hunting activities to avoid manipulation of the quotas and ensure that the targeted animals are not affected by the reduction in population. Unlike PAC, culling of animals involves periodic killing of targeted animals to reduce their population and

maintain optimum land carrying capacity through scientific monitoring and can cause social disturbance and affect the reproductive rate for animals (Hoare, 2001; Muruthi, 2005). Despite this, controlled shooting is not effective among species that are secretive and difficult to locate especially burrowing animals like Aardvark and Mongoose that live in holes and move out only at night.

2.6.2.2 Wildlife drives

This method is used by wildlife authorities to scare away animals from an area. Animals are scared away by using thunder flushes and flares as well as vehicles and helicopters. Unfortunately animals can return back to the area because they are habituated or become used (Bell, 1984; Hoare, 2001; Thouless, 1994; Nyhus, *et al.,* 2000). Likewise, animals are not driven from large areas while small animals such as antelopes and rodents require trained personnel because of their size.

2.6.2.3 Translocation of animals

Theoretically, translocation of animals can resolve human-wildlife conflicts since it involves removing animals from an area without killing them (Omondi,1994; Waithaka *et al.,* 1995, Litoroh *et al.,* 2010). However, studies on animal behavior and family structures are important in order to avoid the separation of family members during translocation. On rare occasions translocation can introduce the same problem of human-wildlife conflicts to new areas where animals were translocated. Nyhus, (2000) cited this problem in India and alluded that sometimes animals die due to stress or injuries sustained during capture. Although the method is very expensive, it is however recommended for restocking animals in areas where they have become extinct.

Translocation requires trained personnel and can cause a lot of political concern when animals are translocated from a different area and the problem of human-wildlife conflict exported to a new area.

2.6.3 Repelling methods

The use of repellent methods is mostly used in developed countries to control human-wildlife conflicts (Muruthi, 2005). Chemicals are sprayed using aircrafts to repel targeted animals and can kill unwanted wildlife such as insects or arthropods. Although the chemicals used often produce irritating smell that affects the sight or respiratory system of the animals targeted, the method is expensive to maintain. In a study by Sitati *et al,*. (2012) it is alluded that local people use traditional methods of smearing chilies or cow dung on crops while burning chilly seeds as well as old vehicle tires among others to repel animals. It is however, important to monitor the impacts of repellants on the environment since they can destroy other species that are not targeted but needs to evaluate the extent of damage.

2.6.3.1 Use of physical barriers.

 Electric fences are constructed to protect human-wildlife conflicts to separate people from wildlife. However, fences have ecological repercussions since they block migratory routes used by animals (Sitati, 2003). Fences are also expensive to construct and maintain, and they require planning for construction because they should be flexible along park boundaries. Although fences are designed in different sizes, height and length depending on the sizes of animals, they can be modified to target the animals that they are designed for such as those that jump, creep or even burrow to cause the damage. However, the fence cannot wholly solve human-wildlife conflicts especially in parks and

other protected areas where large populations of animals are outside protected areas. Occasionally animals do break the fences causing conflicts.

Smith and Kasiki, (1999) reported that no fence is a complete proof to human-wildlife conflicts. This is because barriers do not work in isolation and they are part of an integrated conflict management strategy in order to succeed. Despite their shortfalls, electric fences are more effective methods than other barriers. Apart from controlling human-wildlife conflicts, electric fences also assist in minimizing illegal activities since they are constructed along boundaries to prevent the encroachment of people to the park and therefore they are not supported by local communities. Occasionally, electric fences are demolished by large animals such as elephants and or people require maintenance for a long term. Types of fences used range from simple fences using barbed fences complex fences with many strands of wires as well as different strength in voltage to detect an animal. A constant power supply is important to enhance the effectiveness of fences and this varies from small fences on the farms to longer fences for example in Aberdares National Park in Kenya which has a 400 kilometer long fence. Muruthi *et al.,* (2005) reported that the electric fence constructed around Aberdare National Park in Kenya and costed 20 USD per meter was aimed at mitigating HWC. Further, Ogada *et al.,*(2004) reported that in Samburu District of northern Kenya, fences and modification of traditional stockades significantly reduced livestock predation while in Amboseli National Park fencing in cultivated areas of Kimana and Namelok reduced levels of crop damage (Muruthi,. (2005).

Other barriers used such as moats and trenches are not very effective because animals especially elephants learn how to break down the walls and climb through (Thouless and Sakwa, 1995). At the same time, they are destroyed by floods and they require maintenance in order to prevent soil erosion. Small animals can however, be protected by constructing stone walls (Thouless and Sakwa, 1995) because they cannot jump. Further, stone walls are durable for many years when properly constructed but can be demolished or run over by large mammal such as elephants depending on size. Unfortunately, they can cause death or injuries to other animals when hit at night because they are not visible.

2.7 Compensation strategies

2.7.1 Substitution strategies or measures

In Kenya the policy for compensation was reviewed in 1989 due to inefficiency by government officials, corruption and lack of sufficient funds to compensate people. However, compensation does not solve the conflicts because apart from death or injuries of people, other losses from wildlife damage are not compensated. In addition, delays in payments that are more often under-valued have made people to dislike this remedy and as a result compensation schemes unlike other conflict management strategies are seen to address the effects rather than the cause of conflicts (Bell, 1984; Hoare 1994; Osborn and Parker, 2003). Further, people exaggerate compensation claims and should be monitored especially for snake bites. Inspite of the aforested, compensation payments are not inequitably disbursed because some areas receive more funds than others thereby creating social disputes and resentments among different ethnic communities thus causing more human- wildlife conflicts, as well as differential attitudes towards wildlife and wildlife conservation measures.

2.7.2 Role of tourism in human- wildlife conflicts

According to Ipara *et al.,* (2008) wildlife contributes about 70% of tourism activities in Kenya and is a major revenue earner for this country. Tourism contributes about 25% of the GDP either by employing people directly and indirectly. Despite this, there is however, the opportunity cost of wildlife because wildlife competes for use of space and other resources such as forage and water with people. In addition it is estimated that the net agricultural opportunity cost due to wildlife protected areas of alternative land uses and earning foregone to the Kenyans economy is approximately USD 203 million (Ipara, *et al.,* 2008). This is estimated to be 2.8% of the GDP and is enough to support 4.2 million Kenyans. According to Nthiga *et al.,*(2008); and Okello (2005), communities surrounding parks especially Tsavo, Amboseli and Chyulu have started agriculture because they do not benefit from tourism. Ironically they want to achieve rural development but wildlife is seen as a major threat mainly because of the conflicts and therefore they are not willing to support tourism activities as well as conservation in the area. Further, 70% of wildlife population in Kenya is found outside protected areas and hence thrive on private land.

Naughton – Traves, (2007) reported in Uganda, the government through the ministry of tourism, wildlife and antiquities used tourism to mitigate HWC by promoting tourism and wildlife conservation through improving livelihoods, attitude change, promoting value addition by establishing crocodile farms and breeding guinea fowl for enterprise projects outside parks to mitigate HWCs. Further, they reported that wildlife authorities collaborated with local communities to plan for tourism activities and develop strategies to win space for wildlife outside the parks in order to mitigate human wildlife conflicts.

Similarly, in Botswana studies by Graham, (2010) reported that the government had established eco-tourism outside Makgadikgadi Paris National Park in order to benefit the local communities from livestock predation. He suggested that mitigation measures were implemented to deter willingness of communities to kill lions and other predators causing conflicts.

Group ranches around the Tsavo- Amboseli ecosystem act as a migratory corridor between Tsavo West National Park and Chyulu Hills National Park and support a high population of resident and migrant wildlife. Wishitemi and Okello (2003) allude that conservation of wildlife inside protected areas depends on surrounding areas acting as buffer-zones or wet dispersal areas. To fully utilize this, communities surrounding these parks have started agricultural activities on their lands while at the same time wildlife continues to roam freely on the land thus causing the conflicts. As a way of promoting conservation, KWS is linking local communities with prospective investors in tourism industry to develop eco-tourism facilities along the wildlife migratory corridor between Amboseli, Tsavo and Chyulu Hills National Parks and conserve important wildlife habitats as well as the large populations of migratory wildlife such as the large mammals such as elephants, buffalo and carnivores like lions and hyenas among others while at the same time, benefit the people from conservation.

Naughton-Treves, (1998) alluded that the management of Kibale National Park in Uganda shared revenue with local communities to promote positive attitudes towards conservation and tourism activities while in Kakum , Ghana, communities also benefit from revenues realized from conservation. As such, community representatives serve at the park board of directors that oversees the management of the park and therefore share

the responsibility of protecting wildlife. In the Nyae Nyae Conservancy in, Namibia, the sustainable use of leopards, through ecotourism, was evaluated as an option to balance the cost of living with these predators as borne by the San community. Further, a programme was developed whereby the San community linked up with ecotourism ventures to offer specialized leopard tours. Communities use their traditional tracking skills to provide guided tours for tourists to track leopards and reconstruct movement behaviors of these secretive animals setting up hides at the sites of fresh leopard kills. These expeditions generate as much as US$110 per adult per year, an amount which far exceeded the losses incurred by leopard raids on livestock. The development of crocodile ecotourism is used in Zimbabwe as a means of compensating the communities for crocodile conflicts in Lake Kariba (Osborn and Parker, 2002).

2.8 Theoretical Framework

This study utilised the Value − Belief − Norm (VBN) theory advanced by Paul Stern (Stern *et al*., 1988). This theory addresses the type of values that contribute to the moral obligation to environmentally responsive behavior in solving social and environmental problems. As reported by proponents of this theory, pro-environmental behavior is embedded with a certain value orientation because valued objects are threatened. The theory reveals a chain of influence on the behavior of people to address environmental problems by protecting threats because of the awareness of adverse consequences on other people and thus instigates responsibility to help eliminate the problem. The model divides the value sets into three types; egoistic, biospheric and altruistic. Stern, (1988) reported that, there are three types of support; citizenship actions, policy support and acceptance, and personal-sphere behaviors that accord with socio-environment principles.

The interface between self-concept and collectivism, the theorists argue provides a good foundation to community based management of natural resources and social relations.

This model identified variables affecting the complex relationship between people and wildlife in order to access and maintain resources on land. As the human population increases, changes in land use occur due to competition for resources and clearing of wildlife habitats, and the consequent encroachment of wildlife habitats, affects conservation of wildlife because relationship between people and wildlife changes. In their power relation to acquire and maintain access to land or spaces, humans dominate this and causes varying disturbances to wildlife habitats. Other factors that have compounded this include subdivision of land to individuals, development of land for agriculture or other activities, changes in cultures and lifestyles of people, market forces and policies. These factors affect conservation by causing human-wildlife conflicts and should be resolved by separating people from wildlife found in protected areas like CHNP, and establish laws or legislations to protect wild animals to reduce conflicts As indicated in preceding sections, mitigating HWCs is necessary to control wildlife causing conflicts and promote human tolerance of wildlife since wildlife resources are contested by different actors that have different interests, as well as values, and they are the most powerful in influencing how to make decisions for governing conservation and management of the animals.

The conservation approach is based on the premise that wildlife must be preserved by reserving areas and barring people from living within and using resources from these areas. The needs and interests of local people are therefore ignored. The local people are

seen as a threat and cause of land degradation and species extinction through encroachment and poaching. Kidegesho, (2006) argue that conflict arises because people are denied to negotiate the issue of their basic needs or value resulting to aggression that sometimes can be violent. They suggest that the government can plan for the methods to resolve the conflict by formulating policies that help to establish institutions and the laws and structures to solve the problem and also change the behaviors and attitude of people who encroach on wildlife habitats. It was hypothesized that adopting an approach that balances human needs with conservation and development goals can go a long way in promoting co-existence between humans and wildlife as well as tolerance among local communities living adjacent to protected areas (Kidegesho 2006).

The theoretical theory provides a good foundation to community based management of natural resources and helps build research by identifying variables such as, competition of resources by the people with wildlife due expansion of human settlements and intensification and diversification of land use in wildlife habitats that affects the complex relationship between people and wildlife. Further, intervening variables of distance from park, seasonality and the types of wild animals determines the types of human-wildlife conflicts and should be resolved by separating people from wildlife found in protected areas like CHNP, and establish laws or legislations to protect wild animals and reduce conflicts. Other moderating variables include institutions for conservation, government policies on mitigation measures, new technology and. levels of rural development, community Support to conservation. All these factors significantly influenced conservation of wildlife in the study area and helps to build research as it was hypothesized that balancing human needs with conservation and development goals can go a long way in promoting co-existence between humans and wildlife as well as tolerance among local communities living adjacent to protected areas

2.9 Conceptual Framework

A conceptual framework refers to a network of inter linkages of variables in a relationship or phenomena under study. It is also a collection of interrelated concepts that

guide research and determine what variables will be measured and relationships to look for. Fig 1 represents the conceptual framework of this study and explains the relationship between independent variables and the dependant variable. An independent variable (also called the "predictor variable") is the variable that cause changes in the dependent variables. An independent variable is presumed to affect the dependent variable. A dependent variable is a variable whose outcome depends on the manipulation of the independent variable. In this study dependent variables included human-wildlife conflicts while independent variables which are the causes of conflicts and are not affected by changes included human population increase, blockage of migratory routes used by animals, land use changes, settlement of people and development of land outside parks which are in conflict with conservation and lead to competition between people and wildlife over resources. Change in the cultures and lifestyle of people also causes the conflicts with wildlife due to lack of benefits from wildlife conservation and inadequate or lack of compensation among others.

Further, changes from nomadic to sedentary land tenure, subdivision of land or fragmentation due to adjudication is affecting conservation and hence accelerating the intensity of conflicts which varies depending on distance from the park, animal species and seasonality. Other factors like government policies to develop the land, new technologies, diverse group interests, perceptions and attitudes, management interventions to resolve conflicts, institutions for management, structures for decision making, laws and legislation. A combination of these factors influences conservation and management of natural resources which in this study is shown by the types and nature of

human- wildlife conflicts and their causes, mitigation measures that are done by both local communities and the government agencies to resolve conflicts in experienced as well as their challenges and limitations. Figure 1 shows the interaction between the foregoing variables.

Human- wildlife Conflicts

Causes

Increase in human population
• Competition for resources
• Poaching
• Injury to wildlife

Intervening variable

• Seasons/dry and wet
• Distance from the park

Dependent Variable

Land use changes adjacent to Protected Areas
• Settlement
• Clearing of habitats
• Fragmentation
• Development of land

Human Wildlife Conflicts
• Migration of wild animals
• Change in culture and lifestyles of people

Type of Wildlife species
• Causing human-wildlife Conflicts (crop damage, livestock **predation**, human death & injury

Wildlife Policy (Legislation)
• Lack of compensation
• Lack of benefits

Perceptions towards wildlife conservation

Moderating variable

Mitigation measures to HWC
• Abandoning of human activities

Figure 1.1: Conceptual framework for the study (Source : Author, 2014)

<div align="center">

CHAPTER THREE

MATERIALS AND METHODS

</div>

3.1 Introduction

This chapter describes the study area, research design, target population, sampling

procedures and sample selection, data collection methods and data analysis and

presentation procedures.

3.2 Study Area

3.2.1 Location and size

(MAP OF KENYA SHOWING STUDY AREA)
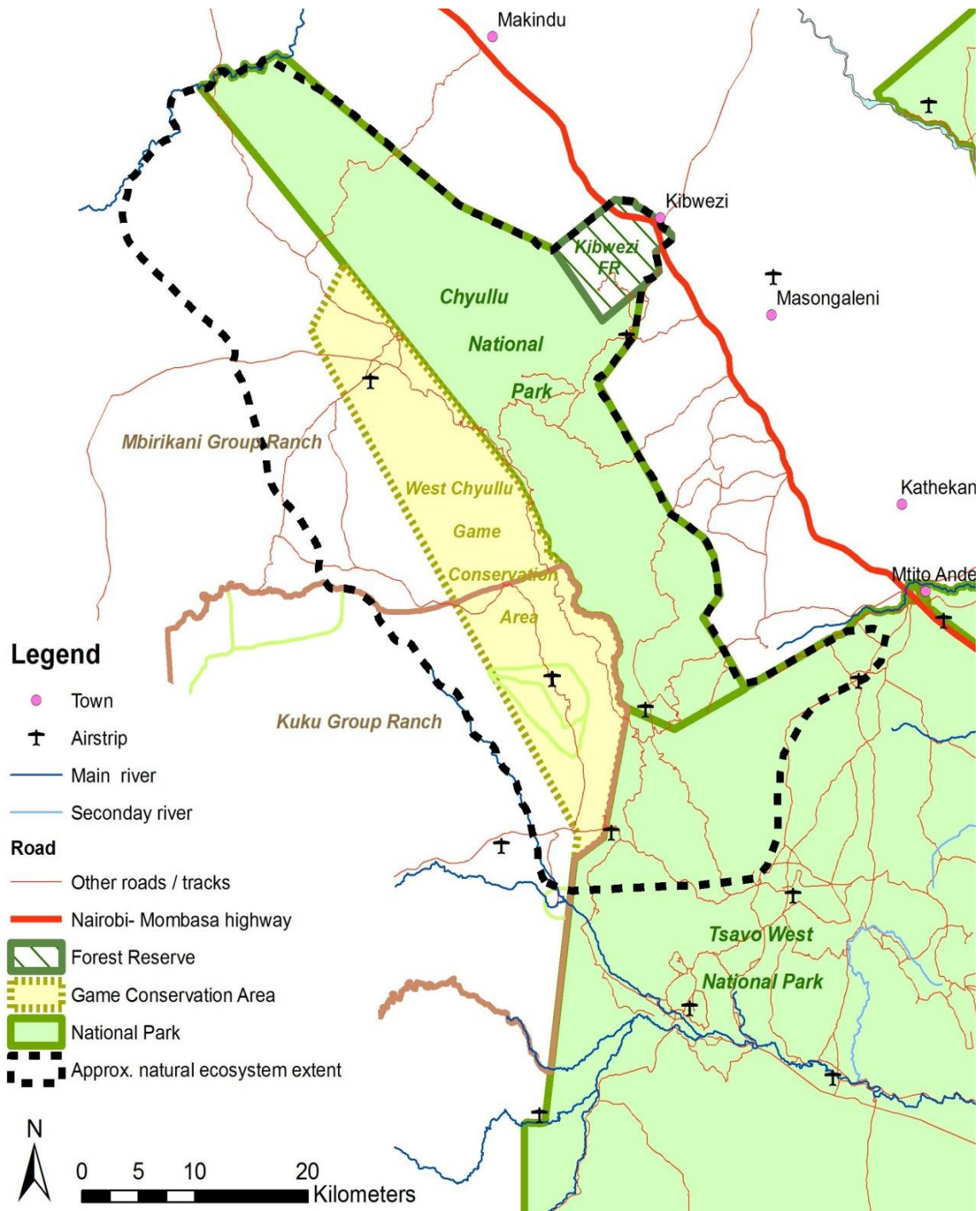
Figure 3.1: Map of the Study Area (Adapted from KWS, 2014)

The study was carried out in the settlement areas surrounding Chyulu Hills National Park in Makueni and Kajiado Counties of Kenya. Makueni County had six administrative locations namely Ngummo and Makindu in Makindu District, Kiboko and Utithi in Kibwezi District, Nzambani and Nthongoni in Mtito Adei District which borders CHNP. Kajiado County had four locations that border the park namely Kimana, Rombo, Mbirikani and Iltilal (Table 1)

The area is semi-arid and is dominated by agro-pastoral communities. Unlike Makueni County, Kajiado County has group ranches that are important dispersal area for the Tsavo- Amboseli migratory corridor (Okello, 2005). The government is encouraging the people to settle on the land hence tenure is changing from group ranches to individual holdings. As a result, communal lands are being subdivided and registered members are being issued with title deeds. The average land holding in Makueni area is between 2-5 acres per household (Kenya National Bureau of Statistics, 2010). Most of the people live below poverty line, and as a result, they greatly rely on natural resources to improve their livelihood which affects their activities and conservation (Personal communication, Warden-CHNP 2012)

According to the 2009 population census, the population of the study area was 1,046,536 people. Makueni District had 771,544 People and Kajiado 274,992 people (Kenya National Bureau of Statistics, 2010). The population is rapidly increasing at a high rate because of the migration of people to these areas due to availability of land for agriculture and other activities. Generally the availability of water has greatly influenced

the expansion of human settlement in the areas. Further, subdivision of group ranches has opened the area to rapid expansion of human settlement because of promoting wider grazing areas for the livestock on individual farms. Farming activities are practiced in small scale by individuals in Makueni County with an average of 2.5 acres while in Kajiado land holding is still large. At the same time, the number of small scale farms has increased near rivers because of people using irrigation. These areas attract wildlife in search of pastures and water, and this has also contributed to conflicts.

3.2.2 Topography

The altitude of Chyulu hills is 7,177 meters above sea level and influences the climate in surrounding areas. Rainfall is fairly reliable, especially on the mountainous areas and very erratic in the lowlands due to global climatic change. The altitude varies from 1600m -7177m above sea level. The major crops grown are maize, beans, cowpeas, pigeon peas, sorghum, millet, cassava, grafted mangoes and oranges. The area is inhabited by the Kamba community in Makueni County and the Maasai communities in Kajiado County while other less dominant communities of Kikuyu, Chaggas, Kisii and Somalis among others are also settle there.

3.2.3 Drainage and soils

The study area has a few perennial rivers such as Thange, Kiboko and Kiumbi which drain into River Athi. The Chyulu range consists of volcanic ashes and much of rain water percolates down through the porous volcanic soils of the 80km-long Chyulu hills, to emerge at the Mzima springs some 20km south of Chyulu hills. The springs drain into Tsavo and Athi Rivers. (Okello, 2005). The soils are generally black cotton soils and sandy clay. Sandy clay soils are easily eroded and leached in the southern district of Kibwezi, Makindu and Mutito Andei.

3.2.4 Climate

The area receives an average rainfall of 200-1000mm per year, which is bimodal with the short rains occurring in the months of October-December and long rains in March-May (Wishitemi *et al.,* 2007).

3.2.5 Demographic and Settlement characteristic

In 2009, Makueni County had a population 771, 544 people with Mutitu Andei, having a population of 66,663, Makindu 50,299 and Kibwezi, 80,236 people. Kajiado south District in Kajiado County had a population of 274,992 people (Kenya National Bureau of Statistics, 2010).While the Masaai community dominates the western side, Kamba communities inhabit the eastern side of Chyulu hills. Like in many African communities, the patterns of economic activities of the Kamba are highly tied to their sedentary agricultural activities which have been established in the lower flanks of Chyulu hills, while the Maasai community still mainly practices pastoralism, though a few are adopting agropastoralism. Although the majority of the people in Kajiado County are pastoralists, the population of livestock has been fluctuating in response to rainfall and drought patterns.

3.3 Research Design

Descriptive research design was used to guide this study. This study design is a scientific method which involves observing and describing the behavior of a subject without influencing it in any way. The design is also used to describe systematically a situation, problem, phenomenon, service or programme by providing information on what is in existence in respect to conditions or variables that are found in a given situation to determine the what, how and why of the study (Kothari, 2004).

This study adopted the descriptive survey research design which helped to generate data on variables contributing either negatively or positively towards human wildlife conflict. The design was appropriate for the study because it shade light on variables like, types, causes of HWC, land use changes, mitigation measures implemented that contribute positively or negatively to human wildlife conflict. Further, it enabled the researcher to undertake a breadth of observation on the phenomena under study. Secondly, the design provided for accurate descriptive analysis of the characteristics of a sample which can then be used to make inferences about populations (Kothari, 2004).

However the research design had disadvantages since the sociological and sample surveys conducted could not provide long-term solutions to sociological problems and issues pertaining to the study as well as the inability to obtain information not known by respondents, and where respondents avoid questions that check on their honesty. However, before the interviews respondents were informed the importance of research and confidentiality of information given to assure them.

3.4 Target Population

The target population constituted of people living in villages adjacent to CHNP since these are the human-wildlife conflict hot spot areas, and staff from KWS and other conservation organizations involved in wildlife conservation and management as well as mitigation of HWCs in the study area.

3.5 Sampling procedures and sample selection

The administrative locations bordering CHNP from Makueni and Kajiado Counties were selected and used as sampling units, while households were used as the units of analysis. According to the 2009 population and housing census, the population in the study area was 1,046,536 people (Kenya National Bureau of Statistics, 2010). The sampling frame was composed of the lists of households in the locations sampled from the two Counties. Random sampling was adopted to ensure that the population in each location got equal representation without biasness. Only households within villages close to the park were randomly selected. The topographical map of the study area was used to guide in the identification of households sampled from each location. The population size per location was used to guide in selecting the sample proportional to each location.

To select the representative sample for each location, numbers corresponding to the names of heads of household were written on papers and samples drawn randomly. The numbers drawn for every location were used to make separate lists that were cross checked with the original lists. The corresponding names on the lists were written against the numbers of the prepared lists and the indentified names of household heads or their representatives interviewed. The proportion of the sample selected within the locations was based on the population found in each. A total of 149 respondents from the six locations was randomly selected and interviewed. Where a respondent selected for interview in a sampling unit refused to be interviewed, a second visit was made to ensure that the interview was held.

Heads of households chosen for interviews in this study were in most cases male household heads or the oldest male as documented by Kathuri and Pals (1993).In households where there were no males, a wife to the head of the household or the oldest female was interviewed. Five community representatives and local chiefs guided the researcher and his team in identifying the selected households. The 149 households selected were considered a representative sample size since they were drawn from a heterogeneous population and gave varied responses in line with what Mugenda and Mugenda, (1999) have documented. Of those 73.3% were from Makueni while 26.7% were from Kajiado counties. A sample of 149 was used for the study. Fraenkel and Wallen (2000) and Kathuri and Pals (1993) recommend a minimum sample of 100 respondents for a survey research thus a sample size of 149 respondents was appropriate for this study in order to cater for possible dropouts occasioned by experimental mortality which is a threat to internal validity or refusal by respondents to participate**.** Table 3.1 gives a breakdown of the sample selected from the local residents in the study area.

Table 3.1: Distribution of Sample selected

Location	Total households	Sample size	% households per location
Ngummo	5774	26	17.4
Makindu	5797	26	17.4
Kiboko	2434	11	7.4
Uthithi	4385	18	12.1
Nzambani	2741	12	8.1
Nthongoni	3854	16	10.7
Kimana	3650	16	10.7
Robo	2272	10	6.7
Mbirikani	1914	8	5.4
Iltilal	1615	6	4.1
TOTAL	34436	149	100

Source: Adapted from Kenya National Bureau of Statistics (2010)

Makueni and Kajiado Counties had six (6) Administrative locations and four (4) Administrative Locations bordering CHNP respectively. A sample of 149 respondents was appropriate for this study because only households in villages closer to CHNP that experienced HWCs were targeted and not the entire location.

3.6 Data Collection Procedures

Both primary and secondary data were collected. Primary data was collected using the questionnaire, discussions and observations. The researcher administered the questionnaire personally with the help of research assistants. Interviews were held with 20 key informants drawn from KWS, KFS, and personnel from other organizations involved in wildlife conservation and conflict management and resolution in the study area.

3.7 Research Instruments

Prior going for the actual field work, a reconnaissance visit was done by the researcher to know the area, and pilot testing of the questionnaire was done using a sample of 20 respondents to pre-test the questions before the interview (Fraenkel and Wallen 2000).

Pre- testing was done using a random sample of 20 households from Voi District in Taita Taveta County which has the same characteristics with the study area. Structured questionnaires were used to collect primary data from local residents. Questionnaires were found to be more economical, efficient, and practical and allowed the use of a large sample (Fraenkel and Wallen, 2000). Mugenda and Mugenda (1999) pointed out that scoring of questionnaires is straightforward and results lend themselves readily for analysis. An interview schedule was used while interviewing key informants while a focus question guide was used to generate data during focus group discussions.

Preparation of the survey team who included the local interviewers and elders included training the team on how to interview respondents. Although questionnaire questions were in English, they were translated and asked in Kiswahili, Kamba, and Maasai to enhance understanding

3.7.1 Validity of research instruments

To ensure face, construct and content validity of the questionnaire, the supervisors and other experts from the Department of Wildlife Management at University of Eldoret reviewed the contents of the questionnaire. Appropriate adjustments were done to improve the quality and relevance of the items.

3.7.2 Reliability of Research instruments

To ensure consistency of the developed instrument, it was pre-tested using a random sample of 20 households from Voi County since the area has the same characteristics as

the study area. Kathuri and Pals (1993) report that the smallest number for a pre-test that can yield meaningful results is 10. The pre- test was subjected to a reliability test using the Cronbach's alpha coefficient method to eliminate the chance of error and also allow for the determination of inter- item consistency. Fraenkel and Wallen (2000) propose a threshold of 0.7 or higher for an instrument to be accepted as good and reliable. A reliability coefficient of 0.78 was observed. This was within the threshold for reliability testing as proposed by Fraenkel and Wallen 2000, (0.7 or higher) for an instrument to be accepted as good and reliable. Had the coefficient fallen below 0.7 (α=0.7) corrections would have been made before final data collection.

3.8 Data Analysis and Presentation

Data was organized and coded and then entered into the computer for analysis using both descriptive and inferential statistics. The Statistical Package for Social Sciences (SPSS, version18) was used to facilitate the processing and analysis of data process and analyze the data. Frequencies, percentages and standard deviations were calculated while the Chi square test was used on selected variables and results either accepted or rejected at 0.05 level of significance. Results on these are presented using tables, charts and qualitative descriptions. Hypothesis testing was done using the chi squire goodness of fit test and results tested at the 0.05 level of significance. If the p-value is greater than the alpha value, the null hypothesis is rejected and vice versa. To empirically ascertain the implications of human-wildlife conflicts on wildlife conservation and management in the study area two hypotheses were formulated and tested at 0.05 level of significance.

3.9 Ethical Considerations

The researcher used a letter of approval from the Graduate School, University of Eldoret (Formerly Chepkoilel University College) and a research permit from the Ministry of Higher Education, Science and Technology to seek assistance and cooperation from Kenya Wildlife Service and the provincial administration.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents results obtained from the questionnaire survey, interviews, discussions and other participatory research methods. Results presented cover types, causes, and impacts of human-wildlife conflicts and their implications on conservation and mitigation measures indentified.

4.2 Socio-demographic characteristics of Respondents

More than one third (36.7%) of the respondents were aged 31-41 years, 36.7% had attained secondary education 39.5%, had farm sizes ranging from 0.1- 5 acres and 38.1% resided between 5.0- 10.0 km from the park boundary. Socio-demographic characteristics of the respondents helped to show how age of the respondents, education, farm size and distance from park influenced them on reporting incidences of HWCs, adopting new methods on mitigation measures and sharing of information among themselves together with other stakeholders. Table 4.1 gives a summary of results on respondents socio-demographic characteristics.

Table 4.1: Socio-demographic characteristics of respondents

Variable	Responses	Frequency	Percentage
Age	Less than 30 years	24	16.1
	31-40 years	55	36.9
	41-50 years	43	28.9
	51-60 years	16	10.7
	More than 60 years	12	7.4
Total		150	100
Education Level	No education	28	18.8
	Primary	47	31.8
	Secondary	55	37.2
	Tertiary(college, university)	19	12.2
Total		150	100
Farm Size	0.1-5acres	59	39.6
	5-20 acres	49	32.9
	20-40 acres	16	10.7
	40-60 acres	7	4.7
	60-100 acres	4	2.7
	More than 100 acres	14	9.4
Total		150	100
Distance of farm from CHNP	Less than 1km	28	17.8
	1-4	54	36.2
	5-7	40	27.8
	8-10	14	9.3
	11-13	9	6.3
	14-16	2	1.3
	Over 17 km	2	1.3
Total		150	100

4.3 Problematic wild animals in the study area

Majority of respondents (70%) reported that elephants were the most destructive animals. They destroyed crops and properties and also posed threats to human life. Problems caused by hyenas ranked second (46.3%), while monkeys and baboons ranked third (37%) and were mainly experienced in Makindu, Nguumo, Nzambani, and Uthithi locations in Makueni County and Rombo location in Kajiado County. Respondents from

Makueni also experienced the problem of bush pigs (2.4%) destroying crops. The problem of leopards was experienced in Mbirikani by 13.3% and Kimana location by 10.3% of the respondents. The same problem was also experienced in all the locations in Makueni though the percentages were comparatively higher (16.7%) than in Kajiado County (15.1%). The problem of eagles was experienced in all locations as well as that arising from snake bites. (Figure 4.1)
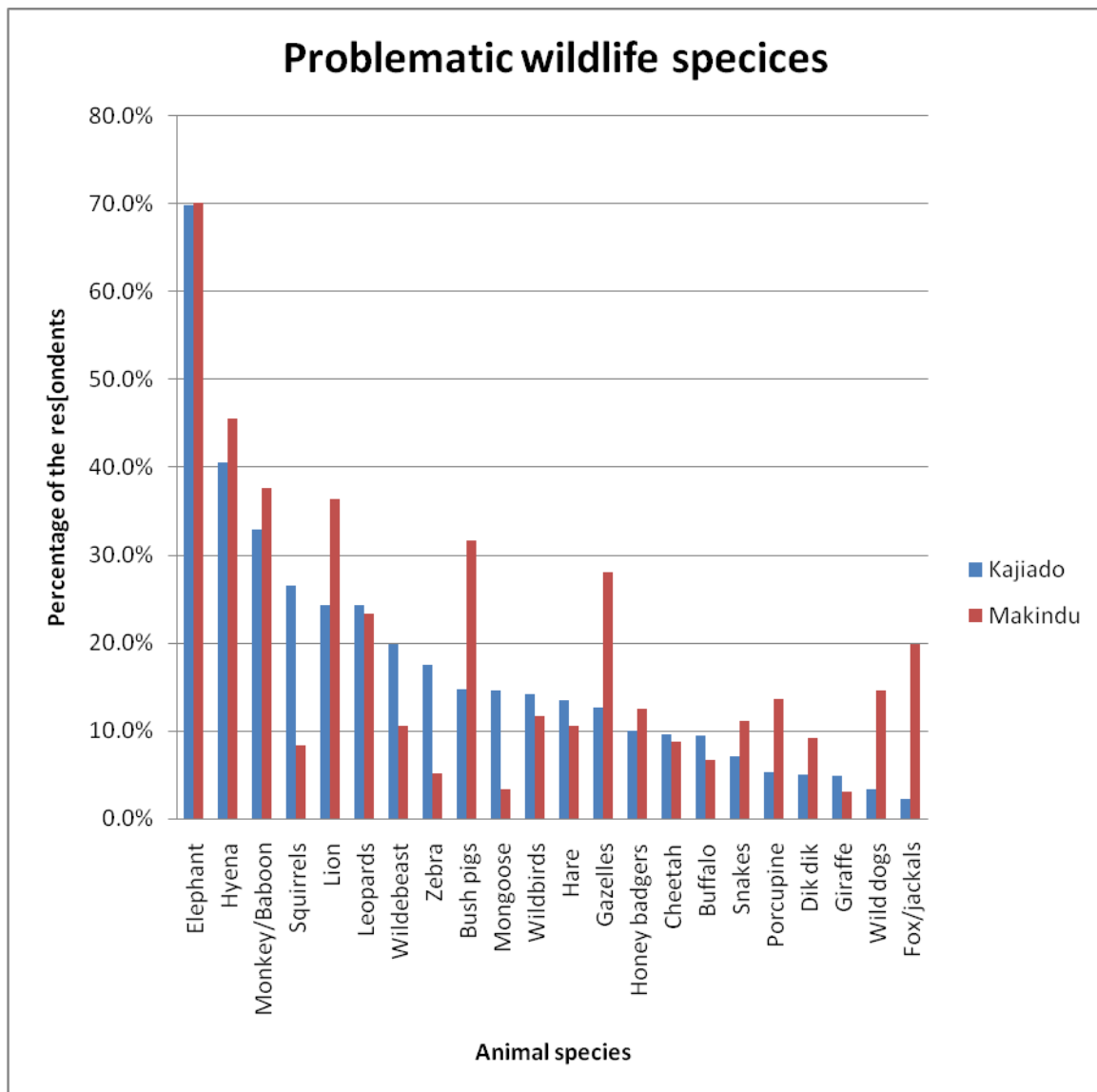
Figure 4.1: Common Problem animals Reported

4.4 Types and nature of Human-wildlife conflicts Experienced

Majority of the respondents (89.3%) reported crop damage as the major problem followed by livestock predation (73.2%), human deaths (65.1 %), injuries from wildlife (65.1%) and threats to human life (63.8%). The foregoing problems have generated conflicts between local communities and the park management. 73.8% of the respondents interviewed reported that destruction of infrastructure was also major problem caused by wildlife outside CHNP.

4.5 Frequency and magnitude of human deaths and injuries by wildlife

Respondents reported that incidences of human deaths and injuries due to wildlife increased outside the park (63.8%), while 32% of the respondents further reported that wild animals threatened their lives and they would not support conservation. The attack on people was reported to KWS as affirmed by 81.9% of respondents. Most of the attacks occurred within the forest or bushy areas outside the park (98 %) and could occur during the day or nights when people were walking on the road or guarding their crops. Majority of the respondents (93.3%) stated that wildlife damage as well as livestock predation and other losses caused by wild animals should be compensated.

A significant number of the respondents (73.2%) reported incidences of livestock predation. The reported predation cases were high in Kajiado County (92.5%) as opposed to Makueni County (66.1%) but there was no significant diference on predation cases in relation to distance (χ^2 = 7.33, df = 5, P = 0.20). This could be attributed to pastoralism being the main activity in the former. Incidences of predation on goats/shoats were highly reported in Kimana location (46.7%) followed by Makindu location (44.4%). In Nthongoni cattle were highly attacked (33.3%) as compared to Chicken (4.2 %.). More

than half of the respondents (55.2%) indicated that incidences of livestock predation had increased over the years (See tables 4.2 and 4.3).

Table 4.2: Livestock attacked by wildlife in locations sampled in the study area

Livestock	Uthithi	Makindu	Nguumo	Mbirikani	Nzambani	Nthongoni	Kimana	Rombo	Itilal	Kiboko
Cattle	5(13.5%)	4(14.8%)	7(16.7%)	6(27.3%)	5(16.1%)	8(33.3%)	3(10%)	6(28.7%)	4(23.5%)	11(32.4%)
Goats	13(35.1%)	12(44.4%)	15(35.7%)	7(31.8%)	9(29%)	10(41.7%)	14(46.7%)	7(33.3%)	6(35.3%)	11(32.4%)
Sheep	10(27%)	1(3.7%)	8(19%)	7(31.8%)	4(12.9%)	5(20.8%)	12(40%)	4(19%)	3(17.6%)	11(32.4%)
Chicken	8(21.7.%)	8(29.7%)	9(21.4%)		11(35.5%)	1(4.2%)	1(3.3%)	2(9.5%)	2(11.8%)	1(2.8%)
Dogs	1(2.7%)	1(3.7%)	-	-	2(6.5%)	-	-	-	-	-
Rabbits	-	-	2(4.8%)	-		-	-	-	-	-
Donkeys	-	1(3.7%)	1(2.4%)	2(9.1%)	-	-	-	2(9.5%)	2(11.8%)	-

Table 4.3: Wild animals that attack livestock

Animal species	Makindu	Nguumo	Mbirikani	Nthongoni	Kiboko	Nzambani	Uthithi	Rombo	Kimana	Itilal
Elephants	1(4%)	3(7.7%)	-	1(5%)	-	-	1(2.4%)	4(18.2%)	-	2(10.5%)
Snakes	4(16%)	2(5.1%)	-	-	2(6.3%)	2(6.8%)	3(7.4%)	-	-	-
Mongoose	2(8%)	6(15.3%)	-	-	-	3(10.4%)	1(2.4%)	-	-	1(5.3%)
Baboons	4(16%)	7(17.9%)	-	6(30%)	-	-	-	7(31.8%)	-	2(10.5%)
Leopards	4(16%)	13(33.4%)	-	3(15%)	11(34.4%)	-	7(17.1%)	4(18.2%)	12(29.3%)	1(5.3%)
Hyenas	2(8%)	4(10.3%)	8(33.3%)	5(25%)	4(12.5%)	9(31%)	17(41.5%)	-	7(17.1%)	4(21.1%)
Wild dogs	-	-	-	-	3(9.4%)		-	-	6(14.6%)	-
Jackal/ fox	-	-	-	-	1(3.1%)	3(10.4%)	-	-	-	-
Eagles	6(24%)	4(10.3%)	-	1(5%)	-	3(10.4%)	6(14.6%)	-	-	1(5.3%)
Lion	1(4%)	-	8(33.3%)	4(20%)	11(34.4%)		-	6(27.3%)	13(31.7%)	6(31.5%)
Cheetah	1(4%)-	-	(33.3%)	-	-	9(31%)	6(14.6%)	-	3(7.3%)	2(10.5%)
Crocodiles	-	-	-	-	-	-	-	1(4.5%)	-	-

Respondents cited different predators that affected their livestock among them hyenas (21.5%) whose attacks were reported in all locations. Livestock killed in all the locations included sheep and goats (36.3%) followed by cattle (21.6%). Although the distribution of livestock attack was random as reported by 21% of respondents, it was rather intense in Mbirikani, Rombo, Kimana and Itilal group ranches of Kajiado County where majority of the people are pastoralists and predators could kill more than one livestock in a boma.

4.6 Crop Damage by Wild Animals

Most of the respondents (89.3%) reported the problem of crop damage by wild animals. Majority of the respondents (74.6%) were from Makueni County as compared to 25.6% in Kajiado County. Most of the respondents (72.8%) were agro- pastoralists. Among them, 98% reported about wild animal invasions on their farms. Crop raiding was reported to occur mainly at night (89.3%). Although crop raiding was done by different types of animals, majority of the respondents (71%) reported the elephant being the most destructive animal. Other wild animal species which raided crops included baboons, squirrels, porcupine, birds, buffalo and gazelles (Table 4.4).

Table 4.4: Wild animals responsible for crop damage

Species	Makindu	Nguumo	Mbirikani	Nthongoni	Kiboko	Nzambani	Rombo	Uthithi	Kimana	Itilal
Elephant	20(45.4%)	22(66.7%)	8(30.8%)	15(57.7%)	7(29.1%)	10(38.6%)	10(43.5%)	18(60%)	3(50%)	6(42.9%)
Squirrel	2(4.5%)	9(27.3%)	-	-	-	2(7.7%)		1(3.3%)	-	-
Baboon	19(43.2%)	-	2(7.7%)	11(42.3%)	10(41.6%)	4(15.4%)	6(26.1%)	5(16.8%)	2(33.3%)	1(7.1%)
Gazelles	1(2.3%)	-	4(15.4%)	-	4(16.7%)	1(3.8%)	4(17.4%)	1(3.3%)	-	1(7.1%)
Dik Diks	1(2.3%)	-	-	-	1(4.2%)	-	-	1(3.3%)	-	-
Wild bird	1(2.3%)	1(3%)	2(7.7%)	-	-	5(19.2%)	-	-	-	1(7.1%)
Hare	-	1(3%)	-	-	-	1(3.8%)	-	1(3.3%)	-	-
Zebras	-	-	4(15.4%)	-	-	-	-	-	1(16.7%)	2(14.3%)
Porcupine	-	-	5(19.2%)	-	1(4.2%)	1(3.8%)	-	-	-	2(14.3%)
Wildbeast	-	-	1(3.8%)	-	1(4.2%)	-	-	-	-	-
Bush pigs	-	-	-	-	-	2(7.7%)	1(4.3%)	3(10%)	-	-
buffaloes	-	-	-	-	-	-	2(8.7%)	-	-	1(7.1%)

Maize crop which was widely cultivated in the study area was reported to be the most affected and damaged crop, with different animals raiding farms at different maturity levels as reported by (89.3%) of respondents. Other crops cultivated and also damaged include beans (9.2%), peas (20%), pumpkins (6.7%), tomatoes (22.4%), sorghum (8.4%), cassava (2.2%), green grams (2.2%) and fruits (16.8%) among others (Table 4.5)

Table 4.5: Crops preferred by animals in percentages

Crops grown	Makindu	Nguumo	Mbirikani	Nthongoni	Kiboko	Nzambani	Uthithi	Rombo	Kimana	Itilal
Maize	18.2%	29.7%	26.7%	36.7%	50%	24.4%	37.8%	35.5%	50%	37.5%
Beans	6.8%	4.7%	6.7%	13.3%	11.1%	4.9%	8.9%	11.8%	-	25%
Peas	6.8%	10.9%	-	26.7%	-	26.8%	28.9%	-	-	-
Pumpkins	-	6.3%	6.7%	-	-	4.9%	8.9%	-	-	-
Bananas	11.5%	9.4%	-	3.3%	-	2.4%	-	5.9%	-	-
Cassava	-	4.7%	-	-	-	9.8%	2.2%	5.9%	-	-
Tomatoes	6.8%	3.1%	26.7%	-	38.9	-	-	23.5%	33.3%	25%
Vegetable	13.6%	-	20%	3.3%	-	-	-	17.6%	-	6.3%
Sorghum	-	--	-	-	-	14.6%	2.2%	-	-	-
Fruits	31.8%	26.6%	-	16.7%	-	2.4%	6.7%	-	-	-
Sugarcane	4.5%	-	-	-	-	-		-	-	-
Sisal	-	4.7%	-	-	-	-		-	-	-
Melons	-	-	13.3%	-	-	2.4%	-	-	16.7%	6.3%
Millets	-	-	-	-	-	7.3%	2.2%	-	-	-
Green grams	-	-	-	-	-	-	2.2%	-	-	-

4.6.1 Encroachment of agriculture into the park

Results showed that farming activities near the CHNP contributed to and also influenced the pattern of human-wildlife conflicts. Majority of respondents in Makueni County (75%) practiced agricultural activities near the park as opposed to 25% from Kajiado County. The land size under cultivation ranged from 1 acre to 10 acres. Farms were cultivated 500 meters from the park boundary thus contributing to the high incidences of conflicts on farms near the park as reported by 76.7% of respondents as compared to farms located far from the park boundary (23.3%)

4.6.2 Types of crops grown and their vulnerability to wildlife raids and destruction

Findings showed that the type of crops grown influenced wild animals' crop raids and preference. Majority of the respondents (89.3%) in the two counties grew maize, beans and peas as the major crops among others. All the respondents reported that all their crops were vulnerable to wild animal attack although preference of crops by different wild animals differed. Maize was however, most preferred crop by elephants (37.5%) followed by tomatoes (22.4%).

4.7 Resource Use Conflicts

Majority of the respondents (77.9%) reported that resource use competition between people and wild animals was a major cause of conflicts while 22.1% alluded to the contrary. Respondents identified water (29 %) and pastures (66 %) as the main resources that are used by people, livestock and wild animals (26.1%). Conflicts among species also occurred due to competition for resources and were high during the dry season due to scarcity of the resources (Table4.6).

Firewood collection from the Park was done by 37.1% of respondents in Rombo, 45.5% in Uthithi and 37.5% in Nthongoni location. Pastures for livestock were obtained by 36.4% of respondents in Rombo, 40% in Nthongoni and 20% in Mbirikani locations. Other respondents reported that they obtained game meat from CHNP as follows; Nthongoni (2.9 %,) Nzambani 2.4% and Uthithi locations (3.6%) The level of obtaining resources from the park, varied among the locations as well as with seasons. Respondents in Kimana and Makindu locations reported obtaining no resources from the park, although resources obtained from the park included wood for carving (4.9%) and building materials such as sand. 44.5% of the respondents reported that conflicts were high during the dry seasons. The dry season is experienced between June and October, and between January to February and June to September. The later are the driest months.

The warden in charge of CHNP Park reported that livestock incursion occurred during the dry period due to search for pastures. The park management complained about recurrent burning of vegetation in the park during the dry season particularly October and blamed the local communities for setting up the fires intentionally. Other materials obtained from CHNP include building poles (25%), thatching grass (11.4%), fencing posts (25%), building materials such as sand (17.9%), different types of herbal medicines (20%) wild fruits (34%) bush meat (11%) and through trapping of wild animals for commercial and subsistence purposes. Hunting was mainly done during the dry season. Key informants further reported that hunting is done by communities' hunters from neighboring Counties (Table 4.6).

Table 4.6: Resources obtained from Chyulu Hills National Park

Resources	Makindu	Mbirikani	Nthongoni	Kiboko	Nzambani	Uthithi	Rombo	Kimana	Itilal	Nguumo
None	26(100%)	-	-	9(81.8%)	-	2(7.1%)	-	16(100%)		21(84%)
Honey	-	3(20%)	-1(2.9%)	-	4(9.8%)	-	-	-	1(5.9%)	3(12%)
Medicinal herbs	-	3(20%)	-	-	1(2.4%)	-	-	-	1(5.9%)	1(4%)
Posts	-	1(6.7%)	1(2.9%)	-	6(14.6%)	7(25%)	-	-	2(11.8%)	-
Pastures	-	5(33.3%)	13(40%)	2(18.2%)	5(12.2%)	2(7.1%)	4(36.4%)	-	8(47.1%)	-
Others benefits vegetables	-	3(20%)	-	-	-	-	-	-	-	-
Stones	-	-	1(2.9%)	-	7(17.1%)	5(17.9%)	1(9.1%)	-	1(5.9%)	-
Firewood	-	-	13(37.1%)	-	9(22%)	8(28.6%)	5(45.4%)	-	3(17.5%)	-
game meat	-	-	1(2.9%)	-	1(2.4%)	1(3.6%)	-	-		-
Thatch grass	-	-	4(11.4%)	-	1(2.4%)	-	-	-		-
Charcoal				-	5(12.2%)	3(10.7%)	-	-	1(5.9%)	-
Carving wood				-	2(4.9%)	-	-	-		-
Sand				-	1(2.4%)	-	1(9.1%)	-		

4.8 Causes of Human- Wildlife Conflicts around CHNP

Human population growth and expansion of settlement and activities accounted for a large percentage (98%) of human- wildlife conflicts experienced. In the last 20 years there has been a high increase in human population in the surroundings of CHNP either through natural population growth and or immigration from other areas. This has in turn led to increase in human activities around the park thus contributing to the increase in human- wildlife conflicts in the area. Most of respondents (65%) live within a distance of 5kms from the park boundary as opposed to 35% who live beyond 5kms away. This proximity to the park has aggravated incidences of human-wildlife conflicts in the study area.

More than half of the respondents (56.4%) reported that the occurrence of human-wildlife conflicts had increased in the study area, 9.4% reported a decrease while 34.2% reported there was no change in incidences. Almost half of the respondents (45.8%) had settled along wildlife migratory routes and animals dispersed to the neighbouring farms and settlements. Other factors that influenced human settlement outside the park were availability of water which had attracted 86.8% of the respondents, majority of whom live within 5 kms from the water points.

4.8.1 Measures adopted by park management to mitigate human-wildlife conflicts

Majority of the respondents (69.1%) indicated that lack of proper mitigation measures by park management contributed to increases in wild animals outside the park and consequently HWCs. According to the park warden the population of wild animals had steadily increased in the park, a fact that was confirmed by majority of the respondents (98%) who reported that the population of wildlife had increased within the study area. Construction of an electric fence near park head quarters coupled with establishment of a Problem Animal Management Unit (PAMU) consisting of well trained personnel with reliable equipments assisted in monitoring the movements of wild animals outside the park for rapid response on cases of wildlife damage thus mitigating human-wildlife conflicts in the study area.

4.8.2 Encroachment on wildlife dispersal areas and migratory routes

Encroachment of people on dispersal areas and wildlife migratory routes in the study area has contributed to human-wildlife conflicts outside CHNP. Although majority of the respondents (90%) had knowledge on the existence of the wildlife migratory corridor, 77.8% of them lived within 5 kms from the migratory corridor, while 82.6% lived within a distance of 5kms from the water point. Table 4.7 shows the distribution of settlements from the migratory corridor.

Table 4.7: Distribution of settlements from the water point and migratory corridor

Distance (Km)	Uthithi	Makindu	Nguumo	Mbirikani	Nzambani	Nthongoni	Kimana	Rombo	Itilal	Kiboko
0 – 5 Kms	11(57.9%)	15(57.7%)	14(53.8%)	3(37.5%)	6(50%)	7(43.8%)	6(37.5%)	3(30%)	2(33.3%)	5(45.4%)
5 – 10 Kms	3(15.8%)	5(19.2%)	7(26.9%)	3(37.5%)	3(25%)	4(25%)	4(25%)	2(20%)	2(33.3%)	3(27.4%)
10 – 15 Kms	3(15.8%)	4(15.4%)	3(11.6%)	1(12.5%)	1(8.3%)	2(12.5%)	4(25%)	3(30%)	1(16.7%)	1(9%)
Over 15 Kms	2(10.5%)	2(7.6%)	2(7.7%)	1(12.5%)	2(16.7%)	3(18.7%)	2(12.5%)	2(20%)	1(16.7%)	2(18.2%)

Availability of resources and infrastructural development comprising of schools, churches, shops and other infrastructure in areas around the park has increased activities undertaken in centers neighboring the park. As a consequence, (63.8%) respondents reported that people were attacked in the afternoons and evenings while returning home from market centers.

4.9 Impacts of Human-Wildlife Conflicts in areas surrounding the park

Majority of the respondents (87.9%) experienced economic losses from wild animals. This included destruction of properties and crop damage by elephants and the buffaloes. Livestock predation by lions, leopards, and hyenas among others, also significantly contributed to the human-wildlife conflicts experienced (Figure 4.2).
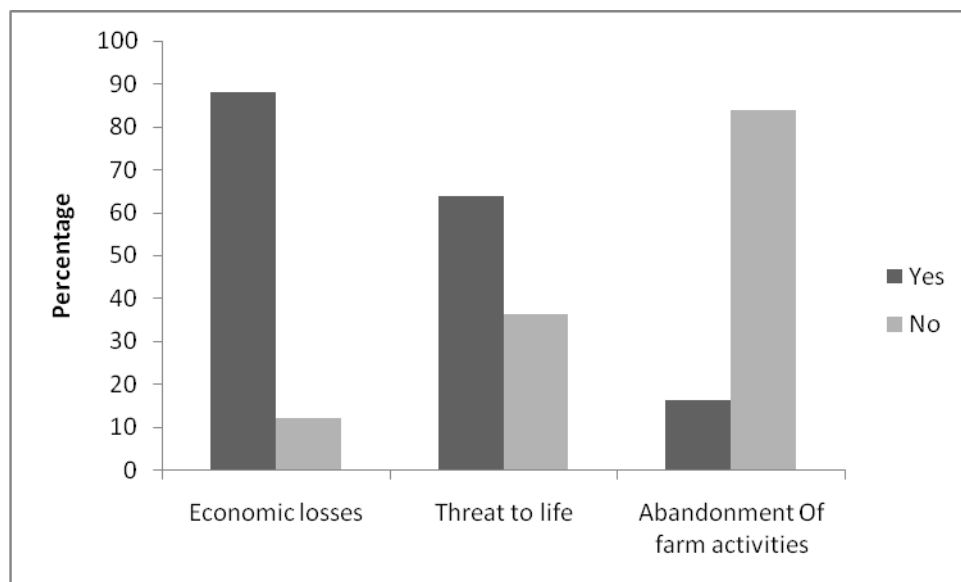
Figure 4.2: Impacts of human-wildlife conflicts around CHNP

34% of the respondents reported that they incurred economic losses of approximately Kshs 10,000 to 30,000 per year from wild animals damage, while 8% reported that they incurred economic losses exceeding Kshs 100,000. (Table 4.8)

Table 4.8: Estimated Economic losses incurred per year in Kshs

	Frequency	*Percentage*
Nil/No- losses	14	9.3
10,000 – 30,000	45	30.2
30,001 – 50,000	25	16.8
50,001 – 70,000	13	8.8
70,001-100,000	16	10.7
<100,000	36	24.2
Total	149	100

4.10 Level of support for wildlife conservation

The study sought to determine whether the respondents were still willing to co-exist with wild animals and support their conservation despite the conflicts. Table 4.9 shows the level of support by the respondents.

Table 4.9: Level of support for wildlife conservation

Level of support	*Frequency*	*Percent*
No support	21	14.1
Little support	17	11.4
Moderate support	36	24.2
Highly support	27	18.1
Very highly supportive	48	32.2
Total	149	100.0

The study revealed that most of the respondents (32.2%) supported conservation efforts despite having been in conflict with wildlife. This could be due to the fact that most of them understood conservation to mean keeping wild animals in parks and reserves with

no wildlife migration outside parks. However, 51.7% of the respondents reported that the park management was overwhelmed by many reported cases of wildlife damage during maize harvesting seasons and therefore, were unable to attend most of them thus causing more conflicts.

4.11 Measures adopted by local communities to mitigate human-wildlife conflicts

Majority of the respondents (95.3%) reported that they used various mitigation measures to mitigate human-wildlife conflicts. Scaring animals by using noise was used by majority of the respondents (74.5%) followed by use of dogs, (73.3%), flash light at night (45.3%) and scarecrows (5.3%). Traps were the least used (1.3 %) while use of electric fences was limited to few areas near the park boundary and therefore majority of the respondents used either barbed wire or chain link to protect wildlife from their properties (Table 4.10).

Table 4.10: Measures used by the local people to mitigate human wildlife conflicts

Mitigation measures used	Frequency*	%*
Making noise	112	75.1
Dogs	110	73.8
Throwing stones	76	51.0
Patrols	73	49.0
Flash light	68	45.6
Making fire	66	44.2
Electric fence	57	38
Scaring	2	1.3
Scare crows	8	5.3
Trapping	2	1.3

* Multiple responses given

4.12. Effectiveness of mitigation measures used

To determine the effectiveness of the mitigation methods used respondents were asked questions on how effective the methods used to mitigate the HWC were. Results are given in figure 4.3. 34.5% of the respondents reported that none of the methods used were effective and therefore several methods were combined in order to achieve better results. In addition, respondents were also asked to give information on the degree of effectiveness on methods adopted to mitigate human-wildlife conflicts. Results are shown below.
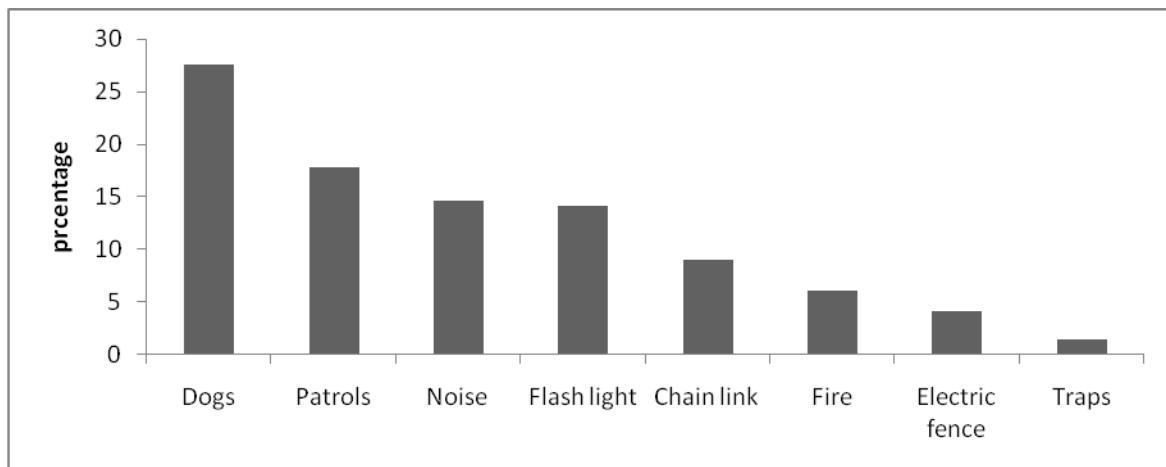
Figure 4.3: Effectiveness of mitigation measures used

4.13 Level of effectiveness of the methods adopted to control wildlife

More than half of respondent (51.7%) reported that the methods adopted to mitigate HWCs were slightly effective in controlling wildlife damage as compared to only 4.1% who felt that the methods were very effective. 4% of respondents contended that the methods used to control wildlife were very effective (Table 4.11)

Table 4.11 Level of effectiveness of methods used to control wildlife

	Frequency	*Percent*
Not applicable	3	2.0
Not effective	50	33.6
Slightly effective	77	51.7
Effective	13	8.7
Very effective	6	4.0
Total	149	100

4.14 Measures proposed to minimize human -wildlife conflicts

Respondents were asked to suggest methods they felt would be effective in mitigating human-wildlife conflicts. Majority of the respondents (76.5%) reported erection of the electric fence around the park as the best option to mitigate human-wildlife conflicts, followed by translocation (17.4%), involvement of the community in revenue sharing (15.4%) and increasing of rangers for patrol at (14.1%) whereas 9.4% suggested killing of problem animals. Others suggested methods which included compensation for wildlife damages (5.4%) and involvement of local people in wildlife management control methods (Table 4.12).

Table 4.12 Suggested measures to minimize HWCs

Suggested measures to mitigate HWCs	*Yes**	*%*	*No**	*%*	*Total%**
Electric fence	114	76.5	35	23.5	100
Translocation	26	17.4	123	82.6	100
Provide water	20	13.4	129	86.6	100
Involve community in Revenue sharing	23	15.4	126	84.6	100
Increase rangers/staff for patrol	21	14.1	128	85.9	100
Patrols/ monitor animal movement	14	9.4	135	90.6	100
Compensation of wildlife damage	8	5.4	141	94.5	100

* Multiple responses given

4.15 Seasonal distribution of wildlife damage

Figure 4.5 presents results about seasonality in wild animal's raids on farms around CHNP. 40.9% of the respondents stated that wildlife damage was high during the dry season as opposed to 34.2% who reported during the wet season while 12.8% reported that damage was high during the harvesting period. 54.4% of the respondents reported that they mitigated human- wildlife conflicts by guarding their farms during the day and night as opposed to day time alone (26.8%) and at night (16.8%). Most of the guarding was done during the early hours of the night and done for approximately 6 – 7 hours. Neighbors teamed up together to guard their farms.
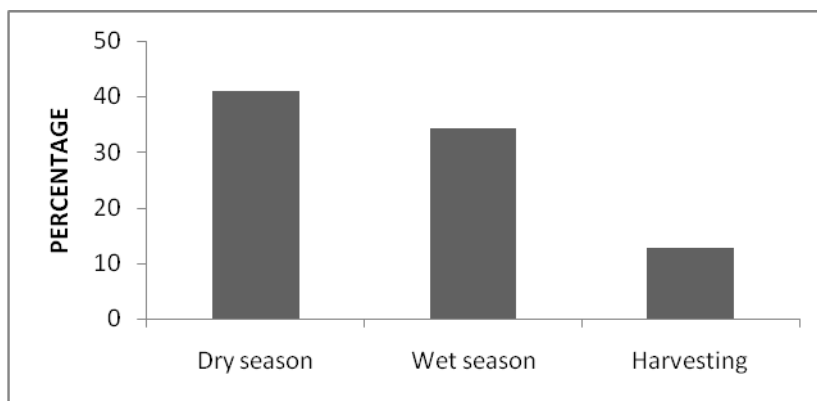
Figure 4.4: Seasonal distribution of wildlife damage

4.16 Analysis Results
4.16. Hypothesis

Chi square results on relationship between impacts of human-wildlife conflicts and support for wildlife conservation revealed that there was a significant relationship between the level of impacts of wildlife conflicts and the level of support for wildlife conservation with those bearing higher impact of conflicts supporting conservation more

(χ^2 = 37.04, df = 12, $P <$ 0.0001. This could be because they supported protection of wild animal movements from the parks to minimize damage or conflicts.

Results of this study found that there was a significant relationship between the level of impacts on wildlife conflicts and the level of support for wildlife conservation. As a result, communities bearing higher impact of conflicts supported conservation more which according to them meant that park management restrict or control movements of wild animal from the parks.

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This chapter discusses study findings guided by the objectives of the study. The discussion is enriched with citations from past studies to show if study findings concur with them. Many authors have documented incidences of human- wildlife conflicts, although they have tended to concentrate more on the perceptions of the people, but giving little emphasis on the types and extent of HWC, causal factors and effectiveness of measures used to mitigate the conflicts. This study examined the occurrences of HWC in areas surrounding CHNP using diverse data collection methods.

5.2 Socio demographic Characteristics and their implications on HWCs

Wildlife conservation outside the park is affected by HWCs and requires protection due to increased human activities in wildlife habitats, high poverty levels, development of land, political instability, development of infrastructure such as roads in wildlife habitats and requires to plan for strategies to prevent conflicts. A discussion on key socio demographic characteristics investigated and their impact on local peoples attitudes and perceptions towards and involvement in mitigating HWCs on this study consisted of 149 respondents randomly sampled from ten locations of Makueni and Kajiado counties.

Age of an individual is known to influence on decisions made in relation to respondents' perceptions and attitudes towards conservation. Age also plays a major role in determining people's involvement in conflict resolution activities since it determines the

experience acquired in mitigation measures and technologies. Further, age of an individual is also known to influence decisions that underline the empowerment process in reporting HWCs cases such as problem animals to wildlife authorities, encroaching on protected areas, harvesting of resources from the park. In addition, age also influences the types of role played by the individual in leadership and conflict resolution functions. Despite this older people are less inclined to adopt new innovations as compared to younger people who readily share information on innovative mitigation measures and use of modern technologies in reporting human wildlife conflicts. Hence younger people because of exposure to various sources of information on conventional methods of mitigating HWCs are willing to adapt such measures compared to the older generation who are generally conservative.

The education level was considered important because it determines how someone acquires, synthesis and interprets information and understands issues pertaining to decisions on use of land for economic purposes, subdivision of group ranches and individualism, wildlife conservation, information on benefit sharing and HWC mitigation measures among others. In addition, education is instrumental in sourcing for new technologies, forming social networks, and entering in contractual agreements that contribute towards people's empowerment. In the study area, better educated communities were more likely to adopt new technologies and seek extension services and report incidences of wildlife conflict to wildlife authorities. There is therefore a link between a respondent's education level, acquisition and use of appropriate information in making informed choices and decisions about mitigating HWCs.

More than one third of the respondents had a farm size of less than 5.0 acres. This is in conformity with the findings published in Kenya's 2009 population report that reported the average land holding for Makueni County to be less than 5 acres per household, while in Kajiado County the average land size was higher since the majority of people were pastoralists. The size of land as an economic asset is linked to production level and by extension to a household's food security status. In the study area, land size was linked to high population densities, incompatible land use activites and human wildlife conflicts. Study findings showed that due to population pressure, coupled with declining farm sizes, residents in Makueni and agricultural areas of Kajiado County had invaded the park thus encroaching on wildlife habitats. This exacerbated HWCs issues.

5.3 Types and Nature of Human-Wildlife Conflicts

Results showed that there are various types of HWCs experienced in areas surrounding CHNP. It was also evident that HWCs have intensified in recent years. These conflicts are due to increases in human activities such as crop and livestock farming and settlement in areas adjacent to CHNP. Other factors that have either directly or indirectly contributed to the occurrence of HWCs include types of crops grown, seasonal changes and distance from the park boundary. Most of the conflicts experienced were reported to KWS. The aforementioned is consistent with what is documented in other studies like in Sitati[s] (2003), who reported that most HWCs occurred more intensively in Transmara District Kenya, where maize farming was done closer to forests and farmers could not tolerate invading wild animals.

5.3.1 Crop damage

Maize was the most affected crop because it was widely cultivated in the study area and was damaged by different animals at different maturity levels. Sakuma *et al.,*(1988) reported that in India elephants invaded maize crops closer to parks due to their greater nutritive content and palatability. More than half of the respondents interviewed (52%) lived within a radius of 3 kilometers from park boundary. The study revealed that incidents of crop raiding were mostly related to the distance of farms from the park. This was in contrast to what Naughton *et al* (1998) reported about Uganda where incidents of elephant raiding crop around Kibare forest were not related to distance from protected areas.

Throughout the study areas, incidences of crop raiding by wildlife were frequent and widespread. Elephants, baboons, porcupines, gazelles and birds were reported as the major raiders, although temporal differences existed among the various crop raiders.

In comparison to the other important crop raiding wildlife species, elephants and porcupines showed nocturnal behavior since most of their raids occurred at night. Respondents regarded species that raided crops at night a more serious problem than crop raiding during the day since the latter could be easily guarded against. Moreover, the elephant was considered the most destructive and dangerous wild animal due to its massive destruction and the dangers posed when confronted. These results are in agreement with those of Sitati *et al.,* (2005) who observed that Transmara elephant family herds raided farms that were not heavily guarded while the bulls were bolder and mostly involved in crop raiding.

Communities in Makueni County reported crop raiding as a major problem since majorities were farmers. This is in contrast with majority of the respondents in Kajiado county who perceived crop raiding as a less serious conflict because most of them were pastoralists, and most crop raiding losses were experienced by few respondents that farmed using irrigation along the few seasonal rivers. In a study by Smith and Kasiki (1999) it has been reported that areas adjacent to Tsavo National Park ranked baboons as the most problematic crop raiders. KWS, (1994) alluded to wild pigs as the most destructive species during crop raiding, while primates were reported to be frequent raiders. Results of the current study had similarities with the foregoing studies as well as those of Ngene (2009) and O'connell Rodwel *et al.,* (2000) who contended that in Marsabit National Park elephants caused the greatest damage in a single attack and were the most feared because of the difficulty in stopping them and the dangers posed.

Field observations coupled with informal discussions with area residents revealed high poverty levels and therefore crop raiding by wildlife could not be tolerated. Few respondents did not report incidences of crop damage to the nearby KWS personnel due to their perceived failure to respond timely to crop raiding reports. This has lead local people's hostility towards wild animals because other than being dangerous crop raiding pests, wild animals were perceived to have no economic value to the respondents. In addition, in Makueni County many farms were destroyed near the park as only a small section of the park was protected by an electric fence constructed near the park headquarters. Despite reports on the effectiveness of the electric fence in controlling crop raiding, most farmers could not adopt the method due to high costs involved in erecting

and maintenance of the fence. Those findings concur with those documented in literature by Smith (1999); Thouless (1994) and Tchamba (1995) that erection of electric fence was the best solution to solve HWCs. Despite the forestated success uses of electric fences was limited by the prohibitive high costs of construction as well as maintenance. Similarly, Thouless and Sakwa (1995) also suggested that Lake Nakuru National park was entirely fenced off by electric fence that was highly effective though it was creating barriers to wildlife migration.

In spite of the high intensity of crop raiding, most of the respondents who lived near the park boundary were not willing to abandon farming on their farms. More than half of the respondents harvested their crops early to reduce crop raiding. However, unlike in Makueni County, only few farmers in Kajiado County had abandoned farming due to widespread crop raiding. Others reduced farm sizes under cultivation to limit heavy economic losses. The average size of farm lands in Makueni County were low with most of the farmers doing subsistence farming of maize, beans, peas, pumpkins and cow peas among others. Crop raiding was high in isolated farms because wild animals could take cover in nearby thickets, bushes and unkempt hedges or abandoned farms.

Several authors among them Hoare, (2000) attest to the foregoing finding and argue that many isolated farms in Central Africa were vulnerable to raiding due to extensive fallow and secondary vegetation between farms. Other factors that may have led to farm abandonment in the study area could be due to improper farming practices leading to soil erosion, lack of crop rotation or use of fertilizers all of which have led to decline in

productivity. As a consequence, some respondents turned to harvesting park resources for domestic use and sale, and this has contributed to HWCs in the study area.

5.3.2 Human death and injuries

Results showed that most of the respondents reported that wild animals were a threat to human lives. Interviews with the park warden revealed that there were no clear records on the numbers of people killed or injured by wild animals. However, these incidences were reported to be fewer when compared to other conflicts. In the study area, attacks on humans by wild animals caused significant threats and a lot of hostility towards wildlife conservation. Supporting the foregoing, Thirgood *et al.,* (2005) alluded that in all the communities their study targeted, death of people and/or injuries by wild animals were the most significant type of HWC since they brought emotions that were critical to determining levels of tolerance towards wildlife.

Human death and injury caused by wild animals' results in public outcry than human death caused by other accidents. Sukumar (1991) alleged that besides emotional and public outcry, human death evokes other consequences such as political activities. In the study area majority of the respondents reported that elephants and buffaloes were the most feared animals followed by lions, and snakes among the reptiles. This study findings are similar to what Dickman (2008) found in India about elephants which either killed or injured many people when they competed with humans for natural resources.

Results revealed that although attacks on people occurred throughout the year, they were generally high during dry seasons. Hence as Dickman (2008) argued, because of lack of appropriate solutions to mitigate the problem, more studies are required to investigate

causes of human attacks and reduce the problems in order to promote co-existence between people and wildlife.

5.3.3 Livestock predation

Results showed that a significant number of the respondents reported incidences of livestock predation as a major cause of human -wildlife conflicts. Livestock predation in the study area was caused by different animals and accounted for a lot of economic losses. As reported earlier, depredation of livestock was intense in Kajiado County compared to Makueni County. Majority of Kajiado County residents practiced pastoralism activities as opposed to Makueni County. The foregoing finding is similar to findings of Dickman (2008) who reported that   livestock predation was a major cause of human-wildlife conflicts in protected area environments.

Globally the aforementioned problem is widely spread and is caused by different species. For example the puma in Brazil, lynx in France, and tiger in India cause a lot of conflicts. Livestock predation causes a decline in livestock numbers thus causing a lot of economic losses to the owners since many domestic stock are killed causing hostility towards predators. In the study area, people were hostile to carnivores and could not tolerate the predators. As a result, they protested by killing the predators to reduce their population. Interviews with the park warden revealed that large carnivore species had experienced major declines in the study area due to retaliatory killings.

 Although most farmers do not report such killings, many predators were killed using poisoned arrows. This finding is similar to what Woodroffe *et al* (2005b) reported about in Northern Kenya where Samburu communities killed predators outside protected areas to

protect their livestock. Dickman (2008) reported that in India local people could not tolerate snow leopards due to frequent livestock attacks and reacted by killing the predators. Just like in India, communities in the study area had a strong social value for livestock which are viewed as source of wealth and social status. As a result, majority of the respondents were happy with the killing of predators or their removal from their area. This finding concurs with what Dickman (2008) reported by alluding that traditionally the Buddhist communities in the Himalayas India celebrated when woof pups were killed for killing their livestock. In their study Ogada *et al* (2004) further report that perceived or real threat to livestock was the driving force for the widespread removal of cheetahs in ranches in Kenya.

In the current study area the level of livestock depredation greatly influenced the attitudes and perceptions local residents had towards carnivores. Lions were the most feared predators followed by hyenas and cheetahs. Lions mostly attacked cattle at night whereas hyenas almost exclusively took smaller sheep and goats. More of than half of the respondents reported that the level of predation was high during dry seasons compared to the wet seasons.

Most respondents in Kajiado County reported that predation was high due to an increase in wild animals outside the park. Respondents further reported that they killed predators to protect their livestock. As a result, different methods including snaring, spearing, use of poison and killing the younger ones were highlighted as methods used to control predators. The warden of CHNP reported that due to threats and indiscriminate killing of predators and other wild animals, the population of predators in the study area had

declined in recent years. CHNP management was unable to protect cases of livestock inside the park. This is because most pastoralists invaded the park during the dry season, and since the park is expansive predators either kill livestock or migrate to other areas where they predate on livestock outside parks. In addition, since majority of the people settled near the park are not protected by an electric fence they are easily attacked together with their livestock. Predators also attack the herders. The foregoing results collaborate with those documented by Dickman(2008) who alludes that snow leopards in a Nepalise village in India killed many livestock in a single attack and also attacked herders. Further, Woodroffe *et al* (2005a) reported that in Northern Kenya's Samburu District herders used dogs to provide early warning on predator attacks.

The attacks on livestock were reported to KWS and NGOs operating in the area so that they could compensate local people especially in Kajiado County. Besides this, herders were encouraged to protect livestock by constructing bomas or kraals made of thick thorn closures and also gave more protection to livestock. Even though the number of predation cases was high, the management of the park could not establish the population of predators within and around the park probably due to lack of census, while on the other hand the actual number of livestock attacked by wildlife could not be established due to failure by residents to report some of the incidences. The attacks were high during the night as compared to daytime since there was limited protection during the night. These findings concur with those of Patterson *et al* (2004) who found the same in ranches adjacent to Tsavo National Park. In CHNP area, while lions, spotted hyenas and cheetahs

were responsible for attacks, occasionally, elephants killed livestock mostly cattle and the hyena attacked sheep, goats and young calves.

In virtually all the foregoing cases people were protecting livestock by monitoring their grazing during the day and defending their bomas/kraals at night using vigilant groups. Those doing the protection were armed with spears, knives or lighting fire. Most attacks however, occurred at night due to poor visibility, inadequate protection by night guards who could fall asleep. Consequently, predators like the cheetah, lions and hyenas could kill many livestock in a boma at night. Predators attacked animals they preferred, and most attacks occurred during the dry season and migration of wild animals while searching for water and foliage. Predators such as hyenas also scavenged on animals that had died of other causes. Scavenger birds such as vultures among others also fed on carcasses of dead animals. In most cases, predators were easily detected by observing their habitats and signs such as footmarks. It was also evident during the study that even domestic animals such as dogs killed young sheep, chicken and other small domestic stock in homesteads.

Personal communication with CHNP warden confirmed that although local communities used poison to kill predators, only few cases were reported. Unlike other areas in Kenya compensation for losses on livestock was done by conservation NGOs in Kajiado County as opposed to Makueni County which lacked such organizations. CHNP Warden confirmed that compensation funds were given by NGOs to deter the people from killing the predators. The foregoing findings concur with those documented by Woodroff *et al.,*

(2004) that pastoralists in northern Kenya were not compensated for livestock predation and therefore had no financial incentive to report their losses.

5.3.4 Resource use conflicts

Majority of the respondents reported that they obtained resources from Chyulu Hills National Park. These resources ranged from firewood, pastures for livestock, game meat, and wood for carving and, building materials among others. The level of obtained resources varied among locations sampled as well as with seasons. Like other protected areas, Chyulu Hills National Park and its wildlife face a lot of threats from people living adjacent to it as well as their activities. These include a decrease in wild animals thus affecting the ecological balance, encroachment on the park and poaching among others.

Protected areas in Kenya cover approximately 8% (KWS, 1994) of the total land and are threatened by people who look at them as a source of income. Unfortunately these people lack sustainable utilization practices while on the other hand, the management of the park had insufficient or no management capabilities due to inadequate funding. Field observations revealed CHNP had not succeeded in reducing these activities because its boundaries are neither demarcated nor effectively protected. The challenges faced by CHNP are like those faced by Queen Elizabeth National Park in Uganda which lacked the capacity to restrict local communities living around it and who greatly depend on its resources for survival.

In Uganda, Naughton–Treves (2005) reported that majority of communities living around protected areas in rural Africa are struggling with several problems such as high population growth, numerous tropical infectious diseases, extreme poverty and

environmental degradation. As a result these communities require basic resources such as game meat, fish and firewood which are found in protected areas to meet their subsistence needs. The techniques of acquiring these resources are often unsustainable and contravene protected area regulations. The outcome is resistance against conservation programs and resentment against implementation of policies often leading to reduced support and participation in its programs. These therefore calls for more proactive sustainable approaches that can enhance local people's participation in sustainable wildlife management with a view to reconciling and harmonizing human needs with conservation and development goals Naughton–Treves (2001). In addition, wild animals competed with livestock for water and pastures both inside and outside the park. The forestated was most severe during dry seasons when wild animals migrated from park hence causing conflicts with people. Further, obtaining resources from the park also contributed to conflict as people encountered wild animals.

5.4 Causes of human- wildlife conflicts

Various authors have documented causes of HWC (Sitati, 2003; Sitati *et al.,* 2005; Hoare, 1999a) and pointed out that factors causing HWC are diverse and include settlement of people in wildlife habitats, land use changes and increase in wildlife population.

5.4.1 Human population and settlement of people within and around protected areas

The subdivision of group ranches accelerated settlements of people within the study area and was occasioned by change of cultures from communal to individualism, increased sedentarization, expansion of human settlements and intensification and diversification of land use in wildlife habitats, migration of agricultural communities to pastoral lands, fragmentation of wildlife habitats and the increased interface between people with

wildlife leading to the intensification of HWC outside the park. The subdivision of group ranches has further intensified conflicts because many land owners have moved to occupy the allocated land on receiving the title deeds. The subdivision of land may therefore be a key factor that has contributed to the expansion of human settlement and encroachment on CHNP. Those settlements have intensified HWC by blocking wildlife migratory corridors and led to further rapid destruction of habitats due to clearing of the land. These findings were similar to past findings on the same by Thouless (1995) that increased migration of people as well as settlements in Laikipia District in Northern Kenya contributed to increased human-wildlife conflicts in the areas.

5.4.2 Land use changes

The land outside CHNP was traditionally occupied by the pastoral community with little or no sedentary farming. However, in the recent past the study area has experienced rapid land use changes. These changes which include land subdivision, fragmentation and the expansion of agriculture were more pronounced in Makueni County where large areas were cultivated for subsistence purposes. The farms cultivated lie next to the park and act as the boundary due to clearing of vegetation. Establishing of new settlements continued to open new farms thus encroaching on the park. Along Kiboko and other rivers, as the new farms open there is challenge of potential HWC. As a result areas closer to the park suffered more conflict especially human death and injuries, and killing of wild animals as opposed to further areas. Land use changes further modified the habitats by clearing the vegetations. The developments of trading centers have further contributed to intensifying conflicts as they are associated with high population. Other impacts and consequences of changing land tenure and land use activities on CHNP and its wildlife include blockage

of migration corridors by cultivated farms leading to increased crop damage and losses, interference with movement of animals, and loss of migration corridors.

At the same time, clearing land for logging and various agricultural practices also led to loss of wildlife habitats. The finding concur with those documented in literature by (Kioko and Okello ,2010) that similar impacts are witnessed in other parts of Kenya for example Amboseli ecosystem where land use changes have occurred due to an increase in agricultural activities leading to decline of forests and drainage of swamps. It was however observed that much of the forest in Makueni County had been replaced by exotic trees. In a study by (Okello & Wishitemi,2006) it observed that wildlife in many protected areas are threatened by incompatible land uses such as settlement of people, poaching , destruction of habitats, loss of migration corridors and dispersal areas, and the ever increasing human-wildlife conflicts.

 In the CHNP area, various mitigation measures have been adopted to minimize wildlife damages to properties and loss of human life among them controlling problem animals, compensation for human death and injuries to improve positive attitudes towards conservation and by empowering local communities to manage and benefit from wildlife resources found in communal group ranch dispersal areas. Further, wildlife conservancies were established in order to promote ecotourism activities while ensuring that community wildlife sanctuaries also meet ecological and socio-economic requirements in order to be viable and acceptable to the local communities to enhance their success.

The study further revealed that there were diverse conflicts experienced around CHNP. These conflicts were divided into two broad categories namely conflicts caused by people

to wildlife and those caused by wildlife to people. Majority of the respondents living around CHNP obtain resources illegally from the park and violated park regulations by encroaching on the park, trespassing and burning vegetation inside the park. The impacts of these activities include destruction of wildlife habitats leading to loss of species and decline in wildlife population. The study further revealed that wild animals caused damages such as crop destruction, livestock predation, destruction of infrastructures, and spread of diseases among others outside the park particularly on private lands.

The management of the park blamed local communities for starting the fires intentionally inside the park thus destroying wildlife habitats and forage. This observation concurs with those of Okello and Kioko (2010) who noted that most fires deliberately started during dry seasons when vegetation is relatively dry and combustible often get to the parks and damage ecosystems. In CHNP and its surroundings, fires were started for various reasons such as to divert the deployment of the park personnel, to protect crops, and to stimulate early growth of grass by pastoralists in order to obtain forage for animals before the onset of the rains. Although fire was not used as a management tool by park authorities to control ticks and allow sprout of new vegetation, communities living adjacent to the park lit fire illegally so as to accomplish their traditional pastoralist activities among them burning to enable palatable grass to regenerate for domestic stock to feed on.

5.5 Mitigation of Human-Wildlife Conflict within and around CHNP

Various measures had been adopted by CHNP management to mitigate HWCs experienced within and around the park. These include increased patrols, increased law enforcement and fencing. The strategy employed by the park management is to prevent

illegal use of park resources and the violation of park regulations by local people. This strategy however offers a temporary solution to parks and park resources since people still enter the park at will. The effectiveness of this control method was limited to the ability of park authorities to fund and maintain security patrol operations. Most of the respondents in the study reported that the rangers are unable to cover large areas due to lack of transport and vastness of the park. Likewise, local people are not cooperative and do not report illegal incidences to park authorities. The rangers conducted foot patrols and could take a longer time to cover the entire park. The boundary surveillance unit had few personnel and could not effectively patrol the boundaries since they also had other park activities such as PAC, tourism, security and administration activities to attend to.

Unlike Makueni County, movement to the western side of the park in Kajiado County was difficult because of the rugged terrain and rangers could only access the area by foot due to lack of roads. Law enforcement by the park staff to reduce illegal activities by local people is not very effective due to the small work force of rangers and limited resources such as budgetary allocation and vehicles among other operation gears. This has constrained regular patrols. As a result the number of people violating park regulations is high. These people rely on resources in CHNP both for household use and for sale as is the case of people who live close to the park. Majority of the people in Makueni County argued that there was discrimination in law enforcement as opposed to those from Kajiado County. The number of people arrested for illegal activities and recoveries made in Makueni was much higher compared to Kajiado County. This finding concurred with my findings based on field observations as well as communication with

the warden of CHNP who revealed that destruction was high in Makueni County compared to Kajiado County due to illegal harvesting of wood for curving and charcoal burning commercial purposes among others.

5.5.1 Proposed Conflict mitigation strategies to be adopted in the study area

Respondents proposed various measures that could be adopted to mitigate human-wildlife conflicts among them erecting an electric fence around the entire park, strengthening the PAC unit, compensation and involving local people in the management of the park and wildlife resources. Majority of the respondents (76.5%) indicated that erection of an electric fence was the major solution to mitigating the conflicts. A section of the park had a fence and majority of respondents had the knowledge of its effectiveness. These results deviate from findings of Smith *et al.,* (1999) who reported that the electric fence around Tsavo National Park, in Kenya had no significant effect in mitigating human-elephants conflict in Taita Taveta District since elephants still crossed the fence where it was not effectively maintained, and secondly the elephants had learnt to walk 30kms to the end of fence and cause damage.

In another study, Hoare (1995) found that fencing of small groups of villages was much more successful in Zimbabwe in preventing human-wildlife conflicts. Despite this, it is the researcher's view that fencing the entire park using the electric fence would be an unsuitable solution towards minimizing human-wildlife conflicts around CHNP if wildlife and other biodiversity have to be locked up inside the park when literature reviewed showed that a large portion of Kenyan's biodiversity is found outside protected areas (Sitati, 2005). Further, it has also been noted that inbreeding is common in areas

where wild animals have been locked up in a protected area and this can have disastrous effects on wildlife populations, structure and trends (Ngene, 2009).

The study revealed that construction of CHNP electric fence was funded by donors in collaboration with KWS and local communities. Creation of barriers has been used to resolve conflicts by physically separating people and wild animals from each other (Ngene 2010). A good example is in Kenyan's Aberdare and Lake Nakuru National parks that are surrounded by electric fences aimed at resolving human-wildlife conflicts. Interviews with CHNP warden revealed that the success of electric fences depended on the fence construction and the design or voltage. These study findings concur with those of Thouless *et al.,* (1995) who reported that in Laikipia District of Kenya elephants associate crossing the fences with an unpleasant experience with the physical barrier itself and was enough to discourage them.

The effectiveness of electric fences varies with voltage since fences are designed to target various species. However, fences are expensive to construct and maintain. The use of fences also leads to blockage of migratory routes for animals because the park is isolated from the outside. As a result this usually affects the seasonal behaviors of animals because they are restricted in the park which often disrupts the animal migration patterns and movements. Consequently, Osborn and Parker (2002) have alluded that the management of the park can resolve human-wildlife conflicts by developing a strategy of strengthening problem animal control (PAC) units.

Of the respondents suggested that an increase in rangers would boost patrols to mitigate HWC. The study further showed that CHNP has established a PAC unit and rangers often patrol outside the park to check on animal movements and resolve conflicts. Findings of this study concur with those of Ngure (1993) who reported that Kenya Wildlife Service solved human-elephant conflict by using the Problem Animal Control (PAC) Units which are established in conflict hot spot areas. The effectiveness of this strategy however depends on availability of reliable transport and good infrastructure to enable the PAC personnel reach the affected areas. This result concurs with what Sitati (2003) found and argued that long distances in Transmara District had a negative impact on the effectiveness of the PAC unit since farmers could not report incidences of human-wildlife conflicts to KWS stations.

The management of CHNP reported that respondents in Makueni County made frequent reports on human-wildlife conflicts as opposed to those from Kajiado County. The majority of those who failed to report HWC incidences in the two study areas argued that KWS personnel delayed to respond when cases are reported or an alarm is sounded, lengthy procedures of reporting, inaccessibility of KWS staff and reluctance by respondents to report insignificant damages. This could mean that PAC units are ineffective. In addition majority of the respondents in Kajiado County reported incidences of HWC to other organizations such as the local administration or chiefs and other conservation bodies such as conservancy management and other non-governmental organizations so that they could inform KWS on their behalf. Majority of the respondents were however, aware that other organizations were not mandated to mitigate HWC. This finding concurs with those of Ngene (2009). In Marsabit National Park it was observed

that PAC units are unpopular because they only acted to confirm raids rather than arresting them (Jillo, *et al.,* 2008).

Involvement of local people in the management of wildlife resources and compensation for wildlife related losses were other suggestions to mitigate HWC. Although majority of the respondents were peasants they expected the government to compensate them for losses incurred from wild animals. Unlike in Makueni County, livestock predation in Kajiado County was compensated for by Wildlife conservation organizations such as African Wildlife Fund; (AWF), African Conservation Centre; (ACC), World Wide Fund (WWF) and local NGOs like Mbirikani Save the Lions and Hyena project among others, in collaboration with group ranches. This influenced the feelings of respondents in Makueni County that the government was biased and discriminated in their conservation efforts hence creating more conflicts with the park management.

5.5.2 Challenges faced by CHNP management in mitigating HWC

The management of CHNP had inadequate PAC personnel and limited resources to effectively patrol outside the park at the time of this study and therefore advocated for alternative approaches such as promotion of eco-tourism activities and planning for conservation by involving local communities in order to mitigate conflicts. These results are consistent with those of Gichohi (2005) and Ngene (2009) who argued that PAC units were regarded ineffective by most residents in areas around Kitengela near Nairobi National Park because they were unable to control the lion conflict. They argued that wildlife was regarded highly by the government than people and therefore wanted wildlife to be eliminated from the area. In the study area the feelings of the people were

that wildlife was not useful to them because no benefits accrued from it other than losses incurred, and therefore they felt that wildlife should be eliminated from their area. This argument could have been out of anger following the displacement of people during the establishment of the park.

Informal discussions with the warden revealed that people reacted by killing animals such as lions while other predators were poisoned in Kajiado County to protect livestock. This finding corroborates with those of Smith, (1999) who found that predators were eliminated in retaliatory attacks to reduce predation on livestock outside Tsavo National Park while in Northern Kenya Woodroffe *et al.,* (2005) reported that farmers do not report incidences of livestock depredation and instead resort to killing predators and this has threatened the extinction of wild dogs in the area.

Unlike other major parks in Kenya, CHNP receives a limited number of tourists and therefore does not generate a lot of revenue. KWS on the other hand has not implemented community projects due to lack of sufficient funds. As a result, efforts to engage surrounding communities in conservation activities have not been successful because people are unable to link conservation with area development. Respondents suggested that projects implemented under KWS corporate social responsibility (CSR) were inadequate to compensate for losses incurred by people living adjacent to the park. Consequently, the highest number of HWC cases were from Makueni County as opposed to Kajiado County where communication to the park headquarters (HQS) was poor. This indicated that incidences of reports were related to distance and accessibility to KWS offices. This is consistent with the finding by KWS, (1994) which showed distance from

rangers posts either encouraged the highest number of reports by those nearer or discouraged those far away.

Most respondents walked for long distances to report HWC cases to park headquarters or ranger's posts. Other respondents living far from these areas could contact KWS offices through calling park hotline wireless numbers or through calling individual personnel numbers. Ideally, this is the most convenient method but was expensive and many neighboring areas had poor network coverage. Most respondents contended that they reported HWC cases to local administration and other non-governmental organizations to inform KWS on their behalf. This was done during different meetings or forums where KWS was not represented. HWC was discussed in these meetings because it was a sensitive political issue. Most of respondents reported that KWS was unable to resolve conflicts in affected areas because rangers were only sent to confirm incidences yet in most cases, the damage had already been caused and the animal left. Although KWS and other conservation agencies are implementing conflict mitigation measures, current measures only partially addressed the problem.

PAC units were unable to respond to the demand for their services at the peak of conflicts during crop harvest. Majority of the respondents reported that the strategies employed by KWS to mitigate HWC were slightly effective. This was confirmed during the study because the number of personnel at CHNP was inadequate and the park was not protected by the fence. As a result, majority of the respondents turned to using traditional methods to mitigate HWC by conducting vigilance on their farms using dogs, burning fires around the fields, beating drums, throwing objects on approaching the animals and fencing farms

among others and concurs with the findings of Osborn *et al.,* (2000) that local communities combined various methods to mitigate HWCs though there success depended on personal dedication as well as commitments. Majority of the respondents however reported that the use of traditional methods was effective when combined with other methods supported by the park authorities.

Other challenges reported included limited budgetary allocation by the government to conduct PAC activities such as construction of fences, lack of political support as well as interferences, insufficient or lack of conservation benefits to local people, and negative attitudes towards conservation among others due to lack of education and awareness programmes by wildlife authorities. All these challenges affect the local peoples' support of conservation.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The study concluded that human wildlife conflicts in CHNP and its surroundings are real and worsening. Various types of conflicts were experienced as a result of different wild animals invading the study area during different times of the day, night and seasons, and also varied with distance from the park wildlife conflicts area. The experienced conflicts impacted negatively to both people and wildlife and included crop damage, loss of human lives and injuries, loss of access to legitimate and traditional rights, damage to properties, livestock depredation and threats to livelihoods through disease transmission ,destruction of habitats among others and could not be tolerated by the people.

Conflicts experienced were due to changes in land use which led to the blockage of migratory corridors, introduction of agriculture, expansion of human settlements and diversification of livelihoods both of which lead to fragmentation of habitats. All the forestated were occasioned by the migration of agricultural communities to pastoral lands, increased sedentarization, as well as an increase in the number of wild animals from CHNP migrating into the study area.

The study concluded that impacts of human-wildlife conflicts outside the park contributed negatively to the livelihoods of people as well as conservation because of economic losses incurred and destruction of habitats in areas adjacent to the park. Further, the impacts also led to a decline in forests and drainage of swamps that were replaced by exotic species thus threatening conservation.

The study concluded that, although communities combined several HWC mitigation measures to improve their effectiveness, personal commitment and dedication was required for them to succeed. Further, the strategies employed by the park management such as problem animal control and compensation for human death and injuries offered a temporary solution and depended on the ability of park authorities to fund and maintain security patrol operations. The study concluded CHNP faced various Challenges to mitigate HWCs that included inadequate personnel and resources to effectively patrol outside park, lack of planning for methods to mitigate HWCs , Poaching , limited budgetary allocation by the government to conduct PAC activities such as construction of fences, lack of political support as well as interferences, insufficient or lack of conservation benefits to local people, and negative attitudes towards conservation among others due to lack of education and awareness programmes by wildlife authorities. All these challenges affect the local peoples' support to conservation.

The study concluded that empowerment of the local community could improve their attitudes towards conservation and promote ecotourism activities because communities will benefit from wildlife as a long-term solution. This necessitates and also calls for urgent innovative management intervention by integrating wildlife conservation with human needs and land use activities with a view of fostering the long term viability of CHNP and its wildlife.

6.2 Recommendations
6.2.1 Policy and Management recommendations
A comprehensive land use planning should be adopted to reduce conflicts in CHNP and its surroundings. This will secure wildlife migratory routes while creating distinct buffer

and human use areas to reduce conflict between people and wildlife in the study area. The plan should encourage settlement of people away from wildlife migratory routes and riverine areas. This will reduce overlap between areas of human-wildlife conflicts and wildlife migration areas.

KWS should solicit for funding to erect an electric fence around the entire park as it has shown promising results elsewhere. In addition, communities should be involved in the construction of the fence from the onset. The fence should be complemented by use of other novel and indigenous knowledge based conflict mitigation strategies like moats, thunder flashes, planting crops not palatable to baboons and other animals among others.

KWS should establish a mobile PAC unit with adequate staff and finances for quick response to cases of HWC. Effective wildlife damage control and conducting targeted environmental education can go a long way in changing the communities' negative attitude towards wildlife, the park and wildlife conservation.

The Government of Kenya, tourism investors and NGOs should assist KWS to set up a consolation or insurance fund to compensate the local community for losses incurred from wildlife damage. Similar attempts have been made in Sri Lanka and other Asian countries with varying degrees of success.

The government should encourage local communities to integrate conservation with development by developing eco- tourism and other integrated conservation and development projects like bee keeping activities outside the park because they will benefit from income accrued thereby raising their socio-economic wellbeing as well as development of the areas.

6.2.2 Recommendations for further research

Further research should be conducted to determine the attitudes and perceptions of local communities living in the two study sites and other areas adjacent to the park towards wildlife, and effectiveness of human-wildlife conflict mitigation measures used in the study area.

Further research should also be conducted to determine other factors leading to the decline in wildlife populations especially the carnivores besides retaliatory killings.

REFERENCES

Awere-Gyekye, K. (1996). *Land use planning and coordination study*. Final Report to the Kenya Wildlife Service on National Land Use Patterns and Trends.

Barnes, R.F.W. (1996). The conflict between humans and elephants in the central African forests. *Mammal Review,* 26, 67-80.

Barnes, R.F.W., Asika, S. and Asamoah-Boateng, B. (1995). Timber, cocoa and crop-raiding elephants: a preliminary study from southern Ghana. *Pachyderm,* 19, 33-38.

Bell, R.H.V. (1984). *The man-animal interface: an assessment of crop damage and wildlife control. Conservation and wildlife Management in Africa* (In R.H.V. Bell and E. Mcshane-Caluzi (eds), pp. 387-416. US Peace Corps, Lilongwe, Malawi

Bruce D. P, Kasiki S. M, Selempo E, .W Kays .R (2004). Livestock predation by lions *(panther leo)* and other carnivores on ranches neighboring Tsavo National park Kenya. Kenya.*Biological Conservation* 119 (2004) 507-516.

Byarunhanga M. (2008)..*Consevation and development: Bwindi Impenetrable National Parks* –Norwagian University of Science and Technology.

Campbell D, Gichohi H, Mwangi A, Chege, L. (1999). Land use conflict in Kajiado District, Kenya. *Land use Policy*, 17: 337-348.

Campbell, D. J. (2003). Interactions between people and wildlife in Southeast Kajiado District, Kenya. *LUCID Project, International Livestock Research Institute.*

Ceyhan E. and Kahraman, A.S, (2011). Effects of Agricultural practices on environment, Paper presented on International Conference on Biology, Environment and Chemistry IPCBEE Vol. 24 (2011) IACSIT, Turkey University -press Singapore

Dickman A.J. (2008) – Key determinants of conflict between people and wildlife, particularly large carnivores, around Ruaha National Park, Tanzania. PhD Thesis, University College London (UCL) and Institute of Zoology. Zoological Society of London

Dickman, A. J. (2010). Complexities of conflict: the importance of considering social factors for effectively resolving human–wildlife conflict. *Animal conservation*, *13*(5), 458-466.

Dublin H.T., McShane T.O., Newby J. (1997). Conserving Africa's Elephants: Current Issues and Priorities for Action. WWF, Gland, Switzerland.

Dublin, H. T., and Hoare, R. E. (2004). Searching for solutions: the evolution of an integrated approach to understanding and mitigating human–elephant conflict in Africa. *Human Dimensions of Wildlife*, *9*(4), 271-278.

Essien E.W and Bisong .F. (2009). Conflicts, conservation and natural resources use in protected area systems. An analysis of recurrent issues. *Europeans Journal of scientific Research* vol No.1 (2009)

Elsen, P., Wittemyer, G., Bean, W. T., Burton, A. C. O., & Brashares, J. S. (2008). Accelerated human population growth at protected area edges. *Science*, *321*(5885), 123-126.

Elsner,R.M., and Reginal. M. (2008). Knowledge, attitudes and opinions about human-wildlife conflicts held by community leaders in Virginia. Virginia Polytechnic Institute and State University, USA.

FAO, (2007) .Accra- Nature and Fauna vol 21, Issue 2 Human Wildlife Conflict

Frank, L. G., Woodroffe, R. O. S. I. E., and Ogada, M. O. (2005). People and predators in Laikipia district, Kenya.C*onservation biology series-cambridge-*, *9*, 286.

Fraenkel, J. R., and Wallen, N. E., (2000). How to design and evaluate research in Education, 4th Edition. McGraw Hill Publishing. New York.

Graham, M. D., and Ochieng, T. (2008). Uptake and performance of farm-based measures for reducing crop raiding by elephants Loxodonta africana among smallholder farms in Laikipia District, Kenya. *Oryx*, *42*(01), 76-82.

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

Hill, C. M. (1997). Crop-raiding by wild vertebrates: The farmer's perspective in an agricultural community in western Uganda. *International Journal of Pest Management*, *43*(1), 77-84.

Hoare, R.E. (1995). Options for the control of elephants in conflict with people. *Pachyderm,* 19, 54-63.

Hoare, R.E. (1999a). Determinants of human-elephant conflict in a land-use mosaic. *Journal of Applied Ecology*, 36, 689-700.

Hoare, R.E. (1999b). *A Standardised Data Collection and Analysis Protocol for Human-Elephant Conflict Situations in Africa*. IUCN African Elephant Specialist Group, Nairobi, Kenya.

Hoare, R. E. (1999c). Assessing the Evidence for the Existence of Habitual Problem Elephants Pages 1-2 IUCN African Elephant Specialist Group Report. Nairobi, Kenya.

Hoare, R. (2000). African elephants and humans in conflict: the outlook for co-existence. *Oryx*, *34*(1), 34-38.

Hoare, R. E. (2001). A decision support system for managing human-elephant conflict situations in Africa. *IUCN/SSC African Elephant Specialist Group, Nairobi*, *105*. Nairobi, Kenya.

Hoare, R.E. and du Toit, J.T. (1999d). Coexistence between people and elephants in African savannas. *Conservation Biology,* 13, 633-639.

Homwhood. K. and Rodgers, A.W. (1987). *Pastoralism conservation and overgrazing controversy. In conservation in Africa; People Policies and Practice* by Anderson and R Crove (eds) Cambridge University press, Cambridge. PP 110-115.

Ipara, H., Odwori, P., Kairu. J, and Sitati.N. (2008). *Governance issues in natural resource management: A Kenyan perspective.* Paper published in Proceedings of 4th Annual International Conference, Moi University July 29th August 2008. Moi University, Eldoret

Ipara, H.I., Kimutai, D., Odwori, P. O Waweru, C. (2007). *Sustainable utilization and management of environmental resources: putting local communities first.* Paper presented at the Fourth Moi University Annual Conference held at Moi University from 29/8/2008. Eldoret, Kenya

E. M. and Van der Duim, R., (2007). *Aspects of tourism in Kenya: thematic proceedings of ATLAS Africa Conferences* Vol 3:57-68. ATLE, Arnhem, The Netherlands.

Jillo, A.H, Wahungu G.M. and Karanja G.G. (2008*) Factors influencing human – elephant conflicts in areas adjacent to Marsabit National Park*, An Mphil thesis, Moi University, Eldoret, Kenya.

Kangwana, K. 1995. Human-wildlife conflict: the challenge ahead. *pachyderm* 19:11-14.

Kangwana, K. (1996). Assessing the impact of human-elephant interactions. *Studying Elephants*, 138-147.

Kathuri.N. and Pals. D., (1993). *Introduction to education research*. Egerton University, Njoro.

Kenya National Bureau of Statistics (2010). *The 2009 Kenya Population and Housing Census* "Counting our People for the Implementation of Vision 2030" vol 1A. Nairobi, Kenya. Government printer.

Kingolian G.K. (1995). *Land use planning and coordination study. An economic appraisal of wildlife conservation as a land use in Kenya.* Kenya Wildlife Service, Nairobi.

Kissui.B.M. (2008), *Livestock predation by lions, leopards, spotted hyenas and their vulnerability to retaliatory killing in the Maasai steppe, Tanzania. Animal conservation 1-11*. The zoological society of London Unpublished Report to AWF, Arusha.Tanzania

Kissui, B.M (2004). *Tarangire Lion Project*. Unpublished Report to AWF. AWF, Nairobi.

Kioko, J., Okello, M., and Muruthi, P. (2006). Elephant numbers and distribution in the Tsavo-Amboseli ecosystem, south-western Kenya. *Pachyderm*, *40*, 61-68.

Kioko, J. and Okello, M. (2010). Land use cover and environmental changes in a semi-arid rangeland, *Southern Kenya Journal of Geography and Regional Planning* Vol. 3(11), pp. 322-326,

Kiiru, W. (1995). The current status of human-elephant conflict in Kenya. *Pachyderm*, (19), 15-19.

Kidegesho J. R. (2006). *Wildlife conservation and local land use conflicts in Western Serengeti corridor, Tanzania*. PhD Thesis.Norwegian University of Science and Technology, Norway.

Kidegesho, J.R. Roskaft E. Kaltenborn, B.P.Tarimo, T.M.C (2005) .Serengeti shall not die: can the ambition be sustained. *International Journal of Biodiversity Science and Management 3 (1); pp150– 166*

Kolowski, J. M., and Holekamp, K. E. (2006). Spatial, temporal, and physical characteristics of livestock depredations by large carnivores along a Kenyan reserve border. *Biological conservation*, *128*(4), 529-541.

Kothari C.R. *Research Methodology: Methods and Techniques* (New Delhi: New Age International Publisher) pgs 97-100.

KWS, (1990). *A policy framework and development programme 1991-1996*. KWS, Nairobi, Kenya.

KWS, (1994). *Wildlife-human conflicts in Kenya*. The five person report .KWS, Nairobi, Kenya.

KWS, (1996). *Land use and wildlife conservation: A policy proposal for land use planning and coordination.* KWS, Nairobi,

Lusigi. W. J. (1990). *New approaches to wildlife conservation. In Lusingi W. J. Managing protected areas.* Proceedings of the regional training workshop on protected areas management in Africa. Mweka, Tanzania.

Lusigi, W. J., and Nekby, B. A. (1991). Dryland management in sub-Saharan Africa: The search for sustainable development options. *World Bank, Africa Region, Technical Department, Environment Division.*

Madden, F. (2004). Creating coexistence between humans and wildlife: global perspectives on local efforts to address human–wildlife conflict. *Human Dimensions of Wildlife*, *9*(4), 247-257.

Merits,J.N. and Kellert,S.R. (1998). Local attitudes towards community –based conservation policy and programmes in Nepal: a case in the environment conservation. *Conservation Biology (4); 320-333.*

MCNeely, A.J. Harrison.J, and Dingwall. P. (1993). *Reviews of protected Areas-IVth World congress of National Parks and protected Areas*, Caracass, Venezuela.

Mackinon, J.K., .Child, G. and Thorsel, J. (1986). *Managing protected areas in the tropics. International Union for Conservation of Nature and Natural Resources.*Gland, Switzerland.

Muruthi.P. (2005). *Human-wildlife conflict: lessons learned from African Wildlife Fund African Heart lands* AWF working papers. AWF, Nairobi

Mugenda, O. and Mugenda, G. (1999). *Research Methods .Quantitative and Qualitative Approaches*. Acts Press: Nairobi.

Mugambe ,J,Marekia, N and Mukii D. (1998). *Biodiversity management in Kenya. In managing biodiversity. National system of conservation and innovation in Africa* pp 91-110. J Mugambe and C. Norman (Eds) ACTS press,Nairobi

Mutinda, H., and Waithaka, J. (1995). The elephant-human conflicts in some areas around Tsavo ecosystem. *Unpublished KWS report, Nairobi, Kenya*.

Naughton-Treves L. (1998). Predicting patterns of crop damage by wildlife around Kibale National Park, Uganda. *Conservation Biology* 12:156–168.

Naughton, L., Rose, R., and Treves, A. (1999). The social dimensions of human-elephant conflict in Africa: a literature review and case studies from Uganda and Cameroon. *African Elephant Specialist, Human-Elephant Task Conflict Task Force of IUCN, Glands, Switzerland*.

Naughton-Treves, L., and Treves, A. (2005). Socio-ecological factors shaping local support for wildlife: crop-raiding by elephants and other wildlife in Africa. *Conservation biology series-cambridge-*, *9*, 252.

Naughton-Traves, Wallace, B., Morales, and A. (2007) .Co-managing human – wildlife Conflicts: A review page *Conservation Biology* 25: 383-396

Newmark, W. D., Manyanza,. D. N. Gamassa D.G.M and. Sariko. H. I. (1994). The conflict between Wildlife and Local People Living Adjacent to Protected Areas in Tanzania: Human Density as a Predictor. *Conservation Biology* 8:249-255.

Ngene, S. M., and Omondi, P. O. (2009). The costs of living with elephants in the areas adjacent to Marsabit National Park and Reserve. *Pachyderm*, (45), 77-87.

Ngene.S.M (2010) .*Why Elephants Roam*. PhD Thesis. University of Twente-Netherlands.

Ngure, N. (1995). People-elephant conflict management in Tsavo, Kenya, *Pachyderm* 19: 20-25

Ngure N. (1993). *History of present status of human–elephant conflicts in Mwatate-Bura area, Kenya*. MSc thesis, University of Nairobi, Kenya.

Nyeki, D M (1992). *Wildlife conservation and tourism in Kenya. Kenya Wildlife Service.* Nairobi Kenya.

Nthiga,R.M, Waudo.J, Okello.M.M. (2008) Perspectives of local communities on involvement in and benefits from tourism investment in Amboseli area, Kenya. *Open Conservation Biology Journal., 4: 48-59.*

Nyhus, P., Fischer, H. Madden, F. (2003). Taking the bite out of wildlife damage. The challenges of wildlife compensation schemes. *Conservation in Practice*. Volume 4(2):130-135

Nyhus, P., Sumianto, Tilson, R., 1999. *The tiger human dimension in southeast Sumatra, Indonesia.* In: Seidensticker, J., Christie,S., Jackson, P. (Eds.), Riding the Tiger: *Tiger Conservation in Human-dominated Landscapes.* Cambridge University Press,Cambridge, pp. 144–145.

Nyhus, P., Sumianto, Tilson, R., 2000. Crop-raiding elephants and conservation implications at Way Kambas National Park, Sumatra, Indonesia. *Oryx* 34, 262–275.

Nyhus, P.J., Fisher, H., Madden, F., Osofsky, S., 2003.Taking the bite out of wildlife damage: the challenges of wildlife compensation schemes. *Conservation in Practice* 4, 37–40.

O'Connell-Rodwell, C. E., Rodwell, T., Rice, M., and Hart, L. A. (2000). Living with the modern conservation paradigm: can agricultural communities co-exist with elephants? A five-year case study in East Caprivi, Namibia. *Biological conservation*, *93*(3), 381-391.

Ogada, O. O., Woodroffe, R. Oguge, N.O. Frank, L.G (2003). Limiting depredation by African carnivores: the role of livestock husbandry. *Conservation Biology* 17(6): 1521-1530.

Ogada, O.O., and. Ogada,D.L (2004). Factors influencing levels of carnivore-livestock conflicts in Samburu Heartland and proposed mitigation measures. *Unpublished consultancy report to African Wildlife.*

Okello, M.M. (2005). Land use changes and human-wildlife conflicts in the Amboseli area, Kenya. *Human Dimensions of Wildlife*, 10(1):19-28.

Okello M. and Wishitemi B. E. (2006). Principles for the Establishment of Community Wildlife Sanctuaries for Ecotourism: Lessons from Maasai Group Ranches, Kenya *African Journal of Business and Economics – AJOBE* Volume 1 no. (1), pp. 90–109.

Okello M.M, and Kioko, J. (2010). Contraction of wildlife dispersal area in Olgulului-Ololorashi Group Ranch around Amboseli National Park, Kenya. *Open Conservation Biology Journal., 4: 28-39.*

Osborn, F. V., and Parker, G. E. (2003). Towards an integrated approach for reducing the conflict between elephants and people: a review of current research. *Oryx*, *37*(01), 80-84.

Osborn, F. V., & Parker, G. E. (2002). Community-based methods to reduce crop loss to elephants: experiments in the communal lands of Zimbabwe. *Pachyderm*, *33*, 32-38.

Ottichilo, W.K, Grunblatt, J, Said, M.Y, Wargute, P.W. (2000). *Wildlife and livestock population trends in the Kenya rangeland*. In: Dolan, T.T (eds). *Wildlife Conservation by Sustainable Use*. Kluwer Academic Publishing Boston, USA, PP. 203–219.

Ottichilo, W. K., De Leeuw, J., Skidmore, A. K., Prins, H. H., and Said, M. Y. (2000). Population trends of large non-migratory wild herbivores and livestock in the Masai Mara ecosystem, Kenya, between 1977 and 1997. *African Journal of Ecology*, *38*(3), 202-216.

Omondi, P. (1994). *Wildlife-human conflicts in Kenya. Integrating wildlife conservation with human needs in the Maasai Mara region*. PhD Thesis, Mcgrill University, Canada.

Otuma.J (2004). *The effects of wildlife livestock –human interactions on habitats in the Meru conservations area*, Kenya Lucid working paper 39.

Osborn, F.V. (2002). *Capsicum oleoresin* as an elephant repellent: field trials in communal lands of Zimbabwe. *Journal of Wildlife Management* 66:674-677.

Osborn, F. V., and Parker, G. E. (2002). Community-based methods to reduce crop loss to elephants: experiments in the communal lands of Zimbabwe. *Pachyderm*, *33*, 32-38.

Osborn, F., and G. Parker. (2003). Towards an integrated approach for reducing the conflict between elephants and people: a review of current research. *Oryx* 37(01), 80-84.

Parker, G.E. and Osborne F.V. (2001). Dual-season crop damage by elephants in Eastern Zambezi Valley, Zimbabwe. *Pachyderm* 30:49–56.

Patterson, B. D. Kasiki, S.M. Selempo, E. and Kays.R.W (2004) Livestock predation by lions (*Panthera leo*) and other carnivores on ranches neighboring Tsavo National Park, Kenya. *Biological Conservation* 119:507-516.

Pienkowski, M. W., Watkinson, A. R., Kerby, G., Naughton-Treves, L. I. S. A., Treves, A., Chapman, C., & Wrangham, R. (1998). Temporal patterns of crop-raiding by primates: linking food availability in croplands and adjacent forest. *Journal of Applied Ecology*, *35*(4), 596-606.

Rodriguez, L. C., Henson, D., Herrero, M., Nkedianye, D., & Reid, R. (2012). Private farmers' compensation and viability of protected areas: the case of Nairobi National Park and Kitengela dispersal corridor. *International Journal of Sustainable Development & World Ecology*, *19*(1), 34-43.

Romanach, S. S., Lindsey, P. A., and Woodroffe, R. (2007). Determinants of attitudes towards predators in central Kenya and suggestions for increasing tolerance in livestock dominated landscapes. *Oryx*, *41*(02), 185-195.

Rood, E. J., Azmi, W., and Linkie, M. (2008). Elephant crop raiding in a disturbed environment: the Effect of landscape clearing on elephant distribution and crop raiding patterns in the north of Aceh, Indonesia. *Gajah*, 17.

Rugunda, G.K (1997), *Crop raiding around Lake Mburo National Park, Uganda.* Mbarara University of Science and Technology, Uganda.

Republic of Kenya, (1997). Sessional Paper No.3, 1975. Policy Paper on of Wildlife Management in Kenya .Government Printers, Nairobi.

Republic of Kenya, (1977). *Wildlife Conservation and Management Act 1977*, Government Printers, Nairobi

Sukumar, R. (1991). The management of large mammals in relation to male strategies and conflict with people. *Biological Conservation*, *55*(1), 93-102.

Sarker, R. A. H. M. and Roskaft. E. (2010) Human attitudes towards conservation of Asian elephants (*Elephas maximus*) in Bangladesh. *International Journal of Biodiversity and Conservation* vol. 2 (10) PP 316-327.

Smith, R.J. and Kasiki, S. (1999) *A Spatial Analysis of Human- Elephant Conflict in the Tsavo Ecosystem, Kenya*. AfESG Report. IUCN/SSC, Gland, Switzerland.

Smith,G.C, Hubert V. P., Simanjorang, Nigel Leader-Williams and Mathew, L.(2010) Crop-raiding by Orangutans (*Pongo Abelii*) and other Nonhuman primate in northern Sumatia, Indonesia *American Journal of Primatchory* 72;866-870 (2010).

Shemwetta, D.T.K and Kideghesho, J. R. (2000). *Human –Wildlife conflicts in Tanzania: what research and extension could offer to conflict resolution*. Proceeding of the 1st University Wide Conference 5th -7th April 2000 Volume 3.

Sillero-Zubiri, C., Sukumar, R., and Treves, A. (2007). Living with wildlife: the roots of conflict and the solutions. *Key topics in conservation biology*, 266-272.

Sitati, N. (2003). *Human-elephant conflict in Trans-Mara district adjacent to Masai Mara National Reserve*. PhD Thesis. University of Kent, Canterbury, UK.

Sitati, N.W, Walpole, M.J, Smith R.J and Williams, N.L (2003). Predicting spatial Aspects of Human – Elephant conflict. *Journal of Applied Ecology* Vol. 40-No. 4 PP. 667-677.

Sitati, N. W. (2004). Traditional Human-elephant conflict mitigation measures in Transmara, Kenya. In *Endangered elephants: past, present, and future: Symposium on Human-Elephant Relationships and Conflicts, Sri Lanka, September 2003* (p. 128). Biodiversity and Elephant Conservation Trust.

Sitati, N. W., and Walpole, M. J. (2006). Assessing farm-based measures for mitigating human-elephant conflict in Transmara District, Kenya. *Oryx*, *40*(03), 279-286.

Sitati, N.W. and Ipara, H. (2007). *The role of tourism development and benefit sharing in mitigating human-elephant conflict inthe Mara ecosystem, Kenya*: In (ed) Kloek E. M., and Rene van der Dium. *Tourism and nature in Africa. Thematic proceedings of Association for Tourism and Leisure Education* (ATLAS) Africa conferences, ATLAS, (1):71-80.

Sitati N.W., Walpole M.J., Williams, N.L. (2005). Factors affecting susceptibility of farms to crop raiding by elephants: Using a predictive model to mitigate conflict. *Journal of Applied Ecology*42:1175–1182.

Sitati, N. W., Leader-Williams, N., Stephenson, P. J., and Walpole, M. J. (2008). *Mitigating human-elephant conflict in a human dominated landscape: challenges and lessons from Transmara District Kenya*.

Sitati, N. W., Walpole, M. W., Leader-Williams, N., and Stephenson, P. J. (2012). Human–elephant conflict: Do elephants contribute to low mean grades in schools within elephant ranges?. *International Journal of Biodiversity and Conservation*, *4*(15), 614-620.

Sitati, N. W., and Ipara, H. (2012). Indigenous Ecological Knowledge of a Human-Elephant Interaction in Transmara District, Kenya: Implications for Research and Management. *Advances in Anthropology*, *2*(03), 107.

Sitienei, A. J., Jiwen, G., and Ngene, S. M. (2014). Assessing the cost of living with elephants (Loxodonta africana) in areas adjacent to Meru National Park, Kenya. *European journal of wildlife research*, *60*(2), 323-330.

Smith R.J.and Kasiki S. (1999). *A Spatial Analysis of Human– Elephant Conflict in the Tsavo Ecosystem, Kenya*. AFESG Report. IUCN/SSC, Gland, Switzerland.

Stern P.C. (1988) *Value, Belief, Norm theory of support for social movement*: the case of environmentalism, pp 16-36.

Sukumar R. (1989). *The Asian Elephant: Ecology and Management*. Cambridge University Press, Cambridge, UK.

Sukumar R., Gadgil M. (1988). Male-female differences in foraging on crops by Asian elephants. *Animal Behaviour* 36:1232–1235.

Swallow, B. (2005). Potential for poverty reduction strategies to address community priorities: case study of Kenya. *World Development*, *33*(2), 301-321.

Treves, A., Wallace, R. B., Naughton-Treves, L., and Morales, A. (2006). Co-managing human–wildlife conflicts: a review. *Human Dimensions of Wildlife*, *11*(6), 383-396.

Treves, A. (2008). Human-wildlife conflicts around protected areas. *Wildlife and Society: the science of human dimensions. Island Press, Washington, DC*, 214-228.

Tchamba, M.N. (1996) History and present status of the human-elephant conflict in the Waza-Logone region, Cameroon, West Africa. *Biological Conservation*, 75, 35-41.

Thouless, C. R. (1994). Conflict between humans and elephants on private land in northern Kenya. *Oryx*, *28*(02), 119-127.

Thouless, C. R. and Sakwa, J. (1995). Shocking elephants: Fences and crop raiders in Laikipia District, Kenya. *Biological Conservation* 72:99-107.

Thirgood, S. Woodroffe, R.and Rabinowitz, A. (2005). *The impact of human-wildlife conflict on human lives and livelihoods.* In R. Woodroffe, S. Thirgood, and A. Rabinowitz, (editors). *People and Wildlife: Conflict or Coexistence*? Cambridge University Press, Cambridge, U.K.PP13-26.

Walpole, M.J and Leader-Williams, N. (2001). Masai Mara tourism reveals partnership benefits. *Nature*, 413, 771.

Walpole, M., and Sitati, N. (2002). Mitigating Human-Elephant Conflict in the Mara Ecosystem, Kenya A preliminary progress report. *Unpublished report, DICE, University of Kent, Canterbury.*

Walpole, M., Karanja, G., Sitati, N., Willians N.L., (2003). *Wildlife and people conflict and conservation in Masai Mara, Kenya:* IIED Wildlife and Development series No. 14, March 2003. University of Kent, At Canterbury.

Waithaka, J.M. (1995). *The ecological role of elephants in restructuring plant and animal communities in different eco-climatic zones in Kenya and their impacts on land use patterns.* PhD Thesis, Kenyatta University.

Waithaka, J. (1999). Monitoring human-elephant conflict through remotely located stations. *Pachyderm*, (27), 66-68.

Wambuguh, O. (1998). *Local communities and wildlife: a spatial analysis of human-wildlife interactions in Laikipia district Kenya* (Doctoral dissertation, University of California, Berkeley).

Western, D., and Waithaka, J. (2002, December). Policies for reducing humanwildlife conflict—the Kenya case with wider application. In *Proceedings of the Conference People and Wildlife—Conflict or Coexistence*.

Wells .M, and Brandon.K and Lee,H. (1995).*People and parks: Linking protected area management with local people.* The World Bank, Washington DC

Wells .M, and Brandon.K. (1992).*People and parks: Linking protected area management with local communities*. The World Bank, Washington DC

Wishitemi E.L.B. and Okello M.M. (2003). *Application of the protected landscape model in Southern Kenya. Parks.* 13 Issue No. 2; 12 – 21.

Woodroffe, R. and Ginsberg, J.R., 2000. Ranging behaviour and extinction in carnivores: how behaviour affects species vulnerability. In: Sutherland, W.J. (Ed.), *Behaviour and Conservation,* pp. 125–140.

Woodroffe, R., Lindsey, P., Romanach, S., Stein, A., and ole Ranah, S. M. (2005a). Livestock predation by endangered African wild dogs (Lycaon pictus) in northern Kenya. *Biological conservation*, *124*(2), 225-234.

Woodroffe, R., Thirgood, S., and Rabinowitz, A. (2005b). *People and wildlife, conflict or co-existence?* (No. 9). Cambridge University Press.

Woodroffe, R., Frank, L.G., Lindsey, P.A., ole Ranah, S.M.K., &Romañach, S.S. (2006) Livestock husbandry as a tool for carnivore conservation in Africa's   community rangelands: case-control study. *Biodiversity and Conservation*, 16, 1245-1260.

Woodroffe, R., Frank, L. G., Lindsey, P. A., ole Ranah, S. M., and Romanach, S. (2007). Livestock husbandry as a tool for carnivore conservation in Africa's community rangelands: a case–control study. In *Vertebrate conservation and biodiversity* (pp. 419-434). Springer Netherlands.

Waithaka, J. and Gachago, S. (1995). *Human-elephant conflict in Kiambu, Muranga, Kirinyaga, Embu and Meru districts* .Kenya Wildlife Service , Nairobi , Kenya

APPENDICES

APPENDEX I: QUESTIONNAIRE FOR THE LOCAL COMMUNITY

Date of interview_____ Location _____

SECTION I: GENERAL INFORMATION ABOUT RESPONDENTS

1. Occupation (1) Farmer   (2) Other (specify)_____
2. Gender   (1) Male   (2) Female
3. Age in years_____
4. Marital status_____(1)   Single   (2)   Married, (3) Others (specify)
5. Education level,   (1) No Education (2) Primary (3) Secondary
   (4) College/University (5) Others (specify)_____
6. Size of land in acres/hectares_____
7. How many years have you lived in this area? _____years
8. Distance from Chyulu Hills National Park boundary_____
9. Types of crops and/or livestock raised on your farm_____
   a) Crops_____
   b) Livestock_____

SECTION II: TYPES AND NATURE OF HUMAN-WILDLIFE CONFLICTS
                EXPERIENCED

10. (a) Do wild animals come to your land?   1) Yes   2) No
    (b)If yes, list the names of the species?

    _____

    _____

    _____

11. What problems do you experience from wildlife?
    (i). Crop raiding   (ii). Livestock predation   (iii). Death/injury to human life
    (iv). Destruction of infrastructure e.g. Fences, houses etc.
    (v). Others (specify)_____

12. Which crops among the ones you grow are most preferred by crop raiding animals (List at least 2 crops)

    _____

13. Name the wildlife species responsible for crop destruction (Please list them according to the order of their importance) _____

    _____

14. a) List the livestock that are attacked by wild animals (list at least 2 animals)

    _____

    _____

    b) Name the wildlife species responsible for attacks on livestock (Please list them according to the order of most problematic) _____

_____

SECTION III: IMPACTS OF HUMAN-WILDLIFE CONFLICTS EXPERIENCED

15. a) Do human-wildlife conflicts experienced in this area have any impact on you?

    i)   Yes   ii) No

    b) If yes in 15 above, how has it impacted on you?

       i.   Led to economic losses
       ii.   Is a threat to life/lives
       iii. Has led to abandonment of land based activities like farming
       iv.   Any other impact (specify)_____

16. How much in terms of money are the economic losses you incur per year? (Tick one)

    (i) Less than 10,000   (ii) 10,000 – 30,000   (iii) 30,000 –50,000

    (iii) 50,000 – 70,000   (iv) 70 – 100,000   (v) Over 100,000

17. What are some of the resources that your household obtains from the park (List in order of importance)

_____

_____

_____

SECTION IV: MEASURES ADOPTED TO MITIGATE HUMAN-WILDLIFE CONFLICTS EXPERIENCED

18. Do you protect your farm from wild animals?

    i.   Yes   ii. No

    ii.   If yes,

19. What methods do you use to control problem animals? (Use table below and tick against measure used)

Species targeted (elephants, lions,hyena,hippo,buffaloes, crocodile,birds,mongoose among others)	Control methods
	Fence;
	i). Electric
	ii). Chain link
	iii). Others
	Patrols
	Light fire
	Throw stones
	Make noise
	Dogs
	Flashlights
	Others (specify)

20. Of the methods you use which is the most effective? _____

21. In your opinion does knowing the impacts of human- wildlife conflicts affect your support to conservation? **Will not support -0) (Strongly support-5)**

        (0) No support, (2) Little support, (3) Moderate support, (4) Highly support, (5) Very highly supportive

22. How effective are the methods adopted in controlling problem wildlife?

    i. Not applicable   ii. Not effective   iii.   Slightly effective

    iv. Effective   v. Very effective

23. What time of the day do you guard your crops/ animals?

   i. Day   ii. Night   iii. Both day and night

24. Which season / months of the year is the wildlife damage ?

   i . Least ……………………………… ii. Highest……………………………….

25. What times does guarding start? a). Starts _____ b) Ends_____

26. How many people _____ and for how many hours per day (man

   hours) _____ _____ are used to guard your crops/animals?

27. Do you report to KWS when wildlife invade your farm?

   i. Yes   2. No

a) If yes, how often   i. Always   ii. Sometimes   iii. Rarely

b) If no, explain why …………………………………………………………..

   ………………………………………………………………………………….

28. How long does KWS take to respond to your report?

    i. Within hours   ii. Within a day   iii. Within a week,

    iv. Never respond at all   vi. Other length of time (specify) _____

29. What strategies have been adopted by KWS in dealing with problem animals?

   i. Shooting

   iii. Scaring

   ii. Translocation

   iv. Others (Specify)

30. How do you describe the occurrence of human –wildlife incidences in this area?

    i. Increased_____ ii. No change_____ iii. Decreased_____

31. Describe the relationship between you as a farmer and KWS?

   i. Good   ii. Poor   iii. Very poor   iv. Not sure

32. (a)Do you report conflicts experienced elsewhere? i. Yes,   ii No

    (b) If yes to whom do you report? _____

33. Please explain why you find it necessary to report elsewhere besides

   KWS?_____

   _____

34. Do other organizations offer any protection against wildlife menace to

communities living in this area?　　i. Yes　　　　　　　　　　ii. No

 b)If yes, what kind of protection do they offer?

 i._____

 ii._____

 iii_____

c) If no, explain why no protection is offered by other organizations---------------------

 ----

 ----

35. Where do you think is the origin/source of animals that come to your land?___

36. What is your view regarding the role of Chyulu Hills National Park in reference to

wildlife menace_____

 _____

 _____

37. As part of the local community have you previously organized any village groups

to enhance security against wildlife invasions here?　　i). Yes　　　ii). No

a) If yes, how is this done?_____

b) If yes, how do they assist the farming community in resolving wildlife conflicts?

 _____

c) If no, explain why no groups have been organized_____

 _____

 _____

38. How far (in km) is the following from your land?

 i. Migration corridor_____ii. Water point _____

39. In your opinion, do you find wildlife to be of any use to you as an individual?

 i) Yes　　　　　　ii) No

a) If yes, explain how_____

b) If no, state why_____

40. How would you feel if wildlife in this area were eliminated?

 i.　　Very bad/sad　　　　　　　　　　　　ii. Not bad

 iii.　　Bad/sad　　　　　　　　　　　　　　iv. No response

41. Are you willing to tolerate the presence of wildlife on your land as you currently do?

   i. Yes   ii. No

42. a) Are wildlife of any benefit to you? i Yes   ii. No

   b) .If yes, how do you benefit from wildlife? _____

_____

_____

43. Have you ever applied for compensation for wildlife damage?

       i.   Yes   ii.   No

44. (a).Do you think wildlife loss or damage should be compensated?

       i.   Yes   ii.   No

   bIf yes, give reasons _____

_____

_____

   c) If no, explain why_____

_____

_____

45. What do you think makes wildlife to cause damage on your farm?

_____

_____

46. Suggest the best ways that can be used to control wildlife problems in this area?

_____

_____

APPENDIX 1I: INTERVIEW SCHEDULE FOR KWS AND KFS STAFF AND OTHER KEY INFORMANTS

1. What resources do people living around Chyulu Hills National Park obtain from the park?

2. During what months of the year are the named resources obtained?

3. Which wild animals go out of the park?

4. During what months of the year do the named animals move out of the Park?

5. What do the animals use/feed on or destroy outside the park?

6. What was the necessity of gazetting Chyulu Hills into a National Park?

7. Do wild animals use the extended portion of the park?

8. How do you control or prevent human use of resources from the park?

9. How do you control/prevent human - wildlife conflicts outside the park?

10. In your opinion should people be allowed to control human - wildlife conflicts outside the park?