

**LAND USE CHANGES AND HUMAN WILDLIFE CONFLICT IN GARBA TULA
SUB-COUNTY, ISIOLO COUNTY, KENYA**

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DECLARATION

This research project is my own original work and has not been presented for examination at any other university or institution.

Signature

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This research project has been submitted for examination with our approval as university supervisors.

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ABSTRACT

Prevention of human-wildlife conflicts is a top priority of wildlife conservationists in Kenya, especially in regions which are close to wildlife reserves and has high population growth of human being. Human-wildlife conflict incidences have been reported in various part of the county and this had been attributed to land use change and rapid population growth of people which result to encroachment of wildlife habitats. In Garba Tula Sub County threats to biodiversity from rapidly increasing human populations, land sub-division, development projects changing land tenure systems, crop farming, poaching and the blockage of wildlife migratory corridors have been on the increase in the recent past. In addition, Garba Tula Sub County is characterized by unregulated influx of livestock, increased agriculture activities, timber harvesting and sand collection. This study therefore sought to assess whether land use changes were responsible for human wildlife conflict, determine whether population increase has led to human wildlife conflict and assess whether pastoralism causes human wildlife conflict in Isiolo County. The study employed the use of descriptive research design. The target population of this study was 2177 household heads in Garba Tula Sub County. This study used simple random sampling technique to select 326 household heads. The study used both primary and secondary data. Secondary data was obtained from conservancy reports and annual reports. This study used semi-structured questionnaires and key informant interview guides. The research instruments generated both qualitative and quantitative data. Qualitative data from the key informant interview guides and open ended questionnaires in the questionnaires was analyzed by use of thematic analysis. Quantitative data was analyzed by use of both descriptive and inferential statistics. Descriptive statistics comprised of frequencies, percentages, mean and standard deviation. Inferential statistics such as correlation analysis and regression analysis were used to test the research hypothesis. The study found that the relationship between land use changes and human wildlife conflict in Isiolo County was significant ($\beta=0.557$, $p\text{-value}=0.000$). Moreover, the study established that there is a positive relationship between population increase and human wildlife conflict in Isiolo County ($\beta=0.745$, $p\text{-value}=0.000$). Further, the study found out that there is a positive significant relationship between pastoralism and human wildlife conflict in Isiolo County ($\beta=0.526$, $p\text{-value}=0.000$). The study recommends that there is need to have scientifically-based (agroforestry) land use planning and this will be essential in ensuring that the human needs and conservation goals in Garba Tula Sub County are balanced. This can be done by improving the ecological process that is affected by land use. There is need for clear land use planning to counteract possible land resource degradation and ameliorate negative implications of land use mainly human-wildlife conflicts which are currently an issue of concern in the study area. There is also need to raise community awareness so as help in improving understanding and appreciating the wildlife resources thus conserving them.

ACRONYMS

IIED	International Institute for Environment and Development
IUCN	International Union for Conservation of Nature
KNBS	Kenya National Bureau of Statistics
KWS	Kenya Wildlife Service
LAPSSET	Lamu Port-South Sudan Ethiopia Transport
LULC	Land-Use and Land-Cover Changes
NGO	Nongovernmental Organizations
RAP	Resource Advocacy Program
TPB	Theory of Planned Behavior
USA	United States of America

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Human-wildlife conflict is defined as the interaction between people and wildlife species resulting to negative impacts on economic, social, cultural activities (Syombua, 2013). Human-wildlife conflict result to death of wildlife species and individuals, destruction of crops and properties (Karanth *et al.*, 2012). Despite of extremely large taxonomic diversification of wildlife species, conflicts normally arise between ungulate species such as elephants and carnivores since the species are often aggressive and large bodied thus their presence tend to trigger the conflict between human being and wildlife. Since human being tend to have innate fear of ungulate species from past experience even the wildlife are not threat to their lives or cause destruction of properties. In addition, wildlife such as elephant damage agricultural crops in farms and this result elicit human hostility toward the wildlife (Tefera, 2015).

In Peru, in South America, about 3200 people live within the protected area of the national border of the Tambopata-Candano Reserve (Spencer *et al.*, 2007). These individuals engage in activities such as agriculture, hunting, fishing and logging which result in destruction of crops, death of the community members and wild animals (Senthilkumar *et al.*, 2016). In Alberta, Canada, from 1982 to 1996 wolves caused the death of about 2086 deaths among domestic animals like cattle, dogs, horses, sheep, goats, turkeys and geese. In the Unites States, between the years 1987 and 2001 wolves killed about 728 animals that consisted of cattle and sheep (Kansky *et al.*, 2016).

In African countries such as Kenya, Namibia, Mozambique, Zambia and Nigeria, Ladan's (2014) research found that human wildlife conflict have been on the increase due to the encroachment of forest areas for agriculture, developmental activities and livestock grazing. In Tanzania, Dickman (2005) indicated that ungulate species especially lions and cheetahs attack livestock of people living around Masaai Mara thus lead to human-wildlife conflict as the pastoralists retaliatory kill the wildlife to protect their livestock.

Isiolo County is located in Arid and Semi-Arid regions in north eastern province in Kenya. Land in the county is held in trust by the county government under Trust lands Act Cap 288 (Jebet, 2016). The main economic activity of Isiolo residents is pastoralism. The people often move about from locality to another in search of water and pasture for their livestock. Since most part of Isiolo County has scanty vegetation, there are a few parcels of lands for grazing. This forces the community members to encroach wildlife reserves in search of water and pasture for their livestock hence resulting to human-wildlife conflict as the pastoralists struggle to acquire and control the little resources that are available. This has led to reduction of land cover and destruction of wildlife habitat and the human population increase and the demand for food and settlement areas increase. In the last two years (2015 to 2017) the human-wildlife conflict in Isiolo County has intensified leading not just to the death of animals and people but also to a conflict between the resident and KWS officers (Kenya Wildlife Service Annual Report, 2015). The conflict has also led to the disappearance of young energetic youths in the region. In 2015, the confrontation of the rangers and community members resulted to death of two individuals as more than ten persons (both the KWS rangers and the community members) survived with fatal injuries (Jebet, 2016).

1.2 Statement of the research problem

Prevention of human-wildlife conflicts is a top priority of wildlife conservationists in Kenya, especially in regions which are close to wildlife reserves and has high human population growth. According to Tefera (2015), human-wildlife conflict incidences have been reported in various part of the county and this had been attributed to land use change as a result of rapid population growth of people which result to encroachment of wildlife habitats. Conflict between wildlife and human is attributed to increase in population growth and increase pressure on the available resources such as water and pasture. Human-wildlife conflict a key issue which inhibits effective wildlife conservation and development of rural areas close to wildlife reserves (Okello, 2013). Poaching as well as killing of wildlife species, which are perceived to be pest has led to extinction and endangerment of wildlife species in various part of the world. Despite of the fact that conservationists have put their frantic efforts to prevent endangerment and extinction of

wildlife species, the ungulate species are still a threat to human lives and their livelihoods (Mogensen *et al.*, 2011). The conflict between human and wildlife has significantly influenced conservation of ungulate species which are often aggressive and attack human being, destroy their crops, livestock and properties as individuals kill the wildlife for protection of their lives and property. According to Okech (2015), poaching is being practiced in 96% of wildlife reserves and this has led to endangerment and extinction of wildlife and it has contributed to 82% of the human-wildlife among the communities which live close to wildlife reserves as the wild animals retaliate to protect themselves.

According to Jebet (2016), human wildlife conflict led to the death of two people and more than 10 injuries in Masai Mara, including a ranger in the year 2015. Most of the residents in Isiolo County are pastoralists. Since the region experience low annual rainfall and has scanty vegetation, the pastoralists move about in search of better pasture and water for their livestock and this tend to trigger conflict human-wildlife conflict. Development projects in Isiolo County may play a role in human wildlife conflict (Sharamo, 2014).

According to Mwangi, *et al*, (2016) there were 14 human wildlife conflicts Garba Tula in the year 2015, the number increased to 16 in the year 2016 and in 2017 there were 22 human-wildlife conflicts in the region. In Garba Tula Sub County, the main activities influence livestock, sand harvesting and gums and resins. According to Sharamo (2014), 59% of the population of Garba Tula is already engaged in some form of collection of gums and resins. As indicated by Food and Agricultural Organization (FAO, 2015), threats to biodiversity from rapidly increasing human populations, land sub-division, changing land tenure systems, crop farming, poaching, and the blockage of wildlife migratory corridors have increased in the recent past. Garba Tula Sub County is characterized by unregulated influx of livestock, increased agriculture activities, timber harvesting and sand collection (Sharamo, 2014).

1.3 Research questions

- i. To what extent does population increase lead to human wildlife conflict in Isiolo County?
- ii. Are land use changes responsible for human wildlife conflict in Isiolo County?
- iii. Is pastoralism a cause of human wildlife conflict in Isiolo County?

1.4 Objectives of the study

To identify land use change that is responsible for human wildlife conflict in Isiolo County.

- i. To assess the perception of land use change that is responsible for human wildlife conflict in Isiolo County
- ii. To determine whether population increase has led to human wildlife conflict or not in Isiolo County
- iii. To assess whether pastoralism causes human wildlife conflict or not in Isiolo County.

1.5 Hypotheses

H₀: There is no significant relationship between land use changes and human wildlife conflict in Isiolo County

H₁: There is significant relationship between land use changes and human wildlife conflict in Isiolo County

H₀: There is no significant relationship between population increase and human wildlife conflict in Isiolo County

H₁: There is significant relationship between population increase and human wildlife conflict in Isiolo County

H₀: There is no significant relationship between pastoralism and human wildlife conflict in Isiolo County

H₁: There is significant relationship between pastoralism and human wildlife conflict in Isiolo County

1.6 Justification of the study

Isiolo County was selected because it functions as a wildlife dispersal area that holds most of the wildlife in the country. However, this function is threatened because of anthropogenic activities resulting in habitat destruction and fragmentation. The area is experiencing land use practices that are perceived as incompatible with wildlife conservation resulting in increased human wildlife conflicts. Therefore, the study provided information on land use changes, pastoralism and population increase that can be used to formulate policies to reduce human wildlife conflict in the County.

The study is therefore necessary as it contributes knowledge to the field of human wildlife conservation. Proper conservation of the wild animals favor the continued existence of national parks in counties for their ecological function and as tourist attraction centers. The study may influence the policy and practice of wildlife management in Kenya to come up with policies which eradicate human-wildlife conflict. The local pastoralist community will benefit from reduced predation of their livestock and hence security of their livelihoods. The international community will benefit from this study because wildlife does not only attract tourists but is also an internationally shared heritage.

The study also adds knowledge to the already existing scientific findings on conservation. The conservation of these animals will promote the conservation of other animals that are important ecologically and for attracting tourists. This is due to the interconnectedness of ecological systems which makes it difficult to conserve species in isolation. Generally this study is important since it is relevant to the government, conservation societies, counties and wildlife at large.

1.7 Scope of the study

This study focused on the relationship between land use changes and human wildlife conflict in Isiolo County. However, the study only focused on Garba Tula Sub County because most of the human wildlife conflicts have been occurring in this area. In addition, the area is best known for its abundant wildlife and spectacular landscapes. The target population was all the household heads in Garba Tula Sub County and the management of conservation organizations such as IUCN, IIED, RAP and the county Council of Isiolo.

1.8 Operational definitions

Conflict: This refers to a fight, battle, or struggle, especially a prolonged struggle between human being and wild animals.

Human population increase: Is defined as the increase in number of persons residing in a particular locality or area.

Human-wildlife conflict: This refers to interaction between persons and wild animals which ultimately result to negative impacts on individuals or their resources or wild animals or their habitats.

Land use changes: This refers to changes in the way land is utilized like clearing of forests for agricultural use and development projects.

Land use: This refers to utilization of land to improve livelihood of individuals.

Pastoralist: This is a person who herds livestock like sheep, goats, cattle and camels, often as a nomadic wanderer without a set farm area.

Pastoralism: This is an agricultural practice which entails livestock keeping (camel, yaks, goats, llamas and sheep) as the farmers move about in search of water and pasture for their animals.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Land cover is defined depending on characteristics of vegetation on the earth surface as well as spatial distribution of water, ice, desert and immediate subsurface materials such as soil, topology, ground water, biota and structure developed through human activities such as mining exposure and settlement (Nelson, 2012). Otherwise, land use is defined as the intent to adopt management strategies on land cover that has been placed by land managers so as to regulate exploitation of land cover through industrial zoning, agricultural fields, grazing area, logging zones as well as residential zoning among others (Karani, 2009).

The change in land use refers to variation in biological, physical or chemical conditions of the land cover attributed to natural or anthropogenic factors such as overgrazing, cropping, excessive use of fertilizer, improvement in drainage, irrigation farming, construction of dams, removal of vegetation cover, and introduction of exotic species, volcanic eruption among others (Eigenbrod *et al.*, 2011). Changes in land cover as well as land use are normally categorized into modification and conversion. Conversion is defined as the change in land usage or land cover while modification is defined as the maintenance of land cover or usage in case of variation in its characteristics (Lamers *et al.*, 2014).

According to Ladan (2014), the main causative agent for change in land use and land cover are anthropogenic factors as well as natural factors in political or socio-economic contexts. Therefore, information of household characteristics demographic profiles as well as regulations on geographical resources administration can be used in determining or measuring the rate at variation in land cover (Gelet *et al.*, 2010). Land usage can interfere with ecosystem services provision such as purification of air through absorption of carbon IV oxide by plants. In a global perspective, conversion of forested lands, wetlands and grasslands into agricultural land so as to increase food productivity, production of timbers, housing can lead to reduction in ecosystem services through degradation of biodiversity (Maitima *et al.*, 2009).

With regard to species richness in Africa, Kenya is the second country with the highest population of mammal of about 394 species, 201 varieties of reptile species comprising of 100 snakes and lizards and 1 type of crocodile specie, 100 species of amphibians as well as 950 fish species comprising of 250 fresh water and 700 fish species (Nyamasyo & Kihima, 2014). However, over the last 30 years, her wildlife numbers have shrunk by between 35% and 50% and, by 2006, the number of threatened species in Kenya included 33 species of mammals. This decline in wildlife numbers globally, regionally, and locally has more been attributed to land use changes, human encroachment into wildlife habitats, recurrent droughts, poaching, and other anthropogenic activities (Bond, 2014; Shah, 2016).

The variation in land usage tends to affect the natural characteristic of land cover thus interfering with the functionality of biological diversity in various part of the world. In East Africa region, the variation in land usage is attributed to encroachment of natural ecosystems for human settlement, crop farming, grazing of livestock as the wildlife habits are invaded by individuals for the agricultural production resulting to human wildlife conflict (Dickman, 2005). These changes are associated with wildlife losses, habitat destruction, land degradation, and blockage of wildlife corridors.

In Kenya, rapid increase in the population of human being has led to encroachment of forested lands which are perceived to be the habitat of wildlife and ultimately result to reduction in wildlife habitats and blockages of their corridors (Nyamasyo & Kihima, 2014). Population instability, degradation of natural ecosystem, extinction of wildlife species is as a result of blockage of wildlife species corridors thus led to conflict between wildlife and human being as the wildlife move in other places in search of conducive habitats. Such incidence tends to create animosity and frustration between the human and wildlife resulting to retaliatory killings. The threat to wild ungulate populations is therefore an eminent one for Kenya, particularly when one considers the fact that many of her protected areas are increasingly becoming insecure as a result of encroachment of the areas attributed to rapid population growth and increase in demand for food productivity and land for settlement. In spite of the frantic effort which has been put in

place by local and international organizations so as to protect and conserve wildlife habitats as well as species, variation in land usage has continued to be rampant due to anthropogenic factors thus leading to human-wildlife conflict (Nyamasyo & Kihima, 2014).

2.2 Land use changes globally

In a global perspective, increase in unplanned land use, both inside and outside of protected areas has result to significant variation in ecological functionality due to reduction in biodiversity in the protected areas. According to Dickman (2005), land usage among individuals led to alteration of land cover and ultimately affects the earth structure and functionality of ecosystem. Blackburn *et al.* (2016) indicated that degradation of biological diversity as well as ecosystem is attributed to poor land usage thus resulting to conflict between human being and wildlife as they compete for available scarce resources such as water and pasture. They also specified that land sub-division among individuals through fencing and leasing lands adjacent to protected areas with the intent of generating more income, have led to blockage of wildlife corridors thus resulting to conflict between human being and wildlife as the animals destroy crops and properties during their movement to favorable conditions. Further, they pointed out that the type of land use resulted to dispersion and loss of wildlife species due to blockage of their migratory routes and inhibit the animals from accessing conducive environment with adequate water and food.

According to Liang and Dirmeyer (2017), USA was a predominantly a rural state until it population begun to rise toward the urban areas. In the year 1910, 46% of US citizens lived in rural region but the percentage increased significantly to 81%. In the year 2006, more than 80% of land cover in 48 states in the lower region in US was endowed with shrub, forest and grassland vegetation as well as agricultural vegetation for production of timber, grazing and crop farming. Land set aside for agricultural practices are cover 18% of the entire land surface in US. Developed areas only covered 5% of the total land cover in USA, with the highest concentration of developments in urban region especially in Midwest, Southeast and Northeast of U (Liang & Dirmeyer, 2017). The small apparent small percentage excluded development in mosaic and agricultural land usage.

Variation in development density tends to have a significant effect on population distribution and ultimately affect the size of land cover and land use. Some of projection on variation in development area is based on the assumption that there is change in the size of household and the concentration of urban development. High population density implied that there is decrease in forested land as well as grassland due to human encroachment (Song & Deng, 2017).

In another study, Lawlera *et al.* (2013) used two baseline trajectories of economic condition to vividly illustrate variation in market forces tend to have an effect on land usage and functionality of ecosystem services. They projected an increase in cropland to be 28.2 million ha in 2007 in comparison with loss in crop land (11.2 ha) which reflected conditions in the period of 1990s. The projected land utilization led to increase in storage of carbon, production of timber, food production and decrease in wildlife habitat of 25% of modeled wildlife species.

In China, Li *et al.* (2016) the influence of physical and socio-economic driving forces on land utilization and land cover in the City Wuhan. The study found that in the last 20 years, the land usage pattern in the city has significantly changed as most land cover in the city was used for agricultural production and other economic developments. The study also established that tertiary industrial proportion and gross yield of agricultural lands were the main type of land use in Wuhan City. Rupesh (2014) also researched on the pattern of land utilization in the state of India. The study found that most lands were used for development of infrastructure at the expense of other land use practices.

2.3 Land use changes in Africa

According to Mogensen *et. al.*, (2011) in Africa, there are numerous development projects which led to human-wildlife conflicts. For instance, construction of road, railway lines, dams, houses, energy generation stations among others. Most of the projects tend to have a direct or indirect negative impact on wildlife habitat. Construction of railway tracks and road tend to pass through wildlife habitats resulting to displacement of wildlife habitats and motor vehicle also knock down some of the wildlife. Constructions of dams create a conducive environment for crocodiles and attract human habitation which ultimately led to human-wildlife conflict. Further, developments of wind projects tend to disrupt movement of wildlife such as birds (Woodroffe et al., 2007).

In Ethiopia, Tefera (2015) indicate that there has been remarkable variation in land usage between the year 1977 and 2015 in Babile district. Indigenous forests, vegetation, grass land, bush lands were decreased while settlement, cultivation land, rocky land and bare land were increasing during the period. In another study, Gelet *et al.* (2010) found that the total area of built-up and crop land increased from 4382.7 ha to 12198.02 ha and from 33144.3 ha to 62916.02 ha, respectively, during this period (1973-2006). On the other hand, the extent of forest cover decreased from 22549.6 ha to 4521 ha and the extent of grassland decreased from 37416.5 ha to 17437.2 ha during the same period. The mean patch-size index of forest cover as well as grassland decreased substantially from 10 ha, to 1.11 ha, and from 17.4 ha to 0.87 ha, respectively. In relation to this, the landscape configuration change indicators such as the interspersion-juxtaposition index increased in crop land from 65.16% to 83.58%, and decreased in-grassland from 57.68% to 34.74%.

In Zimbabwe, (Maramani Communal Area) between the years 2000 and 2003, 241 livestock were attacked and killed by lions, baboons and leopards (Gandiwa & Muboko 2003). The average loss of livestock was consistent within a three year period with a 12% annual loss of livestock in each household. In the state of Cameroon, establishment of Benoue National Park in the year 1968 lead to restriction on land use by wildlife officials as the land was initially used for hunting wildlife (Kansky, *et al.*, 2016). Currently, anthropogenic activities such as fishing, gold mining, livestock keeping as well as crop farming are restricted within national parks. In the year 2008, the communities surrounding the park lost 31% of their annual crop revenue and another 18% of annual livestock income in each household as a result of invasion from wild animals such as elephants, green parrots, warthog and baboons (Ekernas, Sarmiento, Davie & Berger, 2017).

In South Africa, Karani (2009) conducted a study on environmental implications of the road network. Road infrastructure, categorized into surface, un-surfaced and gravel established a huge network which cut across the country covering a distance of 752,700 square kilometers out of 1200000 kilometers of the total roads in that state. The road network also represented environmental frontier to environmental economists and ecologist. The study found that development of the road infrastructure lead to

displacement of species, ecosystem deterioration soil erosion and hydrological effects. The study also established that ecological interruption led to spatial planning, strategic policy intervention and establishment of road networks that supported road-reserve networks of native species with the intent of conserving, restoring and protecting biological diversity. Further, the study established that the negative and harmful effect were directly proportional to increase in road network within the state due to public demand on road usage. Hence, the direct and indirect effect of the road networks had a long term accumulative effect on flora, fauna and community.

In the state of Ghana, Manyimadin (2008) conducted a study to assess the effect of land usage and variation in land cover in Wassa West District in Ghana through the use of remote sensing device. The study found that the main driving forces which led to variation in land cover include: increase in population, socio-economic, cultural and lumbering practices. The study also established that mining activities as well as lumbering practices were the main cause of land change and usage in primary forest. Moreover, the study established that reliance on domestic energy such as wood and increase in demand for food production to feed the ever growing population led to rapid depletion of land cover. Seyram *et. al.* (2012) found out that increase in population growth lead to increase in house demands thus led to reduction of vegetation cover over time. Further, Abubakar (2015) conducted a research on the effect of land usage and land change in Nigeria. The researcher used geospatial technique during his study. The study found that land use as well as land change led to rapid decoration of biological diversity especially in Savanna region which was more vulnerable to interference by community members and wildlife.

2.4 Land use changes in East Africa

In East Africa, various studies highlight various land use changes. Maitima *et al.* (2009) conducted a study to determine the association between land use, degradation of land and distribution of biological diversity in East Africa. The study found that there was a significant relationship between land use, land degradation and distribution of biological diversity. The study also established that pastoralists' maintained native species

compared to crop farming. The study established that increase in farming land led to decline in soil fertility and moisture. In addition, the study established that increase in diversity of crops encouraged regeneration of indigenous species. Further, the study established that moderate farming in regions with moderate forest cover lead to a significant increase in biodiversity. The results also revealed that farmers who adopted livestock farming and crop farming used organic manure to improve soil fertility in their farms thus led to increase in farm yield. Further, the study established that farming in woodland, grassland and bushlands with a few trees led to increase in habitat diversity due to adoption of agro systems which attracted new varieties of species. However, the study established that increase in in farming activities led to reduction in natural ecosystems due to introduction of exotic trees used for agroforestry practices.

In Tanzania, Kwaslema (2013) established that the rate of conversion of natural habitat farming lands was high due to increase population growth within Kwakuchinja wildlife corridors. The study also established that overexploitation of wildlife resources, development of infrastructure led to blockage of wildlife corridors. The results revealed that wild animals in the corridors damaged crops, livestock, infrastructure and prevented individuals from accessing firewood and other social amenities services. Further, the study found that expansion of crop land were experienced between the year 2000 and 2010 hence led to significant loss of biological and habitat diversity.

In addition, Soini (2005) indicated that increase in agricultural activities in marginal lands and climatic variation led to water shortage in the region consequently resulting to change in farming practices. Land scarcities tend to inhibit expansion of agricultural land resulting to scarcity of agricultural resources. The study also established that local initiatives lead to change in land use despite of the fact that the local lacked integrated approaches on economic analysis, policy and agricultural studies. Further, the study established that nonagricultural activities employment opportunities were of much important but due to shortage of non-agricultural jobs, not all household enjoyed the opportunity.

In Uganda, about 54% of the total land within one kilometer from Kibale National Park's border is cultivated. Every year, the farmers lose between 4 to 7% of their crops. In response, the farmers use defensive mechanisms that result in the death of animals such as elephants and injuries to farmers (Makindi *et al*, 2014). Mbaziira (2014) conducted a study on the effects of land use cover change on rangeland ecosystems in Kakooge Sub-County Nakasongola District. The results from remote sensing analysis revealed that land cover changed due to an increase in cultivation activities in woodlands. Nonetheless, socio-economic survey results revealed that cultivation practices in each household decreased from 2.2 ha to 1.8 ha in the last two decades. The study also established that major factors which led to a reduction in land cover include: drought, redistribution of land and degradation of land. Moreover, the study established that the average land holding in each household decreased from 1.6ha to 1.5ha (Mbaziira, 2014). The land cover in Kakooge woodland decreased at the rate of 3.4% annually, while, grass cover increased at the rate of 0.68 in comparison to this, the density of shrub land decreased at an annual rate of 0.11% while that of wetland decreased at an annual rate of 0.83%. Further, the results revealed that there was a net decrease of 45.7% of the vegetation covers due to an increase in population growth (Ghezehei, Shifflett, & Nichols, 2015). In addition, Egeru and Okello (2012) researched on the association between land use and land cover in the sub County of Kirima. Findings indicated that household size and less stringent environmental regulations contributed significantly to an increase in land use and a decrease in land cover. Further, the study established that the type of agricultural crop grown, land tenure system and extension officers' visits played a significant role in predicting land usage and a decrease in land cover.

In Kenya, Kiboro and Kiboro (2016) found that the rapidly increasing human population and changes in lifestyles have a direct threat to wildlife conservation. Land subdivision, human settlement and poorly planned developments around wildlife dispersal areas are particularly posing a major threat to wildlife population. In Nairobi National Park and Kitengela Conservation areas the key land use changes identified as affecting wildlife population were fencing of areas that traditionally were dispersal areas for wildlife, land sub-division and sale of land, mining and quarrying among others. All these activities are incompatible with wildlife conservation strategies. According to Waithaka (2010),

The land use in Laikipia West has changed due to increase in population growth of human being and this has led to encroachment of wildlife ecosystem for agricultural production and establishment of residential areas to sustain the population. Hence, ungulate species such as elephants have invaded human residence due to increase pressure for resources such as food and water. Similarly, Syombua (2013) found that significant transformation occurred in sisal plantation, irrigated agricultural lands and woodland in the period of 1987 to 2011. The habitats of wildlife are projected to significantly decrease due to increase in agricultural activities. The study also established that the reduction in land cover was attributed to increase in agricultural productivity so as to sustain the ever increasing human being population. Further, the study established that effective planning and creating awareness on land use play a key role in improving vegetation cover.

Okello (2013) found that the residents in Kuku Group Ranch supported expansion of its agriculture activity since it was more profitable compared to conservation and pastoralism. The result also revealed that the group supported land partitioning among individuals compared to communal ownership. The study also established that the major causes of land resentment include: lack of stakeholder involvement in wildlife conservation and lack of compensation of losses attributed to wildlife attack. Further, the study established without urgent redress, wildlife population in Masai Mara community is projected to decrease either through indirect or direct prosecution or incompatible land use and change.

Similarly, Nyamasyo and Kihima (2014) conducted a study to determine how change in land use pattern influenced ungulate species in Kimana Ecosystem. The study found that expansion in farm size as well as human population increase led to decline in forested areas, grasslands as well as wetland ecosystem in the region due to human encroachment. The main causative agents for LUC were increase in agricultural productivity, rapid population growth and change in landownership policy, social-cultural and political factors. Furthermore, the study established that land use change led to decrease in the population of ungulate wildlife, destruction of habitat, increased conflict between human being and wildlife, degradation of land and displacement of ungulate species by livestock.

2.5 Human population increase

The population of human being has been increasing significantly in the last two decades compared to that of wildlife in various part of the world. Population increase is particularly high in developing nations such as those in Africa (Lamers *et al.*, 2014). Rapid increase in population growth in the continent of Africa has led to encroachment of wildlife habitats which ultimately result to human-wildlife conflict. Community members in the peri-urban region in the African countries have been living with fear of wildlife attack as well as destruction of properties. For instance, Baboons raid most of agricultural firms, camping areas and lodges in such of food and water causing immense nuisance in peri-urban settlements. Increase in population growth has led to transformation forested lands, Savannah vegetation among other ecosystem into agricultural production areas or urban settlement due to increase in demand of food, raw material and energy which consequentially led to decline in wildlife habitats (Kuriyan, 2013; Holdren & Ehrlich, 2009).

Increase in population growth as well as social transformations place most individuals in direct contact with wildlife as a result of expansion of settlements and increase in population growth of human being living around the wildlife protected areas. (Estes *et al.*, 2012). According to Ladan (2014), rapid population growth of people led to encroachment of wildlife habitats resulting to reduction of species which are in marginal areas, competition of resources in urban conglomerates areas in Colombia, Canada and British. In the recent years, increase in the population of human being has been found to be directly correlated with fatal incidences of cougar attacks such as black bears and grizzly bears.

Eigenbrod *et al.* (2011) conducted a study on the relationship between human population growth in urban areas in Europe and ecosystem services. The study found that urbanization led to increase in land use and change. The study also established that urbanization led to spatial decline in ecosystem service provision. Further, the study found that human population increase in Britain led to desertification of urban areas and decline in permeable surfaces, which ultimately result to 1.7 million people living within one km of rivers with at least 10 % increase in the projected flow of peak leading to suburban sprawl that have minute impact on mitigation of flood.

In the Sichuan Province of southwestern China, Liu et al. (2009) found that population growth of human being increased by 66 percent and household numbers which were within wildlife reserve increased by 115 percent since the year 1975, when the wildlife reserve was established. In the same period, the study found that the quantity of giant panda ecosystem as well as their quality decreased due to anthropogenic factors such as overexploitation of forest during fuel wood consumption. System model predictions indicate that in the same status quo, the reserves experience a drastic increase in human population growth resulting to severe distraction of panda habitats. Otherwise, decline in birth rate of human being and increase in their immigration rate led to decline in population growth which ultimately results to alleviation of human impacts in panda habitats.

Population growth in human being has increased significantly in the last two and half decade to approximately 40 million individuals and the population growth is projected to increase exponentially. Due to the increase, the rate of land use has increase with regard to increase in agricultural production in order to ensure availability of food to sustain the population. Forests have also been cleared and this has led to deforestation thus reducing the habitats for wild animals (World Bank, 2009). Ominde (2001) researched on population and resource crisis in Kenya. The results indicated that the increase in human population growth has been experienced in different rates due to variation in the size of productive land. The variation in the rate of population growth has been caused by increase in soil erosion and inadequate productive land. Similarly, increase in pressure on available water resources and fuel resources.

2.6 Pastoralism

Human-wildlife conflict is a key issue with regard to conservation of wildlife and rural community development. Deliberate killing of wild animals which are perceived to be pests has led to extinction and endangerment of many wildlife species (Tefera, 2015). Despite of the fact that conservation is concerned with the lethal control, it is a fact that not all endangered wildlife species threaten human livelihoods. The conflict between human and wildlife is a key issue in conservation of ungulate carnivorous species which attack livestock and these cause the wildlife officers or farmers to kill the carnivores in

order to protect their livestock (Kiboro & Kiboro, 2016). Lethal control mechanism is normally conducted in response to specific livestock attack. Therefore, any control mechanisms which tend to reduce predation is likely to reduce the population growth on carnivores and this benefit individuals as well as wildlife species which are preyed. There is a need to come up with control mechanism which led to minimization of predation of livestock by wild carnivorous animals. Such control measure is appropriate where the population growth of carnivores living alongside persons as well as livestock and where community members are in a position to benefit from the present of carnivorous wildlife through tourism (Kwaslema, 2013).

In Africa, a large portion of the individuals were traditionally livestock farmers for instance the Masaai community in East Africa and the Fulani community in West Africa. These communities rear goats, sheep and cattle as they move about in search of adequate pasture and water for their livestock, on a season basis. During their migration, their livestock are often attacked by carnivores such as leopards and hyenas. According to WWF report, leopard still attack and kill livestock in a radius of 100km from Cape Town in South Africa.

According to Woodroffe *et al.* (2007), human-wildlife conflict is a key issue in term of conservation of wildlife and development of rural areas. In the rangelands within Africa, wildlife species such as leopards (*Panthera pardus*), wild dogs (*Lycaon pictus*) and Chetahs (*Acinonyx jubatus*) normally attack livestock and the wildlife are killed by pastolists. Such human-wildlife conflicts led to extirpation of the species in various regions and impact the livelihood of farmer in those areas.

In Gobi, Ekernas *et al.* (2017) conducted a study on the pros and cons of desert pastoralism on reared wildlife species. The study found that argali density, the largest wild sheep in the world, at Ikh Nart was the highest Mongolia, however, the population of livestock was found to be 90% more compared to that of ungulate biomass. The results also revealed that dogs' population were 90% more compared to that on large carnivorous biomass. For argali, pastoralism led to decline in availability of food, led to increase in dog mortality due to predation and increased the risk of disease among

wildlife species. The results from Isotope analysis revealed that livestock meat contribute to more than 50% of gray wolves diets and a maximum of 90% of diets among 25% of the sampled gray wolves. The study established that livestock contributed to 96% of ungulate prey in a single wolf pack. The study found out that wolves killed 1 to 4% of livestock in Ikh Nart's annually. Further, the study found out that pastoralists reduced the population of gray wolves through killing since the pastoralists' livestock was the main source of food among grey wolves.

In Tanzania, Nelson (2012) established that the management of land in pastoral communities was through establishment of locally devised legal jurisdiction so as to ensure effective and efficient conservation and management of vital resources such as water and pastures. The study revealed that establishment of dry season grazing reserves played a major role in management of lands among pastoral communities in Tanzania as they acted as a grass bank during the period of drought. Due to significant influence of wildlife species in Tanzania tourism industry, the land use practices have been found to be of economical important. Through conservation of wildlife ecosystems, the local pastoralist in Tanzania collectively contributes to regional as well as national economic development. The economic values of the role of pastoralism in conservation and wildlife management emphasize on how effective policies in tourism sector, land sector and livestock keeping sector enhance communal management of rangelands and support traditional land practices.

According to Ocholla (2013), pastoralists living in rangeland regions in Kenya are often affected by wildlife interference as a large population of mammals roam freely in the rangeland. According to the findings of Ochola (2013), the main cause of conflict between wildlife and human being in rangeland areas include: crop destruction, competition for pasture and water, increase in diseases risk among livestock and direct threat to human security or life. The study established that Samburu community members have intensified their human vigilance; use of guarding animals, fenced livestock sheds and hunted down problematic wildlife species so as to minimize the interference.

2.7 Theoretical framework

The Planned behavior theory (TBT) is a model that is used to explain and predict the behavior of individuals in various contexts. The belief is based on the cognitive theory that was developed from Reasoned Action theory. According to Ajzen (1991), the behavior of an individual is normally regulated by the intention of each individual. Three variables which are independent are normally used to determine the intent of each individual as well as in predicting their behavior. These variables include: attitude (a strong belief about behavior), subjective norm values (a strong belief in the norms of other individuals and their expectations) and perceived control of behavior (a strong belief that an individual is likely to behave as anticipated). Attitude norms include; a strong thought about individual behavior. The subjective norms comprise of the social pressure emanating from the public for an individual to adopt certain behavior. Perceived control of behavior is normally based on individual experience and any anticipated obstacle such as opinion of individual behavior, his or her self-esteem which is very fundamental in determining whether an individual is likely to adopt a particular behavior and succeed in his or her business endeavor (Ajzen, 2002). At times, any of the determinants affects individual intention as the other three variables may be applicable in other incidences. Kansky *et al.* (2016) explained the existing association among the variables as his statement indicate that incase the attitude of a person and subjective norm is positive, the greater the perceived control of behavior an individual has and the stronger the intent to act (Kuriyan, 2013).

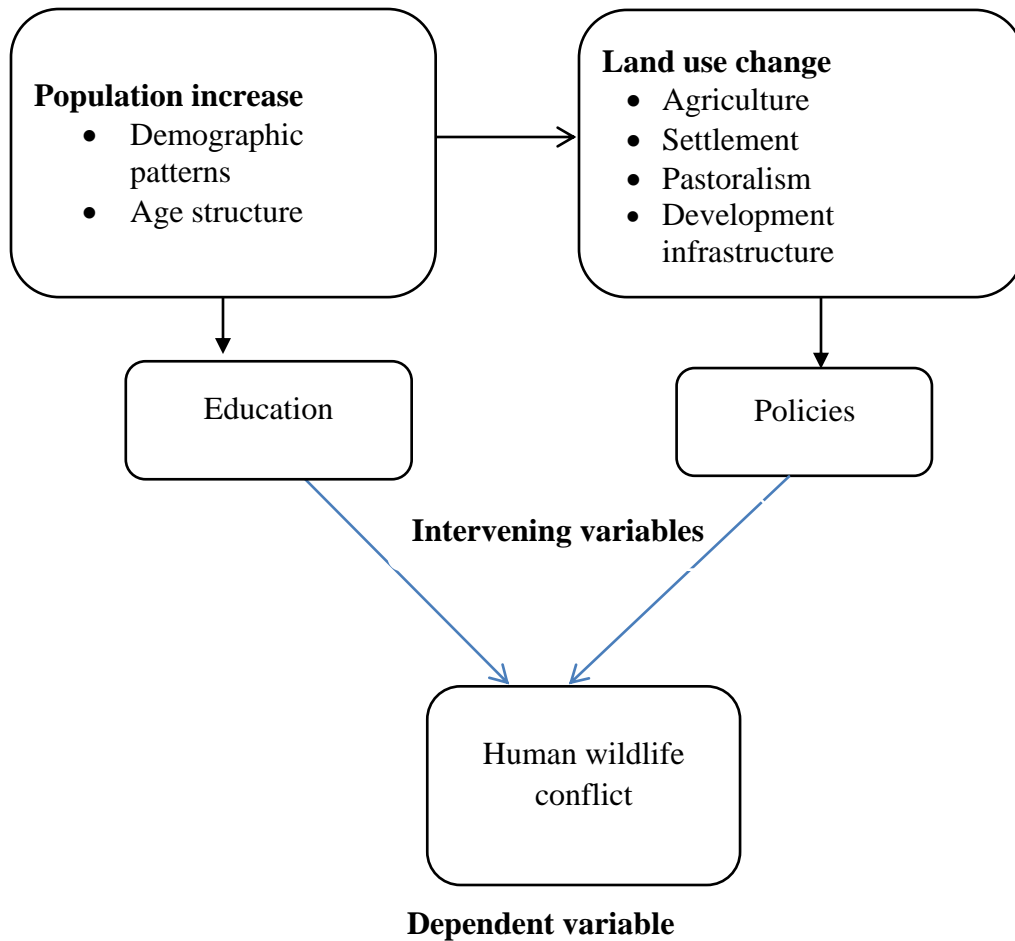
The intention of each individual is centralized in the Planned behavior theory, due to the fact that the stronger the intent of an individual, the more likely for an individual to adopt a certain behavior (Kiboro & Kiboro, 2016). Nonetheless, it is not guaranteed that every individual tend to act according to his or her attitude or belief due to the fact that there are some factors which can also influence the behavior of a person. These factors include: resources availability such as finance, time, competency skill and technical know-how (Kuriyan, 2013).

People tend to believe that change in land usage is beneficial to their social wellbeing as well as economic development. For instance, construction of infrastructure such as water projects, railway lines and roads leads to easier movement from one place to another. In addition, due to rapid population growth as well as demand in food production, people consider the use of forest land in the growing of crops as beneficial (Kuriyan, 2013). This in turn influences their attitude towards wildlife conservation, which subsequently leads to human-wildlife conflict. The theory is used to examine and explain the attitudes of human being towards wildlife species and factors influencing human-wildlife conflicts. The TBT theory provide information on how individuals' behaviors or intent can be controlled so as to identify land use and change practices which are responsible for human-wildlife conflict in Isiolo County. If the KWS can encourage individuals in regions where human-wildlife conflict is rampant, then people can adopt the best land use change practices which ensure conservation wildlife ecosystem as the individuals refrain from harming wildlife species such as elephants (Kwaslema, 2013).

2.8 Conceptual framework

Conceptual framework is defined as diagrammatical structure which given an explanation of the relationship between independent and dependent variables used in a particular study. According to Greener (2008), it is a diagrammatical model which hypothesizes and identifies the association between variables under investigation. The independent variables were population increase and land use changes in terms of agricultural activities, settlement and pastoralism as well as development of projects.

Independent variables



Source: Researcher (2018)

Figure 2 1: Conceptual framework

The independent variables of this study were population increase and land use change while the dependent variable was human wildlife conflict. The study used the theory of planned behavior to explain how human beings belief influence land use change , their social, cultural, political and economic lives. These in turn influenced their attitude towards wildlife conservation, which subsequently leads to human-wildlife conflict. The theory was also used to examine and explain the attitude of land users in Isiolo County toward wildlife species such as elephants and other factors resulting to human-wildlife conflict in the County. The information on individual intention and behavior are applicable in behavioral control which prevent human-wildlife conflict.

CHAPTER THREE: STUDY AREA

3.1 Introduction

The chapter entails presentation of the location and size of the study area (Garba Tula Sub County), topographical and climatic condition, history and culture of the people living within Garba Tula Sub County as well as their economic activity and land use practices.

3.2 Location and size

Garba Tula Sub County is located in the Isiolo County and is home to more than 40,000 pastoralists especially Borana Community. The Sub-county covers an area of 10,000 km.² It is located in latitude 0.533881 and longitude 38.518551. According to Salah (2014) the GPS coordinates indicate that the Sub-county is located in township zone (0° 32' 1.9716" North, 38° 31' 6.7836" East).

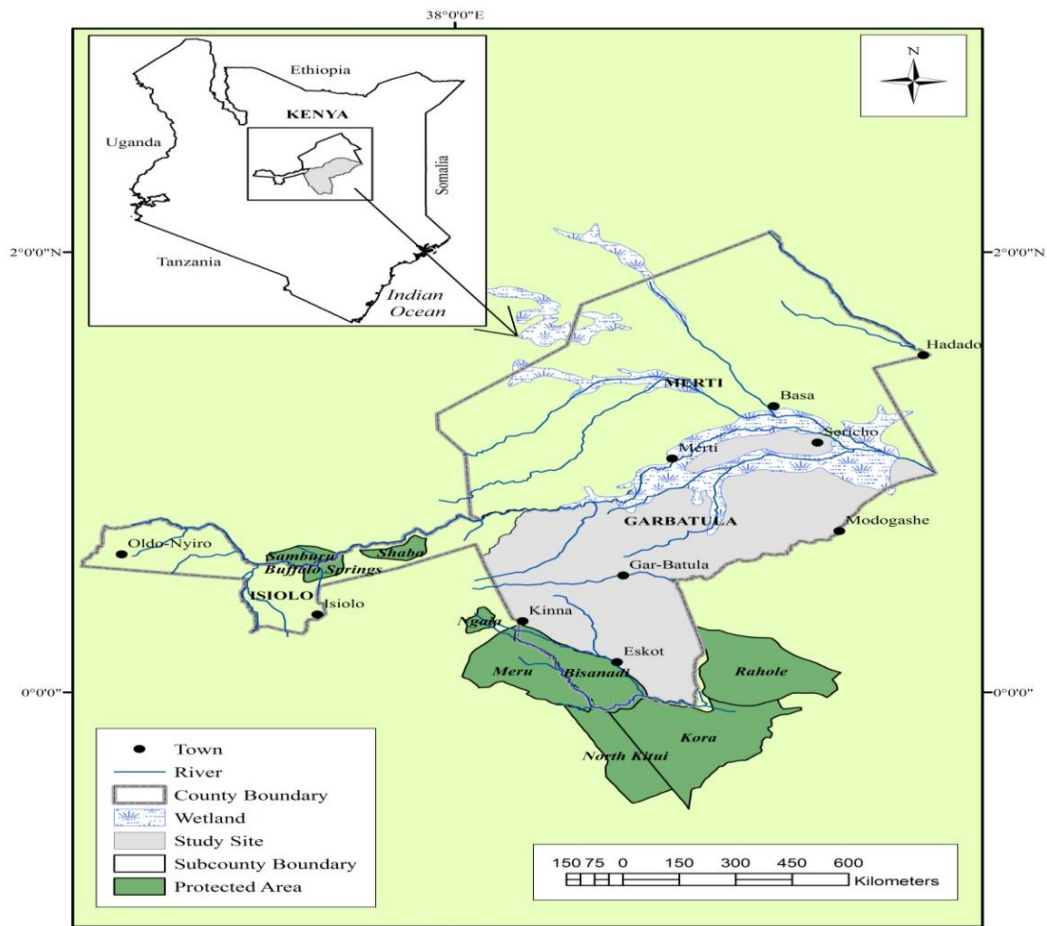


Figure 3.1 A Map on Location and Size of Garba Tula Sub County
Source: Researcher (2018)

3.3 Topography and climate

Garba Tula is located in low plain, rising to the North of Lorian Swamp, in Daaba and Merti plateaus in the extreme south of volcanic hills and in the western part of Laikipia district (Ngasike, 2016). A large parcel of land (more than 95%) in Garba Tula Sub-County falls in the ASALs region as it experience low annual rainfall ranging from 150 to 250 mm in the Northern part and 300 to 350 mm of annual precipitation in the Southern region. The sub-county also experience high temperatures throughout the year, ranging between 24⁰C and 30⁰C. The rate of evaporation in Garba Tula region is extremely high as it is 10 times higher than the annual precipitation. The region has two rainy seasons. The short rainy season is normally experienced in the month of October and November as the long rainy season is experienced between March and May. The wettest months in the Garba Tula sub county are in November with an average annual precipitation of 143mm and in April during long rainy season with annual average precipitation of 149 mm (Salah, 2014).

3.4 History, people and culture

Borana community is regarded as the largest Cushitic groups which originated from the Horn of Africa. Their physical appearances, language and culture clearly confirm their origin from the Horn of Africa. The Borana communities are resulting groups of Oromo migrants who migrated from the Southern part of Ethiopian highland in 1500 AC. Majority of Borana community are related to individuals living in the state of Ethiopia. The Oromo communities migrated in the east but were later pushed back by Somali communities resulting to greater expansion in the South. There are approximately 4 million individuals from Borana community as majorities reside in Ethiopia. In higher elevation regions within Moyale and around river basins in Isiolo County, a large herd of cattle are kept by the Boran communities (Ngasike, 2016). The tribe of Boran is a sub section of major groups (Sakuyye, Waat, Boran-gutu and Gabbra) known as the Galla. The word Borana is normally pronounced with a silent vowel sound. It is refers to individuals or their language or colleague. The Borana communities speak the Afaan Oromo language. Borana is the language of Afan Borana, a dominant language spoken

among community members in the Ethiopia region as well as Kenya. The economic activity and their life style are organized around livestock keeping even though taboo camels are more important. Currently, they herd sheep and goats. The daily mandate of young men is to herd while that of women is nature the family (Kuriyan, 2013).

The homestead groups are supposed to migrate three to four times annually, as far as 100 km during periods of drought. Sturdy modular housing unit which are normally constructed by women comprised of batch-thatched grass unlike to Gabra community who weave mats to cover houses frame. Transportable good are loaded at the back of camels or carried by women as the move to new homesteads in search of water and pasture. They often settle in a group of 10 to 30 homesteads. Each of their cultural aspects is captured in their traditional songs and handed over from one generation to another. Children are normally educated on the culture of the community through music (Salah, 2014).

The community has a monotheistic traditional religion. The traditional name of their God is Waq. In the last 8 decade, Islam has become an influential religion among Borana community. However, estimates of 50% of Boranas have superficial contact with Islamic religion as most individuals have maintained their traditional practices. Nonetheless, the Borana community in Isiolo County are staunch Muslims (Kuriyan, 2013).

3.5 Economy and land use

The Borana community practice livestock keeping for various functions. Donkeys are normally kept for transportation of goods, especially among Boran-gutu community who do not rear camels. Camels, goats, cattle and sheep provide milk, meat, hides and skins among other products. Camels are used for transportation of goods and services.

Pastoralism is the main economic activity practiced in the region. The lands in Garba Tula are held trust by the county government of Isiolo. The region has quite high biological diversity which neighbors the conservation area in Meru. During dry periods, livestock are grazed along river-flood vegetation; however, during the period of rains, the riverine vegetation is unhealthy for herding as the region is infested with tsetse flies, mosquitoes which tend to cause diseases to both livestock and human being (Kuriyan, 2013).

In the recent years, the Garba Tula region has been experiencing a significant increase in population growth which has threatened availability of grazing lands hence threaten the main economic activity of Boranas. Moreover, intercommunity conflict has arisen due to competition on scarce resources such as water and pasture. This has forced the community to depend so much on relief agencies such as Red Cross for them to access food and water (Salah, 2014). In addition, like any area in Northern Province, Garba Tula has high distribution of guns and resins which boost their economic activity (Wekesa *et al.* 2009). Further, opoponax extraction is a key economic activity in the region as the residents earn income through exportation of opoponax products in Somali (Lamers *et al.*, 2014). Therefore, the pastoralism is the main economic activity in Garba Tula Sub County due to availability of few economic activities which can generate income.

3.6 Flora and fauna

Garba Tula Sub County is naturally endowed with wide varieties of plants and wildlife species. The region is part of the larger rangeland ecosystem that stretches from the traditional territory of Meru community in the Southern part (Ekernas, Sarmiento, Davie, & Berger, 2017). The Garba Tula Sub County landscape is mosaicked with a wide variety of perennial vegetation such as *Chloris pycnothrix*, *robanjires*, *Acacia tortilis*, *Boscia spp* and *Salvadora persica*. In relation to wildlife species, the region has reticulated Grant's gazelle, giraffe, dik-dik, Grant's gazelle, oryx, and Grevy's zebra which are common fauna in the typical ASAL region (Blackburn *et al*, 2016).

3.7 Water resources

The region has 6 perennial rivers: Ewaso Ngiro, Bisan-gurach, Liliaba, Bisanadi and Likiundu (Nyamasyo & Kihima, 2014). The Ewaso Ngiro is the main permanent river in the region and its source is at Abedare ranges in Mount Kenya region (Greiner, 2012). Bisanadi and Bisan-gurach are found in the southern part of the sub county and the two rivers drain into Tana River. River Liliaba and Likiundu originate from Nyambane hills and drain into Ewaso Nyiro (Ngasike, 2016).

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 Introduction

The section comprised of the procedures that were used during the study, to select the sample size, data collection and analysis. The chapter has sub section comprising of research design, the target population, the study's sample size, sampling method and instrument of collecting data, procedures of collecting data, pretesting of instrument of data collection and a plan for data analysis.

4.2 Research design

Descriptive research method was used during the study. According to Creswell (2006), descriptive research design is defined as the application of scientific methods in observing and describing the attributes of a phenomenon under investigation without interfering with its state. It is also defined research studies whose general purposes precisely portray the attribute of each individual or phenomenon under investigation (Bryman, 2003). The researcher made use of descriptive research design since it entailed the use of quantitative and qualitative research techniques. This study did not manipulate the variables of the interest in any way, which means that they were only described as they are. This therefore means that descriptive research design was the most appropriate research design for the study.

4.3 Target population

According to Kothari (2004), a population is a collection of objects, of individuals with similar observable attributes. The target population of this study was all the household heads in Garba Tula Sub County. According to KNBS (2009), Garba Tula Sub County has a total of 2177 households. The study also included 3 management staff from KFS and IUCN, 3 staff from IIED, 3 staff from local NGO RAP and 3 members of the County Government of Isiolo.

4.4 Sample size and sampling technique

The researcher used Morgan and Krejcie formula when calculating the sample size of the study. According to Kothari (2004), the use of a confidence level of 95% is a common practice among researchers. The researcher obtained a sample size of 326 from a population of 2177 households.

The following is the mathematical formula that was applied:-

$$n = \frac{X^2 * N * P * (1 - P)}{(ME^2 * (N - 1)) + (X^2 * P * (1 - P))}$$

Where;

N= sample size

X^2 = Chi-square for the specified confidence level at 1 degree of freedom

N=Population size

P= Population proportion

ME=Desired margin of error (expressed as a proportion)

$$= \frac{3.841 * 2177 * 0.5 * 0.5}{(0.05^2 * (2177 - 1)) + (3.841 * 0.5 * 0.5)}$$

n=326 household heads

The researcher made use of simplified random sampling when selecting 326 household heads (who were affected by human-wildlife conflict) from Garba Tula Sub County. Simple random sampling is used in the selection of a group of subjects (sample) from the larger group (population) (Cooper & Schindler, 2006). Each individual is randomly picked from the population and they all have the same probability of inclusion in the sample.

4.5 Data collection instruments

The researcher also used primary and secondary data when conducting this study. Secondary data was obtained from Ministry of environment and forestry conservancy reports and KWS annual reports. This study used questionnaires and key informant interview guides. Semi-structured questionnaires contained both open ended and closed ended questions.

Structured questionnaires (closed ended questions) were used in an effort to conserve time and money. The use of structured questions enabled the research to save on time as well as financial cost incurred during data collection process. The unstructured questions enabled the study participants to answer question without feeling victimized. The

questionnaire was structured in two parts as follows: Part A focused on General information; Part B was focused on questions relating to the general and specific objectives of the study. In addition, the research used interview guides when collecting data from key informants. Interviewing of key informants enabled the researcher to collect substantial information from professionals, community members and leaders (Greener, 2008).

4.6 Pilot test

The researcher conducted a pilot test which enabled him to identify and eliminate ambiguous questions. It also enabled the researcher to remove typographical errors and determine the reliability of data collection instruments. Further, the pre-testing enabled the researcher to determine the reliability of data collection instruments.

4.7 Data collection procedure

The researcher obtain data collecting permit from the campus administration before conducting this study. Moreover, the researcher presented transmittal letter to all the participants so as to assure them that the research was meant for academic purpose. The researcher informed the administrative representatives in the area of the intentions of the project before going to the households in the area. The questionnaires were distributed among the participants through the assistance of individuals who were very competent in data collection process. Furthermore, the research assistants used a drop and pick method when collecting data and the questionnaires were then collected after 14 working days.

4.8 Data analysis

After the field work and before analysis, checking for reliability and verification of all the questionnaires was done. The research instruments generated both qualitative and quantitative data. Qualitative data from the key informant interview guides and open ended questionnaires in the questionnaires was analyzed by use of thematic analysis. Thematic analysis is commonly used in analysis of qualitative data. According to Kothari (2004), it emphasize on examining and recording of data patterns. Thematic analysis also enabled the researcher to effectively describe the phenomenon under investigation.

The steps of preparation of quantitative data included data cleaning, preparation of a codebook, data entry, data validation and screening data for errors. Quantitative data was analyzed through the use of inferential and descriptive statistics. Descriptive statistics comprised of frequencies, percentages, mean and standard deviation. Inferential statistic comprised of correlation analysis and multiple regression analysis. A 95% confident interval was used during this study as it enabled the researcher to utilize a significant level of 0.05. This implied that, the p value of each independent variable ought to be below 0.05 for it to have a significant effect on dependent variable. The researcher used figures and tables to present the results.

Regression model for testing hypothesis one;

H₀: Land use changes has no significant influence on human-wildlife conflict in Isiolo County

H₁: The association between land use changes and human-wildlife conflict in Isiolo County is significant

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Whereby;

Y = Human wildlife conflict in Isiolo County

B₀ = Constant

β₁ =Coefficients of determination

X₁ = Land use changes

ε = Error term

Regression model for testing hypothesis two;

H₀: There is no significant relationship between population increase and human wildlife conflict in Isiolo County

H₁: There is significant relationship between population increase and human wildlife conflict in Isiolo County

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Whereby;

Y = Human wildlife conflict in Isiolo County

B₀ = Constant

β₁ = Coefficients of determination

X₁ = Population increase

ε = Error term

Regression model for objective three;

H₀: There is no significant relationship between pastoralism and human wildlife conflict in Isiolo County

H₁: There is significant relationship between pastoralism and human wildlife conflict in Isiolo County

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Whereby;

Y = Human wildlife conflict in Isiolo County

B₀ = Constant

β₁ = Coefficients of determination

X₁ = Pastoralism

ε = Error term

CHAPTER FIVE: RESULTS AND DISCUSSION

5.1 Introduction

The section entailed presentation and interpretation of results as well as discussion of the findings. The general purpose of the study was to identify land use change that is responsible for human wildlife conflict in Isiolo County. The specific objectives were to establish the influence of land use change, population increase and pastoralism on human wildlife conflicts. The results were presented in tables and figures (bar charts and pie charts).

5.2 Response rate

The sample size comprised of 326 household heads in Garba Tula sub-county. Out of 326 household heads, 273 participants filled and returned their questionnaires to the researcher. The provided a response rate of 83.74%. However, a response rate of 100% was unachievable since some data collection instrument had missing information, hence, they were excluded during data coding and analysis. In relation to the statement of Kothari (2004), a response rate that is greater than 50 percent is effective for data analysis. Thus, a response rate of 83.74% was within acceptable limits.

5.3 General information

The general information comprised of the participants' gender, age bracket, highest level of education as well as the number of people who lived in their household.

5.3.1 Gender

The study participants were asked to specify their gender. Their views were as shown in Figure 5.1.

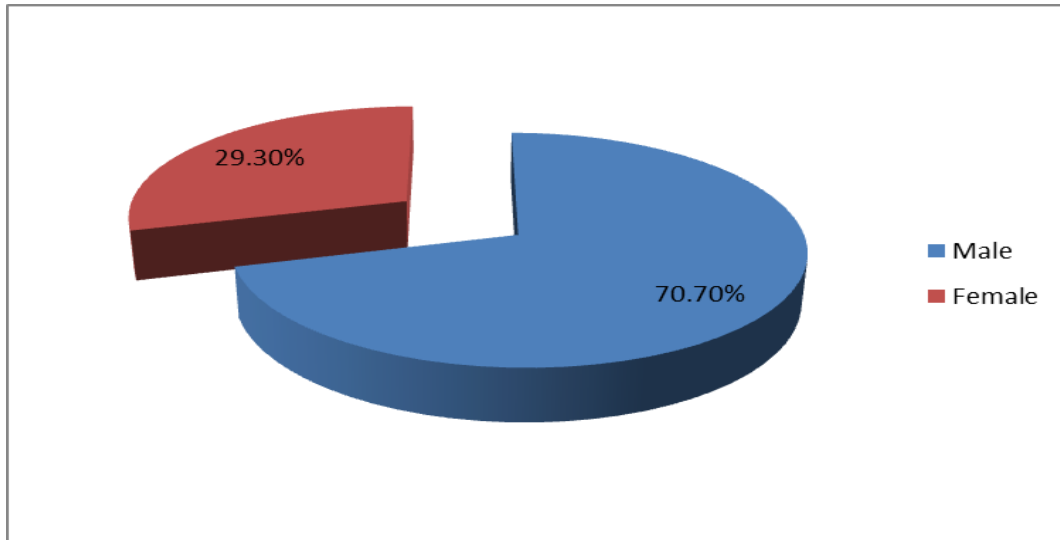


Figure 5.1: Gender
Source: Research Data (2018)

According to the results, 70.70% of the household heads specified that are male while 29.30% pointed out that they are female. This implied that most of household owners in Garba Tula Sub-County were male. This also implied that men are the head of most of the households.

5.3.2 Age of the respondents

The respondents were further asked to indicate their age bracket. The results were as shown in Figure 5.2.

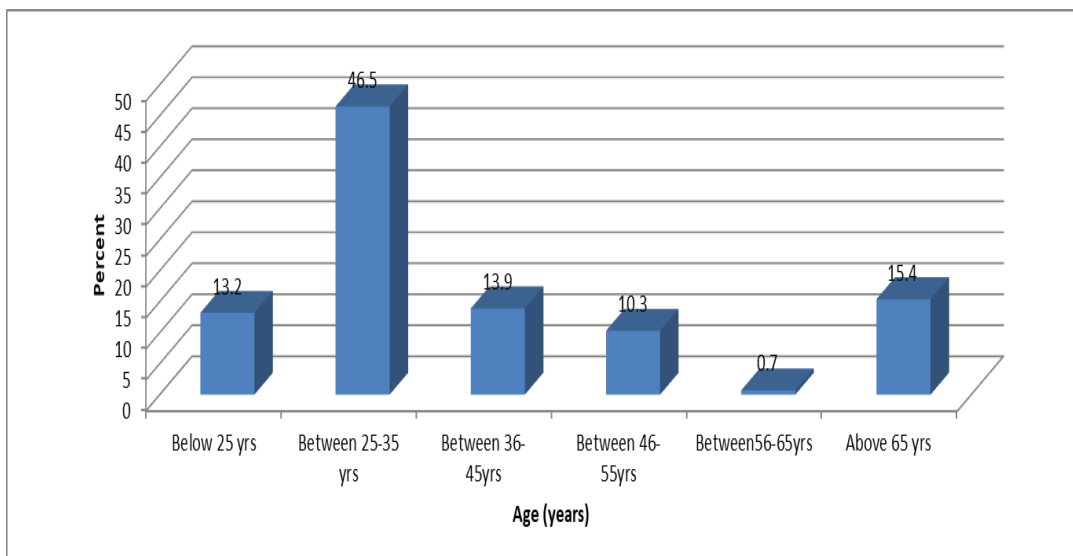


Figure 5.2: Age of the respondents
Source: Research Data (2018)

From the findings, 46.5% of the household head pointed out that they were aged between 25 and 35 years, 15.4% were above 65 years, 13.9% were between 36 and 45 years, 13.2% were below 25 years, 10.3% were between 46 and 55 years while 0.7% of the staffs were aged between 56 and 65 years. This implied that majority of household heads in Garba Tula Sub-County were aged between 25 and 35 years.

5.3.3 Respondents' highest level of education

The respondents were further asked to indicate their highest education level. The results were as presented in Figure 5.3.

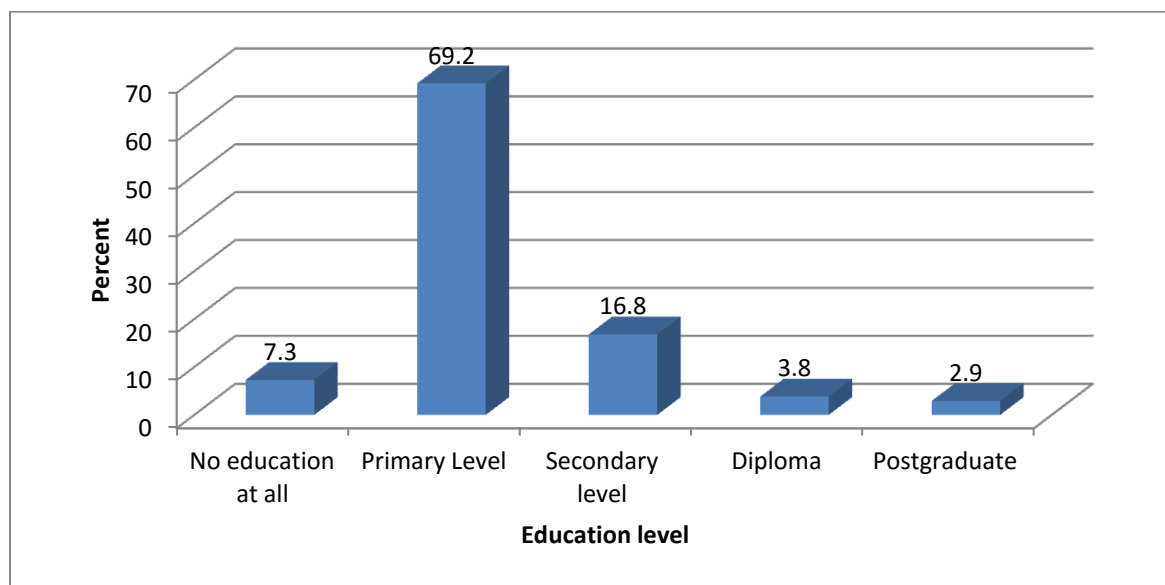


Figure 5.3: Respondents' highest level of education
Source: Research Data (2018)

From the findings, 69.2% of the household heads specified that they had primary education, 16.8% had secondary education, 7.3% did not have any formal education, and 3.7% had diplomas while 2.9% had postgraduate education. This shows that most of the household heads in Garba Tula Sub-County had a primary level of education.

5.3.4 Number of people in households

The respondents were asked to specify the number of people who were living in their households. The findings were as shown in Figure 5.4.

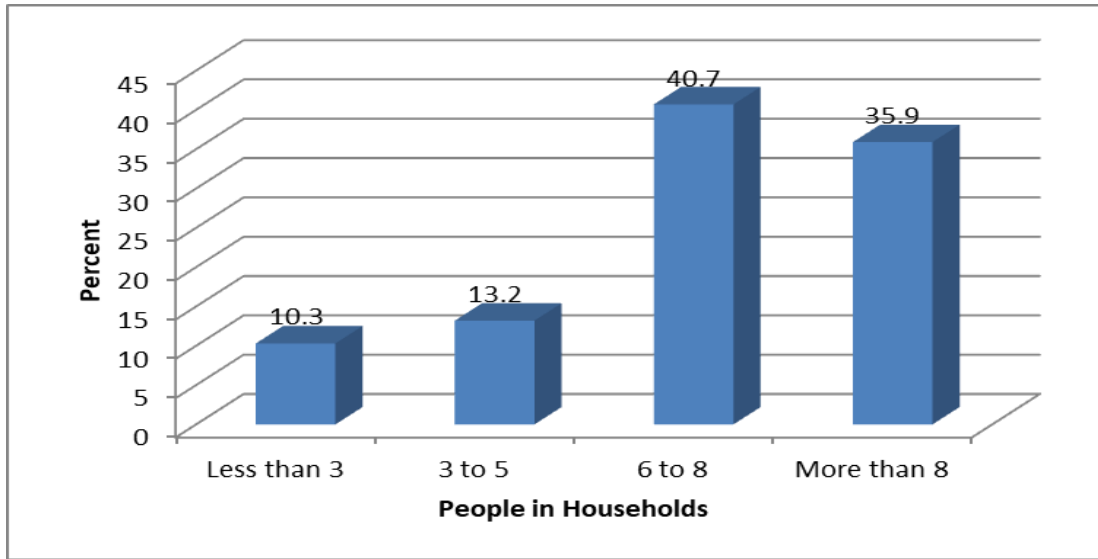


Figure 5.4: Number of people in households

Source: Research Data (2018)

From the findings, the 40.7% of the households specified that there were 6 to 8 people in each household, 35.9% more than 8 people in a household, 13.2% 3 to 5 people while 10.3% had less than 3 people. This implied that most of the households in Garba Tula Sub County have 6 to 8 people.

5.4 Human wildlife conflict

Moreover, the household heads were asked to indicate whether had ever been attacked by a wild animal, how often the attacks were, what happened after the attack, whether livestock's had ever been attacked by wild animals, whether the household heads had ever killed wild animals and whether there were animals that existed in the past and are no longer in existence.

5.4.1 Injuries and loss of life

The respondents were asked to specify whether they have been attacked by wild animals. The results were indicated in Figure 5.5.

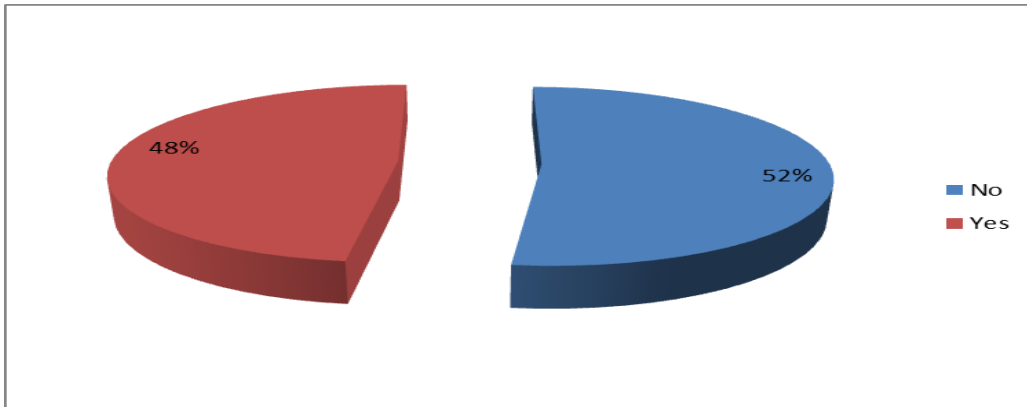


Figure 5.5: Injuries and loss of life due to attack by wild animals

Source: Research Data (2018)

From the findings, 52% of the households specified that their household members had not been attacked by wild animals while 48% indicated that they had been attacked. This implied that most of the household heads or their family members had not been attacked by wild animals.

5.4.2 Occurrence of attacks on human

The respondents requested to specify the period of attack occurrence. Their outcomes of their views were as illustrated in Figure 5.6.

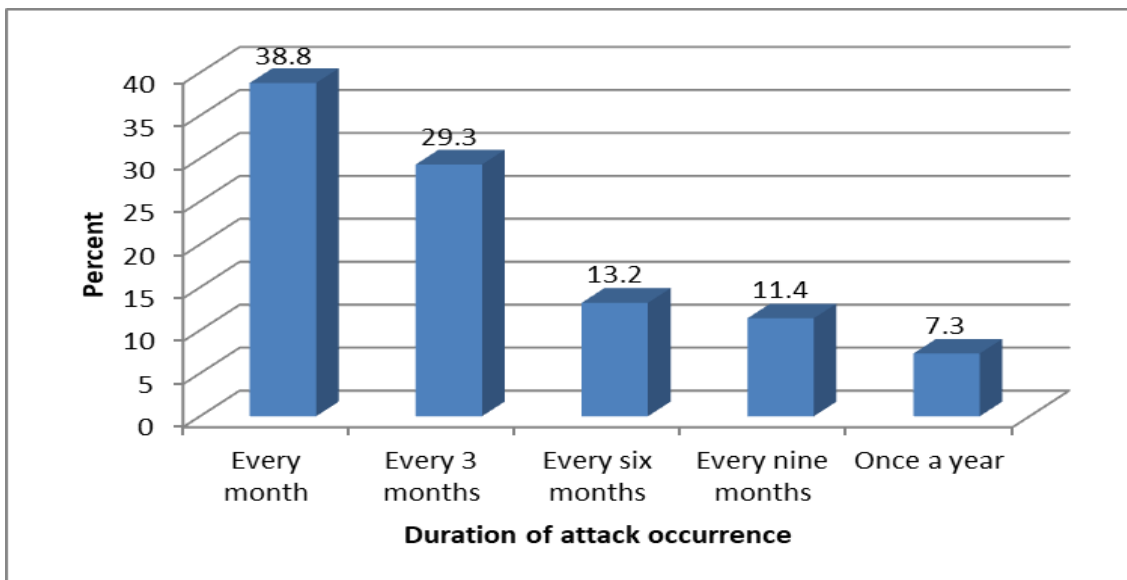


Figure 5.6: Occurrence of attacks on human

Source: Research Data (2018)

According to the results, 38.8% of the household heads specified that the attacks occurred every month, 29.3% every three months, 13.3% every six months, and 11.4% every nine month while 7.3% indicated once a year. The findings show that the attacks on household heads or their family members occurred every month.

5.4.3 Effects of attacks by wild animals

The respondents were further asked to indicate what happened to the persons who are attacked by wild animals. The results are as presented in Figure 5.7.

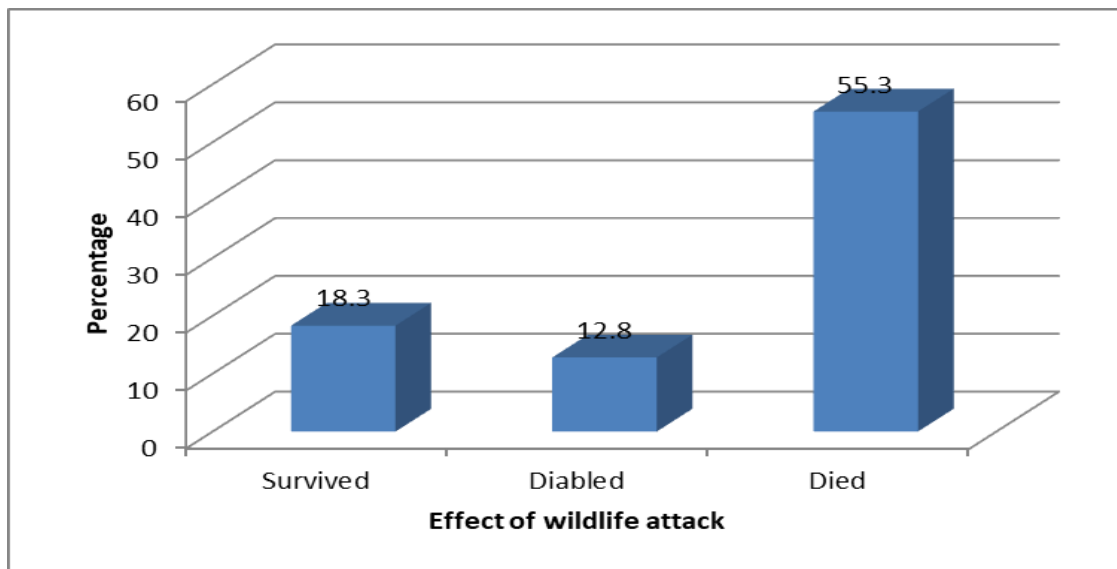


Figure 5.7: Effects of attacks by wild animals

Source: Research Data (2018)

According to the results, 55.3% of household heads pointed out that wildlife attack lead to death, 18.3% specified that the victim survived while 12.8% specified that wildlife disabled the victims. This implied that most of wildlife attack led to death of people and domestic animals in most of the households.

5.4.4 Livestock attack by wild animals

The respondents were asked to indicate whether their livestock had ever been attacked by wild animals. The outcomes were as illustrated in Figure 5.8.

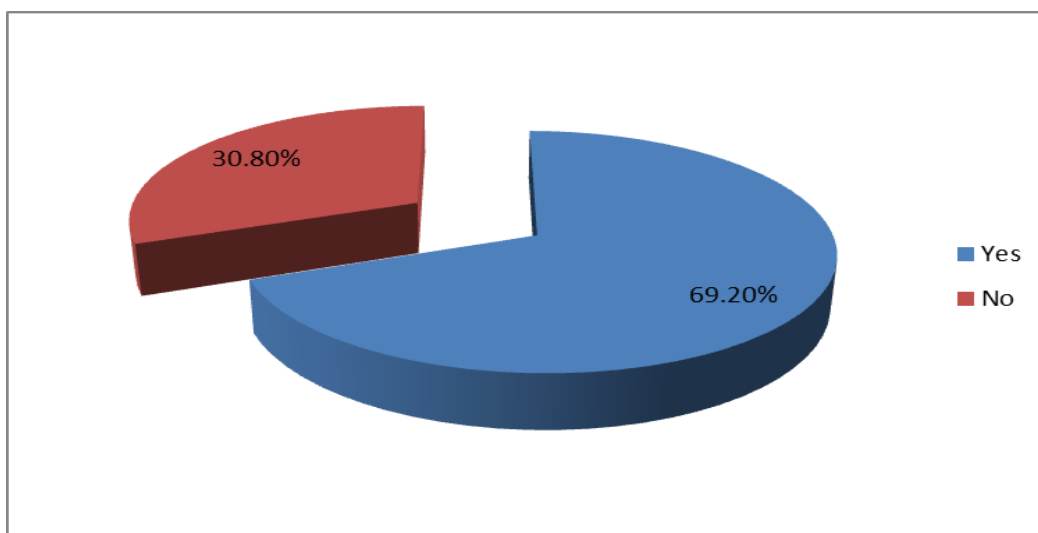


Figure 5.8: Livestock attack by wild animals
Source: Research Data (2018)

According to the results, 69.20% of the household heads specified that their livestock had been attacked by wild animals while 30.80% that they had not been attacked by wild animals. Therefore, most of the households in Garba Tula Sub-County had experienced wild animals attack on their livestock.

5.4.5 Livestock loss due to attacks

The respondents were further requested to indicate the number of cattle that they had lost due to attacks from wild animals in a period of one year. The results were as presented in Table 5.1.

Table 5.1: Goats lost due to attacks from wild animals in one year

Goats	Frequency	Percent
below 5	12	21.1
6 to10	12	21.1
11 to 15	19	33.3
16 to 20	2	3.5
21 to 25	8	14.0
Above 30	4	7.0
Total	57	100.0
Minimum	1	
Maximum	33	
Mean	12.12	
Standard Deviation	8.292	

Source: Research Data (2018)

The results indicated that 33.3% of the household had had lost 11 to 15 goats as a result of attack by wild animals, 21.1% indicated below 5 goats, 21.1% indicated between 6 and 10, 14.0% indicated between 21 and 25, 7.0% indicated above 30 while 3.5% indicated that they had lost 16 to 20 goats. The findings show that most of the households had lost between 11 and 15 goats in a period of one year. The maximum numbers of goats lost due to attack by wild animals were 33 while the minimum was 1. The mean was 12.12 and the standard deviation was 8.292.

Table 5.2: Sheep lost due to attack from wild animals in one year

	Frequency	Percent
below 5	12	19.4
6 to10	4	6.5
11 to 15	40	64.5
21 to 25	2	3.2
26 to 30	4	6.5
Total	62	100.0
Minimum	1	
Maximum	27	
Mean	11.16	
Standard Deviation	6.194	

Source: Research Data (2018)

According to the results, 64.5% of the households specified that they had lost 11 to 15 sheep, 19.4 % indicated that they had lost below 5, 6.5% indicated that they had lost 6 to 10, 6.5% indicated that they had lost 26 to 30 while 3.3% indicated that they had lost 21 to 25 sheep. The findings imply that most of the households had lost between 11 and 15 sheep in one year. The maximum number of sheep lost per household was 27. The minimum was 1 and the maximum was 27. In addition, the mean was 11.16 and the standard deviation was 6.194.

Table 5.3: Cattle lost due to attack from wild animals in one year

	Frequency	Percent
below 5	18	25.0
6 to10	32	44.4
11 to 15	8	11.1
16 to 20	4	5.6
21 to 25	8	11.1
Above 30	2	2.8
Total	72	100.0
Minimum	2	
Maximum	33	
Mean	10	
Standard Deviation	6.994	

Source: Research Data (2018)

The results revealed that 44.4% of the household heads had lost 6 to 10 cattle, 25.0% indicated that they had lost below 5, 11.1% indicated that they had lost 11 to 15, 11.1% indicated that they had lost 21 to 25, 5.6% indicated that that they had lost 16 to 20 while 2.8% indicated that they had lost above 30. This implied that most households had lost 6 to 10 cattle in one year. The average number of the cattle lost in Garba Tula Sub-County was 10. The minimum number per household was 2 and the maximum number per household was 33. The mean was 10 and the standard deviation was 6.994.

Table 5.4: Camel lost due to attack from wild animals in one year

	Frequency	Percent
below 5	30	37.5
6 to10	20	25.0
11 to 15	10	12.5
21 to 25	16	20.0
Above 30	4	5.0
Total	80	100.0
Minimum	1	
Maximum	32	
Mean	10.80	
Standard Deviation	8.531	

Source: Research Data (2018)

According to the results, 37.5% of household heads specified that they had lost below 5 camels, 25.0% indicated that they had lost 6 to 10, 20.0% indicated that they had lost 21 to 25, 12.5% indicated that they had lost 11 to 15 while 5.0% indicated that they had lost above 30. The results show that most of the households had lost less than 5 camels in one year. The minimum was 1 while the maximum was 32. The mean was 10.80 and the standard deviation was 8.531.

Table 5.5: Donkeys lost due to attack from wild animals in one year

	Frequency	Percent
below 5	34	53.1
6 to10	22	34.4
11 to 15	8	12.5
Total	64	100.0
Minimum	1	
Maximum	12	
Man	4.84	
Standard Deviation	3.661	

Source: Research Data (2018)

From the findings, 53.1% of the respondents indicated that they had lost below 5 donkeys, 34.4% indicated that they had lost 6 to 10 while indicated that they had lost 12.5% 11 to 15. This shows that most of the household heads had lost less than 5 donkeys in one year. The minimum was 1 while the maximum was 12. The mean was 4.84 and the standard deviation was 3.661.

5.4.6 Killing of wild animals by household heads

The respondents asked to specify whether they have ever killed wild animals. The results were as shown in Figure 5.9.

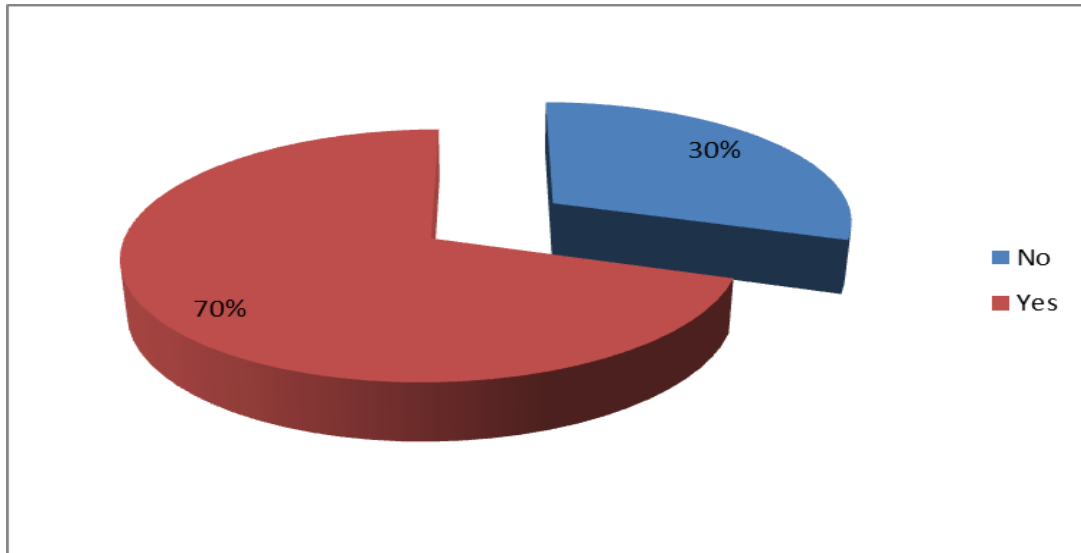


Figure 5.9: Killing of wild animals by household heads

Source: Research Data (2018)

According to the results, 70% of the household heads specified that they have ever attacked/killed wild animals while 30% they have not. From the findings, most household heads had attacked or killed wild animals. The animals that the households had killed include leopards, lions, elephants and hyenas. The respondents further indicated that they attack wild animals so as to protect their livestock. They also indicated that they attacked them to prevent crop damage and for food safety. This is because there is a tendency of competition between human and wild animals for food and water resources. The respondents also indicated that they attack wild animals in order to help reduce livestock disease.

5.4.7 Animals in the past and were no longer in existence

The participants were requested to specify whether there were wild animals that were there in the past and they are no longer in existence. The results were as depicted in Figure 5.10

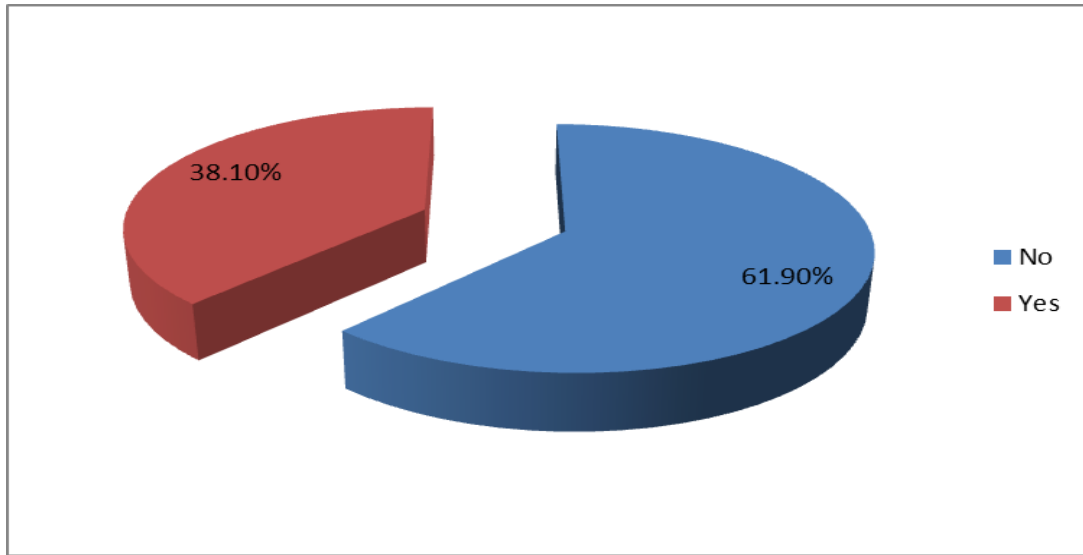


Figure 5.10: Animal existence from the past

Source: Research Data (2018)

The results revealed that, 61.90% of the household heads specified that some wildlife have face extinction while 38.10% specified that the wild animals in the region have not undergone extinction. The respondents also indicated that the animals that have faced extinction were rhinos and Grevy's Zebras.

5.4.8 Consequences of human-animal conflict

The respondents indicated that individuals that were living close to the wildlife reserves were attacked often by carnivorous animals such as leopards. The results also revealed that wildlife damaged the crops of the community members thus lead to human-wildlife conflicts. Further, the study established that deforestation lead to reduction of wildlife habitats hence resulting to decline in wildlife in the area as they migrated to other places in search of new habitats.

5.4.9 Main factors causing human wildlife conflict in Garba Tula Sub -county

The key informants were asked to indicate the main factors causing human wildlife conflict in Garba Tula Sub –county. From the findings they indicated that one major factor is lack of proper planning as far as settlements are concerned. There is no proactive planning that identifies certain area for settlements and others for wildlife. This led to corridors being blocked by human settlements e.g. Shaba to Bisan Adi corridor blocked

as a result of farming that is taking place. They also indicated that poor management style by the Kenya Wildlife Service personnel led to hatred between the locals and authority. There is no effective community participatory approach. In addition, there was lack of sensitization on the importance of the community though cultural belief on wildlife and the environment is practiced by the community. The key informants also indicated the failure of the local leadership has also led to the human-wildlife conflict. On some occasions, the KWS official consults or meets the local leadership on the same but the message does not trickle down to the community or gets distorted along the way. It is hijacked at the decision making level without community involvement e.g. community issues of compensations and other important aspects. One of the key informants said:

“Over the past years the relationship between the two was good i.e. there has been no bad blood and they coexisted peacefully until the issue of managing wild animals come into force where death and destruction are experienced leading to conflict every now and then. Poaching menace and management style of Kenya Wildlife service are to blame for the problem. For example the issue of not allowing pastoralists to graze their animals in National parks during severe drought doesn't go well with the pastoralists. If they dare do that (by grazing them in the parks) the authority brutally drives them away using for example helicopters. This is torture according to humans because it leads to deaths and injuries on both humans and animals K07.”

5.5 Land use changes

The first objective of the study was to identify land use changes that are responsible for human wildlife conflict in Isiolo County. Therefore, the study sought to establish the extent to which land use changes occurred in Garba Tula Sub-County as well as how land use changes leads to human-wildlife conflict in Garba Tula Sub-County.

5.5.1 Size of land

The respondents were also requested to specify the size of their land. Their opinions were as illustrated in Figure 5.11.

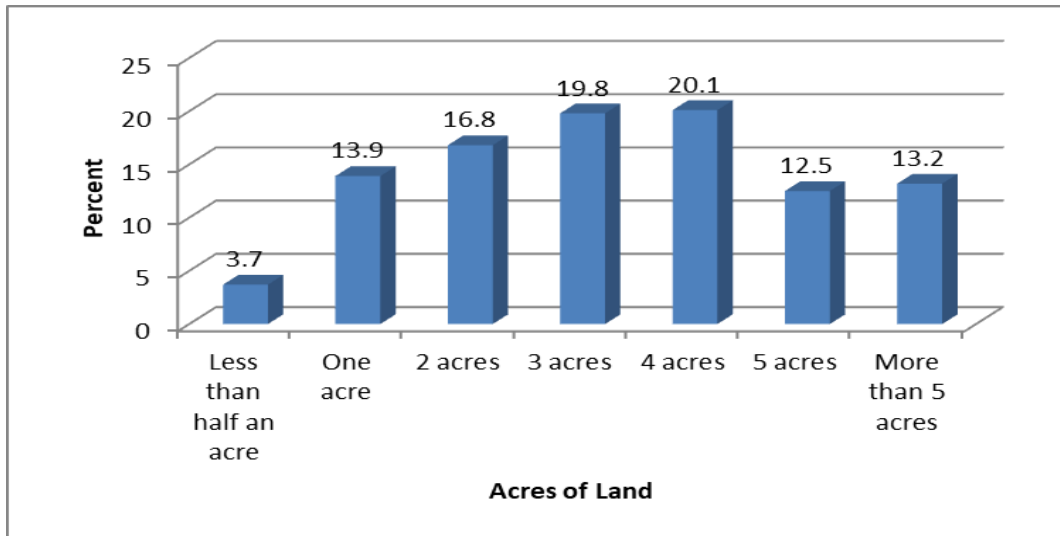


Figure 5.11: Size of land
Source: Research Data (2018)

The results revealed that, 20.1% of the household head had 4 acres of land, 19.8% had 3 acres, 16.8% had 2 acres, 13.9% had one acre, 13.2% had more than 5 acres, and 12.5% had 5 acres while 3.7% had less than half an acre. This implied that most of the households were having 4 acres of land and the size of the land for pastoralism has changed leading to human wildlife conflict.

5.5.2 Farming activities

The household heads were also asked to specify the type of farming activity they were engaged in. The findings were as presented in Figure 5.12.

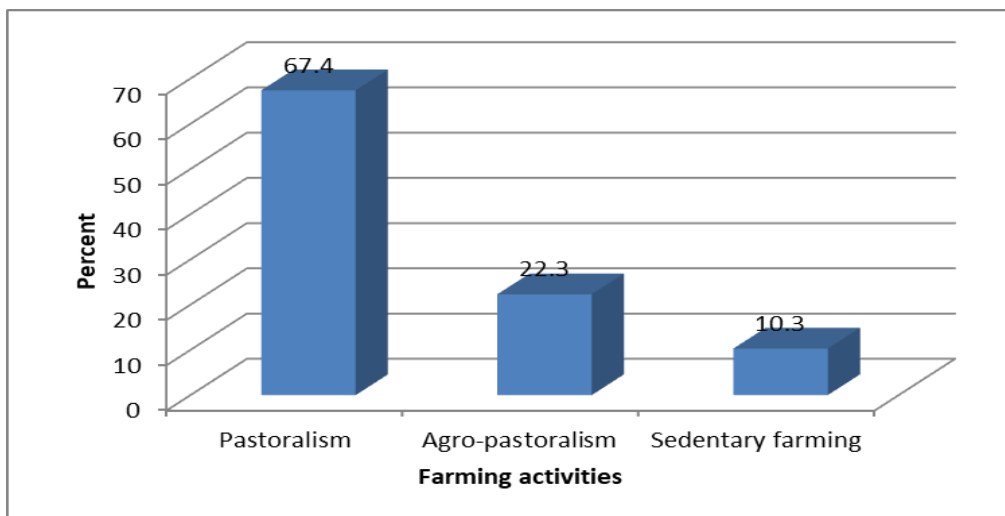


Figure 5.12: Farming activities
Source: Research Data (2018)

From the findings, 67.4% of the household heads indicated that they engaged in pastoralism, 22.3% in agro-pastoralism while 10.3% indicated that they engaged in sedentary farming. This implied that most of the households Garba Tula Sub-County were engaging in pastoralism.

5.5.3 Land use changes over the years

The household head were requested to specify whether there has been any land use changes (in terms of agricultural land utilization and forests, built area) in Garba Tula Sub-County. The findings were as shown in Figure 5.13.

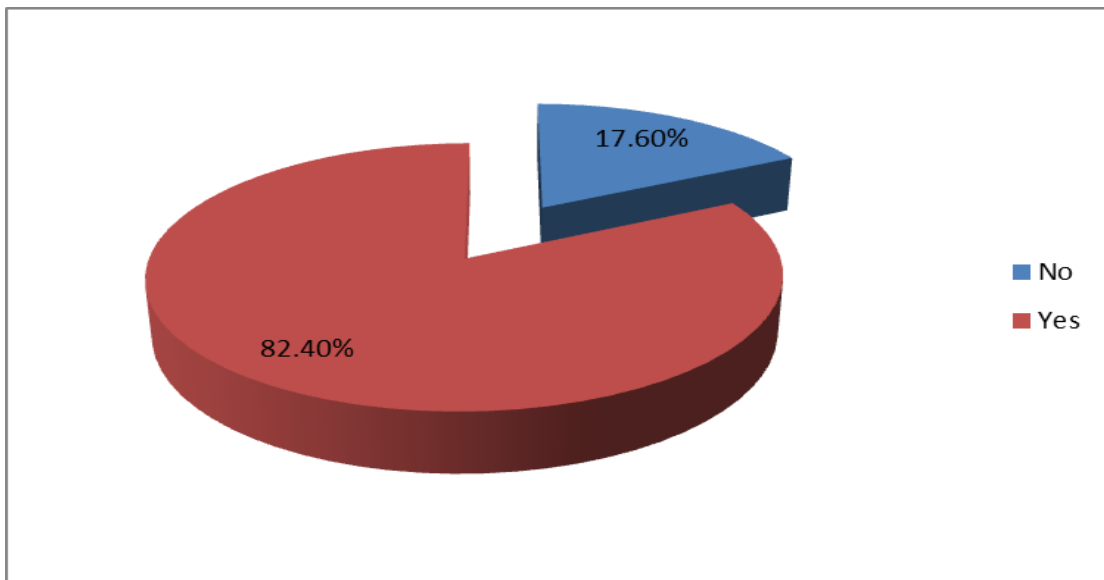


Figure 5.13: Land use changes over the years
Source: Research Data (2018)

From the findings, 82.40% of the respondents indicated that the land use pattern in the region has changed over the years while 17.60% indicated that there the land use pattern in the region has not changed. This implied that the land use pattern in Garba Tula Sub-County has changed over the years with regard to agricultural land utilization and forest coverage and built area.

5.5.4 Occurrence of land use changes

The participants were asked to specify the extent of land use-changes in the region. A Likert Scale was used where 5 symbolizes very great extent, 4 symbolizes great extent, 3 symbolizes moderate extent, 2 symbolizes low extent, 1 symbolizes No extent at all. The results were as illustrated in Table 5.6.

Table 5.6: Occurrence of land use changes

	1	2	3	4	5	Mean	Std. Deviation
Land use changes, conversion of grazing to cropping	18	28	120	76	31	3.271	1.014
Drainage improvements	24	163	32	20	34	2.549	1.149
Installation and use of irrigation	44	36	82	64	47	3.124	1.300
Building farm dams	18	64	36	37	118	3.633	1.402
Conversion to non-agricultural uses	26	34	50	75	88	3.604	1.307
Building of infrastructures	26	16	48	70	113	3.835	1.288

Source: Research Data (2018)

From the findings, the respondents indicated that building of infrastructures occurred in Garba Tula Sub-County to a great extent as shown by the means of 3.835. Building farm dams also occurred to great extent as shown by the mean of 3.633. In addition, conversion to non-agricultural uses occurred in Garba Tula Sub-County to a great extent as indicated by the mean of 3.604. The respondents indicated with a mean of 3.271 that land use changes, conversion of grazing to cropping occurred in Garba Tula Sub-County to a moderate extent. Further installation and use of irrigation occurred to a moderate extent as indicated by the mean of 3.124. Drainage improvements also occurred to a moderate extent as indicated by the mean of 2.549. The key informants also indicated that land use changes in Garba Tula Sub-County included expansion of already existing settlements like Duse, Kinna and Bibi. Other land use changes included new farm land as a result of expansion of agricultural activities into the grazing zones.

5.5.5 Impact of land use changes on human wildlife conflict

The respondents were further asked to indicate to what extent changes in land usage leads to human wildlife conflict. A Linkert scale was used where 5 symbolizes Strongly Agree; 4 symbolize Agree; 3 symbolize Neutral; 2 symbolizes Disagree; and 1 symbolizes Strongly Disagree. The results were indicated in Table 5.7.

Table 5.7: Impact of land use changes on human wildlife conflicts

	1	2	3	4	5	Mean	Std. Deviation
Land use changes lead to increased interactions between humans and wildlife	28	50	83	76	36	3.153	1.175
Land use changes lead to long-term degradation of ecosystem		18	32	100	123	4.201	.890
Farmers fence round their land thus fragmenting wildlife habitats and blocking their migratory routes	40	32	32	92	77	3.490	1.390
Pastoralism maintains native plant and animal species more effectively than crop cultivation		18	46	105	104	4.080	.899
Increased agricultural activities lead to encroachment of wildlife habitats and hence interruption of the ecosystem.		14	76	119	64	3.853	.836
Construction of infrastructure such as railway lines and roads destroys wildlife habitats	24	26	67	60	96	3.652	1.286
Human settlement and poor planned developments around wildlife dispersal areas are particularly posing a major threat to wildlife population	8	28	62	87	88	3.802	1.090
Local communities often regard the large wild animals as government property and hence reiterate in unison when they attack		20	44	148	61	3.915	.820

Source: Research Data (2018)

From the findings, the household heads agreed that land use changes lead to long-term degradation of ecosystem as shown by the means of 4.201.

They also agreed that pastoralists maintained native plants and animals compared to crop cultivation of crops as shown by a mean of 4.080. In addition, they agreed that local communities regarded wildlife species as government property as shown by a mean of 3.915. The household heads agreed with a mean of 3.853 that increased agricultural activities (cattle and camel keeping) lead to encroachment of wildlife habitats and hence interruption of the ecosystem. Further, the household heads agreed that human settlement and poor planned developments around wildlife dispersal areas are particularly posing a major threat to wildlife population as shown by the mean of 3.802. They also agreed that construction of infrastructure such as roads destroys wildlife habitats as indicated by the mean of 3.652. However, they moderately agreed that farmer's fenced round their land thus fragmenting wildlife habitats and blocking their migratory routes as shown by the mean of 3.490. They were also neutral on the statement indicating that land use changes lead to increased interactions between humans and wildlife as shown by the mean of 3.153. The key informants indicated that extensive deforestation through, for example, illegal charcoal burning had massive negative impact on the environment in form of degradation. The key informants also indicated that land use changes led to habitat destruction and hence loss of wildlife.

The argument here is all about enough space that both humans and wildlife require on daily basis for their survival. These changes are associated with loss of wildlife, habitat destruction, land degradation and corridors blockages K02

5.5.6 Regression analysis

The study sought to assess the perception of land use change that is responsible for human wildlife conflict in Isiolo County. The null hypothesis was:

H₀3: The relationship between land use change and human-wildlife conflict in Isiolo County is insignificant

Regression model for objective one;

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Whereby; Y= Human wildlife conflict in Isiolo County, B_0 = Constant, β_1 =Coefficients of determination, X_1 = land use changes and ε = Error term

The r-squared value of 0.466 implied that land use change has a significant effect on human-wildlife conflict in Isiolo County. This implies that the land use changes can explain 46.6% of the human wildlife conflict in Isiolo County

Table 5.8: Model summary for land use changes and human wildlife conflicts

R	R Square	Adjusted R Square	Std. Error of the Estimate
.683	.466	.464	.42305

Source: Research Data (2018)

The ANOVA was used to assess whether the model was a good fit for the data. The F-calculated was 236.601 and was less than the F-critical (1, 271) which was 3.8415. In addition, the p-value (0.000) was below the significant level of 0.05 thus implying the model was fit for data analysis.

Table 5.9: ANOVA for land use changes and human wildlife conflicts

	Sum of Squares	df	Mean Square	F	Sig.
Regression	42.345	1	42.345	236.601	.000 ^b
Residual	48.501	271	.179		
Total	90.846	272			

Source: Research Data (2018)

The results, as shown in Table 5.10, showed that land use changes had a positive and significant effect on human wildlife conflict in Garba Tula Sub-County as shown by a regression coefficient of 0.557. The p-value (0.000) was less than the significance level and hence we reject the null hypotheses “there is no significant relationship between land use changes and human wildlife conflict in Isiolo County”.

Table 5.10: Coefficients for land use changes and human wildlife conflicts

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.696	.123		13.747	.000
Land use changes	.557	.036	.683	15.382	.000

Source: Research Data (2018)

5.6 Human population increase

The second objective of the study was to determine whether population increase leads to human wildlife conflict or not in Isiolo County. This section describes the increase in human population. The respondents were required to rate population increase and describe to what extent it had increased.

5.6.1 Population increase for the past 10 years

The respondents were asked to indicate whether there has been an increase in population for the past 10 years. The results were presented in figure 5.14.

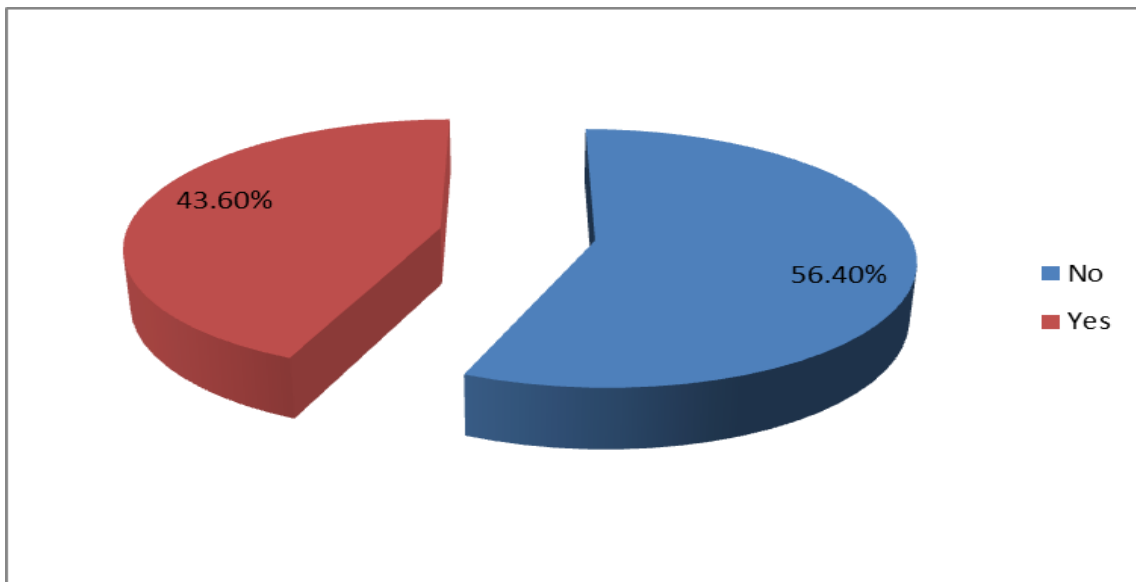


Figure 5.14: Population increase for the past 10 years

Source: Research Data (2018)

According to the results 56.40% of the household heads specified that there has been population increase in Garba Tula for the past 10 years while 43.60% indicated that there was no population increase. This shows that there has been an increase in population in Garba Tula Sub County.

5.6.2 Population increase

The respondents were asked to indicate the population of Garba Tula Sub County currently and 20 years ago. The outcomes of their views were as illustrated in Table 5.11.

Table 5.11: Population increase in Garba Tula Sub County

	Population	% change
2017	42930	45.62
1997	23345	

Source: KNBS (2018)

From the findings, the population of Garba Tula was 23,345 in the year 1997 and 42,930 in the year 2017. This was a 45.62% increase in population for the year between 1997 and 2017.

5.6.3 Impact of population increase on human wildlife conflict

The respondents were asked to indicate how various factors on population increase relate to human wildlife conflicts. The results were indicated in Table 5.12.

Table 5.12: Impact of population increase on human wildlife conflicts

	1	2	3	4	5	Mean	Std. Deviation
Population growth result to increase in the demand of food production and encroachment of forests, savannah grassland and other ecosystems within agrarian areas	30	26	71	134	12	3.263	1.065
Increase in human population is rapidly leading to encroachment into wildlife habitats	20	24	77	102	50	3.505	1.111
Population increase leads to reduction of wildlife space and blockage of wildlife corridors	16	18	40	111	88	3.868	1.116
Encroachment into wildlife habitats leads to genetic drift and inbreeding	22	34	177	40		2.860	.7590
Encroachment into wildlife habitats leads to loss of ecological integrity, and possibly local extinction	10	18	65	108	72	3.783	1.025

Source: Research Data (2018)

According to the results, the household heads agreed with a mean of 3.868 that population increase leads to reduction of wildlife space and blockage of wildlife corridors. They also agreed that encroachment into wildlife habitats leads to loss of ecological integrity and possibly local extinction as shown by a mean 3.783. Further, the respondents indicated that Increase in human population is rapidly leading to encroachment into wildlife habitats as shown by the mean of 3.505. However, the respondents moderately agreed on the statement indicating that population growth result to increase in the demand of food production and encroachment of forests, savannah grassland and other ecosystems within agrarian areas 3.263. They household heads moderately agreed that encroachment into wildlife habitats leads to genetic drift and inbreeding as shown by the mean of 2.860. The key informants indicated that human population increase led to the challenge of space / availability of space, which in turn leads to invading of wildlife habitat.

Expansion of settlement and coming up of new ones together with enhanced economic activities will take up areas used for grazing and in so doing threatens the existence and survival of the animals K03

The key informants also indicated that human population increase leads to environmental degradation through improvement of their economic wellbeing as a result of demand and supply factors like deforestation. This leads to scarcity as far as pasture is concerned hence conflict arises.

5.6.4 Regression analysis

The study sought to assess whether human population increase causes human wildlife conflict or not in Isiolo County. The null hypothesis was:

H₀₃: There is no significant relationship between human population increase and human wildlife conflict in Isiolo County

Regression model for objective two;

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Whereby; Y= Human wildlife conflict in Isiolo County, B₀ = Constant, β₁ =Coefficients of determination, X₁= Human population increase, ε = Error term

The r-squared for the relationship between human population increase and human wildlife conflict in Isiolo County was 0.575. This implied that pastoralism can explain 57.5% of the human wildlife conflict in Isiolo County

Table 5.13: Model summary for human population increase and human wildlife conflicts

R	R Square	Adjusted R Square	Std. Error of the Estimate
.758 ^a	.575	.573	.37751

Source: Research Data (2018)

The F-calculated was 366.453 and was less than the F-critical (1,271) which was 3.8415. In addition, the p-value (0.000) was less than the significance level, which implies that the model is a good fit for the data. This shows that the model is a good fit for the data in predicting the influence of human population increase in human wildlife conflict in Isiolo County.

Table 5.14: ANOVA for human population increase and human wildlife conflicts

	Sum of Squares	df	Mean Square	F	Sig.
Regression	52.225	1	52.225	366.453	.000 ^b
Residual	38.621	271	.143		
Total	90.846	272			

Source: Research Data (2018)

The results, as shown in Table 5.14, showed that human population increase has a significant effect on human wildlife conflict in Garba Tula Sub-County as shown by a regression coefficient of 0.745. The p-value (0.000) was less than the significance level and hence we reject the null hypotheses “there is no significant relationship between human population increase and human wildlife conflict in Isiolo County”.

Table 5.15: Coefficients for human population increase and human wildlife conflicts

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.977	.137		7.154	.000
Human Population increase	.745	.039	.758	19.143	.000

Source: Research Data (2018)

5.7 Pastoralism

The third objective of the study was to assess whether pastoralism causes human wildlife conflict or not in Isiolo County. This section comprised on the animals species kept by household heads, the number of animals they had as well as the relationship between pastoralism and human wildlife conflicts in Garba Tula Sub-County.

5.7.1 Animal species in households

The household heads were asked to indicate the type of animal species that they kept. The various animal species included camel, cattle, Goats and sheep and Donkeys.

Table 5.16: Animal species in households

Animal species	Yes	No
Camels	66.7	33.3
Cattle	90.5	9.5
Goats and Sheep	89.7	10.3
Donkeys	63.7	36.3
All Animal species	57.9	42.1

Source: Research Data (2018)

From the findings, as shown in Table 4.15 66.7% of the household head specified that they kept camels while 33.3% indicated that they did not. In addition, 90.5% of the respondents kept cattle while 9.5% indicated that they did not. Further, 89.7% of the respondents indicated that they kept goats and sheep while 10.3% did not. Additionally, 63.7% of the respondents indicated that they kept donkeys while 36.3% did not. Also, 57.9% of the respondents kept all the animal species while 42.1% did not. Therefore, most of the households in Garba Tula Sub-County kept all animal species.

5.7.2 Number of animals

The respondents were further asked to specify the number of domestic animals that they had. The results were as illustrated in Table 5.17.

Table 5.17: Sheep/Goats

	Frequency	Percent
Below 50	66	26.9
51 to 100	51	20.8
101 to 150	28	11.4
201 to 250	16	6.5
301 to 350	38	15.5
351 to 400	2	.8
401 to 450	14	5.7
451 to 500	14	5.7
501 to 550	8	3.3
Above 550	8	3.3
Total	245	100.0
Minimum	11	
Maximum	566	
Mean	191.91	
Standard deviation	175.384	

Source: Research Data (2018)

The results revealed that, 26.9% of household heads specified that they had below 50 sheep/goats, 20.8% indicated that they had 51 to 100, 15.5% indicated that they had 301 to 350, 11.4% indicated that they had 101 to 150, 6.5% indicated that they had 201 to 250, 5.7% indicated that they had 401 to 450, 5.7% indicated that they had 451 to 500, 3.3% indicated that they had 501 to 550, 3.3% indicated that they had above 550 while 0.8% indicated that they had 351 to 400 sheep/goats. The minimum numbers of sheep/goats owned was 1 while the maximum was 566. The mean was 191.91 and the standard deviation was 175.384.

Table 5.18: Cattle

	Frequency	Percent
Below 50	70	28.3
51 to 100	19	7.7
101 to 150	32	13.0
151 to 200	28	11.3
201 to 250	52	21.1
251 to 300	16	6.5
301 to 350	14	5.7
351 to 400	6	2.4
451 to 500	4	1.6
501 to 550	6	2.4
Total	247	100.0
Minimum	11	
Maximum	543	
Mean	161.40	
Standard deviation	123.884	

Source: Research Data (2018)

According to the results, 28.3% of household heads specified that they had below 50 heads of cattle, 21.1% had 201 to 250, 13.0% had 101 to 150, 11.3% had 151 to 200, 7.7% had 51 to 100, 6.5% had 251 to 300, 5.7% had 301 to 350, 2.4% had 351 to 400, 2.4% had 501 to 550 while 1.6% had 451 to 500 cattle. The minimum number of cattle owned by the respondents was 11 while the maximum was 543. The mean was 161.40 and the standard deviation was 123.884.

Table 5.19: Camels

	Frequency	Percent
Below 50	134	73.6
101 to 150	36	19.8
201 to 250	12	6.6
Total	182	100.0
Minimum	1	
Maximum	222	
Mean	48.44	
Standard deviation	63.843	

Source: Research Data (2018)

From the findings, 73.6% of the respondents indicated that they had below 50 camels, 19.8% had 101 to 150 while 6.6% had 201 to 250 camels. Therefore from the findings, most of the household heads had below 50 camels. The minimum number of camels was 1 while the maximum was 222. The mean was 48.44 and the standard deviation was 63.843.

Table 5.20: Donkeys

	Frequency	Valid Percent
Below 50	162	93.1
51 to 100	12	6.9
Total	174	100.0
Minimum	2	
Maximum	83	
Mean	16.89	
Standard deviation	17.808	

Source: Research Data (2018)

From the findings, 93.1% of the respondents indicated that they had below 50 donkeys while 6.9% had 51 to 100 donkeys. From the findings most of the household heads had below 50 donkeys. The minimum number of donkeys owned by the participants was 2 while the maximum was 83. The mean was 16.89 and the standard deviation was 17.808.

5.7.3 Impact of pastoralism on human wildlife conflicts

The respondents were asked to indicate how various factors on pastoralism relate to human wildlife conflicts. The results were indicated in Table 5.21.

Table 5.21: Impact of pastoralism on human wildlife conflicts

	1	2	3	4	5	Mean	Std. Deviation
Wild animals often attack livestock and humans in the area	16	18	69	102	68	3.688	1.095
Responding to wild animals attacks, pastoralists deliberately kill wild animals	22	18	113	24	96	3.564	1.253
During the dry seasons, pastoralists encroach wildlife habitats which leads to attacks	18	18	57	122	58	3.674	1.084
Encroachment of wildlife habitats increases the risk of livestock diseases	30	24	39	108	72	3.615	1.266

Source: Research Data (2018)

According to the results, the household heads agreed that wild animals often attacked livestock and humans in the area as shown by a mean of 3.688. This implied that the residents in Isiolo were frequently attacked by wild animals. They also agreed with a mean of 3.674 that during the dry seasons, pastoralists intrude wildlife habitats which lead to attacks. This implied that pastoralists invaded the habitats of wild animals in search of pasture and water for their livestock. In addition, the respondents agreed that encroachment of wildlife habitats increases the risk of livestock diseases as shown by the mean of 3.615. Further, they agreed that responding to wild animals attacks; pastoralists deliberately kill wild animals as indicated by the mean of 3.564. The key informants indicated that pastoralists kill for meat during dry spells on need basis like killing of giraffes. Other key informants indicated that conflict between pastoralists and wildlife arose mostly during drought as pastoralists are forced to graze in protected areas.

From the results, pastoralists coexisted peacefully with wildlife since time immemorial until the management style of KWS failed to favor the pastoralists. The human-wildlife conflict often arise due during incidences of severe drought whereby there is inadequate pasture as well as water for pastoralists’ livestock. This ultimately resulted to encroachment of wildlife habits as the pastoralists searched for sufficient water and pastures for their livestock. However, the wildlife authority introduced brutal punitive measures which lead to death and injuries among the pastoralists.

5.7.4 Regression analysis

The study sought to assess whether pastoralism causes human wildlife conflict or not in Isiolo County. The null hypothesis was:

H₀3: There is no significant relationship between pastoralism and human wildlife conflict in Isiolo County

Regression model for objective three;

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Whereby; Y= Human wildlife conflict in Isiolo County, B₀ = Constant, β₁ =Coefficients of determination, X₁= Pastoralism, ε = Error term

The r-squared for the relationship between pastoralism and human wildlife conflict in Isiolo County was 0.597. This implies that the pastoralism can explain 59.7% of the human wildlife conflict in Isiolo County. It also means that pastoralism account for 59.7% of the human wildlife conflict in Isiolo County.

Table 5.22: Model summary for pastoralism and human wildlife conflicts

R	R Square	Adjusted R Square	Std. Error of the Estimate
.773	.597	.596	.36738

Source: Research Data (2018)

The F-calculated was 402.096 and was less than the F-critical (3.842). This shows that the model is a good fit for the data in predicting the influence of pastoralism on Isiolo County.

Table 5.23: ANOVA for pastoralism and human wildlife conflicts

	Sum of Squares	df	Mean Square	F	Sig.
Regression	54.270	1	54.270	402.096	.000 ^b
Residual	36.576	271	.135		
Total	90.846	272			

Source: Research Data (2018)

According to the findings, pastoralism has a significant effect on human-wildlife conflict in Garba Tula Sub County as shown by a regression coefficient 0.526. This implied that an improvement in pastoralism lead to improvement in human wildlife conflict. The p-value (0.000) was less than the significance level and hence we can reject the null hypotheses “there is no significant relationship between pastoralism and human wildlife conflict in Isiolo County”.

Table 5.24: Coefficients for pastoralism and human wildlife conflicts

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.640	.098		16.734	.000
Pastoralism	.526	.026	.773	20.052	.000

Source: Research Data (2018)

Regression coefficient was used to determine the relationship between the dependent (human wildlife conflicts) and independent variables (pastoralism). As shown in table 5.24, there was a positive and significant association between pastoralism and human wildlife conflicts. This implied that improvement in pastoralism could directly lead to improvement in human wildlife conflicts.

5.8 Recommendations to reduce human wildlife conflict

The respondents indicated that educating villagers in practical skills would help them deal with dangerous wild animal species and acquire and develop new tools for defending their crops and livestock. The findings are in agreement with the findings of Dickman (2005) that education plays a key role in reducing human-wildlife conflicts as it provides the community members with practical skills which enable them prevent human-wildlife conflicts before it happens. In addition, they indicated that incase of availability of alternative lands and incentives, voluntary relocation of community members increased accessibility of natural resource and improvement in socio-economic opportunities which reduced human-wildlife conflict. The findings are in line with the findings of Blackburn *et al.* (2016) that the best approach to manage human-wildlife conflict is through provision of better access to natural resources and improvement of social economic development. The respondents further recommended that identification of conflict hot spots enabled the wildlife management authority to receive adequate funding which was proactivity used in reducing the conflict between human being and wildlife through geographical mapping. The findings are in agreement with Ladan (2014) that early identification of areas prone to human-wildlife conflicts by relevant authorities such as KWS and KFS lead to reduction in human wildlife conflict as the authorizes come up with preventive strategies such as fencing of wildlife reserves and educating the society on the importance of wildlife.

Fixing of electric fences was also another recommendation that the respondents made as animals will fear getting closer to the fence as they may be shocked by the fence. The findings are in agreement with the findings of Estes *et al.* (2012) that installation of electronic fences as well as fixing them prevent wild animals from invading community members as they fear to get closer to the electric fences. The key informants recommended that KWS management should adopt consultative and people driven leadership. In addition, the government of Kenya should come up with plans and policies to incorporate the community. The study also recommends that lives lost and property damaged should be compensated the soonest possible. The process should be fast, friendly and fair. Sensitization on the same should be done i.e. when, how, who and where aspects. The findings are in agreement with the findings of Kiboro and Kiboro (2016) that the KWS should make sure they promptly compensate individuals whose properties and livestock have been damaged by wildlife.

5.9 Discussions

This subsection entailed discussion on the perception of land use changes, pastoralism and population increase on human wildlife conflict in Isiolo County.

5.9.1 Land use changes

The first objective of the study was to identify how land use changes are responsible for human wildlife conflict in Isiolo County. The study found out that Land use changes lead to long-term degradation of ecosystem. The study also found that pastoralists maintained native plants and wildlife species compared to cultivated crops. In addition, the findings indicated that local communities often regard the large wild animals as government property and hence reiterate in unison when they attack. Moreover, the finding revealed that increased agricultural activities lead to encroachment of wildlife habitats and hence interruption of the ecosystem. Further, the study found out that human settlement and poor planned developments around wildlife dispersal areas are particularly posing a major threat to wildlife population. The study also established that construction of infrastructure such as railway lines and roads destroys wildlife habitats. The finding also revealed that farmers fenced round their land thus fragmenting wildlife habitats and blocking their migratory routes. Further, the study found out that land use changes lead to increased interactions between humans and wildlife.

These research findings are in agreement with Dickman (2005) who stated that land use tend to provide adequate goods and services for human consumption despite of the fact that it result to change in land cover which ultimately affects ecosystem functions. The change in land use pattern lead to displacement of wildlife specifiers in natural ecosystem and reduction in the functionality of ecosystems. Blackburn *et al.* (2016) indicated that land tenure system has led to blockage of wildlife migratory routes.

5.9.2 Human population increase

The second objective of the study was to determine the effect of population increase on human wildlife conflict or not in Isiolo County. The study found out that population increase lead to reduction of wildlife space and blockage of wildlife corridors. The study also found that encroachment into wildlife habitats leads to loss of ecological integrity,

and possibly local extinction. In addition, the finding indicated that increase in human population has led to encroachment of wildlife habitats thus result to displacement and migration of some wildlife species in Isiolo County. Moreover, the study found that rapid population growth lead to reduction of forests, savannah vegetation due to increase in agricultural productivity so as to sustain the large population. Furthermore, they finding also indicated that encroachment into wildlife habitats lead to genetic drift and inbreeding.

These research findings are in agreement with Ladan (2014) findings which indicated that rapid population growth of human being in Africa has led to decline in wildlife ecosystems as the ecosystem are encroached and transformed into agricultural firms. According to Estes *et al.* (2012), rapid population growth result to human wildlife conflict in regions around game reserves.

5.9.3 Pastoralism

The third objective of the study was to assess whether pastoralism causes human wildlife conflict or not in Isiolo County. The study found out that wild animals often attack livestock and humans in the area. The finding also indicated that during the dry seasons, the pastoralists encroached wildlife habitats which lead to attacks. In addition, the finding revealed that encroachment of wildlife habitats increases the risk of livestock diseases. Further, the study found that in responding to wild animals attacks, pastoralists deliberately kill wild animals.

These research findings are in agreement with Tefera (2015) who indicated that human-wildlife conflict affect conservation of wildlife species in urban regions. The findings also indicate that deliberate killing of wild animals which are perceived as pest has led to extinction of wildlife species as other are endangered. According to Kiboro and Kiboro, (2016) ungulate species such as leopards and lions attack livestock hence resulting to human-wildlife conflict and decrease in the population of the animals impeding wildlife conservation.

CHAPTER SIX: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The chapter presents discussion on the key findings; conclusion which was drawn from the study as well as recommendations which were made in relation to the research questions of this study. The purpose of the study was to investigate the effect of land use changes on human wildlife conflict in Garba Tula sub-county, Isiolo County, Kenya.

6.2 Summary of the findings

The sub section entailed presentation of the summary of the findings with regard to the perception of land use change, human population increase and pastoralism on human wildlife conflict in Garba Tula Sub County.

6.2.1 Land use changes

The study found that land use changes have a positive and significant effect on human wildlife conflict in Garba Tula Sub County. The study found out that Land use changes lead to long-term degradation of ecosystem. The study found out that pastoralists maintained native plants and wildlife species compared to cultivated crops. In addition, the findings indicated that local communities often regard the large wild animals as government property and hence reiterate in unison when they attack. Moreover, the finding revealed that increased agricultural activities lead to encroachment of wildlife habitats and hence interruption of the ecosystem. Further, the study found out that human settlement and poor planned developments around wildlife dispersal areas are particularly posing a major threat to wildlife population. The study also established that construction of infrastructure such as railway lines and roads destroys wildlife habitats. The finding also revealed that farmers fenced round their land thus fragmenting wildlife habitats and blocking their migratory routes. Furthermore, the study found out that land use changes lead to increased interactions between humans and wildlife.

6.2.2 Human population increase

The study established that population increase has a positive and significant effect on human wildlife conflict in Garba Tula Sub County. The study found out that population increase lead to reduction of wildlife space and blockage of wildlife corridors. The study also found that encroachment into wildlife habitats leads to loss of ecological integrity, and possibly local extinction. In addition, the finding indicated that increase in human population has led to encroachment of wildlife habitats thus result to displacement and migration of some wildlife species in Isiolo County. Moreover, the study found that rapid population growth lead to reduction of forests, savannah vegetation due to increase in agricultural productivity so as to sustain the large population. Furthermore, they finding also indicated that encroachment into wildlife habitats lead to genetic drift and inbreeding.

6.2.3 Pastoralism

The study established that pastoralism has a positive and significant effect on human wildlife conflict in Garba Tula Sub County. The study found out that wild animals often attack livestock and humans in the area. The finding also indicated that during the dry seasons, the pastoralists encroached wildlife habitats which lead to attacks. In addition, the finding revealed that encroachment of wildlife habitats increases the risk of livestock diseases. Further, the study found that in responding to wild animals' attacks; pastoralists deliberately kill wild animals.

6.3 Conclusion

The study concludes that land use changes have a positive effect on human wildlife conflict in Garba Tula Sub County. This implies that an increase in land use changes leads to an increase in human wildlife conflict in Garba Tula Sub County. Land use changes such as construction of infrastructure, pastoralism, increased agricultural activities, man settlement and poor planned developments lead to long-term degradation of ecosystem posing a major threat to wildlife population.

The study also concludes that human population increase has a positive and significant effect on human wildlife conflict in Garba Tula Sub County. Increase in human population is rapidly leading to encroachment into wildlife habitats, encroachment into wildlife habitats leads to loss of ecological integrity, and possibly local extinction. In addition, population increase leads to reduction of wildlife space and blockage of wildlife corridors.

The study further concludes that pastoralism has a positive and significant effect on human-wildlife conflicts in Garba Tula Sub County. In the Sub county wild animals often attack livestock and humans in the area, in responding to wild animals attacks; pastoralists deliberately kill wild animals and encroach their habitats thus increasing the risk of livestock diseases during the dry seasons.

6.4 Recommendations

There is need to have scientifically-based land use planning and this will be essential in ensuring that the human needs and conservation goals in Garba Tula Sub County are balanced. This can be done by improving the ecological process that is affected by land use. There is need for clear land use planning to counteract possible land resource degradation and ameliorate negative implications of land use mainly Human-wildlife conflicts which are currently an issue of concern in the study area.

Raising community awareness on wildlife was another recommendation that was made. This will be essential as it will help in improving understanding and appreciating the wildlife resources thus conserving them.

Identifying conflict hot spots would also help to pinpoint ranger manpower and funding to proactively address the issue of human-wildlife conflict and this is done through mapping. Mapping of the wildlife corridors will therefore be important as it will reduce the conflicts. The study also recommends that voluntary relocation of pastoralists, alternative land use and increasing accessibility of natural resources tend to reduce conflict between human being and wildlife.

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APPENDICES

Appendix I: Questionnaire

The purpose of this questionnaire is to collect data on “Land Use Changes and Human Wildlife Conflict in Garba Tula Sub-County, Isiolo County”. You are requested to fill each question by providing honest responses. The researcher will ensure confidentiality of the information provided and it will be used for learning purposes.

General Information

1. Gender

1. Male 2. Female

2. Kindly indicate your age bracket

1. Below 25 years 2. Between 25 and 35 years
3. Between 36 and 45 years 4. Between 46 and 55 years
5. Between 56 and 65 years 6. Above 65 years

3. Which is your highest level of education?

1. Primary
2. Tertiary
3. University
4. Postgraduate Degree
5. Any other (specify)

4. How many people live in your household?

1. Less than 3 2. 3 to 5
3. 6 to 8 4. More than 8

Land use changes

5. What is the size of your land?

- 1. Less than half an acre 2. One acre
- 2. 2 acres 3. 3 acres
- 4. 4 acres 5. 5 acres
- 6. More than 5 acres 7. Others (Specify).....

6. Which are your main farming activities?

- 1. Pastoralism
- 2. Agro-pastoralism
- 3. Sedentary farming

7. Have land uses in Garba Tula Sub-County changed over the years?

- 1. Yes
- 2. No

8. To what extent have the following land use changes occurred in Garba Tula Sub-County? Where 5=very great extent, 4=great extent, 3=moderate extent, 2=low extent, 1=No extent at all

	1	2	3	4	5
conversion of grazing to cropping					
Drainage improvements					
Installation and use of irrigation					
Building farm dams					
Conversion to non-agricultural uses					
Building of infrastructures					

9. To what extent do you agree with the following statements on land use changes and human wildlife conflict in Garba Tula Sub-County? Where 5=Strongly Agree; 4=Agree; 3=Neutral; 2= Disagree; and 1= Strongly Disagree.

	1	2	3	4	5
Land use changes lead to increased interactions between humans and wildlife					
Land use changes lead to long-term degradation of ecosystem					
Farmers fence round their land thus fragmenting wildlife habitats and blocking their migratory routes					
Pastoralism maintains native plant and animal species more effectively than crop cultivation					
Increased agricultural activities lead to encroachment of wildlife habitats and hence interruption of the ecosystem.					
Construction of infrastructure such as railway lines and roads destroys wildlife habitats					
Human settlement and poor planned developments around wildlife dispersal areas are particularly posing a major threat to wildlife population					
Local communities often regard the large wild animals as government property and hence reiterate in unison when they attack					

Human Population increase

10. Has the human population of Garba Tula Sub-County increased in the last 10 years?

1. Yes [] 2. No []

11. To what extent do you agree with the following statements on population increase and human wildlife conflict in Garba Tula Sub-County? Where 5=Strongly Agree; 4=Agree; 3=Neutral; 2= Disagree; and 1= Strongly Disagree.

	1	2	3	4	5
Population increase leads to increasing demand for land, food production and hence transformation of forests, savannah and other ecosystems into agrarian areas					
Increase in human population is rapidly leading to encroachment into wildlife habitats					
Population increase leads to reduction of wildlife space and blockage of wildlife corridors					
Encroachment into wildlife habitats leads to genetic drift and inbreeding					
Encroachment into wildlife habitats leads to loss of ecological integrity, and possibly local extinction					

Pastoralism

12. What species of animals do you keep?

1. Camel [] 2. Cattle []
 3. Goats [] 4. All species []
 5. None []

13. How many animals do you have?

Type	Number
Goats	
Sheep	
Cattle	
Camels	
Donkey	

14. What crops do you grow?

.....

15. To what extent do you agree with the following statements on pastoralism and human wildlife conflict in Garba Tula Sub-County? Where 5=Strongly Agree; 4=Agree; 3=Neutral; 4= Disagree; and 5= Strongly Disagree.

	1	2	3	4	5
Wild animals often attack livestock and humans in the area					
Responding to wild animals attacks, pastoralists deliberately kill wild animals					
During the dry seasons, pastoralists encroach wildlife habitats which leads to attacks					
Encroachment of wildlife habitats increases the risk of livestock diseases					

Human wildlife conflict

16. Have you or any member of your family been attacked by wild animals (lions, hyenas and leopards)?

1. Yes [] 2. No []

17. If yes, how often do attacks by wild animals occur in your household?

1. Every month [] 2. Every 3 months []
 3. Every six months [] 4. Every nine months []
 5. Once an year [] 6. Every two years []
 7. After more than two years []

18. What happened to individuals who were attacked by the wild animals?

1. Survived [] 2. Disabled []
 3. Died [] 4. N/A []

19. Which wild animal carried out the attack?

20. Have you ever lost livestock as a result of wild animals' attacks?

1. Yes [] 2. No []

21. If yes, how many?

Type	Number
Goats	
Sheep	
Cattle	
Camels	
Donkeys	

22. Have you ever attacked or killed wild animals?

1. Yes [] 2. No []

23. If yes, which ones?

24. What were the reasons for attacking or killing wild animals?

.....
.....

25. Are there some wild animals you used to see in the past but now they are no more?

1. Yes [] 2. No []

26. If yes, which ones?

27. What are the consequences of human-animal conflict?

.....
.....

30 How do you recommend that humans should do to reduce human wildlife conflict in Garba Tula Sub-County?

.....
.....
.....

Appendix II: Interview Guide

1. How long have you lived in Garba Tula Sub-County?
2. How can you describe the relationship between humans and wild animals in Garba Tula Sub-County?
3. Which are the main factors causing human wildlife conflict in Garba Tula Sub-County? Explain
4. Which are the main land use changes that have occurred in Garba Tula Sub-County in the recent years?
5. What role does land use changes play in human wildlife conflict in Garba Tula Sub-County?
6. How does human population increase influence human wildlife conflict in Garba Tula Sub-County?
7. How does pastrolism influence human wildlife conflict in Garba Tula Sub-County?
8. What do you recommend that humans should do to reduce human wildlife conflict in Garba Tula Sub-County?

Appendix III: Research authorization letter from NACOSTI



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 3310571, 2219420
Fax: +254-20-318245, 318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No. **NACOSTI/P/18/53662/25537**

Date: **15th September, 2018**

Mohamednoor Adan Alio
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Land use changes and human wildlife conflict in Garba Tula Sub-County, Isiolo County*" I am pleased to inform you that you have been authorized to undertake research in **Isiolo County** for the period ending **14th September, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Isiolo County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.


BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:


The County Commissioner
Isiolo County.


The County Director of Education
Isiolo County.


Appendix IV: NACOSTI research permit

THIS IS TO CERTIFY THAT: **Permit No : NACOSTI/P/18/53662/25537**
MR. MOHAMEDNOOR ADAN ALIO **Date Of Issue : 15th September,2018**
of UNIVERSITY OF NAIROBI, 30197-100 **Fee Received :Ksh 1000**
Nairobi,has been permitted to conduct
research in Isiolo County
on the topic: LAND USE CHANGES AND
HUMAN WILDLIFE CONFLICT IN GARBA
TULA SUB-COUNTY, ISIOLO COUNTY.

for the period ending:
14th September,2019


Applicant's Signature


Director General
National Commission for Science, Technology & Innovation




THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014.

CONDITIONS

1. The License is valid for the proposed research, location and specified period.
2. The License and any rights thereunder are non-transferable.
3. The Licensee shall inform the County Governor before commencement of the research.
4. Excavation, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
5. The License does not give authority to transfer research materials.
6. NACOSTI may monitor and evaluate the licensed research project.
7. The Licensee shall submit one hard copy and upload a soft copy of their final report within one year of completion of the research.
8. NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice.

National Commission for Science, Technology and Innovation
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TEL: 020 400 7000, 0713 788787, 0735 404245
Email: dg@nacosti.go.ke, registry@nacosti.go.ke
Website: www.nacosti.go.ke



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CONDITIONS: see back page

Appendix V: Plagiarism report

11/27/2018

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Turnitin Originality Report

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Designation: Supervisor

Checked & verified by: Prof. ...

Appendix VI: Declaration of originality

Declaration Form for Students

UNIVERSITY OF NAIROBI

Declaration of Originality Form

This form must be completed and signed for all works submitted to the University for examination.

Name of Student:	Mohamednour Adan Alio
Registration No:	CSO/84465/2016
College:	Humanities and Social Sciences
Faculty/School/Institute:	Arts
Department:	Geography and Environmental Studies
Course Name:	Environmental Planning and Management
Title of the work:	Land use changes and Human Wildlife Conflict in Garbatulla Sub-County, Isiolo County

DECLARATION

1. I understand what Plagiarism is and I am aware of the University's policy in this regard.
2. I declare that this ~~thesis~~ ^{project} (Thesis, project, essay, assignment, paper, report etc) is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work, or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirements.
3. I have not sought or used the services of any professional agencies to produce this work.
4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own.
5. I understand that any false claim in respect of this work shall result in disciplinary action in accordance with University Plagiarism Policy.

Signature: 

Date: 13th Sept. 2018