Dissertation

Title Elephant-Human Wildlife Conflict – The Elephant (Loxodonta africana) conflict and Livestock number factor In Tsavo Conservation Area, Kenya. A Case Study

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NT3008 - Dissertation

Elephant-Human Wildlife Conflict – The Elephant (*Loxodonta africana*) conflict and Livestock number factor In Tsavo Conservation Area, Kenya. A Case Study.

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Declaration

I hereby declare that the main text of this dissertation is all my own work and does not exceed 10,000 words. Any texts/literature used is appropriately cited in the text and referenced.

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Abstract

Human wildlife conflict is increasingly becoming an important factor on the survival of wildlife in and outside wildlife protected areas. The rapid increase in human population and change in land use practice in areas neighbouring protected areas has continued to put more pressure to wildlife habitats, leading to species that require large home ranges to come into contact with humans resulting to conflicts.

This study is aimed at establishing if the higher stocking densities of livestock in the region had an influence or could be a contributing factor on the occurrence of Human- Elephant conflict in the Tsavo conservation area in south eastern Kenya. The rapid influx of livestock numbers in the region has resulted in increased human settlement in the region and illegal grazing in the Tsavo conservation area. These factors are believed to be incompatible with wildlife conservation in the region leading to increased conflict.

Using data available from the Kenya wildlife service on Livestock numbers, Human wildlife conflict and Elephant population data from the from the International Union for Conservation of Nature and Natural Resources (IUCN) African Elephant Specialist Group (AfESG). The study analysed the data to establish if there was any relationship between increased livestock numbers and human- elephant conflict in the region

From the study, the results show that even though there has been a general increase in livestock numbers in the region, Human- elephant conflict overall is on the decline, suggesting that an increase in livestock numbers may not have a direct effect on the human-elephant conflict in the region and that other factors coupled with the higher livestock numbers may contribute to such conflict.

Acknowledgement

I would like to say special thanks to my family for all their support and patience during my time of study, without your support I would have given up.

Secondly I would like to pay a special thank you to Dr Mark Toogood, Dr Chris Lowe, Mr Temba Mudariki and Geraldine McAdam for their endless support and encouragement throughout my studies. Your Knowledge and enthusiasms is second to none.

Thank you very much.

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List of Abbreviations/ Acronyms

KWS – Kenya wildlife Service

TCA – Tsavo Conservation Area

ASAL- Arid and Semi-Arid Lands

PAC – Problem Animal Control

IUCN - International Union for Conservation of Nature and Natural Resources

AfESG - African Elephant Specialist Group

ILIRI – International Livestock Research Institute

Chapter 1

1.1 Introduction

Human-elephant conflict refers to a range of direct and indirect negative interaction between people and elephants which results in harm to both humans and elephants (Ngure 1995).Where human interests extend beyond normal elephant foraging ranges this can lead to conflicts ranging from crop destruction, diseases, death and injury to wildlife, human and livestock.

Human –elephant conflict can heavily impact on the species populations and distribution, with some studies suggesting that in the absence of poaching for ivory, elephant conflict with humans over crops and other resources is a significant source of elephant mortality and injury (Graham 2007).

Historically, communities and tribes have lived in harmony with elephants until recently where cases of human- elephant conflict have been in the rise. This has led to many studies being done to identify the causes of such increased incidences of these conflicts. Some of the suggested causes include

- The rise in elephant numbers due to the ban on ivory trade (Smith and Kasiki 2005).
- An increase in human population (Approx. 40m people in Kenya) (Kenya National Bureau of Statistics 2014) has also contributed to the shrinking of elephant habitats and displacement of elephants in most regions of Africa. This displacement and the uncontrolled elephant movement and migration has led elephants to frequently come into contact with humans resulting to conflicts. Studies show that about 80% of the African elephant range currently laying outside formally protected /gazetted areas (Hoare 1999). This increase in both human and elephant population numbers

has contributed to the increase in human- elephant conflict in most African countries.

- The change in land use and loss or abandonment of traditional methods of human wildlife conflict control are also believed to be contributing factor in the rise of conflict (Graham and Litoroh 2009). Most elephant ranges have continued to be converted to agricultural land to accommodate the demand of a growing population, such changes coupled with the lack of proper management of human -elephant conflict can be a pre-cursor for the increased human-elephant wildlife conflict resulting to a further decline in elephant population and their distribution.

Human elephant conflict not only results in direct loss or damage to property and life, it has an additional socio-economic and opportunity cost that is borne by the communities that live adjacent to elephant ranges and protected areas (World Wide Fund for Nature 1997). Although these costs can be difficult to quantify they may outweigh the direct cost of agricultural damage and can form a major component of the conflict to the local communities. Such opportunity cost may include restriction on people's movement, competition for water resources and grazing land for livestock.

Some of these hidden cost or impacts of conflict have been found to impact heavily on the poor or low-income communities, leading to resentment of wildlife and protected areas from these communities (Orga 2008)

1.2 Research Rationale

Human wildlife conflict is a complex conservation issue in Kenya and in Africa as a whole. With elephant and human ranges frequently overlapping, this can led to increased conflict

incidents between humans and elephants which threatens the survival of the African elephant in the region. The study will help in:-

- Analysing and establish the possibility of the rise in conflicts in the Tsavo conservation area.
- The need and ways in which management can help to reconcile conservation and land use practices in the Conservation area.
- To highlight the inherent pressure on Tsavo and adjacent land by higher commercial stocking density rates.
- Establish some of the causes and possible recommendations towards the conflict issues in the Tsavo region.

1.3 The aims and objectives of the study

The aim of the research is to examine the evidence that increased livestock numbers is a contributing factor to Human-Elephant conflict in Tsavo conservation area in Kenya. With the objectives of

- Identifying any relationship between livestock grazing and human elephant conflict
- To analyse the trend over time of human-elephant conflict in the adjacent human settlements in Tsavo national park
- To establish the livestock numbers and trend in the Tsavo region
- To offer analysis of the possible underlying drivers of elephant-livestock conflict

Chapter 2

2.1 Literature review

Human wildlife conflict is a growing concern all over the world where humans' border protected areas. With increase in human and wildlife population over a period of time the boundaries have been overlapped resulting in the escalation of the problem. Human wildlife conflict in Kenya has become a persistent problem for wildlife managers and conservationist in areas that border protected areas. These conflicts range from crop raids, livestock predation, death and injury to both human and wildlife. Large mammals tend to feature heavily in these conflicts; this is mainly due to their perceived increase in population and the need for larger home ranges. The shrinking and subsequent loss and fragmentations of habitats, as a result of incompatible land use practice adjacent to protected areas, has continued to pose a challenge in wildlife conservation and management.

In Tsavo conservation area, recent elephant population counts have indicated an increase in the elephant population in the region. The results from 1998 to 2011 have shown a 70% increase in elephant population in Tsavo conservation area i.e. (1998= approx. 7000 elephants to approx. 13,000 in 2011) (Ngene *et al 2013*). This increase in elephant population in the region has been attributed to the good species management and improved security in the region.

Such increases in elephant populations have regularly been associated with an increase in human- elephant conflict e.g. in the period of 1990-93 the country wide mortality for elephants and humans in conflict zones was recorded to be 130 and 108 deaths respectively while in 1993 to 2004 Tsavo/Amboseli ecosystem alone had 15 reported human deaths and

44 elephant deaths with the results suggesting a possible overall increased countrywide conflict (Kioko *et al* 2006).

Other drivers of conflict include the general increase in human population and the incompatible land use practice in areas neighbouring conservation areas. The Kenyan population grew from 38.5 million in 2010 to 42million people in 2013(Kenya National Bureau of Statistics 2014).This increase in human population has resulted in the demand for more land and other natural resources to meet the needs for the growing population resulting to illegal encroachment of wildlife protected areas. This increased pressure on protected areas often lead to habitat fragmentation and subsequent loss of wildlife habitats and migration corridors. Such changes in land use are believed to contribute to the rise in frequency of human wildlife conflicts. Elephants require large ranging areas for foraging and migration but such loss and fragmentation of habitats have to elephant elephants straying or trespassing in human settlements causing a potential threat to both human, property and wildlife in general.

In semi-arid areas of Africa livestock husbandry forms a major source of livelihoods of many rural dwellers, where milk, meat and blood are important dietary components. Livestock to pastoralists is also important in the generation of prestige, and there are also aesthetics of keeping large herds livestock's in some communities. Huge livestock numbers are also used as a store of wealth or as a means of dealing with risks as insurance against droughts (Kabubo 2009).

More than 80% of the land in Kenya is classed as arid to semi-arid lands (ASALs), which is characterized by low unreliable and poorly distributed rainfall; these areas are extensively used mainly for livestock production and wildlife conservation (Sombroek *et al.* 1982). It is

estimated that the ASALs support about 25% of the nation's human population and slightly over 50% of its livestock. In ASALs, the livestock sector accounts for 90% of employment and more than 95% of family incomes.

However despite the higher economic potentials of ASALs they are faced with higher rate of poverty, with very low access to basic social services such as infrastructure and education facilities. This has resulted to vulnerability and marginalisation from the central government hence very susceptible to severe impacts of human wildlife conflicts.

Despite the poor environmental conditions associated with these regions, arid rangelands have traditionally provided habitat for majority of drought-tolerant wildlife species leading to many protected areas being created in these regions. Some of the species in these areas require conservation efforts and human interventions for their successful survival. The development of drinking water sources for people and livestock forms one of the main development interventions in these arid rangelands. However, the impact of availability of permanent drinking water in arid range lands on wildlife remains unknown. In their study to analyse the distribution of wildlife and livestock in northern Kenya in relation to distance to permanent water (J.de leew *et al*. 2001), established that livestock were concentrated in areas close to permanent water, and wildlife were frequently further away from water with their distributions inversely correlated. Their results suggest that livestock and human activities related to water points negatively affects the distribution of wildlife. This displacement of wildlife by human activities can result in conflict from competition for scarce resources like water and pasture in these arid rangelands. Other studies have shown that livestock husbandry in arid range lands to have both negative and positive effects on biodiversity and wildlife in general (Corinna *et al* 2012).The presence of Cattle in arid lands limited the presence of many species of wild herbivores especially grazers, presumably

through competition for their shared resources, with the nature of competition being dependent on rainfall and the presence of other herbivores. The pastoral practice of housing livestock nightly in protective corral enclosures ("bomas") over time produces long-lived nutrient hotspots preferred by both livestock and wild herbivores with these hotspots being utilised frequently during dry season. Fire, which is also frequently used by pastoralists, is valuable for improving grass quality and reducing woody cover, which benefits some species of wild herbivores especially grazers.

According to the international livestock research institute (2013), Kenya has in recent years been trading in live animals, which are exported mostly to the Middle-East meat market. The country has also been striving to create "disease-free zones" to improve on the marketability of its meat and meat products in Europe which has a stringent regime for products that are allowed into that market. These efforts have led to some parts of the Coastal region been classified as "disease-free zones" and are used as fattening/finishing grounds for cattle (International Livestock Research Institute 2013). This classification of the region as a disease free zone has led to an influx in the number of livestock in the Tsavo region. Majority of the livestock use adjacent ranches, where the ranch managements offer grazing rights and leaseholds to commercial livestock traders. Originally most ranches were formed on the concept of creating a stable livestock production systems where community groups jointly owned and agreed to the stocking levels, but the sudden influx of livestock numbers and uncontrolled livestock grazing regimes has led to shortage of water resources and poor pastures due to land degradation from heavy grazing regimes. This has led to most of the livestock encroaching the Tsavo national parks in search of pasture and water, leading to conflicts between livestock and wildlife.

A survey conducted in the Tsavo conservation area from the year 2002 to 2005 indicated a large increase in the number of livestock in the ecosystem. The results showed a 64.5% increase in livestock during the survey period with 90% of all the livestock in the region estimated to be inside the protected area and only a 15% of all livestock recorded being in the ranches (Omondi *et al* 2005). The survey also indicated that Tsavo west was the most overstocked region of the Tsavo protected area with 80% of all livestock recorded in the park. Such large numbers of livestock are believed to be contributing to the complex human wildlife conflict challenge facing the parks management. This has led to Kenya wildlife service to allocate a large percentage of financial resources and personnel to try and address the problem of livestock incursions in the protected areas.

2.2 The Cost of human wildlife conflicts

Human–wildlife conflict has traditionally been viewed to occur 'when the needs and behaviour of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife' (Madden 2004). To understand the impacts of conflicts on humans and wildlife there is need to look at the different impacts and their underlying cause may have on the affected individuals.

As with many other conflicts, human wildlife conflict has costs associated with its occurrence, some of these costs can be considered visible while others can be considered invisible. Most studies on human wildlife conflicts have focused on the visible impacts to humans affected but very little focus on the invisible impacts of conflicts.

I. Visible impacts of Human wildlife conflicts

Some of the well documented visible impacts range from death and injury to people and livestock, crop and property damage. These impacts constitute a majority of the conflict

reports and studies for example in India and some southern African countries which are characterised by low income, its estimated that over a hundred people are killed by crocodiles annually. While in India elephants kill an average of one person every day, with up to 15% of agricultural output lost to elephant damage (Lamarque *et al* 2009, and Rangarajan *et al* 2010). Although such losses may be insignificant at national level, they heavily contribute to the raise of the cost of living for the affected communities or individuals who in most cases are from the under privileged members of society.

In Tanzania for example studies carried out between 1990 and 2004 indicated that attacks by lions led to injury or death of 800 people. Crop damage also featured heavily in most conflicts in Asia and Africa with large mammal's especial elephants being cited as the main problem animal species in the affected regions (Parker et al 2005 and Parker et al 2007). Other visible impacts documented include livestock predation where carnivores have consistently lifted cattle from traditional "bomas" and grazing fields in ranches and homesteads.

Human wildlife conflict has an visible ecological consequence i.e. the loss of genetic diversity , population structures , edge mortality and species range collapse due to persecution or retaliatory killings and from problem animal control measures applied(Courchamp & Macdonald 2001).

II. Hidden (Invisible) impacts of Human wildlife conflicts

Hidden impacts of human–wildlife conflict may be defined as costs characterized as uncompensated, temporally delayed, and may be psychological or social in nature (Ogra, 2008).Until recently these impacts have widely been disregarded with the main focus and

resources being invested in resolving the visible impacts regarding human wildlife conflicts (DeMotts and Hoon, 2012 and Ogra, 2008).

Hidden impacts of human wildlife conflict exist in many forms that have rarely been quantified, with some of the hidden impacts coming as a result of the visible impacts of conflicts, usually delayed and only pronounced after the occurrence of such conflicts. This has led to suggestion that both forms of impacts are in some cases interlaced with each other.

Examples of some of these hidden impacts includes poor/diminished states of physio-social wellbeing due to resulting injury and death, disruption of families, loss of livelihoods from crop raids and livestock losses. The severity of these impacts are dependent on the vulnerability of the individuals or community e.g. the poverty levels, limited access to resources and political and ethnic marginalization (Jadhav 2011).

Other hidden impacts of conflict include opportunity cost, transaction cost when pursuing compensation in some countries and poor health and nutrition.

During conflicts where death or injury of a family member occurs this can have a big impact on the family of the deceased, especially where the deceased was the main bread winner of that family, leading to the transfer of responsibilities to other family members in most cases children. Such cases may result in disruption of parent-child relationships, poor attendance in school or aggravation of debts and pre-existing poverty (Lamarque et al 2009 and Jadhav 2011).

In Africa where substance farming constitutes the main source of income for most communities, the loss of crops and livestock from conflict can be detrimental for these poor rural communities. In Uganda and Cameroon the loss of crops from elephant raids amount

to US$60 to US$510 per farmer a figure too high for marginalised communities and individuals with limited resources (Naughton et al 1999).

Persistent crop raids in affected regions can also lead to displacement of communities where they are compelled to abandon traditional farmlands for fear of their safety and the search for reliable sources of income. This displacement of individuals can cause increased level of stress, the loss and splitting of individual family members and loss of social and family bonds (Choudhury 2004).

The disproportional cost of conflicts, which in most cases is too high for poor farmers, has led to farmers resorting to physically guarding their crops and livestock. This approach has resulted to higher exposure to vectors and parasites e.g. malaria and trypanosomiasis with countries like India reporting a higher overlap of human wildlife conflict zones and malaria infested areas (Dixon *et al* 2009 and Dhingra *et al* 2010). Most communities rely on men for crop guarding, these men are in most cases the main wage earners, the long night crop guarding duties can lead to the lack of sleep, increased workload and diminished mental health to these individual (Hoare 2000)

Human–wildlife conflict also imposes restrictions on certain day-to-day activities such as travel, with affected individual unable freely move or conduct their activities due fear of attack by wildlife. In most extreme cases for example in Kenya's Taita Taveta district which borders Tsavo national park and parts of North east India, authorities have imposed curfews on rural communities in order to protect them from marauding elephants (Kimega 2003 and Jadhav 2011).

Studies in India have also indicated the evidence of Post- traumatic Stress Disorder on individuals affected by conflict incidents. Cases of Psychosis, PTSD, and Childhood Emotional

Disorder in children and adults have closely been linked with the death of a family member resulting from elephant attacks (Jadhav, 2011, Jadhav and Barua, 2012)indicating the severity of human wildlife conflict impact on the psychological wellbeing of the affected communities and individuals.

2.3 Measure to Reduce /control Human wildlife conflicts

There are several measures that have been adopted or put in place to manage conflicts. Depending on the area and severity of the conflict, different measures have been practiced or been imposed in efforts to address the conflict. Some of the measures include:-

- **Problem animal control**

Problem animal control (PACs) measures are mainly carried out by wildlife authorities where they actively pursue and identifying problem animals e.g. animals that are frequently involved in conflicts. In most case it involves lethal control measures such as killing the identified individual animals or driving stray wildlife back into protected areas. In countries with good legislation and security, hunting has been used as a tool to control problem animals (Bisi et al 2007). Although hunting might be seen as a good alternative it can be hard and difficult to police in volatile regions in Africa where poaching is rampant.

- **Translocation and relocation**

This involves the selective removal of wildlife populations to different areas with suitable habitats to ease pressure on the existing habitats and for re-introduction of species in areas where they formally used to be present.

Animals maybe selectively be removed or translocated from areas of human settlements and affected areas to safer areas away from the conflict zones. In extreme cases communities have been relocated to safer areas away from conflict zones, this has been

argued to be effective in solving human wildlife conflict especially where alternative land and resources might be available to the affected community (Karanth and Madhusudan 2002). Although relocation of individuals or communities may be beneficial studies have suggested that this relocation of people may cause more aggravation of conflicts due to the feeling of disposition of communities in favour of wildlife, and in some cases e.g. forest dwelling communities it's difficult to replace the dependence of forest resources from the affected communities (Adam and Hutton2007). The translocation exercise can be an expensive undertaking especially for countries with higher poverty levels leading to dependence on donor funding to undertake such exercises.

- **Compensation and community based Eco-tourism enterprises**

Compensation has been used as a tool to mitigate human wildlife conflict in many parts of Kenya and African in general, with some legislation supporting different forms of compensation. The aim is to compensate community neighbouring conservation areas for human death and injury, losses in crops and livestock to reduce the economic impact of the human wildlife conflicts.

Compensation has being viewed as a way to enhance toleration of wildlife by communities in conflict areas, (Madhusudan, 2003, Naughton-Treves et al., 2003 and Schwerdtner and Gruber, 2007)**.** Compensation is mainly done on monetary terms with each conflict case and degree of severity of the incident determining the amount of compensation to be awarded.

Other forms of economic incentives for communities living in conflict zones include the formation of eco-tourism enterprises where the local community engage in conservation of wildlife for tourism purposes with the revenues accrued being distributed back to the community. This has been considered to be the most sustainable way of addressing conflict

with studies suggesting that strong economic rewards prevented escalation of conflict and illegal killing of wildlife (Liu *et al* 2011).

Although compensation has been viewed as the most effective ways of mitigating conflicts and promoting tolerance for wildlife in human settlements, it has faced some unforeseen challenges in its implementation and application. Studies have shown compensation can lead to dependency on the payment and in many cases affected communities completely abandoning or neglecting some of the preventive measures (Nyhus *et al* 2005).

Other challenge is that of the bureaucracy of the compensation process. Affected individuals face an additional transaction cost in filling and follow-up on compensation cases. Corruption from officials has also been cited in many cases with affected individual having to bribe officials for the necessary forms needed to quickly and correctly asses their claims. Affected individuals also incur expenses in pursuing the compensation i.e. travel cost and in some cases lawyer's fees for representation in claims hearing. All the above adding to financial burden for the rural poor who live in conflict zones (Nyhus et al 2005, Demotts and hoon 2012, Naughton et al 2003 and Madhusudan 2003).

- **Fencing and Creation of Physical barriers**

With the rapid development in agriculture, increased human population and settlement around or near protected areas, human wildlife conflict has been reported to be in the rise (Nyabwari 2002). This rapid change in land use has led to fragmentation of habitats, loss of migratory routes and dispersal areas, causing wildlife mostly large mammals to venture into adjacent human settlement resulting into conflict.

In efforts to address the issue around these areas conservationist and wildlife management authorities have adopted the creation of physical barriers e.g. fences to create safer zones for people and wildlife as a means to manage human wildlife conflict.

Although expensive, physical barriers have been considered to be the most permanent solutions to the human wildlife conflict problem in higher conflict zones (Taylor 1999). The use of electric fences to control larger mammals has been deployed in many conflict zones. This has resulted in reduced number of conflict incidents in some areas providing a long term solution to conflict

As with many options to address conflict fencing has its challenges, including the cost and time required to set up these fences. For fences to be effective there is need for them to be constructed with durable material of which in most cases the materials are not locally available and in some instances require foreign outsourcing .

Some electrical fences have performed below expectation due to their design and layout which although might seem applicable are not effective on long term cases and may result in expensive and laborious maintenance regimes (Thouless 1994).

Another deficiency of fencing is the lack of reliable information and knowledge of the patterns and frequency of conflict and conflict animals. Often many wildlife management result in putting fences anywhere conflicts have been deem severe even though the fences may not be appropriate (Thouless 1995). The local ecology and knowledge is vital for the success of these fences especially in the control of elephants where some elephant individuals have been known to be habitual crop raiders and fence breakers. Knowledge of wildlife movement is also crucial for the effectiveness of fences i.e. a disregard on

established migratory route may result in constant pressure on the fence and higher maintenance cost from wildlife damage.

2.4 Kenya Wildlife laws and legislation with regards to human wildlife conflict and resolution measures

The real and perceived loss of habitat and species in Africa led to creation of wildlife protected areas, a process that began during the colonial days and continued through modern independent Africa. Formal wildlife conservation in Kenya dates back to 1898, when the first regulations were enacted. Wildlife conservation and use has however been limited i.e. non consumptive use of wildlife. At first wildlife conservation benefited the colonial settlers and ignored the rights to use and accesses of wildlife resources by the indigenous and local communities (Ministry of forest and wildlife 2011).

The process establishing protected areas involved a top-down approach characterized by incidences where the local communities have been evicted from their own lands with considerable social disruption. In such circumstances, the states appropriated communal lands without the consent of the local people, which became state property and restricting further access to natural resources by these communities. The Act governing wildlife conservation in Kenya is based the same philosophy whereby resource rights are vested in the state and therefore any form of extractive use of resources in parks is prohibited. These kinds of biodiversity management styles are also sometimes referred to as preservation or protectionism approaches since they restrict consumptive use of resources in protected areas. Conservation using these approaches is usually unsympathetic to the needs of the people leading to resentment of wildlife and protected areas by neighboring communities.

By the turn of the century, Kenya as a country was enormously benefiting from wildlife with most of the benefits accrued only accessible to the political elite and settlers than to rural

communities who bear high costs of wildlife destruction (Lusigi, 1981). These led to increased negative attitudes towards wildlife conservation from the very communities that lived adjacent to wildlife protected areas.

The human-wildlife conflict forms one biggest challenge to the Kenya wildlife service on its efforts to conserve its wildlife and wild resources (Kenya Wildlife Service 1994). In independent Kenya, Kenya Wildlife Service (KWS) was created to be the main custodian of Kenya's wildlife resources. The KWS, in its effort to address human wildlife conflict, formed a community wildlife service through which it has encouraged conservation by ensuring that local community are involved in decision making and ensuring that these communities receive tangible benefits in return for tolerance of wildlife in their lands. Other efforts by the organisation to minimize the conflicts have been to advocate for compatible land use practice and help in planning and construction of wildlife barriers. Other roles played by the organisation include the facilitation in reviewing the legislation regarding human wildlife conflict and compensation to the local communities.

Despite these efforts, human wildlife conflict is still a common challenge in most areas close to protected areas. This has led to biodiversity conservation becoming an issue of increasing concern at the local, national and international levels with some of the problems being linked to the lack of the legal frame work to promote conservation and sustainable use of natural resources (Owen 1971). Another problem is associated with the neglect and disregard of the socio-economic aspects of neighbouring communities to protected areas by wildlife authorities, highlighting the need to have a coordinated protected area management with land use planning and human activities on adjacent land.

2.5 The livestock problem in Tsavo conservation Area (TCA)

Livestock production is an important economic and survival resource for many pastoral communities surrounding protected areas. This form of land use presents a major challenge to management of protected areas in Kenya. This is particularly evident in many conservation areas that border pastoral communities or are in areas designated as disease free zones or fattening areas. Tsavo Conservation Area (TCA) is one such area, which is both surrounded by pastoral communities (Masai and Orma) and whose environs has been declared disease free zone. Livestock incursion into Kenya's protected areas has been a great concern for the Kenya Wildlife Service management. According to the Kenya wildlife management and coordination Act, livestock and other domestic animals are prohibited in the National parks. However, in National Reserves that are managed by the local authorities, livestock maybe permitted into the National Reserves depending on agreements between the local authorities and the local communities. These agreements differ from one local authority or National Reserve to another. Kenya Wildlife Service management has for a long time been spending huge amounts of money and time to control and forestall the incursion of livestock from the National parks.

The high concentrations of livestock present on the park boundaries in places such as Rombo, Maktau, Ziwani, Mang'elete, Mukururo, Finch, Kilaguni, Kibwezi area, Chyulu, Bonham and Jipe presents a major livestock encroachment problem in Tsavo and Chyulu National Parks. Most of the livestock originate from Somalia and north eastern Kenya. These livestock's are herded to the region prior to sale at the coastal town of Mombasa. Tsavo Conservation Area therefore becomes a suitable and convenient fattening ground probably due to its vastness, hence more available grazing area, its strategic location along the trade route and the declaration of Taita Taveta district and its environs as disease free zones (ILIRI

2013). These large concentrations of livestock in the park and nature reserves can lead to problems such as habitat degradation, resource (pasture and water) competition with wildlife, increased human-wildlife conflicts, heavy soil erosion and destruction of roads and other infrastructure, increased snaring, increased conflict with predators leading to poisoning (lions), increase in accidental or intentional fires (e.g. in Chyulu to encourage fresh growth), transmissions of zoonotic diseases between wildlife and livestock, increase in invasive and opportunistic species, change of vegetation structure and composition, aiding commercial poaching (poachers hiding among herders), decline in wildlife numbers, increased water abstractions on streams, change in wildlife behavior, destruction of water pipelines to attract livestock and wildlife and tourist dissatisfaction.

Apart from the declaration of disease free zones in the region, livestock encroachment in Tsavo conservation area has been linked to other factors e.g. the lack of enough grazing pastures outside protected areas due to degradation caused by overstocking and poor range land management, change in land use resulting in reduced grazing area, erratic climate patterns and increased droughts probably due to climate change, uncontrolled influx of livestock from outside the region, high stocking rates by ranch owners probably due to lack of knowledge on appropriate stocking rates or lack of capacity to control appropriate stocking rates, lack of enforcement of ranching practices by livestock department, high poverty levels in the region, conflict of interest and corruption among the enforcing agents (KWS, politicians, administrators are among the livestock owners), squatting and livestock "bomas" on road reserve, lack of enough resources and personnel to control over the large expanse of protected area, weak penalties awarded to culprits in courts as well as cultural attachments (Orma and Masai).

Chapter 3

3.0 Methodology

3.1 Study area

Tsavo National Park in located in Kenya's south east region. The park was established in 1948 with an area of 21,812Km^2. It is the largest Park in Kenya which is home to the largest elephant population (omondi et al 2008). In 1948 Tsavo National Park was divided into East and West for administrative purposes. The two Parks are divided by Nairobi – Mombasa railway /road with community and private ranches and settlements bordering the protected area. The ranches and community land under study enclave the block of land between Tsavo west, chyulu and the south eastern part of Tsavo East. Some Parts of the regions especially around the Taita hills and Taveta are densely populated with settlements and agricultural land forming majority of land use, while other parts e.g. the ranches represent important habitat for both wildlife and livestock farming. Average annual rainfall for the region varies from 250 to 500mm, with most parts being dry and arid grassland (Leuthold 1978). Livestock and crop farming form the majority of land use practice in the area with communities like the Taita and Kamba predominantly practicing farming while the Masai and Orma are mainly pastoralists.

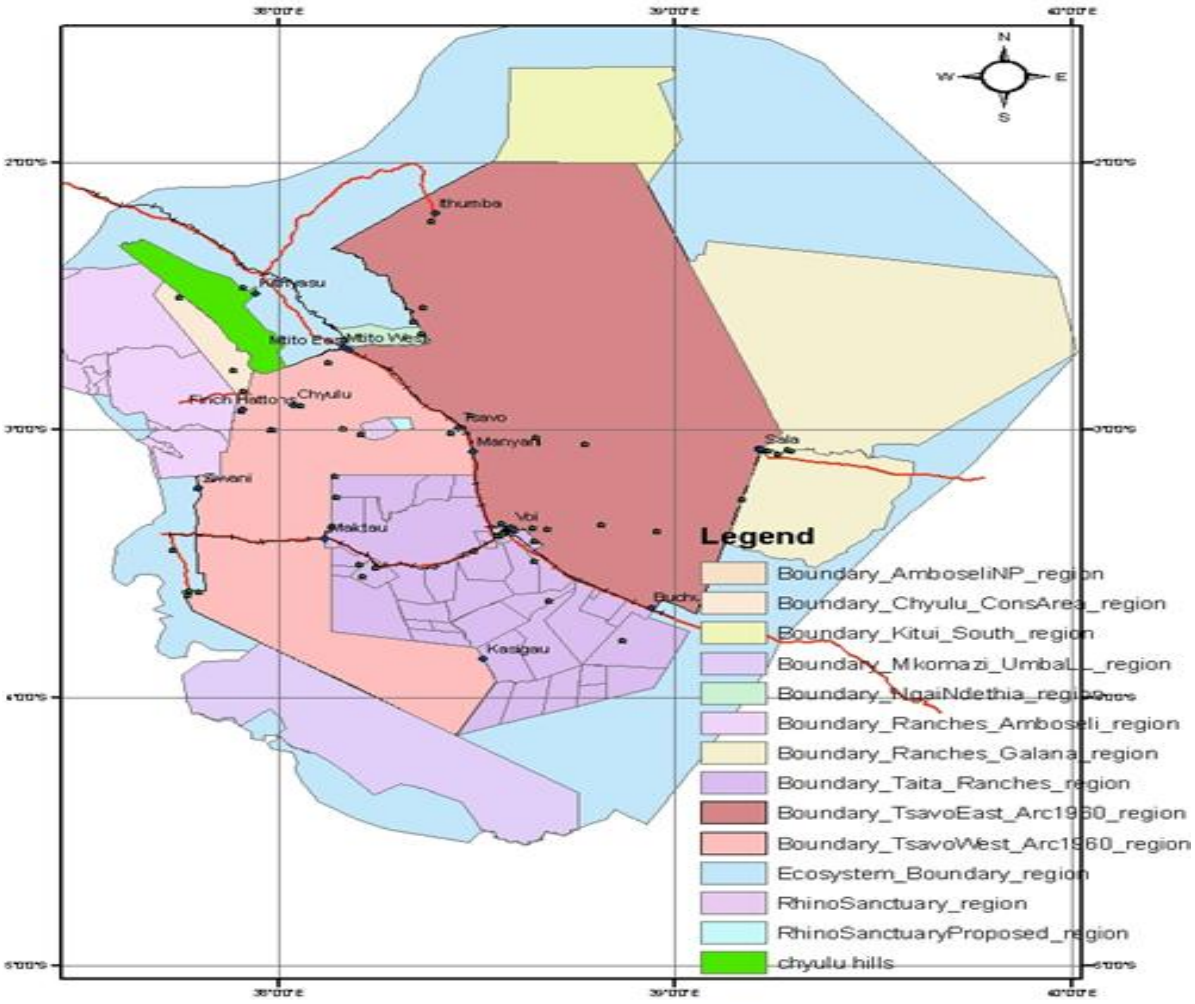

Figure 1 Tsavo Conservation Area map showing the protected areas and the ranches bordering the parks (KWS 2012)

3.2 Data collection and analysis

The research was based upon available raw data in time-series from the Tsavo conservation area. Where three data sets were analysed and compared, these data sets include one of human-wildlife conflict with elephants, one of livestock number and, one of total numbers of elephants in the area. The first two are from Kenya Wildlife Service and the latter from the International Union for Conservation of Nature and Natural Resources (IUCN) African Elephant Specialist Group (AfESG).

Using Microsoft excel programme the data was analysed to establish:-

I. Livestock numbers and trends over the years for the conservation area and for each individual regions

II. Elephant population numbers and the trends over the years

III. Analysed to identify the most common form of conflict in the region and the type of animal species that are involved in conflict on the Tsavo conservation area for the period of five years.

IV. Analysis and comparison of trends for both livestock and Elephant –human conflict in The Tsavo conservation area and the sub regions i.e. Taita, Taveta, Kimana, Chyullu and Mtito

Although conflict occurs in various forms and type for the study the type of conflict was limited six types. These categories were selected due to their nature and degree of severity of the impact they have on the regions and community that bear the brunt when such conflicts occur. They include

- Crop damage
- Property damage
- Injury to human
- Death to human
- Injury to wildlife
- Predation of livestock

The analysis was also limited to large mammals and wildlife species that caused severe conflict with humans and the perception that such species will have a direct competition for resources with domestic livestock. These species included in general Elephants, Buffaloes,

Lion, Leopard, Hyena and Cheetah. With more emphasis being put on the Elephant conflict cases as the main species of study in the region.

Due to the relatively large size of the study area, the area was subdivided to 5 sub regions in relation to the area adjacent to the protected areas and ranches, this was to simplify the analysis down to geographical location and which also helps to establish the worst and least affected areas of the conservation area. It also helped to establish the common type of conflict and respective species affecting the sub regions. By using the administrative boundaries the following sub regions were established for use in the study. They include

I. Taita
II. Taveta
III. Kimana
IV. Mtito
V. Chyullu

The lack of availability of up to date elephant data from the IUCN (AfESG) to match the selected study period resulted on the use of previous available AfESG elephant data for reference and focus modelling to help in predicting the possible elephant population trend in the area.

The lack of up to date elephant population data is due to the fact that elephant census in Tsavo region usually being conducted once every three years. Although there wasn't up to date available data to compare for the time frames for the study, the AfESG has a clear and accurate elephant population data from the years 1995 to 2011. For the study data from the previous five elephant census i.e. 1998- 2011 was used. To establish population status and as an indication of the possible current population trend of elephants in the region, a linear

focus trend line calculation was applied to help establish and predict the population trend over the years.

Chapter 4

4.0 Results

From the analysis of the data, several factors and trends were established

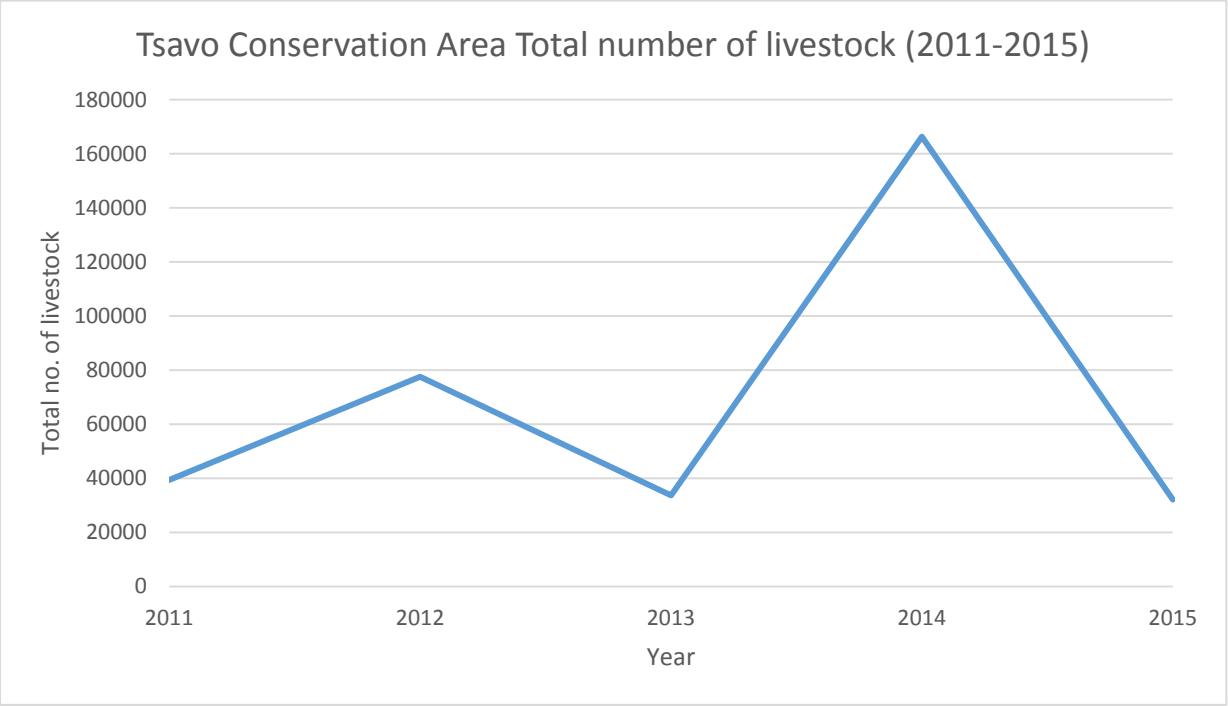

Figure 2: The livestock trend in Tsavo conservation area

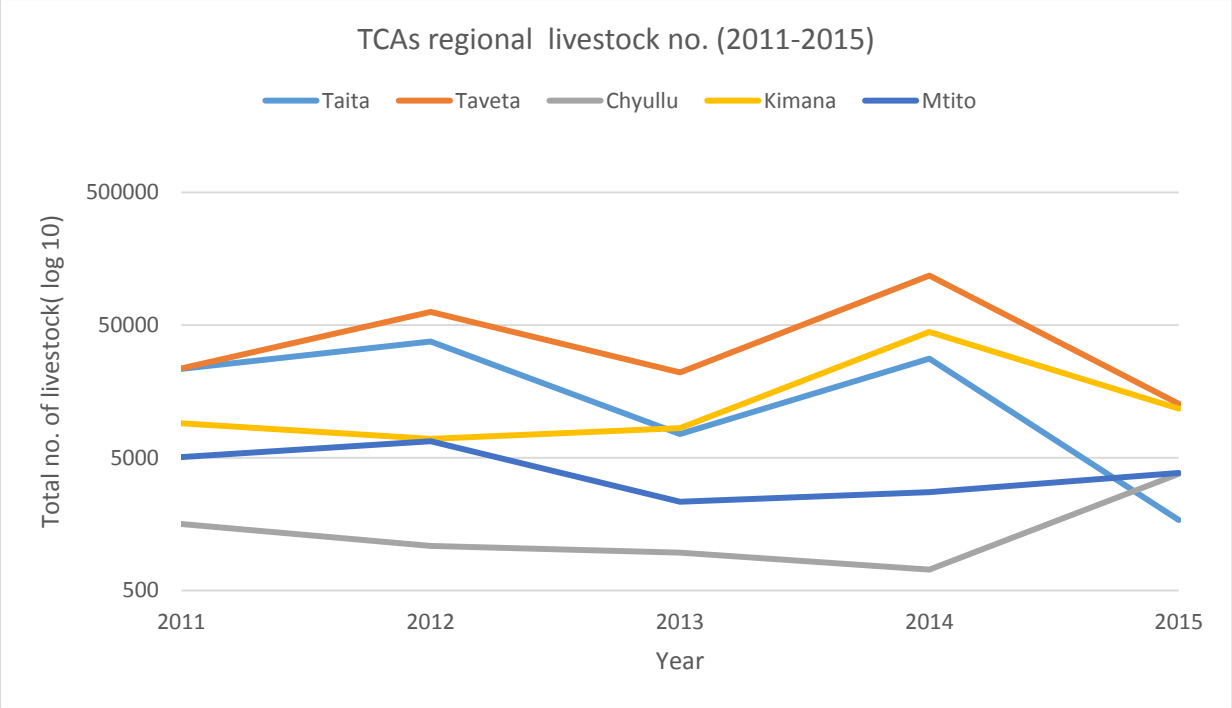

Figure 3: The Tsavo conservation area regional livestock trend

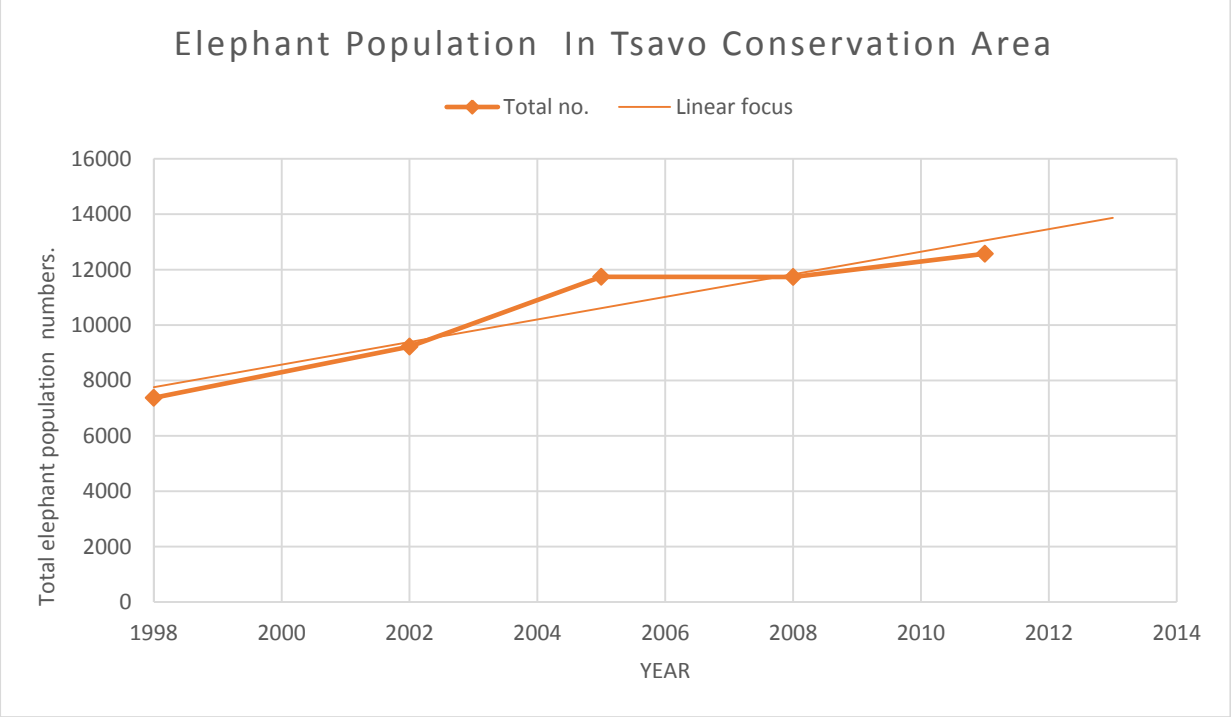

Figure 4: Total elephant population in Tsavo conservation area, with linear focus trend line

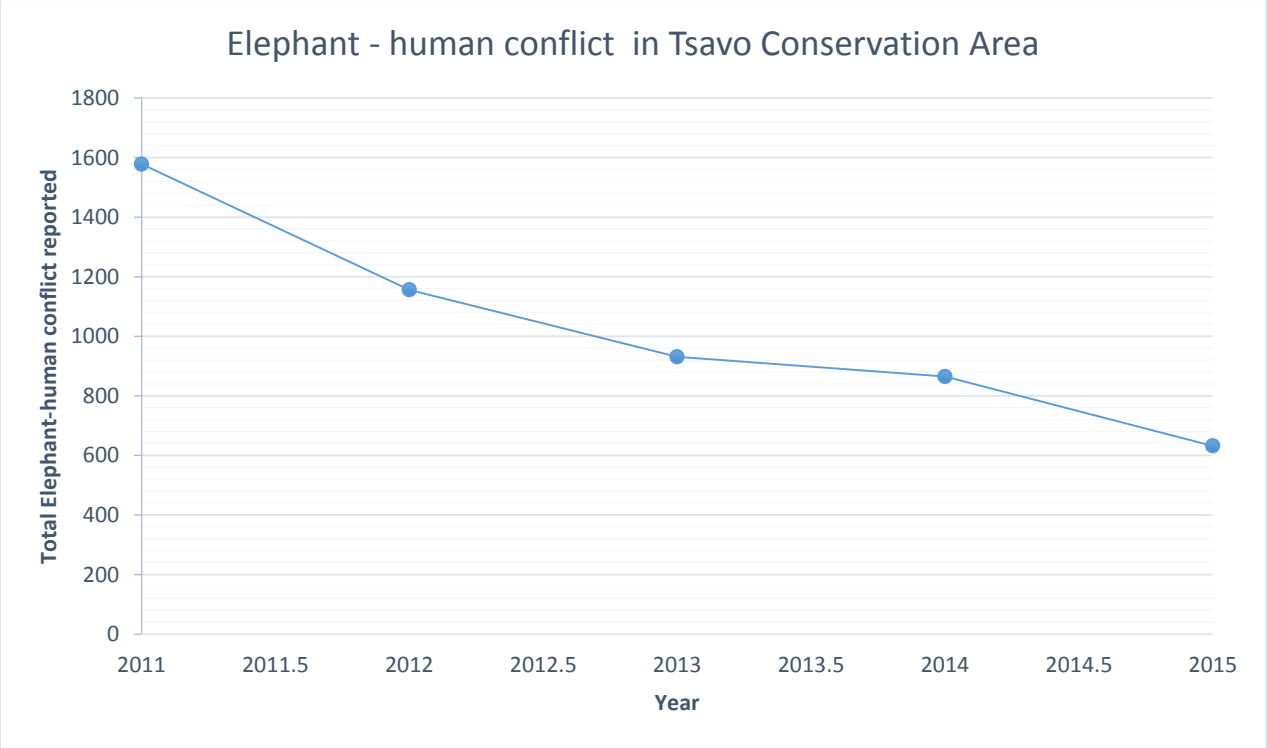

Figure 5: The elephant-human conflict yearly trend

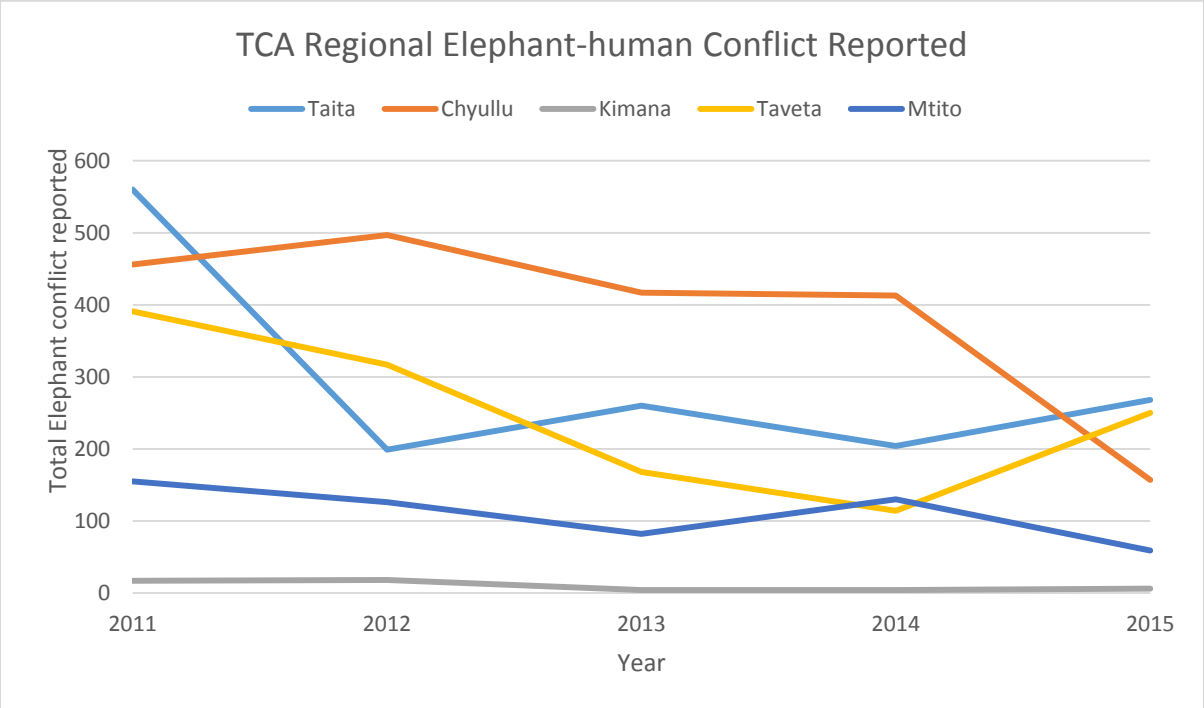

Figure 6: The Regional comparison of elephant- human conflict reported in Tsavo conservation area.

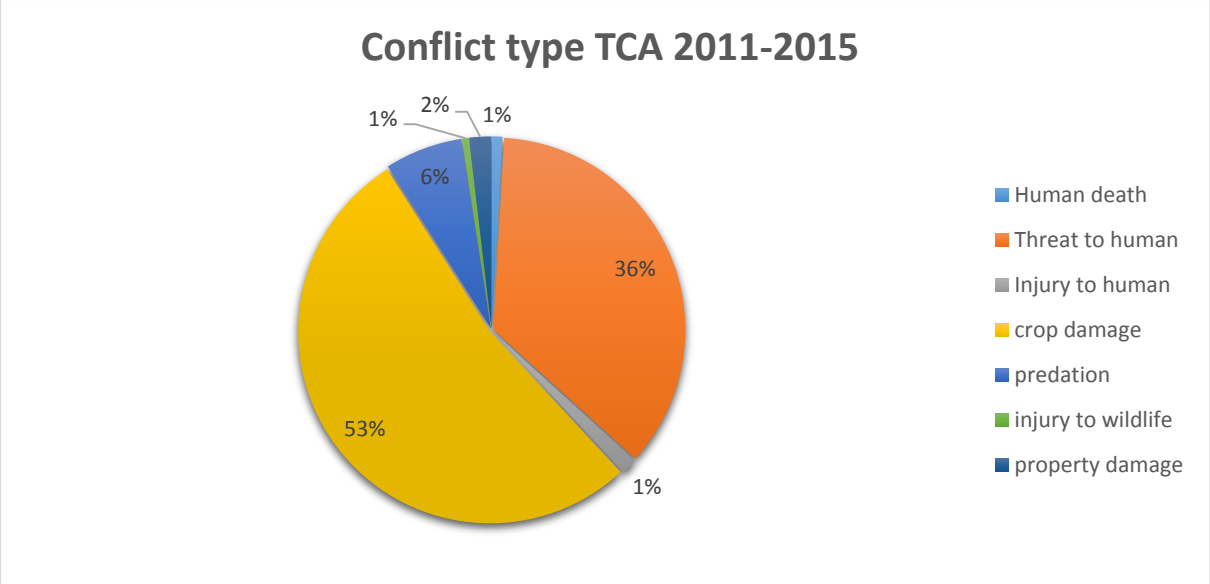

Figure 7: The percentage/ proportion of the type of conflict reported in Tsavo conservation Area for the five year period (2011-*2015)*

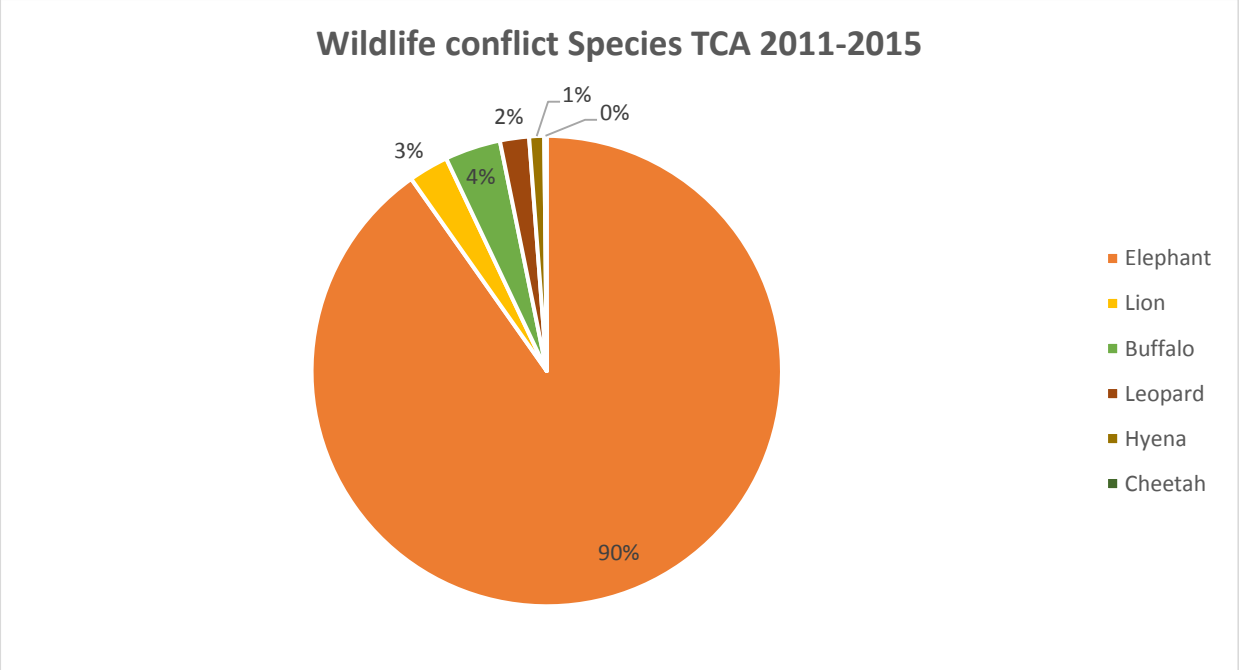

Figure 8: The percentage of the type of wildlife species involved/reported in human wildlife conflict incidences in Tsavo conservation area.

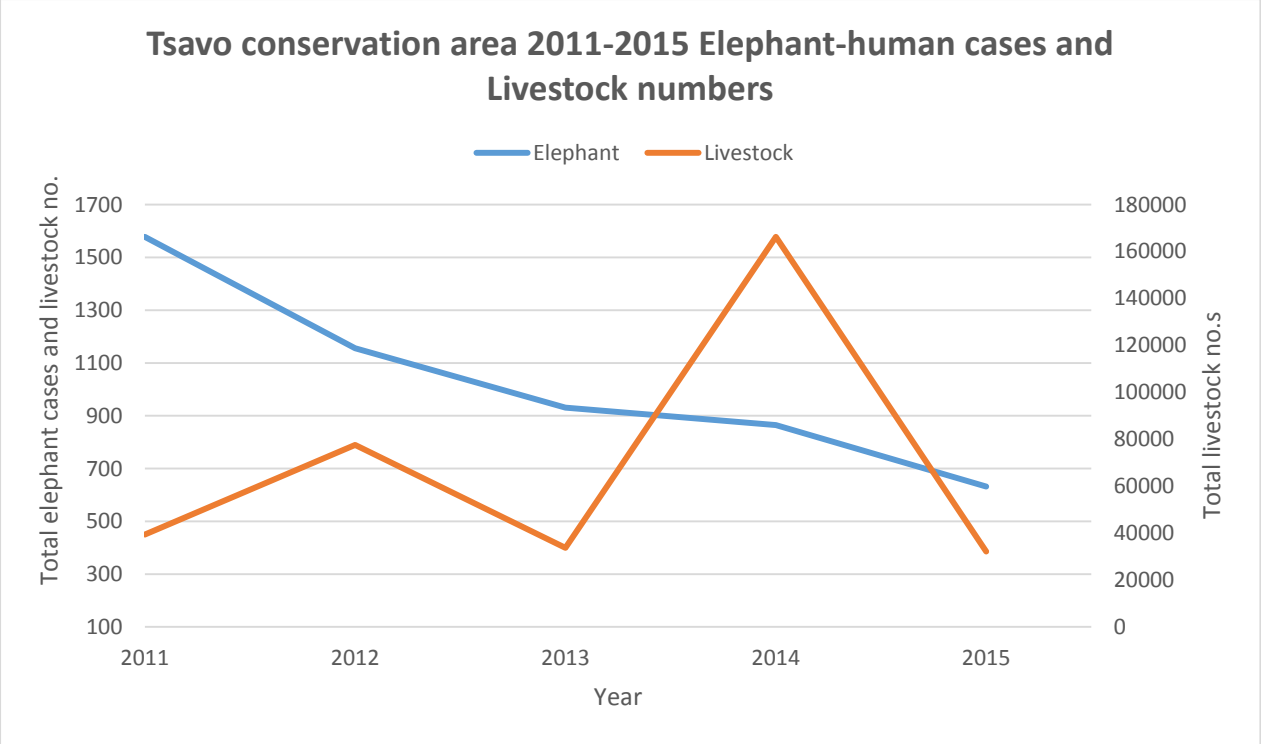

Figure 9: The comparison between Elephant- human conflict and the livestock numbers in Tsavo conservation area

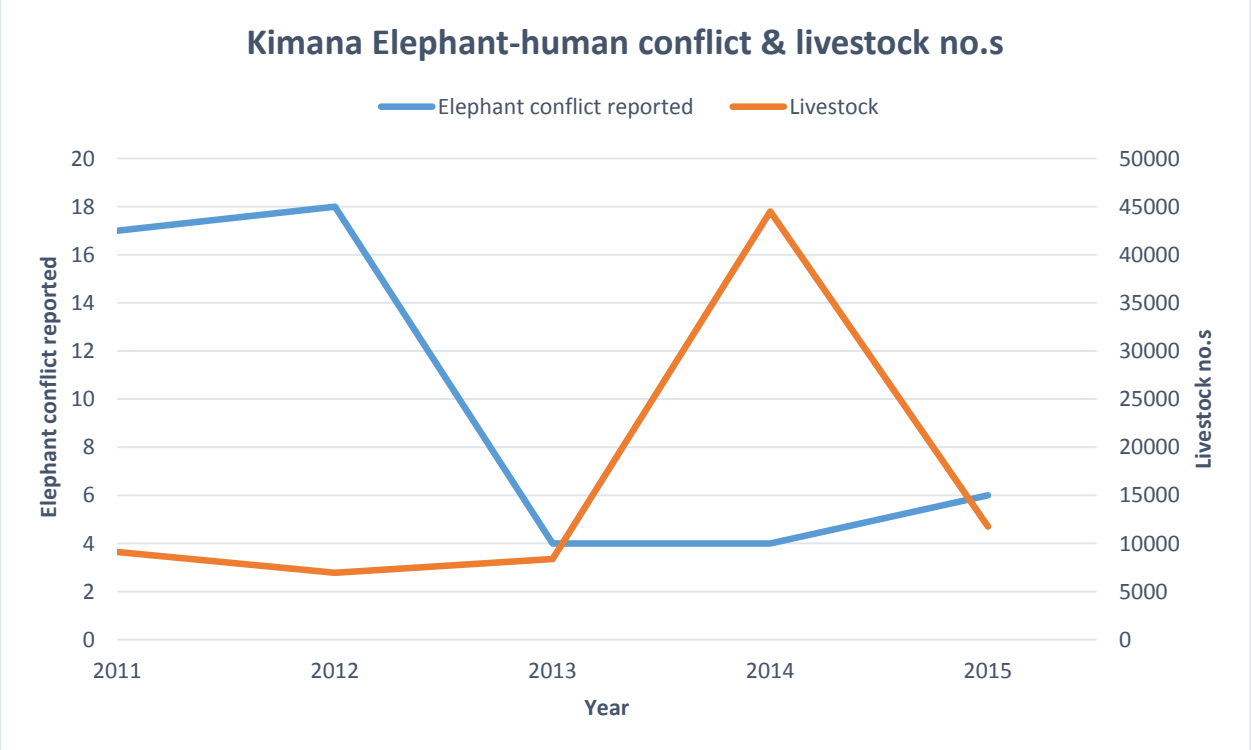

Figure 10: Comparison between Elephant-human wildlife conflict and livestock numbers in the region of Kimana

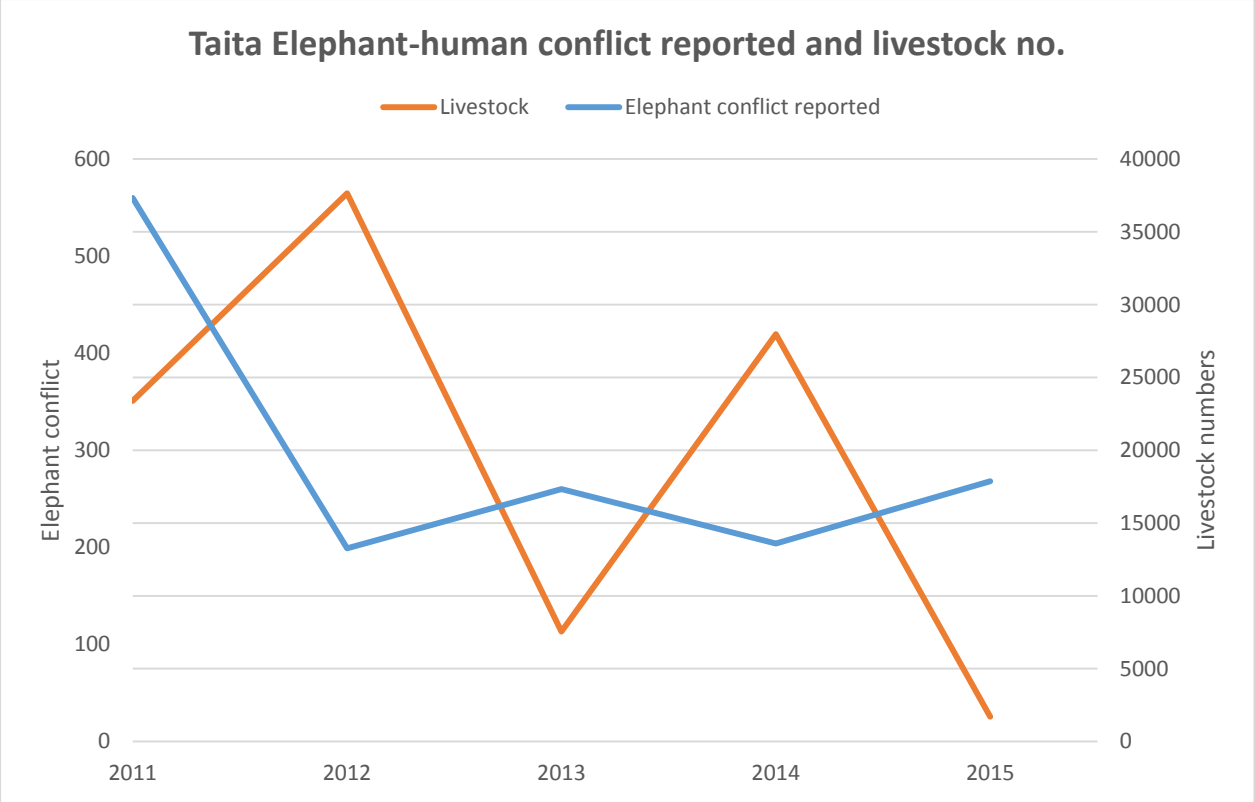

Figure 11: The comparison between Elephant - human conflict cases and Livestock numbers in the region of Taita

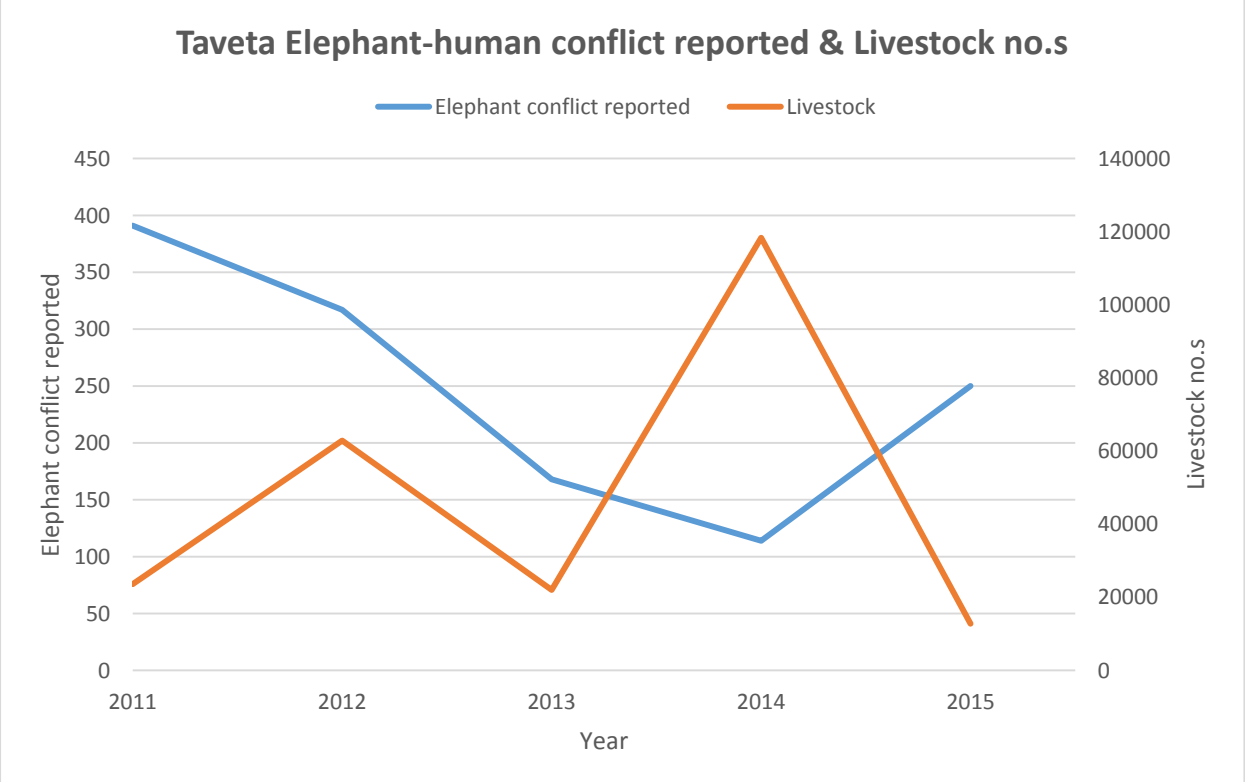

Figure 12: The comparison between Elephant- human wildlife conflict cases and livestock numbers in Taveta region

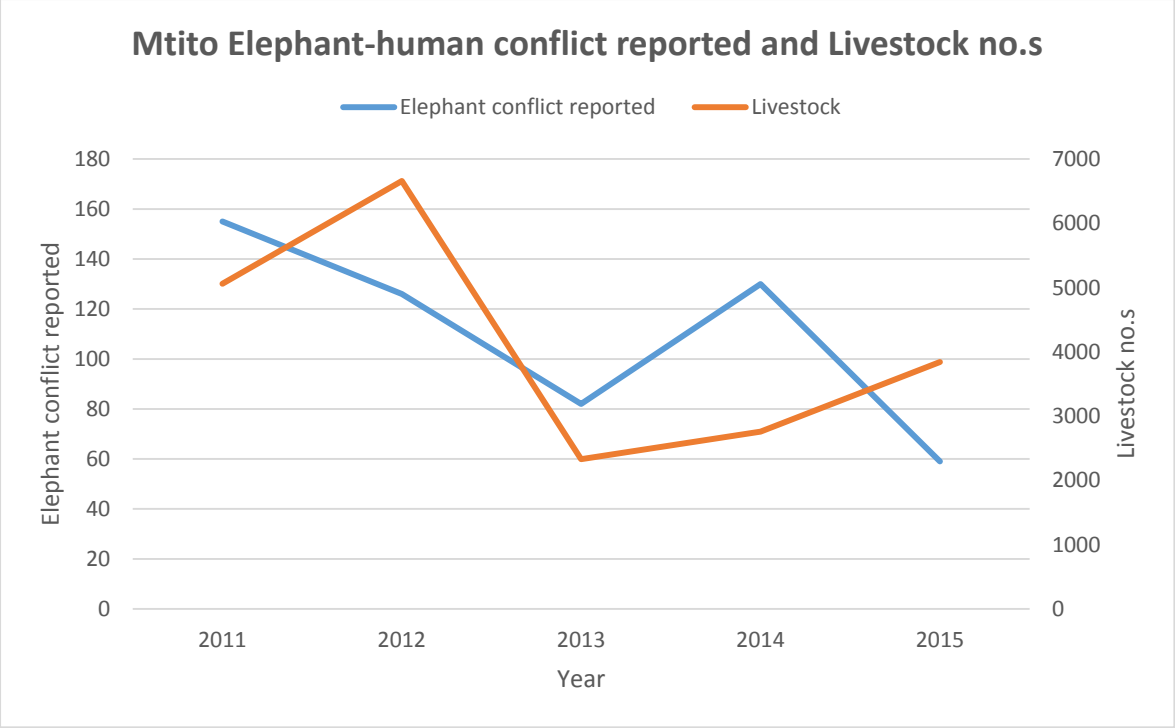

Figure 13: The comparison between Elephant conflict cases and livestock numbers in the Mtito region

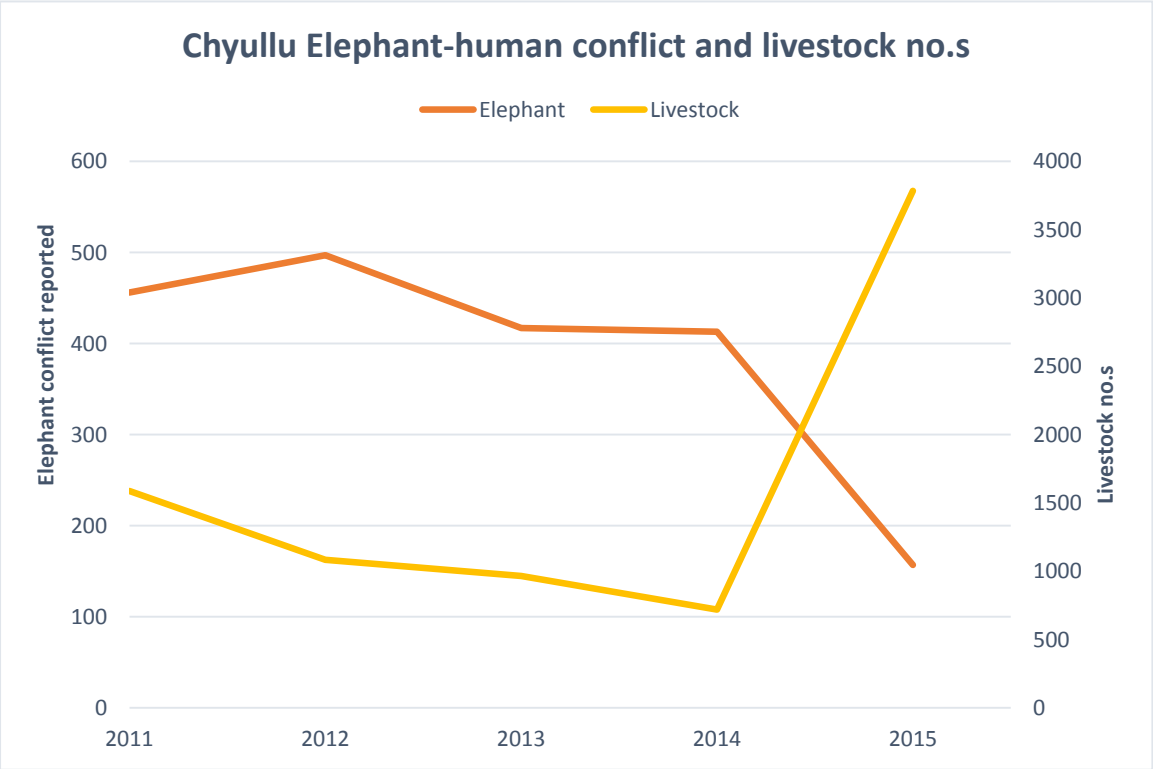

Figure 14: The comparison between Elephant-Human conflict cases and Livestock numbers in chyullu

Chapter 5

5.1 Discussion

The analysis of the results has shown that human wildlife conflict in the Tsavo region is a complex and a far reaching phenomenon with different aspects contributing to the conflict in the region. Elephant- human conflict in the region has had wider implication to the conservation of the species, the management of protected areas and adjacent range lands. Many factors have been believed to contribute to the occurrence of such conflicts. From the analysis of the data the following findings were evident:-

Elephant population numbers

The result show that there has been an increase in elephant population in the region, with a 71% increase in population in the years 1998 to 2011 as shown in fig 4.

By using a linear focus the results indicates a steady increasing trend in the elephant population in the region. This increase in elephant population can be associated with the ban in ivory trade, better elephant management plan by the Kenya wildlife service and improved security in the region (Ngene *et al* 2013). Improved methods of elephant census over the years e.g. the use of technology may also have helped to improve the accuracy in elephant population estimates in the region (Hamilton 1996).

Livestock numbers

The results have shown a general decrease in overall numbers in livestock the Tsavo conservation area over the last five years, with fluctuations between years as shown in fig 2. The individual regions analysis however has shown that in 2014 areas like Taita, Taveta, and Kimana which traditionally had a higher livestock numbers all through the years, experienced further major influx during this year followed by a sharp decline the following

year (see fig 3). While Chyullu and Mtito which had relatively lower number over the years had a further decline in livestock numbers in 2014 but experienced an sharp increase in livestock numbers the year after as shown in fig 3. The reversed trend could likely be due to the seasonal movement of livestock from one area to another in search of pasture. The higher stocking density rates and intensive grazing in these arid rangelands rapidly exhausted grazing resources which might take some time to replenish (ILIRI 2013).When most of the region pastures decline pastoralist tend to abandon and move their livestock to better grazing grounds which may explain the sudden influx and decline of livestock in some areas. Another possible cause of fluctuation can be attributed to increased security patrols by the Kenya wildlife service in areas affected by the influx of livestock and the allocation more resources to Tsavo conservation area, an approach that the wildlife service has taken to address the problem of illegal grazing and habitat degradation in the protected area (Omondi et al 2005).Weather conditions e.g. drought may also contribute to the fluctuations of livestock numbers, with many livestock preferring to move or concentrating in areas with permanent water supply during dry spells(J. de leew *et al* 2001). Areas like Chyullu have natural permanent water sources which can be valuable and important to livestock in such dry areas of the region.

Other possible cause of the fluctuations in numbers could be related to bias on the way livestock numbers and data is recorded in the region. The reliance on security patrols to record illegal grazing rather than the livestock owners and ranches accounts of livestock might not accurately reflect the actual livestock numbers in the area. An increased presence of park authority may discourage herders from illegal grazing on these regions but may lead to them moving to other grazing grounds in other parts of the protected area hence the fluctuations of livestock numbers over time.

Elephant- human conflict in Tsavo conservation area

From the analysis, the results show that over the years Elephant- Human conflict in wider Tsavo conservation area and its regions has been on the decline (Fig 5 & 6). Although this may be true for the larger Tsavo conservation area, a specific area/regional analysis has shown Taita and Taveta regions have had an increase in conflict in the period between 2014 to 2015 (Fig 6).

The general decline in Elephant- human conflict can be linked several factors e.g.

- Fencing: - Electric fences have been viewed as the most effective tool used in the control of Elephant-human wildlife conflict in human dominated landscapes, with the use of electric fences to control larger mammals being deployed in many conflict zones to reduce conflict and in some cases providing a permanent solution to these conflicts (Kioko et al 2008).

  The rapid human development and land use change in the Tsavo regions have led to habitat fragmentations and loss of migratory corridors for elephants and other large herbivores. Elephants require larger foraging range this may lead them to frequently straying in human settlement resulting in increased conflict in Tsavo. The Kenya wildlife service in its efforts to reduce human wildlife conflict has embarked on a programme to identify and build electric fences in the most affected area as is evident In some parts of Taita and Chyullu where KWS has created electric fence along the parks boundary (Smith and Kasiki 2000).The presence of these fences have contributed to the control of movement of elephants in these regions hence the decline in human elephant conflict in the areas.

- Better problem animal control management (PAC) and stakeholder involvement in conservation: The Kenya wildlife service through its community wildlife branch has embarked on community education and awareness on how best to incorporate human activity with wildlife conservation in the area (KWS 1994). Some of the projects help community benefit from ecotourism leading to tolerance of wildlife near human settlements and changes in attitude of people towards wildlife especially Elephants. Educational programmes have also improved the understanding on wildlife movement by farmers especially elephants and how best to protect their crops e.g. use of traditional methods like beehive fencing to protect farm crops.

- Lack of compensation leading to improved management from communities can also be contributing factor to the decline in conflicts. Due to the lack of provision for crop damage compensation from the wildlife act (KWS 2015), this may lead to farmers taking extra efforts to protect their crops. With studies showing that compensation can lead to dependency on the payments and complete disregard for the need for communities to protect their crops and livestock (Nyhus *et al* 2005) hence the lack of such provisions on the Kenyan wildlife act has resulted to farmers owning full responsibility of their crop and property guarding from wildlife damage. Some of the active methods adopted by local communities in wildlife areas include guarding of farms and livestock especially at night, proper crop planting times and the type of crops farmers can grow at what times of the year and regions. This active involvement of traditional methods of human wildlife control measures can greatly reduce conflict.

- Bias and Lack of reporting of conflict; although the lack of compensation can lead to improved human wildlife conflict management techniques by the local community, it might have a negative effect on the reporting of human elephant conflict i.e. local communities might lack the incentive to make a report to wildlife conflict to authorities due to the belief that any action taken won't be able to compensate for the damage already done by wildlife. This may result in a biased reporting trend where only severe cases of conflict are reported hence explain the possible decline in reported cases of conflict.

- Another reason for decline in conflict can be attributed to the seasonal movement of cattle from one region to another, Most of the livestock grazing is for commercial fattening/finishing of cattle, where a large number of livestock are brought in from the northern eastern part of the country to the Tsavo area where fattening is done before being moved to the market (ILIRI 2013). The intensive grazing usually happens on the ranches and edges of protected areas and buffer zones. This intensive grazing and high stocking density can lead to rapid habitat degradation and the constant presence of humans leads to wildlife moving further deeper into the protected areas away from human settlement resulting in reduce conflict with humans, with some studies on effect of livestock in arid areas on wildlife distribution indicating that the presence of Cattle in arid lands limited the presence of many species of wild herbivores especially grazers, presumably through competition for their shared resources, with the nature of competition being dependent on rainfall and the presence of other herbivores(Corinna *et al* 2012).

Conflict species (Problem animal) composition in Tsavo conservation area.

From the results, Elephants form a majority of the species that were involved in human wildlife conflicts, with a total of 90% of all conflict reported in Tsavo conservation area involving elephants as shown in fig 8. This may be a result of the fact that majority of African elephant range currently laying outside protected areas (Hoare 1999). Other factors for the large proportions can be linked to fact that elephant require large ranging areas for foraging and migrating compared to other large herbivores, with the shrinking and constant fragmentation of these habitats resulting to elephants frequently coming to contact with humans and human settlements.

The larger proportions of elephants in conflict cases can also be due to the increase in crop land around or near protected areas, with subsistence horticultural farming forming a majority of land use forms in the region. This change in land use can be a contributing factor to elephant- human conflict (Graham and Litoroh 2009).

Type of conflict in Tsavo conservation

From the study, threats to human and crop damage are the most common types of conflict in Tsavo conservation area with 53% and 36% respectively of all conflict types reported as shown in Fig7.

These large proportions may be as a result of the rapid and incompatible change in land use practice adjacent to the wildlife protected area (Graham and Litoroh 2009). Human settlement and the rapid conversion of land to arable farmlands have reduced the elephant habitat range in the region resulting to elephants straying to farmlands and destroying crops, and the presence of these elephants threatening humans in the area. The lack of proper and efficient crop protection measures have led to a considerable loss from elephant

crop raids in the areas affected. Crop damage has also featured heavily in human wildlife conflict studies in Asia and Africa with large mammal's especial elephants being cited as the main problem animals in the affected regions (Parker et al 2005 and Parker et al 2007).

Traditionally these adjacent areas around the Tsavo national park have provided dispersal and migratory corridors for larger mammals especially elephants but the increased number in livestock and subsequent encroachment and illegal grazing in the national park for pasture and water has led to disruption on elephant movement and foraging patterns. Most of the regions have no physical barriers to control both livestock and wildlife movement leading to elephants straying into human settlements and crop raiding. The presence of elephants near human settlements may not be fatal in most cases but can lead to imposed curfew due to fear of physical attacks to human by rogue elephants explaining the large proportion of threat to humans in conflict reports (Kimega 2003 and Jadhav 2011).

Does increase in Livestock numbers increase Elephant-human conflict?

From the results, an increase in livestock numbers in the Tsavo conservation area didn't result in an increase In Elephant-human conflict in the region (Fig 9). Contrary to what was hypothesised i.e. that an increase in livestock numbers may lead to increase in Elephant – human conflict, the results have indicated that although there was a general increase in livestock numbers the cases of Elephant-human conflict in Tsavo conservation area were generally and steadily on the decline over the study period irrespective of the change in livestock numbers.

A further analysis of each regions in the larger Tsavo conservation area however showed slight regional variation on both livestock numbers and Elephant- human conflict but did not indicate any positive changes to the trends i.e. an increase in livestock numbers was

followed by a decrease in elephant-human conflict as shown in Fig 13 and 14, While a decrease in livestock numbers was accompanied by an increase in Elephant -human conflict as shown in Fig 10, 11, &12.

Due to the complexity of Human wildlife conflict, the above can be associate with several factors of which some might not have been included in the study. Some of the possible reasons to the trend highlighted could be attributed to:

- **Competition for resources**

Most of the competition between livestock and Elephant is associated with access to water sources and grazing or foraging areas. Tsavo conservation area being an ASAL region, these resources are usually very scarce and the competition for access can be high, leading to one party being displaced in this case elephants. The constant presence of humans and livestock in these resources like permanent water and pastures in wildlife areas may be forcing elephants to move to other regions with low or no human presence hence reducing the occurrence of conflict in these areas of higher livestock numbers (Corina *et al* 2012 and J. de leew 2001). Some of the human activities and practices associated with the pastoral communities like the use fire to stimulate regeneration as tool to manage grazing land and also for night guarding of livestock in “bomas” in most cases help to drive away wildlife in these burning areas (Corina *et al* 2012). This results in less contact between wildlife and humans during this period.

The presence of pastoralists in the conservation area also makes it difficult to police illegal activities like poaching, The presence of poaching in such areas especially for ivory may result in elephants avoiding or moving further away from such areas with their absence leading to lower conflict cases.

5.2 Study limitations

During the study, several challenges and limitations were highlighted. Although only a few minor limitations were identified in the beginning of the study, it became clear during the analysis of the data that some of the objectives of the study could not be met. This was due to:-

I. **<u>Quality and reliability of data</u>**

- Lack of quality and reliable data on livestock numbers

The data on livestock consisted entirely of reports from the Kenya wildlife service patrol teams. This data probably did not, in most cases, reflect the accurate numbers of livestock in the regions. The data recorded relied on the chance of these patrol teams coming into contact with the livestock and herders. This led to biased data set with some areas not recording any livestock numbers for extended period of time, while others had recorded unrealistically higher numbers of livestock at the same period of time. The lack of inclusion of rancher's data on their stocking numbers made it difficult to verify the accuracy and reliability of the available data on livestock.

- Gaps and Lack of sufficient historical data and studies on human wildlife conflict with regards to Elephants and livestock

Majority of the reports on conflict were generalised in nature with the Tsavo conservation areas reports lacking clear demarcation on regions which had been most affected by conflict. Some of the historical studies done in the region were generalised with Tsavo conservation area being included as part of the province despite the large variation in climate conditions, location and land use practice in the region. There was also a lack of available literature on the region with regards to both livestock farming, human settlement

and human wildlife conflict. Where literature was available it consisted of some inconsistencies, with some of the authors reporting contradicting findings on same area of study, making it difficult to choose the reliable source of information for references.

The data recording for livestock in the region was only established in 2011, this made it difficult to compare previous and current trends. Over the years human wildlife conflict data lacked consistency, with some areas having no data available for comparison.

- Lack of standardised data collection and reporting

There was apparent lack of coordinated and standardised data collection and reporting. The reliance on the Kenya wildlife service livestock data did not reflect the true number of livestock in the region, the inclusion of ranchers in providing livestock numbers in their land would have improved the accuracy for the data in the region. The conflict data in the region was also inconsistent from one region to the other. The lack of uniformity on the data recording e.g. type of conflict can led to skewed representation of the conflict in the region. The lack of a central data reporting centre or data base made it difficult to obtain some of the secondary data.

- Lack of up to date elephant population data

The lack of available up to date Elephant data for the study period to overlap or compare with the available livestock and conflict data for the same period, made it difficult to establish any links or relationships between an increase in elephant population and conflict in the region. This is due to elephant population counts being conducted once every three years with the results taking at least 2 years to verify and publish on the African elephant specialist group data base. The lack of population data during the 2012 to 2015 made it impossible to establish any trends and comparisons with other factors that might affect

rates of conflict but instead relied on previous available data to help focus or predict current possible population estimates for the region.

Time frame and deadlines

Human wildlife conflict is a very complex issue to study and to establish its likely root cause. With the time frame that was available for the study, it became apparent that most of the objectives couldn't be fulfilled sufficiently e.g. some of the aspect of the data would have required first hand data collection and verification in the field, this would have required travelling to the study site to trying and verify some of the aspect of the data. During the study some of the analysis had to be delayed in order to confirm some of the aspect of data material which in most cases relied on a third party to verify e.g. security patrols and the demarcation of areas and ranges of patrol to avoid overlapping of information and data. Due to the remoteness of the study area most of these request required a significant amount of time allowance in order to get a true reflections and account of what was being reported.

5.3 Future work and recommendations

From the study various aspect of conducting scientific research were learned and shortfalls highlighted. In order to conduct a successful research undertaking in human wildlife conflict with specific emphasis on elephant in the region I would recommend the following:-

- The nature of the research requires access to first hand data. The reliance on second hand data made it difficult to achieve some of the objectives of the study hence emphasizing the need to collect data in person from the field for future similar studies.

- The need to incorporate rainfall data in future studies is vital, Rainfall affects many aspects of land use and the movement of wildlife. This inclusion could help identify some other drivers of conflict over time e.g. access to grazing grounds and water resources by both pastoralist and wildlife.
- In order to establish long term reliable trend it's important to include the "before" data i.e. long term available data to study a phenomenon like human wildlife conflict which might have several root causes or precursors that might not be reflected on most recent data sets
- Personnel and community education awareness on the importance of correct data collection, reporting and recording. Due to the amount of data that may be required for such a study it's important that individuals that are collecting the data are trained on the importance of collecting accurate data. This particularly important if large volumes of data are required to meet the objectives of the study.
- A standardised data collection method. There's a need to review on data collection methods i.e. the need to how conflict data should be reported and recorded. This will make it easier in future on how data can be handled and harmonised to a common data base. There is that need also to involve other stakeholders e.g. ranchers on how to report data on the movement of livestock in the region, this is particularly important in establishing the correct carrying capacity of these rangelands and on how best to manage limited resources for both livestock and wildlife.
- Use of local knowledge, this is particularly important for aspects of study that lack written records. By consulting local residents one is able to have a clear knowledge

of issues that might not be academically recorded but might be valuable in the course of the study.

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