STATUS OF HUMAN-WILDLIFE CONFLICTS AND EFFECTIVENESS OF THE REMEDIAL MEASURES IN TSAVO WEST NATIONAL PARK AND ADJACENT AREAS, KENYA

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A thesis submitted to the Graduate School in partial fulfilment of the requirement of the Master of Science Degree in Natural Resources Management of Egerton University

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DECLARATION AND APPROVAL

DECLARATION

This thesis is my original work and has not, wholly or in part, been presented for an award of a degree in any other university.

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SUPERVISORS' APPROVAL

This thesis is the candidate's original work and has been prepared under our guidance, and is submitted with our approval as his official university supervisors.

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DEDICATION

I dedicate this work to my family in particular my wife Jennifer and children for their full support and love during my MSc. Study.

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ABSTRACT

Kenya wildlife resources are economically important and represent a major source of employment and foreign exchange for the country. Numerous people and organisations benefit directly and indirectly from the presence of wildlife and many people and businesses derive their livelihood from wildlife. However, human-wildlife conflicts have presented serious obstacles to wildlife conservation worldwide and is more prevalent where human populations increase, development expands and where people engage in land use activities which are not compatible with wildlife conservation, as is the case in Kenya. Despite concerted efforts and mechanisms put in place to curb the interactions and conflicts between people and wildlife, the conflicts are still prevalent and predominant in the Tsavo West National Park (TWNP), resulting to serious problems in the Park and in the adjacent ranches and farms. In an effort to examine the status of human-wildlife conflicts, this study investigated the causes and impacts of livestock, human and wildlife interactions that perpetrate and perpetuate human-wildlife conflicts in TWNP and adjacent areas, and subsequently, suggested some practical remedial measures to curb the conflicts. A socio-ecological survey using a structured questionnaire was used for the study which was also supported by 43 Key Informants' interviews, observation (ocular) methods, and secondary data. A sample of 220 households was selected through stratified sampling, and the collected data analysed using the Statistical Package for the Social Sciences (SPSS) version 11.5. Both descriptive and analytical procedures were used in data analysis. Findings from the hypotheses testing revealed that: (1) Livestock incursion into the parks is in fact associated with conflicts; (2) Human encroachment is in fact associated with resources degradation; (3) Wildlife dispersal from the TWNP into adjacent areas negatively impacts resource availability and community socioeconomics; (4) Human-wildlife interactions in the park and adjacent areas are in fact not significantly associated with incurred losses (contrary to the community's claims), since the relationship is statistically insignificant; (5) Human-wildlife interactions in the park and adjacent areas are in fact associated with accrued benefits; but (6) The accrued benefits from human-wildlife interactions in the park and adjacent areas do not influence community support to wildlife conservation contrary to the popular belief.

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LIST OF ACRONYMS AND ABBREVIATIONS

ASALs	Arid and semi-arid lands
GoK	Government of Kenya
GIS	Geographical information system
HWCs	Human Wildlife Conflicts
IUCN	International Union for Conservation for nature
KNBS	Kenya National Beaureu of Statistics
KWS	Kenya Wildlife Service
NGO	Non-Governmental Organization
PA	Protected Area
SPSS	Statistical Packages for the Social Science
SCBD	Secretariat of the Convention on Biological Diversity
TENP	Tsavo East National Park
TWNP	Tsavo West National Nark

CHAPTER ONE

INTRODUCTION

1.1. BACKGROUND INFORMATION

Kenya wildlife resources are economically important and represent a major source of employment and foreign exchange. Numerous people benefit directly and indirectly from the presence of wildlife, including tour and hotel operators, tourists, hunters, scientists and commercial game ranchers (Aboud, 1989; Burrow *et al.,* 1995). Many other workers and businesses derive their livelihood from wildlife (Aboud, 1989). Human-wildlife conflict is a serious obstacle to wildlife conservation worldwide and is more prevalent where human populations increase, development expands and where people engage in land use activities which are not compatible with wildlife conservation.

The impacts of human-wildlife conflict are significant. People lose their crops, livestock, property, and sometimes their lives (Bell, 1984). The animals, many of which are already threatened or endangered, are often killed in retaliation or to 'prevent' future conflicts. Human-wildlife conflicts are some of the main threats to the continued survival of many species in different parts of the world, and are also a significant threat to local human populations (Kiringe & Okello, 2007; Hoare, 2001). If solutions to conflicts are not effective, local support for conservation will decline. The attitude and perception of the local communities living in wildlife areas is a key element in the support for wildlife conservation. Understanding this is still a challenge to the wildlife managers, conservationists and other wildlife practitioners in the wildlife sector. This issue is more critical in areas that experience high incidences of human wildlife conflicts.

According to the Secretariat of the Convention on Biological Diversity (SCBD, 2008), much of the current biodiversity crisis is as a result of increasing competition with humanity for space and resources. As a result protected areas become isolated islands of natural habitation in a sea of human settlement. Human wildlife conflict is affecting more and more species

particularly the large mammals (West *et al.,* 2006). Where such species have negative impacts on people's livelihoods, local support for conservation is eroded (Hill, 1998). Hence large mammals are at higher risk of extinction.

Agro-ecological factors such as climate, the nature and property of soils, landforms and terrain determines productivity of an area and influence species interactions such as competition for available natural resources. Human settlement in the Arid and Semi Arid Lands (ASALs) has further contributed in reduction of wildlife range. Human settlement on wildlife migratory routes connecting different habitats and the establishment of incompatible land use practices have escalated direct conflicts between humans and wildlife (KWS, 1994). Among the Maasai pastoralists who border Tsavo West National Park (TWNP), due to modernization, they have now adopted sedentary lifestyle as opposed to nomadism (Chiemelu, 2004). They have also engaged in cultivation and increasingly planting cereal crops to diversify their diet.

Practical mitigation of human-wildlife conflict is critical to the success of conservation in TWNP and wildlife conservation in Kenya in general. With the advent of the industrial revolution, human population especially in Kenya since independence has dramatically increased. Mankind's technological ability permanently altered much of the land surface culminating in the destruction of wildlife habitat beyond its capacity to regenerate. Man therefore uses tools to modify and manipulate the environment for his own sake without putting in mind other organisms which utilise the same environment resulting in the misuse or overuse of the natural resources. The belief that wildlife has many values should continue to be the guiding principle and driving force behind our actions as we continue to keep nature in the equilibrium. The moral duty of conservationists or wildlife manager's is therefore to educate the entire humanity to embrace conservation ethics in their day to day activities and actions geared towards conserving and utilising nature, not only for human gain but for its own sake (Lockwood *et al.,* 2006).

Wild animals' dispersal from TWNP into the adjacent ranches, farms, and residences, and human and livestock encroachment from the neighbouring ranches, farms and residences into the Park, occur all the year round. Conflicts are reported on both sides (the Park's and the neighbouring areas). The reason for the causes of the conflict is that both the wildlife and livestock movements are in search of grazing and water resources, especially during dry/drought periods when these resources are deficient in both sides. The human encroachment into the Park is either in herding or in illegal pursuit of certain commodities found primarily in the Park.

The mechanisms put in place by the park authorities' like arrests by the law enforcers and court sentences, establishment of fences, provision of education and awareness creation and enforcing the park boundary do not effectively curb the conflicts. There was need therefore to access community perception on the effectiveness of these mechanisms and suggest potential remedial measures.

1.2. STATEMENT OF THE PROBLEM

Despite all the efforts and mechanisms put in place to curb the interactions and conflicts between people and wildlife, wild animals still continue to destroy crops, kill livestock and attack humans. The local people also still seek some vital resources from the park e.g. pasture, building materials, bush meat etc despite the Wildlife Act Cap 376. These conflicts are very prevalent and predominant in TWNP. Livestock, wildlife and human interface tend to cause serious problems, losses and conflicts in the Park and in the adjacent ranches and farms. There is therefore an urgent need for a research undertaking to investigate issues in the resource use conflicts and come up with practical solutions to curb the conflicts. This research addressed some of these issues.

1.3. RESEARCH OBJECTIVES

1.3.1. Broad objectives

In an effort to examine the status of human-wildlife conflicts and effectiveness of the remedial measures, this study investigated the causes and impacts of livestock, human and wild animals' interactions that perpetrate and perpetuate human-wildlife conflicts (HWCs) in TWNP and adjacent areas, and subsequently suggested some practical remedial measures to curb the conflicts.

1.3.1. Specific objectives

The following specific objectives guided the accomplishment of the broad objective stated above;

1) To examine the causes and frequency of livestock incursion into the TWNP.
2) To examine the causes and frequency of human encroachment into the TWNP and its affects resource degradation.
3) To establish the wild animals dispersal patterns from TWNP to the adjacent areas.
4) To assess losses incurred and benefits received by local communities due to human-wildlife interactions.
5) To identify respondents' own impression and resolutions on HWCs conflicts and recommend appropriate practical remedial measures to curb the conflicts.

1.4. NULL HYPOTHESES

The following Null hypotheses were formulated and tested:

Ho 1: Livestock incursions do not cause conflicts in TWNP.

Ho 2: Human encroachment into the park and do not cause resource degradation.

Ho 3: Wildlife dispersal from TWNP, into adjacent areas, does not affect resource availability and interfere with the communities' social life.

Ho 4: Human-wildlife interactions in the TWNP do not generate both losses and benefits to the local communities and influence their support for conservation.

1.5. SIGNIFICANCE OF THE STUDY

Conflict arises from various sources; wildlife destroys crops, kill livestock and attack humans and the local people are denied access of some vital resources from the park. The local communities therefore, view wildlife parks/reserves with hostility perhaps because issues of HWCs do not seem to be adequately addressed (Aboud, 1989; Hoare, 1992; Kwayera, 2003). The local community also threaten the survival of wildlife through poaching for meat and trophies.

The study examined the nature, extent and effectiveness of remedial measures of human-wildlife conflicts in TWNP and adjacent areas. Based on the findings, appropriate potential, practical solutions and policy recommendations were made with a view of minimizing the conflicts. The outcome of the study will explicitly help wildlife professionals and key decision makers shift from reactive mitigation of human-wildlife conflicts to a proactive, prevention of all conservation conflicts.

1.6. DEFINITION OF TERMS

In the context of this study, the following terms will be defined as follow:

Conflict: Refer to competition for important resources within and outside the national park. Conflict situations present a significant challenge in achieving participatory resource management and sustainable livelihoods. Rising tensions and disputes can undermine the formal and informal institutions and rules that govern resource use, resulting to environmental degradation and economic decline.

Biodiversity: The variability of living organisms present in a particular ecosystem.

Conservation: Care and management of natural environment.

Farms: Privately owned parcels of land mainly used to grow crops/rare livestock.

Household: A social group in which members resides at the same place, share needs, and make joint coordinated decisions on resources allocation and income pulling.

Land use: Relates to the human activity or economic function associated with a specific piece of land.

National park: Gay and David (1985) define a National park as a relatively large area where: (1) one or several ecosystems are not materially altered by human exploitation and occupation, where plant and animal species, geo-morphological sites and habitats are of special scientific, educative and recreactive interest or which contains a natural landscape of great beauty; (2) the highest competent authority of the country has taken steps to prevent or eliminate as soon as possible exploitation or occupation in the whole area and enforce effectively the respect of ecological, geo-morphological or esthetic feature which have led to its establishment; (3) visitors are allowed to enter, under special conditions, for inspirational, educative, cultural and recreation purpose.

Ranch: Farm where cattle and other livestock are raised on large parcel of open land.

Wildlife: Animals or birds living free in natural conditions; not tamed or kept in a house or on a farm. It also means a plant or a fruit growing in natural conditions not cultivated.

1.7. OPERATIONALIZATION OF VARIABLES

The variables were operationalized as follows;

1.7.1. Livestock incursion into the Park

This variable was drawn from the following indicators: the types of livestock that enter the park (during each season), the numbers of livestock (during each season), the frequency of incursions (during each season), the resources sought in the park, how deficient are the

commodities/resources in own ranching and farming areas, other reasons for the incursions, the mechanisms put in place to curb the incursion, and how effective or ineffective the mechanisms were.

1.7.2. Human encroachment (without livestock) into the Park

Human encroachment into the park was influenced by: the type of persons (neighbour or distant visitor, during each season), the numbers of persons, (during each season), the frequencies of encroachment (during each season), the commodities and/or resources sought, the alleged reasons for the encroachment, how deficient are the commodities/resources are in own areas, what mechanisms were put in place to curb the encroachment, and how effective or ineffective were the mechanisms.

1.7.3. Wildlife dispersal into the neighbouring ranches/farms

Wildlife dispersal outside the park was determined by: the types of wildlife that disperse into the adjacent ranches and farms (during each season), the numbers of wildlife involved (during each season), the frequencies of dispersion (during each season), the commodities and/or resources sought, how deficient are the commodities/resources in the Park, other reasons for the dispersal, what mechanisms were in place to curb the dispersal, and how effective or ineffective were the mechanisms.

1.7.4. Losses incurred and benefits received by local communities due to human wildlife interactions

Losses and benefits from wildlife established from: estimate of losses incurred due to human-wildlife conflicts (HWCs), number of people injured or killed by wildlife and any compensation received by the local communities as a result of wildlife damage and other benefits received in support of conservation.

CHAPTER TWO

LITERATURE REVIEW

2.1. LIVESTOCK INCURSION INTO THE PARK

The TWNP environs are made up of livestock ranches, seasonal small-scale agricultural farms and community wildlife reserves. Increasing competition for forage and water and disease risk, particularly from wildebeest and buffaloes has been rampant among the Maasai pastoralists (Stelfox *et al*, 1980). The foregoing prevailing scenarios have not satisfied the optimal utility of the Maasai people; and over time dissatisfaction has created lots of competitions and conflicts between the Maasai and the park authority.

Natural resource based conflicts involving land, water and pastures are quite prevalent in TWNP. For example, stiff competition over scarce pastures and water is claimed to be the major cause of conflicts in Kenya (Kaino, 2001). At the same time, battles unfolded pitting groups of prominent ranchers in Tsavo ecosystem against local communities angered by little benefits they derive from wildlife that they host on their land. Many from the Maasai ethnic groups are crying out that they receive little or no benefits, suffer from human and livestock losses by wildlife, continue to be marginalized by KWS and unclear land tenure policies (Opala, 2001).

Consequently, some of the greatest conflicts for food and space between livestock and wild herbivores have been observed to occur on the grasslands and shrublands. The competition has been serious especially among cattle, sheep and goats, wildebeests, buffaloes, kongoni, burchell's zebras, impalas, Grant's and Thomson's gazelles (Andere *et al*, 1981). Direct conflicts between wildlife and agro-pastoralists have manifested themselves in damage to structures (e.g. fences, watering points, and even homesteads), and human or livestock injuries or deaths (Peperkamp, 1986).

Among the major wildlife resource stakeholders, are the local communities (mainly the agro-pastoralists) who have been observed to be most marginalised. This is because it is the agro-

pastoralists' ranches and rangelands that have continued to provide resort and grazing for wildlife, inflicting lots of problems (Peperkamp, 1986). There are many factors contributing to conflict involving pastoralists, and these have tended to become mutually reinforcing. They include; socio-economic and political marginalisation, inadequate land tenure policies, weakened traditional governance in pastoral areas, vulnerability to climatic variability and competition with wildlife. Most of the wildlife uses land adjacent to or completely outside protected areas in most parts of the year (Mbugua 1994; Mwangi 1995; Norton-Griffiths 1997; Sindiga 1995, cited in Okello and Kiringe 2004).

Pastoralists are particularly vulnerable when droughts or developments limit their already restricted access to water and pasture. Moreover, conflicts involving pastoralists are increasingly widespread. The patterns of these conflicts, and the factors contributing to them, are complex. It is becoming clear that existing policies and measures relating to pastoralists adjacent to TWNP and similar protected areas in Kenya are inadequate. Efforts to prevent and reduce conflicts need to be fully integrated into government and development programmes throughout the region. There are many ways in which the park authority can assist in preventing and reducing conflicts involving pastoralists in TWNP and similar parks. They require systematic and concerted attention, and the development of appropriate and effective partnerships with government, pastoralist and other communities including the broader civil society groups.

Nevertheless, livestock depredation by the predators is the root cause of conflict between people and wildlife. As predators kills the valued livestock, the people feel that the predators are their enemy and must be either killed or moved away from the affected area (Pandey and Chetri, 2004). Most of the national parks and reserves in Kenya suffer from the incipient conflict between local people and park management (Adhikary, 1998). Among the many arguments regarding emergences of park-people conflict issues it is believed that the protected areas were established without proper understanding of people needs and their interaction with park resources (Nepal and Weber 1993, Paudel 2002, Bhatta 1994, Dudley *et al* 1999, Wells *et al* 1992) and lack of involvement of local communities at the inception of parks.

2.2. HUMAN ENCROACHMENT INTO THE PARK

Wildlife in many protected areas is under threat from human encroachment, insularisation, poaching for commercial or subsistence purposes, habitat degradation, encroachment of incompatible land uses, loss of migration and dispersal areas, and ever increasing human-wildlife conflicts. In a scenario where wildlife-induced damages to human property and life are neither controlled nor compensated, negative local attitudes towards conservation and wildlife resources become entrenched (Okello & Wishitemi, 2006). This is made worse when local communities do not benefit from wildlife resources and are alienated from wildlife-related economic enterprises such as the lucrative tourism industry.

It is obvious that controlling human encroachment and associated activities is a difficult endeavour (Osemeobo 1993). Local people are dependent upon natural resources to meet fuel wood, fodder, construction and heating needs throughout the year. Managing population increases, improved livelihoods and poverty reduction can help reduce human impacts within and around protected areas. Involving local communities in sustainable natural resource use and conservation must be encouraged. No rural-based education about the use of such resources will succeed if local community needs and opinions are not met and incorporated in conservation practice and policies (Sarkar 1999). If they do not benefit from biodiversity resources, and are not compensated for opportunity costs and wildlife-induced losses, they will not support the conservation of biodiversity. A national land use plan can also help and will put into perspective land use practices that are compatible with the socio-economic needs, natural resource endowment, and ecological and climatic constraints within different regions of the country.

2.3. WILDLIFE DISPERSAL FROM THE PARK

The lands outside the parks are crucial to wildlife since they serve as dispersal areas. These areas are threatened with increasing 'land sub-division, agricultural expansion and unplanned development of tourist accommodation, thus increasing human-wildlife conflicts' (Sindiga

1999). TWNP provide a good case to examine conflicts between wildlife conservation and local people.

Potentially, all wildlife species compete with humans for access to habitat, food and water. Human-wildlife conflicts vary according to geography, land use patterns, human behaviour, and the habitat and behaviour of wildlife species or individual animals within the species (WWF, 2008). However, some individual animals may develop habits, which select or target crops and livestock. Such individual animals can be classified as "problem animals" since they have become specialized in habitually targeting the property of people (WWF, 2005). Conflict generally occurs when people have different views or perception on an issue, when someone's interest is not considered or fulfilled while making a decision or when others interest is encroached (Shrestha, 1995). Natural resource conflicts are disagreement and disputes over access to, and control and use of, Natural resources (Paudel, 2003). Permanent farms at the periphery of any national parks will inevitably aggravate conflicts between local people and the protected area (Wegge, 1989).

2.4. LOSSES AND BENEFITS DUE TO HUMAN-WILDLIFE CONFLICTS

Both people and wildlife can suffer from human-wildlife conflict. Farmers suffer economically from the loss of crops and livestock. In other more serious cases, people are killed. However, the overall impact of people wildlife conflict tends to be low when the losses are spread over a whole community (WWF, 2005). The people who suffer most tend to be those living on the edges of settlements. On the other hand, some wild animals may decline or become locally extinct because of extensive people wildlife conflict (WWF, 2005). The success of wildlife conservation turns into a considerable costs for many (poor) farmers (Gurung, 2006). In many respects wildlife threaten the livelihoods of local's inhabitants due to growing livestock and crop losses (Mahato, 2003). Unfortunately the poorest of the poor and the most vulnerable households seem to bear the heaviest blunt of conservation measures, as their subsistence livelihoods depend highly on forest and wildlife resources and marginal farmers are more prone to wildlife raids (Gurung 2006).

When local communities feel that both the government and conservation stakeholders value wildlife more than their lives, livelihoods or their aspirations, retaliation and opposition to conservation initiatives can be inherent. One solution to this is to empower communities to manage and benefit from wildlife resources found in communal group ranch and dispersal areas.

2.5. REDUCTION IN NATURAL WILDLIFE HABITATS

The resulting transformation of forests, savannah and other ecosystems into agrarian areas or urban agglomerates as a consequence of the increasing demand for land, food production, energy and raw materials, has led to a dramatic decrease in wildlife habitat. Under these conditions, conflict between wildlife and local communities inevitably increased (Siex *et al.*, 1999; Muruthi, 2005; Tjaronda, 2007).

As human populations expand and natural habitats shrink, people and wild animals are increasingly coming into conflict over living space and food (Brashares *et al.*, 2001). Human-wildlife conflicts is occurring more and more and affecting many different species. From baboons in attacking young cattle, to the greater elephants destroying crops, the problem is universal, affects rich and poor and is bad news for all concerned. The solutions are often specific to the species or area concerned, and are often creative and simple (Hoare, 1995). An important aspect of the work is that it benefits both the animals and local human communities, and actively involves these communities (Bell, 1984). The premise therefore is finding solutions that lead to mutually beneficial co-existence.

2.6. THE NATURE, EXTENT AND CHALLENGES OF HUMAN-WILDLIFE CONFLICTS

Economic losses and fear of wildlife caused through destruction of property and crops are the primary sources of conflict (Okong'o, 1998). Crop destruction, human injury, deaths due to wild animals, livestock predation, time spent on guarding croplands, children missing school

to guard farms, sleepless nights spent to guard farms and medical expenses incurred following hospitalization and treatment cause unbearable financial suffering to local communities. More than 200 people were killed in Kenya over the last seven years by elephants alone (WWF, 2007a). Crop damage is the most prevalent form of human-wildlife conflict. The occurrence and frequency of crop raiding is dependent upon a multitude of conditions such as the availability, variability and type of food sources in the natural ecosystem, the level of human activity on a farm and the type and maturation time of crops as compared to natural food sources.

A wide variety of vertebrate pests come into conflict with farming activities including birds, rodents, primates, antelopes, buffalos, hippopotamus, bush pigs, and elephants. While it is widely recognized that in most cases elephants do not inflict the greatest damage to subsistence agriculture, they are regularly identified as the biggest threat to African farmers (Parker *et al.,* 2007). Elephants are able to destroy a field in a single night raid. In addition, in the case of elephant damage, most peasant farmers are unable to deal with the problem themselves and there is rarely any compensation from the government.

Human-wildlife conflicts still remain a big challenge to Kenya's wildlife and conservation (KWS, 1994). Kenya wildlife service, as the custodian of wildlife resources in Kenya, has encouraged conservation of wildlife by assisting local people adjacent to protected areas obtain tangible benefits in return for their tolerance to wild animals. The organization's efforts are aimed at minimising conflicts between animal and people interactions through appropriate land use planning, constructing animal barriers such as fences and offering incentives. Despite these efforts, the problem still prevails in most areas close to protected reserves. In the recent years, biodiversity has become an issue of increasing concern at the local, national and international levels. Legal framework to promote conservation, sustainable use of its components and fair and equitable sharing of benefits arising from the genetic resources is also lacking (Owen, 1991). Most of the human-wildlife conflicts facing protected areas today arise from the relation between these areas and the neglected adjacent local communities. Hence, there is need to address socio-economic aspects of the neighboring

communities through either partnerships or collaborative management. Mackinnon, (1986) argues that there is need to coordinate park management with land use planning and human activities on lands adjacent to protected areas.

2.7. TYPES OF BARRIERS USED FOR CONTROL OF CONFLICTS AND ILLEGAL ACTIVITIES

Fencing is used in the management of African wildlife principally with the aim of controlling large mammal species (Harrison, 1993). Fencing helps to demarcate boundaries to contain animals in order to avoid conflict with people, exclude domestic livestock or restrict illegal activities. KWS has used a variety of wildlife barriers, such as electric fences, molts and walls, to mitigate HWCs around many protected areas in the country. KWS also promotes and supports the planting of live fences (e.g. using Mauritius thorn) around individual land parcels in particularly HWC-prone areas.

Electric fences used to prohibit wildlife are often considered to be the most preferred solution (Thouless & Sakwa, 1995). There are several benefits of these fences. For example, they can stop large animals including elephants, buffalo, zebra, and wildebeest from raiding and damaging crops. Physical barriers are seen by many people as potentially a permanent solution to an elephant problem (Taylor, 1999). Several types of barriers have been tried against elephants, with most commonly used being electrified wire fences. However, fence maintenance and proximity of fences to areas of high elephant concentration appear to be significant determinants of long term performance of electric fences in mitigating elephant crop-raiding (Kioko *et al.*, 2007). In practice, long-term success with anti-elephant fences has often fallen well below expectation. These might be a management or 'institutional' problem, not a technological one. The conventional model of an elephant and rhino fence project is being questioned by trying smaller projects with simpler fence designs (Thouless, 1994).

There are, however, disadvantages of electric fences. These fences have high installation and maintenance costs, are ineffective for keeping out small animals that can go under the wires or dig under the fence, and they may cause negative ecological impacts such as habitat

fragmentation or blocking traditional wildlife migratory routes (Thouless & Sakwa, 1995). A combination of deterrents for crop raiding, as well as compensation for wildlife damages may help to solve some human–wildlife conflicts in Kenya, but these actions are costly.

There is often also a temptation to put up electric fences anywhere where human-wildlife conflict is deemed to be severe. But fences are not appropriate for all situations (Thouless, 1995). There should be sufficient and reliable prior information on the damage caused by both human and wildlife to justify both the considerable expense of constructing a fence and the commitment to continual maintenance that any fence requires. Newmark *et al.,* (1994) suggested that landowners should be encouraged to practice land uses that do not promote wildlife destruction. Carefully planning the layout and design of fences, for example, is especially important for non-target species (Taylor, 1999). The local ecology and movement pattern of animals must be reasonably well known since disregarding established movement routes may put a fence under such severe challenge that the maintenance demand cannot be met as is the case with for elephants.

Many expensive fencing projects have failed completely against elephants by disregarding the simple observation that elephants encountering a fence will often merely walk along it until they reach the end. This of course exacerbates problems for people who live near the end. As problem elephants appear not to be 'deflected' from their target, the only option is to identify that target and keep them out. Thus encircling fence around a valuable resource (example an irrigated field, a water point or a food storage facility) has the best chance of success both in terms of reduced elephant damage and overall cost effectiveness.

Electric fencing technology is simple and definitely deters wild animals, if it is kept continuously under good management. Fences need electrification in most savanna elephant ranges or where crop raiders are determined and persistent. The expectation is that a fence will reduce human wildlife problems. This is never true in practice. Some elephants that are 'habitual fence breakers' do exist and these may need to be removed or eliminated if they can be individually identified.

2.8. WILDLIFE CONSERVATION IN KENYA

Establishment of national parks dates back to colonial period (Marekia, 1994). Since the 1940s, conservation of Kenya's natural resources has been largely based on the IUCN category II park model (McKinnon *et al.,* 1986). This model necessitates; identifying an area based on resource endowment or physical features, displacing local people, outlawing human settlement, and designating the resource as protected. Displacing local people and preventing them from using protected resources can lead to local resentment for conservation of resources such as wildlife. In Kenya, there are approximately 50 of these protected areas that cover about 8% of the land (Mwangi, 1995; Nyeki, 1993). Each protected area faces challenges (Mwale, 2000; Okello & Kiringe, 2004), partly because of this model approach and the exclusion of local community interests (IUCN, 1990; Mwale, 2000). Involving local communities and their traditions fulfils the important requirement of a protected area being managed through other effective means and not necessarily through legal means (Beresford & Phillips, 2000; McKinnon et al., 1986).

Most of the protected areas were taken from indigenous inhabitants by force or through treaties (Marekia 1994). It dates back to 1898, when the first regulations were enacted. In the process local people were deprived their livelihood. Wildlife conservation and use of natural resources have however been limited. At first wildlife conservation benefited the colonial settlers than the original inhabitants. By the turn of the century, Kenya was reaping enormous benefits from wildlife than rural communities who bear high costs of wildlife destruction (Lusigi, 1981). For instance, the gazettement of Tsavo west national park in 1948 was made without adequate consultation with the surrounding communities and without or no adequate compensation for displaced households that forthwith lost their important source of livelihood.

2.9. COMPETING LAND USE SYSTEMS, INCLUDING PASTORALISM AND INTENSIFIED CROP LAND ENTERPRISES

Although wildlife in Kenya is state owned, most of the animals are found on private land outside protected areas. Where livestock and human numbers are high, then human wildlife conflicts and environmental degradation becomes a concern. Protected areas, when surrounded by agricultural activities and urban centers, become more threatened as human wildlife conflicts intensify and wildlife dispersal areas and habitats become lost, converted or degraded (KWS, 1994; Okello & Kiringe, 2004,). In addition, problem wild animals get out of the park due to seasonal variation of resources available and the limited forage in the parks. This undermines other forms of land use and poses threat to human life and disrupts the normal life of communities.

Agricultural developments around protected areas through clearing of forests and other forms of vegetation to create room for crops have greatly affected wildlife conservation and this has reduced wildlife dispersal areas (Nyabwari, 2002). Similarly, increased human settlements and business premises resulting from high population growth due to immigration have led to the blocking of wildlife corridors, thus heightening human-wildlife conflicts.

Excess livestock in an increasingly impoverished region has resulted in some illegal grazing in surrounding national parks, especially during the dry season (Ngethe *et al.,* 1994). Conflicts with park authorities have stimulated persistent, unresolved, and ever increasing human-wildlife conflicts. Lack of conflict resolution has created negative opinions for conservation of wildlife resources and endangered wildlife that range outside protected areas. It can be argued that local people should not be expected to allow wildlife on their land where the animals might compete with livestock and endanger locals. However, this may affect the viability of protected areas, as wildlife migration and dispersal patterns may be disrupted (Mackinnon *et al.,* 1986). In Kenya, human–wildlife conflicts challenge conservation, especially in the TWNP and surrounding areas where wildlife range outside parks and confront local communities.

2.10. PARTICIPATORY PLANNING AND COMMUNITY INVOLVEMENT IN CONSERVATION

There is increasing evidence that protected areas have often caused further impoverishment of already economically marginal communities, through loss of access to livelihood resources, physical displacement, and other impacts (Chatty & Colchester (eds), 2002; Colchester 2004; Lockwood et al 2006; West *et al.,* 2006). Increasingly, though, it has been realized that this is not only violative of the basic human rights and often backfires on conservation itself. Retaliatory action by disempowered communities, conflicts with Protected Area (PA) managers, inability to use the knowledge and practices of local people, and many other factors have contributed to this. Reversing these trends requires a significant shift in protected areas management paradigms. Though a number of countries had already begun to experiment with such new paradigms, the biggest international push towards them was given by the IUCN World Parks Congress, Durban, in 2003, (SCBD, 2008).

Local opinions can influence conservation efforts (Feycrabend, 2002). Monitoring local people's concerns related to conservation and wildlife resources can provide a foundation for effective decision making that mitigates wildlife impacts. The local people's opinions on wildlife and conservation are influenced by benefit systems, wildlife damage to property, danger to human life, and changes in land use patterns. For the local people in this area, lack of compensation for wildlife damages is likely to modify their opinions of wildlife and conservation. So there is need to examine the factors that influence local people's opinions and support for wildlife resources and conservation.

It is possible that cultivators overreact to modest crop damage by wildlife, especially crops that are deemed to be of high economic value (e.g., the effects of monkeys on coconuts) (Hill, 1998; Siex & Struhsaker, 1999). Poor and impoverished people are often subjected to more suffering when their only annual crop production is destroyed by wildlife and governments such as Kenya have no compensation programs in response to these damages (Sindiga, 1995).

2.11. CONCEPTUAL FRAMEWORK

The conceptual framework applied in this study as depicted in Figure 1, shows livestock incursion and human encroachment into the park cause conflicts in the park while wildlife dispersal from the park cause conflicts into the ranches/farms/areas. Livestock incursion, human encroachment and wildlife dispersal are independent variable while conflicts in the park and in the ranches/farms/areas are the dependent variables.

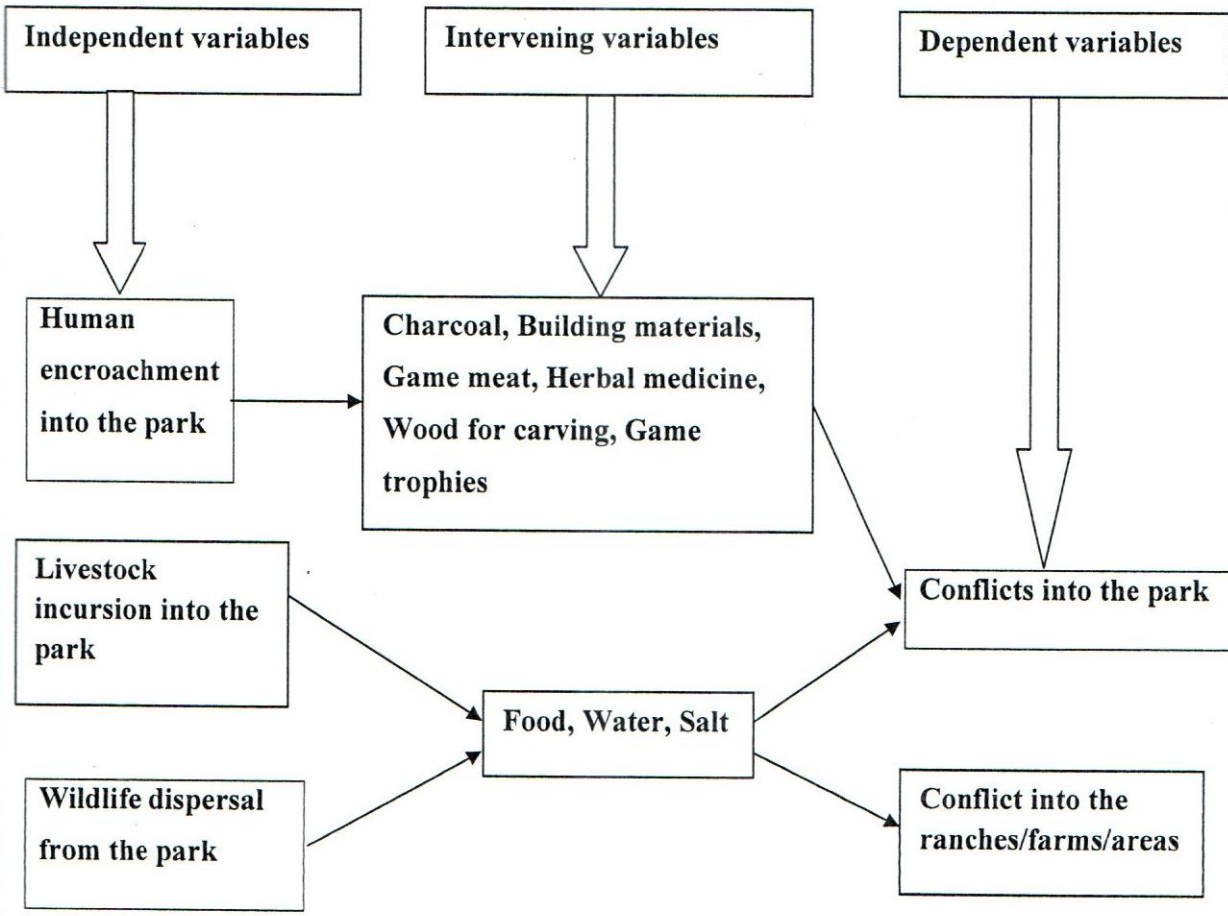


Figure 1: Conceptual framework

This study is based on this conceptual framework, and so are the study objectives and hypotheses.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. DESCRIPTION OF THE STUDY AREA

3.1.1. Park establishment

Tsavo National Park was established on 1st April, 1948 and constituted by Tsavo West (7,800 sq km/3,000 sq mi) and Tsavo East (13,000 sq km/5,000 sq mi). It is the largest Park in Kenya. In May 1948, Tsavo National Park was divided into East and West for administrative purposes. The boundary between the two parks is the Nairobi – Mombasa railway /road. Nationwide, Tsavo comprises 52% of total protected area in the country, which translates to about 3.9 % total land cover. The area under study covers Tsavo west national park and its neighbouring ranches and farms comprising of Kibwezi, Loitokitok, Taveta and Taita Districts. (See figure 2)

3.1.2. Landforms and Geology

A few groups of hills stand out from this plain, notably Taita, Kasigau, Kangechwa, Salaita and Ngulia. Tsavo West National Park is underlain by Basement System rocks, which give way in the southern half to the east to Permo-Triassic rocks, consisting of fine to coarse-grained sandstones, siltstones and shale's. It also covers parts of the Permo-Triassic rocks in the east.

Although not rich in minerals or precious metals there are a number of commercially exploitable deposits of garnets and similar gemstones. The most famous of these is the gossular garnet known as Tsavorite. The main known deposit of these occurs just inside the boundary of park at Kasigau. These are mined commercially mainly by large mining companies. There are also a number of areas where small scale miners are extracting minerals. Known mining locations are near Bura, Kasigau and the Kishushe. The local

communities illegally encroach into the park to mine these minerals thus interfere with wildlife habitat resulting to conflicts.

3.1.3. Soils and Vegetation

The soils of the Tsavo area show a wide range in depth, colour, drainage, condition, structure, and chemical and physical properties. Extreme differences in texture, however, are uncommon. Most soils have a sandy-clay texture in the subsoil. The distribution and properties of the soils were closely related to the geology and geomorphology of the area.

The vegetation of the area is strongly related to soils and climate. Approximately 90 percent of the vegetation of the Tsavo west area belongs to plant communities which are often dominated by Commiphora spp, Combretum spp and Acacia spp. The available vegetation in the park attract local community adjacent to the park in search of vital commodities e.g. building materials, pasture, medicinal plants, charcoal, honey etc therefore causing conflicts in the protected area.

3.1.4. Drainage

The area is dry and water distribution and dry season availability has a profound effect on the wildlife, livestock and people living in the area. Currently, Tsavo River is the main permanent river within the area. Owing to the relief and the low rainfall in the area, probably coupled with climate changes and land degradation in their catchments, many of the rivers often dries up immediately after rains. These cause human-wildlife conflict whereby wild animals stray into people's farms and the same time livestock and the local resident illegally enter the national park in search of water.

Springs are vitally important to the people well-being in the area but only to the far hills of Taita and a few seasonal ones in Mbulia. Many of the more permanent ones have been known

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for centuries Mzima springs which supplies water to Mombasa city has its source in the park. The Mzima pipeline passes through the study area but none of the residents benefit from it. The local communities' a times puncture the pipeline in order to access water for their livestock and domestic use.

3.1.5. Climate

The Tsavo ecosystem climate is characterised by alternating dry and rainy seasons: along dry season from June to October, short rains in November/December, a short dry season from January to March and long rains in April/May. However, this pattern is quite variable and often modified by out-of-season rains or dry spells. Rainfall in TWNP is generally high (500-800 mm p.a.) and usually less erratic in spatial and temporal distribution than in TENP (300-600 mm p.a.). Wild animals in TWNP usually move in and out of neighbouring farms and ranches in response to spatial and temporal occurrences in the distribution of fodder and water leading to conflicts in the neighbouring farms and ranches. Human-wildlife conflicts are normally high in the dry period.

3.1.6. People and land use

In the pre-colonial times the area was communally owned by the Taita, Taveta, Maasai and Kamba communities and was used solely for grazing livestock. The gazattement of TWNP was done without proper consultation of the neighbouring communities resulting to their resentment to the park. From late 1960's people began to settle practising agriculture leading to subdivisions of the land and allocations for settlement. These practises are not compatible to wildlife management therefore intensifying human-wildlife conflicts.

The ranches and wildlife sanctuaries bordering TWNP are Lumo, Taita Hills, Kasigau, Lualenyi and Kishushe-Mbulia in Taita Taveta District and Rombo and Kuku ranches in Kajiando District. Human settlement in the ranches is increasing and settlement is relatively

dense in Kishushe and Mbulia ranches. Unfortunately Somali grazers use much of the land, often with dubious legal hold documents where they extensively graze their cattle. These have also increased resource use conflict in the park and adjacent areas.

Subsistence farming and livestock keeping are the main pre occupation of the communities living in and around the ranches. The livestock keepers mainly encroach into the park especially during the dry period in search of water and fodder for their livestock causing conflicts in the park. Horticultural farming is undertaken in areas endowed with water. Wild animals especially in dry period disperse into farming areas in search of water and fodder causing conflicts in the local community areas. Eco tourism provides employment to some locals where lodges and tented camps occur. The locals comprise the bulk of unskilled labour and game scouts who play a crucial role in conservation. Small scale mining practised especially in Bura, Kasigau and the Kishushe areas also employs a considerable number of local inhabitants.

3.2. Study area map

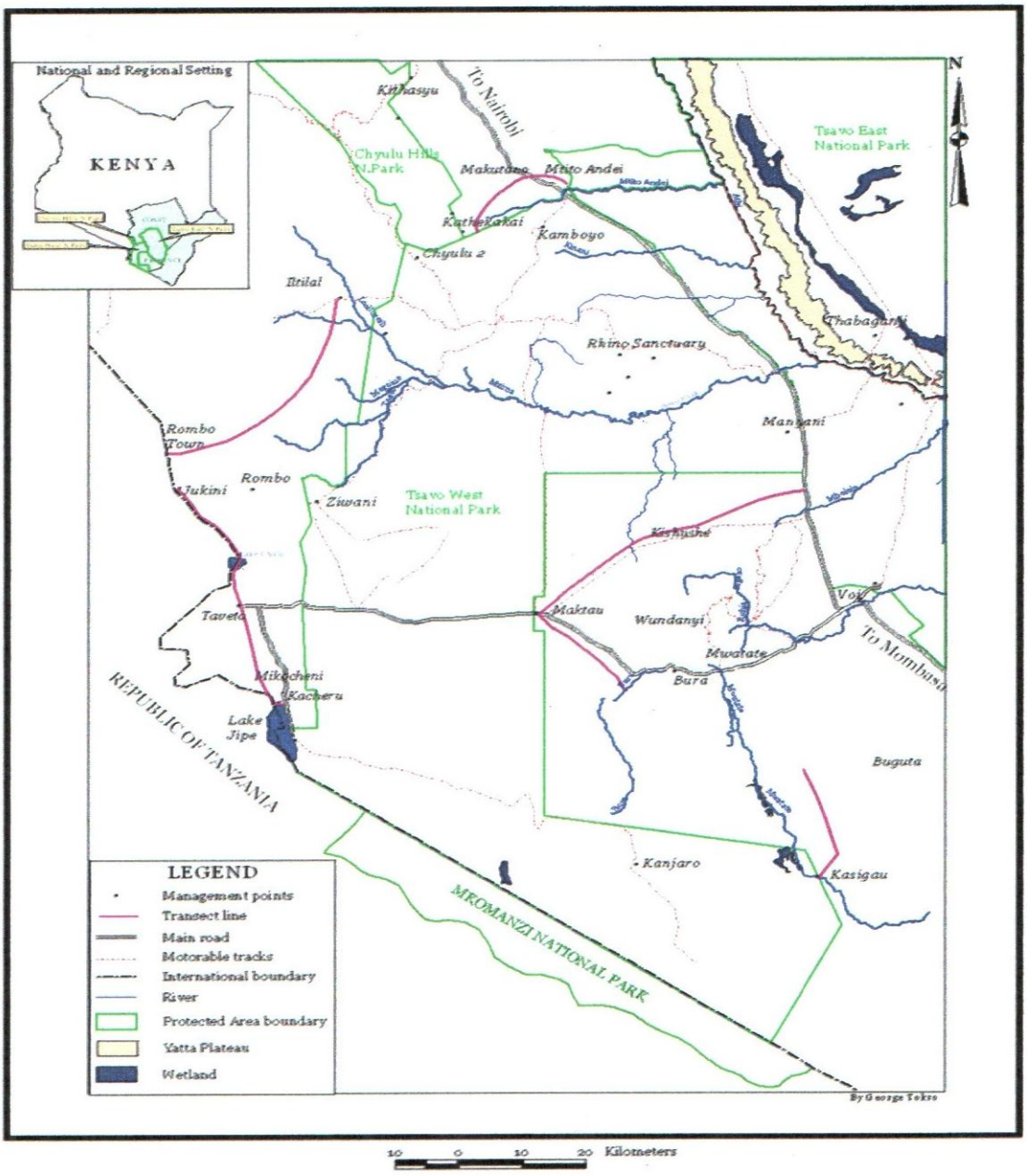


Figure 2: Map of the study area

Source: Kenya wildlife service, GIS department (2009)

3.3. RESEARCH DESIGN (METHODOLOGY)

The study utilised a socio-ecological survey using a structured questionnaire, and supported by Key Informants' interviews and observation (ocular) methods. The research also made use of secondary data from University libraries, KWS library at the headquarters and in the park, public offices and other relevant sources.

3.3.1. Population

The study population was the total number of households in the administrative units adjacent to the TWNP, namely, Wundanyi, Mwatate, Voi, Taveta districts, and Tausa division in Taita district, Mtito Andei division in Kibwezi district, and Rombo and Kuku group ranches in Loitokitok district. According to the 1999 population and housing census, the population in the study area was approximately 401,104 people (GoK, 1999) amounting to 57,300 households. Numerous key informants amongst both local communities, KWS personnel and other stakeholders also constitute the study population.

3.3.2. Sampling procedure and sample size

The local communities in the administrative units adjacent to TWNP constituted the sampling frame. The unit of analysis was the household and the subject of analysis (the respondent) was the head of the household or his /her representative.

The population under study was stratified into four areas adjacent to TWNP based on the local communities' socioeconomics. The areas were Mtito Andei (Kibwezi), Rombo/Kuku (Loitokitok), Taveta and Taita. A socio-ecological survey was conducted using a structured questionnaire and 55 households were randomly sampled in each stratum making a sample of 220 households for the study. The sample size was taken in consideration of the available resources and decided upon in conformity with the Statistical Package for the Social

Scientists (SPSS) regulation that a sample of 200 or more comply appropriately with all statistical analyses provided by SPSS.

The researcher took transects through each stratum (area), considering human-wildlife conflict hotspots in the adjacent communities to the park. The first sampling unit (household) was randomly selected. Thereafter sampling units (households) on the transect were selected on either side of the transect at an interval of about 200 meters between households.

3.3.3. Key Informant interview

A Key Informant technique was undertaken using a structured set of questions administered to TWNP senior staff and rangers, wildlife conservancy, ranch and farm managers' adjacent to TWNP, Provincial Administration, and other stakeholders, totaling to 43 informants. The list of the key informants is appended in Appendix I.

3.3.4. Data collection procedure

An exploratory visit to the study sites was initially made for the purpose of familiarisation and determining the parameters of the research, and later on for pre-testing of the questionnaire. A standard questionnaire in Appendix II was used to collect primary data from the respondents. It was administered in the form of an interview schedule since some of the respondents were illiterate. Research assistants were appointed on merit and trained to assist the researcher in the study, including interpretation. Collection of the primary data was undertaken after involving and seeking support from Government's administrative officials, relevant Government Ministries including, Ministry of Agriculture, Ministry of livestock, Ministry of education, the local authorities and communities. Preceding all these was the procurement of the research permit from the National Council of Science and Technology and logistics arrangements.

3.3.5. Data analyses

The data from both primary and secondary sources was processed and analysed using the Statistical Package for the Social Sciences (SPSS) version 11.5. The filled questionnaires were first edited, for the purpose of checking completeness, clarity, consistency in answering the questions and avoiding outliers. Coding of the open-ended questions and construction of a codebook for entry in the Statistical Package for the Social Sciences computer software then followed. Both descriptive and analytical procedures were used in data analysis.

3.3.5.1. Descriptive analysis

For the survey, descriptive analysis was used to generate frequency distributions and associated statistics on the respondents' personal particulars and their assets (including number and types of livestock owned, land tenure and sizes of the ranches and farms, types of ranching/farming operation, distance from the Park's boundary, etc). The data was used to describe the respondents' socioeconomic statuses which was assessed for their potentiality and likelihood of causing conflicts and examined effectiveness of the mechanisms put in place to curb the conflicts.

The data variables in the study objectives and hypotheses were described and analysed, including: the causes and frequency of livestock incursion into the TWNP and in adjacent ranches and farms; the causes and frequency of human encroachment into the TWNP and in adjacent areas as it affects resource degradation; the wild animals dispersal patterns from TWNP to the adjacent areas; the losses incurred and benefits received by local communities due to human-wildlife interactions; the respondents' own impression and resolutions on HWCs conflicts and recommendations for appropriate practical remedial measures to curb the conflicts.

3.3.5.2. Analytical procedures

Analytical procedures were used to test the relationships/associations suggested in the four study hypotheses, using cross-tabulation and correlation analyses, applying Pearson's chi-square, Sommer's d, Gamma and Pearson' correlation statistics.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Results and discussions presented in the chapter include, first, the respondents' characteristics and land use systems that have some influence on human-wildlife interaction and conflicts in the study area. These include the respondents' geographic distribution by districts and locations, the household sizes, their sexes, ages, occupations, educational levels, livelihoods and production systems, land tenure and sizes, and land use systems and crops grown.

Each of the five specific objectives of the study is addressed and accomplished through discussion of respective selected indicators. Thus, objective one examines the causes and frequency of livestock incursion into the TWNP and in adjacent ranches and farms; Objective two examines the causes and frequency of human encroachment into the TWNP and in adjacent areas as it affects resource degradation; Objective three establishes the wild animals dispersal patterns from TWNP to the adjacent areas; Objective four assesses losses incurred and benefits received by local communities due to human-wildlife interactions; and Objective five identifies respondents' own impression and resolutions on HWCs and recommends appropriate practical remedial measures to curb the conflicts.

Finally, results of each of the four study hypotheses are discussed and concluded. These relate to relationships and influences between livestock incursions and conflicts in TWNP and in adjacent ranches and farms; Human encroachment inside the park and adjacent areas and resource degradation; Wildlife dispersal from TWNP, into adjacent areas, and resource availability and interference with the communities' social life; and Human-wildlife interactions in the TWNP and resultant losses and benefits to the local communities that will influence their support for conservation.

4.1. RESPONDENTS' CHARACTERISTICS AND LAND USE SYSTEMS

4.1.1. Respondents distribution by district and location

The study covered four districts namely Taita, Taveta, Loitokitok, and Kibwezi within TWNP, with 55 randomly selected respondents taken from each of the four districts, totalling to a study sample of 220 respondents. This provided a good representation of the communities affected by human-wildlife conflict in the TWNP.

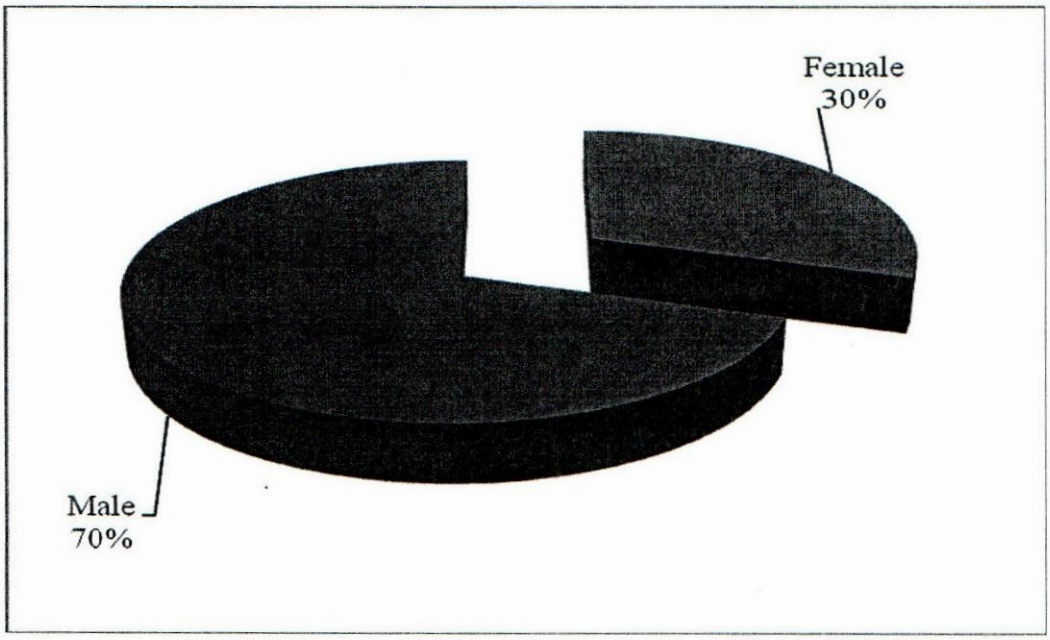
As indicated in Table 4.1.1, the 220 respondents are spread in 15 locations of the four districts.

Table: 4.1.1. Respondents' distribution in the study area

Location	District				Total
	Taita	Taveta	Loitokitok	Kibwezi	
Chala	0	16	0	0	16
Mata	0	11	0	0	11
Timbila	0	7	0	0	7
Kimila	0	1	0	0	1
Njukini	0	17	0	0	17
Rombo	0	0	55	0	55
Mwakitau	17	0	0	0	17
Bura	23	1	0	0	24
Kishushe	10	0	0	0	10
Mtito-Andei	0	0	0	17	17
Nthongoni	0	0	0	16	16
Kathekani	0	0	0	16	16
Mahandakini	0	2	0	0	2
Kishamba	5	0	0	0	5
Thange	0	0	0	6	6
Total (n)	55	55	55	55	220

4.1.2. Respondents' Gender

As indicated in Figure 3 below, 30% of the households are female headed, while the male headed households are 70%. The percentages compare well with the figures found by Kenya Integrated Household Budget Survey 2005/06 (KNBS, 2008) for the study area. Being the majority, the male respondents are more involved in exploitation of natural resources for their families' survival and are thus heavily dependent and rely on the park for grazing, game poaching, building materials etc. This exhibits why human-wildlife conflicts in the study area are numerous and probably inevitable.



n=220

Figure 3: Respondents' Gender

4.1.3. Age of the respondents

An analysis of the age frequency distribution indicates that the mean age of the respondents is 48 years, the median 47 years, the mode 56 years, the minimum 20 years, the maximum 82 years, and therefore a range of 62 years. These statistics suggest an active and a demanding population, with a growing demand for natural resources for household subsistence and survival, from both their own areas and from the TWNP.

Table 4.1.2 lists the age categories, as derived from the frequency distribution, which indicates that 79.2% of the respondents are within the active and productive age category with high demands for natural resources for livelihood and survival. The TWNP is therefore a potential source of the resources.

With the majority of the household members being active and relying on the park for their livelihoods, conflicts are likely to be prompted in the park.

Table: 4.1.2. Respondents' age categories

Age categories	Frequency	Percent
20-30 years	23	10.5
31-40 years	56	25.5
41-50 years	50	22.7
51-60 years	45	20.5
61-70 years	35	15.9
above 71 years	11	5.0
Total	220	100.0

Mean 48.0, Median 47.0, Mode 56.0, Standard Deviation 14.32, Minimum 20, Maximum 82 and Range 62.

4.1.4. Respondents' main occupations

Seven different types of occupations were reported by the household heads. These included farming/ranching, business, religious leadership, teaching, politics, civil service and NGO work. Majority (91%) of the respondents, as indicated in Table 4.1.3 reported their main occupation as either farming or ranching, while 3% of the respondents were engaged in business activities. As revealed by the study, farmers/ranchers are the majority and it is this group which is linked to human-wildlife conflict especially in the farms whereby wild animals destroy crops and farm structures resulting to conflicts. The trend also is for the ranchers/farmers livestock venturing into the TWNP.

Table: 4.1.3. Respondents' occupations

Main occupation	Frequency	Percent
Farmer/Rancher	201	91
Business	7	3
Religious leader	5	2
Teacher	3	1
Politician	2	1
Civil servant	1	1
NGO worker	1	1
Total	220	100

4.1.5. Respondents' levels of formal education

As shown in Table 4.1.4, twenty percent (21%) of the respondents had not attended any institution for formal education, while the majority (57%) had attained the primary level of formal education, 20 % had reached secondary level and 4% had reached college level.

Loitokitok district had the highest percentage of people who had not gone to school for formal education, followed by Taveta district. These figures compare well with the ones provided by the Kenya Integrated Household Budget Survey 2005/06 (KNBS, 2008) for the study area.

Poor or lack of education is linked with lack of exposure and rigidity to change. Therefore, for Loitokitok residents who are pastoralist and who heavily depend on the park for pasture for their livestock, might be very difficult to enlighten them to diversify to other more profitable livelihoods in other sectors of the economy which are not directly linked to natural resources.

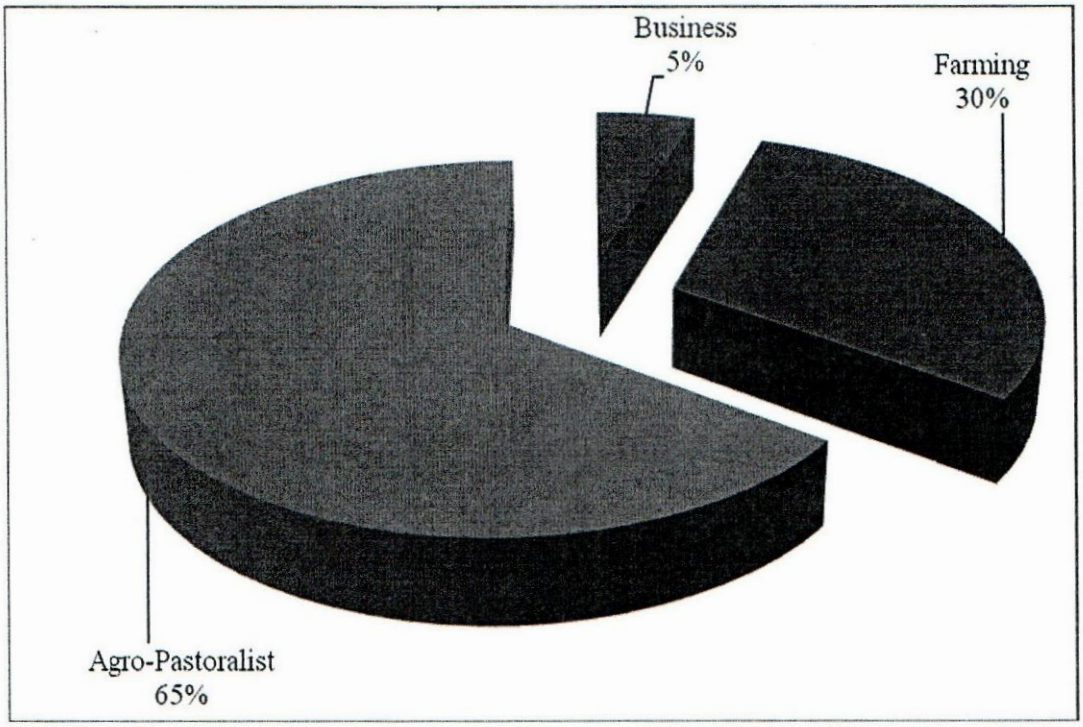
Importantly, poor or lack of education will usually lead to lack of conservation awareness which is necessary for the TWNP wellbeing.

Table: 4.1.4. Highest formal educational level attained by the respondents.

Education level		District				
		Kibwezi	Taita	Taveta	Loitokitok	Total
Never went to school	Count	4	1	10	30	45
	% of Total	2%	0.0%	5%	13%	20%
Primary	Count	35	41	32	15	123
	% of Total	16%	19%	15%	7%	57%
Secondary	Count	15	10	11	6	42
	% of Total	7%	5%	5%	3%	20%
College	Count	1	3	1	4	9
	% of Total	0.0%	0.0%	0.0%	2%	2%
University	Count	0	0	1	0	1
	% of Total	0.0%	0.0%	0.0%	0.0%	0.0%
Total (n)	Count	55	55	55	55	220
	% of Total	25%	25%	25%	25%	100%

4.1.6. Household production and livelihood system

Closely linked to the respondents' occupations discussed earlier, majority of the households (65%) undertake production and livelihood system based on agro-pastoralism, while 30% on farming and 5% on business (Figure 4). Thus, majority of the peoples' livelihood are related to the natural resources available in the study area, and only 5% of the population is engaged in livelihoods not related to the land and natural resources. Human-wildlife conflicts are therefore imminent in such situations.



n=220

Figure 4: Household production and livelihood system

4.1.7. Household sizes

The average number of people living in the different households within the study area was found to be 9, the minimum was 1 and the maximum was 16 people and over (Table: 4.1.5). The majority (75%) of the households carry and provide for between 4 and 12 persons, which is indicative of large sized households, and a corresponding high level needs and demands for natural resources that are found in both the family farms/ranches and in the TWNP. The large numbers of people in the households imply greater needs for natural resources, and so the likely impacts on natural resources and associated conflicts.

Table: 4.1.5. Household size categories

Number	Frequency	Percent
1-3 persons	20	9.1
4-6 persons	90	40.9
7-9 persons	52	23.6
10-12 persons	23	10.5
13-15 persons	11	5.0
16 and above persons	24	10.9
Total (n)	220	100.0

Mean 9.0, Median 7.0, Mode 5.0, Standard Deviation 6.71, Minimum 1, Maximum >16

4.1.8. Land tenure systems

As indicated in Table 4.1.6, six land tenure categories have been reported by the respondents. The most common type of land tenure in the study area was land ownership without title deeds (52.7%), followed by communal land ownership (24.1%). These are followed by land ownership with title deeds (12.3%). The rest of the households either had borrowed the land (2.3%), leased the land (2.7%) or are squatters on the land they lived in (5.9%). The problem of squatters is more prevalent in Taveta district (5%) while communal ownership of land was prevalent in Loitokitok district (18.6%). This can be explained by the fact that majority of people residing in Loitokitok are pastoralists (the Maasai) who own land communally, while Taveta is an agricultural area where people mostly depend on irrigation farming. Land tenure relates to land use system which influence exploitation of natural resources and ensuing conflicts.

Land tenure can be associated with the people's degree of concern over the wellbeing of the land and therefore the amount of investment put in for resources conservation. With 87.7% of the households having no title deeds for their lands, the concern and investment in conservation will be minimal, which in turn will influence land degradation, shortage of resources and so conflicts as the need to exploit the TWNP increases.

Table: 4.1.6. Types of land ownership by districts

Land tenure		District				Total
		Taita	Taveta	Loitokitok	Kibwezi	
Squatters	Count	1	11	1	0	13
	% of Total	0.5%	5.0%	0.5%	0.0%	5.9%
Borrowed	Count	4	0	0	1	5
	% of Total	1.8%	0.0%	0.0%	0.5%	2.3%
Leased	Count	1	0	5	0	6
	% of Total	0.5%	0.0%	2.3%	0.0%	2.7%
Communal	Count	1	11	41	0	53
	% of Total	0.5%	5.0%	18.6%	0.0%	24.1%
Owned without	Count	38	33	3	42	116
title	% of Total	17.3%	15.0%	1.4%	19.1%	52.7%
Owned with title	Count	10	0	5	12	27
	% of Total	4.5%	0.0%	2.3%	5.5%	12.3%
Total (n)	Count	55	55	55	55	220
	% of Total	25.0%	25.0%	25.0%	25.0%	100.0%

4.1.9. Land sizes owned by the households

The land sizes owned by the households in the districts studied are given in Table 4.1.7. The average land size owned was 26 acres, the land owned range from 0 to 321 acres, the mode was 38, the median 11 and the standard deviation was 48 acres, indicating a large variation in the land sizes. Majority of the households (51.8%) owned land of less than 12 acres. Households that owned land ranging between 1 and 4 acres were 17.3%, land between 4 and 8 acres the households were 20.9%, land between 8 and 12 acres the households were 11.8%.

The households with the largest land sizes were mainly found in Loitokitok district and the households with the smallest land sizes were found in Kibwezi and Taita districts. This is because majority of Loitoktok residents are pastoralists and stays in ranches (not subdivided)

while Kibwezi and Taita residents are mostly agriculturalists and have subdivided their parcels of land.

Livestock keeping is more compatible to wildlife conservation thus leading to less wildlife conflicts in pastoral communities while in agricultural areas where land is privately owned and subdivided into small portions is not compatible to wildlife conservation therefore resulting to higher human-wildlife conflicts.

4.1.10. Types of Land use by the communities

Five different types of land use were identified in the communities as indicated in Table 4.1.8, and included land for dwelling, crop farming, grazing, agroforestry and beekeeping. The common land use in the study area was found to be for dwelling (83.7%), followed by crop farming (77.7%), grazing (47.7%), agroforestry (14.5%), and finally beekeeping (10%).

Crop farming was common in the three districts Taita, Taveta and Kibwezi and less common in Loitokitok, while grazing was more common in Kibwezi and Loitokitok than the other two districts. This is because Taita, Taveta and Kibwezi residents commonly depend on crop farming for their livelihoods while Loitoktok residents are herders. Mostly, herders depend on the park for grazing causing conflicts in the park while agriculturalists are the most aggrieved through wildlife invasion into their farms.

Table: 4.1.7. Land sizes owned by the households

Land size categories acres		District				
		Taita	Taveta	Loitokitok	Kibwezi	Total
0	Count	0	0	3	0	3
	% of Total	0.0%	0.0%	1.4%	0.0%	1.4%
0.5	Count	1	0	0	0	1
	% of Total	0.5%	0.0%	0.0%	0.0%	0.5%
1 -3.99	Count	17	9	2	10	38
	% of Total	7.7%	4.1%	0.9%	4.5%	17.3%
4-7.99	Count	15	15	1	15	46
	% of Total	6.8%	6.8%	0.5%	6.8%	20.9%
8-11.99	Count	15	7	1	3	26
	% of Total	6.8%	3.2%	0.5%	1.4%	11.8%
12-15.99	Count	6	9	0	4	19
	% of Total	2.7%	4.1%	0.0%	1.8%	8.6%
16-19.99	Count	0	6	0	3	9
	% of Total	0.0%	2.7%	0.0%	1.4%	4.1%
20-40	Count	1	7	23	13	44
	% of Total	0.5%	3.2%	10.5%	5.9%	20.0%
41-60	Count	0	1	16	4	21
	% of Total	0.0%	0.5%	7.3%	1.8%	9.5%
61-100	Count	0	1	4	1	6
	% of Total	0.0%	0.5%	1.8%	0.5%	2.7%
101-400	Count	0	0	5	2	7
	% of Total	0.0%	0.0%	2.3%	0.9%	3.2%
Total (n)	Count	55	55	55	55	220
	% of Total	25.0%	25.0%	25.0%	25.0%	100.0%

Mean 26.1, Median 11.0, Mode 38.0, Standard Deviation 48.0, Minimum 0, Maximum 321.

Table: 4.1.8. Types of land use practised by the households

	Districts				
Land use type	**Taita**	**Taveta**	**Loitokitok**	**Kibwezi**	**Total**
Dwelling	22.3%	16.8%	21.4%	23.2%	83.7%
Crop farming	22.7%	22.3%	10.0%	22.7%	77.7%
Grazing	7.7%	5.0%	16.4%	18.6%	47.7%
Agro-forestry	0.0%	8.6%	2.3%	3.6%	14.5%
Bee keeping	0.9%	1.8%	5.9%	1.4%	10.0%
Total (n)	55	55	55	55	220

4.1.11. Types of crops grown by farmers

The results (Table 4.1.9) indicate that majority of the farmers (85.5%) planted maize in their farms while 35% of them planted beans. These two crops were grown using rain-fed agriculture. The other crops mainly grown for sale and using irrigation included onions (17.7% of the farmers) and vegetables (9.5% of the farmers).

Taveta and Loitokitok districts were leading in the growing of cash crops under irrigation, while Kibwezi had most farmers growing rain-fed crops (maize and millet) and vegetables also under irrigation. Taveta and Loitokitok resident tap streams for irrigation emanating from Kilimanjaro ranges. The crops grown attract wild animals to the farms, so without proper control of the wild animals they will cause havoc and conflicts in the community areas.

Table: 4.1.9. Types of crops grown by the households in the four districts

	District				
Type of crop	**Taita**	**Taveta**	**Loitokitok**	**Kibwezi**	**Total**
Maize	21.8%	20.9%	18.6%	24.1%	85.5%
Beans	11.4%	6.8%	6.8%	10.0%	35.0%
Tomatoes	1.8%	12.3%	10.0%	5.0%	29.1%
Millet	5.5%	2.3%	1.8%	11.4%	20.9%
Onions	1.4%	5.9%	9.5%	0.9%	17.7%
Vegetables	0.9%	1.4%	0.9%	6.4%	9.5%
Green grams	2.7%	0.0%	2.3%	0.5%	5.5%
Groundnuts	0.5%	0.0%	0.0%	0.5%	0.9%
Fruits	0.0%	0.0%	0.0%	0.9%	0.9%
Total (n)	55	55	55	55	220

RESULTS AND DISCUSSIONS OF FIVE STUDY OBJECTIVES

The five study objectives are analyzed and discussed accordingly in the following sections.

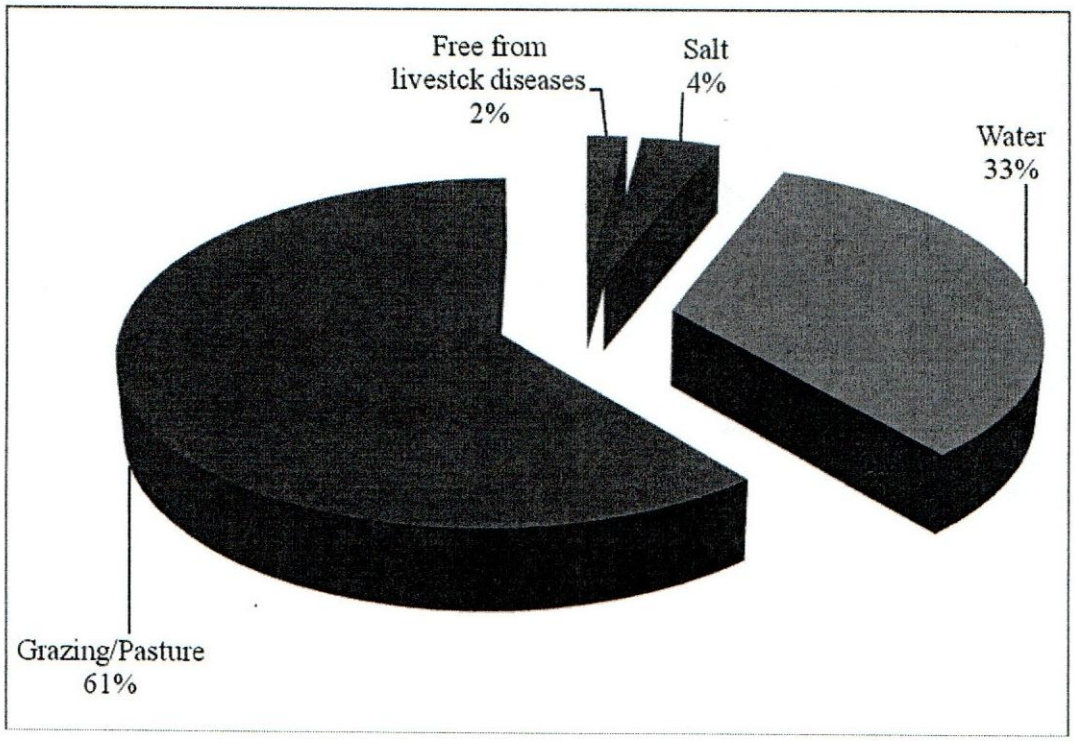
4.2. STUDY OBJECTIVE ONE

To examine the causes, frequency of livestock incursion into the TWNP

To be reviewed are: the reasons of livestock incursions into the park; the types and numbers of livestock entering the park; the number of livestock owned by the households; the distance of the households to the park boundary; adequacy of grazing in the areas surrounding the park; frequency of livestock grazing and seasons of grazing in the park; the number of households that graze in the park and the seasons of grazing.

4.2.1. Reasons for livestock incursion into the TWN Park

The respondents gave four reasons as to why they took their livestock to the park. These included the search for grazing/pasture, water, salts and freedom from livestock diseases. Majority of the households (61%) frequented the park for grazing and pasture for their livestock, causing conflicts in the park. See Figure 5 below.



n=220

Figure 5: Reasons for livestock incursions into the park.

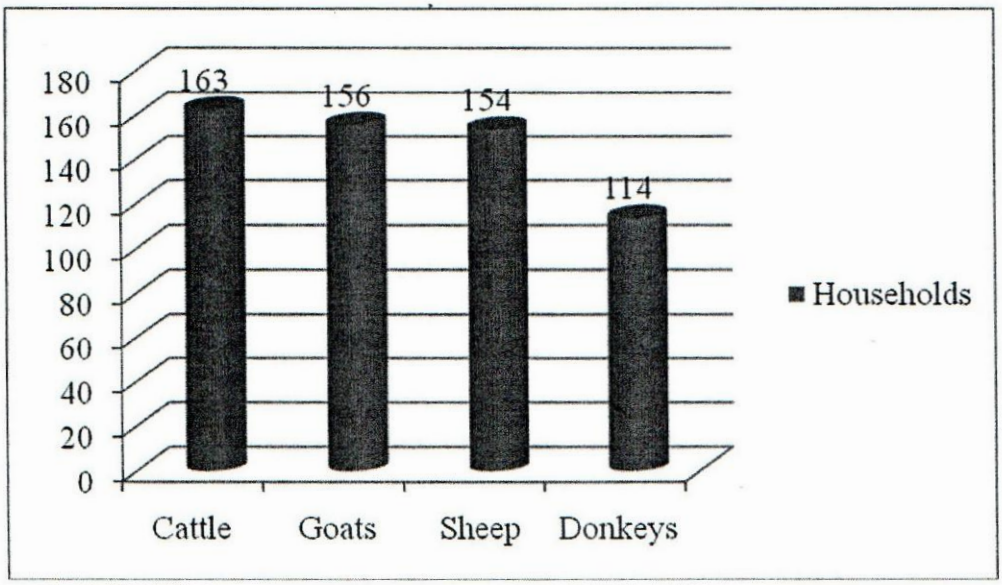


Plate 1: Cattle in search of water inside the park.
Source: TWNP (2009)

Plate 1 shows livestock drinking water in TWNP. Resources outside the park especially during the dry season are very scarce. Livestock influx in the park for pasture and water becomes inevitable.

4.2.2. Types and numbers of livestock entering the TWNP

The number of households that grazed their livestock in TWNP is given in figure 6. One hundred and sixty three households grazed their cattle in the park, while 156 grazed their goats, 154 their sheep and 114 their donkeys. This reveals that over 50% of the households graze their livestock in the park indicating that they very much depend on the park for pasture.



n=220

Figure 6: Number of households grazing their livestock in TWNP

4.2.3. Number of livestock owned by households

Livestock play significant roles in the pastoral households, including the provision of food, serving as different forms of capital, acting as wealth, cementing social relations and mediating other cultural and ritual practices such as marriage and traditional ceremonies (Tablino, 1999). A household ownership of large herds is not only a source of social standing and prestige, but also serves as savings and insurance against future losses of livestock to shock events. It is for these reasons that any means of herd accumulation is economically, socially and culturally rewarding. This influences the pastoralists to keep large herds, beyond the carrying capacity of the lands, leading to environmental degradation. Those pastoralists who live adjacent to TWNP depend on the park for pasture after their own pastures get depleted due to overstocking.

As shown in Table 4.2.1, majority of the households (28.6%) owned between 1 and 5 cattle, majority of the households (21.4%) kept goats ranging between 1 and 5, majority of the households (43.6%) did not keep any sheep within their herds, and majority of the households surveyed (70.0%) did not keep donkeys in their herd.

Table: 4.2.1. Number of livestock owned by the households

Categories		Cattle	Goats	Sheep	Donkeys
0 (None)	Count	47	26	96	154
	% of Total	21.4%	11.8%	43.6%	70%
1- 5	Count	63	47	32	40
	% of Total	28.6%	21.4%	14.5%	18.2%
6-10	Count	27	26	21	19
	% of Total	12.3%	11.8%	9.5%	8.6%
11-20	Count	20	40	16	5
	% of Total	9.1%	18.2%	7.3%	2.3%
21-30	Count	5	15	4	1
	% of Total	2.3%	6.8%	1.8%	0.5%
31-40	Count	9	9	5	1
	% of Total	4.1%	4.1%	2.3%	0.5%
41-60	Count	7	17	14	0
	% of Total	3.2%	7.7%	6.4%	0.0%
61-80	Count	2	4	5	0
	% of Total	0.9%	1.8%	2.3%	0.0%
81-100	Count	6	4	10	0
	% of Total	2.7%	1.8%	4.5%	0.0%
Above 100	Count	34	32	17	0
	% of Total	15.5%	14.5%	7.7%	0.0%
Total (n)	Count	220	220	220	220
	% of Total	100%	100%	100%	100%

Cattle: Mean 61, Median 6, Mode 0, Minimum 0, Maximum 865.

Goats: Mean 50, Median 12, Mode 0, Minimum 0, Maximum 500.

Sheep: Mean 29, Median 3, Mode 0, Minimum 0, Maximum 325.

Donkeys: Mean 2, Median 0, Mode 0, Minimum 0, Maximum 40.

Table: 4.2.3. Adequacy of grazing land

Land adequate for herd		District				
		Taita	Taveta	Loitokitok	Kibwezi	Total
Yes	Count	14	6	12	18	50
	% Total	6.4%	2.7%	5.5%	8.2%	22.8%
No	Count	40	49	43	37	169
	% Total	18.3%	22.4%	19.6%	16.9%	77.2%
Total (n)	Count	54	55	55	55	219
	% Total	24.7%	25.1%	25.1%	25.1%	100.0%

4.2.6. Acreage allocated per animal in the study area

Table 4.2.4 shows the land area allocated for each animal by the households. Some households had 0 acres meaning they have no available land to graze their animals so they have to depend on the park to survive.

Table: 4.2.4. Acreage allocated per animal in the study area

	Districts			
	Taita	Taveta	Loitokitok	Kibwezi
Mean	4.56	2.79	3.86	7.672
Median	1.11	1.25	0.29	1.53
Mode	0	0	0	0
Std dev	8.79	5.72	14.35	15.6
Minimum	0	0	0	0
Maximum	40.0	30.87	95.0	100

n=220

These figures compare well with the figures given by Key informants' interview on the number of animals driven out of the park in 2007 and 2008, The Key informants' from the park authority gave a figure of 306,950 and 423,902 respectively (Figure 7).

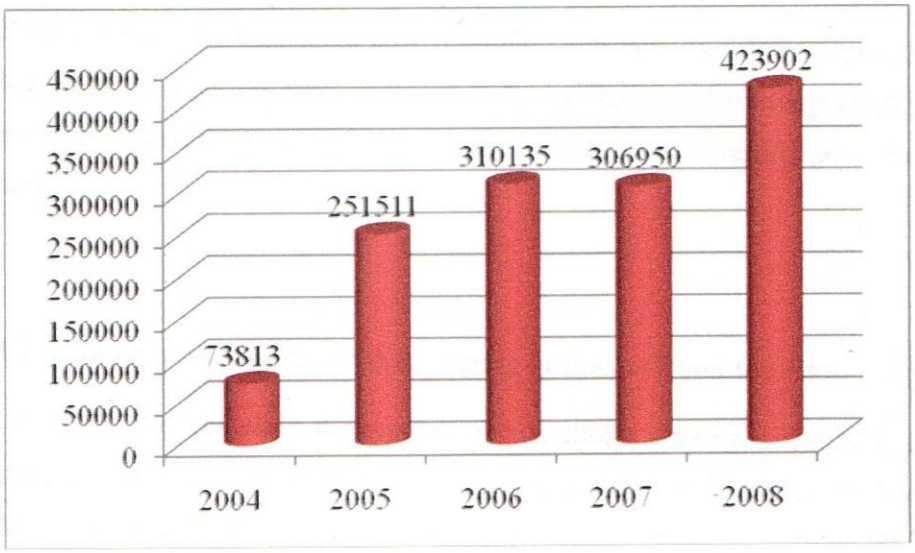


Figure 7: Number of cattle driven out of the park by the park authority.

Source: TWNP 2009



Plate 2: Emaciated cow due to effects of drought in the community area.
Source: (TWNP 2009)

Plate 2 depicts an emaciated cow resulting from lack of pasture especially during the dry season in the adjacent areas of the park. It also indicates bare (degraded) pastoral land with no trace of pasture. As a result the livestock owners opt to illegally graze their livestock in the park.

4.2.7. Number of households that grazing in the park and the season of grazing

Cross-tabulation between the number of households grazing in the park and the season of grazing is given in Table 4.2.5. The Table indicates that of the 163 households that grazed their cattle in the park, majority of them (78.5%) grazed the park during the dry season, while 22.5 % of them grazed all year round and only 1.2 % grazed the park in the wet season.

The relationship between the number of households grazing their livestock in the park and the season of grazing was statistically significant, with a $\chi 2$ of 200.16, significant at $p \leq 0.001$).

Table: 4.2.5. Number of households grazing cattle in the park and the season of grazing

		Cattle graze in park		
Season cattle graze in park		**Yes**	**No**	**Total**
Wet season	Count	2	0	2
	%	1.2%	0.0%	0.9%
Dry season	Count	128	0	128
	%	78.5%	0.0%	58.2%
All year round	Count	33	0	33
	%	22.5%	0%	22.5%
Not applicable	Count	0	57	57
	%	0.0%	100.0%	100.0%
Total (n)	Count	163	57	220

4.2.8. Frequency of livestock graze in the park and the seasons of grazing

Table 4.2.6 presents a cross-tabulation analysis between the frequency of livestock grazing within the TWNP and the season when the grazing takes place. The animals significantly frequented the TWNP for grazing in the dry season. The animals were found to always visit the park in the dry season (47.7 %) compared to the wet season (5 %) and all year round (7.3 %).

Table: 4.2.6. Livestock frequency and season of grazing within the TWNP

	Season of grazing		
Frequency	**Wet season**	**Dry season**	**All year round**
Always	5.0%	47.7%	7.3%
Often	2.3%	17.3%	11.4%
Once in a while	8.6%	4.5%	39.5%
Rarely	27.7%	3.2%	15.5%
Very rarely	15.0%	1.8%	2.3%
Never	41.4%	25.5%	24.1%
Chi-square statistic ($\chi 2$)	150.855	210.091	119.273
df	5	5	5
P value	≤ 0.001	≤ 0.001	≤ 0.001

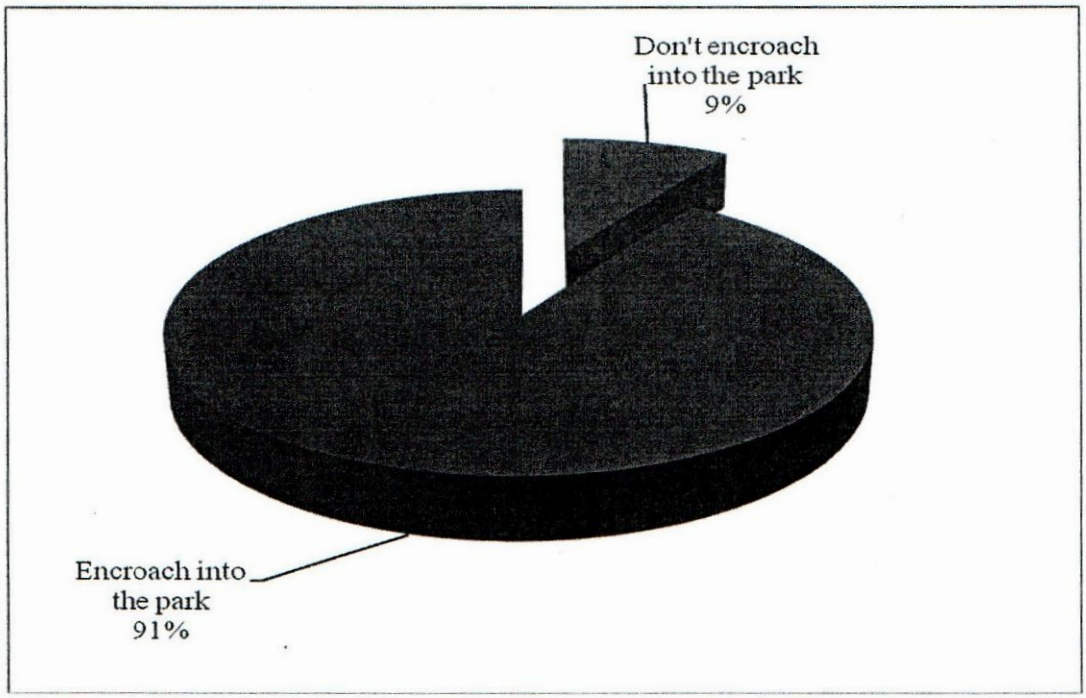
n=220

Thus, the cross-tabulation above indicates a significant relationship between frequency of grazing and the seasons of grazing in the park. Chi-square statistics generated have a significant level (p value) of ≤ 0.001.

The park authority uses a lot of resource in curbing livestock incursions in the park e.g. personnel, vehicles, light aircrafts and helicopters. Plate 3 shows cattle being driven out of TWNP by the KWS staff. During the dry season livestock migrate into the park from as far as Tanzania and Somali. There is also a lot of Somalis who have leased ranches bordering the park but in the essence they end up grazing their livestock in the park. Tsavo ecosystem is believed by communities to be a disease free zone and therefore attracts a lot of livestock for fattening purposes.

4.3.1. People's illegal entry into the park and reasons of entry

Majority of the people (91%) reported that they enter the park for one reason or the other as shown in Figure 9. This indicates that the adjacent communities to TWNP rely on the park for some vital commodities which are deficient on their own areas. Commodities like firewood, pasture, building materials, honey, bush meat, etc.



n=220

Figure 9: Percent of respondents entering the park

4.3.2. Frequency and season of humans' entry into the park

A cross-tabulation analysis indicated a significant relationship between the frequency and the season of peoples' entry into the park. As suggested by Table 4.3.1, people more often enter the park in the dry season than in any other season of the year. Majority of the people (83.2%) always or often entered the park in the dry season.

Table: 4.3.1. Frequency and season of human entry into the park

	Season of human encroachment		
Frequency	**Wet**	**Dry**	**All year round**
Always	2.7%	35.5%	3.2%
Often	26.4%	47.7%	35.9%
Once in a while	0.5%	8.6%	50.9%
Rarely	19.5%	0.0%	0.5%
Very rarely	40.9%	0.0%	1.8%
Never	10.0%	8.2%	7.7%
Chi-square statistic ($\chi 2$)	157.291	103.527	302.0
df	5	5	5
P value	≤0.001	≤0.001	≤0.001

n=220

4.3.3. Reasons for human encroachment into TWNP

The households identified eleven commodities that they seek from the park, including: grazing, water, charcoal, building materials, game meat, herbal medicine, wild vegetables/fruits, wood for carving, game trophies, mining/minerals and farmland as shown in Table 4.3.2. The communities ranked grazing, water, charcoal and building materials as the most sought after commodities from the park.

While most of the commodities were sought for in the dry season, building materials, herbal medicine and wood for carving were sought for all the year round by the communities.

Table: 4.3.2. Commodities sought by humans from TWNP and season they seek them

Commodity	Total households seeking	Season		
		Wet	Dry	All year round
Grazing	81.4%	1.4%	73.2%	6.8%
Water	69.6%	5.9%	55.5%	8.2%
Charcoal	69.6%	0.9%	41.4%	27.3%
Building materials	65.0%	0.7%	13.0%	51.3%
Game meat	63.2%	0.2%	30.0%	33.0%
Herbal medicine	58.6%	5.9%	15.9%	36.8%
Wild vegetable/fruits	53.6%	10.9%	24.1%	18.6%
Wood for carving	46.8%	0.9%	15.0%	30.9%
Game trophies	23.6%	0.9%	10.0%	12.7%
Mining/minerals	8.6%	0.0%	0.0%	8.6%
Farmland	1.4%	1.4%	0.0%	0.0%

n=220



Plate 3: Cattle driven out from TWNP by KWS Rangers.

Source: TWNP (2009)

4.3. STUDY OBJECTIVE TWO

To examine the causes and frequency of human encroachment into the TWNP and its effects on resource degradation

While study objective one looked at the ***livestock incursions*** into the TWNP, objective two looks at the ***human encroachment*** into the TWNP. To operationalize the objective, the following indicators will be reviewed so as to show the implications of human encroachment on resource degradation in the park, which leads to human-wildlife conflicts: People's entry into the park and reasons of entry; Frequency and season of humans' entry into the park; Reasons for human encroachment into TWNP and adjacent areas; and Efforts in the control of illegal activities in TWNP.



Plate 4: Poachers arrested by KWS Rangers with zebra carcasses in the park

Source: TWNP (2009)

Poaching in the park is rampant especially for bush meat. Poachers are reported to intrude from the park adjacent communities and also from the neighbouring countries of Tanzania and as far as Somalia. The KWS spares no effort to control the menace, as depicted in Plate 4 above.



Plate 5: A Rhino and an Elephant carcass poached in the park.

Source: TWNP (2009)

Unfortunately, poaching affects the most endangered species from TWNP. Elephant and rhino are among the top five wild animals mostly poached, with the others being buffalo, leopard and lion, as they are highly targeted by poachers for their trophies. The park authority suggests that poaching of elephants and rhinos is mainly done using guns and poisoned arrows. The poachers always come with new tactics or methods to outwit the park rangers. Plate 5 depicts some of the animal slaughter that takes place in TWNP.

The local communities also engage in other illegal activities like charcoal burning, overgrazing, and collection of building material resulting to environmental degradation. As shown in Plate 6, illegal logging also takes place in the park, and in this case the culprit has been apprehended by the KWS rangers.

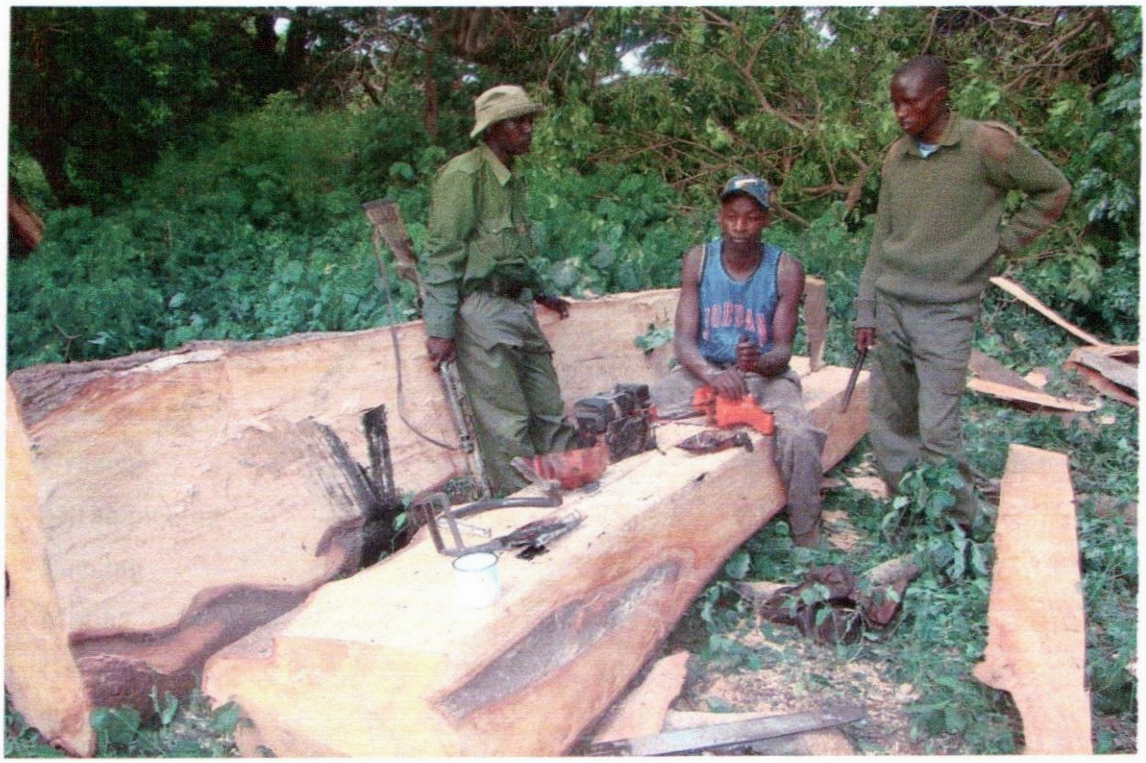


Plate 6: A culprit is apprehended for illegal logging in the park

Source: TWNP (2009)

4.3.4. Efforts in the control of illegal activities in TWNP

While the KWS and other park authorities put a lot of efforts in controlling illegal activities in the TWNP, complete success has yet to be achieved. Consequently, through such illegal activities significant amount of biodiversity is lost and through clearance of vegetation, environmental degradation ensues.

Table: 4.3.3, generated from the park authority records, shows the number of arrests resulting from engagement in illegal activities. However, court sentences for these offences seem to be too lenient, and the culprits do not fear them and so continue to contribute heavily towards environmental destruction through the illegal activities. For instance, the custodial sentence for the offence is between one month to twelve months jail, while the fine is between KShs

1,000 and KShs 19,000. It is feared that there is some weaknesses and discrepancies with the relevant Kenyans Wildlife Act Cap 376 which provides for the control of illegal activities.

Table: 4.3.3. Arrests on illegal activities in the park

Number of arrests on illegal activities in Tsavo west/Chyulu National parks					
Offence	**2004**	**2005**	**2006**	**2007**	**2008**
Charcoal burning	50	73	182	156	171
Bush meat	23	56	58	50	63
Grazing	158	464	880	386	683
Miraa picking	75	87	110	76	134
Logging	24	31	40	89	144
Mining	5	0	0	0	0
Game poaching	20	20	33	15	41
Trespass	30	23	30	1	11
Wood carving	11	44	41	71	49
Sandal wood	0	182	23	7	13
Fishing	0	0	5	2	0
Encroachment	0	23	28	1	2
Elephant poaching	0	0	3	0	0
Ivory	0	0	3	0	9

Source: TWNP (2009)

4.4. STUDY OBJECTIVE THREE

To establish the wild animals dispersal patterns from TWNP to the adjacent areas

4.4.1. Whether wild animals move into the farms

Almost all of the respondents (99%) confirmed that wild animals do move into their farms. Since the respondents are distributed all over the 15 locations of the study area, it means that wild animals do disperse in all directions of the adjacent lands owned by communities resulting to human-wildlife conflicts (Figure 10).

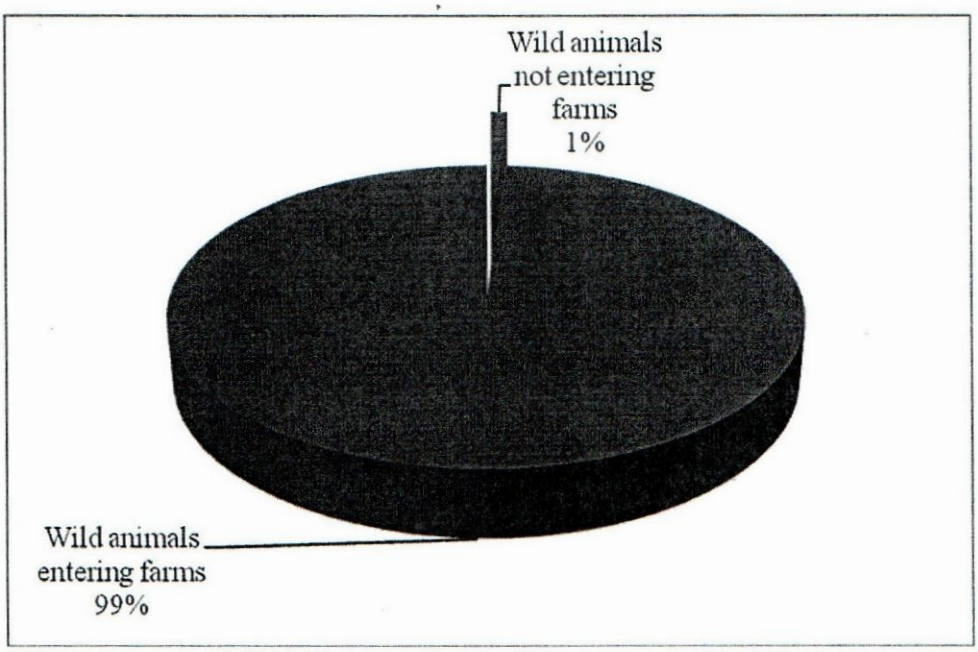


Figure 10: Wild animals' dispersal from the park into the adjacent farms

4.4.2. Human-wildlife conflict hotspots

Sketch map in Figure 11 below indicates the locations of the hotspots, obtained from the Key Informant's interviews. These are areas, adjacent to the TWNP (shaded green in the map), where most of the conflicts occur in the study areas. They include areas of Mtito Andei, Iltilal, Ziwani, Jipe, Mbulia, Oza, Maktau, and Maktau South.

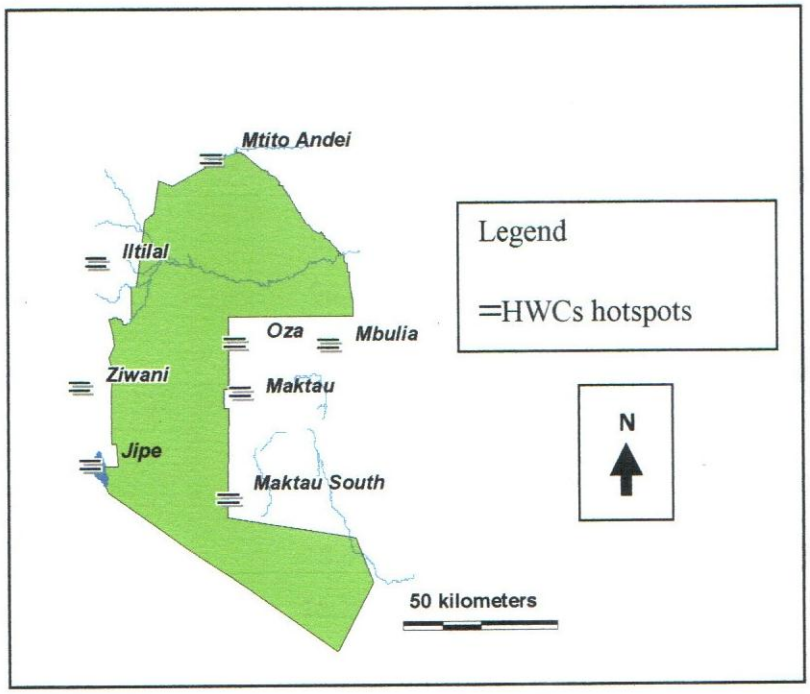


Figure 11: Human-wildlife conflict hotspots

Source TWNP (2009)

4.4.3. Types of wild animals that invade the farms and the seasons involved

Twelve different types of wild animals were reported to have invaded the communities' farms (Table 4.4.1). Baboons were reported by 99.1% of the farmers while monkeys 97.3%, buffaloes 96.4%, elephants 95.5%, hyenas 63.2%, and lions by 35.9% of the farmers.

The baboons, monkeys and hyenas frequented the farms throughout the year, while the elephants, buffaloes and lions mainly visited the farms in the dry season.

These statistics indicate the magnitude of the wildlife problem to the farmers and the resulting conflicts that arise from having the wild animals throughout the year feeding on and destroying their crops, and predating on their livestock especially during the dry seasons.

Table: 4.4.1. Animals moving out of park and season they move out

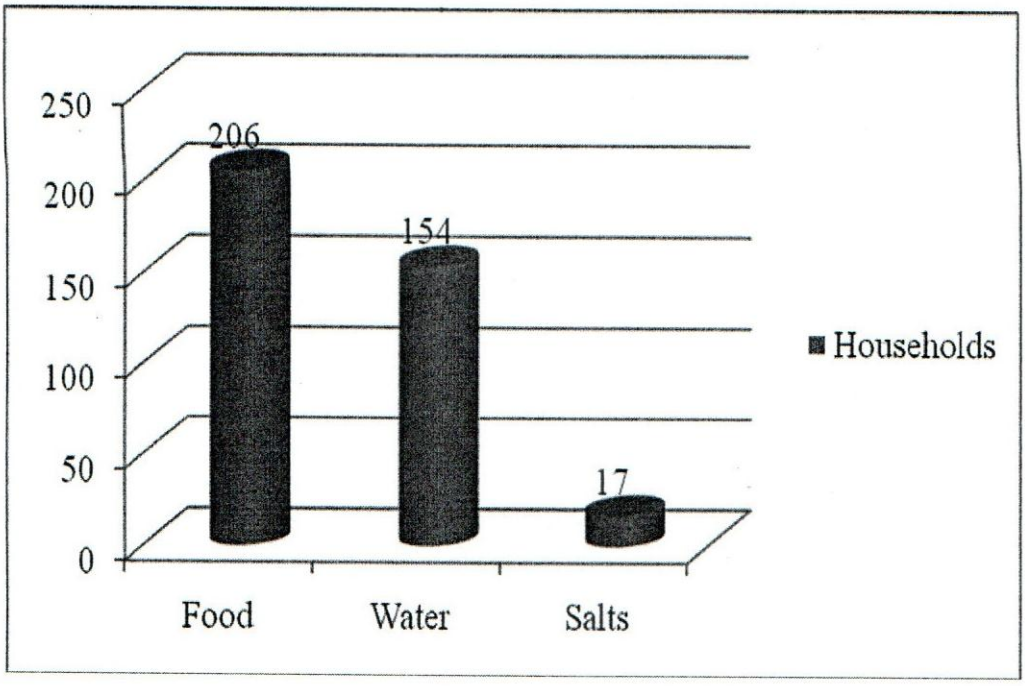
Animal species	Total households reporting	Wet Season	Dry season	All year round
Baboons	99.1%	2.8%	3.2%	93.1%
Monkeys	97.3%	1.8%	2.3%	93.2%
Buffalo	96.4%	30.5%	46.8%	19.1%
Elephants	95.5%	14.5%	57.3%	27.7%
Hyena	63.2%	0.5%	9.0%	52.7%
Lion	35.9%	1.8%	24.1%	10.0%
Genet	29.1%	1.4%	1.7%	26.0%
Leopard	18.6%	1.4%	5.9%	11.4%
Wild pig	14.1%	2.7%	5.9%	5.9%
Porcupine	13.6%	0.5%	4.5%	8.6%
Mongoose	13.2%	0.5%	2.2%	9.5%
Wildebeest	11.4%	0.9%	8.2%	2.3%

n=220

4.4.4. Commodities sought for by the wild animals in the community farms

The animals invade the farms in search for three commodities, namely food, water and salts, as indicated in figure 12. Of the three, food was the most mentioned by 206 households as the reason why wild animals move out of the park and invade the farms.

The other two commodities, water and salts, are usually in adequate supply in the park and so the wild animals do not go out looking for them.



n=220

Figure 12: Commodities sought by wild animals in the farms

Maize, being one of the major crops grown in the adjacent farms to the TWNP is most affected by the wild animals' invasion. Plate 7 shows a maize plantation destroyed by elephants as reported by one of the affected farmers. In Kenya, over 90% of crop raiding incidents of wild animals involve elephants (Hoare, 1999). Pressure to convert wild animals' habitats to other developments that are not compatible with conservation threatens the future of wild animals. The rise in human population has been found to be an ecological constraint, especially in matters of human-wildlife interactions (Thornton *et al.* 2003). Wild animals diperse from the park in search of food, water, breeding, shade, migration and salt as reported by the communities neighbouring the park.



Plate 7: A maize plantation adjacent to the park facing risk of invation by elephants

Source: Author (2010)

4.4.5. Frequency of wild animal visits to the farms

The frequency of wild animals' visits to the farms and the season when they mostly visit the farms is given in Table 4.4.2. The wild animals were found to always visit the farms in the dry season and rarely in the wet season, when they move back to the park. However, the majority of the wild animals do once in a while frequent the farms all year round. Table 4.4.2 also presents a cross-tabulation analysis which indicates a significant relationship (p value $\leq$ 0.001) between the frequency of wild animals' visits to the farm and the seasons of visits.

Table: 4.4.2. Frequency and season of wild animal visit to farms and $\chi 2$ statistics

	Season wild animals visit the farms		
Frequency	**Wet**	**Dry**	**All year round**
Always	11.2%	99.0%	23.2%
Often	12.3%	86.1%	52.4%
Once in a while	15.1%	8.6%	83.7%
Rarely	13.4%	1.3%	9.3%
Very rarely	77.2%	0.0%	0.0%
Never	1.3%	0.0%	1.8%
Chi-square statistics ($\chi 2$)	245.109	199.745	269.545
df	5	5	5
P value	≤0.001	≤0.001	≤0.001

n=220

4.5. STUDY OBJECTIVE FOUR

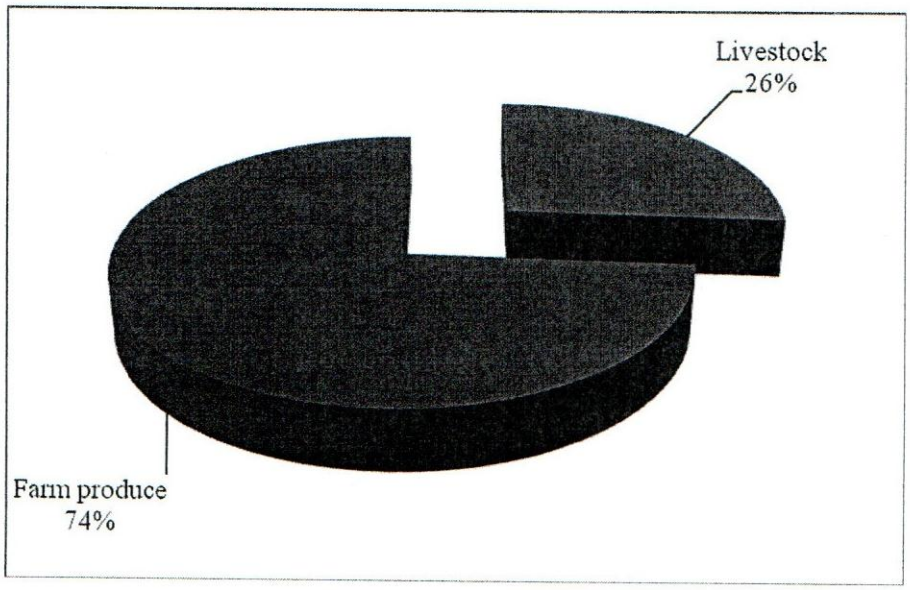
To assess losses incurred and benefits received by local communities due to human-wildlife interactions.

To operationalize this study objective, the following indicators are reviewed in way of assessing the losses and benefits resulting from human-wildlife interactions: Categories of losses incurred by communities resulting from human-wildlife interactions; Human and livestock related injuries and losses from wildlife interactions; Financial costs incurred by the households due to wildlife problems; Compensation for wildlife damage; Benefits received by communities derived from the interactions with wildlife; Types of benefits received by the households; Amount and adequacy of wildlife benefits; and the types of benefits communities would prefer.

4.5.1. Categories of losses incurred by communities resulting from human-wildlife interactions

Two general categories of losses were reported by respondents to have been incurred by the communities resulting from human-wildlife interactions. The more common of these is the farm produce and general crop destruction category in which 74% of the communities were affected, and the livestock-related loss category, in which 26% of the communities were affected. These statistics are depicted in Figure 13.

The total of the losses represents an enormous damage to the communities adjacent to park, which induces community retaliation against the wildlife and so human-wildlife conflicts.



n=220

Figure 13: Categories of losses from human-wildlife interactions

4.5.2. Human and livestock related injuries and losses from wildlife interactions

Table 4.5.1 presents the human and the livestock related injuries and losses as reported by the respondents for the year 2009. As indicated in the table, the number of people killed by wildlife averaged one person and a maximum number of 12 persons per year among the 220

households, while the livestock killed per year averaged 19 for cattle, 14 for goats, and 3 for sheep. People who were injured by wildlife averaged 9 per year, with a maximum of 340.

Table: 4.5.1. Human and livestock related injuries and losses from wildlife interactions

Type	Mean	Minimum	Maximum
People killed 2009	1	0	12
People injured 2009	9	0	340
Cattle killed 2009	19	0	720
Goats killed 2009	14	0	520
Sheep killed 2009	3	0	50

n=220

4.5.3. Financial costs incurred by the households due to wildlife problems

As shown in Table 4.5.2, the mean financial costs incurred by the households per year was KSh 90,409 for food crop destruction, KShs 107,264 for tree destruction, KShs 39,223 for structure destruction, and KShs 111,426 for livestock losses.

By any standards, these figures are high and burdening especially in consideration of the households' low socioeconomic statuses. With unfavourable returns and benefits from living with and in some cases hosting the wildlife, the communities are bitter and have developed poor attitudes towards wildlife and so disregard and downplay any conservation efforts.

Table: 4.5.2. Household financial costs incurred due to wildlife

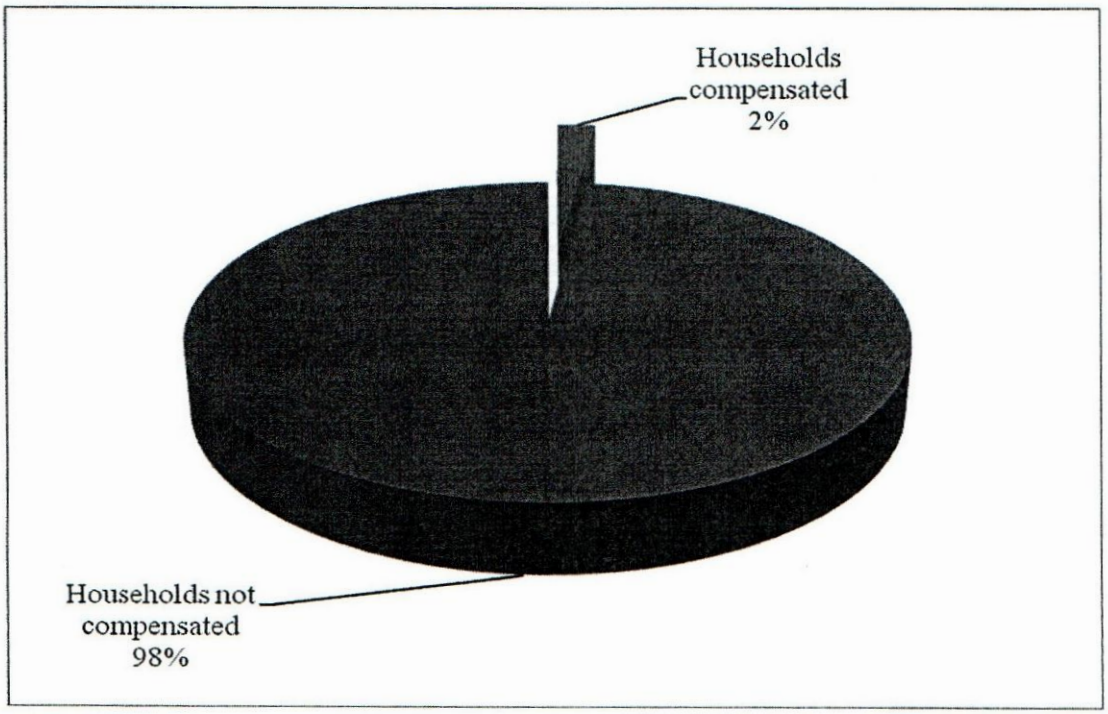
Type	Mean (KShs)	Minimum (KShs)	Maximum (KShs)
Destruction of food crops	90,409	0	10,000,000
Destruction of trees	107,264	0	2,000,000
Destruction of structures	39,223	0	1,000,000
Livestock loses	111,426	0	2,000,000
Other	1,706	0	200,000

n=220

4.5.4. Compensation as a result of wildlife damage

Only two percent of the households had received some compensation for the losses they had incurred from wildlife menace as shown in Figure 14. Since the Kenya Wildlife Service is the lead agency in wildlife compensation matters and also the major controller of wildlife conservation, the local communities have become resentful on wildlife conservation and management. The communities see the KWS as the prosecutor and at the same time the judge and so tend to be biased.

The communities are very bitter about compensation for wildlife damages and injuries, since they consider the amounts offered for compensation to be very little relative to the degree of damages caused. In anyway, the compensation is hardly paid, and comes very late if paid.



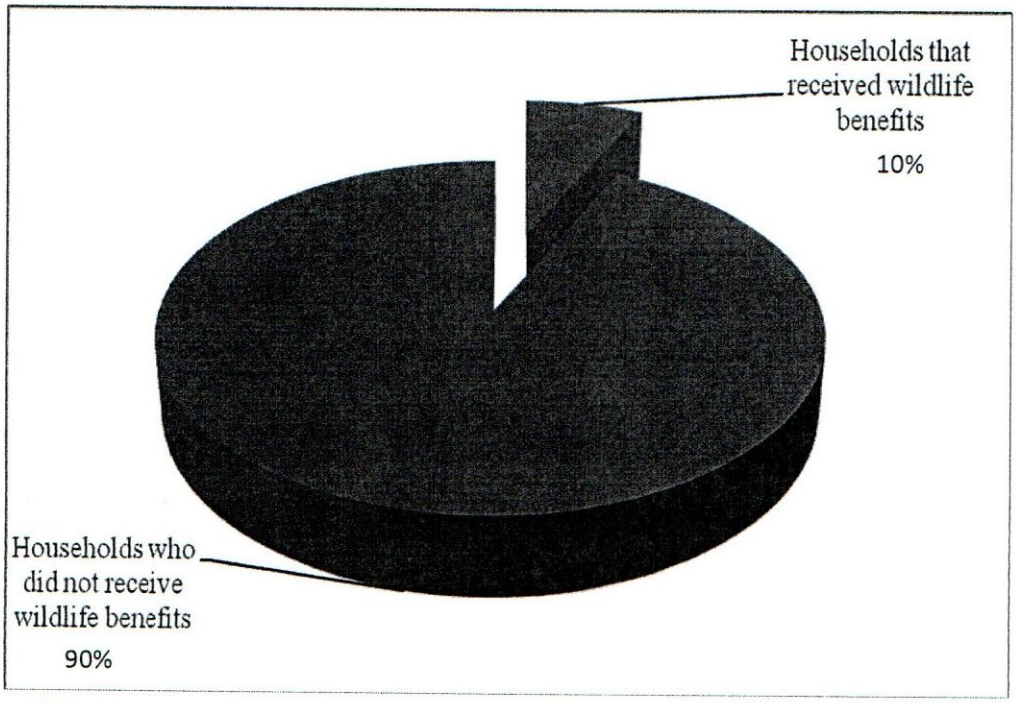
n=220

Figure 14: Reported households compensation rate

4.5.5. Benefits received by communities derived from the interactions with wildlife

Figure 15 indicates that 10% of the communities receiving some benefits from wildlife, while 90% did not receive. Therefore, from the perception of the communities very little benefit is trickling to them as compared to the losses incurred from the wild animals.

What is responsible for the communities' poor attitudes and insensitivity towards the wildlife is primarily lack of, or the inadequate benefits received by those affected by the wildlife menace, disturbances and damages through interactions with the wild animals from the parks. This in turn affects the communities' acceptance and participation in any wildlife conservation efforts and interventions.



n=220

Figure 15: Benefits derived from interactions with wildlife

4.5.6. Types of benefits received by the households

As indicated in Table 4.5.3, four types of wildlife benefits were reported by the 10% households that received some benefits. These included assistance through school bursaries, community development interventions and projects, benefits disbursed through the county councils, and benefits offered by conservancies run by NGOs and local groups. Benefits received through community development projects were reported by most of the farmers (4.6% out of the 10% who reported receiving some benefits).

Table: 4.5.3. Types of benefits received by households, derived from interactions with the wildlife

Benefits	Frequency	Percent
School bursaries from KWS	8	3.6
Community development projects	10	4.6
County council administered benefits	2	0.9
Benefits from NGO and local groups conservancies	2	0.9
TOTAL	22	10.00

n=220

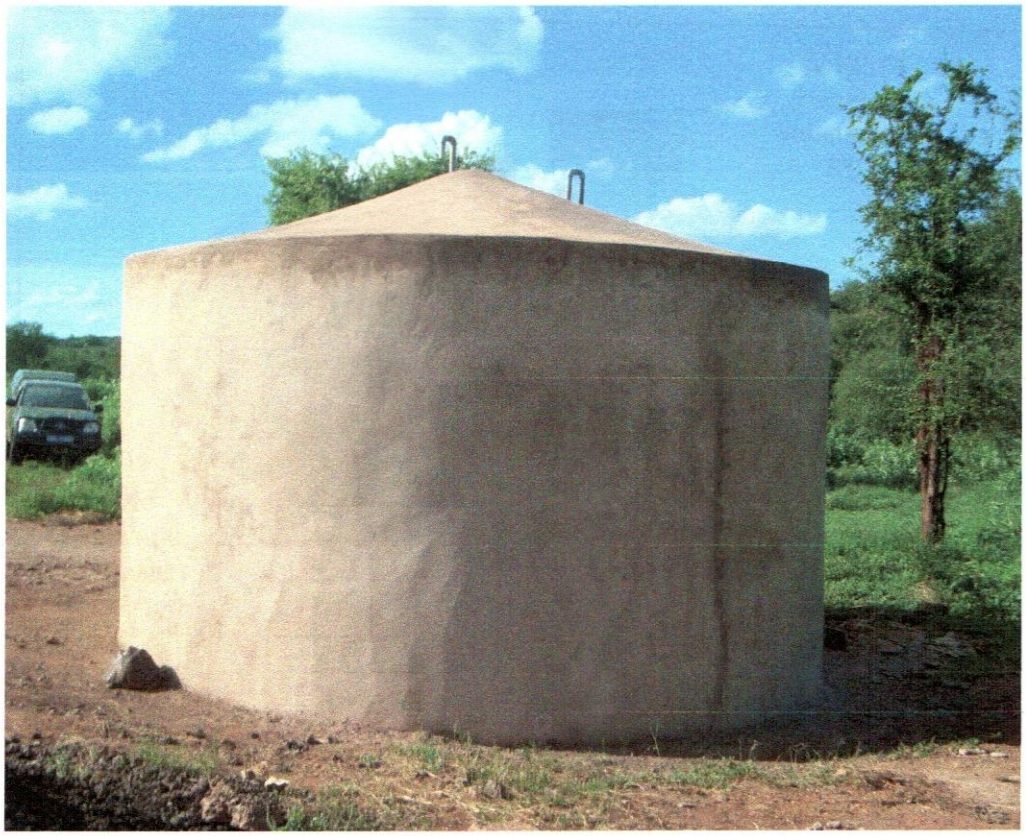


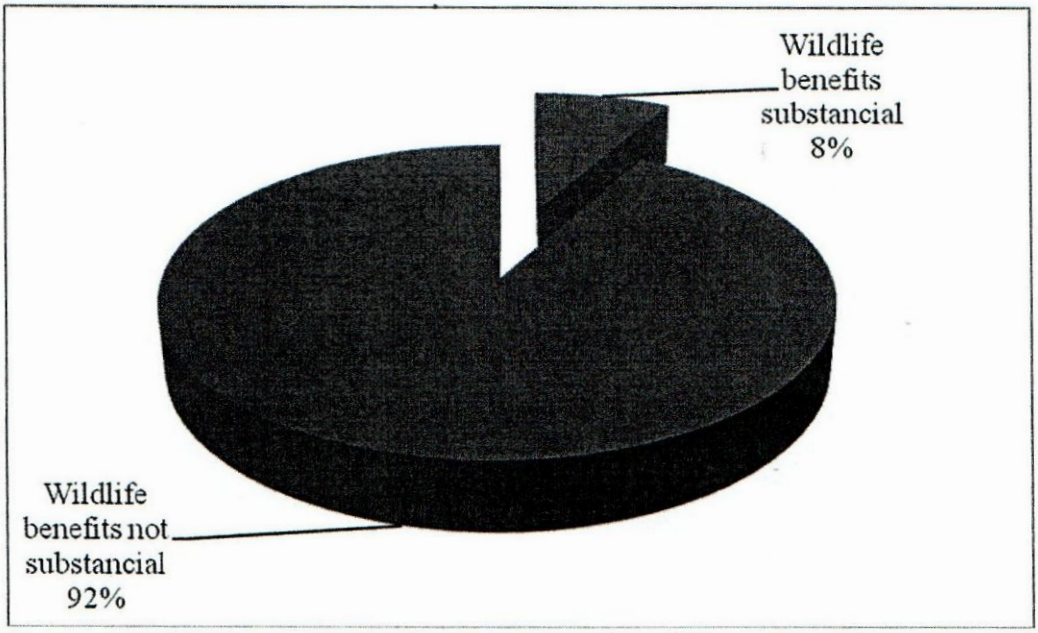
Plate 8: KWS Rehabilitated community water tank, adjacent to the park

Source: (TWNP 2009)

Plate 8 depicts a rehabilitated community water tank, adjacent to the TWNP, as an example of the community projects donated by the park authorities in support of the local community in wildlife conservation. This is one of the TWNP efforts as a mitigation measure to curb or reduce human-wildlife conflicts.

4.5.7. Wildlife benefits perceived by the households

Wildlife benefits were perceived to be substantial and adequate by only 8 % of the households, while the majority 92 % believed that the benefits were not substantial and adequate (Figure 16). This has negative implications and attitudes of the communities affected by the wildlife menace towards conservation of the wild animals.



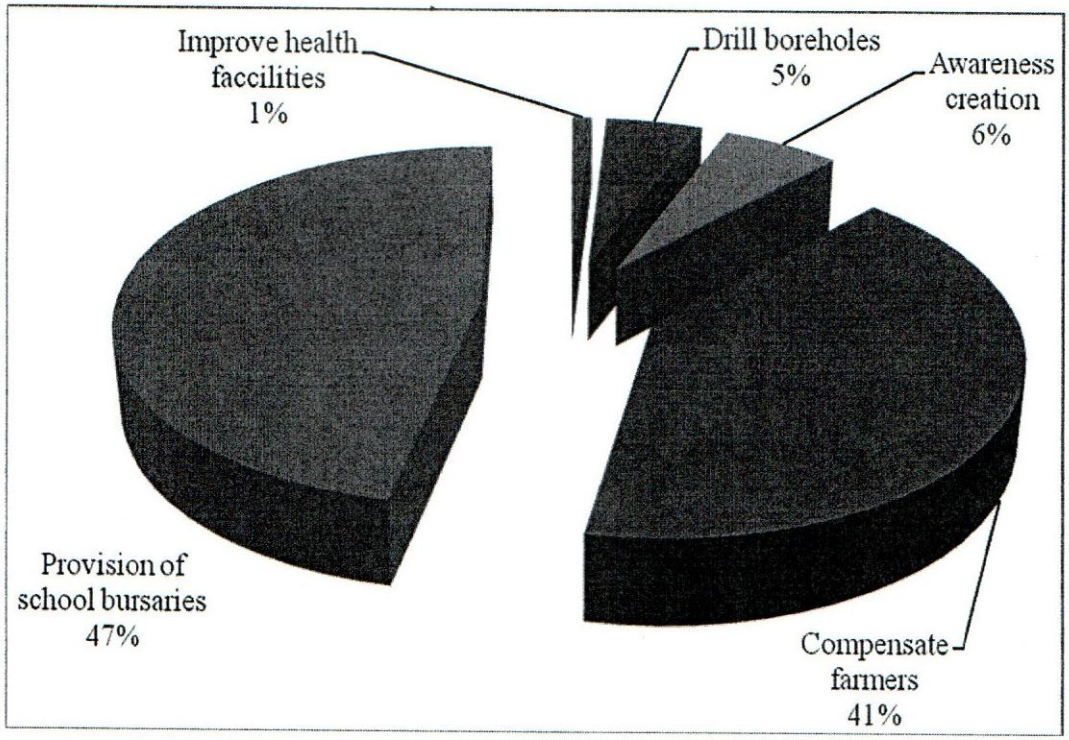
n=220

Figure 16: Households' perceptions of wildlife benefits.

4.5.8. The types of benefits communities would prefer

Asked to suggest the types of benefits they would prefer so as to enhance and sustain their appreciation and support for wildlife conservation efforts, the communities listed five types of benefits in the following order of preference: provision of school bursaries (47%); appropriate and fair compensation rates and quick processing (41%); enhanced awareness creation of wildlife values and conservation efforts (6%); drilling and provision of boreholes for wildlife and livestock water (5%); and improvement of health facilities in the affected areas (1%).

These statistics are depicted in Figure 17. A favourable coincidence is that provision of school bursaries is already one of the benefits that are provided by the park authorities and is appreciated by the communities.



n=220

Figure 17: Benefits preferred by the communities in the park vicinity

4.6. STUDY OBJECTIVE FIVE

To identify respondents' own impression and resolutions on human wildlife conflict and recommend appropriate practical remedial measures to curb the conflicts.

This study objective will be operationalized through the following indicators: The types of measures for curbing livestock incursion into the park and communities' perception of their effectiveness; The types of measures for curbing human encroachment into the park and communities' perception of their effectiveness; Community methods used for protection and deterrence of wildlife from invading households and farms; and Communities' rating of the effectiveness of the measures for curbing human-wildlife conflicts in general

4.6.1. The types of measures for curbing livestock incursion into the park and communities' perception of their effectiveness

Respondents listed four types of measures currently applied to curb livestock incursion into the TWNP, including: provision of wildlife education and awareness; making arrests by law enforcement staff and court sentences; establishing fences to control animal movement; and enforcement of park boundaries.

As indicated in Table 4.6.1. communities perceive provision of wildlife education and awareness as the most effective measure since 74.1% of them rated the measure as being between very effective to moderately effective. Only 25.9% of the communities considered provision of wildlife education and awareness as being ineffective. The other three measures are also rated as being between very effective and moderately effective by a slight majority of the communities.

Encouragingly, the two measures perceived as the most effective are already being implemented by the park authorities, but need reinforcement, while the other two are rather controversial and have mixed feelings among the communities. While crop farmers support and endorse enforcement of boundaries and fences, the livestock herders are totally opposed to them

The pastoralists adjacent to the park are reported by the park authority to be vandalizing the fences while in search of pastures in the park especially during the dry season. The farmers on the other hand highly support erection of electric fence in the park thus conflict with the pastoralists interest.

Table: 4.6.1. The type of measures for curbing livestock incursion into the park and communities' perception of their effectiveness

	Effectiveness (% mentioned)				
Conflict curbing measure	**Very effective**	**Effective**	**Moderately effective**	**Cumulatively effective**	**Not effective**
Provision of education and awareness	21.8	26.4	25.9	(74.1)	25.9
Arrest by law enforcers and court Sentences	25.5	17.1	20.9	(63.5)	36.5
Establishment of fences	28.6	13.2	14.5	(56.4)	43.6
Enforcing park boundary	18.6	11.4	20.5	(50.5)	49.5

n=220

4.6.2. The types of measures for curbing human encroachment into the park and communities' perception of their effectiveness

Human encroachment into the park is mainly for indulgence in illegal activities, including poaching, tree logging, charcoal burning, etc, all of which are unsupportive on conservation and are in fact environmental unfriendly.

The data in Table 4.6.2 represent community perceptions of the effectiveness of the various measures used to curb human encroachment into the park, and suggest that the most effective is the arrests of the culprits by law enforcing agents and associated court sentencing. Close to seventy one percent (71%) of the respondents rated the arrests and the court sentences to be between moderately effective to very effective.

As suggested by the data in the Table 4.6.2, humans are not deterred by enforcement of park boundaries and fences. However, provision of wildlife education and awareness is perceive to be effective to some extent in controlling human encroachment into the park.

Table: 4.6.2. Community perceptions of the effectiveness of measures used in curbing human encroachment into the park

	Effectiveness (% mentioned)				
Conflict curbing measure	Very effective	Effective	Moderately Effective	Cumulatively Effective	Not effective
Arrest by law enforcers and court Sentences	30.5	32.7	7.7	(70.9)	29.1
Establishment of fences	7.1	36.2	3.8	(47.1)	52.9
Provision of education and awareness	3.2	36.4	4.5	(44.1)	55.9
Enforcing park boundary	13.6	2.3	4.5	(20.4)	79.6

n=220

4.6.3 Community methods used for protection and deterrence of wildlife from invading households and farms

Ten methods that communities use to protect their households and farms from wildlife invasion include, in order of popularity: reporting the cases to KWS (mentioned by 23% of respondents); keeping vigil and chase the invading animals (22%); making noise with metal objects to scare away the animals (16%); staying put and doing nothing (14%); erecting scarecrows to scare the animals (9%); killing the invading animals (8%); lighting fires to keep the animals at bay (4%); reporting the case to the Administration Chief (2%); building trenches to keep the animals at bay (1.1%); and building livestock enclosures to protect their livestock from the animals (0.9%).

Table 4.6.3, indicates respondents' rating of their use of each of the methods against the specific wildlife species. A few households sit back and do nothing about such invasions, as a sign of frustration and having no power or capacity to do anything. Fewer households opt to kill the invading animals out of annoyance, frustration and vengeance, and usually kill the predators such as hyenas, leopards, mongoose and baboons.

Table: 4.6.3. Community methods used for protection and deterrence of wildlife from invading households and farms

Animal	Methods of control used (% mentioned by households)									
	Report cases to KWS	Make noise with metal objects	Keep vigil and chase Animals	Light fires	Erect scarecrows	Stay put and do nothing	Report cases to the Chief	Dig trenches	Build livestock enclosures	Kill the invading animals
Elephant	43	23	12	8	6	5	1	0.5	0.5	-
Buffalo	47	18	7	3	13	10	2	-	1	-
Lion	46	5	7	1	16	11	5	-	5	4
Hyena	24	10	16	14	16	5	1	3	2	11
Leopard	37	16	16	1	16	9	4	3	1	2
Genet	9	6	36	0.5	3	31	-	0.5	1	15
Mongoose	5	7	39	9	5	29	5	-	-	6
Wild pig	8	31	23	3	6	15	-	6	-	8
Wildebeest	12	23	22	0.5	15	22	1	-	-	9
Baboon	11	22	36	-	2	5	1	-	-	23
Monkey	23	24	34	0 5	7	5	0.5	-	-	7
Porcupine	14	15	23	5	9	23	-	-	-	12
Overall mentioned	**(23%)**	**(16%)**	**(22%)**	**(4%)**	**(9%)**	**(14%)**	**(2%)**	**(1.1%)**	**(0.9%)**	**(8%)**

n=220

4.6.4. Communities' rating of the effectiveness of the measures for curbing human-wildlife conflicts in general

While Tables 4.6.1 and 4.6.2 present communities' ratings of the effectiveness of the measures in curbing livestock incursions into the park and measures in curbing human encroachment into the park respectively, Table 4.6.4 presents communities' rating of the effectiveness of the methods used to curb or reduce human-wildlife conflicts in general.

As will be seen from the cumulative figures for effectiveness, increased fencing (with 77.7% mention) is considered the most effective method used to curb or reduce human-wildlife conflicts in the study areas. This is followed by: control of wildlife by the KWS (75.5% mention); creation and provision of wildlife education and awareness (73.6%); use of livestock enclosures (66.9%); animal translocation into the park (63.7%); eliminating rogue animals (63.6%); guarding own properties (63.6%); building trenches (60.9%); use of traditional methods (58.2%); and rely on community social responsibility (57.7%).

From the community perspective, the measures are adequately effective, and yet the human-wildlife conflicts are still prevalent in the study area. Thus, there is need for new ideas to come up as ways to curb and/or reduce the conflicts.

Table: 4.6.4. Communities' rating of the effectiveness of the measures for curbing Human-wildlife conflicts in general

	Effectiveness (% mentioned)				
Conflict curbing measure	**Very effective**	**Effective**	**Moderately Effective**	**Cumulatively effective**	**Not effective**
Increased fencing	30.1	31.2	16.4	(77.7)	22.3
Control of wildlife by KWS	30.0	17.3	28.2	(75.5)	24.5
Creation and provision of wildlife education & awareness	31.8	20.0	21.8	(73.6)	26.4
Use of livestock enclosures	16.4	13.2	37.3	(66.9)	33.1
Animal translocation into the park	12.7	20.5	30.5	(63.7)	36.3
Eliminating rogue animals	23.2	10.9	29.5	(63.6)	36.4
Guarding own properties	33.6	8.6	21.4	(63.6)	36.4
Building trenches	2.3	16.8	41.8	(60.9)	39.1
Use of traditional methods	8.2	26.8	23.2	(58.2)	41.8
Rely on community social Responsibility	21.4	25.5	10.9	(57.7)	42.3

n=220



Plate 9: A python trapped by KWS Ranger in community area

Source: TWNP (2009)

Plate 9 depicts a python trapped by KWS ranger in community area and translocated into the park. This is an illustration of one of the ways KWS personnel help to minimize human-wildlife conflict in areas adjacent to the park from dangerous and rogue wild animals.

4.7. TESTING OF THE STUDY HYPOTHESES AND RESULTS

The four study hypotheses are tested and discussed in this section as follows.

Since all of the variables in the four hypotheses are categorical and are in collapsed ordinal scale, the most appropriate measure of association between the variables in each hypothesis

is through the use of crosstabulation analysis, applying the Pearson Chi-square, the Gamma and the Somer's d, statistics (Healey, 1984).

The Chi-square technique is a form of frequency count occurring in two or more mutually exclusive categories, in way of comparing the proportion of independence between the two variables in the crosstab cells. If the observed frequency greatly departs from what is expected, then the null-hypothesis is rejected, in that the two variables are independent of each other, and is therefore concluded that one variable is in fact related to the other. The technique yields a Chi-square value which will be equal or greater than zero.

The technique also yields the Gamma and Somer's d statistics both of which are measures of association appropriate for ordinal measured variables organized into table format. The two summarize the overall strength and direction of the association between the variables (Mugenda and Mugenda, 1999).

Also, the Correlation technique is used to analyze the degree of relationship between two variables, using the Pearson Product-Moment correlation (r) statistic. While this statistic is more commonly used when the variables are measured at ratio-interval scales and are continuous, in some cases categorical variables can be used with Pearson Product-Moment correlation statistic to test for relationship between two variables as long as the variables are changed into dichotomous variables, with values of zero (indicating the absence of the characteristic) and one (indicating the presence of the characteristic). The correlation coefficient (r) indicates the magnitude and the direction of the relationship between the two variables, and is assigned values ranging from -1 to +1.

The processes of testing the four study null-hypotheses will entail, first, the presentation of the frequency distributions of the two variables in the hypothesis (the independent and the dependent variables), followed by the crosstab with row and column cells indicating the observed and expected frequency counts, and the Chi-square statistical tests. Finally, the

Correlations are presented for triangulation purposes to ascertain and support the results of the other statistics.

4.7.1. TESTING HYPOTHESIS ONE

Ho 1: Livestock incursions do not cause conflicts in TWNP.

The following are frequency distributions of the two variables in the null-hypothesis one:

Independent variable: Livestock incursion into park

	Frequency	Percent	Cumulative Percent
Never	21	9.5	9.5
Most of the times	72	32.7	42.3
Always	127	57.8	100.0
Total	220	100.0	

Dependent variable: Conflict status

	Frequency	Percent	Cumulative Percent
Not serious	81	36.8	36.8
Moderately serious	50	22.7	59.5
Serious	15	6.8	66.3
Very serious	74	33.7	100.0
Total	220	100.0	

As indicated in the crosstab Table 4.7.1, the observed frequencies in the cells depart from what were expected, and the null-hypothesis (that the two variables are independent of each

other) is rejected. It is therefore concluded that livestock incursion into the parks is in fact associated with conflicts.

Table: 4.7.1. Livestock incursion into park and status of conflicts

			Conflict status				Total
			Not serious	Moderately serious	Serious	Very serious	
Livestock incursion into park	Never	Count	12	5	0	4	21
		%	14.6%	10.0%	0.0%	5.5%	9.5%
		Residual	4.2	.2	-1.4	-3.0	
	Most of the times	Count	23	23	8	18	72
		%	26.6	46.0%	53.3%	24.7%	32.7%
		Residual	-3.6	6.6	3.1	-6.0	
	Always	Count	47	22	7	51	127
		%	28.0%	44.0%	46.7%	69.9%	57.7%
		Residual	-0.6	-6.8	-1.6	9.0	
Total (n)		Count	82	50	15	73	220

Chi-square statistical tests

Statistic	Value	Df	Significant level	P – Level
Pearson Chi-square	15.399	6	0.170	$P \leq 0.05$
Somers' d	0.116		0.044	$P \leq 0.05$
Gamma	0.186		0.045	$P \leq 0.05$

Further to confirmation by the crosstab that livestock incursion influence conflicts in the TWNP, the Pearson Chi-square (15.399) indicates a statistical significance of the association at $p \leq 0.05$, while the Somer'd and Gamma statistics indicates a moderate association between the two variables with the livestock incursion (independent variable) positively influencing conflicts (the dependent variable).

As a way of supporting the above findings, correlation analysis was undertaken which also showed a moderate association between livestock incursion into the TWNP and the generation of conflicts, with a Pearson correlation coefficient (r) of 0.136, significant at $p \leq 0.05$ level. The Correlation table below presents the results.

Correlations

		Livestock incursion dummy variable	Conflicts in the park dummy variable
Livestock incursion dummy variable	Pearson Correlation	1	0.136*
	Sig. (1-tailed)	0.0	0.022
	n	220	220
Conflicts in park dummy variable	Pearson Correlation	0.136*	1
	Sig. (1-tailed)	0.022	.
	n	220	220

* Correlation is significant at the 0.05 level (1-tailed).

4.7.2. TESTING HYPOTHESIS TWO

Ho 2: Human encroachment into the park do not cause resource degradation

The following are frequency distributions of the two variables in the null-hypothesis two:

Independent variable: Human encroachment in park

	Frequency	Percent	Cumulative Percent
Never	9	4.1	4.1
Most of the times	44	20.0	24.1
Always	167	75.9	100.0
Total	220	100.0	

Dependent variable: Resource degradation

	Frequency	Percent	Cumulative Percent
Not degraded	20	9.1	9.1
Moderately degraded	20	9.1	18.2
Degraded	85	38.6	56.8
Very degraded	95	43.2	100.0
Total	220	100.0	

As indicated in the crosstab Table 4.7.2, the observed frequencies in the cells depart from what were expected, and the null-hypothesis (that the two variables are independent of each other) is rejected. It is therefore concluded that human encroachment into the parks is in fact associated with resources degradation.

Statistical tests

Statistic	Value	Df	Significant level	P – Level
Pearson Chi-square	76.542	6	0.000	$p \leq 0.001$
Somers' d	0.464		0.000	$p \leq 0.001$
Gamma	0.789		0.000	$p \leq 0.001$

Further to confirmation by the crosstab that human encroachment into the park influence resource degradation, the Pearson Chi-square (76.542) indicates a statistical significance of the association at $p \leq 0.001$, while the Somer'd and Gamma statistics indicates a strong association between the two variables with the human encroachment (independent variable) influencing resources degradation (the dependent variable).

Table: 4.7.2. Human encroachment in park and resource degradation

			Resource degradation				Total
			Not degraded	Moderately degraded	Degraded	Very degraded	
Human encroachment in park	Never	Count	1	3	2	3	9
		%	5.0%	15%	2.4%	3.2%	4.1%
		Residual	0.2	2.2	-1.5	-0.9	
	Most of the times	Count	14	9	21	0	44
		%	70.0%	45%	24.7%	0.0%	20%
		Residual	10.2	5.0	3.9	-19.1	
	Always	Count	5	8	62	92	167
		%	25%	40%	72.9%	96.8%	75.9%
		Residual	-10.4	-7.2	-2.4	20.0	
Total (n)		Count	20	20	85	95	220

As a way of supporting the above findings, correlation analysis was undertaken which showed a statistically significant relationship between human encroachment into the TWNP and resource degradation, with a Pearson correlation coefficient (r) of 0.018, significant at $p \leq 0.05$ level. The Correlation table below presents the results.

Correlations

		Human encroachment dummy variable	Resource degradation dummy variable
Human encroachment dummy variable	Pearson Correlation	1	0.018*
	Sig. (1-tailed)	0.0	0.396
	n	220	220
Resource degradation dummy variable	Pearson Correlation	0.018*	1
	Sig. (1-tailed)	0.396	.
	n	220	220

* Correlation is significant at the 0.05 level (1-tailed).

4.7.3. TESTING HYPOTHESIS THREE

Ho 3: Wildlife dispersal from TWNP, into adjacent areas, do not affect resource availability and interference with communities' social life

The following are frequency distributions of the two variables in the null-hypothesis three:

Independent variable: Wildlife dispersal from TWNP into adjacent areas

	Frequency	Percent	Cumulative Percent
Rarely	1	0.5	0.5
Once in a while	8	3.6	4.1
Often	86	39.1	43.4
Always	125	56.8	100.0
Total	220	100.0	

Dependent variable: Resource availability and community socioeconomics

	Frequency	Percent	Cumulative Percent
Very available	17	7.7	7.7
Available	18	8.2	15.9
Hardly available	70	31.8	47.7
Unavailable	65	29.5	77.3
Very unavailable	50	22.7	100.0
Total	220	100.0	

As indicated in the crosstab Table 4.7.3, the observed frequencies in the cells depart from what were expected, and the null-hypothesis (that the two variables are independent of each other) is rejected. It is therefore concluded that wildlife dispersal from the TWNP into adjacent areas is in fact associated with resource availability and community socioeconomics.

Chi-square statistical tests

Statistic	Value	df	Significant level	P – Level
Pearson Chi-square	47.695	8	0.000	$p \leq 0.001$
Somers' d	-0.156		0.012	$p \leq 0.05$
Gamma	-0.243		0.012	$p \leq 0.05$

Further to confirmation by the crosstab that wildlife dispersal from the TWNP and adjacent areas influence resource availability and community socioeconomics in the TWNP into the adjacent areas, the Pearson Chi-square (47.695) indicates a statistical significance of the association at $p \leq 0.001$, while the Somer'd and Gamma statistics indicates a negative but moderate association between the two variables, meaning that wildlife dispersal from the TWNP into adjacent areas (independent variable) negatively influences resources availability and community socioeconomics (the dependent variable).

Table: 4.7.3. Wildlife dispersal from TWNP into adjacent areas and resource availability and community socioeconomics

			Resource availability and community socioeconomics					Total
			Very available	Available	Hardly available	Unavailable	Very unavailable	
Wildlife dispersal from TWNP into adjacent areas	Rarely	Count	0	0	1	0	0	1
		%	0.0%	0.0%	1.4%	0.0%	0.0%	0.5%
		Residual	-0.1	-0.1	0.7	-0.3	-0.2	
	Once in a while	Count	0	1	2	0	5	8
		%	0.0%	5.6%	2.9%	0.0%	10.2%	3.6%
		Residual	-0.6	0.3	-0.6	-2.4	3.2	
	Often	Count	14	1	15	31	25	86
		%	77.8%	5.6%	21.4%	47.7%	51.0%	39.1%
		Residual	7.3	-6.1	-12.5	5.5	5.8	
	Always	Count	4	16	52	34	19	125
		%	22.2%	88.9%	74.3%	52.3%	38.8%	56.8%
		Residual	-6.6	5.8	12.4	-2.8	-8.7	
Total (n)		Count	18	18	70	65	49	220

As a way of supporting the above findings, correlation analysis was undertaken which also showed a moderate but negative association between wildlife dispersal from the TWNP into adjacent areas and resources availability and community socioeconomics, with a Pearson correlation coefficient (r) of -0.060, significant at $p \leq 0.05$ level. The Correlation table below presents the results.

Correlations

		Wildlife dispersal dummy variable	Resources availability dummy variable
Wildlife dispersal dummy variable	Pearson Correlation	1	-0.060*
	Sig. (1-tailed)	0.0	0.038
	n	219	219
Resources availability dummy variable	Pearson Correlation	-0.060*	1
	Sig. (1-tailed)	0.038	.
	n	219	220

* Correlation is significant at the 0.05 level (1-tailed).

4.7.4. TESTING HYPOTHESIS FOUR

Ho 4: Human-wildlife interactions in the TWNP do not generate both losses and benefits to the local communities and influence their support for conservation

The four variables in this hypothesis are: human-wildlife interactions (independent variable); generated losses by the community (dependent variable); accrued benefits by the community (another dependent variable); and community support for conservation (yet another dependent variable). Associations between the independent variable and each of the dependent variables will be undertaken separately as follow:

(a) Association between human-wildlife interaction (independent variable) and incurred losses (dependent variable)

The following are frequency distributions of the two variables in the first part of the Null-hypothesis four:

Independent variable: Human-wildlife interactions

	Frequency	Percent	Cumulative Percent
Low degree interaction	1	0.5	0.5
Moderate degree interaction	14	6.4	6.8
High degree interaction	48	21.8	28.6
Very high degree interaction	157	71.4	100.0
Total	220	100.0	

Dependent variable: Wildlife losses categories

	Frequency	Percent	Cumulative Percent
No loss	29	13.2	13.6
Little loss	1	0.5	13.7
Moderate loss	3	1.4	15.1
Big loss	10	4.5	19.6
Very big loss	177	80.4	100.0
Total	220	100	

As indicated in the crosstab Table 4.7.4, the observed frequencies in the cells depart from what were expected, and the null-hypothesis is rejected that the two variables are independent of each other. It is therefore concluded that human-wildlife interactions in the park and adjacent areas are in fact associated with incurred losses.

Table: 4.7.4. Human-wildlife interactions and wildlife losses

			Wildlife losses categories					Total
			No loss	Little loss	Moderate loss	Big loss	Very big loss	
Human-wildlife interactions	Low degree interaction	Count	0	0	0	0	1	1
		%	0.0%	0.0%	0.0%	0.0%	0.6%	0.5%
		Residual	-0.1	0.0	0.0	0.0	0.2	
	Moderate degree interaction	Count	0	0	0	2	11	13
		%	0.0%	0.0%	0.0%	20%	6.5%	5.9%
		Residual	-1.8	-0.1	-0.2	1.4	0.6	
	High degree interaction	Count	7	1	0	0	39	47
		%	19.4%	100%	0.0%	0.0%	22.9%	21.4%
		Residual	.6	.8	-0.7	-2.2	1.5	
	Very high degree interaction	Count	29	0	3	8	119	159
		%	80.6%	0.0%	100%	80%	70%	72.3%
		Residual	1.3	-0.7	0.9	0.9	-2.3	
Total (n)		Count	36	1	3	10	170	220

Chi-square statistical tests

Statistic	Value	df	Significant level	P -Level
Pearson Chi-square	12.495	8	0.407	Not significant
Somers' d	-0.058		0.335	Not significant
Gamma	-.159		0.335	Not significant

Further to confirmation by the crosstab that human-wildlife interactions influence incurred losses in the TWNP and the adjacent areas, the Pearson Chi-square (12.495) indicates the statistical insignificance of the association, while the Somer'd and Gamma statistics suggest a negative association between the two variables with the human-wildlife interactions (independent variable) negatively influencing incurred losses (the dependent variable). In other words, the association between human-wildlife interactions and incurred losses is statistically negative but insignificant.

As a way of supporting the above findings, correlation analysis was undertaken which also showed a moderate negative association between human-wildlife interactions in the TWNP and adjacent areas and the incurred losses, with an insignificant Pearson correlation coefficient (r) of -0.105. The Correlation table below presents the results.

Correlations

		Human-wildlife interaction dummy variable	Wildlife losses categories dummy variable
Human-wildlife interaction dummy variable	Pearson Correlation	1	-0.105
	Sig. (1-tailed)	0.0	0.063
	n	220	220
Wildlife losses categories dummy variable	Pearson Correlation	-0.105	1
	Sig. (1-tailed)	0.063	.
	n	220	220

(b) Association between human-wildlife interactions (independent variable) and accrued benefits from the wildlife interactions

The following are frequency distributions of the two variables in the second part of the Null-hypothesis four:

Independent variable: Human-wildlife interactions

	Frequency	Percent	Cumulative Percent
Low degree interaction	1	0.5	0.5
Moderate degree interaction	14	6.4	6.8
High degree interaction	48	21.8	28.6
Very high degree interaction	157	71.4	100.0
Total	220	100.0	

Dependent variable: Benefit from wildlife

	Frequency	Percent	Cumulative Percent
Always	4	1.8	1.8
Most of the times	25	11.4	13.2
Never	191	86.8	100.0
Total	220	100	

As indicated in the crosstab Table 4.7.5, the observed frequencies in the cells depart from what were expected, and the null-hypothesis is rejected that the two variables are independent of each other. It is therefore concluded that human-wildlife interactions in the park and adjacent areas are in fact associated with accrued benefits.

Table: 4.7.5. Human-wildlife interactions & benefit from wildlife

			Benefit from wildlife			Total
			Always	Most of the times	Never	
Human-wildlife interactions	Low degree interaction	Count	0	0	1	1
		%	0.0%	0.0%	0.5%	0.5%
		Residual	0.0	-0.1	0.1	
	Moderate degree interaction	Count	2	4	8	14
		%	40%	16%	4.2%	6.4%
		Residual	1.7	2.4	-4.1	
	High degree interaction	Count	1	6	41	48
		%	20%	24%	21.6%	21.8%
		Residual	0.1	0.5	-0.6	
	Very high degree interaction	Count	2	15	140	157
		%	40%	60%	73.7%	71.4%
		Residual	-1.8	-2.8	4.7	
Total (n)		Count	5	25	190	220

Chi-square statistical tests

Statistic	Value	df	Significant level	P- Level
Pearson Chi-square	18.956	6	0.004	$p \leq 0.01$
Somers' d	0.153		0.043	$p \leq 0.05$
Gamma	0.413		0.043	$p \leq 0.05$

Further to confirmation by the crosstab that human-wildlife interactions influence accrued benefits in the TWNP and the adjacent areas, the Pearson Chi-square (18.956) indicates the statistical significance of the association at $p \leq 0.01$, while the Somer'd and Gamma statistics indicates a moderate association between the two variables with the human-wildlife interactions (independent variable) influencing accrued benefits (the dependent variable).

As a way of supporting the above findings, correlation analysis was undertaken which also showed a moderate association between human-wildlife interactions in the TWNP and adjacent areas and the accrued benefits, with a Pearson correlation coefficient (r) of 0.214, significant at $p \leq 0.001$ level. The Correlation table below presents the results.

Correlations

		Human-wildlife interaction dummy variable	Benefit from wildlife dummy variable
Human-wildlife interaction dummy variable	Pearson Correlation	1	0.214**
	Sig. (1-tailed)	0.0	0.001
	n	220	220
Benefit from wildlife dummy variable	Pearson Correlation	0.214**	1
	Sig. (1-tailed)	0.001	.
	n	220	220

** Correlation is significant at the 0.01 level (1-tailed).

(c) Association between accrued benefits from the wildlife interactions and support for wildlife and conservation

The following are frequency distributions of the two variables in the last part of the Null-hypothesis four:

Independent variable: Benefit from wildlife

	Frequency	Percent	Cumulative Percent
Always	4	1.8	1.8
Most of the times	25	11.4	13.2
Never	191	86.8	100.0
Total	220	100.0	

Dependent variable: Support for wildlife & conservation

	Frequency	Percent	Cumulative Percent
Strongly support	19	8.6	8.6
Support	26	11.8	20.5
Moderately support	61	27.7	48.2
Do not support	114	51.8	100.0
Total	220	100.0	

As indicated in the crosstab Table 4.7.6, the observed frequencies in the cells do not significantly depart from what were expected, and the null-hypothesis (that the two variables are independent of each other) is accepted. It is therefore concluded that accrued benefits from human-wildlife interactions in the park and adjacent areas is in fact not associated with community support to wildlife conservation.

Table: 4.7.6. Benefit from wildlife and Support for wildlife & conservation

			Support for wildlife & conservation				Total
			Strongly support	Support	Moderately support	Do not support	
Benefit from wildlife	Always	Count	0	0	1	3	4
		%	0.0%	0.0%	1.6%	2.7%	1.8%
		Residual	-0.3	-0.5	-0.1	0.9	
	Most of the times	Count	1	3	10	11	25
		%	5%	11.5%	16.4%	9.7%	11.4%
		Residual	-1.2	.0	3.0	-1.9	
	Never	Count	19	23	50	99	191
		%	195%	88.5%	82%	87.6%	86.8
		Residual	1.5	0.4	-2.9	1.0	
Total (n)		Count	20	26	61	113	220

Chi-square statistical tests

Statistic	Value	df	Significant level	P – Level
Pearson Chi-square	3.811	6	0.702	Not significant
Somers' d	-.010		0.843	Not significant
Gamma	-.030		0.843	Not significant

Further to confirmation by the crosstab that benefits accrued from human-wildlife interactions do not influence community support for wildlife and conservation, the Pearson Chi-square (3.811) indicates a statistical insignificance of the association while the Somer'd and Gamma statistics indicates a negative association between the two variables, with human-wildlife interactions (independent variable) not influencing community support for wildlife and conservation (the dependent variable).

As a way of supporting the above findings, correlation analysis was undertaken which also showed a negative association between accrued benefits from wildlife and community support for wildlife and conservation , with an insignificant Pearson correlation coefficient (r) of 3.811. The Correlation table below presents the results.

Correlations

		Benefit from wildlife dummy variable	Support for wildlife & conservation dummy variable
Benefit from wildlife dummy variable	Pearson Correlation	1	0.026
	Sig. (1-tailed)	0.0	0.351
	n	219	219
Support for wildlife & conservation dummy variable	Pearson Correlation	0.026	1
	Sig. (1-tailed)	0.351	.
	n	219	220

4.7.5. SUMMARY CONCLUSIONS OF HYPOTHESES TESTING

The hypotheses tests have concluded that: (1) Livestock incursion into the parks is in fact associated with conflicts; (2) Human encroachment into the parks is in fact associated with resources degradation; (3) Wildlife dispersal from the TWNP into adjacent areas is in fact associated with resource availability and community socioeconomics, but negatively (meaning that wildlife dispersal reduces resources availability and community socioeconomics); (4) Human-wildlife interactions in the park and adjacent areas are in fact not associated with incurred losses, since the relationship is statistically insignificant; (5) human-wildlife interactions in the park and adjacent areas are in fact associated with accrued benefits; but (6) The accrued benefits from human-wildlife interactions in the park and adjacent areas is in fact not associated with community support to wildlife conservation.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. CONCLUSIONS

5.1.1. Respondents' characteristics and land tenure systems on HWCs

This conclusion is arrived at in consideration of the communities' wide distribution in and around the TWNP, their sexes, ages, occupations, educational levels, household sizes, land tenure, land sizes, and types of crops grown as inviting and encouraging human-wildlife conflicts. These are summarised below.

The distribution of the communities in 15 locations in 4 districts implies a considerable coverage of the people around the TWNP, and so a wide spread of the conflicts. Being the major sex group, the male respondents are more involved in exploitation of natural resources for their families' survival and are thus heavily dependent and rely on the park for grazing, game poaching, building materials etc. This exhibits why human-wildlife conflicts in the study area are numerous and probably inevitable.

In respect to age distribution, the majority of the respondents are within active, mature and reproductive age categories, and so create high demands for natural resources for livelihood and survival. The TWNP is therefore a potential source of the resources, and consequent conflicts. However, the average age of the household heads in the study area seems to be decreasing, meaning that younger people will sooner or later head the households in the area. This factor can aid in sensitization of the communities on the benefit of wildlife conservation and enhancement of the resolution of wildlife-human conflicts. The younger generation is more open to change and is more sympathetic to wildlife conservation issues, especially for the fact that the tourism industry opens a lot of opportunities for them. The data also reveal that farming/ranching is the major occupation of the respondents, and it is this group which is linked to human-wildlife conflict especially in the farms whereby wild

animals destroy crops and farm structures resulting to conflicts. The trend also is for the ranchers/farmers livestock venturing into the TWNP, influencing more conflicts.

Respondents' low levels or lack of education is linked with lack of exposure and rigidity to change. Therefore, especially for pastoralists who heavily depend on the park for pastures, it might be very difficult to enlighten them to diversify to other more profitable livelihoods in other sectors of the economy which are not directly linked to natural resources and conflicts. Importantly, poor or lack of education will usually lead to lack of conservation awareness which is necessary for the TWNP wellbeing. The literacy levels remain low in the study area and this will call for increased extension work to educate the communities on wildlife (Berger, 1989), as more formal approach in education may take longer to realise.

With the majority of the households being large sized, there will be a correspondingly high level needs and demands for natural resources that are found in both the family farms/ranches and in the TWNP. The large numbers of people in the households imply greater needs for natural resources, and so the likely impacts on natural resources and associated conflicts.

Land tenure can be associated with the people's degree of concern over the wellbeing and therefore the amount of investment put in for resources conservation. With 87.7% of the households having no title deeds to their lands, the concern and investment in conservation will be minimal, which in turn will influence land degradation, shortage of resources and so conflicts as the need to exploit the TWNP increases. Land tenure regimes have a direct bearing on the management of wildlife (Eriksen *et al,* 1996). The communal land ownership in the form of group ranches (Bekure, *et al,* 1991) allows the movement of wild animals into the area for grazing and also for migration. This situation is changing with the communal areas being subdivided into individual ownership without title deeds, making this provision to be lost to wildlife. As for household land sizes, there is a large variation between the land parcels. However, majority of the households owned land of less than 12 acres, and so need to supplement resources from the TWNP. This will invite competition and associated

conflicts. The household sizes are large and the land sizes are small. These two combined factors tend to have negative impacts to the wildlife conservation practices due to the increased need of the households and the reliance on the Park for their livelihood, creating a strain on the natural resources.

With the majority of respondents being farmers and planting maize, beans and other crops mainly grown for sale, through both rain-fed and irrigation farming, such crops attract wild animals to the farms. Without proper control of the wild animals they will cause havoc and conflicts in the community areas. Thus, the land use system practiced by the communities living around the TWNP and the adjacent private ranches and farms is not compatible with the management of wildlife. The communities practice crop agriculture and livestock keeping on small land sizes which are fenced. These create barriers for wildlife to access their dispersal areas and migratory routes and also end up destroying crops. The conflicts generated by the land use are currently increasing due to the increase in human population and the changing land use systems making the long term viability of the protected area to be questionable. The Global Environmental Fund (GEF, 1992) recommends that there should be a larger area adjacent to the park whose management is compatible with conservation and that can be integrated into park use. This fact has been overlooked in the development of the areas surrounding the conservation areas, the Tsavo West and the Tsavo East National Parks.

Conclusively, the demographic and socioeconomic characteristics of the communities in the study area, and their land tenure systems indicate a growing and mature population with high demand for natural resources from the communities' own areas and from the TWNP. This invites and encourages human-wildlife conflicts.

5.1.2. Livestock incursions into the TWNP

The respondents confessed having taken their livestock into the TWNP, giving four reasons as to why they did so, including the search for grazing and pasture, water, salts and freedom

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from livestock diseases. Livestock traders have also invaded Tsavo conservation area in search of pasture and fattening ground for their livestock. The ranches adjacent to the park acquired diseases free zone status in 2004, when livestock traders including politicians from north eastern Kenya moved in to lease grazing land that had been lying idle for many years (Daily Nation, 2011). Livestock traders use the diseases free zone status of the ranches to fatten cattle for export to the Middle East and Mauritius. The traders have been at loggerheads with KWS over grazing in the national park.

The study revealed that over 50% of the households graze their livestock in the park implying a dependence on the park for pasture. As livestock play significant roles in the pastoral households, majority of the households owned cattle and goats, while a number of them also kept sheep and donkeys in their herds. And since majority of the households are located within a distance of 10 km from the park boundary, which is in close proximity to the park, there is a resultant reliance on park for resources. This state of affair is partly caused by the majority of the households having inadequate grazing in their own ranches and farms, and so they rely on the TWNP for grazing. Majority of the households grazed their livestock in the park during the dry season, with very few grazing in the park during the wet season.

Conclusively, it can be stated that the influx of livestock into the park for grazing and water is a common problem that was identified by the study. The problem is created by the communities as they are keeping many animals in very small pieces of land that they own. This causes them to seek grazing in the protected area. The recommended minimum area for a Tropical Livestock Unit (TLU), which is an animal weighing 250 kg or its equivalent, is estimated to be between 3 and 7 ha (7 and 17 acres) per TLU (Bekure *et al,* 1991). The land area allocated for each animal by the households was calculated by dividing the number of animals owned by the households and the total acreage of land owned by the household. This revealed an average of 2.2 acres (0.891 ha) allocated per animal (cattle), which is very low considering that the recommended one for the area is between 7 and 17 acres (3 to 7 ha) per animal or an average of 12 acres (4.85 ha).

The case is made much more severe by the fact that some households had no land allocated for grazing animals meaning they have to graze in the park to survive. In Taveta and Loitokitok where the land allocated to a TLU cattle was 3 and 4 acres (1.2 and 1.6 ha) respectively the situation was grave. Considering the number of animals owned by the households and the land units they occupy, the land actually allocated per TLU in each homestead is very small and this will lead to overgrazing of the vegetation and degradation of the natural resources both in the community areas and the conservation areas where they go to seek for grazing.

The history of cattle grazing in the park started way back before the conception of TWNP. This is because most the communities adjacent to the park are pastoralist/agro-pastoralist (Maasai, Kamba, Taita, Taveta) and used to graze in the park even before the gazattement of the park. They were displaced and denied access to the park resources. The government should build capacity to the local people on more viable land use practises compatible to wildlife conservation. The influx of livestock from Somalis to the park as alluded by the park authority is becoming a serious challenge.

5.1.3. Human encroachment into the park and its effects on resource degradation

The majority of the communities (91%) living in proximity with the TWNP reported that they enter the park for a number of reasons, which is indicative the communities' reliance on the park for some vital commodities which are deficient on their own areas, including grazing, water, charcoal, building materials, game meat, herbal medicine, wild vegetables/fruits, wood for carving, game trophies, mining/minerals and farm land. The communities ranked grazing, water, charcoal and building materials as the most sought after commodities from the park. While most of the commodities were sought for in the dry season, building materials, herbal medicine and wood for carving were sought for during all the year round by the communities.

Poaching in the park is rampant especially for bush meat. Poachers are reported to intrude from within and from neighbouring countries of Tanzania and as far as Somalia, with the KWS sparing no effort to control the menace. Elephant and Rhino are among the top five wild animals mostly poached, with the others being buffalo, leopard and lion, as they are highly targeted by poachers for their trophies.

The local communities also engage in other illegal activities like logging, charcoal burning, overgrazing, and collection of building material resulting to environmental degradation. Consequently, through such illegal activities significant amount of biodiversity is lost and through clearance of vegetation, environmental degradation ensues, which in turn generates competition for the diminishing resources and so human-wildlife conflicts.

A number of arrests resulting from engagement in illegal activities are reported, which unfortunately end up with lenient court sentences, and which the culprits do not fear, and so continue to contribute heavily towards environmental destruction through the illegal activities. The lenient sentencing provided by Kenya Wildlife Act Cap 376 laws of Kenya pose a create challenge in conserving Kenyans national heritage. One of the reasons cited by experts for failure to eradicate poaching in Kenya is weak penalties meted on offenders. A person caught with ivory can be fined Ksh 10,000 while in some countries, the same offence leads to a life sentence (The Standard, 2011). Poachers kill wild animals and get very lenient sentencing which is not commensurate with the damage cost. A Nairobi court fined a tourist arrested at Jomo Kenyatta Airport with 15 elephant tusks without a licence worth Ksh 1 million only a total of Ksh 50,000 or serves eight months imprisonment (Daily Nation, 2010).

With regard to the people that settled within the surrounding areas of the TWNP, majority of them settled within the period of 1980-1982. These were people seeking land for cultivation and this can be confirmed in the 1982 Development Plan where it was noted that the population density was increasing and the land use system was changing from livestock keeping what used to exist in the area to crop farming. This development has a negative

impact on wildlife conservation as it reduces the wildlife dispersal area and the humans also tend to encroach into the park in search of resources such as firewood, building materials, pasture and charcoal which are detrimental to the conservation of the park. Killing of wild animals for bush meat and trophy poaching are also main threats.

The creation of parks especially the Tsavo and the Chyulu National Parks in what was then public lands, reduced the dry season grazing areas of the Kamba and Maasai communities who used the areas for grazing their animals (Eriksen, 1996). This caused antagonism while decline in the communities' access to resources tends to cause the communities to still frequent the protected areas, resulting to human-wildlife conflicts.

5.1.4. Wildlife dispersal to community areas

Almost all of the respondents confirmed that wild animals do invade their farms, implying that the wild animals disperse in all directions of the adjacent lands owned by communities, resulting to human-wildlife conflicts. Such conflicts are mostly concentrated in the hotspots, adjacent to the TWNP, where most of the conflicts occur in the study areas. These include areas of Mtito Andei, Iltilal, Ziwani, Jipe, Mbulia, Oza and Maktau.

It is well known that wildlife is supposed to be confined in designated and protected areas (the national parks and game reserves) in Kenya, a large proportion (up to 90%) of the wildlife live outside the designated areas (Mwanjala, 2005; Nyamwaro *et al*, 2006; Parker, 2003).Wildlife dispersal from TWNP into adjacent areas directly affects crops, livestock and social life of the communities. The majority of the households (99%) confirmed that wild animals move to their farms.

Twelve different types of wild animals were reported to have invaded the communities' farms, with the baboons, monkeys, buffaloes, elephants, hyenas, and lions mentioned most by the farmers. Statistics on the invasion indicate the magnitude of the wildlife destruction

of the farmers' crops and predation of their livestock, throughout the year and during the dry seasons.

The animals invade the farms in search for food, water, breeding, shade, migration and salts, with the food mentioned by most households as the reason why wild animals move out of the park and invade the farms. In the process preying on livestock and damaging crops and plants, killing humans, destroying infrastructure, and enhancing spread of disease-causing organisms (such as tsetse flies and trypanosomes) to livestock (Kwayera, 2003; Nyamwaro *et al*, 2006). They also interfer movement of people especially school going children. No compensation is made by the government for property damage and compensation for human death and injury is very inadequate. These makes the local community to embrass wildlife with hostility. The local people were not oblivious to the value of wildlife as, the problems posed by wildlife tended to obscure related benefits to the communities in the study area. This suggested to an almost unanimous view from respondents that wild animals provided no benefits but destruction to the people.

Maize, being one of the major crops grown in the farms adjacent to the TWNP is most affected by the wild animals' invasion. As is the case in other areas of Kenya, most of crop raiding incidents involve elephants. Wild animals diperse from the park in search of food, water, breeding, shade, migration and salt. Conversion of wild animals' habitats to other uses threatens the future of wild animals. The rise in human population and the consequent increased production of food in the areas adjacent to the parks has been found to be an ecological constraint, especially in matters of human-wildlife interactions.

The wild animals were found to always visit the farms in the dry season and rarely in the wet season, when they move back to the park. However, the majority of the wild animals do once in a while frequent the farms all year round.

Wild animals (both herbivores and carnivores) tend to leave the park and enter the surrounding areas causing damages to the communities. The problem was reported by almost all of the respondents indicating its grave seriousness. According to a KWS (1994) report most wildlife attacks on humans in Kenya appear to be perpetrated (in order of importance) by elephants, buffalos, lions, and occasionally by leopards, hippos and crocodiles. In the TWNP areas, eight human-wildlife conflict hotspots have been identified.

It can be clearly seen that the conflicts tend to take place outside the parks in areas where the communities live, and farm and also the problem tends to occur in all the corners surrounding the park. The problem is more common during the dry season, when many animal species are recorded to move into the farms. The herbivores, specifically the elephants and baboons tend to cause more problems and tend to become endemic in the area, causing havoc on the irrigated crops throughout the year. Consequently, the residents have come up with ways of discouraging the wildlife from invading the crop areas such as erecting electric fencing. This causes conflicts as the wildlife areas are reduced in size. The Maasai pastoralists are totally against fencing off the park because it will deter them from assessing pastures in there. Complaints of crop damage in the wildlife dispersal areas surrounding the TWNP is also a reflection of the changes in socioeconomic activities of the Maasai people who were previously more associated with pastoralism (Chiemelu, 2004) but are now adopting crop farming.

Further, human-wildlife conflicts which is a function of human population increase and encroachment to protected areas, arises from conflicts between human and wildlife needs. Incidences of these conflicts are now considered the biggest threat to protected areas in Kenya (KWS, 1994). Any action such as controlling problem animals as well as reconsidering compensation to property as well as increasing compensation amounts would reduce negative attitudes to protected areas (Sindiga, 1995, Seno & Shaw, 2001).

5.1.5. Losses incurred and benefits received by communities due to human-wildlife interactions

The two general categories of losses incurred by the communities resulting from human-wildlife interactions are the farm produce and general crop destruction which was the more common, than the livestock-related loss. The total of the losses represents an enormous damage to the communities adjacent to park, which induces community retaliation against the wildlife and so human-wildlife conflicts.

A number of people and livestock have been reported killed or injured by wildlife. The financial costs incurred by the communities for wildlife damages are high and burdening especially in consideration of the households' low socioeconomic statuses. They consider the amounts offered for compensation to be very little relative to the degree of damages caused. In anyway, the compensation is hardly paid, and when it is, it comes very late. With unfavourable returns and benefits from living with and in some cases hosting the wildlife, the communities are bitter and have developed poor attitudes towards wildlife and so disregard and downplay conservation efforts. To win community support in wildlife conservation the park authority should initiate more community programmes. Wildlife related activities (e.g. tourism, ecotourism, controlled hunting, culling and marketing of wildlife products) should become accepted land use practices (Nyamwaro *et al*, 2006; Okech, 2005).

The four types of wildlife benefits reported received by the households included: assistance through school bursaries, community development interventions and projects, benefits disbursed through the county councils, and benefits offered by conservancies run by NGOs and local groups. Benefits received through community development projects were reported by only 10 % of the respondents. However, the benefits were considered to be inadequate and not substantial. This again, has negative implications and attitudes of the communities affected by the wildlife menace towards conservation of the wild animals.

The types of benefits the communities would prefer so as to enhance and sustain their appreciation and support for wildlife conservation efforts, included, in the following order of preference: provision of school bursaries; appropriate and fair compensation rates and quick processing; enhanced awareness creation of wildlife values and conservation efforts; drilling and provision of boreholes for wildlife and livestock water; and improvement of health facilities in the affected areas.

Direct conflicts between wildlife and agro-pastoral communities have manifested themselves in damage to structures (e.g. fences, watering points, and homesteads), and in human and livestock injuries and deaths (Manundu, 1997; Peperkamp, 1986). Thus, the community losses incurred through interactions and consequent conflicts with wildlife can be summarized as loss of livestock, loss of farm crops, damages to structures, injuries to humans and to a small extent loss of human life.

Crop damage not only affects a farmer's ability to feed his family, it also reduces cash income and has repercussions on health, nutrition, education and ultimately, development. Finances are thus diverted from these social services to staple food. Nuisance encounters with wild animals, exposure to diseases, physical injury or even death caused by wild animals' attacks have high financial costs for individuals and society in the form of medical treatments. The surveillance of the fields at night results in a higher exposure to malaria (WWF SARPO, 2005).

Amended wildlife act of 1989 removed compensation of property due to previous misuse. According to KWS (2007), wildlife-caused human death and injury, is currently compensated at Ksh 50,000 and Ksh 200,000 respectively, an amount that cannot help families who may have lost their sole family income earner. However, compensation is viewed as a treatment of the symptoms but not as a cure to human-wildlife conflicts which still persist (Ngure 1995, Tchamba 1995, Hoare 2000). The compensation process is cumbersome and takes long to be paid. The communities adjacent to conservation areas have often expected relief from costs associated with living with the wildlife through

adequate and prompt compensation (Chiemelu, 2004). These losses tend to make the communities not to appreciate and be sympathetic to wildlife and wildlife issues. There are reports of people killing wild animals (KWS, 2007) in retaliation, and many reports of wild animals hunting.

Compensating landowners for wildlife-related damages has become such an issue that many studies have called for adoption of a comprehensive compensation scheme as part of a conflict management strategy for wildlife areas (Hulme & Murphree 2001; Infield 2001; Kiss 1990; KWS 1991, 1994; Lewis & Carter 1993; Murombedzi 1999; Rutagarama & Martin 2006). Similarly, Chiemelu, (2004) and Okech, (2005) have also advocated for formulation and implementation of community friendly policies to revert conflicts to cooperation.

It is a big anomaly that communities are not receiving any tangible benefits from wildlife, especially in consideration of the fact that the KWS policy has been to share the benefits of wildlife with the communities, as a way of encouraging them to embrace wildlife conservation efforts and in the process reduce costs on law enforcements (Western, 1982 and 1989).

Although majority of the households mentioned school bursary as the type of benefits they would prefer to receive from living and interacting with wildlife, effective implementation of community developmental projects can be a promising way that has the potential to realise substantial biodiversity conservation benefits (Newmark & Hough 2000). Infield (2001) noted that, although initiatives to encourage and partner with rural people in biodiversity conservation have received wide support, they have largely remained ignored in practice.

The KWS in 1991 came up with a policy of giving 25 % of the revenues collected from park gate fees to communities living in wildlife dispersal areas (Bensted-Smith, 1992; KWS, 1991). This policy was later on not implemented. The money was meant to cater for damages inflicted to the communities by wildlife and to encourage them to conserve and protect the animals within their areas. In 1993 the KWS created the Wildlife for Development Fund (WDF) to administer this revenue sharing, (KWS, 1994). The WDF has provided support to community projects (like in Kimana in south Kajiado) that are directly related to wildlife enterprises. Though one of the reasons of this fund is to share benefits with the communities (KWS, 1991), the KWS hopes to have the communities share in the wildlife conservation efforts (Western, 1982), which is an idea not fully bought by the communities. For the communities to be involved in wildlife conservation efforts, there is need to find ways of providing direct services to the communities (Berber, *et al,* 1996) in the form of mutual agreements (accepted by both parties). The services that the community and the park can mutually share are the grazing resources and water and in return the communities can provide protection to the wildlife within their localities. However, such arrangements need to be planned and agreed upon.

Development projects, which include building dispensaries, water projects, cattle dips and roads, and which the KWS Wildlife Partnerships Department has been introducing to local people as inducements to value wildlife (KWS 2007), may not be a popular option to local people. This could be due to several reasons, including the fact that (1) development projects are regarded as government endeavours that would still be implemented in given time; (2) the priorities of development projects are biased and favoured by both KWS and local elites that may not always reflect the wishes and priorities of the majority of landowners; and (3) involvement of a few local politicians who are not transparent and accountable to the communities is not helpful.

A major benefit attributed to compensation programmes is that they may increase tolerance of wildlife and promote more positive attitudes and support for conservation among people who live closest to endangered and dangerous animals (Wagner et al. 1997). Timely

payment can help victims to get over their anger, and may reduce their incentives to retaliate against the animals that caused the damage, or to complain to neighbours or the media. Programmes self-reported to be effective (Nyhus et al., 2003) typically compensate quickly following verification, and strive to provide a transparent and fair claims process. A transparent process can be vital to avoid abuse, such as when a few individuals manipulate the system (Sillero-Zubiri & Laurenson, 2001), and insufficient information about a programme can lead to frustration among participants (Wagner et al., 1997). Sarkar (1999) observes that lack of involvement of local communities in wildlife conservation as well as providing them with economic interest in resource conservation will be reason enough for their continued indifference to poaching and bush meat trade, or concern for the plight of wildlife migration corridors and dispersal areas.

5.1.6. Communities' suggestion on measures used in curbing human-wildlife conflicts and their effectiveness

Respondents listed types of measures currently applied to curb livestock incursion into the TWNP, including: provision of wildlife education and awareness; making arrests by law enforcement staff and court sentences; establishing fences to control animal movement; and enforcement of park boundaries.

Communities perceive provision of wildlife education and awareness as the most effective measure applied for curbing livestock incursion into the park, followed by arrests made by law enforcement staff and court sentences. The other two measures are also rated as being between very effective and moderately effective by a slight majority of the communities. The measures are already being implemented by the park authorities, but need reinforcement. Crop farmers support and endorse enforcement of boundaries and fences while the livestock herders are totally opposed to them.

Human encroachment into the park is mainly for indulgence in illegal activities, including poaching, tree logging, charcoal burning, etc, all of which are unsupportive on conservation and are in fact environmental unfriendly. Community perceptions of the effectiveness of the

various measures used to curb human encroachment into the park, suggest that the most effective is the arrests of the culprits by law enforcing agents and associated court sentencing. Thus, while humans are not deterred by enforcement of park boundaries and fences, provision of wildlife education and awareness is perceive to be effective to some extent in controlling human encroachment into the park.

Ten methods that communities use to protect their households and farms from wildlife invasion include, in order of popularity: reporting the cases to KWS, keeping vigil and chase the invading animals, making noise with metal objects to scare away the animals, staying put and doing nothing, erecting scarecrows to scare the animals, killing the invading animals, lighting fires to keep the animals at bay, reporting the case to the Administration Chief, building trenches to keep the animals at bay and building livestock enclosures to protect their livestock from the animals. Incidentally, few households sit back and do nothing about such invasions, as a sign of frustration and having no power or capacity to do anything. Fewer households opt to kill the invading animals out of annoyance, frustration and vengeance, and usually kill the predators such as hyenas, leopards, mongoose and baboons.

Communities' rating of the effectiveness of the methods used to curb or reduce human-wildlife conflicts in general, indicates that increased fencing is considered the most effective method used to curb or reduce human-wildlife conflicts in the study areas. This is followed by: control of wildlife by the KWS, creation and provision of wildlife education and awareness, use of livestock enclosures, animal translocation into the park, eliminating rogue animals, guarding own properties, building trenches, use of traditional methods and relying on community social responsibility to curb or reduce human-wildlife conflicts in general. From the community perspective, the measures are adequately effective, and yet the human-wildlife conflicts are still prevalent in the study area. Thus, there is need for new ideas to come up as ways to curb and/or reduce the conflicts.

While the majority of the famers use the method of "reporting to KWS officials" as the one of the methods of controlling human-wildlife conflicts, this can be less effective especially in community areas where the KWS offices are located away. It also shows lack of initiative and involvement by the farmers in mediating the problem. Thus the solution to the problem to be one sided. Many other farmers use the "making of noises with metal objects, and "keeping vigil and chasing the animals". Few of them opt to do nothing and others to erected scarecrows. These methods tend to be less effective compared to those recommended by the UNDP/FAO, which include pepper spray, guard, and bobbie trapping food with snakes (Daily Nation, 2010).

Many farmers and livestock herders use the method of killing when dealing with predators such as lions, hyenas, leopards, mongoose and also when controlling baboon menace. This is illegal according to Kenya Wildlife Act Cap 378 laws of Kenya and in terms of wildlife conservation it affects the wildlife numbers and also the conservation efforts.

The farmer's perceptions on the effectiveness of the different wild animal control measures vary with the type of animal species that causes problems to the community farms. The main species that cause the most problem are identified as the elephants and the baboons. These two animal species have different methods that the communities reported as being effective in their control. This means for the same farm more than one method may need to be used making the control of the animals to be difficult, cumbersome and expensive.

The community perception of the effectiveness of the different methods in controlling specific animal species and the actual methods used seem to be inconsistent. For instance, the communities believed that electric fencing was effective in controlling wildlife movements but none of the farmers mentioned to be using it as an animal control measure. On the other hand, fencing a protected area is costly and is also not a good choice due to some ecological reasons. The fencing of the park also creates some conflict of interest i.e. the farmers are for it while the pastoral communities are against it because it will deny them access to the park for grazing.

5.1.7. Attributes to conflicts in TWNP and adjacent areas

Establishment of national parks during and after the colonial period has contributed conflict between the National parks/Reserves and the adjacent communities. Land alienated for the creation of National Parks was forcefully taken from local people without compensation or relocation plans. Ownership of such land is vested in the State as natural reserves or Local authorities as Trust Land. Many affected communities remain squatters following evictions to create national parks and reserves. So the local communities were displaced and prevented from using park resources leading to their resentment. They were deprived their livelihood. The local communities are excluded in any decision making regarding park management (Mwale, 2000). The gazettement of TWNP in 1948 was made without sufficient consultation of the adjacent communities and without or no adequate compensation for displaced households. This has resulted to continuous conflict between the park and the local communities. At Kamnarok national reserve in Baringo County gazetted in 1984, the local community still reside inside the reserve despite several attempts by the government to remove them because they were not properly consulted. At Kyulu of Makueni County, squatters are living with no alternative livelihoods, proper shelter or land to till for food after being evicted from Chyulu hills national park.

The population density in the study area has tremendously increased and land use system changing from livestock keeping to farming has escalated human-wildlife conflicts. Land use system in the study area range from; households owned land without having title deeds, communal, land with title deeds, borrowed the land, leased the land and squatters. Majority of the households (52.7%) owned land without title deeds.

Majority of the households (73.2 %) also are located within a distance of 10 km from the park boundary. Land in close proximity to protected areas where necessary an environmental impact assessment needs to be conducted if that land, is indeed required for the continued existence of wildlife. Those bordering the Park their land might not be beneficial for other economic purpose but for conservation. Where alternative land and incentives are available, relocation of local communities to areas offering better access to

natural resources and socio-economic opportunities can be an adequate solution to HWCs (Madhusudan, 2003). In fact, resettlement schemes aiming to prevent the overlap between wildlife and people, can be successful in the long run if some essential assumptions are met: first the local people should gain substantial benefits, such as better access to resources, secondly they should be relocated to an area where the risk of losing property is lower and thirdly they should not face any political, social or cultural opposition (Treves and Karanth, 2003b).

5.2. RECOMMENDATIONS

- To minimize the conflicts arising from the illegal grazing within the TWNP the stakeholders should encourage and support local communities to make transition from pastoralism to sedentary agro-pastoralism, which implies keeping fewer herds of livestock (cattle, sheep, goats and donkeys). This will require diversifying economic activities investing in ecotourism to provide alternative sources of livelihood for the communities, and to make them benefit from wildlife resources.

- Group ranches should develop management plans in order to enhance good management systems. Most of the group ranches in the study area were poorly managed and did not have management plans to guide their operations.

- The community should be sensitised on the use of alternative source of fuel, building materials and livelihoods in order to reduce environmental degradation. Planting trees especially on farm land should be encouraged to mitigate against climate change as well as sources of wood, wood products and food.

- Enact a land use policy that recognises various development activities and wildlife as an important form of land use. This will provide clear zonation, setting aside areas for human settlement and agriculture that are far removed from dangerous wildlife.

- There is need to promote viable alternative income generation using ecologically viable agricultural so as to increase productivity through increasing yield per unit area, rather than increasing acreage of arable land; and farming of useful animals and plant species that will enhance soil productivity.

- The local communities should be incorporated in the management of the national parks. Whereas the forest Act 2005 laws of Kenya allows community participation in conservation, the Wildlife Act does not. (Forest Act, 2005, Wildlife Act, Cap 376 Laws of Kenya)

- Set up an insurance scheme for compensation of crops and livestock. Shorten the time taken to process the claims to no more than six months.

- Provision of water in the park and outside. This will reduce conflict by containing wildlife inside the park and the same time curb livestock from coming to the park in search of water. These can be done by construction of earth dams and boreholes.

- Policies of making local people feel that they also own wildlife need to be developed. Community conservation programmes need to be emphasised and encouraged. The capacity of communities that live in proximity to wildlife also need to be developed and continually strengthened and appropriate measures taken to market community based enterprises so that people benefit from wildlife.

- Promote public education and awareness programmes on the values of wildlife to cultivate a culture of public responsibility towards conservation and protection. It is also important that the level of awareness on the part of the local communities on how to implement the various designs of conservation projects to be enhanced. Education and training activities at different levels, for instance in schools or in public barazas, would have the objective of disseminating innovative techniques, building local capacity in conflict resolution and increasing public understanding of HWCs. Educating rural villagers in practical skills would help them to deal with

dangerous wild animal species and to acquire and develop new tools for defending their crops and livestock.

- There is need to develop policy that integrates traditional ecological knowledge, innovations, and practices of indigenous communities embodying traditional styles that are relevant to conservation. Further, traditional cultural practices such as self imposed hunting restrictions, lineal ownership of land, taboos on hunting, protection of wilderness and conservation areas for special reasons such as places of worship that are compatible with wildlife conservation to be encouraged. The management of wildlife is participatory and local people need to be involved in decision making and planning processes.

- The most sensible approach to addressing HWCs is to implement a combination of different approaches: short-term mitigation tools along with long-term preventative strategies, so as to reduce the problems while fostering the rapid development and use of innovative approaches to address future issues and eradicate the HWCs. When traditional deterrents are not successful, some invasive approaches, such as regulated harvest, wildlife translocation or human relocation, electric fence, control by KWS personnel, may need to be emphasized.

- Kenya Wildlife Act needs to be reviewed in order to address adequately HWCs especially on compensation due to game damage and also enhance fines imposed on those dealing in poaching and trafficking in game trophies.

5.3. FURTHER RESEARCH

1) Assess the impact and the effectiveness of the fencing in curbing human-wildlife conflict.

2) Seasonal movement of wildlife should be studied and mapped.

3) Proper stocking rate/carrying capacities of group ranches and individual parcels adjacent to the TWNP needs to be assessed and documented in line with the present range condition.

4) Periodic review of wildlife biomass in relation to the park food resource base and determine the need for occasional wildlife cropping and relocation.

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APPENDICES

APPENDIX I: LIST OF KEY INFORMANTS MET DURING THE VISITS

SERIAL No.	NAME	INSTITUTION	RANK
1	Nyamongo Nyabero	Provincial Administration, Makindu	District Commissioner
2	Mike Kimoko	Provincial Administration, Kibwezi	District Commissioner
3	Ms. Shufaa O. Mwijuma	Provincial Administration, Mwatate	District Commissioner
4	Nkaduda Hiribae	Provincial Administration, Taveta	District Commissioner
5	Muzne A. Abdullatif	Provincial Administration, Wundanyi	Senior DO 1
6	George M. Kamwero	Provincial Administration, Voi	DO 1
7	Paul M. Mwangi	Provincial Administration, Makindu	District Officer
8	Anderson Kitheme	- do -	Chief, Makindu
9	Peter Kengia	Provincial Administration, Taveta	Chief, Nakruto
10	Josephat A. Kibanda	Provincial Administration, Taveta	Chief,Mata
11	Justin Kamiri Mehili	Provincial Administration, Taveta	Asst. Chief, Chala
12	Kimario Ngelesani Mbagga	Provincial Administration, Taveta	Asst. Chief, Kidon'gu

13	Michael Benedict Mrisha	Provincial Administration, Taveta	Asst. Chief, Mahandakini
14	Jonathan N. Kirui	Kenya Wildlife Service, Tsavo Conservation Area (TCA)	Assistant Director
15	Daniel F. Woodley	Kenya Wildlife Service, Komboyo Headquarters	Senior Warden
16	Gabriel Kiio	Kenya Wildlife Service, Taita	District Warden
17	Ms. Constance Mwasho	Kenya Wildlife Service, Southern Sector, Tsavo West N. Park	Warden i/c
18	Ms. Rose A. Malenya	Kenya Wildlife Service, Tsavo West National Park, Komboyo Headquarters	Warden Community Service and Education
18	John M. Kaariuki	Kenya Wildlife Service, Tsavo West National Park, Komboyo Headquarters	Research Scientist
19	Cplr. Adan Sheikh	Kenya Wildlife Service, Bura Station (Tsavo East N.Park)	I/c Bura Station
20	Kiptoo Lang'at	Kenya Wildlife Service, Bura Station (Tsavo East N.Park)	Ranger, Bura Station
21	Lerapo Iltuken	Kenya Wildlife Service	Ranger
22	Angaine Kipambi	Kenya Wildlife Service	Fence Attendant
23	Kasiana Acheche	Kenya Wildlife Service	Fence Attendant

24	Ladan M. Muvea	Ministry of Education, Makindu	DQA&SO
25	Kilonga Nyamai	- do -	Z-QA&SO
26	Roba A. Sereka	Ministry of Education, Kibwezi	DEO
27	George Owuoche	Ministry of Education, Taveta	DEO
28	Samuel M. Nyantika	Ministry of Education, Taita	DEO
29	Gibrael M. Malusha	Ministry of Education, Voi	AEO
30	Mr. Mjomba	Ministry of Education, Wundanyi	SQA&SO
31	Nyaberi Robert Manyange	Ministry of Education, Mwatate	DQA&SO
32	Franklin K. Muriithi	Ministry of Education, Voi	DQA&SO
33	Michael M. Wangai	Ministry of Education, Mwatate	QA&SO
34	Martin Oyindo	Ministry of Livestock, Mwatate	District Livestock Production Officer
35	Oliver Mnyambo	Sarova Taita Hills Game Lodge	Senior Warden
36	Jonathan W. Mutua	Kidon'gu Conservation	Chairman
37	Moses Mulaki Munyao	Kidon'gu Conservation	Secretary
38	Isaac Mutua	Kidon'gu Conservation	WSPA Liaison

39	Miriam Njeri Kamau	Kidon'gu Conservation	Caretaker, Education Centre
40	Mr. Orukung'u	Local community	Livestock herder
41	Mr. Reuben Kipampi Tiges	Local community	Villager
42	Muhidin Musa	Local community	Villager
43	Matano Muhuhi Mwandware	Local community	Villager

APPENDIX II: SURVEY QUESTIONNAIRE

Questionnaire **Serial No** _____

Interviewer's name _____

We are currently carrying out a survey in households regarding the relationship between Tsavo West National Park (TWNP) and the surrounding communities. I would therefore ask you a few questions. The information that you give me is strictly confidential.

A. Demographic information and household characteristics

1. District_____Division_____Location_____

2. Name of settlement ☐Mtito-Andei ☐Taita ☐Taveta ☐Kuku/Rombo

3. Ethnicity ☐Maasai ☐Kamba ☐Taita ☐Taveta ☐Other, specify

4. Sex ☐Male ☐Female

5. Age_____ years

6. Main occupation ☐Teacher ☐Politician ☐Farmer ☐Business person ☐Religious leader ☐other, specify

7. Highest education level ☐None ☐Adult education ☐Primary ☐Secondary ☐middle level college ☐University

8. Type of production system practised by household ☐Pastoralism ☐Agropastoralist ☐Farmer

9. How much income does this household get per month? K shs _____

10. Duration of household stay in named location _____years

11. Distance of the household to the TWNP boundary _____KMs

B. Socioeconomic status

12. Description of main dwelling house: ☐Temporary ☐Semi-permanent ☐Permanent

13. Do you own this land ☐Yes ☐No

14. When was the land acquired? _____

15. Under what types of land tenure do you hold land?

☐Squatter ☐Borrowed ☐Leased
☐Communal ☐Own without title deed ☐Own with title deed

16. How much land do you have as specified above _____acres

17. What are your main land use activities in order of important?

a)_____ d)_____

b)_____ e)_____

c)_____f)_____

18. How much land is used for cultivation? _____ Acres

19. What crops do you mainly grow on your farm?

a)_____
d)_____

b)_____
e)_____

c)_____
f)_____

20. How much land do you use for your grazing? _____Acres

21. Is the land adequate for your herd size? ☐Yes ☐No

22. Number of livestock on the individual holding

1. Cattle _____ 2 Goats_____ 3 Sheep_____

4. Donkeys_____ 5 Others_____

23. What type of livestock grazing do you mostly practise?

☐Transhumant (seasonal change of grazing land) ☐Sedentary (no migration) ☐Nomadic (moving from one place to another in search of pasture)

24. How much annual income does this household get from the following sources?

Source	**KShs**
a. Farming	_____
b. Livestock	_____
c. Trade	_____
d. Others specify	_____
Total	_____

25. Since you came to settle here what is the trend of your income

☐Very stable ☐Moderately stable ☐Stable ☐Unstable ☐Very unstable

26. What are the reasons for the above trend?

_____

_____

C. Livestock incursion into the park and other Ranches/Farms

27. Are livestock grazed inside TWNP? ☐Yes ☐No

28. If yes, what are the types of livestock grazed into the park seasonally?

No	Livestock type	Season
1	Cattle	
2	Sheep	

3	Goats	
4	Donkeys	
5	Others	

Response for season
1: Wet season
2: Dry season
3: All year round
4: N/A

29. How often are you forced to graze livestock inside TWNP each season?

	Always	**Often**	**Once in a while**	**Rarely**	**Very rarely**	**Never**
Wet season						
Dry season						
All year round						

30. When do you graze in the park? ☐During the day ☐at night ☐both day & night

31. What are the commodities and/or resources sought inside the park?

☐Pasture ☐Water ☐Salt ☐Other, specify

32. How deficient are the commodities/resources for livestock in your own areas each season?

	Very much	**Much**	**Moderate**	**Not deficient**
Wet season				
Dry season				
All year round				

33. What are other reasons for livestock incursion inside the park?

_____

_____

34. How effective are the following mechanisms in curbing livestock incursion in the park?

	Very effective	**Effective**	**Fairly effective**	**Not effective**	**Remarks**
Park boundary					
Arrests by Law enforcing					

agent					
Fines/sentencing by courts					
Fences					
Education creation & Awareness					
Other, specify					

35. In your opinion, what mechanisms do you think would practically resolve livestock incursion in TWNP?

_____

_____

36. Are livestock grazed in other wildlife sanctuaries, ranches and private farms adjacent to TWNP? ☐Yes ☐No

37. If yes, please specify which; Sanctuaries_____ ranches_____ private farms_____

38. What are the types of livestock graze seasonally?

No	**Livestock type**	**Season**
1	Cattle	
2	Sheep	
3	Goats	
4	Donkeys	
5	Others , specify	

Response for season
1: Wet season
2: Dry season
3: All year round
4 N/A

39. How often are you forced to graze livestock into wildlife sanctuaries, ranches and private farms adjacent to TWNP during each season?

	Always	**Often**	**Once in a while**	**Rarely**	**Very rarely**	**Never**
Wet season						
Dry season						
All year round						

40. When do you graze in the other wildlife sanctuaries, ranches and private farms adjacent to TWNP? ☐During the day ☐at night ☐both day & night

41. What are the commodities and/or resources sought in other wildlife sanctuaries, ranches and private farms adjacent to TWNP?

☐Pasture ☐Water ☐Salt ☐Other specify

42. What are other reasons for livestock incursion in other wildlife sanctuaries, ranches and private farms adjacent to TWNP?

_____

_____

43. How effective are the following mechanisms in curbing the livestock incursion in other wildlife sanctuaries, ranches and private farms adjacent to TWNP?

	Very effective	**Effective**	**Fairly effective**	**Not effective**	**Remarks**
Park boundary					
Arrests by Law enforcing agent					
Fines/sentencing by courts					
Fences					
Education creation & Awareness					
Other, specify					

D. Human encroachments into TWNP

44. Do people encroach in TWNP? ☐ Yes ☐ No

45. How often does encroachment occur in the park during each season?

	Always	**Often**	**Once in a while**	**Rarely**	**Very rarely**	**Never**
Wet season						
Dry season						

All year round						

46. What are commodities and/or resources sought in the park?

Resources	Season
Water	
Charcoal	
Herbal medicine	
Wild vegetables/fruits	
Farm land	
Grazing	
Wood for curving	
Minerals (mining)	
Building materials	
Game meat	
Game Trophies	
Other, specify	

Response for season
1: Wet season
2: Dry season
3: All year round
4 N/A

47. Other reason for human encroachments in the park?

_____

_____

48. How deficient are the above commodities/resources in your own areas during each season?

	Very much	Much	Moderate	Not deficient
Wet season				
Dry season				
All year round				

49. How effective are the following mechanisms in curbing the encroachments in the park?

	Very effective	**Effective**	**Fairly effective**	**Not effective**	**Remarks**
Park boundary					
Arrests by Law enforcing agent					
Fines/sentencing by courts					
Fences					
Education creation & Awareness					
Other, specify					

50. In your opinion, what mechanisms do you think would practically resolve human encroachments in TWNP?

_____

_____

51. Do people encroach in other wildlife sanctuaries, ranches and private farms adjacent to TWNP? ☐ Yes ☐ No

52. If yes, please specify which; Sanctuaries_____ ranches_____ private farms_____

53. How often does encroachment occur in other wildlife sanctuaries, ranches and private farms adjacent to TWNP during which season?

	Always	**Often**	**Once in a while**	**Rarely**	**Very rarely**	**Never**
Wet season						
Dry season						
All year round						

54. What are commodities and/or resources sought in other wildlife sanctuaries, ranches and private farms adjacent to TWNP?

Resources	Season
Water	
Charcoal	
Herbal medicine	
Wild vegetables/fruits	
Farm land	
Grazing	
Wood for curving	
Minerals (mining)	
Building materials	
Game meat	
Game Trophies	
Other, specify	

Response for season
1: Wet season
2: Dry season
3: All year round
4 N/A

55. Other reasons for encroachments in other wildlife sanctuaries, ranches and private farms adjacent to TWNP?

_____

_____

56. What mechanisms were in place to curb the encroachments and their effectiveness in other wildlife sanctuaries, ranches and private farms adjacent to TWNP?

	Very effective	Effective	Fairly effective	Not effective	Remarks
Park boundary					
Arrests by Law enforcing agent					
Fines/sentencing by courts					
Fences					

Education creation & Awareness					
Other, specify					

E. Wildlife dispersal from TWNP

57. Do wild animals come into your farm? ☐ Yes ☐ No

58. What are the types of wild animals that mostly come into your farm each season?

Wild animal	Season
Elephant	
Buffalo	
Lion	
Hyena	
Leopard	
Genet	
Mongoose	
Wild pig	
Wildebeest	
Baboon	
Monkey	
Porcupine	
Other, specify	

Response for season
1: Wet season
2: Dry season
3: All year round
4 N/A

59. How often does wild animals' dispersal occur outside the park each season?

	Always	Often	Once in a while	Rarely	Very rarely	Never
Wet season						
Dry season						
All year round						

60. What are the commodities and/or resources sought?

☐Food ☐water ☐salts ☐others specify

61. How deficient are the above commodities/resources in the Park?

	Very much	Much	Moderate	Not deficient
Wet season				
Dry season				
All year round				

62. Other reasons for the dispersal of wild animals outside the park?

_____

_____

63. Do you benefit from wildlife? ☐Yes ☐No

64. If yes, what benefits do you receive from wildlife? ☐School bursaries ☐Community development projects (e.g. water, schools, hospitals etc) ☐others specify

65. Who administer this benefit? ☐KWS ☐County council ☐Group ranch ☐Conservancy ☐others specify

66. Do you think the benefit you receive is substantial? ☐Yes ☐No

67. If not, what level of benefit would be sufficient? -

_____

_____

68. If you are not receiving any benefits from wildlife, what type of benefits would you like to see?

_____

_____

69. What property do the wild animals destroy or use in your farm if any?

_____

_____

70. What is the estimate of the loss you suffered in the year 2009 on your property as a result of wild animals' destruction or use?

1 Food crops KShs _____ 3 Structures KShs _____

2 Trees KShs _____ 4Livestock KShs _____

5 Others, specify KShs _____

71. Is there any family members killed or injured by wildlife in 2009? ☐Yes ☐No

If yes, how many killed_____ injured_____

72. Number of livestock killed and injured by wildlife in past 2009?

Killed; Cows_____ Goats_____ Sheep_____ Donkeys_____

Injured; Cows_____ Goats_____ Sheep_____ Donkeys_____

73. Did you get any compensation as a result of the damages from wildlife? ☐Yes ☐No

74. If yes, from who? _____

75. What action do you take to reduce wild animals menace?

Wild animal	Action
Elephant	
Buffalo	
Lion	
Hyena	
Leopard	
Genet	
Mongoose	
Wild pig	
Wildebeest	
Baboon	
Monkey	
Porcupine	
Others, specify	

Response category

1: Keeping vigil & chasing

2: Making noise with metal objects

3: Erecting scarecrows

4: Trenches

5: Building livestock enclosures'

6:Killing

7: Fire

8: No action

9: Report to KWS

10: Report to Chief

11: Other, specify

76. How effective are the following mechanisms in curbing wild animal's conflicts?

	Very effective	Effective	Fairly effective	Not effective	Remarks
Translocation					
Control by KWS personnel					
Education creation & Awareness					

Fences					
Community social responsibility					
Elimination of rogue animals					
Traditional methods					
Other, specify					

77. In your opinion, how do you rate the overall effectiveness of KWS in controlling problem wild animals?

☐Very effective ☐Effective ☐Fairly effective ☐Note effective ☐not sure

78. In order of priority what are the most effective mechanisms do you wish KWS to do to minimise the problem you have had with wild animals?

_____

_____

F. How can the following problems which exist in your community be practically solved?

79. Grazing shortage

_____

_____

80. Wood fuel shortages

_____

_____

81. Building materials

_____

_____

In your opinion do you support?

		Strongly support	**Support**	**Fairly support**	**Do not support much**	**Remarks**
82	Use of park by both livestock & wildlife					
83	The community obtaining resources from park					
84	Occasional use of resources in the community ranches & farms					

Thank you very much for your time and input

APPENDIX III: STRUCTURED QUSTIONS FOR KEY INFORMANTS

Questions for interview with key personnel in the management of Tsavo west national park, wildlife sanctuaries, ranches, private farms, provincial personnel and other stakeholders adjacent to the park

1. What resources do people living around the park obtain from the park/wildlife sanctuaries/ranches/private farms during each season?

2. What species, number and frequency of livestock incursion occur into the park/wildlife sanctuaries/ranches/private farms during each season?

3. What are the type, nature and the frequency of damages to the park each season? Please specify the individual(s) involved? (For encroachment and livestock incursion)

4. What is the degree of damage? (For encroachment and livestock incursion)

5. Can you estimate the damages in financial terms?

6. Are there any offenders that have been taken to courts 2008, 2007 and 2006?

7. What verdicts?

8. What species, number and frequency of wild animals go out of the park each season?

9. What do the wild animals seek and/or destroy outside the park?

10. What mechanism do you use to manage conflicts and how effective are they?

11. How deficient are the resources outside the park such that the livestock and people move into the park?

12. Does livestock incursion affect forage availability in the park?

13. Do people who graze in the park sometimes come from very far areas? If yes please specify these areas.

14. What make them to prefer grazing in TWNP and not other areas?

15. What is the abundance of pasture in the park each season to attract illegal grazer?

16. In your opinion, should the local community be allowed access to park resources? Why or why not?

17. In your opinion, how can the following problems be practically solved? a)Grazing b)vegetation destruction c)wild animals raiding d)wild animals poaching e)etc.

Thank you very much for your time and input

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