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GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

MSc. THESIS

**EVALUATING EFFECTIVENESS OF MITIGATION MEASURES FOR
CONFLICT RESOLUTION BETWEEN HUMANS AND PROTECTED AREAS,
Case study; Maktau Area in Taita Taveta Region, Kenya**

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THESIS APPROVAL

This thesis entitled “*Evaluating Effectiveness of Mitigation Measures for Conflict Resolution between Humans and Protected Areas, Case study; Maktau Area in Taita Taveta Region, Kenya*” prepared on 3/5/2013 by Jackton Mwakughu MASABO in partial fulfillment for degree of **Master's of Science** in the Graduate School of Natural and Applied Sciences of Ankara University, Department of Landscape Architecture, has been examined and approved by unanimous vote from the undersigned jury members.

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ABSTRACT

Master Thesis

EVALUATING EFFECTIVENESS OF MITIGATION MEASURES FOR CONFLICT RESOLUTION BETWEEN HUMANS AND PROTECTED AREAS

Case study; Maktau Area in Taita Taveta Region, Kenya

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Formulation of management strategies for sustainable conservation of protected areas requires knowledge of the conflicts between people and wildlife. This study aims to evaluate the status human wildlife conflict and the effectiveness of the management strategies for conflict resolution in Maktau area adjacent to Tsavo West National Park in Taita Taveta, Kenya. Questionnaires and informal interviews were administered to 120 households and to 4 Park staff respectively. Crop damage and livestock predation affected the community at different magnitudes with 49% of households experiencing 1-4 ha of crop damage and 28% experiencing 2-3 livestock loss annually. Conflict increased with close proximity to the National Park with 92% of respondents perceiving wildlife as a threat. Crop and livestock loss, physical threat by wildlife, wildlife retaliation killings and management challenges were the principal causes of conflicts. The local residents and park staff had different perceptions toward the conflict and its management. Conflict management strategies applied by both the locals and Kenya Wildlife Service were not effective. This study suggests that, to reduce conflicts and promote sustainable conservation, importance should be given to co-management and interdisciplinary participation of different development sectors including participation of local communities in policy formulation and implementation.

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Key Words: Human-wildlife conflict, protected areas, conservation, participation approaches

ÖZET

Yüksek Lisans Tezi

KORUNAN ALANLAR, VE İNSANLAR ARASINDAKİ ÇATIŞMANIN ÇÖZÜMÜ İÇİN
ALINAN ÖNLEMLERİN ETKİNLİĞİNİN DEĞERLENDİRİLMESİ: MAKTAU ALANI –
Taita Taveta Bölgesi, Kenya

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Korunan alanlarda sürdürülebilir koruma için yönetim stratejilerinin formülasyonunda insanlar ve yaban yaşamı arasındaki çatışmaların incelenmesi ve değerlendirilmesi gerekmektedir. Bu çalışma, Kenya'nın, Taita Taveta bölgesinde Tsavo West Milli Parkı yakınındaki Maktau alanında insan ve yaban yaşamı arasındaki çatışmanın mevcut durumu ve çatışma yönetim stratejilerinin etkinliğini değerlendirmeyi amaçlamaktadır. Anketler ve informal mülakatlar, 120 hane halkına ve 4 Park personeline uygulanmıştır. Ürün hasarı ve hayvancılık predasyonu, toplumu değişik ölçüde etkilemiştir. Çalışma alanındaki hanelerin %49'unda, yaban hayvanlarından kaynaklanan 1-4 ha/yıl ürün kaybı ve %28'inde 2-3 hayvan kaybı görülmüştür. İnsan ve yaban yaşamı arasındaki çatışmanın, Milli Parka olan yakınlık ile ilişkili olduğu tespit edilmiştir. Anket katılan halkının %92'si yaban yaban yaşamını tehlikeli görmektedir. Ürün kaybı, fiziksel tehditler ve yönetim zorlukları, yaban yaşamı ile insanlar arasındaki çatışmanın temel nedenleri olarak belirlenmiştir. Yerel halkın ve Milli Park görevlilerinin çatışma ve çatışmanın yönetimi hakkında farklı algılamaları bulunmaktadır. Yaban Hayatı Hizmetleri ve yerel paydaşlar tarafından uygulanan önlemlerin çatışma yönetiminde etkili olmadığı sonucuna varılmıştır. Çatışmaları azaltmak ve sürdürülebilir korumayı teşvik etmek için politika oluşturulması ve uygulanması sürecinde, yerel toplulukları da dahil eden, farklı geliştirme sektörlerinde disiplinlerarası katılıma ve ortak yönetime önem verilmelidir.

Mayıs 2013, 91 sayfa

Anahtar Kelimeler: İnsan-yaban yaşamı çatışması, korunan alanlar, koruma, katılımcı yaklaşımlar

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Jackton Mwakughu MASABO
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LIST OF SYMBOLS

AWF	African Wildlife Foundation
CBCM	Community Based Conflict Management
CWS	Community Wildlife Service
HEC	Human-Elephant Conflict
HETF	Human Elephant Task Force
HWC	Human-Wildlife Conflict
IUCN	International Union for Conservation of Nature
KNBS	Kenya National Bureau of Statistics
KWS	Kenya Wildlife Service
MET	Ministry of Environment and Tourism
MRBZ	Mgeta River Buffer Zone
NGO	Non-Governmental Organization
NP	National Park
NR	National Reserve
PA	Protected Area
PAC	Problem Animal Control
PAMU	Problem Animal Management Unit
SCP	Selous Conservation Program
SGR	Selous Game Reserve
UCF	Uganda Conservation Foundation
UWA	Uganda Wildlife Authority
WCNPP	World Congress on National Parks and Protected Areas
WHS	World Heritage Site
WPC	World Park Congress
WWF	World Wide Fund
WWF-SAPRO	World Wide Fund for Nature South African Regional Office

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1. INTRODUCTION

Protected areas for a long time have been the most effective and widely used as a measure for conserving nature and natural resources. It is estimated that in virtually in all countries, over five percent of the earth's land surface has been allocated for conservation purposes. These areas are important tourist attractions, watershed protection, national identity points, and conserve biological diversity (Jeffrey 1996). In the recent past protected areas have also been tagged as "National parks" or "national nature reserves" (Jeffrey 1996) for their important output to a country. However, over a long period of time protected areas have become the perfect niche for conflict between man and wildlife.

This conflict occurs when the needs and behavior of wildlife negatively affects the interests of humans or when the interests of humans negatively impact the needs of wildlife (Madden 2004). Conflicts between wildlife and people, particularly those who share the immediate boundaries with protected areas, is a common phenomenon all over the world (Shemwetta and Kideghesho 2000). The depletion of wildlife resources has been linked to human actions through overexploitation, habitat destruction, pollution and introduction of non-native species. On the other hand, local people look at wildlife as a liability to them. In 1992 a conflict management program in protected areas was developed in the World Congress on National Parks and Protected Areas (WCNPP) IV workshop held in Caracas, Venezuela. Since then, human conflict management has benefited from works done by various researchers.

Human-Wildlife Conflicts (HWC) present an urgent challenge worldwide because often these conflicts engender problems between communities and conservationists who seek to preserve wildlife populations (Karanth and Madhusudan 2002). In Kenya for example, the World Bank has estimated that 65-80% of wildlife in Kenya live outside designated protected areas. Kenya has lost over 50% of its wildlife in the last 25 years and is continuing at this pace (Norton-Griffiths and Butt 2003). The 50% loss of wildlife is attributed to myriad factors but chiefly results from habitat loss, population growth, and encroachment of local people into protected areas—leading to conflict

between people and wildlife (Woodroffe and Ginsberg 1998). While a great deal is known about conflict issues between wildlife and agriculturists (Hill 1997, Naughton-Treves 1998), pastoralists also share a large part of their land with wildlife, but less research has been conducted on their views and attitudes towards wildlife (Gadd 2005).

In the case study area; Maktau area in Taita Taveta district of Kenya, Human-wildlife conflict continues to escalate, as farmers and pastoralists incur massive losses due to wildlife. Elephants are the most troublesome, causing crop damage, destruction of property and even human loss. In a three year period from July 1994 to June 1997 there were 1448 such incidents in Taita Taveta district, most of which involved crop-raiding elephants. These incidents and human loss have increased over the decade as will be shown in this study. Maktau area in Taita Taveta Kenya is one of the areas that have suffered significant loss due to HWC. Little research has been done in this area, and there is limited academic material that focuses on the conflict in this area.

To provide a better understanding of HWC, specific cases in the African continent can be reviewed to highlight common problems across local, regional and national levels of various African countries. These case studies further show that HWC is relatively intense in African developing countries where livestock holdings and agriculture are an important part of rural people's livelihoods and incomes. In these regions, competition between local communities and wild animals, for the use of natural resources, is particularly intense and direct. The resident human populations are very vulnerable (Distefano 2005). According to Messmer (2000), the relative impact of wildlife damage on farm production and household income varies greatly according to the amount of land owned and people's economic dependence on rural activities. The individuals at high risk of losses are agro-pastoralists with low standards of living that depend exclusively on production and income from their land.

Most of Africa's protected areas were created by colonial administrators without taking into account the concerns of local communities, and in most cases people were displaced or deprived of the traditional use of resources causing them to suffer economic hardship (Gurung 1995). Today crop damage and livestock depredation by

wildlife are major sources of economic losses (Newmark et al. 1994) and local communities continue to threaten protected areas by poaching and by causing habitat loss through encroachment of farms into protected areas (Njiforti 1996).

As discussed in the above paragraphs, human-wildlife conflict occurs whenever there is interaction between wildlife and human beings. In the African history, it is argued that farmers had to build large well defended villages to reduce crop loss and predation. This confirms that wildlife had a dramatic effect on the development of arable farming in pre-colonial Africa (Parker and Graham 1989). This relationship began to change with the arrival of European who developed the existing international trade routes and introduced colonial governments. Wildlife animals example the Elephant, were highly valued for their ivory and so there was an added incentive to shoot any wildlife animal that were seen to threaten human life or property (Hanks 1979, Eltringham 1990).

In Africa large numbers of big mammals, including several hundred thousand wild elephants and more than 20,000 lions, still roam freely, particularly in rangeland areas in or adjacent to protected areas. The pastoralist, agro-pastoralists, small and large-scale farmers and their families who live around these protected areas, all have to cope with the consequences: damage to and destruction of crops, livestock predation, competition for grazing and water, increased risk of some livestock diseases, various inconveniences – such as loss of sleep due to protecting crops at night – and even direct threats to human life. As human populations rapidly increase and settled agriculture spreads to more marginal rangelands, conflict between wildlife and people inevitably increases (Muruthi 2005).

Conflict between people and wildlife today undoubtedly ranks amongst the main threats to conservation in Africa - alongside habitat destruction and commercially motivated hunting of wildlife to satisfy the demand for bush meat - and represents a real challenge to local, national and regional governments, wildlife managers, conservation and development agencies and local communities (Treves and Karanth 2003).

In summary, O'Connell-Rodwell et al. (2002) statements can be agreed upon, that many communities in Africa bear the costs of coexisting with wildlife without receiving any benefits and often the cost are very considerable in relation to their standards of living.

Human wildlife conflict in Caprivi region of Namibia

The Caprivi Region is one of the few areas in Namibia where people practice mixed farming, and continues to experience heavy losses to crops and livestock due to HWC. Human wildlife conflict in Caprivi has over time been investigated and well documented by various experts. Species identified as causing damage to crops include elephants, hippos and other herbivores. Lions, hyenas and crocodiles inflict damage to or losses of livestock. These predators, along with elephants, also sometimes attack people and cause fatalities (Mulonga et al. 2003).

In Caprivi region of Namibia, competition for natural resources particularly water and land is high because of its high density of human and wildlife populations. Caprivi region holds a population of 5000 elephants which is the single largest free ranging population of elephants in Africa and is aggravated by the fact that elephants are not confined to the two East Caprivi National Parks, but often stray into areas outside the park. A study done by O'Connell-Rodwell et al. (2002) revealed that most of the conflict occurred in villages bordering those national parks. Elephant crop damage between 1991 and 1995 amounted to a total economic loss of US\$ 39,200 while lion depredation between 1991 and 1994 totaled US\$ 70,570. Another study done by Sutton (2001) in 1998, estimated the value of damage to crops (caused by livestock, elephants and other wild herbivores) in six villages at N\$216,097; and to livestock at N\$82,410. His figures only covered 165 households in six villages across Caprivi in the same region.

A further study done in 1996-2001 by Mulonga et al. (2003), in collaboration with Ministry of Environment and Tourism (MET) of Namibia further showed the gravity of human wildlife conflict in Caprivi region. The combined damage to crops and livestock

in 2001 was estimated at N\$300,000 (N\$240,000 for livestock and N\$60,000 for crops). Later in 2005, 157 incidences of crocodile attacks on humans and cattle were recorded by community rangers in registered conservancies (Murphy 2007).

Human-wildlife conflict in Budongo Forest Reserve, Uganda

In the last 30 years, numerous conflicts in the Central African nations of Rwanda, Uganda, Zaire and Sudan, have had significant impacts on the natural resources of many of the region's protected areas. These conflicts have ranged from civil war and rebellions to tribal wars and revolution (d'Huart 1998). One of the most affected protected area is the Budongo Forest Reserve in Uganda. Budongo Forest Reserve in the northern part of Uganda, comprises 435 km² of, semi-deciduous tropical rainforest, and is home to numerous duikers, birds, small mammals and six species of primate (Reynolds 2005). The Reserve is also the largest mahogany forest in East Africa (Reynolds et al. 2003). However due to civil unrest in the neighboring countries of Democratic Republic of Congo, Rwanda and Sudan, there was an influx of refugees to the protected area (Hill 1997). The population has continued to rise, resulting in the clearance of many forest fragments for agriculture (Reynolds et al 2003); of which 16% of forest cover was lost in this area between 1986 and 2001 (Plumptre et al. 2003).

According to the study conducted by Mwavu and Witkowski (2008), analysis from multi-temporal LandSat images on land-use and cover changes between 1988 and 2002 around Budongo Forest Reserve revealed a significant decrease on forest cover due to human encroachment. The villages south of Budongo Forest Reserve are the site of persistent human-wildlife conflict. Complaints regarding crop damage have increased in the last 10 years and local communities consider crop raiding the biggest challenge of living close to a forest edge (Webber et al. 2007). Whilst a number of wild and domestic animals raid food and cash crops, primates are a particular concern and baboons (*Papio anubis*), chimpanzees (*Pan troglodytes*), red-tailed monkeys (*Cercopithecus ascanius*) and blue monkeys (*Cercopithecus mitis*) regularly consume agricultural crops (Hill 2000). Baboons cause significant damage and are much reviled by local people (Hill 1997, 2000). Despite growing antagonism to chimpanzees raiding sugar cane in the area

(Reynolds et al. 2003) most farmers are still tolerant of their presence and do not actively hunt them.

Human wildlife conflict in areas bordering the Selous Game Reserve, Tanzania

The Selous Game Reserve (SGR) is a protected area of rural exceptional conservation value that has been designated a World Heritage Site (WHS), but that has also experienced a long history of human-wildlife conflict in the villages along its boundaries (Rodgers and Lobo 1982). Following heavy commercial poaching in the reserve in the late 1970s and 1980s, the Selous Conservation Programme (SCP) was established in 1988 to safeguard the ecological integrity of the SGR, and to promote improved relations between the reserve and its neighboring human population based on community participation in wildlife management and local access to wildlife benefits (Anonymous 1994 a). Implementation of the SCP community wildlife management initiative involved the establishment of five buffer zones bordering the SGR (Gillingham and Lee 2003).

A study was carried out by Gillingham and Lee (2003) to evaluate local community perceptions of wildlife due to crop-damage in the Mgeta River Buffer poaching Zone (MRBZ), an area of 1,670 km² that lies along the northern boundary of the Selous Game Reserve. As per the 202 participants response results from 20 villages adjacent to the game reserve, it was evident that the local population had a perceived wildlife as a liability. This was as a result of the magnitude of loss from wildlife through crop destruction and the risk of physical harm to the community. Of the 198 households interviewed, 95.5% reported wild life crop-damage as a factor limiting crop yields, and 34.8% of respondents ranked it as the primary constraint on their agricultural production. The most commonly cited wildlife causing crop- damage in the MRBZ villages were bush pigs (*Potamochoerus larvatus*), vervet monkeys (*Cercopithecus aethiops*), and rats (*Rattus rattus*). These animals were also ranked as causing most damage across the sample as a whole. Consistent with the perception of wildlife crop-damage as having markedly negative impacts on the livelihoods of MRBZ villagers, the survey found high intolerance of wildlife (59.1%) 193 respondents agreed that wild

animals that cause crop-damage were pests and should all be shot. Wildlife crop-damage was also widely perceived as a direct function of the proximity of the MRBZ villages to the Selous Game Reserve (Gillingham and Lee 2003).

Consistent with the conflict, as reported by Baldus (2005) in Jukumu Wildlife Management Area, an area of about 500 km² protected with the aim of protecting crocodiles, constituted by 22 villages located in the northern buffer zone of the Selous Game Reserve, like in many other areas with crocodiles in the country, people pay the heavy losses. Records show that from 1999 to February 2004, crocodiles killed a minimum of 28 people and injured 57 others in the Jukumu area. In addition the crocodiles killed 53 and injured 41 livestock. Within one year, there were 11 human deaths reported as a result of crocodile attacks.

Human-wild dog conflict in northern Botswana

Northern Botswana comprises the arid northern extension of the Kalahari Desert and the Okavango Delta, an alluvial freshwater ecosystem that is one of southern Africa's richest wildlife regions and supports a thriving wildlife tourism industry (Gusset et al. 2009). An extensive veterinary cordon fence divides protected areas from adjacent livestock grazing areas. The study done by Gusset et al. (2009) focused on cattle posts adjacent to the veterinary cordon fence in the southern part of the wild dog study area. The study showed that a total of 938 predator attacks were reported, the majority of which (99%) were fatal, causing an estimated financial loss of USD 57,000.

The study revealed that livestock losses caused by predators represented an economic concern for livestock owners in northern Botswana. The study further suggested that leaving livestock, particularly goats, unattended during daylight increased the likelihood of livestock predation, irrespective of the predator implicated. The magnitude of predation of livestock to wild carnivores, further adds to the negative impact on conservation initiatives of the Moremi Game Reserve (Gusset et al. 2009).

Despite the efforts of the Government to manage the conflict through Compensation payments for livestock losses, the local community still showed their unwillingness to coexist with the wildlife (Gusset et al. 2009). This is a perfect example of the increasing challenges that face conservation initiatives not only in Botswana but also the rest of the World where HWC is prevalent.

Human wildlife conflict in Cameroon

Cameroon has an extensive network of protected areas in which there is a rich animal biodiversity. HWC is a significant issue in Cameroon with effects on animal species and communities living around protected areas and beyond. Crops destruction by wildlife has important implications in terms of food security, safety and well being of local communities. HWC also affects the perceptions local communities have of conservation in protected areas and therefore the long term survival prospects of wildlife in these areas (Eyebe et al. 2012).

An example of this is the conflict associated with the Campo Ma'an National Park. This is located on a large landscape (264,064 ha) dominated by two main types of relief: the north covered by mountains and few plains and the south-covered by hills and small valleys. This is a site rich in biodiversity including endangered animal species such as elephants, buffalos and great apes. In Campo Ma'an National Park, animals shifted their migration corridors from the northern to the southern part of the park as a consequence of commercial palm oil and rubber plantations expansion resulting in interaction with human settlements (Eyebe et al. 2012). Destructive wildlife species include elephants that destroy millet fields, farmers' granaries, and sometimes even boats. Hippos also have been known to attack boats (Weladji and Tchamba 2003). In October 2006 reports from Ministry of Forestry and Wildlife in Cameroon revealed that, districts in the North Region experienced heavy crop damage loss due to elephants, amounting to 65% of the maize, groundnuts, cowpea and cotton crop in the entire region. The reports further showed that conflicts were more prevalent at the peripheries of protected areas or along migration routes of elephants.

Though elephants are the main wildlife species involved in crop destruction in Cameroon overall, many other raiders are also known: rodents such as cane rat, (*Thryonomys* sp), birds, buffalos, baboons (*Papio anubis*), Warthog (*Phacochoerus aethiopicus*) and antelopes (Eyebe et al. 2012).

In the 8,438 km² Be'noue' Wildlife Conservation Area which was created in 1968, a study conducted by Endamama et al. (2006) revealed that species most responsible for crop destruction around the National Park in the North of Cameroon are monkeys (44%), birds (44%) and then elephants (13%). Be'noue' National Park was derived from the Be'noue' Forest and Wildlife Reserve, which was until 1932 a hunting reserve owned by local communities and controlled by village chiefs. Local communities were resettled when the Be'noue' National Park was created (Weladji and Tchamba 2003).

Conflict between humans and elephants in the Tsavo ecosystem, Kenya

Kenya conserves its biodiversity through protected area systems in form of National Parks, Reserves and Sanctuaries which cover approximately 8% of the Kenyan landmass. However; these are insufficient for conservation of wildlife. The land outside Protected Areas is largely under the control of private owners and communities. The surrounding community and private lands provide dispersal areas for food, water, security and breeding grounds (Anonymous 2010a). Before independence in 1963 Kenya was teeming with unique wildlife. In beginning of the British colonial period, no effective policies had been formulated to conserve wildlife. Kenyan hunters were hunting wildlife without restrictions for the British white men. However from 1945, legislation for wildlife conservation began to develop. The National Park Ordinances were the first to be enacted. In 1953 the Wildlife Animal Protection Ordinance was further enacted, but due to lack of proper application and strictness of execution, the two were not effective. In 1976, the Wildlife Conservation and Management Act replaced the former ordinances and started to create changes in conservation policies. The 1976 act was also unable to achieve efficient conservation measures (Kelvin 2001).

In 1990, when the weaknesses of existing legislation were finally realized, the Kenya Wildlife Service (KWS) was established by a new act. KWS replaced all the former conservation-aimed organizations and it was secured to have a more independent position on its own field (Tolvanen 2004). The Kenya Wildlife Service is a state cooperation established by the Act of parliament, CAP 376, with a mandate for wildlife conservation and management in Kenya. The Act spells out the functions of the organization both within and outside protected areas. A key function is to establish linkages and gain support for wildlife conservation with stakeholders and communities co-existing with wildlife (Anonymous 2012).

According to KWS there are 31 national parks or reserves in Kenya. Tsavo East and Tsavo West National Parks are the largest two. Together they form an area of approximately 21, 000 km², which covers 48% of all conserved areas (Anonymous 2003). The Land use in Kenya report, published by Kenya Land Alliance claims that there were 50 conservation areas in 1998. In addition to national parks and reserves, they have also included 25 other community-based privately owned parks. All the areas result in an area of 44 600 km², which means 7.5% of total Kenyan land area. Most of the areas are quite small in size, but they still tend to cover a complete ecosystem (Tolvanen 2004). The Tsavo ecosystem is an area of 43,000 km² found between 2° and 4° South and 37.5° and 39.5° East in the Taita Taveta district in Kenya. Its borders are defined by the densely populated parts of Ukambani in the northwest, by Mounts Kilimanjaro, Pare and Usambara in the south-west, and in the south-east by a fairly densely populated coastal hinterland (Cobb 1976, Wijngaarden 1985). The core of this area is formed by Tsavo East and Tsavo West National Park in Kenya, which together occupy about 21,000 km² and the Mkomazi Game Reserve which occupies about 5,000 km² in Tanzania. The Tsavo ecosystem provides vital habitat for almost one thousand elephants and hundreds of buffalo that move seasonally in search of water.

For years now since the National parks were introduced, the Tsavo ecosystem has become a challenging niche of conflict between Humans and wildlife especially elephants and lions. The Tsavo National Parks boundaries were chosen without regard to the migration and dispersal of wild animals, especially the elephant, across PA

boundaries. When the National Parks were created in 1948 the human population density was very low, at less than 5 per km² (Anonymous 1982). Over the past five decades the number and distribution of people have expanded continuously and this has had a profound influence on the ecology of the Tsavo ecosystem and patterns of land use within it. For instance, the National parks contain extensive Acacia-Commiphora savannas which over time have been depleted due to cropland conversion or exploitation for charcoal. Also the search for water and firewood within the national parks by the communities living adjacent to the national parks, leads to harsh interactions between human and animals.

Elephants that move out of the National Parks onto many of the neighboring areas now come into conflict with legitimate human interests, whose outcome is intolerable to the poor neighboring human community. A field study conducted by Kasiki (1998) between 1995 to 1997 in Taita Taveta county that borders the Tsavo (Figure 1.1), of the 210 respondents who participated in the survey, crop destruction by the elephants account to 61% of all complaints in the district. In the same period, there were seven unexplained deaths of elephants which presumably were done by the local community through poisoning the elephants. Kasiki (1998) also found that the annual expenditure of most households on materials and services to reduce crop-raiding exceeded their annual income. In addition, each household spent an average of 9.3 hours watching their fields during the crop seasons. This clearly shows that crop-raiding elephants have an enormous effect on the lives of the peasant farmers who neighbor the Tsavo NP.

In effort to manage this problem, 1995/96 the government through KWS constructed an electric fence between Ndara and Ndi as an additional Human Elephant Conflict (HEC) mitigation measure (Figure 1.1). It is powered by solar energy and runs for 30km along the south east boundary of Tsavo East NP (Anonymous 2010b). The fence is 2 m high and consists of six strands of high tensile wire with an average vertical wire spacing of 28 cm. Four of these wires are live, and a barbed wire runs at the bottom of all the other wires to prevent the passage of smaller animals. Its estimated installation cost was US\$10,800 per km and the calculated annual cost of maintenance per km is US\$1,100. However, this annual maintenance cost was expected to increase as electrical

components and fence posts needed replacing (Kasiki 1998). This fence for the past decade has served to reduce the conflict in that area, yet the other areas bordering Tsavo west like Maktau have been left vulnerable to wildlife damage costs.

On the other hand, lions also account for a substantial cause of Human-Wildlife Conflicts in Kenya. In Tsavo, they trail behind only elephants (*Loxodonta africana*) in the number of complaints filed with the Community Office of the Kenya Wildlife Service. Each year lions kill hundreds of cattle, sheep and goats on the ranches surrounding Tsavo NP. This may cause ranches to fail and lead to habitat conversion for other income-generating activities (e.g. sisal plantations or subsistence agriculture). Alternatively, the predominantly nomadic herdsman who tend livestock there may initiate poisoning campaigns, killing lions and other carcass-visiting predators (Anonymous 2010c).

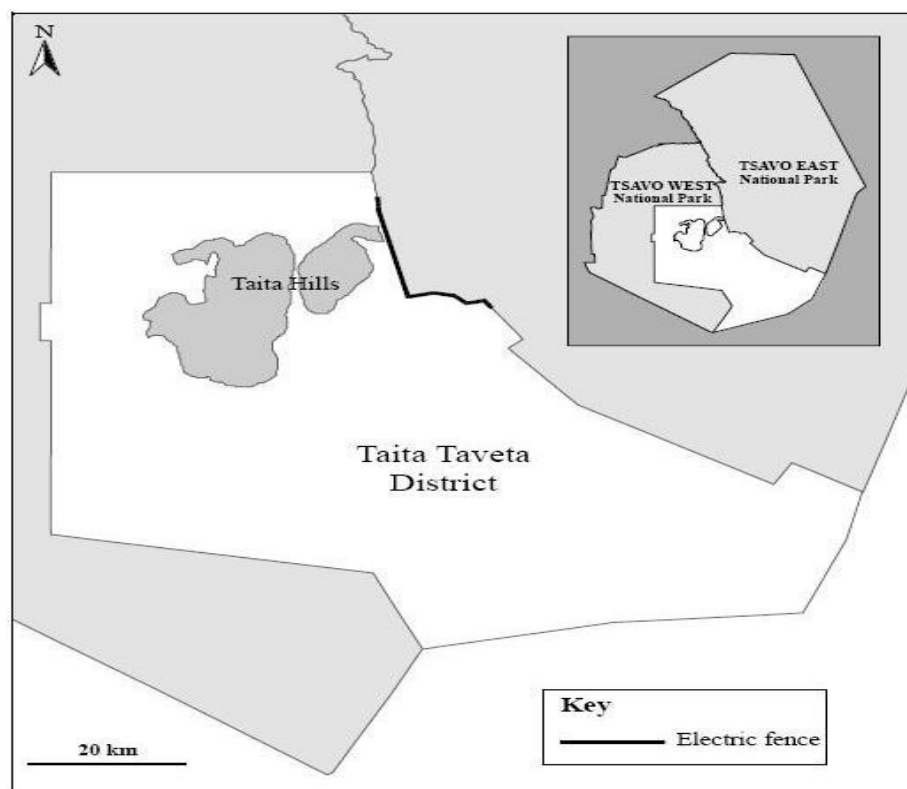


Figure 1.1 Position of Ndara and Ndi 30 km fence in Tsavo ecosystem (Smith and Kasiki 2000)

1.1 Problem Statement

HWC has played a significant role in threatening the success of conservation initiatives (Madhusudan 2003) and in 2003 the World Park Congress (WPC) addressed this issue (IUCN 2003). Although this conflict is regarded as almost inevitable, failure to recognize its significance has in the recent past resulted in contentious issues among authorities, personnel, and local communities (Hill 2004) and significantly contributed to a negative attitude to wildlife. In the long run these problems have had a detrimental effect on the long-term success of conservation programs and are especially significant where rural livelihoods are dependent on agriculture (Webber et al. 2007).

In the recent past, in many parts of the world, new approaches - often termed co-management – are being adopted as a way of helping to resolve conflicts between local people and protected areas (Jeffrey 1996). Despite the growing contribution of literature and research based on conflict mitigation objectives, recent management strategies (e.g. electric fences, taste aversion, sterilization, compensation) for primates and other species have shown potential but are only temporarily effective, expensive, invasive, labor intensive and unnecessarily bureaucratic, and thus neither sustainable nor suitable for many human-wildlife conflict situations (Strum 1994). In addition, research has seldom examined the perceptions of local people towards such methods (Madhusudan 2003).

In Kenya, HWC is no exception. Kenya has an area of 584,000 km², of which 7.5 % has some type of protected area status. This protection is either in the form of National Parks, where human interests are limited to tourism or National Reserves (NR) where limited human activity is allowed. However, with all the set measures for conflict management by the KWS, human-wildlife conflict continues to escalate especially in areas adjacent to protected areas. Before independence in 1963 Kenya was teeming with unique wildlife. Example, elephant population was approximately 165,000. However this was short-lived since just two decades after independence, the herds declined to a paltry 16,000, largely due to poaching driven by the lucrative ivory trade. In 1989 a ban

on poaching and ivory trade was imposed and there was a increase in elephant population Ironically, it has now become a management concern due to increasing human-elephant conflicts (Thouless and Sakwa 1995, Anonymous 1996). A survey of human-wildlife conflict conducted across the country in 1994 identified baboons and monkeys as the most important wildlife pest (Anonymous 1994 b). However, elephants are widely considered as the most serious threat because they can destroy crops and property, as well as kill and injure people. In addition, these incidents often affect those people who can least afford the resultant loss of income and labor. HWC in Kenya is a problem wherever elephants are found but it is most intense in agricultural areas, particularly when cropland borders NPs and NRs (Kiiru 1995). Between January 1989 and June 1994, wild animals in Kenya killed or injured 448 people, of which elephants were responsible for 173 (Anonymous 1994 b). A common view advanced by the people interviewed during the survey was that elephants, secure in their protected status, had increased in number and lost their fear of humans. They had, in turn, become bold enough to invade homesteads and break into food stores and huts. A significant proportion of respondents felt that the Government valued elephants more than people and was reluctant to kill problem elephants (Anonymous 1994b).

1.2 Objectives and Aims of Study

The aim of this study is to evaluate the feasibility of implemented measures both by the government through KWS and by the local stakeholders, to curb the existing human wildlife conflict in Maktau location in Taita Taveta county in Kenya. Taita Taveta county is an area of 5,000 km² that makes up part of the Tsavo ecosystem. It is surrounded on three sides by Tsavo East and West NPs and shares 80% of its perimeter with these protected areas. Maktau area is adjacent to Tsavo West National Park.

This general objective can further be broken down into three specific objectives;

1. To uncover the possible driving forces of Human -wildlife conflict among the communities in Maktau location adjacent to Tsavo West National Park.

2. To identify the measures and recommendations proposed for curbing the Human-wildlife conflict around the Tsavo West National Park.
3. To evaluate the feasibility of the proposed recommendations and measures carried out to curb the Human-wildlife conflict around the Tsavo West National Park.

These objectives will be supported by the following research questions;

- What is the magnitude of HWC in Maktau area?
- How do socioecological variables shape an individual's tendency to kill wildlife?
- What are the seasonal dynamic changes in Tsavo that propel wildlife to break their geographical barriers?
- What are the local citizens' perceptions towards the effectiveness of measures implemented to curb the wildlife barrier breach?
- What are local citizens' attitudes towards conservation and tolerance of wildlife invasion?

1.3 Definition of Terms

Protected Areas

Protected areas are locations which receive protection because of their recognized natural, ecological and/or cultural values. There are several kinds of protected areas, which vary by level of protection depending on the enabling laws of each country or the regulations of the international organizations involved. The term "protected area" also includes marine areas, the boundaries of which will include some area of ocean. In this study, protected areas will be recognized as national parks that are set aside to protect plant biodiversity and home to wildlife animals (Jeffrey 1996, IUCN 2003, Tolvanen 2004).

Wildlife conservation

Wildlife conservation is the practice of protecting endangered plant and animal species and their habitats. Among the goals of wildlife conservation are to ensure that nature will be around for future generations to enjoy and to recognize the importance of wildlife and wilderness lands to humans (CARE 2012).

Wildlife

Traditionally wildlife is a term used to refer to non-domesticated vertebrates, but has come into more general usage to refer to all wild plants, animals and other organisms. In this study, the term wildlife will be used to refer to terrestrial vertebrates (larger than one kilogram) rather than smaller organisms that typically produce greater economic losses, because larger organisms pose a greater immediate physical threat and provoke more political strife between environmental interests and other stakeholder groups (Treves 2007).

Wildlife management

This involves attempts to balance the needs of wildlife with the needs of people using the best available science. Wildlife management can include game keeping , wildlife conservation and pest control . Wildlife management has become an integrated science using disciplines such as mathematics, chemistry, biology, ecology, climatology and geography to gain the best results (Potter et al. 1973).

Co-management

This is management that involves the governmental agencies or NGOs and the affected communities. Ideally, the affected community would manage HWC itself without permanently damaging biodiversity in the protected areas. This particular management

requires collaboration, technical, material, and financial inputs that may exceed the training and capacity of rural wildlife managers (IUCN 2003, Gadd 2005).

National parks

National parks are natural, semi-natural, or developed areas of land that are of special scenic, historical, or scientific importance, which protect native plants and animals and their habitats, and are set aside, owned and maintained by a national government (IUCN 2003).

1.4 The scope and Structure of Study

This thesis consists of six chapters, the first of which contains the introductory information described above. The second chapter consists of literature review describing in depth the HWC problem, its causes, impacts and management. The third chapter gives an overview of HWC in Africa using various case studies that have been documented. This is followed by a chapter that describes the HWC in Kenya and introduces study site in giving details of HWC in that region. The next chapter describes the methods used to analyze the available data and the results of this analysis. The final chapter discusses these results and suggests gives recommendations on how and where the Government should focus their resources to manage the problem in the area.

This thesis focuses on HWC in Maktau area of the Taita Taveta county in southern Kenya and uses a qualitative and quantitative analysis through structured and semi-structured questionnaires to obtain data relevant to the objectives of the study. The data is then analyzed using statistical software tools (SPSS 15.0) and interpreted to expound on the magnitude and nature of conflict, perception of the local community of the conflict management and conservation. This study will help in understanding the HWC problem at a local perspective than at district level. It will in turn help in future research by both the KWS and NGOs to formulate management strategies and recommendations that are sustainable and effective in the locality.

2. THE CONCEPT OF HUMAN- WILDLIFE CONFLICT

HWC occurs when humans or wildlife harm or threaten one another in the course of pursuing their needs or interests (WPC 2003). In particular, it includes cases where wildlife threatens, attacks, injures, or kills humans, as well as cases where wildlife threatens, attacks, injures, or destroys their livestock, crops or property. HWC also occurs when humans deliberately injure, abuse, or kill wildlife because of perceived or actual threats to their property, livelihoods, lifestyle, person, or family (Madden 2008).

Wildlife plays one of the most important role to the economy of a country. This includes, game viewing, tourist hunting, resident hunting, ranching and farming. These forms of utilization are the basis of the country's social and economic development through provision of employment, generation of foreign currency and market for local commodities (Shemwetta and Kideghesho 2000). Nevertheless, the benefits realized from wildlife sector are more often than not undervalued by the negative impacts caused by wildlife to the socio-economic status of the communities living in areas bordering wildlife protected areas. These problems are caused by the inability of wildlife to effectively compete for available resources with the communities. As a result, local people perceive wildlife as a liability and thus doom the success of wildlife conservation efforts. The risk of wildlife damage to crops, livestock, and human lives provides incentives for rural residents to kill wildlife and to reduce the quantity and quality of habitat on private and communal lands (Philip et al. 2003).

This chapter provides an introduction to HWC in Africa and begins by describing population trends in this species. It goes on to review studies on conflict throughout the continent and to describe the recently established Human-Elephant Taskforce (HETF) and the database they have developed to record and analyze conflict data. The chapter finishes by describing the history of conflict in Kenya, where this research took place, and by listing the aims of this report and its overall structure.

2.1 Impacts of Human-Wildlife Conflict

According to Parker et al. (2007), human wildlife conflict can be categorized into two “Direct” or “Indirect” depending with the impact. Direct conflict involves the impacts that affect the physical and economic wellbeing of rural communities by causing damage to crops, livestock and property, transmission of diseases, as well as human injury and death. Indirect conflict causes broad and indirect social impacts upon people, for example, the disturbance of normal activities such as walking at night, and the fear of injury or death, and the negative perception to wildlife and conservation initiatives.

Direct impacts of Human -Wildlife Conflict

Destruction of crops

Crop damage is the most prevalent form of Human-wildlife conflict across the World but more prevalent in Africa continent. 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 (Lamarque et al. 2008). The level of human activity on a farm, the type and maturation time of crops as compared to natural food sources, also plays a role. Crop damage not only affects a farmer’s ability to feed his or her family, it also reduces cash income and has repercussions for health, nutrition, education and ultimately, development (Parker et al. 2007).

In Africa for example, a wide variety of vertebrate pests come into conflict with farming activities including birds, rodents, primates, antelopes, buffalos, hippopotamus, bush pigs, and elephants (Lamarque et al. 2008). 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). Bark stripping is another form of crop depredation that is caused by primates. The target of this kind of behavior by Monkeys and baboons is the inner barks of exotic tree species specifically the *Pinus*, *Eucalyptus*, *Acacia* and *Cupressus* species.

Predation on domestic animals

This is predominantly caused by carnivorous species. In America, Europe and Asia, the main culprits of attacks include wolves (*Canis lupus*), Bears (*Ursus arctos*), lynx (*Lynx sp.*), tigers (*Panthera tigris*), leopards (*Panthera pardus*), and snow leopards (*Uncia uncia*). The target preys are sheep, and cattle. In Africa, documentation evidence has shown that in the sahara heartland, death of domestic animals are caused by; lions (*Leo panthera*) (35% of reported deaths), leopard (35%), hyena (18%), baboon (4%), elephants (3%), buffalo (2%), wild dog (2%) and cheetah (1%). In the Gokwe communal land, neighboring the Sengwa Wildlife Research Area (Zimbabwe), between January 1993 and June 1996, in a study area of 33 km², 241 livestock were killed by baboons, lions and leopards, which contributed respectively to 52%, 34% and 12% of the kills (Lamarque et al. 2008). The Nile crocodile (*Crocodylus niloticus*) which is the most widespread in Africa is the main culprit in attacks on livestock. This large species (mass up to 1,000 kg) is entirely predatory on aquatic and terrestrial prey species. In Tanzania already quoted, for instance, 53 heads of cattle have been killed and 41 injured by crocodiles in a single year (Baldus 2005).

Human injury and death

Human injuries and deaths by wildlife are less common but are the most severe manifestation of human wildlife conflict and universally regarded as intolerable. Many of these occurrences have been reported in Africa. The principal culprit is the elephant (*Mammuthus sp.*) and the crocodile (*Crocodylus sp.*). Example in one of the study done in Kenya, alcohol was found to be a key factor in one third of the deaths; victims were drunk and returning home from the bar. Others died protecting their crops, herding cattle and walking at night between neighboring villages (Parker et al. 2007).

Transmission of diseases

Several diseases are known to be transmitted by wildlife to domestic livestock. Some of these diseases may also be zoonotic. This happens when predators and scavengers

(spotted hyenas, jackals, and vultures) eat, dismember or disperse carcasses of infected animals. The ingested pathogens may be spread widely through their faeces or even bites. According to Hugh et al. (2002), Anthrax is widely spread to livestock through the faeces of infected scavengers. In the late 1960s, the African buffalo was identified as the host of Foot and Mouth Disease making farming of cattle in the presence of both buffalo and a suitable vector, a hazardous undertaking (Bengis et al. 2002). African horse sickness is endemic in zebra populations, making zebras ideal maintenance hosts under these conditions (Lamarque et al. 2008).

Indirect impacts of human -wildlife conflict

Food security

This is significantly felt by the agricultural rural communities living around protected areas. These communities rely on a single cropping season or on the sale of some of their livestock. The loss of crop due to destruction by elephants, baboon or hippopotamus in a single raid, the food supply for the year to the family concerned may be significantly affected. The loss of one's small herd of cattle to lion can mean the effective destruction of a family's way of life and wealth. For rural populations, domestic animals are not only the main resource through manure, milk, meat, live sales, but also their only wealth (means of saving, source of income, social role). Predators such as lions often kill numerous domestic animals like cattle in one raid and strongly impact household's food security. In the Kanamub area of the Namibian Sesfontein Conservancy, farmers lose as many as three to four animals in a month to lions, leopards, hyenas and cheetahs (Tjaronda 2007). This will be made even worse when the government does not have the capacity to pay compensation for the losses.

Socio-economic costs

HWC causes several economic losses that cut across the board of several human economic activities. Destruction of crops affects a farmer's ability to feed his family, reduces income, and consequently affects health, nutrition, education and ultimately,

development. Overall production in the forestry sector may be reduced by the notorious behavior of baboons to strip the barks of exotic trees. International trade of livestock is jeopardized by transmission of disease from wildlife to livestock.

The economic cost of the damages caused by wildlife particularly bears and elephants to the infrastructures is primarily high. Example, in the Pama National Reserve (Burkina Faso) the cost to repair infrastructure due to elephant destruction is about US\$ 587/pond/year and US\$ 23/track kilometre/year (Imorou et al. 2004).

Human Health

According to the WWF SARPO report (2005), encounters with small animals, exposure to zoonotic diseases, physical injury or even death caused by large animals' attacks have high financial costs for individuals and society in the form of medical treatments.

Influence on Politics and Media

There is frequently a political dimension to HWC. Incidents occurring in rural areas, particularly where the outcome is fatal and where there is no official response or action, frequently lead to parliamentary questions and debate. In Mozambique and Burkina Faso, HWC is part of the issues which are more often directly addressed to the President when he goes to the field and meet the populations. This has the effect of raising the profile of HWC to being an issue that receives national government attention (Lamarque et al. 2008).

2.2 Causes of Human-Wildlife Conflict

Several reasons that escalate the problem of HWC have been discussed. These can be classified into three upon the causal agent; Human- induced causes, Wildlife-induced causes and the Habitat-induced causes.

- **Human-induced causes**

Population growth and land use transformation

Demographic and social changes place more people in direct contact with wildlife: as human populations grow, settlements expand into and around protected areas (IUCN 2003) as well as in urban and sub-urban areas. The main cause of HWC worldwide is the competition between growing human populations and wildlife for the same declining living space and resources. This has resulted in constriction of wildlife into marginal habitat patches and in direct competition with local communities. This has eventually led to land use changes 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. In the long run, there is a dramatic decrease in wildlife habitat. In Africa, protected areas are fragmented and sold to private investors. This results in creation of new corridors used as passage routes by wildlife and human pedestrian traffic between two settlements, thus increases the occurrences of contact between humans and wildlife.

Human migration and blockage of migratory corridors

Wildlife corridors, besides serving as a passage route of animals from one place to another during a certain period of the year, they are also critical wildlife habitats on their own. Migrations of people for reasons of security or food safety, e.g. drought, floods, civil unrest, natural disasters or war, disrupt the normal production and distribution of food, resulting in famines in many countries in the world. In Africa particularly, these factors spur the continuing migration of rural people into areas where resources could be obtained and which are frequently occupied by wildlife. War and civil unrest push people to take shelter in protected areas where they exert a strong pressure on natural resources and enter into competition with wildlife. In places of food shortages due to famine or desertification, migration of people is towards pockets of natural resources that are protected areas. The resultant occupation of the habitat of wild animals by humans leads to conflict (Lamarque et al. 2008).

Human attitudes and perceptions on wildlife

Rural communities consider wildlife and particularly large mammals as threats to their safety and food security. This adverse perception is particularly developed near protected areas where the presence of wildlife populations inflicts daily costs on local communities that can erode local support and tolerance. In turn, local people can develop a negative attitude towards reserves and wildlife, worsening the conflict and undermining conservation efforts (Shemwetta and Kideghesho 2000).

Increased interest in ecotourism

Growing interest in ecotourism and increasing human presence in protected areas are creating the platform for conflicts between humans and wildlife (Lamarque et al. 2008). Recreational activities and growing public interest in charismatic species, such as large carnivores and endangered species, have increased the human presence in protected areas and raised concern about capacities to manage and regulate public access and large-scale use of protected areas (Distefano 2005).

Each year, tourists are killed or injured by elephants, crocodiles, lions or other wildlife species in protected areas. For instance, in 2004, an American tourist was killed by a crocodile while in a canoe at Mana Pools National Park (Zimbabwe) on the Zambezi River (Anonymous 2007).

- **Wildlife-induced causes**

Competition for resources between livestock and wild herbivores

Growing densities in livestock populations can create an overlap of diets and forage competition with wild herbivores, resulting in overgrazing and decline or local extinction in wild herbivore populations in the protected areas (Mishra et al. 2003). In India for example, domestic animals often outnumber wild herbivores within a protected area. It has been reported that these densities go as high as 1,500 per km² and has farther

ascertained that livestock graze 73% of wildlife habitats and 39% of protected areas (Mishra 1997). This in turn causes the wild herbivores to cross their boundaries into the local farms around the protected area in search for food, eventually escalating the HWC problem.

The character and behavior of wildlife animals

Wildlife's intrinsic features like: food preferences, migrations, wariness or predation behavior can explain the occurrence and/or the extent of HWCs. For wild herbivores, preferential foods can attract them over long distances. The species of the wild preys has an impact on potential HWC as revealed by a study carried out in Tanzania by Packer et al. (2006). This study showed that the number of humans attacked by lions in each district was highly correlated with two factors: the abundance of medium-sized prey (zebra, hartebeest, or impala) and the abundance of bush pigs. Lion attacks would be most common in areas with the lowest abundance of normal prey and with the largest numbers of bush pigs.

- **Habitat induced causes**

Human activities and Natural factors

Conflict between humans and wildlife is one of the negative results of the escalating habitat loss. As wildlife range becomes more and more fragmented and as wildlife gets confined into smaller pockets of suitable habitat, humans and wildlife are increasingly coming into contact and in conflict with each other (Lamarque et al. 2008). Recent research has shown that conflicts are particularly common in reserve buffer zones where healthy wildlife populations stray from the protected area into adjacent cultivated fields or grazing areas. This shows that border zones of protected areas may be considered population sinks: critical zones in which conflict is one the major problem (Woodroffe and Ginsberg 1998). The modification of habitat's quantity or quality is due two important factors.

Human activities like husbandry, agriculture, fishing, infrastructural development and even tourism or wildlife protection itself, can also modify dramatically wildlife habitat directly or indirectly. Droughts, bush fires, climatic changes and other unpredictable natural hazards can contribute to the decrease in suitable wildlife habitat and therefore have an impact on HWCs' occurrence and extent. Similarly, the seasonal habitat's modification owed to rainfall can have an impact on HWC.

2.3 The Management of Human- Wildlife Conflict

Taking into account the gradual population growth rate of humans, increasing demand for natural resources and the growing pressure for access to land, it is right to conclude that the human wildlife conflict will not be eradicated in the near future; nevertheless an urgency is required to manage it. A wide range of different management tools has been developed worldwide to address HWC, but most of these are strongly site and species/genera specific and are not widely or easily accessible (IUCN 2003).

This chapter gives an overview on common methods that have been applied to manage HWC problem. It also introduces the concept of Community-Based Conflict Management (CBCM), which is a short-term approach that enables rural community contribution in management of HWC issue at their level. Based on different global research, many HWC measures have been recommended. Despite the management strategies have similar goals, their implementation at global scale becomes difficult due to differences in ecological, social, cultural and economic realities; they are also targeted towards different taxonomic groups. Mitigative strategies attempt to reduce the level of impact and lessen the problem; while preventative strategies endeavour to prevent the conflict occurring in the first place and take action towards addressing its root causes. Some are efficient in the short-term while others show results only in the long-term; others are more effective within defined geographic regions or specific taxonomic groups (Distefano 2005).

Preventive measures

Barriers

Barriers function as physical exclusions preventing spatial contact between wild animals and local communities. These barriers may be artificial or natural (rivers, coast, and mountain ranges). It has been proven over time that spatial separation especially the use of physical barriers enclosing large nature reserves, is a successful strategy. Natural barriers despite their occurrence around protected areas, have been of use to curb HWC. Example, Nyhus and Tilson (2004), recorded limited tiger conflict around the Way Kambas National Park in Sumatra India, owing to the presence of rivers along more than two-thirds of the park's boundary, this discouraged tigers from leaving the park. Natural barriers however are genera specific, example, rivers may be effective in controlling the Felidae family (lions, tigers, cheetah etc), but an advantage for the Crocodylidae (crocodiles) and Hippopotamidae family (Hippopotamus) . Mountain ranges may curb large wild herbivores like Elephants, but heavy cost to the farmers in controlling Monkeys and baboons.

Man-made barriers are effective in instances where problem animals don't destroy them, or the cost of maintenance does not impute financial burden on farmers. Several barriers have been used either as one or more than one, depending with the extent of HWC problem. In Uganda for example, The Uganda Conservation Foundation (UCF) in conjunction with Uganda Wildlife Authority (UWA), worked with the communities on the southern boundary of Queen Elizabeth National Park to dig a 15 km trench to control elephants conflict. So far the trench has been 100% effective at keeping elephants out of the fields (Anonymous 2009 b). Electric and Non-Electric Fencing have also been used as an effective measure to control wildlife movement from protected areas to peoples settlements. Strong, non-electrified fences have been used to restrict elephant movements in many parts of Africa and Asia. While these fences have met with some success, they can be expensive to erect and maintain, there is a large labor investment required and expert advice is needed (Messmer 2002).

Guarding

Monitoring herds and active defense are essential features of animal husbandry in East Africa, where human herders are effective and fearless in warding off predators. In this region, herders are reported to challenge and scare away dangerous carnivores such as lions, hyenas and cheetahs with nothing more than simple weapons like spears, knives or firearms (Patterson et al. 2004). In Northern Kenya, the presence of human guards, dogs and human activity were associated with lower rates of livestock attacks by large predators (Ogada et al. 2003).

Guarding is also a popular preventative strategy in some parts of India as a study in the Sariska Tiger Reserve, Rajasthan, demonstrates. In this region, the majority of the farmers ranked guarding as the most efficient and common measure to protect their crops, despite requiring additional labor (Sekhar 1998). In North America dogs are often left alone to safeguard domestic animals and are not as effective as in Europe and North Asia where shepherds and ranchers work directly with their dogs (Musiani et al. 2003)

Deterrent systems

Movement activated guard devices and electronic training collars are deterrent systems based on aversive stimuli, they are very high-cost and cutting edge techniques. The first one relies on disrupting a predator's attack through stimuli that disturb the animal's normal behavior; these stimuli can be gustatory (chemical), visual (light), olfactory or auditory (siren) and are activated by the animal approaching protected resources (Distefano 2005). Repellents based on resin from *Capsicum* spp. peppers have been used to alter animal behavior for a range of wildlife, including bears, ungulates, dogs, and humans.

Relocation/ Re-settlement

Relocation is mainly done to animals but in extreme cases of conflict, human resettlement by the government on voluntary basis can also be done. The removal of a problem animal through translocation has been used in Kenya and South Africa, among other places. Usually elephants are tranquilized and transported to a new location on specially adapted vehicles, where they are released. Translocation is a humane management alternative to killing problem elephants. However, the cost of translocation is extremely high and the operation involves specialist equipment and skills. In several cases the operations have ended in failure, either with an animal dying en route, or with the animal returning to the source area a short time after its release.

Mitigative measures

These are control measures taken by government, organizations that deal with wildlife or by the people who are affected, after an occurrence of conflict has been ascertained, measured and valued.

Compensation strategy

Compensation schemes reimburse individuals or their families who have experienced wildlife damage to crops, livestock, property, or who have been injured, killed, or physically threatened by wildlife. This is done in two main systems; reimbursements and settlement rights. Financial reimbursement has in the past been a very contentious issue and the least popular due to its inefficiency. This is a reality in many developing countries, which face budget constraints and usually pay on an irregular basis and to a limited extent. According to Madhusudan (2003), In a survey done between 1996 and 1999 in Karnataka India, only 11% of livestock depredation and 26% crop damage by wildlife were refunded. Moreover these refunds took more than 6 months to be processed undervaluing the losses incurred. In Kenya, compensation schemes are very

problematic. The government has not provided any reimbursement for crop and livestock losses since 1989 and it neither replaces nor repairs any installations that are destroyed by wild animals. The settlement of rights compensation scheme, allows the local community to use natural resources in the protected such as hunting for game, collecting of timber and firewood or fodder. This appears to be a better strategy as it defines which resources can or cannot be exploited and sets defines through law the reserve zones that are accessible to local villagers. Indeed, the benefits derived from the legitimate collection of natural resources influence the attitudes and perceptions of rural residents towards wildlife conservation while promoting community responsibility and awareness (Sekhar 1998).

Licensed hunting and killing of problem animals

This also known as regulated harvesting or lethal management strategy by various researchers. It is argued that the money obtained from licensing can be used to boost conservation initiatives and avail protection to human settlements from wildlife attacks and losses. The sole reason for the strategy is to appease the anger of the local people due to losses or injury incurred. However due to lack of monitoring systems, this strategy raises skepticism due to random killings of untargeted wildlife animals. As a result, animals that were not responsible for the attack or raid are killed while the ones responsible keep affecting loss to local community, in the long run, conservation initiatives are thwarted due to negative wildlife perception.

Problems with Current HWC Management Techniques

The effectiveness of any recommended technique in HWC entirely depends on its ability to be sustainably implemented. This involves the applicability, problem solution, economically affordable and low cost of maintenance, for the given technique. Many techniques used have proven efficient on starting but after some time they fail due. These problems are summarized below.

- As discussed earlier some of these management techniques are specific to a given species of animals and also only applicable to a given cultural zone.
- The labor output that is required for installation and maintenance for some of these methods is intensive. E.g. trenches and fences.
- The technology behind some of these methods e.g. the chemical or biological deterrents may not be understood by the local communities so implementation may be thwarted.
- The initial cost for installation (Materials, consultancy, labor) and the eventual cost (Maintenance), is in most scenarios very high and there are tendencies for governments especially in developing countries, to rely on donors and funds from NGOs. This eventually affects the general effectiveness of the methods.
- The effectiveness of some of these methods become ineffective due to animal adaptive behaviors. E.g. Elephants can get used to noise deterrents if they are used for a long period of time, Monkeys and birds get used to scarecrows.
- Policies developed by the government to handle HWC sometimes never get implemented at national level especially in Africa.
- The government response to HWC in some countries is slow. Compensation systems and insurance for the affected communities are done late or sometimes never done, thus escalating the conflict problem.

The problems facing these management strategies have resulted in escalated HWC problem. These in turn has led to a wrong perception about wildlife especially in places where these strategies have completely failed. Local people have resolved in turn to take matters in to their own hands, killing animals indiscriminately, hindering conservation initiatives for protected areas. HWC problem is wide and efforts only by government and NGOs are not enough. A more decentralized approach that involves the affected local communities in problem solution is required. Recently, the management of HWC problems is being increasingly decentralized as community-based conservation programs are established. In line with this, community based conflict management has

gained support both from the governments and the local communities (Parker et al. 2007). The rationale behind this program is explained below.

Community based conflict management (CBCM)

CBCM is a more recent approach to the conflict between people and wildlife. Throughout this paper, it can clearly be noted that the fate of wildlife survival and improvement of conservation efforts depends on the human's tolerance to wildlife. However, due to delay in response in handling HWC from wildlife governmental agencies, the local community realized that they could not rely upon outside agencies to solve their conflict problems. But on the other hand, their traditional methods of conflict mitigation were weak and vulnerable to habituation by wildlife. Thus a more holistic approach that involves collaboration of all involved parties, and which at the same time empowers communities to address their own conflict problems (without destroying biodiversity), was necessary. Thus CBCM approach was developed. Its general principle focuses on changing attitudes to wildlife through education and by ensuring that affected communities and individuals are active participants in, and enjoy tangible benefits from, wildlife management. The rationale for this approach can be broken into two; Community involvement in wildlife threats reduction, and Participation planning (co-management).

Community involvement wildlife threats reduction

This involves the use of effective, low cost HWC mitigation techniques that rural farmers can administer and when the need arises. These CBCM techniques are developed to overcome the problems experienced by current mitigation methods used. The key attributes of these include; Inexpensive and affordable to rural farmers; Effective at reducing conflict, as farmers tend to give up on ideas that don't work; Decentralized, so communities take responsibility for their own conflict issues and no longer rely entirely on outside help. Farmers must take responsibility for guarding their own crop; locally available, so that farmers can source the materials from within their

area; Adaptable to local conditions; and, variable, using multiple methods to overcome the problems of wildlife habituation.

These techniques focus on reducing HWC at a farmer level/ household level. They include increasing vigilance by guarding the crop fields against sudden wildlife attacks, use of acoustic alarms which are placed at the boundaries of the farms, the use of simple fencing, made from bush poles and string (ideally fibre ropes) constructed at the edge of the fields, chilli grease can be applied to the fences to deter large wild-herbivores like elephants. For large predators like lions, tigers and jackals, fences made from thorny bushes are made. During the night when wild predators are likely to attack, the livestock animals are put in these fenced pens. This method has been recorded to be effective in many parts of Africa especially Kenya, where the wild living communities like the Maasai use thorn bushed fences for their protection and those of their animals.

In the search for long term CBCM techniques, the above discussed methods tend to reduce rather than eradicate the conflict. For this reason, long term CBCM strategies have been suggested. According to Parker et al. (2007), Land-use planning approaches to HWC attempt to separate agricultural activities and wildlife. This can be achieved through the identification and zonation of separate areas for farming and wildlife, or through the development of buffer zones at the edge of protected areas, or through the restriction of agricultural development in wildlife corridors. Separating agriculture and wildlife within a landscape should reduce the potential HWC in the long term.

The use of Community insurance schemes as a long term CBCM strategy has shown great promise against the conventional use of compensation schemes. This method has been used in Namibia and proven successful. Community insurance uses revenues generated from wildlife to balance the losses of individuals within a conservancy. Payments are only made to registered conservancy members according to the conditions agreed by all conservancy members. This system has much tighter controls than a conventional compensation scheme and there is less opportunity for corruption. Most importantly, all conservancy members pay into the system and therefore have a stake in it (Parker et al. 2007).

Co-management

Co-management refers to management shared between affected communities and governmental agencies or NGOs (Treves et al. 2006). Managing HWC may require collaboration. Indeed, effective management without destruction of biodiversity depends on technical, material, and financial inputs that may exceed the training and capacity of rural wildlife managers. Participation in planning, implementation and monitoring has potential advantages and disadvantages. The disadvantages reflect the costs of meeting, building consensus and organizing participants into coordinated roles, as well as potential politics that arise from differences of opinion or conflicts of interest. The advantages include recruiting influential stakeholders as partners, generating additional ideas for implementation that a subset might have overlooked, combining resources and personnel to attain a shared goal, and providing a model for more democratic and transparent decision making (Treves 2007).

If affected individuals and households would manage HWC independently without permanently damaging biodiversity, there is need for collaboration between affected households and other stakeholders. For one, many conflicts occur at the borders of protected areas or involve endangered species, which may fall under the jurisdiction of wildlife managers. A third party (for example, an NGO or outside researcher) may be needed if there is a history of mistrust among local stakeholders. A third party or a middle man (e.g., NGO or outside researcher) can also potentially play an important role if there is a history of mistrust between affected communities and wildlife managers. However, outsiders bear a special burden to avoid being seen as allies of central authorities rather than local communities. According to Treves (2007), the effectiveness of co-management is dependent on three important phases of its execution.

1. A Baseline Research Study which aims to analyze the timing and locations of conflicts, as well as the behaviors of the involved individuals (wildlife and human) is carried out. This tends to evaluate perceptions of conflict and its management by the local communities.

2. Participatory planning helps define joint objectives, build consensus on which interventions to implement and recruit participants. It does this by identifying shared objectives between wildlife conservation and human welfare.
3. The final phase is Monitoring. This measures the success of the co-management project at three levels: (a) implementation, (b) threat-reduction, and (c) outcomes for targets. It is done by prepare two monitoring plans for approval by affected stakeholders.

3. MATERIALS AND METHOD

3.1 Materials

The materials used in this study to review, collect, study and analyze data was as follows.

- Administrative letters from the Department of Landscape Architecture of Ankara University. These were used as introduction tools to the Ministry of Education and Technology of Kenya as a prerequisite for the field study.
- Boundary, Physical features, and Land use maps of Kenya and the Taita Taveta county were obtained from the Independent Electoral and Boundaries Commission of Kenya and from the Kenya Bureau of Statistics.
- Social, economic and cultural information of the area was obtained from related literature and from the Kenya Bureau of Statistics.
- Kenya's demographic county fact sheets were used to obtain the population information of the case study.
- Consultations and meetings with the KWS officials were used to obtain information on the human wildlife conflict in the Taita Taveta district and Maktau locality.
- Study related reports, strategic plans and annual reports from Kenya Wildlife Service and from biodiversity research and monitoring divisions publications (1999-2012) were used to review the HWC in the study area.
- Published articles, Doctorate and Master thesis that focus on the human wildlife conflict in Taita Taveta county, were reviewed to explore the theoretical foundation and the magnitude of the HWC problem.
- Photographs taken from the actual visit of the study area, from related articles, and from the internet were used as visual reference.

- Face to face discussions with the local inhabitants of Maktau area and physical observations were used to ascertain and evaluate the objectives of study.
- Structured and open questionnaires that captured the objectives of the study were used to obtain analyzable information from the local community and KWS officials.
- SPSS and MS excel computer programs were used for keying in obtained questionnaire results, analysis and presentation of the result obtained from the study.

3.1.1 Study area

Maktau area is located in Taita Taveta county at the coast district of Kenya. It lies at a latitude of -3.4 (3° 23' 60 S) and a longitude of 38.13 (38° 7' 60 E). The location is situated 489 kilometers south (178°) of the approximate center of Kenya and 277 kilometers south east (148°) of the capital Nairobi. Maktau is also referred to as Mwakitau by the local community, and consist of 3 sub-location namely Mlugh/Mwashuma, Gudoma and Mwakitau. Two of the 3 sub-locations; Gudoma and Mwakitau are bordered to the west by Tsavo West National Park (Kasiki 1998).

3.1.1.1 Topography and soil

The altitude of Maktau location ranges between 914 and 1,219 m above sea level. This location lies within the Tsavo ecosystem which has an altitude range of between 200 and 1000 m above sea level, with an even and gradual slope rising upwards from the east towards the Taita Hills, which rise to 1 500 m above (Kasiki 1998).

These hills are densely populated due to their much higher rainfall and agricultural potential (Sombroek 1980). Generally, the soil in Maktau region has low fertility and is classified as having marginal agricultural potential though this varies as the relief changes towards the catchment area in Taita hills (Kasiki 1998).

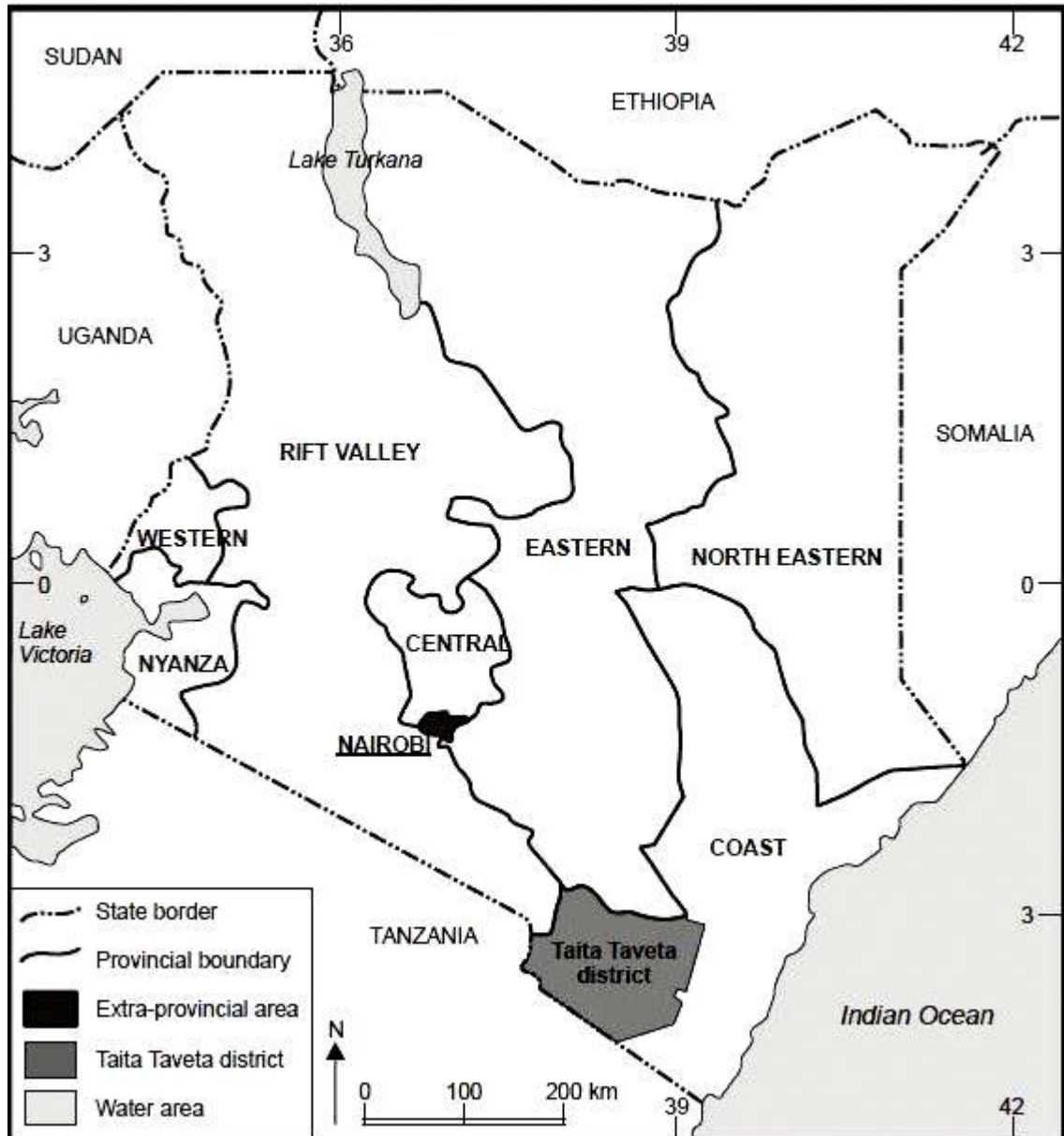


Figure 3.1 The boundaries of Kenya provinces and Taita Taveta county (Rutten 1990)

3.1.1.2 Climate

The hilly areas have ideal conditions for condensation of moisture, which results in relief rainfall. These areas experiences two rain seasons the long rains between the months of March and May and the short rains between November and December thus have more potential for agriculture specifically the production of horticultural crops,

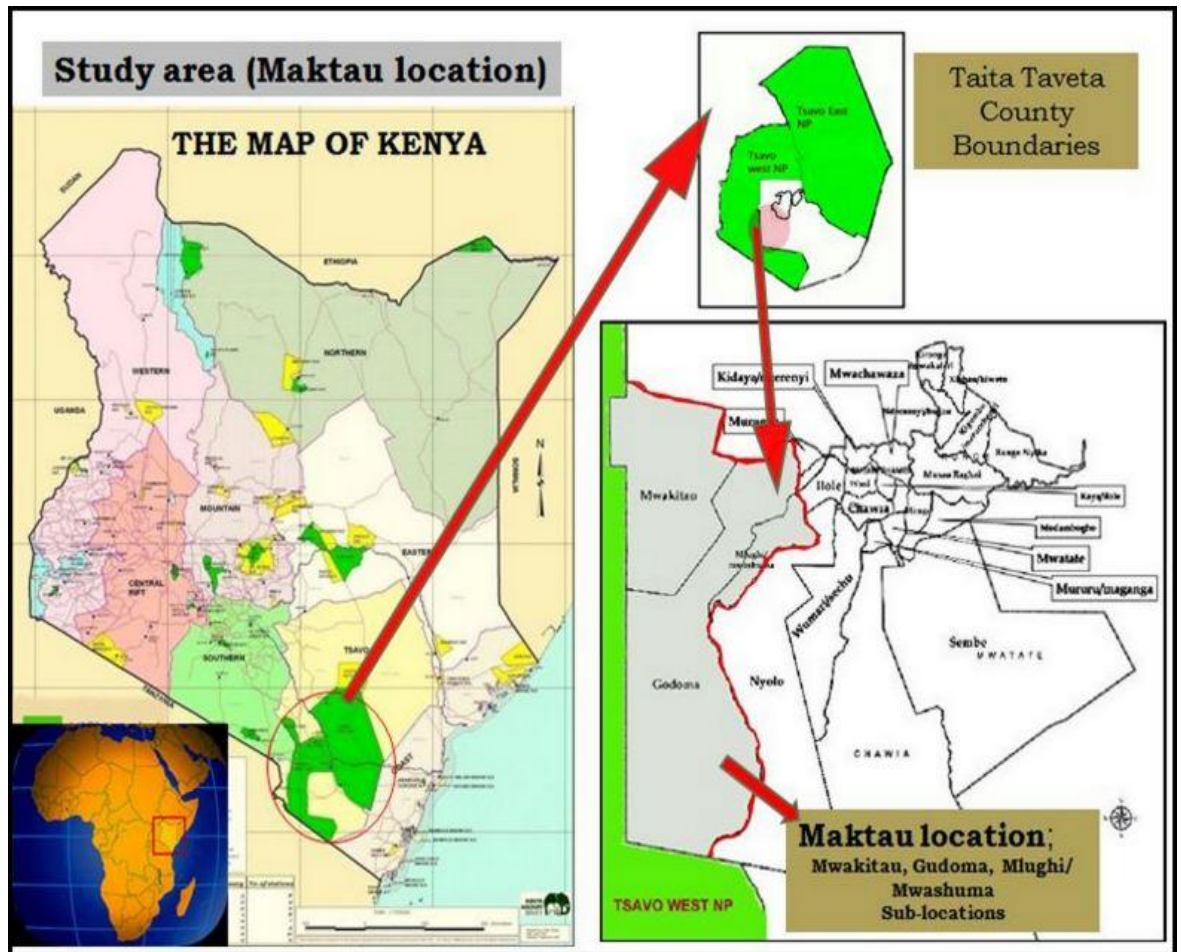


Figure 3.2 Showing the study area of Maktau location in Taita Taveta district and its boundaries against the Tsavo NP (Kasiki 1998, Anonymous 2010a)

maize and beans. However the lowland areas, which are mainly ASAL, are only suitable for planting crops with short maturing period like sorghum, cowpeas, green grams, cashew nuts, sunflower, millet and dry land hybrid maize varieties (Parkolwa 2007).

Climatic condition in Maktau area and in Taita Taveta county in general differ with the altitude. The average rainfall in lowlands is 500 mm/year and 1500 mm/year or more up in the hills. The average temperature in the lowlands varies seasonally approximately between 22°C and 30°C and up in the hills approximately 16°C and 24°C (Anonymous 2002).

3.1.1.3 Hydrology

The erratic and generally low rainfall in the Tsavo ecosystem means that the availability of surface water plays a major role in determining the distribution of many species. Natural permanent water sources are very limited in this area and the Tsavo ecosystem at large. The only natural source of water that supplies the Maktau community is Lake Jipe and small springs are found along the Yatta plateau and in some places on the dissected plains. The springs discharge is small and the water often becomes saline by the end of the dry season (Wijngaarden 1985). Numerous waterholes, which are usually shallow depressions in the landscape, hold water after the rains and may contain water for several months into the dry season. To counteract the shortage of water, Maktau locals sink boreholes in the areas.

3.1.1.4 Vegetation

There are three major vegetation types in the Maktau location and these are;

- Mixed *Commiphora-Acacia* woodland
- Grassland
- Riverine vegetation

The mixed woodland is the dominant vegetation type but it was even more widespread in the past. However, recently there has been a slow reversal back to woodland, probably because of the drop in elephant numbers. The riverine vegetation is found along the banks of the Lake Jipe and consists of several species of large trees (Leuthold 1996).

3.1.1.5 Population

The population in Maktau location as per 2009 census report is 6,926 (Anonymous 2009a). Mlugh/Mwashuma sub-location has a population of 1,633, Gudoma sub-location with a population of 2,700 and Mwakitau sub-location with a population of

2,593. Maktau location has a total of 1,859 households scattered about the area. The population density varies within the location.

3.1.1.6 Socio-economic and cultural structure

The largest source of livelihood within Taita Taveta county is agriculture that contributes to 95 per cent of household income (Anonymous 2002). Generally, the households own few acres of land maize, beans or millet cultivation and to keep a cow or few goats. The average household size is 7 persons. Unemployment in Maktau location is high which accounts to approximately about 44 per cent of the total labour force. About 66 % of the population lives in absolute poverty. However, the literacy rate within adults is above 80 % (Anonymous 2002).

In Maktau location, the highlands are potential for the production of food crops such as maize, beans, cassava, cowpeas, sweet potatoes and horticultural crops. The main cash crops produced in this area is sisal. Bee keeping and honey production is also an emerging economic activity in this region. However tourism is the main economic activity that is growing in Maktau area and the at the district level at whole (Himberg 2004). Infrastructure is poor throughout the district meaning about all of its factors: roads, telephones, electricity, water pipes, sanitation and public premises. Power failures are common and roads are continuously broken and literally flown away because of rain 70% of rural households use wood charcoal as the main source of energy (Anonymous 2002).

3.2 Method

The method for the study involved five important steps; An introduction that constituted the research objectives and problem statement; The concept of study that involved the literature and framework of study, Collection of study area information; Collection and analysis of data; Results compilation and presentation; Discussion and Conclusion (Figure 3.3).

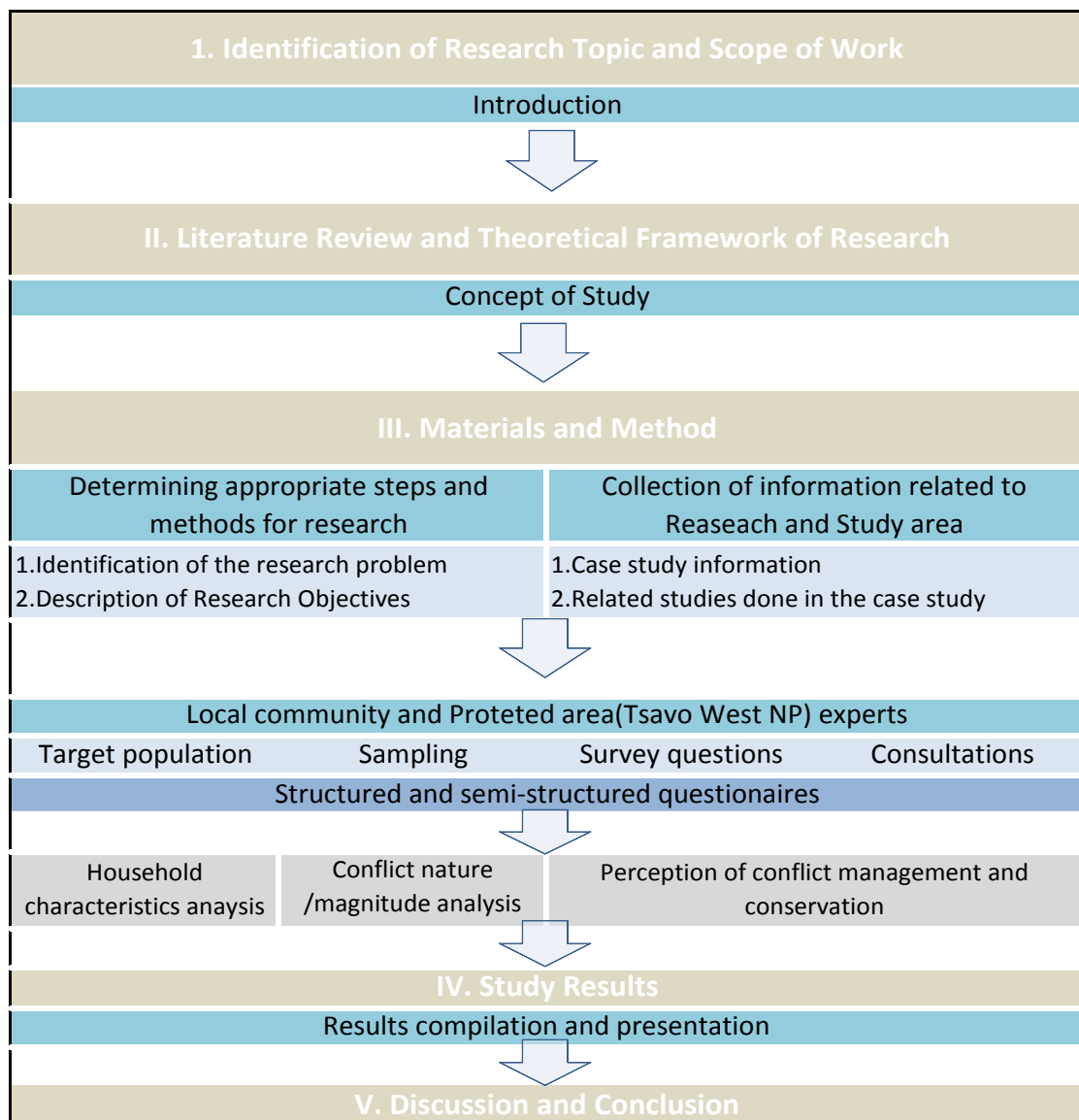


Figure 3.3 Flow chart of the research

The field study involved several important stages namely;

- Identification of a target population
- Consultation meetings and training
- Sampling
- Data collection (Questionnaire)
- Data analysis

3.2.1 Identification of Target population

To determine the target population of the study, distance from the protected area , education and literacy levels , social and economic activities , were used as the criteria for selection in the three sub-locations of the Maktau location. This resulted to a large number of individuals of which required extensive financial cost for research, and it was thus resolved to be the theoretical population. A further specific selection was done to determine the accessible study population that conclusions of studies could be applied on. This selection was based on lower criterion unit; Household. The term “Household” was taken to mean “a group of persons who normally live together and take their meals from a common kitchen”.

The household characteristics varied from Age of the household head, Landholding size, Number of members in the household, ooccupation of the household head, economic source for the household and geographical location from Tsavo protected area. The focus to households rather than farmers only was justified by the fact that human wildlife conflict is not biased to farmers alone but to the general population around protected areas either through wildlife raids (resulting to property loss, human injury or death) or visits (wildlife crossing their protected area barriers to the human settlements but cause no harm).

3.2.2 Consultation Meetings and Training

The study was done between July- September for a period of 6 weeks. Before the study began, a meeting was held with the Chief administrative head of the area, where legal authorization of the study was obtained. Six local enumerators, two from each of the sub-divisions, who could speak the local language were recruited and were first trained on probability sampling approach, how to conduct interview, data coding and entry (Figure 3.4). Each enumerator randomly covered at least three villages or more that were within their selected sub-division. The use of the local enumerators was to boost confidence within the household participants and also to ensure that all sub locations had equal chance of being randomly sampled. Given that 3 sub-locations were targeted, each enumerator was to target 20 households per their allocated location.



Figure 3.4 Enumerator training outside the Chief's office in Maktau

Structured questionnaires that captured the participants and household characteristics, nature of the conflict, magnitude of the conflict, perception of the local community towards HWC management and towards wildlife conservation were administered to the locals. In total a number of 120 households were interviewed within 18 villages in Maktau sub-location. Progress monitoring of the field survey was monitored through phone calls and frequent visits to the different villages.

Apart from the structured surveys, this study also used qualitative research approach in which consultations, meetings, observations, and retrieval of documents were used in examining the extent and management strategies implemented in Maktau area, and the whole district at whole. A consultation meeting was held with the Mr. Scio, the Chief of the area, The KWS chief warden of the area, Madam Njeri. Different consultations through telephone calls were done to the Chief Research Officer of Tsavo west. Visits were also made to Kenya National Bureau of Statistics (KNBS) and Kenya Wildlife Service library for retrieval and study of documents.

3.2.3 Sampling method

A sample size determination formula proposed by Turner et al. (2003) was adopted. This targeted households where land use decisions are made. The estimation formula for the sample size, (nh) used was;

$$nh = (z^2) (r) (1-r) (f) (k) / (p) (n) (e^2), \dots \dots \dots (1)$$

nh was the parameter to be calculated and was the sample size in terms of number of households to be selected;

z was the statistic that defined the level of confidence desired, which was set at 95%;

r was an estimate of a key indicator to be measured by the survey- small scale household vulnerability;

f was the sample design effect, $deff$, assumed to be 2.0 default value (Turner et al. 2003)

k was a multiplier to account for the anticipated rate of non-response;

p was the proportion of the total population accounted for by the target population

and upon which the parameter, *r*, was based (it was assumed 70% are small scale farm households);

n was the average household size (number of persons per household);

e was the margin of error to be attained.

The following values for some of the parameters were used as recommended by Turner et al. (2003) or adjusted to suit the study situation:

The z-statistic used was 1.96 for the 95-percent level of confidence. The default value of *f*, the sample design effect, was set at 2.0 (a default value since there was no supporting empirical data from previous or related surveys that suggest a different value).

According to Turner et al. (2003) the non-response multiplier, ***k***, should be chosen to reflect the country's own experience with non-response – typically under 10 percent in developing countries; a value of 1.1 for *k*, therefore, was a conservative choice.

The parameter, *p*, can usually be taken from the most recent census, although a reasonable rule of thumb was to use 0.03 for each year of age that the target population represents; for example, if the target population was children under 5 years old, *p* would be equal to 0.15 (5 * 0.03).

The parameter, *n*, was often about 6.0 in most developing countries, but the exact value should be used - usually available from the latest census. For the margin of error, *e*, it was recommended to set the level of precision at 10 percent of *r*; thus $e = 0.10r$; a smaller sample size can be gotten with a less stringent margin of error, $e = 0.15r$, but the survey results would be much less reliable of course.

Substituting these recommended values gave

$$nh = (3.84) (1-r) (1.2) (1.1) / (r) (p) (6) (.01) \dots \dots \dots (2)$$

Formula [2] reduces further to

$$nh = (84.5) (1-r) / (r) (p). \dots\dots\dots(3)$$

Using equation (3)

r is an estimate of a key indicator to be measured by the survey (A house hold ;70%)

p is the proportion of the total population accounted for by the target population

(This was taken to be 90%; households where land use decisions are made by the head)

Therefore,

$$nh = (84.5) (1-0.7) / (0.7) (0.9).$$

$nh = 40$ households per sub-division (Approximated from 40.2)

and there were 3 sub-divisions (40 by 3) = 120 households .

therefore the minimum number of respondents targeted were 120 households.

3.2.4 Questionnaire survey

The questionnaire was divided into 6 main sections. The first section investigated the respondent characteristic. This captured the person participating in the survey, not necessarily the household head. It also investigated whether the respondent was a visitor or a permanent resident of the area. Questions in the second section obtained the information of the household characteristics. It investigated the number of members in the household, occupation of the household head , landholding size of the household, and the land use. Water source point and their distance to the household was also investigated in this section. The third section assessed the magnitude of the conflict within the area.

This section assessed the distance of household from the Tsavo NP, the period of HWC, average crops destroyed and the number of livestock lost due to wildlife predation. It also introduced the wildlife animals involved in the conflict. The fourth section investigated the nature of the conflict within the area. It investigated whether conflict

was one way or two way, the frequency of conflict and the period of the months in which wildlife cause attacks or raids within the area. The fifth section investigated the perception of the population towards HWC management. This section investigated the management strategies implemented by the Government (KWS) or by the locals, the effectiveness of the measures, and opinions by the locals as to why the measures were effective or not. The final section was more open rather than structured and its objective was to evaluate the perception of the local population towards wildlife conservation. It assessed the perception of wildlife to the community, the incentive to kill wildlife, and allowed for any other comments that the local community had towards Human wildlife conflict in the area.

3.2.5 Data analysis

The data was first standardized before analysis by having category ranks and ranges that was applied all data set. Data from completed questionnaires were compiled and entered into SPSS 15.0 for Windows (SPSS Inc) for data analysis. Descriptive analysis was done using SPSS 15.0. The mean, median, mode variance and standard deviation (Central tendency) for various data were analyzed. These were later explored using histograms with a normal curve.

Multiple regression analysis was used to determine the correlation and extent of variance of the nature and magnitude of conflict to the distance of household from the protected area. The variables related to nature and magnitude of conflict was set as the dependent variable and distance of household from the protected area was identified as independent variable. A multiple regression analysis was performed to determine if there was a statistical significance between the two dependent and the independent variables already stated. These correlations were later presented using box plots and histograms.

3.2.6 Non-Response Analysis

According to Dolsen and Machlis (1991) response rates >65% generally are assumed to provide reliable results and accurately represent the populations being sampled and reduce concerns about bias arising from non-response.

To monitor the effects of non-response bias, an implementation adopted from Elsner (2008) was used to account for potential non-response bias in cases where response fell below 65%. For such cases, the non-respondents were contacted by telephone and the questions that were not responded to were rephrased in way understandable to the respondent. The original answer scoring was reduced to few options to facilitate the answers on the telephone. Additional questions were asked to assess whether the respondents received the original questionnaire, and their reasons for not responding (Elsner 2008). Results gathered from non-respondents were thereafter compared to those of respondents using Chi-square and correlation tests to determine the significant variations of opinions.

4. RESULTS

4.1 Household Characteristics

The response rate varied from village to village depending on the participant's willingness to answer and the knowledge they had about the conflict (Table 4.1). All the interviewed households were permanent residents of the area.

Table 4.1 Distribution of interviewed households across selected sub-divisions in Maktau and the response rate

Sub-division	Village	No. of interviewed households	Percentage response rate
Mwashuma	Mbelenyi	4	100
	Kenya	6	75
	Mwambingu	4	80
	Vinesenyi	8	75
	Madangonyi	5	90
	Ivarenyi	2	75
	Mandale	3	45
	Ng'ombenyi	8	75
Mwakitau	Msorongo	14	80
	Latika	6	80
	Mwambota	18	80
Gudoma	Vikorowenyi	7	100
	Wadoka	4	65
	Kizingo	6	100
	Kilingonyi	5	80
	Kajiado	5	100
	Kandala	5	75
	Bengi	5	100
	Mwashoti	5	90

The economic activity involved by the households varied on account of the location of the village to the nearest town. Of the 120 households, 79 % were farmers, 18 % were self employed and 3% were employed either to work in farms or in the towns.

The number of individuals in a household varied from 1-3 members to >9 (Table 4.2). 62% of households had 1-5 ha land holding size, 26% had 5-10 ha (Table 4.3).

Table 4.2 Distribution of members in a household

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-3 members	28	23.3	23.3	23.3
	4-6 members	57	47.5	47.5	70.8
	7-9 members	22	18.3	18.3	89.2
	above 9 members	13	10.8	10.8	100.0
	Total	120	100.0	100.0	

Table 4.3 Household land holding size of interviewed households

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 1 ha	2	1.7	1.7	1.7
	1-5 ha	74	61.7	61.7	63.3
	5 -10 ha	31	25.8	25.8	89.2
	10 - 20 ha	11	9.2	9.2	98.3
	Above 20 ha	2	1.7	1.7	100.0
	Total	120	100.0	100.0	

There was no statistical correlation between land holding size and the number of household members living in it ($F= 4.996$; $r^2= 0.041$; $P< 0.05$).

The source of water for households in the area varied. 34 % of the households used borehole and spring tapped water, while 21 % used river water and 8% used wells (Figure 4.1).

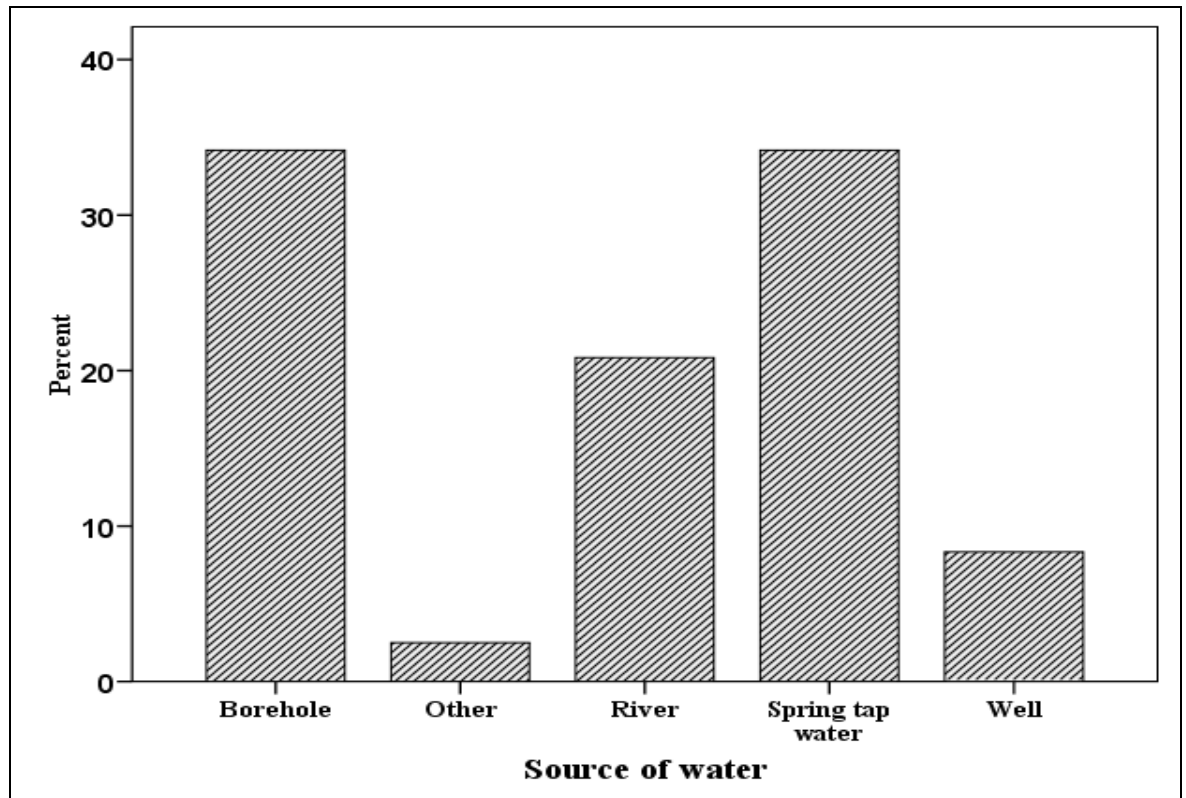


Figure 4.1 Distribution of sources of water in Maktau area

There was a statistical correlation between the source of household's water and the location of the household within the sub-location ($\chi^2=162.17$; $P > 0.05$, d.f.=8). There was a significant variation of the distance of the source of water from the household (Table 4.4).

Table 4.4 Distance of household from water source in Km

N	Valid	120
	Missing	0
Mean		3.9700
Median		3.0000
Mode		3.00
Std. Deviation		3.63775
Variance		13.233
Range		15.90
Sum		476.40

4.2 Nature and Magnitude of Conflict

Of the households interviewed, 33% of homesteads were located <1 km from the Tsavo National park, 27% were within 1-5 km, 28% within 5-10 Km and 13% were > 10 km vicinity to the protected area. 71% of the interviewed sample felt the number of wildlife visits and attacks in the were increasing, while 29 % felt wildlife animals were just roaming freely in the area. A significant difference was noted between different sub-locations on the response to conflict duration (Table 4.5) however 81% of the total sampled population experienced human-wildlife conflict for more than 10years.

Wildlife animals were responsible for damage of maize *Zea mays L.*, millet *Pennisetum glaucum L.*, sorghum *Sorghum bicolor Pers.*, and beans *Vigna unguiculata* in crop farms. 49% of farmers had 1-4 ha damage, 23% had crop damage of 4-8 ha, 19% had 0.5-1ha crop damage, 8% had crop damage >8ha while 2% had <0.5 ha crop damage (Figure 4.2) Because of problems quantifying availability of the different crop types to raiding wildlife animals, analyzing the selection of these crop types was not attempted.

Table 4.5 Duration of conflict with wildlife in the three sub-Location of Maktau area

			Sub-division area			Total
			Mwakitau	Gudoma	Mwashuma	
Duration of conflict with wildlife	2-5 years	Count	1	3	1	5
		% of Total	.8%	2.5%	.8%	4.2%
	5-10 years	Count	5	10	2	17
		% of Total	4.2%	8.3%	1.7%	14.2%
	More than 10 years	Count	34	27	37	98
		% of Total	28.3%	22.5%	30.8%	81.7%
Total			40	40	40	120
		% of Total	33.3%	33.3%	33.3%	100.0%

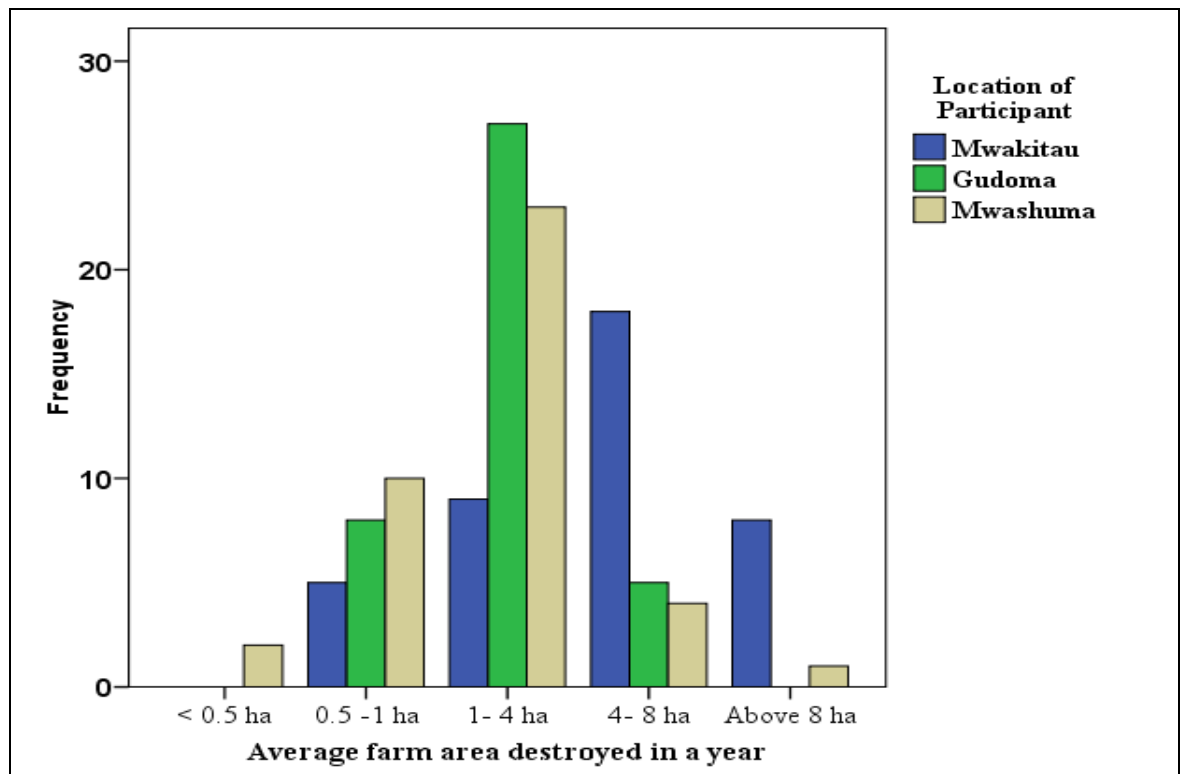


Figure 4.2 Annual average farm area destroyed by wildlife in Maktau area

Livestock predation by carnivorous wildlife was prevalent for the year. Farmers who practiced livestock keeping, 28% lost 2-3 livestock in a year, 13% lost 4-5 livestock, 11% lost >5 livestock, while 11% also lost a livestock animal to predation. However, 37% reported no loss of livestock to wildlife predation (Figure 4.3).

The Elephant (*Loxodonta Africana*) was perceived as the most destructive both to crops and human safety. The lion (*Leo panthera*) was also the most destructive in terms of livestock predation. Other animals like the Patas monkey (*Erythrocebus patas*) Wildcats (*Felis silvestris*) Rat (*Cricetomys sp*) and the Ground squirrel (*Xerus erythropus*) caused an insignificant loss to the local population (Table 4.6).

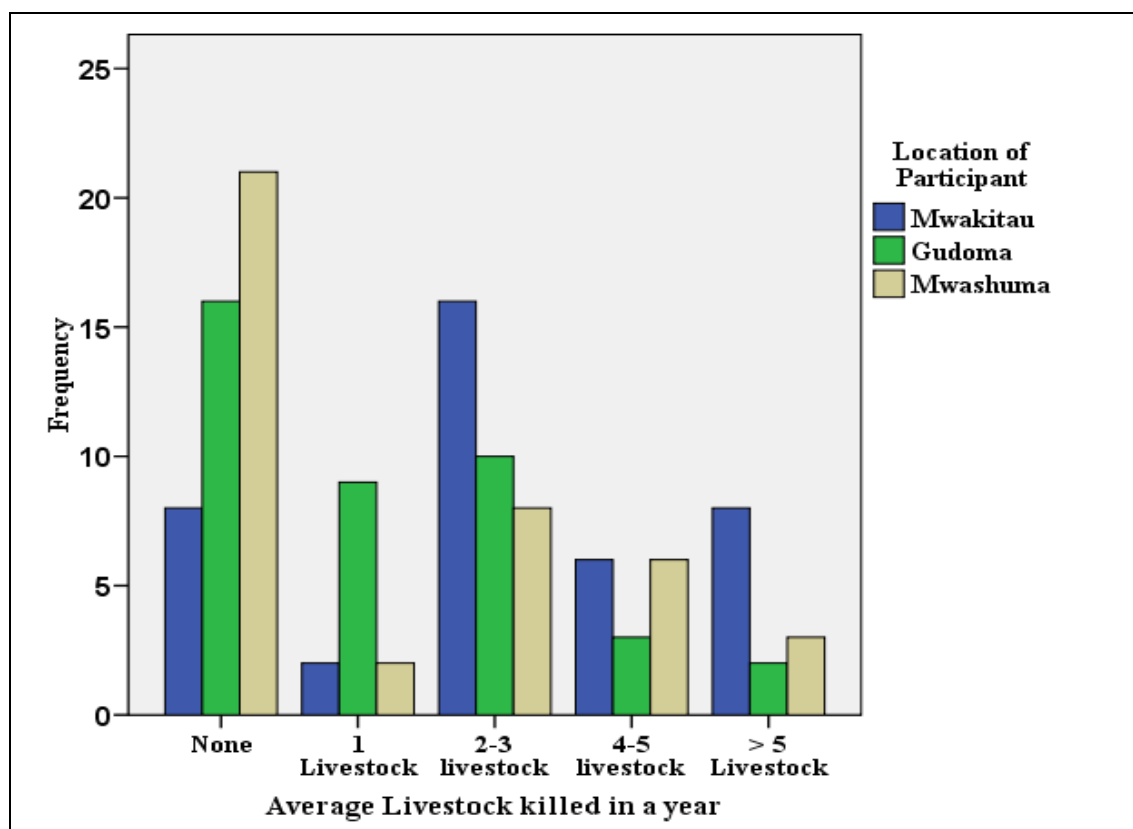


Figure 4.3 Annual livestock predation by wildlife animals in Maktau area

Table 4.6 Perception of the most destructive wildlife animal in Maktau area

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Elephant	100	83.3	83.3	83.3
	Lion	12	10.0	10.0	93.3
	Monkeys	5	4.2	4.2	97.5
	Other	3	2.5	2.5	100.0
	Total	120	100.0	100.0	

The period between March and August showed high frequencies of wildlife raids and attacks; however it was noted that other interviewed households felt conflict at different periods other than the ones provided by the questionnaire, while others felt the attacks were all year round (Figure 4.4).

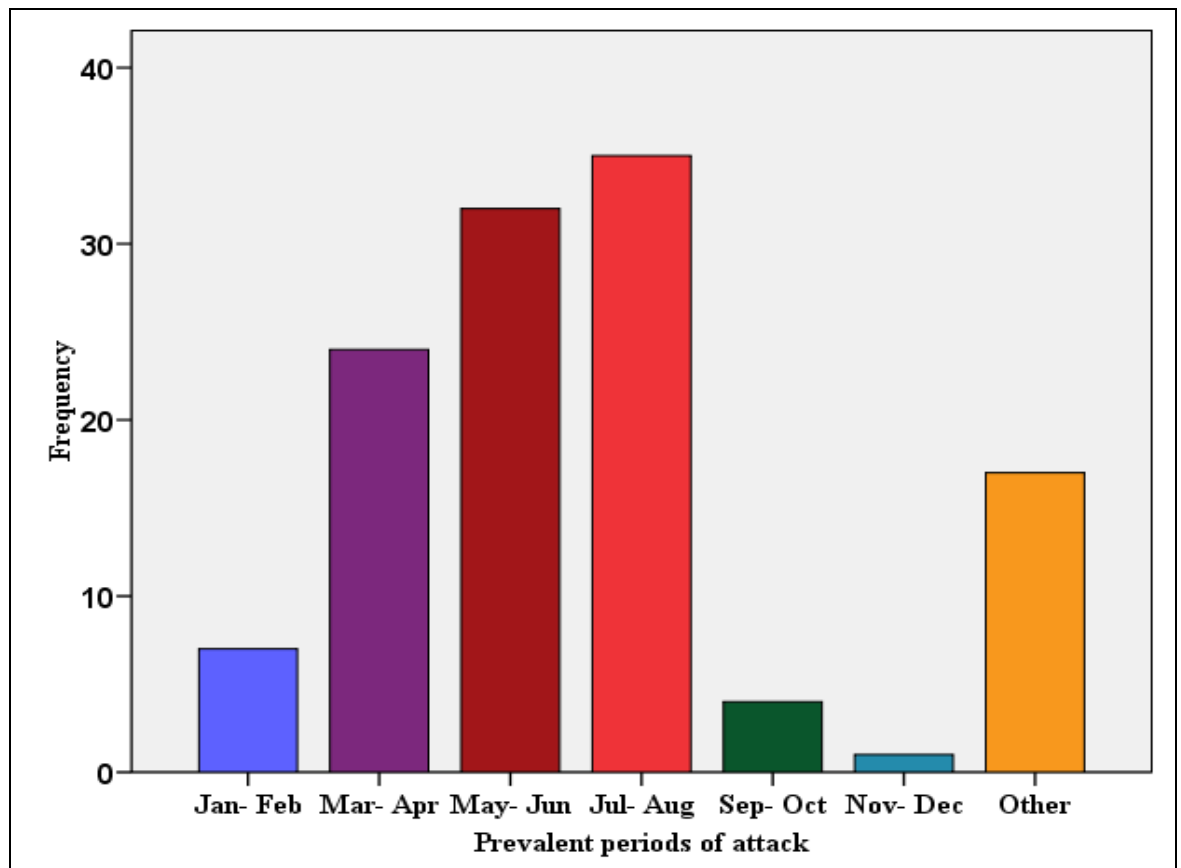


Figure 4.4 Monthly distribution of the frequency of attacks in Maktau location

The frequency of attacks and raid in the farms showed significant correlation with the prevalent monthly periods of attack ($F= 10.369$; $r^2=0.081$; $P< 0.05$). During the period of July and August when frequency of attacks were high, weekly attacks in that period were considerably high in the area (Figure 4.5).

Regression analysis revealed that there was a significant loss due crop damage to households that were near the Tsavo NP ($F= 1.946$; $r^2=0.032$; $P< 0.05$). The households living less than a kilometer from the national park suffered an average of 1-4 ha of crop loss with a others complaining > 8 ha of crop loss (Figure 4.5). However from the results, farmers living more than 10 km from the NP also showed the same trend of crop damage. This was attributed to the small number of individuals ($n=15$) interviewed from that proximity as compared to the ones interviewed in the < 1 km proximity (Table 4.7).

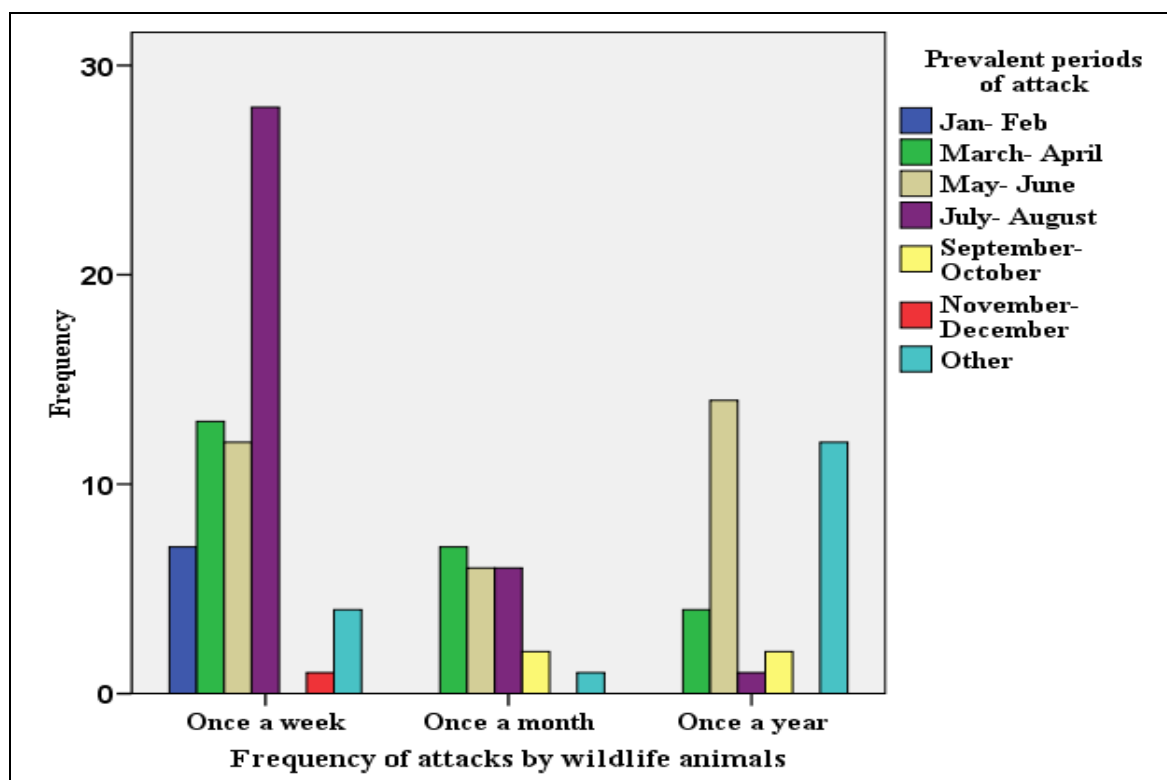


Figure 4.5 Monthly Periods of wildlife attacks and raids within Maktau area

Average livestock killed by wildlife also showed to differ with the proximity of household to the protected area ($F= 69.23$; $r^2=0.37$; $P< 0.05$). Households living 0-5 km lost an average of 2-3 livestock with a variability of 1 and 4 livestock while the ones living 5 km and above from the NP had variations of livestock loss, ranging from none to 2-3 livestock (Figure 4.6).

Table 4.7 Comparison of farm area destruction with the proximity to Tsavo NP

		Home Distance from the protected area				Total
		Less than 1 km	1-5 km	5-10 km	Above 10 km	Less than 1 km
Average	< 0.5 ha	1	0	1	0	2
farm area	0.5 -1 ha	5	6	10	2	23
destroyed	1- 4 ha	17	21	14	7	59
in a year	4- 8 ha	11	3	8	5	27
	Above 8 ha	6	2	0	1	9
Total		40	32	33	15	120

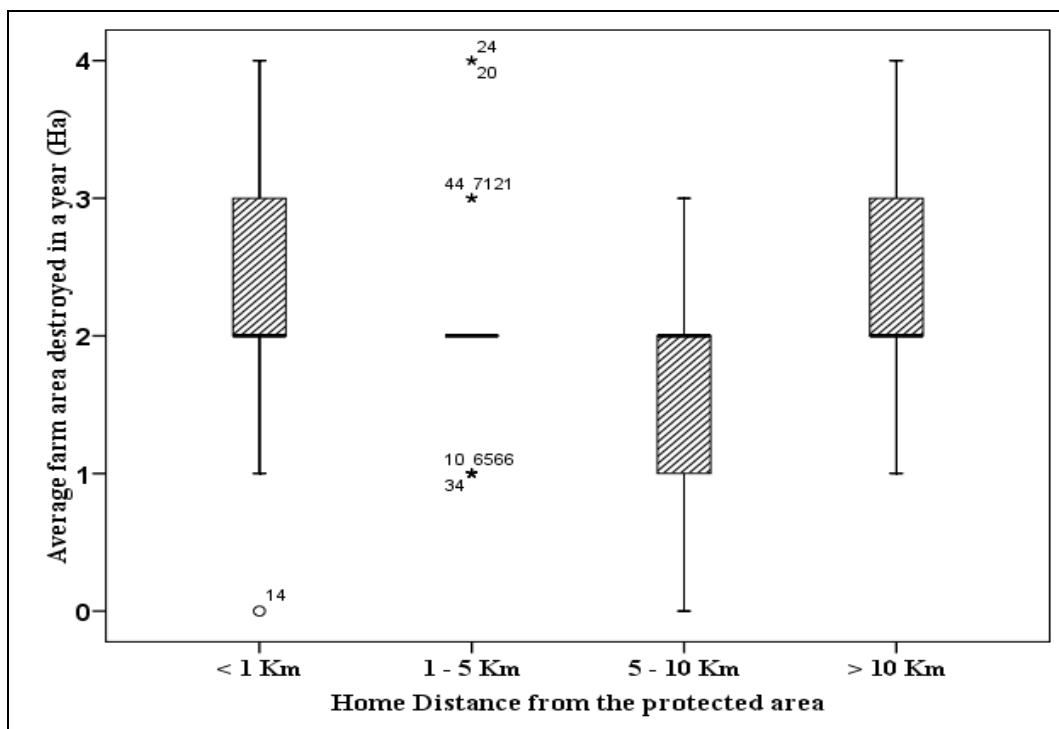


Figure 4.6 Average farm area destroyed by wildlife at different distances from the NP

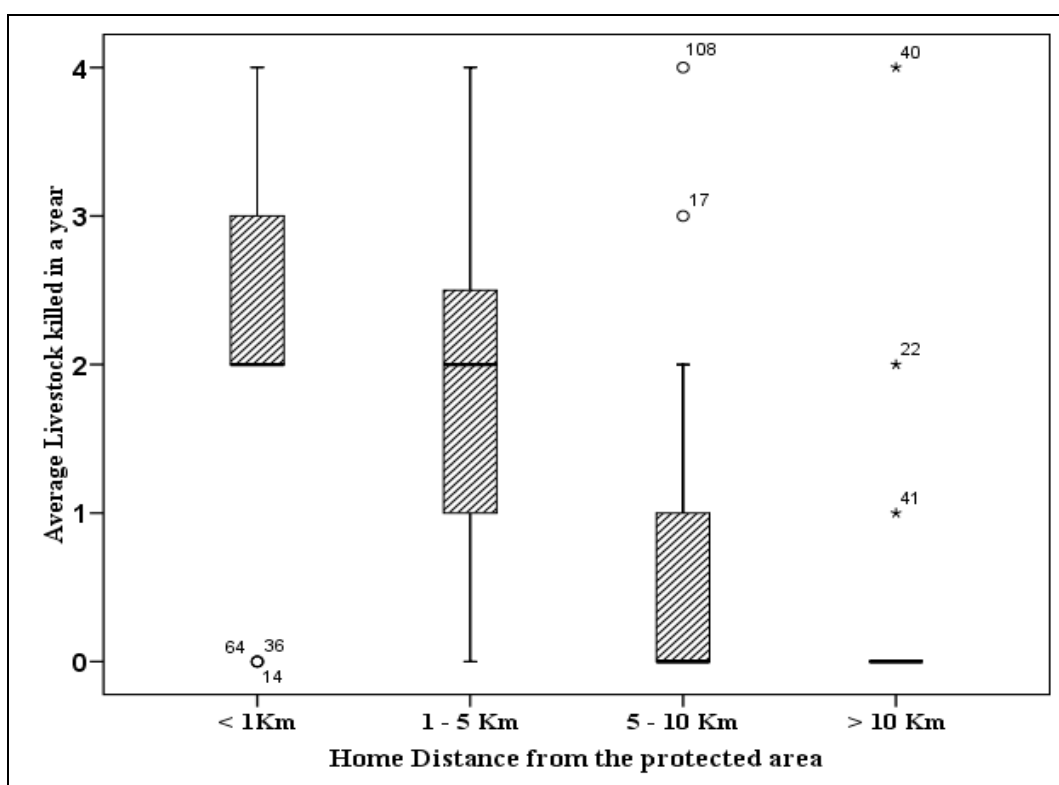


Figure 4.7 Comparison of livestock predation with respect to household distance from Tsavo national park

There was no significant difference in the frequency of raids and attacks when the proximity of the NP was factored in. The number of raids in the farms < 1 km from the NP varied insignificantly with the raids which occurred in the 1-5km, and 5-10 Km . However 54% of all the participants reported a weekly raids by mostly elephants and buffalos (Table 4.8).

Table 4.8 Frequency of attacks by wildlife at different distances from Tsavo NP

		Home Distance from the protected area				Total
		< 1 km	1-5 km	5-10 km	>10 km	
Frequency of attacks by wildlife animals	Once a week	19	16	19	11	65
	Once a month	6	8	7	1	22
	Once a year	15	8	7	3	33
Total		40	32	33	15	120

4.3 Community perception toward conflict management and wildlife conservation

58% of the interviewed population agreed that the government had and was making effort to manage the conflict in the area (Figure 4.8a). This was further substantiated by the 53% of the locals who agreed that the 32 Km Bura- Maktau electric fence had been built to contain wildlife in to the protected area and 1 % who had received some sort of compensation for their losses.

5 % of the interviewed population reported other measures implemented by KWS to manage HWC e.g. Arial drives of wildlife by helicopters and constant monitoring patrols by the KWS unit. On the contrary, 42% of the residents reported that the KWS was not doing enough to manage the conflict (Figure 4.8b). This was attributed to their losses through crop damage and livestock predation. Some felt that the electric fence built was short and did not go through the whole boundaries of the national park. The

households living within close proximity to the fence also complained of the inability of the strategy to contain small animals like monkeys, squirrels and birds.

The measures implemented by KWS to mitigate the conflict were termed not effective by 63 % of the interviewed population. 30% of these were residents of Mwashuma sub-location where the Bura-Maktau fence transects. 22% reported moderate effectiveness of the measures applied by KWS, with 17% of that from Mwakitau sub-location.

There was a significant range in the response to effectiveness of KWS measures in Gudoma sub-location, with 10% feeling the measures were very effective while 20% differed in opinion. 5% of the total sampled population were unable to evaluate the effectiveness of the measures by KWS (Figure 4.8c).

Ineffectiveness of the measures implemented by KWS were attributed to their slow response to conflict when it occurs, incomplete Bura-Maktau fence and unequipped wildlife wardens.

Other locals went further to say that the number of wildlife in the area outnumbered the available KWS wardens thus being incapable of managing the conflict. The results showed that despite the efforts by the government through KWS to manage the conflict, 55 % of the sampled local community at household level had some form of personal measure against wildlife attacks and raids (Figure 4.8d).

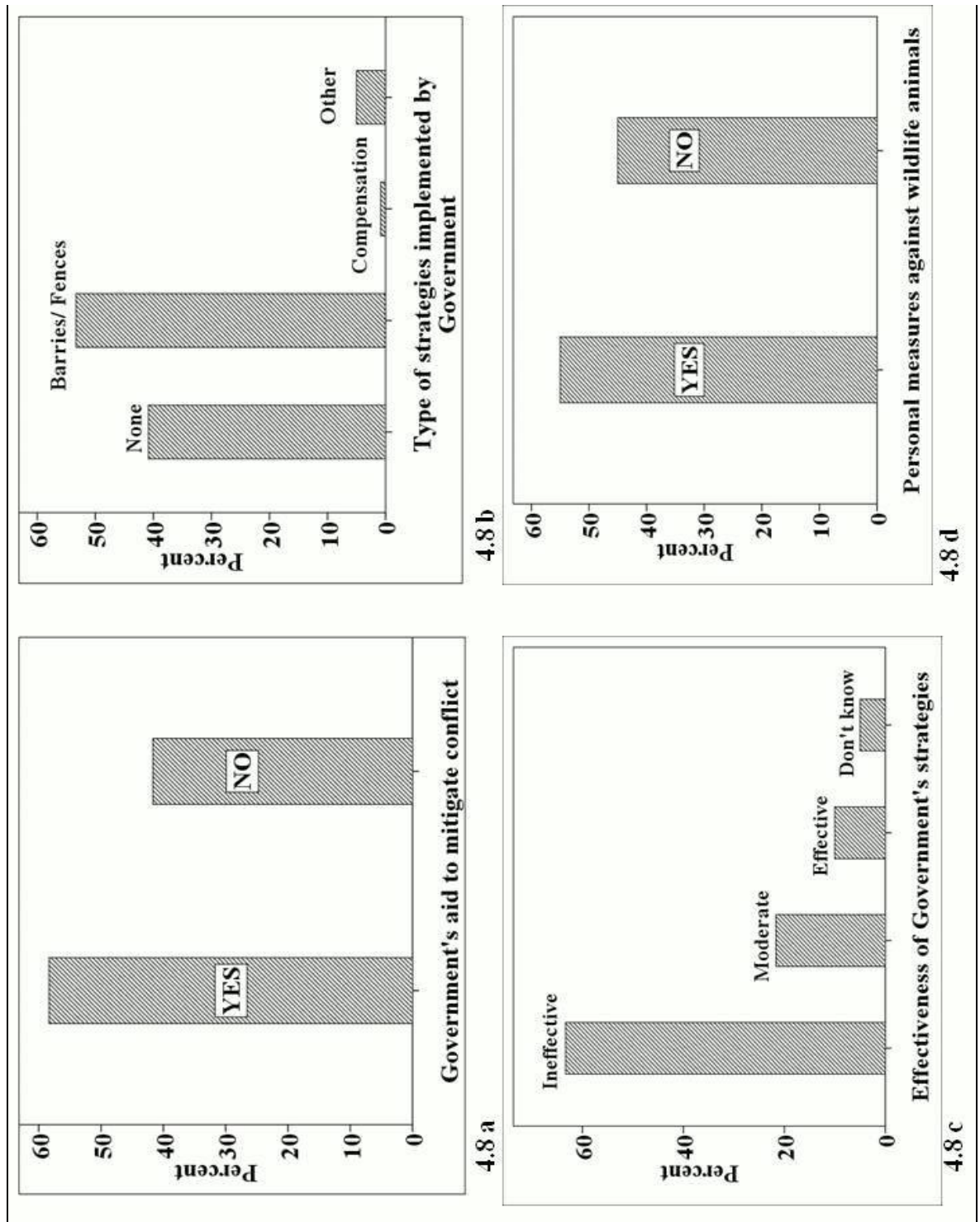


Figure 4.8 Graphical representations of the overall perception toward 4 variables

Strategies like the use of pepper deterrents, beating drums, shouting, use of fires, keeping watch on farms, throwing stones, use of scarecrows, and use of short thorn fences were constantly used by the locals. Nevertheless 61% of these reported that the personal measures were not effective, 23% felt their measures were moderate in efficiency while 5% reported effectiveness in their measures (Figure 4.9a). The reasons for ineffectiveness included; high cost of implementation and maintenance, constant destruction by elephants and buffaloes and inability of the measures to work after some time due to the adaptive nature of wildlife.

92% of the total interviewed population perceived wildlife as a threat (Figure 4.9b). This perception was substantiated by 48% of the population having witnessed a wildlife animal being killed (Figure 4.9c). The small scale farmers attributed their loss to wildlife; the household attributed the destruction of property to large wildlife animals while the small business owners reported the early closure of their shops and service rendering due to the danger of walking or commuting past 7 o'clock in the night.

In response to perception of best management strategy, 60% of the sampled population was confident of that barriers specifically the electric fences would contain wildlife movement, 22% felt compensations would reimburse losses incurred by wildlife. 10% inclined to eradicate problem wildlife animals. 6% perceived other methods like creating buffer zones and resettlement of farmers to other areas were the best measures to manage the conflict (Figure 4.9d).

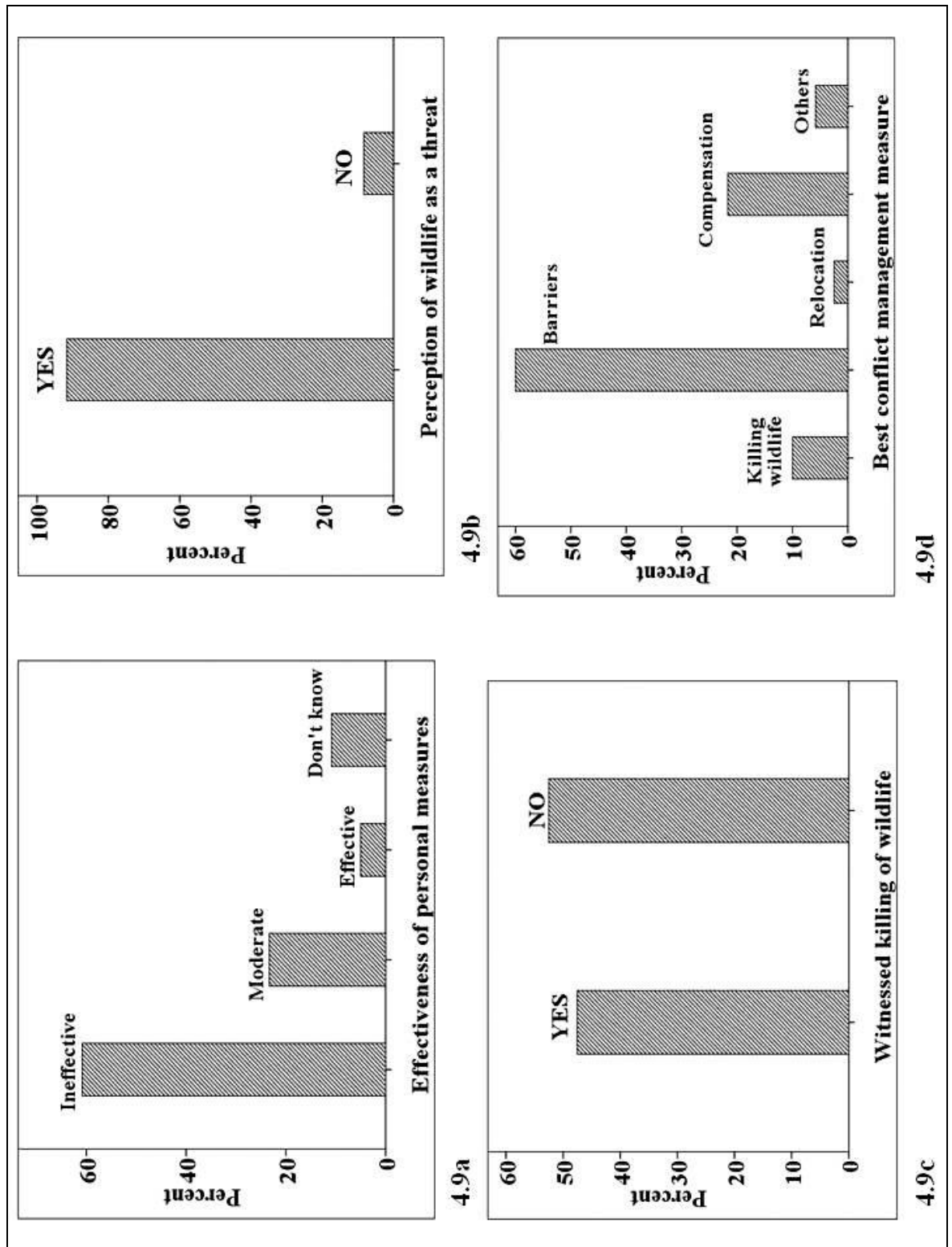


Figure 4.9 Graphical representation of 4 variables

4.4 Experts perception toward conflict management and conservation

However according to the different consultation meetings held with the KWS officials in Taita taveta county, it was noted that there was similarity in reports on the magnitude and nature of conflict for both the KWS officials in the area and the local residents. Nevertheless, the approach toward conflict management differed between the KWS experts and the locals residents in Maktau location. According to Human Wildlife Conflict reports collected between January 2009 – November 2012 in the larger Taita taveta county, two sets hotspots for HWC were identified. The first set of hotspots included areas that were adjacent to the Tsavo West national park near Maktau area. These areas included Bura, Kamtonga, Alia and Mwatate . In this set, a total of 1,029 complaint cases of crops and property destruction were reported by the locals in that region. 10 human deaths and 30 human injuries were also reported. The wildlife animals involved were the Elephant (*Loxodonta Africana*) and the African buffalo (*Syncerus caffer*) (Table 4.9).

The second set included Maktau, Kishushe, Msorongo and Ndii. In these areas, a total of 849 cases of crop and property destruction, human threat and livestock predation complain were made by the local community to the KWS office in Maktau location. In the same period of time, 4 human deaths and 14 human injuries were also reported. In general, the magnitude of conflict in these areas was significantly extreme as substantiated by a total of 1820 conflict cases, 44 human injuries and 14 human deaths between January 2009 - Nov 2012 (Table 4.9). As reported by KWS officials in charge of Maktau location, the reasons for this conflict was largely due to the movement of elephants and buffaloes from Tsavo West NP and the neighboring Lualenyi/ Mugeno ranches to the human settlement areas.

The growing interest of irrigation farming by the local community, which has also been aided by KWS in providing water sources like boreholes and spring tapped water, has led the animals to raid the farms and water points in search of food and water. The tendency of ranches to overstock game animals like antelopes and zebras and also

livestock, attracts predators like lions and leopards leading to the indiscriminate predation of both wildlife and livestock in the ranches.

Table 4.9 KWS conflict report for Maktau location and its environs (Jan 2009-Nov 2012)

Human Wildlife Conflict in Larger Taita from January 2009 – November 2012				
Hotspot set	Period	Cases reported	Problem animal	Conflict type
Bura/ Kamtonga/ Alia/ Mwatate	2009	92 Cases HD 1 HI 16	Elephants Buffaloes	Human threat Crop destruction Waterpipe destruction Human death Human injury
	2010	47 Cases HD 1 HI 2		
	Jan - Jun 2011	56 Cases		
	Jul 2011-Nov 2012	834 Cases HD 8 HI 12		
Maktau/ Kishushe/ Msorongo/ Ndi	2009	55 Cases HD 2 HI 2	Elephants Buffaloes Lions Leopards	Human threat Crop destruction Predation Human injury Human death
	2010	89 Cases HD 1 HI 5		
	Jan - Jun 2011	96 Cases		
	Jul 2011-Nov 2012	609 Cases HD 1 HI 7		
Total no.of cases= 1820 HI-Human injury = 44 HD- Human death = 14				

The greatest challenge to contain wildlife in the Tsavo West NP has come from the slow progress of building the 30 km fence from Bura area to the Park's boundary. This is due

to the constant land boundary disputes between the Taita hills sanctuary and the Kamtoga/Alia community. This has made the building of the fence slower as still the case is pending in the court.

Despite the challenges, KWS officials reported positive progress to manage the conflict in Maktau through the Problem Animal Management Unit (PAMU) established in 2006. PAMU is a unit within the community wildlife service department established to ensure swift response to human wildlife conflict incidents within the country. The role of the rapid response team is to beef up the local problem animal control teams in all Community Wildlife Service (CWS) stations to handle conflicts. The aim of this mobile team is to reduce significantly the number of conflicts within the country and specifically in the following identified conflict hot spots. In Maktau, PAMU is making effort to enhance corporate image and positive public attitude towards wildlife conservation and management.

According to the District KWS warden, the communities who host wildlife on their land and make effort to manage human wildlife conflict at their level have begun appreciating wildlife. More communities have started growing the desire to set aside land for conservation through establishment of nature based businesses for benefits. PAMU had already organized several wildlife campaigns and public education on the importance of wildlife. Moreover, the constant patrols by the unit in the villages and aerial monitoring of wildlife movement in Maktau area, was reported to be a positive success by the KWS wardens in Maktau.

5. DISCUSSION AND CONCLUSION

The overall status of Human Wildlife Conflict in Maktau area

With the gradual increase of human population in the world, the need for space to accommodate development, and the increased degradation of natural resources, it is right to say that the prevalence and resulting effects of HWC will continue to exist. This study has shown that the status of conflict between wildlife animals from Tsavo West NP and the local community at Maktau location has been a prevalent problem for years. As revealed by the study results, at subsistence level, the greatest threat to crop loss by a single species was attributed to elephants. This concurs with results obtained from other research studies conducted in Taita Taveta county by Kasiki (1998) and Colonna (2011).

Human-Elephant Conflict (HEC) is a problem that dates back in the history of Taita Taveta region and its inhabitants. Before Tsavo West National park was gazetted in 1948, tribal groups (Watta, Taita, Taveta, Orma and Kamba) had settled in the Tsavo ecosystem for thousands of years. These tribes had used this ecosystem for grazing their livestock and hunting wildlife for game products such as meat, ivory and skins. One of the main factors for choosing the location of the park by the British colonialist government was that the area had a small human population consisting of hunters, gatherers and nomadic pastoralists. Once the NP was proclaimed, the only lawful use of the ecosystem for the public was only tourism and recreation through game viewing. The people who had occupied and used the area for centuries were evicted. This had a severe effect on the tribes who had habitually used this land for grazing, hunting and other needs. In addition, the authorities made hunting illegal but it was ignored by the locals and instead they turned to full time poaching of both elephants and rhinoceroses. The Government responded to this in 1956 by waging a massive anti-poaching campaign to suppress all traditional and tribal hunting throughout the Tsavo ecosystem (Smith and Kasiki 2000).

It is therefore clear that the Tsavo NPs boundaries were chosen disregarding the existing local community and the future outcome of migration and dispersal of wild animals, especially the elephant, across PA boundaries. When the NPs were created in 1948 the human population density was very low, at less than 5 per km² (Anonymous 1982). However over the past five decades the number and distribution of people have expanded continuously and this has had a profound influence on the ecology of the Tsavo ecosystem and patterns of land use within it. Elephants that move out of the NPs onto many of the neighboring areas now come into conflict with legitimate human interests, whose outcome is intolerable to the poor neighboring human community.

In answering the status of HWC in Maktau, the study showed that wildlife visited household farms all year round. However, visits by elephants intensified in March to August. In a similar study conducted by Nyhus et al. (2000) in 13 villages around Way Kambas National Park in Indonesia, results showed that elephants visited farms throughout the year. Nyhus et al. (2000) attributed this to the fact that planting and harvesting of crops was carried on within the wet and dry seasons creating a patchwork of different crops at different stages of growth. At Maktau area, elephants increased their visits when crops were physiologically mature, that is from March to August. It is at this growth stage that the crops were most palatable and vulnerable to elephant attacks. Maize was the crop that incurred the greatest economic loss due to damage by elephants. Studies in other areas have shown that the crops most preferred by farmers are the most affected by wildlife. On farms around Maasai Mara National Reserve in Kenya, wildlife damage to maize accounted for over half of all crop damage (Omondi 1994). Around Kakum and Bia Conservation Areas in Ghana, maize was the most attractive crop for elephants and other herbivorous wildlife. Naughton-Treves (1998) reported that around Kibale National Park, in Uganda, all the frequent crop foragers consumed maize.

Proximity of farms and households to the national park was a strong predictor of crop raiding by elephants and monkeys and livestock predation by lions. High farm losses due to crop damages caused and livestock predation occurred within 1 km from the Tsavo West NP. The overall loss of crop damage and livestock predation by wildlife

significantly decreased as the distance from the NP increased. This study did not evaluate the economic costs in monetary terms incurred by individual households due to crop destruction and livestock loss to animals, but it can be rightly assumed that crop damage and livestock loss was directly proportional to the economic loss; the greater the crop damage or livestock loss incurred, the greater the economic loss incurred by the individual homestead. In addition, crop raiding by elephants in the village was related to elephant migration. In an earlier study conducted by Smith and Kasiki (2000) on the spatial distribution of elephants in Taita Taveta, it was revealed that some of the villages in Maktau area are located in the migratory routes of elephants.

There was enormous variation in crop damage and livestock losses borne by individual households. Some households had severe losses while others incurred less and not every household in the villages had crops attacked by elephants. This can be attributed to animal behavior of food crop preferences, effectiveness of KWS measures and personal mitigation measures, or the combination all the above factors.

In response to the seasonal changes in Tsavo ecosystem that propel wildlife to break their boundaries, dietary preferences of wildlife animals rather than water, was main attributed factor for wild herbivores like the elephant and the buffalo. In contrast with other studies that have shown that the distance of household to water source play a strong role in predicting damage (Naughton-Treves 1998), the relatively similar distances among households surveyed in this study showed no significant correlation to the extent of human wildlife conflict. As shown by this study, the Maktau community utilizes boreholes, wells, spring tap water and occasionally the Bura river. Many of the artificial sources of water are initiative projects by the government through KWS within the Tsavo NP and areas around it. Artificial water points were first created within Tsavo NP in the early 1950s to achieve three objectives.

These were to prevent wildlife from moving outside the NPs in search of water, to attempt to distribute wildlife evenly throughout the NPs and to improve the touristic potential of the area. More water-points were created in the 1960s and some of these were supplied by pumping water from the Galana river and by sinking boreholes.

However, many of the water-points that were formed by damming rivers silted up and others were affected in the 1970s when lack of funds prevented pump maintenance. Since 1994 to date, KWS and other tourism companies has rehabilitated these pumps and added several water points and so artificial water is again available during the dry season. In addition, water development projects, primarily for livestock and for human consumption have also been undertaken outside the NPs, which increased the availability of drinking water in the Tsavo ecosystem. Most ranches and community groups have developed their own water supply, either by pumping from the Galana river or by using a supply from the pipeline that runs from Mzima springs in Tsavo West. With this in mind and also the prevalent occurrence of wildlife raids and attacks in periods when water is plenty, it can be concluded that the search for water is not a significant predictor to HWC in Maktau area. In addition, livestock predation also was more prevalent in periods shortly after the long rains. At this time, farmers in Maktau area convert big portions of their lands to farming thereby reducing land for livestock pasture thus the open fields in the NP become the alternative source for livestock grazing. With the abundance of livestock, wild predators like the Lion and Leopards shift attention to easy preys like sheep, goats and cattle. It was noted that livestock animals that were left unattended for were severely predated on by wild carnivores.

Severe economic losses resulting from crop damage and livestock predation was the major socio-ecological variable that motivated the local community to kill wildlife. This study showed that nearly half the interviewed population had participated or witnessed the killing of a wildlife animal. According to the KWS reports, between the year 2000 and 2009, a total of 268 elephants were killed illegally in the Tsavo ecosystem and its surrounding. This was either done by local communities living adjacent to the national parks or by poachers. This is attributed to the increasing number of elephants in the NP. According to the elephant survey done in 2009, it was reported that there were 10,346 elephants within the NP and approximately 1,387 elephants that are outside the NP (Anonymous 2010b). The distribution of Lions in the NP is still being surveyed. With this large numbers of single species of wildlife in Tsavo, we can conclude that severity of the HWC is great for such a small area like Maktau which holds less than a population of 2000 people. It can even further be assumed that the number of animals in

the NP outnumbered the overall population of humans living adjacent to it. This assumption can further be supported by the number of 1,820 conflict cases reported by local residents of Maktau area and its neighbors to the KWS wardens, which also included 44 human injuries and 14 human deaths between January 2009 and November 2012. With the conflict escalating, local residents living in the area feel threatened by wildlife as shown by this study. In addition, it was noted that apart from retaliation killings, majority of respondents saw no possible benefits from wildlife while others felt that killing wildlife animals was a factor in improving farm production.

Perception toward HWC management and conservation

From this study, it can be seen that efforts by both the KWS and the local community to manage HWC in Maktau area have not been entirely effective. Before 1992 the issue of HWC was not an important concern of the Government of Kenya or KWS. To a large extent, authorities managed human-wildlife conflict by avoidance and force. It was generally perceived by affected communities that management departments used provisions of the law to protect animals but turned to slow and inefficient administrative protocol, inaction and delaying tactics when processing compensation for death, injury or damage to property (Smith and Kasiki 2000). This resulted in great discontent with the wildlife authority (Anonymous 1994b).

KWS has responded to these criticisms by introducing several policies to understand and mitigate HWC in Kenya. In Maktau area as seen from this study, these measures have included constructing electric fences, translocation of problem animals, PAC team aerial and ground patrols, awareness campaigns and compensations. However the management measures have had challenges to effectively manage conflict. The construction of the Ndi-electric fence around Tsavo West NP has come to halt due to problems of boundaries with the local residents. The PAC teams could be more effective with sufficient gear and training to quickly respond to conflict cases wherever and whenever they occur. Translocation of problem animals can only be done to one animal at a time and it's expensive.

Compensation generally, has also had its share of challenges in Kenya since its introduction after the ban on hunting in 1977. The allocated resources were not enough to compensate all wildlife damage due to corruption and thus the compensation strategy came to a halt. Since the communities were no longer being compensated by the government for wildlife damage, KWS has made steps to establish community welfare projects in areas adjacent to NPs. In Maktau area, projects like provision of water points e.g. boreholes and provisions of education bursaries to children of affected households have been implemented. This policy was intended to give communities direct benefits from conservation, and has been a success in that respect (Ogada 2009).

However, the discontinuation of compensation without a formal information to the community, has left a volatile chance through which the obtained gains could be overlooked by the communities. There is enough evidence in literature that show compensation is neither an effective nor sustainable conservation tool, raising questions as to why “conservationists” and qualified scientists are involving themselves in this practice (Madden 2004). Either way, data from this study does not show any significant reduction conflict as a result of the monetary compensation.

On the other hand, personal measures implemented by the Maktau local residents to mitigate raids and attacks have been of least effective in HWC management. This is attributed, incapability to implement and maintain mitigative measures due to the low level of education and high level of poverty in the area. The most used measures, by the surveyed population, were shouting, guarding, use of fire, stone throwing, and use of short wire fences also known as bomas. The problems with these measures included; the fences are weak to guard against lions and elephants, maintenance costs were high, methods like shouting, stone throwing were tiresome and dangerous. Some animals especially primates, often awaited the departure of farmers before moving into fields. A study by Sitati et al. (2005) concerning factors that affect susceptibility of farms to crop raiding by elephants found that many farmers often sacrifice guarding effort as a result of increased fencing. In this study, some of the households reported that they still engaged in guarding efforts despite the existence of a physical barrier. This indicates that farmers view barriers as inadequate deterrents to crop raiding and thus, continue to

guard. This is promising evidence as both of these deterrents in combination constitute one of the most effective methods to mitigate human wildlife conflict in the short-term (Colonna 2011). However despite the fact that household guarded their farms and used various strategies to scare animals, there was a perception that crop damage and livestock predation was increasing.

Conservation of most resources requires wide spaces on public and private property, participation and involvement of local communities. In Kenya, there are close interactions, interdependence and interface between people and natural resources or protected areas where they are legally conserved. Therefore community participation and involvement is important for the viability of these protected areas. This is important especially for wildlife which was a source of food, sport and source of cultural stories in many African societies for ages. The western model of conservation that separated wildlife into protected areas (such as NPs) was totally alien to the use and interactions that Africans had with such resources. Many rural communities depended on these resources for livelihoods, especially where other options (such as commerce and trade) were limited (Okello 2009).

In this study, Maktau residents did not completely perceive HWC problem unsolvable, or the inability of the KWS to sufficiently manage it, however the problem was that their views toward conservation and management were completely opposite those of the KWS. The differences between the two groups are a reflection of their top priorities. The KWS conceptualizes conservation as an activity at the ecosystem level, and for them, the assurance of the existence of wildlife is vital and conservation means removing the negative effects of human activities on wildlife habitats.

In contrast, for the local residents, the most important thing is not the existence of wildlife but their own subsistence; their crops and livestock animals. Conservation was accepted among the local people only if it was in accordance with farming and their livestock needs which were their primary economic source. This has resulted to lack of participation of the local community in conservation initiatives irrespective of efforts being made by the KWS. Other challenges to effective community participation in the

resource conservation for the Tsavo NP in Maktau area include low technical expertise and education among the local residents especially on land tenure and resource ownership policies. The growth of population in the area is another challenge. This has led to increased unsustainable demand for natural resources.

There is an increased wildlife-based tourism in the area which includes Tsavo West NP itself, Lumo conservancy in Taita Hills and Lualenyi and Mugeno ranches, however they are centered on protected areas, with limited opportunities for participation and investment of the local community due to poor financial endowment and expertise in tourism enterprises. There is also generally poor local institutional framework where the communal benefits and property are dominated and mostly exploited by local elites. This lowers economic empowerment of the majority of the locals in Maktau area, especially because there are few economic alternatives and low economic diversification and investment in the area.

Conclusion

The method applied in Maktau area both by The KWS and local community are not effective and only seek to reduce rather than manage the existing conflict. More research needs to be done to find develop better and sustainable conflict management solutions. Key stakeholders like wildlife agencies in Kenya, NGOs, governments ministries and even the affected communities need to work hand in hand to come up with better ways of handling this escalating conflict through proper management and sustainable conservation. The best way of looking at this problem is to critically look at what has already been done and analyze their strengths and weaknesses, and improve on the strengths and reduce the weaknesses.

Intensive management measures, like the ones implemented at Maktau area, are alternatives options for manipulating local wildlife densities with an objective to control their movements to settlements of local communities living adjacent to protected area. Each of them has its benefits and costs, its advantages and undesirable consequences. I agree with the fact that, safeguarding wildlife corridors within and without the PA to

maintain the animal mobility should be the paramount objective of management. Importance should be given to policy integration and interdisciplinary participation of different development sectors in Kenya with KWS and participation of communities in policy formulation and implementation, in order to secure protected ecosystems. It is equally important for KWS to strengthen its research efforts. More often than not, the wildlife conservation sector in Kenya is dominated by independent scientists and consultants whose agendas are dictated by sources of funding. When a particular problem attracts good funding, scientists tend not to try and solve it, so as to maintain the stream of funding, publications and continued professional relevance that the problem provides (Ogada 2009).

From this study, it is clear that conservation can only be valuable to most local communities if economic and other benefits returns are realized and if they are involved in resource management (Emerton 2000) Community sanctuaries as a way of involving communities is a good initial step, but challenges in implementation, local accountability and transparency, together with appropriate professional marketing and product standards are a big challenge (Adams and Hulme 2001), especially if conservation has to be integrated in rural development (Alpert 1996).

Conservation must be compatible with the community's natural history and way in which they view and utilize natural resources. There is need to reconcile conservation and community's needs. It will be difficult to strike a balance between use and conservation unless there is practical education, willingness on all stakeholders and diversification of economic activities to reduce demand on the critical natural resources. Other disciplines may reason that local communities are devoid of sufficient scientific and ecological knowledge about resources and sustainable use to effectively play a positive role in the conservation of these resources. It is therefore paramount that the issue for community education and information distribution to be a priority for local governments and wildlife bodies if conservation has to be dealt hand in hand with the local community. According to Okello (2009), this principle may not be based on rigorous science, but it can provide hope for critical habitats and species if it is followed under scientific collaboration to enhance resource stewardship and conservation.

In conclusion, temporal patience, intellectual commitment and public education is paramount to enable the capacity to manage wildlife-related threats to human safety and property effectively without compromising wildlife population viability or human life and livelihoods. But all involved stakeholders, must combine technical expertise with local knowledge and embrace transparent and democratic processes of participatory planning, with compromises where necessary.

REFERENCES

- Adams, W. and Hulme, D. 2001. If Community Conservation is the Answer in Africa, What is the Question? *Oryx* 35(3): 193-200.
- Alpert, P. 1996. Integrated Conservation and Development Projects: Examples from Africa, *Bioscience* 46(11): 845-855.
- Anonymous. 1982. Ecosystems Ltd. Tsavo regional land use study: Final report to Ministry of Tourism, Government of Kenya.
- Anonymous. 1994a. SCP Project Brief. Selous Conservation Programme Project Brief. Project Report, Gesellschaft für Technische Zusammenarbeit/ Department of Wildlife, Dar es Salaam, Tanzania.
- Anonymous. 1994b. Kenya Wildlife Service Wildlife-human conflicts in Kenya. Report of the Five-Person Review Group. Kenya Wildlife Service, Nairobi
- Anonymous. 1996. Kenya Wildlife Service . National Parks of Kenya: 50 years of challenge and achievement. Nairobi, Kenya.
- Anonymous. 2002. Taita Taveta development plan 2002-2008. Effective management for sustainable economic growth and poverty reduction (s.a.). 76 p. Republic of Kenya. Ministry of finance and planning.
- Anonymous. 2003. Land use in Kenya (2002). Kenya Land Alliance. 19.4.2003. <http://www.oxfam.org.uk/landrights/KLAFull.pdf>
- Anonymous. 2007. U.S. Department of Stat. Country specific information: Zimbabwe (http://travel.state.gov/travel/cis_pa_tw/cis/cis_1063.html)
- Anonymous. 2009a. Kenya National Bureau of statistics. Kenya Demographic and Health Survey. Preliminary report.
- Anonymous. 2009b. Uganda Conservation Foundation. Elephants Crops and People. Online article. www.ugandaucf.org
- Anonymous. 2010a. Kenya Wildlife Service. Corporate Policy Document .Policy on establishment of Conservancies, training and management of county reserve, private and community rangers.
- Anonymous. 2010b. Kenya Wildlife Service. Conservation and Management Strategy for the Elephant in Kenya 2012-2021.
- Anonymous . 2010c. Earthwatch Educational Resources, Lions of Tsavo Managing Human Wildlife Conflict. www.earthwatch.org //
- Anonymous. 2012. Kenya Wildlife Service. Community Enterprise Strategy (CES) 2012-2021. Reaching out to the community. KWS 2.0.

- Baldus, R.D. 2005. Community in Tanzania to Harvest Problem Crocodiles African Conservation foundation (<http://www.africanconservation.org/forum/hunting-.....-conservation/9269-community-in-tanzania-to-harvest-problem-crocodiles>)
- Bengis, R.G., Kock, R.A. and Fischer, J. 2002. Infectious animal diseases: the wildlife/livestock interface. *Rev. Sci. Tech. Off. Int. Epiz.*, Vol. 21(1): pp.53-65
- CARE 2012. Cooperative Alliance for Refuge Enhancement. <http://www.fundrefuges.org/>
- Cobb, S. 1976. The abundance and distribution of large herbivores in Tsavo National Park. Kenya. Unpublished PhD thesis, Oxford University.
- Colonna, C.B. 2011. Human-Wildlife Conflict on Small, Subsistence Farms in Kenya. Honors College Capstone Experience/Thesis Projects. Paper 308
- d'Huart, J.P. 1998, Armed Conflict and Protected Areas in Rwanda, Uganda, and Zaire. IUCNB Biological Diversity Programme Article; Managing conflict in Protected Areas. P. 68.
- Distefano, E. 2005. Human-Wildlife Conflict worldwide: collection of case studies, analysis of management strategies and good practices. SARD Initiative Report, FAO, Rome.
- Dolsen, D. E., and Machlis, G. E. 1991. Response rates and mail recreation survey results: how much is enough? *Journal of Leisure Research* 23:272-277.
- Elsner ,R.M. 2008. Knowledge, attitudes, and opinions about human-wildlife conflicts held by community leaders in Virginia. Dept. of Fisheries and Wildlife Sciences. Virginia Tech Blacksburg, Virginia.
- Eltringham, S.K. 1990. Wildlife carrying capacities in relation to human settlement. *Koedoe*, 33, 87-97.
- Endamana, D., Tarla, N.F., Gomse, A., and Botna, B. 2006. Etudes de base sur les conflits populations-Faune autour du Park national de la Bénoué, Rapport de recherché, WWF, Garoua, Cameroon.
- Emerton, L. 2000. Economic Incentives for Biodiversity: How Eastern African Countries Are Making Biodiversity Attractive, *Innovation: Biodiversity for Secure Livelihoods in Africa* 7(1): 17-20.
- Eyebe, A.J., Dkamela, G. P., Endamana, D. 2012. Overview of Human Wildlife Conflict in Cameroon. Poverty and conservation learning group discussion paper No. 05
- Gadd, M. E. 2005. Conservation outside of parks: attitudes of local people in Laikipia, Kenya. *Environmental Conservation*, 32(1), 50-63.
- Gillingham, S. and Lee, P. C. 2003. People and protected areas: a study of local perceptions of wildlife crop-damage conflict in an area bordering the Selous

Game Reserve, Tanzania. Department of Biological Anthropology, University of Cambridge, Downing St Cambridge, UK.

- Gurung, C.P. 1995. People and their participation: new approaches to resolving conflicts and promoting cooperation. In *Expanding Partnerships in Conservation* (ed. J.A. McNeely), pp. 223–233. Island Press, Washington, DC, USA.
- Gusset, M., Swarner, M.J., Mponwane, L., Keletile, K. and McNutt, J.W. 2009. Human–wildlife conflict in northern Botswana: livestock predation by Endangered African wild dog *Lycaon pictus* and other carnivores
- Hanks, J. 1979. A struggle for survival: the elephant problem. Struik Publishers, Cape Town.
- Hill, C.M. 1997. Crop-raiding by wild vertebrates: the farmer's perspective in an agricultural community in western Uganda. *International Journal of Pest Management*, 43, 77–84.
- Hill, C.M. 2000. Conflict of interest between people and baboons: crop raiding in Uganda. *International Journal of Primatology*, 21, 299–315.
- Hill, C.M. 2004. Farmers' perspectives of conflict at the wildlife-agriculture boundary: some lessons learned from African subsistence farmers. *Human Dimensions of Wildlife* 9: 279–286.
- Himberg, N. 2004. Community based ecotourism as a sustainable option in Taita Taveta, Kenya. In Pellikka, Petri. Jussi VII (Ed), Taita Hills and Kenya. 2004 - seminars reports and expedition to Kenya. *Expedition Reports of Department of University of Helsinki* 40. 87-95. <<http://www.helsinki.fi/science/taita.fieldreport.html>>.
- Hugh-Jones, M.E. and de Vos, V. 2002. Anthrax and wildlife. *Rev. Sci. Tech. Off. Int. Epiz.*, 21(2): 359-383
- IUCN 2003. World Parks Congress Recommendation 20: Preventing and Mitigating Human-Wildlife Conflicts. Gland, Switzerland
- Imorou, A., Gambari, S., Mama, A., Tehou, A. and Sinsin, B. 2004. Les conflits hommes/éléphants dans les terroirs villageois du parc national du W du Niger : cas des villages riverains d'Alfakoara dans la zone cynégétique de la Djona au Bénin. In: Actes du 6e Symposium International sur l'Utilisation Durable de la Faune Sauvage "La faune sauvage : une ressource naturelle", 6-9 juillet 2004, Paris, France, P. Chardonnet, F. Lamarque & M. Birkan, coord., Tome 2. *Game Wildl. Sci.*, 21(4): 553-569
- Jeffrey, A. M. 1996. INTRODUCTION. Lewis, C. Managing Conflicts in Protected Areas. IUCN, Gland, Switzerland, and Cambridge, UK. ix.
- Karanth, K. U. and Madhusudan, M. D. 2002. Mitigating human wildlife conflicts in Southern Asia. Pages 250-264 in J. Terborgh, C. van Schaik, L. Davenport, & M.

- Rao (editors) *Making Parks Work: Strategies for Preserving Tropical Nature*. Island Press, Washington DC, USA.
- Kasiki, S.M. 1998. Human-elephant conflict in areas adjacent to the Tsavo National Parks, Kenya. *Unpublished PhD thesis*, University of Kent.
- Kelvin, K. 2001. Testing the techniques for resolving conflicts in natural resource management: the case of Nairobi national park in Kenya. UNESCO. 26.4.2003.
- Kiiru, W. 1995. The current status of human-elephant conflict in Kenya. *Pachyderm*, 19, 15-20.
- Lamarque, F., Anderson, J., Chardonnet, P., Fergusson, R., Lagrange, M., Osei-Owusu, Y., Bakker, L., Belemsobgo, U., Beytell, B., Boulet, H., Soto, B. and Tabi Tako-Eta, P., 2008. Human-wildlife conflict in Africa; An overview of causes, consequences and management strategies .International Foundation for the Conservation of Wildlife Food and Agriculture Organization of the United Nations, Rome.
- Leuthold, W. 1996. Recovery of woody vegetation in Tsavo National Park, Kenya, 1970-94. *African Journal of Ecology*, 34, 101-112.
- Madden, F.M. 2004. Creating Coexistence between Humans and Wildlife: Global Perspectives on Local Efforts to Address Human–Wildlife Conflict, *Human Dimensions of Wildlife*, 9:4, 247-257.
- Madden, F.M, 2008. The Growing Conflict Between Humans and Wildlife: Law and Policy as Contributing and Mitigating Factors. *Journal of International Wildlife Law & Policy*, 11:189–206.
- Madhusudan, M.D. 2003. Living amidst large wildlife: livestock and crop depredation by large mammals in the interior villages of Bhadra Tiger Reserve, south India. *Environmental Management*, 31, 466–475.
- Messmer, T.A. 2000. The emergence of Human–Wildlife Conflict Management: turning challenges into opportunities. *International Biodeterioration & Biodegradation*.
- Messmer, T. A 2002. The emergence of human– wildlife conflict management: turning challenges into opportunities. *International Biodeterioration & Biodegradation*. Issue 45 pg 97-102.
- Mishra, C. 1997. Livestock depredation by large carnivores in the Indian trans-Himalaya: conflict perceptions and conservation prospects. *Environmental Conservation*, 24(4): 338-343.
- Mishra, C., Allen, P., McCarthy, T., Mudhusudan, M., Bayarjargal, A. and Prins, H. 2003. The role of incentive programs in conserving the snow leopard. *Conservation Biology* 17:1512–1520.
- Mulonga, S., Suich, H. and Murphy, C. 2003. The conflict continues: Human wildlife conflict and livelihoods in Caprivi. DEA Research Discussion Paper 59. 29pp.

- Murphy, C. 2007. Community-based crocodile management. Travel News Namibia. Available at: www.travelnews.com.na/index.php?fArticleId=1042.
- Muruthi, P. 2005. Human Wildlife Conflict: Lessons Learned From. AWF's African Heartlands. African Wildlife Foundation Working Papers, July.
- Musiani, M., Mamo, C., Boitani, L., Callaghan, C., Gates, C., Mattei, L., Visalberghi, E., Breck, S. and Volpi, G. 2003. Wolf Depredation Trends and the Use of Fladry Barriers to Protect Livestock in Western North America. *Conservation Biology*, 17(6): 1538-1547.
- Mwavu, E.N. and Witkowski, E.T.F. 2008. Land-use and cover changes (1988–2002) around Budongo Forest Reserve, NW Uganda: implications for forest and woodland sustainability. Restoration and Conservation Biology Research Group, Johannesburg, PO WITS 2050, Johannesburg, South Africa.
- Naughton-Treves, L. 1998. Predicting Patterns of Crop Damage by Wildlife around Kibale National Park, Uganda. *Conservation Biology*. Vol. 12. No. 1. pp. 156-168.
- Newmark, W.D., Manyanza, D.N., Gamassa, D.M. and Sariko, H.I. 1994. The conflict between wildlife and local people living adjacent to protected areas in Tanzania: human density as a predictor. *Conservation Biology*, 8, 249–255.
- Njiforti, H.L. 1996. Preferences and present demand for bushmeat in north Cameroon: some implications for wildlife conservation. *Environmental Conservation*, 23, 149–155.
- Norton-Griffiths, M.; Butt, B. 2003. The economics of land use change in Loitokiok Division of Kajiado District, Kenya. LUCID Working Paper, no. 34. Nairobi (Kenya): ILRI
- Nyhus, P.J., Tilson, R. and Sumianto, T. 2000. “Crop Raiding Elephants and Conservation Implications at WayKambas National Park, Sumatra, Indonesia”, *Oryx* 34(4): 262-274.
- Nyhus, P.J. and Tilson, R. 2004. Agroforestry, elephants, and tigers: balancing conservation theory and practice in human-dominated landscapes of Southeast Asia. *Agriculture, Ecosystems & Environment*.
- O'Connell-Rodwell, C.E., Rodwell, T., Rice, M. and Hart L.A. 2002. Living with the modern conservation paradigm: can agricultural communities co-exist with elephants. A fiveyear case study in East Caprivi, Namibia. *Biological Conservation*. Issue 93 pg 381-391.
- Ogada, M., Woodroffe, R., Ouge, N. and Frank, G. 2003. Limiting Depredation by African Carnivores: the Role of Livestock Husbandry. *Conservation Biology*.
- Okello, M. 2009. Community Participation Challenges in Resource Conservation in Kenya's Rural Landscapes: Lessons from Amboseli, Kenya. Article in, Re-

conceptualization of Wildlife Conservation Toward Resonance between Subsistence and Wildlife. proceedings of a workshop. African Centre for Technology Studies.

Ogada, M. 2009. Livestock Depredation and the Changing Face of Human-Wildlife Conflict. Article in, Reconceptualization of Wildlife Conservation Toward Resonance between Subsistence and Wildlife. proceedings of a workshop. African Centre for Technology Studies.

Omondi, P. 1994. Wildlife-Human Conflict in Kenya: Integrating Wildlife Conservation with Human Needs in the Maasai Mara Region, Ph. D. thesis, McGill University, Quebec.

Packer, C., Ikanda, D., Kissui, B. and Kushnir, H. 2006. The Ecology of Man-Eating Lions in Tanzania. *Nature & Fauna* 21(2): 10-15.

Parker G.E., Osborn, F.V., Hoare R.E. and Niskanen, L.S. (Eds.) 2007: Human-Elephant Conflict Mitigation: A Training Course for Community-Based Approaches in Africa. Participant's Manual. Elephant Pepper Development Trust, Livingstone, Zambia and IUCN/SSC AfESG, Nairobi, Kenya.

Parker, I.S.C. and Graham, A.D. 1989. Elephant decline: Downward trends in African elephant distribution and numbers. Parts I & II. *International Journal of Environmental Studies*, 34: 13- 26 & 287-305.

Parkolwa, H. 2007 Office of the President Programmes. Arid Lands Resource Management project in Taita Taveta district Annual Progress Report. DMO TAITA TAVETA DISTRICT, Kenya.

Patterson, B. D., Kasiki, S. M., Selempo, E. and Kays, R. W. 2003. Livestock predation by lions (*Panthera leo*) and other carnivores on ranches neighboring Tsavo National ParkS, Kenya. *Biological Conservation*.

Philip, J. N, Steven, A. Osofsky, Paul, F., Francine M. and Hank, F. 2003. Bearing the costs of human-wildlife conflict: The challenges of compensation schemes. *Conservation in Practice* (Vol 4, No. 2) pp. 37-40.

Plumptre, A.J., Cox, D. and Mugume, S. 2003. The Status of Chimpanzees in Uganda. Albertine Rift Technical Report No. 2, Wildlife Conservation Society, New York, USA.

Potter, D.R., Kathryn, M. S., and John, C. H. 1973. Human Behavior Aspects Of Fish And Wildlife Conservation - An Annotated Bibliography. U.S. Dept. of Agriculture. p. 290.

Reynolds, V. 2005. The Chimpanzees of the Budongo Forest. Oxford University Press, Oxford, UK.

- Reynolds, V., Wallis, J. & Kyamanywa, R. 2003. Fragments, sugar and chimpanzees in Masindi District, western Uganda. In *Primates in Fragments: Ecology and Conservation* (ed. L.K. Marsh), pp. 309–320. Kluwer Academic/ Plenum Publishers, New York, USA.
- Rodgers, W.A. and Lobo, J.D. 1982. Elephant control and legal ivory exploitation: 1920–1976. *Tanganyika Notes and Records*, 85, 25–54.
- Rutten, M. E. M. 1990. The district Focus Policy for Rural Development in Kenya: the decentralization of planning and implementation. 1983—9. In Simon. David (Ed). *Third world regional development - a reappraisal*. 154-170. Paul Chapman Publishing Ltd. London
- Sekhar, N.U. 1998 Crop and livestock depredation caused by wild animals in protected areas: the case of Sariska Tiger Reserve, Rajasthan, India. *Environmental Conservation*.
- Sitati, N.W., Walpole, M.J., and Leader-Williams, N. 2005. Factors affecting susceptibility of farms to crop raiding by African elephants: using a predictive model to mitigate conflict. *Journal of Applied Ecology*. Vol. 42.pp. 1175-1182.
- Shemwetta, D.T and Kideghesho J. R.2000.Human-wildlife conflicts in Tanzania:What research and extension could offer to conflict resolution?. *Proceedings of the 1st University Wide Conference*, 5-7 April 2000: Vol. 3
- Smith, R. J., and Kasiki S. M. 2000 . A spatial analysis of human-elephant conflict in the Tsavo ecosystem, Kenya Durrell Institute of Conservation & Ecology University of Kent, CanterburyKent, United Kingdom.
- Sombroek, W.G.H. 1980. Legend of the exploratory soil map of Kenya, scale 1: 1,000,000. Internal communication No. 22, Kenya Soil Survey, Nairobi
- Strum, S.C. 1994. Prospects for management of primate pests. *Revue D' Ecologie - La Terre Et La Vie*, 49, 295–306.
- Sutton , W. R.2001.The economics of Elephant damage in Namibia,Phd. Dissertation.Davis University of California.
- Thouless, C. R. and Sakwa, J. 1995. Shocking Elephants: Fences and crop raiders in Laikipia District, Kenya. *Biological Conservation*. 72: 99-107.
- Tjaronda, W. 2007. Namibia:Conservancies suspend compensation schemes. *New Era* (Windhoek) 6 November 2007.
- Treves, A. and Karanth K. U. 2003. Human-carnivore conflict and perspectives on carnivore management worldwide. *Conservation Biology* 17(6): 1491-1499.

- Treves, A., Robert, W., Naughton-Treves, L. and Morales, A. 2006. Co-Managing Human-Wildlife Conflicts: A Review. *Human Dimensions of Wildlife* Volume: 11, Issue: 6, Publisher: Taylor and Francis, Pages: 383-396.
- Treves, A. 2007. Balancing the needs of people and wildlife: when wildlife damage crops and prey on livestock. *Tenure Brief Issue no.7*. University of Wisconsin-Madison. Pg 1-10
- Tolvanen, R. 2004. Nature conservation areas in Kenya - Tsavo East and West National Parks . Taita Hills and Kenya, 2004 – seminar, reports and journal of a field excursion to Kenya. Expedition reports of the Department of Geography, University of Helsinki 40, 59-63. Helsinki 2004, ISBN 952-10-2077-6, 148 pp.
- Turner, B.L., Kasperson, R.E., Matson, P.A., McCarthy, J.J., Corell, R.W., Christensen, L., Eckley, N., Kasperson, J.X., Luers, A., Martello, M.L., Polsky, C., Pulsipher, A. and Schiller, A. 2003. A framework for vulnerability analysis in sustainability science. *Proceedings of the National Academy of Sciences* 100(4)
- Webber, A. D., Hill, C. M. and V. Reynolds. 2007. Assessing the failure of a community-based human-wildlife conflict mitigation project in Budongo Forest Reserve, Uganda. *Oryx* 41: 177–184.
- Weladji, R.B. and Tchamba, M.N., 2003. Conflict between people and protected areas within the Bénoué Wildlife Conservation Area, North Cameroon, *Oryx*, 37(1): 72-7.
- Wijngaarden, W. 1985. Elephants - trees - grazers: Relationship between climate, soils, vegetation and large herbivores in a semi-arid ecosystem (Tsavo, Kenya). ITC Publication No.4.
- Woodroffe, R. and Ginsberg, J.R. 1998. Edge effects and the extinction of populations inside protected areas. *Science*, 280(5372):2126-2128.
- WPC 2003. World Parks Congress. WPC Recommendations, Recommendation 20: Preventing and Mitigating Human-Wildlife Conflicts (8–17 Sept. 2003).
- WWF SARPO. 2005. Human Wildlife Conflict Manual. Southern African Regional Programme Office (SARPO). Action Set Printers, Harare Zimbabwe.

APPENDICES

**Appendix 1 Field research Introduction Letter from A.U Department of
Landscape Architecture**

Appendix 2 Field Study questionnaire sample

Appendix 1 Field research Introduction Letter



ANKARA ÜNİVERSİTESİ ZİRAAT FAKÜLTESİ PEYZAJ MİMARLIĞI BÖLÜMÜ

Sayı:

Date: August 27, 2012

Ankara:

To whom it may concern; .

RE: FIELD RESEARCH INTRODUCTION LETTER.

Jackton Mwakughu Masabo, student no. 10811601, is a bona fide postgraduate student pursuing a Master's degree in Landscape Architecture in the Department of Landscape Architecture, Faculty of Agriculture, Ankara University, Turkey.

He has finished his course-work and is currently in Kenya to undertake his MSc. field research in Maktau area, Taita Taveta, Coast region under the title; EVALUATING EFFECTIVENESS OF MITIGATION MEASURES FOR CONFLICT RESOLUTION BETWEEN PROTECTED AREAS CONSERVATION AND PEOPLE' S INTEREST.

His supervisor is Prof. Dr. Nilgöl KARADENİZ from Ankara University, Faculty of Agriculture, Department of Landscape Architecture, Turkey. While in Kenya, the student will be assisted by Prof. Dr. John Bosco Mukundi Njoroge, Department of Horticulture, Faculty of Agriculture, Jomo Kenyatta University of Agriculture and Technology (JKUAT).

Any assistance accorded during his research shall be highly appreciated.

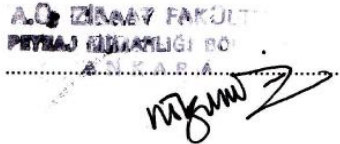
Supervisor

Prof. Dr. Nilgöl KARADENİZ

Head of the Department

Prof. Dr. Yalçın MEMLÜK

Official stamp



Appendix 2 Field Study questionnaire

EVALUATING EFFECTIVENESS OF MITIGATION MEASURES FOR CONFLICT RESOLUTION BETWEEN PROTECTED AREAS CONSERVATION AND PEOPLE' S INTEREST

Case study Maktau area in Taita Taveta region,Kenya

My name is Jackton Mwakughu Masabo, am a student pursuing a Masters degree in Landscape architecture from the department of Landscape Architecture Ankara University,Turkey. I am conducting this field survey to provide information that will aid in my thesis which is a prerequisite for my degree.

The objective of this questionnaire is to provide useful ground information that will help to evaluate the feasibility of implemented measures both by the government through Kenya Wildlife Services and by the local community, to curb the existing human wildlife conflict in Maktau area adjacent to Tsavo National Park .

The interview will take about 25 minutes and your participation is voluntary. All the information you give will be confidential. The information will be used to prepare general reports, but will not include any specific names. There will be no way to identify that you are the one who gave this information.

General information:

Questionnaire Number: _____

Date of Interview.../.../2012

Location of study: _____

Village name: _____

Tel No of interviewee_____

Interview start time_____

Name of interviewer_____

Sign_____

A. Respondent characteristics

1. Participants age? ☐ 18-25 ☐ 25-35 ☐ 35-45 ☐ >45
2. Sex? ☐ Male ☐ Female
3. Marital status ? ☐ Single ☐ Married ☐ Married spouse away ☐ Divorced/separated
☐ Widow/ widower
4. Education level? ☐ None ☐ Primary ☐ Secondary ☐ Graduate
5. Are you a resident of this area? ☐ Permanent ☐ Visitor

B. Household characteristics

1. What is the age of the household head? ☐ 18-25 ☐ 25-35 ☐ 35-45 ☐ >45
2. What is the gender of the household head? ☐ Male ☐ Female
3. What is the level of education of household head?
☐ None ☐ Primary ☐ Secondary ☐ Graduate
4. What is the occupation of the household head?
☐ Farmer ☐ Agro pastoralist ☐ Business ☐ Employed ☐ Self employed ☐ other
5. Number of household members? (Parents plus children) ☐ 1-3 ☐ 4-6 ☐ 7-9 ☐ >9
6. What is your land holding size? ☐ <1 ha ☐ 1-5ha ☐ 5-10ha ☐ 10-20ha ☐ >20ha
7. What kind of livestock do you keep? ☐ Cattle ☐ Sheep ☐ Goats ☐ Chicken ☐ Sheep
☐ donkey ☐ Rabbits ☐ Other
8. How many livestock animals do you have? ☐ 5 ☐ 10 ☐ 20 ☐ >20
9. Source of water

Use of water	Water source (Rain, borehole, tap, well, lake, river, spring, dam, specify other	Km	Time to and from water source
Drinking water			
Other domestic use			
Livestock			
Cultivation/ Irrigation			

C. Magnitude of conflict

1. What's the distance between farms and protected area?
☐ <1km ☐ 1-5km ☐ 5-10km ☐ >10km
2. How do you consider the numbers of wildlife in the area?
☐ Decreasing ☐ Stable ☐ Increasing ☐ Roaming ☐ Other ☐ Don't know
3. How long have you had problems with wild animals?
☐ <1yr ☐ 1-2yrs ☐ 2-5yrs ☐ 5-10yrs ☐ >10yrs
4. What is the average area destroyed? ☐ <0.5ha ☐ 0.5-1ha ☐ 1-4ha ☐ 4-8ha ☐ >8ha
5. In your livestock, how much animals have been killed? ☐ None ☐ 1 ☐ 2-3 ☐ 4-5 ☐ <5
6. How many times have you complained in a year?
☐ None ☐ Once ☐ 2-3times ☐ 5times ☐ >5times
7. Indicate the number of animals concerned? ☐ Elephants ☐ Lions ☐ Monkeys ☐ others...
8. How would you describe the conflict with wildlife in the area?

☐ *Not a problem* ☐ *Severe* ☐ *Don't know*

D. Nature of conflict

1. What type of farming do you practice? ☐ *Crop husbandry* ☐ *Livestock* ☐ *Mixed* ☐ *Other.*
2. Indicate your ☐ *Type of crop*.....☐ *Type of livestock*.....
3. Do you have/had damages from wildlife animals? ☐ *Yes* ☐ *No*
4. If yes, what kinds of damages?...
5. What is the frequency? ☐ *Never* ☐ *Once a week* ☐ *Once a month* ☐ *Once a year*
6. Which is the culprit wildlife animal? ☐ *Elephants* ☐ *Lions* ☐ *Monkeys* ☐ *others...*
7. Do you see other effects of the wildlife in the village? ☐ *Water* ☐ *Buildings* ☐ *People*
8. Which is the most harmful animal? ☐ *Elephants* ☐ *Lions* ☐ *Monkeys* ☐ *others*
9. What period of the month is attacks and raids more prevalent?
☐ *Jan-Feb* ☐ *Mar-Apr* ☐ *May-Jun* ☐ *Jul-Aug* ☐ *Sep-Oct* ☐ *Nov-Dec* ☐ *other*

E. Perception of the population towards HWC management

1. Has the government helped in managing the conflict in the area? ☐ *Yes* ☐ *No*
2. If yes, what strategies have they used?
☐ *Barriers* ☐ *Compensation* ☐ *Resettlement* ☐ *Other...*
3. How would you describe the effectiveness of the strategies?
☐ *Not effective* ☐ *Moderate* ☐ *Very effective*
4. What are the problems of the management strategies?
5. Do you have personal measures of protection? ☐ *Yes* ☐ *No*
6. If yes' which ones?
7. If no, why?.....
8. If yes, describe the effectiveness? ☐ *Not effective* ☐ *Moderate* ☐ *Very effective*
9. What are the problems with your personal protection measure?.....

F. Perception of the population towards conservation

1. What is the best way to manage HWC?
☐ *Nothing* ☐ *Killing animals* ☐ *Barriers* ☐ *Relocation* ☐ *Compensation* ☐ *Other*
 2. Do you consider wildlife as a threat? ☐ *Yes* ☐ *No* ☐ *I don't know*
 3. What may cause you to kill wildlife animals?.....
 4. Have you ever witnessed the killing a problematic wildlife animal? ☐ *Yes* ☐ *No*
 5. If yes, what animal was it?
- Any other comment or question from the participant

CURRICULUM VITAE (CV)

Name: Jackton Mwakughu Masabo
Place of birth: Taita Taveta, KENYA
Date of birth: 1985
Marital status: Married
Foreign Language: English, Turkish

EDUCATION

Secondary: Kirwara High School, Thika, KENYA (2000-2003)
College: Academy Business College, Nairobi. (2004-2005)
Undergraduate: Jomo Kenyatta University of Agriculture and Technology.
Institute of Agriculture, Department of Horticulture, Ornamental
Science and Landscaping (2005-2009).
Post graduate: Ankara University, Institute of Science, Department of
Landscape architecture. Turkey,(2010-2013).

EMPLOYMENT

1. Institution: Mysticah Designs LTD
Date/Place: 2009-2010, Nairobi
Position: Project Manager
2. Institution: Bayer crop science East Africa
Date: 2008, Nairobi
Position: Field attachee

Institution: Redland Roses LTD

Date/Place: 2007, Ruiru

Position: Industrial attachee

4. Institution: Seabelt Enterprises LTD

Date/Place: 2005-2006, Nairobi

Position: Employment contract