ASSESSMENT OF THE EFFECTS OF HABITAT TRANSFORMATION ON THE NAIROBI NATIONAL PARK AND KITENGELA ECOSYSTEM

By

Anne Wanja Kuria (B. Env. Studies and Community Development)

N50/ 12583/ 2005

Thesis submitted in partial fulfilment for the award of the degree of Master of Environmental Studies and Community Development in the School of Environmental Studies and Human Sciences of Kenyatta University

July 2008

Declaration

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

Signed..... Date..... 7/7/2008

Anne Wanja Kuria

This thesis has been submitted for examination with our approval as University Supervisors

Signed..... Date..... 7/7/08

Dr. Caleb Mireri

Department of Environmental Planning, Management and Community Development

Signed ..... Date 08/07/08

Dr. Fuchaka Waswa

Department of Environmental Planning, Management and Community Development

Dedication

To my most beloved mum, Joyce Wakonyo, who always gave me moral support, and was there for me through thick and thin. To my entire beloved family, who are God's most precious gift to me.

Acknowledgements

The author wishes to take this opportunity to thank her Supervisors namely Dr. Caleb Mireri and Dr. Fuchaka Waswa, for their invaluable support, encouragement and guidance throughout this study. The author also wishes to thank the Kitengela community members and key informants for their rich information, which made this study a success. More specifically, thanks go to Dr Samuel Kasiki (KWS Deputy Director- Biodiversity, Research and Planning Department (formerly KWS Head of Ecosystems and Landscape Development Department); Moses Lekishoni Kenana (KWS Senior Scientist- Savannah), Mohammed Said (ILRI, GIS Scientist), Jared Lumbasi (KWS Research Department), Everlyn Oroni (Nairobi National Park Administration Officer), Mark Yobesia (KWS Tourism Department), Stanley Sompiloi (Chief, Kitengela) and all those who assisted in one way or another. Many thanks to my colleagues namely Samuel Mbugua Gathu, Peter Mureithi, Lilian Mwikali, and Wachira for their support, prayers and encouragements throughout this study. Finally, 'I will always thank the Lord; I will praise Him for what He has done in my life' (Psalms 34:1).

Abstract

Nairobi National Park's wildlife migratory and dispersal area (Kitengela) has over the last three decades undergone numerous changes from an open, communally owned wet season grazing area to heavily fragmented private property. New immigrants have introduced land uses that are incompatible with wildlife management. These include urban residential, industrial and commercial premises; and agricultural land uses. This research aimed at evaluating the drivers, trends and effects of habitat transformation on the Nairobi National Park and Kitengela ecosystem. The ultimate aim was to isolate policy and action entry points towards the ecosystem's effective management (use, care and improvement) for the common good. The research was based on the assumption that if the current trend of habitat transformation in Kitengela continues; Nairobi National Park will be reduced to an ecological island and will eventually "collapse". The park will thus lose its value as a major tourist destination. Although various interventions are being employed in the area, the problem still persists. Primary data were collected using seasonal calendars, historical timelines, maps, direct observations, photography, questionnaires, Focus Group Discussions and Key Informant Interviews. Secondary data sources included journals, books, and other published reports. Stratified random sampling and Purposive sampling was used for sample selection. Both qualitative and quantitative data analysis methods were used. More specifically, descriptive statistics were used to summarise and interpret findings. Pearson Correlation Coefficient was applied to assess the relationship between selected variables under study. The study findings indicate that approximately 68% of Kitengela wildlife habitat has been transformed from communally to individually owned land. The main causes of habitat transformation were the rapid increase in human population in Kitengela, estimated to be growing at a rate of 3.8% per annum. There were also high rates of industrialization in the area. This has resulted to loss of Nairobi National Park's wildlife dispersal and migratory habitat and restricted movement of wildlife. This is because as human population increases in Kitengela, the land sizes have become smaller ($r=-0.81$, $n=127$, $p=0.01$). Decline in wildlife numbers was strongly related to decline in tourist visitation in Nairobi National Park from 1996 to 2006 ($r=0.86$, $n=11$, $p=0.01$). As a result, there were reduced national and community benefits accruing from wildlife tourism. About 60% of the entire Kitengela population felt that they had received some benefits accruing from Nairobi National Park's management. This study therefore recommends that wildlife conservation within the NNP and Kitengela ecosystem should be guided by a national land policy that designates zoned land use activities and recognizes biodiversity conservation as critical in sustainable environmental management and development. The success of this approach would require among others changes in institutional and environmental governance frameworks, promoting the use of economics and incentives, dealing with social and behavioural responses, and integrating indigenous systems into conventional scientific knowledge systems.

Table of Contents **Page**

List of Tables

List of Figures

List of Acronyms and Abbreviations

ACC	African Conservation Centre
AWF	African Wildlife Foundation
CSR	Corporate Social Responsibility
CWS	Community Wildlife Service
EAEN	East African Environmental Network
EAWLS	East African Wildlife Society
EMCA	Environmental Management and Coordination Act
FoNNaP	Friends of Nairobi National Park
FOT	Friends of Tsavo West and East National Parks
GIS	Geographical Information System
GOK	Government of Kenya
ILRI	International Livestock Research Institute
KWS	Kenya Wildlife Service
KILA	Kitengela Ilparakuo Landowners Association
MDG	Millennium Development Goals
NDP	National Development Plans
NNP	Nairobi National Park
PRA	Participatory Rural Appraisal
TWF	The Wildlife Foundation
WCL	Wildlife Conservation Lease Programme
WWF	World Wildlife Fund

CHAPTER 1: INTRODUCTION

1.1 Background

The landmark of protected areas began with the establishment of the world's first National Park, Yellowstone, in the United States in 1872 (Khisa, 2001). Since then, many countries have recognized the value of protected wildlife areas. Globally, there are more than 2600 protected areas, covering nearly 4 million Km^2 in 124 countries. Kenya currently has 23 National Parks and 29 National Reserves among other protected areas, covering a total of 47,674.12km^2. National parks accounts for 5.2% while national reserves account for 2.8% of Kenya's total land area.

Approximately 63% of the National Parks and Reserves in Kenya are located in the savannah ecosystem. Because savannah ecosystems are seasonal, 75% of the wildlife species occur in savannah non- park areas (Esikuri, 1998), such as Kitengela. Kitengela area is privately owned by the local community, while Nairobi National Park (NNP) is managed by Kenya Wildlife Service (KWS). NNP is the only park in the world that neighbours a capital city. It was gazetted as Kenya's first National Park in 1946 and covers an area of 117km^2. It is home to more than 100 mammalian species, including rare and endangered species such as the black rhino and the leopard (Nkedianye, 2005; ILRI, 2005). The park has the highest concentration of rhinos in the country and is now generating stock for reintroduction to other sanctuaries (KWS, 2005).

Livestock and large numbers of wild herbivores dominate Kitengela, with wildebeest and zebra constituting over half the total wildlife population. Other wildlife species in the

area include the Coke's hartebeest, Grant's gazelle, Thomson's gazelle, impala, eland and giraffe. Predators such as lion, cheetah, leopards and hyena and a large diversity of bird life are also found (Gichohi, 2003).

Nairobi National Park serves as a dry season refuge (June – November) for the major wildlife migrants that make up over 50% of the total wildlife biomass, which then disperses into the surrounding areas during the wet season (March – May). The park is part of a much larger system comprising Kitengela, and the Athi Kapiti plains to its south, approximately 2,200km^2 in size (Gichohi, 1996). Although the plains are much smaller than it was at the turn of the century, it supports the second largest annual migration of large herbivores in Kenya.

Most of the parks are not ecologically viable in the absence of wildlife dispersal areas, especially for species that require seasonal migrations (EAEN, 2003), for instance between calving and feeding grounds. NNP by itself is unable to host such large herds throughout the year because it is small (117km^2); hence it is not a self-sustaining ecological unit (Rodriguez *et al*, 2004). The park's wildlife survival therefore is dependent on the willingness of private landowners in the Kitengela dispersal area to tolerate wildlife from NNP to migrate and disperse through their property. Based on its importance for the sustainability of NNP, the Kitengela Plains (390 km^2) were declared a conservation area in 1967, to provide protection for migratory wildlife. The area was unfortunately never legislated and as a result, it had no land use constraints (Gichohi,

2000). However, in 1963, grazing rights for the neighbouring communities were revoked and livestock excluded from the park completely in May 1967.

Historically the area had no permanent settlements and the land was an important grazing ground for the pastoral community. Currently as a result of increasing population pressure and due to its proximity to Nairobi, Kitengela area is in a fast process of transformation. Today, open land is being converted as new immigrants introduce to the area new land uses that are incompatible with wildlife conservation. These include: extensive commercial agriculture such as horticulture and irrigation, subdivision of farms into paddocks for intensive livestock management, Export Processing Zones, mining of gypsum, quarrying and sand harvesting among others.

These changes in land-use affect the integrity of the dispersal area; declining its primary productivity, diminishing wildlife diversity, and reducing the wildlife migratory corridor (Nkedianye, 2004). The park is now fenced on three sides and only the southern boundary marked by the river Mbagathi is open. This allows the continuing movement of wildlife to the wet season feeding areas in the South (USAID, 2006). However, the southern area is also threatened to extinction by human activities. The local community's numerous socio-economic activities are resulting to loss of and degradation of the wildlife habitat in the NNP and Kitengela ecosystem.

The degradation of ecosystems is a significant barrier to achieving the Millennium Development Goals (GEF, 2000; Reid, 2000). This study was undertaken within the

framework of MDG 7 (Environmental sustainability) and MDG 1 (Eradication extreme poverty and hunger). KWS is collaborating with other organizations such as local CBOs, non-governmental organizations, and Government Ministries to promote the attainment of MDGs by employing various habitat conservation approaches in Kitengela.

1.2 Problem Statement and Justification

Kitengela wildlife migratory and dispersal route is crucial to the survival of NNP. It links NNP to the Amboseli ecosystem because the park is not self-sustaining. NNP's future is threatened by the rapid habitat transformations occurring in Kitengela. The park is on its way to becoming an amalgam of Nairobi city, which has rapidly expanded in the last three decades. Fencing, cultivating and land fragmentation in its immediate vicinity amongst other things, have significantly reduced land available for wildlife. If this corridor is sealed off, the park might be reduced to an ecological island. It may also cease to exist (Western, 1989), if no meaningful interventions are put in place.

Kenya has not had a clearly defined National Land Policy since independence. Also, the Wildlife Conservation and Management Act (Cap 376) has had inadequacies such as the exclusion of local communities from wildlife management, inadequate compensation for loss of life, livestock and crops; and inadequate revenue sharing (Else, 1993). This has made the local people to develop a negative attitude towards wildlife management, thereby developing conflicting land use interests. Further, with the increasing population growth rate in Nairobi city, non-pastoral people have settled in Kitengela due to its proximity to the city. It is also among the few surrounding areas that still have cheaper

open land available for further development. New immigrants have introduced new land uses that are incompatible with wildlife management, such as agriculture, urban residential and business premises. As a result, land is being lost and wildlife movement is being restricted.

Approximately 70% of gross tourism earnings and 50% of Kenya's GDP is attributed to wildlife tourism (GOK, 2004). Through maintaining wildlife numbers, tourism visitation will be improved, thus promoting national and community development (GOK, 2003). NNP is the only park in the world that is situated within a country's capital city. It is therefore a major potential destination for conference tourism. Maintaining domestic and cultural tourism is a further justification why NNP must be conserved. Also by conserving the ecosystem, human wildlife conflicts in Kitengela will be mitigated.

The purpose of this study was therefore to assess the current situation on the ground, find out the extent of damage caused by massive habitat transformations and formulate sustainable options to harmonize ecosystem-human wildlife relationships in Kitengela and Kenya in general.

1.3 Research Questions

i. How has the Nairobi National Park and Kitengela ecosystem transformed over the years?

ii. What are the most critical factors causing the habitat's transformations?

iii. How have the habitat transformations affected the entire ecosystem, its services and surrounding communities?

iv. How effective are the approaches being employed to conserve Nairobi National Park and Kitengela ecosystem?

v. What options exist to manage this ecosystem in a sustainable way?

1.4 Research Assumption

The main assumption in this work was that habitat transformation in Kitengela threatens the sustainability of Nairobi National Park hence the well being of the surrounding communities.

1.5 Objectives

The broad objective of this study was to assess the effects of habitat transformation on the Nairobi National Park and Kitengela Ecosystem. The specific objectives were:

i. To assess the drivers and trends of habitat transformation in Nairobi National Park and Kitengela ecosystem.

ii. To examine the effects of these transformations on the ecosystem, its services and surrounding communities.

iii. To evaluate the effectiveness of the existing habitat conservation approaches for the Nairobi National Park and Kitengela ecosystem.

iv. To develop sustainable ecosystem management options for the conservation of the Nairobi National Park and Kitengela ecosystem

1.6 Conceptual Framework

The conceptual framework of this study was derived from the Millennium Ecosystem Assessment Framework (MA), which shows the links between ecosystems, their services and human well-being (Alcamo *et al*, 2003). The complex links between ecosystems and human well-being is the single most important pre-requisite for both analysis and action under the MA (Reid, 2000). It was also the basis for policy suggestions in this study.

In this work, habitat/ ecosystem transformation was caused by various drivers, whose ultimate negative and positive effects would be on human well-being (Figure 1.1). As such, the management of such ecosystems must be holistic and integrated in nature (Shepherd, 2004). Kitengela and NNP's ecosystem transformations have been as a result of both direct and indirect drivers of change. Direct drivers included land use changes, increase in human population, pollution and introduction of alien species. Indirect drivers of change included education and income disparities, lack of a National Land Policy, and a poorly formulated Wildlife Management Act. These have resulted to adverse effects such as restricted wildlife movement, and decline in both wildlife and tourist numbers.

This in return has influenced tourism-related benefits at the national and community levels. At present, the interventions being employed to conserve Kitengela are piecemeal and sectoral; which has resulted in minimum positive impacts.

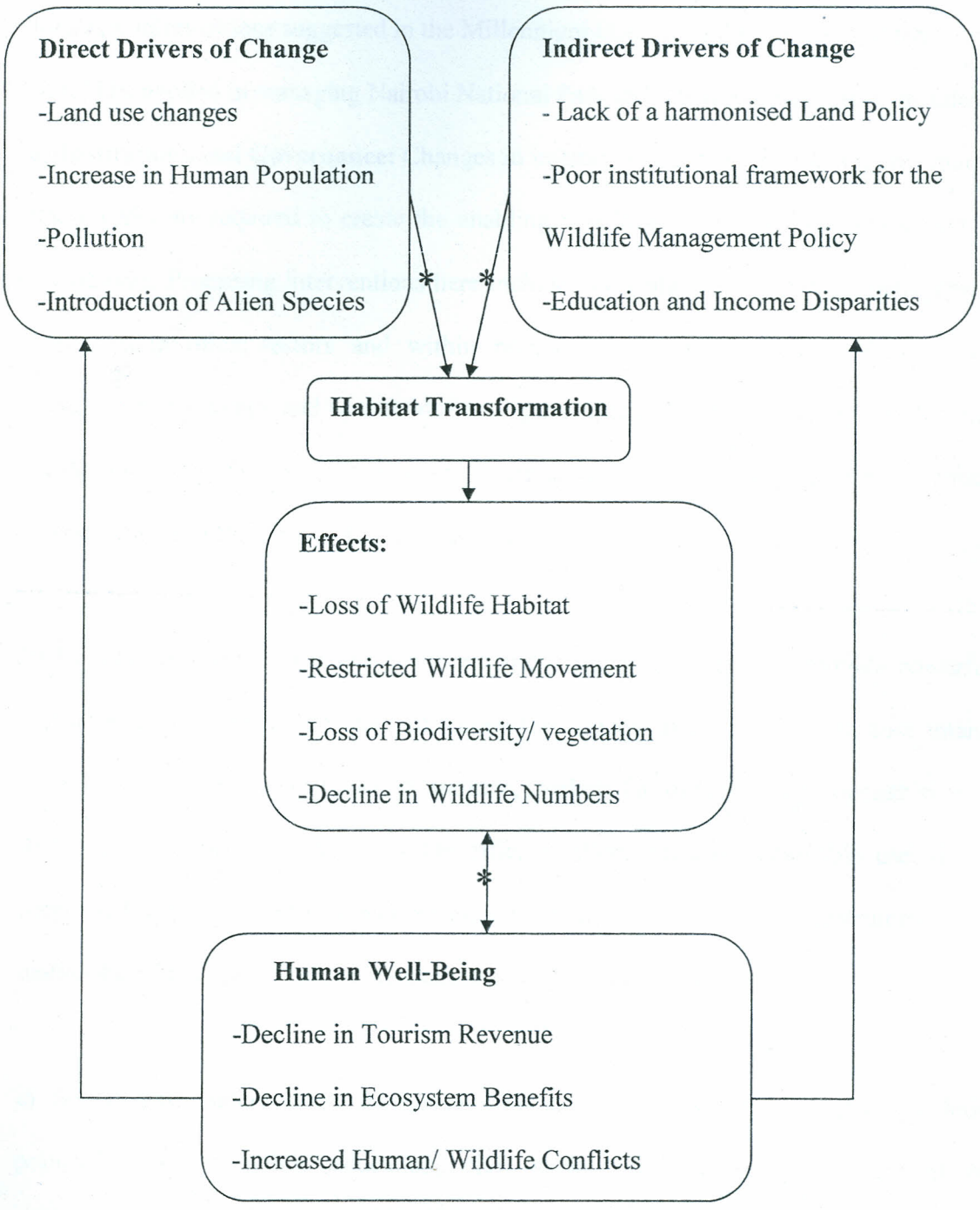

Figure 1.1 Habitat Transformation / Human Well-Being Conceptual Framework
Source: Author 2007

Note: (*) are areas where strategic interventions could be made, which have been derived from Millennium Ecosystem Assessment suggested response options to integrated ecosystem management discussed in the following page.

Strategic interventions suggested in the Millennium Ecosystem Assessment, which should be applied in managing Nairobi National Park and Kitengela ecosystem include:

a) Institutions and Governance: Changes in institutional and environmental governance frameworks are required to create the enabling conditions for effective management of ecosystems. Promising interventions here include: integration of ecosystem management goals within other sectors and within broader development planning frameworks; increased transparency and accountability of government and private sector performance on decisions that have an impact on ecosystems, including through greater involvement of concerned stakeholders in decision making.

b) Economics and Incentives: Economic and financial interventions provide powerful instruments to regulate the use of ecosystem goods and services. Because many ecosystem services are not traded in markets, markets fail to provide appropriate signals that might otherwise contribute to the efficient allocation and sustainable use of the services. Promising interventions here include greater use of economic instruments and market-based approaches in the management of ecosystem services.

c) Social and Behavioural Responses: Social and behavioural responses include population policy, public education, civil society actions, and empowerment of communities, women and youth, are instrumental in responding to ecosystem degradation. Promising interventions here include: improved communication and education-which are essential to achieve the objectives of sustainable natural resource

management, and empowerment of groups dependent on ecosystems or affected by degradation, including women, indigenous people and youth.

d) Knowledge Responses: Effective management of ecosystems is constrained both by lack of knowledge and information about different aspects of ecosystems and by the failure to use adequately the information that does exist in support of management decisions. Promising interventions here include: incorporation of non-market values of ecosystems in resource management and investment decisions; use of all relevant forms of knowledge and information in assessments and decision making including traditional and practitioners' knowledge; and enhancing and sustaining human and institutional capacity for assessing the consequences of ecosystem change for human well-being.

e) Technological Responses: Given the growing demand for ecosystem services and other increased pressures on ecosystems, the development and diffusion of technologies designed to increase the efficiency of resource use or reduce the impacts of drivers of ecosystem change is required. Promising interventions here include: restoration of ecosystem services; and application of science to manage ecosystems.

1.7 Scope and Limitations of the Study

This study was based on the recommendations of EAWLS's survey (EAWLS, 2004), conducted to determine the availability of land for wildlife migration on the Athi- Kapiti plains. The survey's findings revealed that the rest of the plains namely Isinya and Athi-river have already been taken up by massive developments. Kitengela, the only area that could be made available for wildlife migration is also threatened to extinction.

The survey further revealed that the areas to the West (Oloosirkon), East (Namanga road), and South (Kisaju), had all been affected by development, heavy fencing, land fragmentation and increasing human population (Figure 1.2). Only the Northern and the central parts of Kitengela could be used for wildlife migration. Although based on this previous survey, this research was not confined to these areas. This study was holistic and aimed at assessing the situation on the ground, for both the open land and the already developed land, in order to formulate workable strategies for the entire ecosystem. Due to time limitation dictated by the Masters Degree Programme's time schedule, exhaustive analysis of multiple variables may not have been possible. This study thus provides general trends that could still be vital in directing policy changes. Another limitation included high illiteracy levels of the pastoral population.

This study was undertaken in the entire of Kitengela Location. Administratively, Kitengela Location is in Kajiado Central Division, Kajiado District, Rift-valley province. Nairobi National Park is in Nairobi province. Kitengela covers approximately 390.4km^2, while Nairobi National Park covers an area of 117km^2, and both are part of the Athi-kapiti plains. According to 1999 censuses, Kitengela has a population size of 17,347 people, with 44 persons per square km, while Nairobi City has a population of approximately 2.8 million people. Nairobi National Park is only 7 kilometres from Nairobi city centre, at an altitude of 5,000ft above sea level. NNP is 13km south of Nairobi City Centre and lies approximately 2 18' South and 35 50' East. The park has six gates namely: the Main Gate, Cheetah Gate, East Gate, Lang'ata Gate, Banda and Maasai Gates (KWS 1995). Kitengela area can be accessed through Nairobi-Namanga road, Nairobi -Kiserian road, and Kiserian -Isinya road.

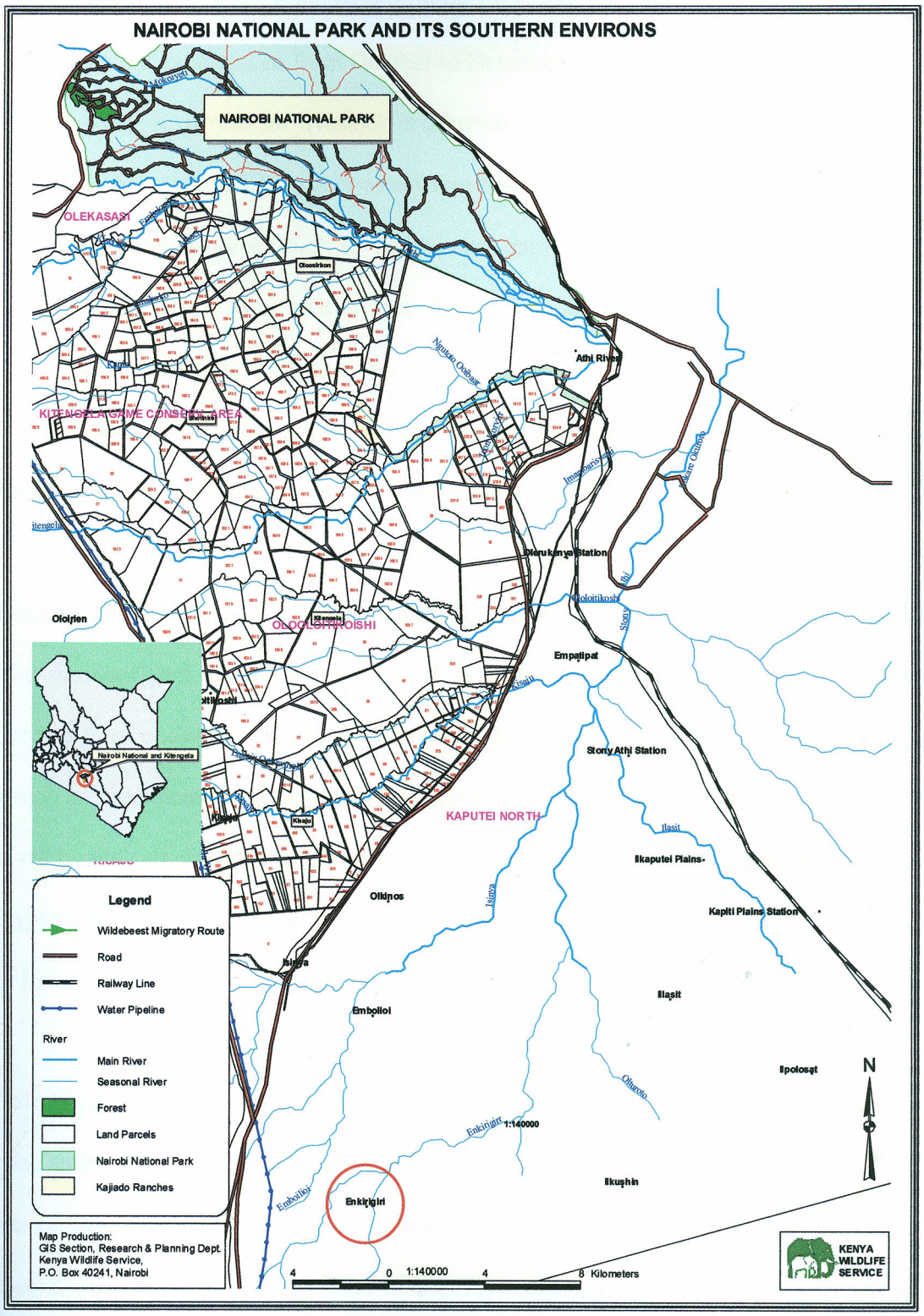

Figure 1.2 Nairobi National Park and the Heavily Fragmented Kitengela Area
Source: KWS (GIS Section, Research and Planning Department), 2006

The rainfall patterns are bimodal with long rains experienced from March to May and short rains are experienced from October to December. Kitengela does not have adequate surface water resources for livestock and human consumption, hence mostly depends on ground water reserves. The other alternative source of water for domestic and livestock are sub-surface resources such as water pans, dams and shallow wells. The amount of surface water varies from area to area. The main source of water for Nairobi National Park is Mbagathi River. Other rivers though seasonal are Mokoiyet, Olomanyi, Sosian and Kisembe. To supplement water requirements for wildlife during the dry season, 15 dams have been constructed within Nairobi National Park.

Most of NNP has volcanic rocks formed during the middle and upper tertiary periods. The southern part of the park is covered by calcareous and non-calcareous clay loams derived from colluvium. Other areas of the park have dark brown calcareous clay loams which are associated with old lacustrine deposits (KWS, 2005). The geological formation gives rise to minerals of economic importance such as gypsum, limestone, and soda ash. Gypsum is mined at Enkirkir and Kitengela. Quarrying of building stones is mostly found in Enkurunka, Noonkopir and Emakoko.

Nairobi National Park has a wide and rich indigenous variety of wildlife habitats such as: open grassland, riverine vegetation, open plains, thorny bushes, swamps and marshes, acacia woodlands. These landscapes host a wide rich variety of vegetation. Endemic species include *Eurphobia brevitata* tree species. Tree species of special concern therein include *Blachystelma linneare, Drimia calcuta* and *Crassula spp. Blachylaena huchinsii*

is a tree species of high economic value (KWS, 1995). The park has a wide variety of wildlife of great importance such as: Rhino, buffalo, hippopotamus, wildbeest, zebra, lion, cheetah, Columbus monkey, impalas and leopards. Key wild animal species include wildderbeests, zebra and buffallo. The black rhino (*Diceros bicornis*), the cheetah (*Acinonyx jubatus*), the Lion (*Panthera Leo*) and the leopard (*Panthera pardus*) are classified as endangered and threatened species.

1.8 Conceptual Definition of Variables

- **Communal/ Group Ranch Schemes:** are demarcated areas of rangeland to which a group of pastoralists, who graze their individually owned herds on it, have official land rights.
- **Dispersal Areas/ Migratory Corridors**: These are areas that border key protected areas that are critical for the survival of one or two adjoining conservation units.
- **Driver**: This refers to any natural or human-induced factor that directly or indirectly causes a change in an ecosystem.
- **Ecosystem Services**: This refers to the benefits people obtain from ecosystems such as provisioning, regulating, cultural and supporting services.
- **Ecosystem**: A dynamic complex of plant, animal and micro organism communities and their non-living environment interacting as a functional unit.
- **Government/ Public Land:** This comprises all land owned by the Government and dedicated to a specified public use or made available for private uses at the discretion of the Government.

- **Human Well-being:** A context- and situation- dependent state, comprising basic material for good life, freedom, health, good social relations and security.
- **Individual/Private Land:** Private land refers to land held by an individual or other entity under freehold or lease tenure. Freehold tenure confers unlimited rights of use, but it is subject to the regulatory powers of the state.
- **Land Use Planning**: is a process that is concerned with the preparation and actualization of spatial frameworks for orderly management of human activities.
- **Land Use**: The human utilization of a piece of land for a certain purpose.
- **Land tenure** refers to the terms and conditions under which rights to land and land-based resources are acquired, retained, used, disposed off, or transmitted.
- **Provisional Services:** The products obtained from ecosystems, including, for example, genetic resources, food and fibre, and fresh water.
- **Strategic Interventions:** Human actions, including policies, and responses, to address specific issues, needs, opportunities, or problems. These may be legal, technical, institutional, economic and behavioural. Interventions may operate at local or micro, regional, national, or international levels and at various time scales.
- **Sustainable Development**: development that meets the needs of the present generation without compromising the ability of future generations to meet theirs.
- **Trust Land:** Trust land consist of areas that were occupied by the natives during the colonial periods and which have not been consolidated, adjudicated and registered in individual, group or government's name.

CHAPTER 2: LITERATURE REVIEW

2.1 The Drivers of Kitengela and NNP Habitat Transformation

UNEP and SCOPE (2000) identifies socio-economic drivers of ecosystem change as one of the priority emerging environmental issues of the 21st Century that need further and immediate research. Rapidly increasing human population and changing socio-economic lifestyles (leading to greater natural resource exploitation) have been identified as the greatest threats to wildlife conservation within rangelands the world over (ILRI, 2002).

Earlier studies of the Kitengela/ NNP ecosystem by (Mango, 2003; Mungai, 2003; Khisa, 2001; Gichohi, 1996; and Else, 1993) indicated that a large fraction of the Athi-Kapiti ecosystem is already lost to development. The studies revealed that Kitengela, the only remaining wildlife migratory route, is being swallowed up by human encroachment at an alarming rate. This has threatened the survival of migratory wildlife species. Various drivers of Kitengela/ NNP habitat change have been discussed below.

2.1.1 Lack of a Harmonised National Land Policy

Kenya has not had a clearly defined or codified National Land Policy since independence (GOK, 2006). This, together with the existence of many land laws, some of which are incompatible, has resulted in a complex land management and administration system. From the advent of colonialism, Kenya has been struggling with the land question, which subsequent government regimes have been unable to or are unwilling to solve. In Kitengela, this problem has manifested itself in terms of unmitigated encroachment by

humans into protected areas, urban sprawl including slum development, land use conflicts, land fragmentation and environmental degradation.

2.1.2 A Weak Institutional Framework of the Wildlife Act (Cap. 376)

The Wildlife Act (Cap 376) has generally regarded wildlife as a national heritage belonging equally to all citizens, exploited only under national auspices and for the nationwide benefit (Khisa, 2001). The effects of ecosystem change may therefore be partly due to the exclusion of the local people, who are the main custodians of wildlife, from decision-making. Still, the local communities do not receive adequate wildlife-related benefits. They thus develop a negative attitude towards wildlife, which makes them to adopt other livelihood practices that conflict with wildlife management.

Further, wildlife often represents a direct threat to crops, livestock, property and personal safety, all costs felt by the local people. There has been no compensation for such losses (Mango, 2003). Worse still, conflicts become more pronounced in areas surrounding gazetted parks where local people view land and water, which they need as theirs by right, being alienated and set aside for wild animals.

2.1.3 Rapid Population Growth and Urbanization Rates

Over the past four decades, Kenya's human population density has rapidly increased, which has created the need for more land. Nairobi has experienced a high rate of urbanization as people seek better livelihoods. This has pushed such populations to settle in areas such as Kitengela due to its proximity to the city. Human population of Nairobi

city was about 2.2 million in 1999 (Table 2.1), currently stands at over 2.8 m. With an estimated growth rate of 3.6 % per annum (GOK, 1998), population in Nairobi city is projected to reach approximately 30 million people by the year 2050.

Table 2.1 Changes in Human Population within Four Decades

Year	Kenya (Millions)	Nairobi	Athi-kapiti	Kitengela
1969	10.9	-	23,490	-
1979	15.32	828,000	43,783	3,236
1989	23.2	1,325,000	60,000	6,548
1999	30.4	2,137,000	69,402	17,347

Source: GOK, 2001

Because of rapid human population growth in Nairobi city, population in Kitengela has increased from 6,548 persons (1,044 households) in 1989 to 17,347 persons (5,005 households) in 1999 as new immigrants settle in Kitengela. In 1989, the population density was 14 persons per km square and in 1999; it was 44 persons per km square. It is important to note that this three fold rise in population in a period of only two decades overstretch the carrying capacity of this semi-arid savannah grassland.

2.1.4 Introduction of New Land-Uses

New land-uses result in an ecosystem's habitat transformation (GEF, 2004). Kitengela's proximity to Nairobi city has attracted industrial developments, such as the EPZ, and major cement manufacturing industries, which are incompatible with wildlife

management (Gichohi, 1996). These industries have taken up most of the land, not to mention causing massive air and water pollution to rivers, streams and dams within NNP. This has resulted in wildlife deaths and deformities, and caused ecological/ vegetation changes within the park, which threatens wildlife's future sources of forage.

Introduction of agriculture in Kitengela has contributed significantly to habitat transformation (Ndung'u, 2005). Agriculture prompts fencing of individual parcels of land (Ngare, 1996). The area receives inadequate rainfall and also has seasonal water sources; hence agriculture (horticulture and subsistence farming) is mostly through irrigation. This lowers the ground water levels, making water unavailable for wildlife. Agriculture has also fuelled land fragmentation, thereby transforming the initially open land to cultivated and fenced land, which hinders wildlife migration (Gichohi, 2000).

Numerous quarrying activities are being undertaken in Kitengela and the neighbouring Athi river area. The richest areas in building stones are the Enkurunka valley, Emakoko and Noonkopirr (ILRI, 2002). There is an increased demand for building stones and gypsum, a raw material used in the manufacture of cement (Korir, 2006). The habitat in such areas has been transformed through open cast mining and excavations. It is therefore a potential health hazard to wildlife, local communities and their livestock.

Athi River, Isinya, Kitengela, Ongata Rongai and Kiserian centres have tremendously expanded in both development and size over the past three decades (EAWLS, 2004). The growth of Nairobi metropolitan city has also influenced people to establish business and

residential premises, including slums in Kitengela. As a result, the initially open land has been lost to development, hindering wildlife movement.

2.2 The Trends of NNP and Kitengela Habitat Transformation

Land ownership in Kitengela has gradually changed from communal to individual land tenure system (GOK, 1984). Before independence, land was held in trust by the Kitengela community. In 1968, land ownership status was changed to communal ranches. In the 1980's, group ranch subdivision was initiated, which changed communal land to individually owned parcels (Kimani, 1998). This is a period when the government encouraged private land ownership in pastoral systems, to intensify and commercialise livestock production (Grandin, 2001).

As a result of sub-dividing group ranches, land ownership in Kitengela changed to 0.92 hectares per household in 2004 compared to 70.35 hectares at the time of the group ranch incorporation in 1979 (EAWLS, 2004, Nkedianye, 2005). Upto 80% of land has been sold to willing buyers (Kameri-Mbote, 2005). The trend indicates that land tenure system in Kitengela will be predominantly privately owned before the decade ends.

Land value has also gradually increased. In the early 1990's, land was being sold at a very cheap price, approximately Kshs 20,000 per acre. Demand for land in Kitengela has raised its monetary value. Land prices are high at urban centres such as Kitengela, Kiserian, Rongai and Isinya; along tarmac roads, and near NNP. For example, prices of land in prime areas near NNP goes for up to Ksh. 800,000 ($10,700) per quarter acre. In

areas far away from the tarmac such as Sholinke, prices go at Ksh.40, 000 ($530) per acre (ACC, 2005). The current trend of land sale poses a serious challenge to the maintenance of the migratory route.

There has also been a trend toward diversification of income sources in Kitengela. Given its proximity to Nairobi and the EPZ, the range of 'off-land' income-earning opportunities is also relatively large in Kitengela. Results of an ILRI household survey in 2000 showed that one-third of households obtained between 10-30% of their total annual income from 'off-land' activities, such as formal employment (Radeny et al., 2005). In a study carried out by ILRI and ACC in 1999 aimed at valuing alternative land-use options in the Kitengela wildlife dispersal area, over 68% of the respondents reported willingness to leave part of their land (between 0.5–250 acres) unfenced, if in return they were paid a modest sum of money for accommodating wildlife (Kristjanson, *et al*, 2002). Following such agreements, the Wildlife Conservation Lease Programme was formed.

2.3 Effects of the Kitengela and Nairobi National Park Ecosystem Transformation

2.3.1 Restricted Wildlife Movement and Reduced Habitat Range

Traditionally, wildlife had vast tracks of land to roam about, graze and migrate through seasonally. Following land demarcations, which peaked in the 1990s, the new land owners erected perimeter fences on their farms, restricting wildlife movement between Nairobi and Amboseli National Parks (Kimani, 2006). If this trend continues, in-breeding of wildlife may occur, thereby passing on recessive genes to future wildlife generations

(Ndung'u, 2005). Developments such as agriculture and urban settlements have reduced the habitat range and the wet-season forage available for wildlife.

2.3.2 Decreased Wildlife and Tourist Numbers

KWS studies reveal that between 1977 and 2002, the population of zebra and wildebeest in Nairobi National Park declined by 72% (KWS, 2005). This was blamed on the unplanned developments in Kitengela and Isinya, and illegal hunting of wildlife (Kireria, 2000). KWS Director Julius Kipng'etich warned: "It would be a disservice to the future generation for the park to be left to die in 20 to 30 years." With the steadily escalating human population, the numbers of wildebeest and zebra have dropped, which has in return reduced the variety of food available for the 'big cats' and other predators, thus encouraging predation of livestock. Also, as a result of declined wildlife numbers, there has been a decrease in the total number of tourists visiting the NNP, from 124,291 tourists in 1999 to 99,927 tourists in 2006. Therefore, fewer tourist-related benefits are being derived at the national and community level.

2.3.3 Induced Desertification and Increased Open Quarry Accidents

A recent study based on Satellite Imagery Interpretation of various dates and a ground truth survey by Onywere (2006), revealed the large extent of mining on the slow conversion of the once faunal and floral-rich rangeland into an arid environment. This process of human induced desertification is an ecological disaster in waiting that is going to impact on the wildlife, the local community and their livelihood (livestock).

Open cast mining is the chief method of mining practiced in Kitengela Division (Kòrir, 2006). The open quarries left after stone excavations pose a great threat to wildlife through accidents and death, especially the migratory herbivores. Since the quarries are never rehabilitated, this has contributed to the current decreasing number of wildlife in the park. Open-cast quarrying in Emakoko has increased alarmingly due to increased demand for construction materials in Nairobi and its environs.

2.3.4 Air, Land and Water Pollution

Numerous residential areas have been established around Kitengela, which produce solid and liquid wastes. Also, numerous slums have mushroomed. As is the characteristic of slums, they are unplanned, and have poor sanitation, and often the effluent is drained into water bodies that wildlife relies upon (IPS, 2006). Air pollutants and waste paper often find their way into NNP, thereby resulting to respiratory disorders of the wildlife.

2.3.5 Human to Wildlife and Human to Human Conflicts

During migration periods, wildlife pass through areas inhabited by humans in Kitengela, thereby preying upon livestock (Table 2.2). Wildlife also competes for pasture and water with livestock, damages crops and property, and threatens human life. In Kitengela, human-to-human conflicts have occurred over land ownership and access to natural resources caused by lack of tenure rights, clear resource allocation and planning. There has been increased competition for water among the different users namely wildlife, farmers, urban developers and pastoralists (ACC, 2005).

Table 2.2 Number of Livestock Lost to Wildlife in Kitengela (1998 to 2003)

Predator	Cow	Sheep	Goat	Total
Lion	64	102	80	246
Leopard	-	66	90	156
Cheetah	-	16	5	21
Hyena	1 calf	-	5	5
Total	65	185	178	428

Source: KWS, 2005

2.3.6 Increased Poverty for the Indigenous Pastoralists

Sale of land in Kitengela by pastoralists to new immigrants has been expressed as a downward spiral. "The Maasai sold their wealth to buy poverty. Some people who have sold their land are worse off a couple years later" (Nkedianye, 2005). Sale of land has also led to reduced grazing land for the community's livestock. Still, parcels of land that the people are left with are too small for economic productivity.

2.3.7 Positive Changes in Cultural Attributes

Unlike in the past, Maasai community in Kitengela is nowadays interacting with other tribes, thereby borrowing some cultural practices from them (ILRI, 2005). More pastoral children, especially girls are currently enrolled in schools. Cultural practices that undermine society's well-being such as early girl child marriage and female genital mutilation are also being gradually phased out.

2.4 Conventions, Policies and Acts Critical in Ecosystem Management

2.4.1 The Convention on Biodiversity Conservation

The Convention on Biodiversity Conservation's main objective is to conserve biodiversity and promote the sustainable use of its components and the fair equitable distribution of its products and benefits arising from the utilization of genetic resources (Hoagland, 1993). The Convention on Biological Diversity was ratified in Kenya on July 26, 1994. KWS is following recommendations of this convention to enhance the utilisation of participatory modes of wildlife conservation and management.

2.4.2 The Wildlife (Conservation and Management) Act

The Wildlife (Conservation and management) Act, Cap 376 provides for the protection and management of Kenya's wildlife resources through the establishment of National Parks and Game Reserves (GOK, 1989) .The act empowers KWS to manage all wildlife resources on behalf of Kenyans. One of the objectives of KWS in the 2005-2010 Strategic Plan is to improve management of protected areas, important wildlife areas and endangered species (Korir, 2006). This is envisaged in three activities namely: securing wildlife dispersal areas and wildlife migratory corridors; managing livestock/wildlife interface, developing community wildlife benefit programmes; and developing conservation education programmes for communities and collaborating institutions.

2.4.3 The Environmental Management and Coordination Act (1999)

The Environmental Management and Coordination Act (EMCA) provides for the protection and conservation of the environment (GOK, 1999). Part VI of the Act

stipulates that an Environmental Impact Assessment (EIA) study should be carried out on all proposed projects, which have potential to cause harm to the existing environment and its resources. Based on EMCA's Second Schedule, projects in Kitengela and its surrounding areas that require EIA include: new land-uses, establishment of industrial estates, drilling for the purpose of utilising ground water resources, mining, including quarrying and open-cast extraction, agriculture, irrigation, and horticulture.

2.4.4 Kenya's Draft National Land Policy

Though the draft land policy has not been tabled in parliament, its implementation will address the critical issues of land administration, access to land, land use planning, restitution of historical injustices, environmental degradation, conflicts, unplanned proliferation of informal urban settlements, outdated legal framework, institutional framework and information management (GOK, 2006). Through the policy, the government will ensure that all land is put into productive use on a sustainable basis. National, regional, urban, peri-urban, spontaneous settlements planning principles and guidelines will be formulated and implemented in a transparent, accountable, sustainable, comprehensive and participatory manner. To ensure sound and sustainable environmental management of land based resources, dealings in such land will be guided by conservation and sustainable utilization principles outlined in national environmental laws and policies. The revised land policy shall also provide for compulsory acquisition processes and procedures that are efficient, transparent and accountable. Further, it shall provide that the power of compulsory acquisition be exercised by the State and local authorities through the National Land Commission.

2.4.5 Kenya's Draft Wildlife Policy

Kenya's draft wildlife policy, which is yet to be tabled in parliament, is a radical departure from the previous approach to wildlife conservation, which emphasized protected areas. The key elements of the proposed policy include:

a. It identifies the primary goal of wildlife conservation as the optimization of returns from wildlife defined broadly to include aesthetic, cultural, scientific and economic gains, taking into account the income from other land uses;
b. It pointed out the need to identify and implement compatible land uses and fair distribution of benefits derived from wildlife including from both non-consumptive and consumptive uses of wildlife;
c. It underscored the need for an integrated approach to wildlife conservation and management in order to minimize human–wildlife conflicts; and
d. The government assumed the responsibility of paying compensation for damages caused by wildlife.

2.5 Specific Habitat Management Approaches for Kitengela

2.5.1 Corporate Social Responsibility

Since 1992, KWS has been facilitating eco-friendly coexistence with the communities around NNP by ensuring they benefit from the wildlife (Gichohi, 2000; Nkedianye, 2004). This is through the Conservation of Biodiversity Resource Areas (COBRA) Initiative, which was later replaced by CORE (Conservation of Resources through Enterprise) in 2000. It is funded by USAID, and through it, KWS has constructed

classrooms, water dams, cattle dips, boreholes and homes for teachers, roads, hospitals, and paid fees bursaries for their children in Kitengela (Mungai, 2003).

2.5.2 Isinya-Kitengela Master Plan

Key stakeholders for Kitengela wildlife habitat management are in the process of coming up with a comprehensive Master plan for the area since 2000 (Korir, 2006). A three days workshop attended by officers from KWS, Physical Planning Department, several other government departments, non- governmental organizations and community representatives was held in March 2006 in Kitengela. The workshop produced a land use master plan. According to the participants, since wildlife and livestock do not follow specific tracks/paths during their migrations and local movements, the whole of Kitengela-Isinya area is therefore critical for their dispersal.

In the proposed master plan, Zone A includes the areas around Nairobi National Park (5 km from the park boundary) up to the sheep and goat ranch, and areas around the Kitengela-Isinya and Isinya-Kiserian roads. This zone has many developments and relatively small parcels of land. Developments will be controlled through compulsory land acquisition. However, to cater for urban centres and human developments, existing major centres have been excluded from this dispersal area. Ample space for future developments of these centres has been provided.

Zone B area will be controlled using the land leases and easement programmes. This includes rest of the interior of Kitengela area, which contains relatively large parcels of

land and has little developments. Land leases provide a disincentive for land fragmentation. Land subdivisions below 60 acres will be prohibited and further developments will not be allowed. Fences will be pulled down except only around homesteads. The calving and breeding area around Engirgir and kapiti was identified as the most critical area within this zone.

2.5.3 Establishment of Kitengela Ilparakuo Landowners Association (KILA)

KILA is acting as a focal point for discussing issues with other stakeholders involving the Wildlife Conservation Lease program and other issues relating to Kitengela migratory route. The association performs various functions including: formalizing the lease programme funding organizations and individual landowners, and conducting all transactions with full transparency. It also distributing funds directly and equitably to every family in the program, based solely on the area of land under contracts.

2.5.4 Wildlife Conservation Lease Programme (WCL)

The Wildlife Conservation Lease (WCL) initiative represents an innovative, "direct payment" approach to sustaining wildlife on private lands. This is a form of consolation for not fencing, quarrying, cultivating or subdividing the designated area of land, and to actively manage their land for wildlife and sustainable livestock grazing (Nkedianye, 2005). EMCA (1999) makes clear provisions for the application of environmental easements such as the WCL Programme (GOK, 1999). WCL is being employed in areas such as Simanjiro migratory corridor, which links Lake Manyara National Park and

Tangawire National Park; in Amboseli / Longido ecosystem which links Kenya and Tanzania; and in Mara / Trans-mara ecosystem in Kenya.

In Kitengela, the WCL Programme was officially inaugurated at the launching of the Nairobi National Park Migration Appeal in November 2000 (ILRI 2005, Gichohi 2003, Khisa 2001). Its key stakeholders are: KILA, KWS, FoNNaP, TWF, ACC, AWF, ILRI, Elkejuado County Council, Department of Resource Surveys and Remote Sensing, and Department of Physical Planning of the Ministry of Lands. The WCL program began the pilot project with 214 acres owned by 2 households, growing to 7,000 acres owned by 84 households by April 2002. In July 2003, 115 households were signed up and a total of 8,400 acres were under this initiative. More families are on the waiting list with a total of more than 14,000 acres.

Before land is registered under the programme, several critical steps must be taken:

- Land must be confirmed to lie within the primary wildlife migration/dispersal area.
- Titles are checked to verify clear ownership, the recorded location of each parcel, and the exact number of acres owned by the household.
- Physical verification is undertaken and measurements of areas around houses and livestock enclosures that will not be used by wildlife are taken and excluded from WCL.

The WCL Programme pays a fee of Kenya shillings 300/acre (approximately US$ 4 per acre) per household per year directly to the landowners, issued in three phases.

2.5.5 Memorandum of Understanding (MOU)

Memorandum of Understanding aims at fostering and enhancing possible collaboration measures through strategic partnerships for maintenance of ecological processes and sustainable utilization of biodiversity resources (Khisa, 2001). In Amboseli, KWS has allowed the Amboseli Community Wildlife Tourism Project (ACWTP) in Loitokitok to benefit from wildlife tourism, as a way of alleviating the poverty levels of the rural people. In Kitengela, KWS has established Olmakao Cultural Boma run by Maasai women, where they sell artefacts. Group ranches have also been established using Memorandum of Understanding.

2.5.6 Conservation Education

Conservation education is useful in changing attitudes and behaviour, through increasing people's awareness of the value of natural resources, both now and in the future, along with the ecological processes that maintain these resources. In Tsavo, Friends of Tsavo initiative (FoT), seeks to create educational awareness by organizing educational field trips to Tsavo East and West National Parks with its members and school children from urban centres and those in the vicinity of the national park. This is an effort geared towards showing pastoral people how they can contribute to improved management of wildlife resources.

CHAPTER 3: METHODOLOGY

3.1 Research Design

This study involved a field survey with the aid of a questionnaire (Appendix 1) with both structured and unstructured questions on a sample of households from the local community living within Kitengela migratory corridor. Qualitative data was collected using Participatory Research Appraisal techniques.

3.2 Target Population and Sampling Procedure

According to 1999 censuses, Kitengela has a population size of 17,347 people, with 44 persons per km^2, while Nairobi City has a population of approximately 2.8 million people (GOK, 2001). The target population in this study was categorised into two groups namely the local community and the key informants.

Stratified Random Sampling was used to gather information from the local community members. Unlike Simple Random Sampling and Systematic Sampling, Stratified sampling was preferred because it ensured a greater degree of representation of the sample population (Mendenhale, 1979). In addition, unlike cluster sampling, it was free of clustering and thus gave a fair representation of the entire population geographically.

Stratified Random sampling was achieved by separating the Kitengela population into three non-overlapping groups, called strata, based on the major homogenous land uses existing in Kitengela. These were pastoralists, agriculturalists and urban developers. Then, a simple random sample was selected from each stratum namely: 40 samples for pastoralists, 42 samples for agriculturalists and 45 samples for urban developers. This

was based on the theory that a sample above 30 is statistically logical to make inferences about the entire population under study (Mugenda and Mugenda, 1999). A total of 127 samples were collected for data analysis. The unit of analysis was the individual households and the unit of observation was the household heads.

Stratified random sampling was based on the sampling theory by Aneshensel (2002), which states that the more homogeneous the study population, the smaller the sampling error. Therefore, this design aimed at reducing the variances of the sample results for the entire population, thereby achieving greater precision for the sample estimates. It also allowed comparison of results from different strata; hence meaningful conclusions were made based on such comparisons.

Purposive sampling was used to select Key Informants. This design was preferred because the researcher targeted the organizations and individuals who had the desired characteristic, that is, in-depth and more specific information (Egerton University, 2000), concerning Kitengela and Nairobi National Park ecosystem.

3.3 Data Collection Methods and Instruments

Social data was collected using PRAs (Participatory Rural Appraisals) namely Questionnaires, Key Informant Interviews and Focus Group Discussions. Questionnaires had both open and closed ended questions (Appendix 1). Open ended questions were used to probe in-depth information, while closed-ended questions were used to encourage quick response, especially where fixed answers were expected. All questionnaires were

administered by the researcher, which was advantageous because it allowed clarification of the questions, thereby generating the most relevant information. The questions were administered in Kiswahili since the entire population understood the language. The exercise took place from early October 2006 to mid February 2007.

A Focus Group Discussion was held on the third week of February 2007, in Kitengela Chief's Office in Kitengela town. The Chief, Mr. Stanley Sompiloi, was the Facilitator in the whole process. At least three members representing the various Locations were present, with at least one of them being a woman, which ensured gender equity. Issues discussed during the Focus Group Discussion (Appendix 3) included the effects of Kitengela/ NNP habitat change on the community, the contribution of the ecosystem to the local community's development, and their involvement in various NNP/ Kitengela habitat management and conservation programmes.

Key Informant Interviews were held with different organizations from October 2006 to February 2007. Organizations interviewed were KWS, Government Ministries of Planning and Lands, FoNNaP, ILRI, ACC, NEMA, Elkejuado County Councils, Provincial Administration and KILA. Key issues discussed (Appendix 2) included: drivers, trends and effects of Kitengela / NNP habitat change, ecosystem benefits and the existing wildlife habitat conservation and management approaches.

Temporal data namely seasonal calendars were used to examine demographic trends in NNP's wildlife numbers and tourist numbers. Historical timelines were also used to

assess human population trends in Kitengela. Spatial data namely maps, still photographs and direct observation were used to capture the current state of habitat transformation. The research was also based on the existing secondary data such as journals, books, National Development Plans, and other published reports.

3.4 Data Management and Analysis

Both qualitative and quantitative data analysis methods were used. Data collected was first cleaned, coded and entered into appropriate spreadsheet (Microsoft Excel). It was then analysed using Statistical Package for Social Sciences (SPSS).

Qualitative data was used to assess the drivers, trends and effects of habitat transformation and evaluate the contributions of the ecosystem to community development. Focus was placed on descriptive statistics mainly frequency distributions. Pearson Correlation analysis (Gorard, 2003) on the other hand was used to assess whether there were relationships between selected variables under study. Pearson Correlation Coefficient (r) values were calculated with absolute figures indicating the strength of the relationships between the variables, and positive (+) or negative (-) signs showing the direction of the relationships. The relationships identified were then used to make meaningful conclusions for the study.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Drivers and Trends of NNP and Kitengela Habitat Transformation

Approximately 68% of the Kitengela wildlife dispersal habitat has already been purchased by new immigrants hence was thus not available for wildlife migration and dispersal. Only 26% of the habitat belonged to open communal land tenure, while 6% of the habitat was government owned. The main driver of Kitengela/NNP ecosystem transformation was the growth in human population due to influx of new immigrants. About 63% of urban developers were from Nairobi province, while 62% of agriculturalists were from Central province. They had introduced new land uses that were incompatible with wildlife management. Such included urban residential, industrial and commercial premises and agricultural enterprises. These prompted fencing, fragmentation and sub-division of land, thereby restricting the traditional wildlife migration. Still, about 48% of the pastoral population was uneducated, thus had fewer livelihood alternatives. This led to distress land sale, which has contributed significantly towards habitat transformation.

4.1.1 Education and Household Income Disparities

Approximately 29% of the entire Kitengela population had attained post-secondary education, 28% had at least primary education, while 21% of the population were uneducated (Table 4.1). However, education level of the population varied significantly among the three strata, with the most uneducated (48%), being the pastoralists. About 50% of agriculturalists had attained secondary education while 84% of urban population had attained post-secondary education.

Table 4.1 Level of Education for the Kitengela Population (Percentage)

Gender	M	F	M	F	M	F	M	F	M	F	M	F
Age	**1-10**		**11-20**		**21-30**		**31-40**		**41-50**		**>51**	
No education	21	29	3	6	3	7	8	11	5	8	10	13
Primary education	24	26	24	20	8	9	11	13	3	4	10	9
Secondary education	-	-	23	21	11	8	21	21	13	11	12	10
Post secondary	-	-	-	-	30	24	29	28	30	26	19	17
Total (%)	100		100		100		100		100		100	

Source: Field Study, 24-6-2007

There was a strong negative correlation between level of education and number of children per household (r=-0.63, n=127, p=0.01) (Table 4.2). The pastoralists, who were the least educated, had 5 children per household, agriculturalists had 4 children, while the urban population, who were most educated, had 3 children per household. To raise large family sizes, the pastoralists therefore required more income, but were limited by low status of education from getting formal employment. They thus resulted to selling part of their land, thereby contributing to habitat fragmentation, hence loss of the traditionally open wildlife migratory and dispersal land.

Table 4.2 Pearson's Correlation Coefficient (r) values for Selected Variables

	Number of Children	Education Level	Income Level	Migration Period	Land Size
Children	1				
Education Level	-0.63(**)	1			
Income Level	-0.39(**)	0.51(**)	1		
Migration Period	-0.56(**)	0.63(**)	0.31(**)	1	
Land Size	0.55(**)	-0.64(**)	-0.32	-0.80(**)	1

= (r) Values significant at p<=0.01 ***n=127***

Source: Field Study, 24-6-2007

More educated household heads were more likely to earn more incomes (r=0.51, n=127, p=0.01). The average monthly household income for the entire population was Kshs 31,457 per month (Figure 4.1). The pastoral households earned Kshs. 21,375 (from livestock and off-land sources); agriculturalists earned Kshs 31,905, while urban developers earned Kshs. 40,000 per month.

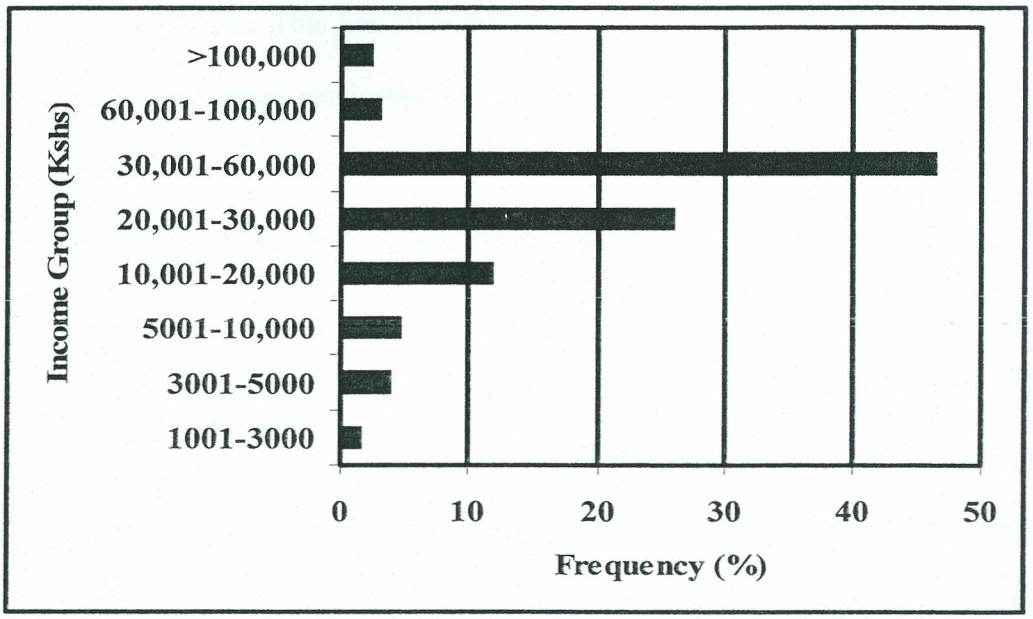

Figure 4.1 Monthly Household Incomes for Residents
Source: Field Study, 24-6-2007

Disparities in both education and income have played a crucial role in the Kitengela habitat transformation. Land sale by pastoralists to new immigrants in order to secure more incomes has been a key driver of Kitengela habitat transformation. This has encouraged heavy land sub-division, fragmentation and fencing of individual land, thereby blocking the wildlife migratory route linking NNP and Amboseli National Park. However, Nkedianye (2004) expressed this sale of land as a downward spiral, stating that the "Maasai sold their wealth to buy poverty", since some people who had sold their land were worse off a couple years later than they were initially.

On the other hand, the high-income earning urban group can afford to buy land in Kitengela. An eighth of an acre costs between Sh700, 000 and Sh850, 000 depending on where it is located. Land very close or neighbouring the park, or near the tarmac roads along Nairobi-Namanga road, and Nairobi-Kiserian road is also more expensive than on the interior areas. Still, land in Kitengela is cheaper than in other peri-urban areas surrounding Nairobi. This has attracted large populations of high-income earners, who have established urban residential settlements, industrial and commercial buildings and agricultural land uses. These have resulted transformation of land from open to highly developed habitat, thus blocking wildlife migration.

There is also an upcoming income-driven trend for pastoralists to diversify their livelihood options. In order to supplement their small incomes, low-income earning pastoralists are now adopting other forms of survival such as small-scale agriculture, which prompts fencing. Kitengela habitat is therefore being transformed not only by the new immigrants, but also by the original immigrants.

4.1.2 Increase in Human Population Density and Industrialization

Before 1968, all land was held in trust by the Kitengela community. In 1968, the Group Ranch Scheme (GRS) was launched in Kitengela, which saw the conversion of communal land tenure, with flexible access to resources, to group tenure with fixed and legally recognized boundaries. This change was expected to encourage the pastoralists to limit their livestock numbers to match the group ranch resources. However, the pastoralists continued exploiting group ranch land along traditional lines. In 1987, sub-

division began within each group ranch. Group ranch members were issued title deeds to individual plots. Most agriculturalists and urban developers migrated from 1991 to 2000 (Figure 4.2). Urban developers are still migrating to Kitengela at a high rate than agriculturalists. The pastoralists currently moving into the area are nomads, therefore are temporary inhabitants.

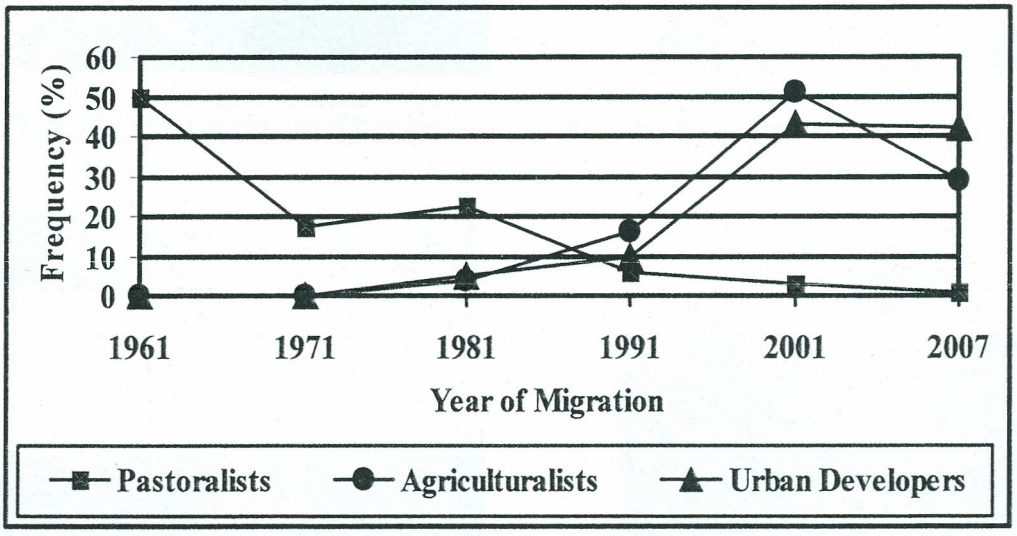

Figure 4.2 Migration Trends for Pastoral, Agricultural and Urban Communities
Source: Field Study, 24-6-2007

The year 1981 to 2000 is the most significant period in the history of Kitengela ecosystem transformation. Key players in the Kitengela habitat transformation is the agriculturalists and the urban populations since they introduced new land uses. This included the establishment of massive urban residential and industrial developments, agricultural and horticultural enterprises, heavy fencing of privately owned land and numerous quarrying activities (Plates 4.1.2). These activities resulted to heavy fragmentation and loss of wildlife habitat, thereby restricting Nairobi National Park's wildlife migration. This threatens the future of the park.

4.1.2 Major Land Uses in Kitengela

Plate 1: Urbanization in Kitengela

Plate 2: Agriculture in Oloosirikon

Plate 3: Horticulture in Kisaju

Plate 4: Quarrying in Emakoko

Plate 5: Fencing in Ololooitikoshi

Plate 6: Industries in Athi-river

Source: Field Study, 24-6-2007

For instance, in 1978, Magadi was the sole mining company in the Kitengela/ Athi river area. In 1982, other industries were initiated such as the East Africa Portland Cement, Kenya Marble Quarries, Athi river mining company and Kenya Gypsum Company. Today, massive industries have been put up in the area, whose cumulative impacts in both space and time, such as pollution, permanent loss of land and heavy fencing, are detrimental to wildlife in Nairobi National Park.

Using the geometric population growth model, bases on the 1979 and 1999 population censuses, the author estimates that Kitengela's human population is growing at a rate of 3.8% per annum. As human population increases, the household land sizes are becoming smaller ($r=-0.81$, $n=127$, $p=0.01$). This study showed that the current average land holding for the entire population was 52.38 acres per household. The pastoralists had about 153 acres of land per household, compared to the agriculturalists (9.309 acres), and urbanites (3.075 acres). While the large-scale urban industrial premises took up most of the wildlife habitat, most of the small-scale urban residential and business plots ranged from 0.056 acres (50 by 50 ft) to 0.224 acres (100 by 100 ft). The urban habitat was thus intensified and highly fragmented through fencing, completely restricting wildlife migration. Fencing was more frequent on private land; and along Nairobi-Namanga road, Nairobi-Kiserian road, and Kiserian-Isinya road.

4.1.3 Changes in Land Tenure Systems

About 68% of land in Kitengela belonged to freehold tenure system (agriculturalists and urban developers), while 26% of land belonged to the communal tenure system (Figure

4.3). Most land in the Kitengela is currently in the hands of individual land owners, thus is not available for wildlife migration. This threatens the future of NNP, hence national and community well-being, since the presence of wildlife on private land is not guaranteed.

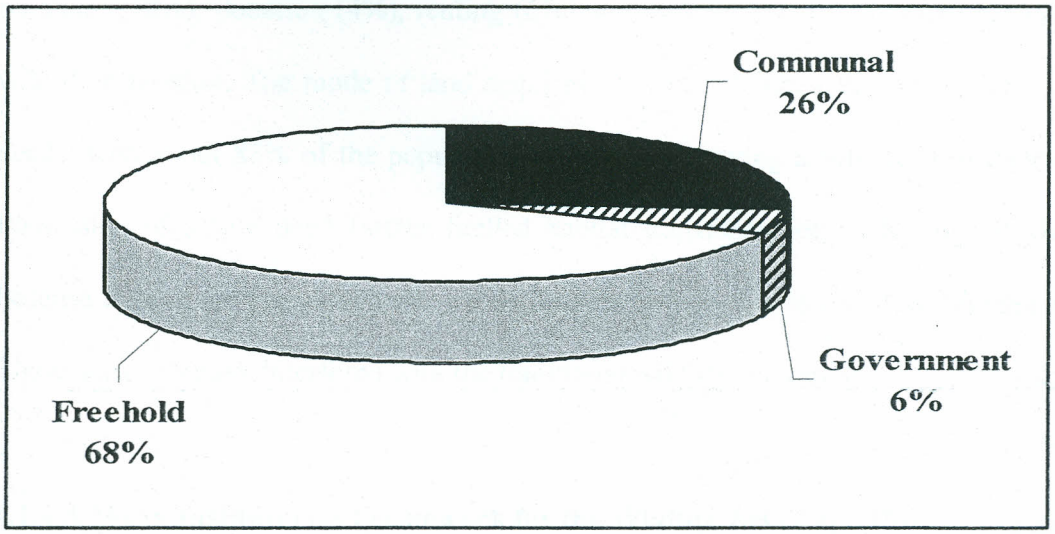

Figure 4.3 Land Tenure Systems in Kitengela
Source: Field Study, 24-6-2007

The government committed a big mistake because it should have acquired the most critical land in Kitengela in 1967 when it declared Kitengela plains a wildlife conservation area. This way, the government could have been able to prevent developments on this wildlife migratory corridor. Better still; the government should have formulated a land policy on time, which would have controlled developments on communal land to avoid excessive fragmentations. Though the government is finally in the process of debating on the proposed land policy, the move may be late, and will require a lot of effort and resources to implement the plan. The process of compensation and relocation of populations to other areas will be economically costly, not to mention

disrupting their socio-cultural dynamics, especially the indigenous pastoralists. Land under freehold tenure was acquired through purchase while communal land was acquired through inheritance. Pastoralism is practiced on land acquired through inheritance (26%). Agriculture and urban developments have been established on land acquired through purchase (58%), donation (4%), renting (6%) and squatter (6%). This therefore hinders wildlife migration. The mode of land acquisition further dictated the possession of title deeds; with about 85% of the population in Kitengela having a title deed to their land. Possession of a title deed further fuelled habitat transformation in Kitengela. This is because it gave the population the freedom to fence, sub-divide and develop their land. These activities have interfered with the traditional wildlife migration.

4.1.4 A Weak Institutional Framework for the Wildlife Act (Cap. 376)

About 78% of the total Kitengela population, who are the main custodians of NNP's wildlife, felt marginalised and alienated from the decision making processes concerning the park's wildlife management. Although 75% of pastoralists said they were involved, only 21% of agriculturalists and 4% of urban developers felt they were involved in decision-making (Figure 4.4). They thus had a negative attitude towards wildlife conservation, thereby adopting land uses incompatible with wildlife management. The current Wildlife Conservation and Management Act has therefore failed to involve the communities living in wildlife non-protected areas in decision making. They are thus unlikely to show support or even accommodate wildlife in their land, thereby making the implementation of Kitengela habitat management measures ineffective.

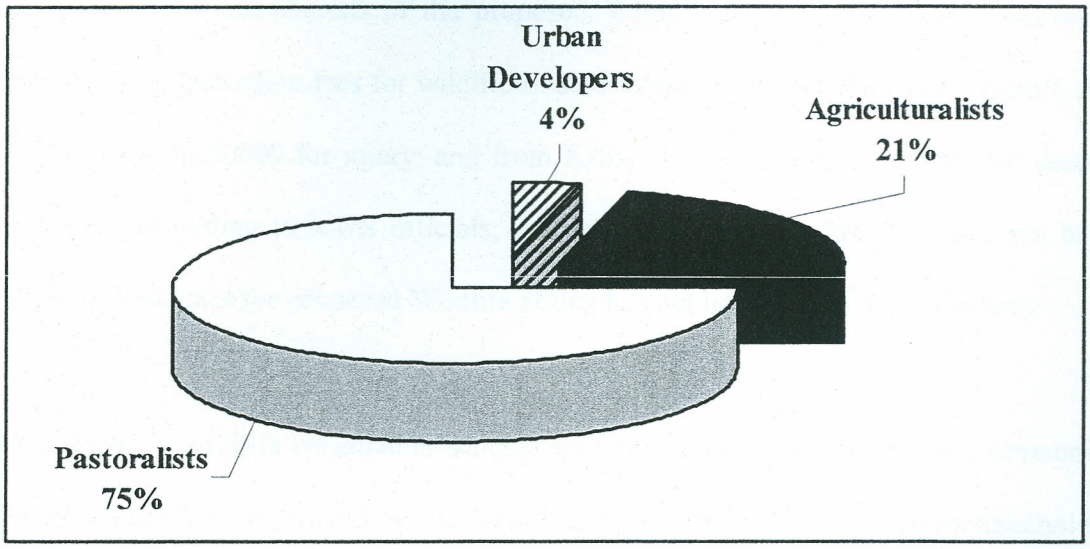

Figure 4.4 Community Involvement in Management of NNP/ Kitengela Ecosystem
Source: Field Study, 24-6-2007

Further, the issue of compensation for wildlife damage has also created mistrust between wildlife managers and the Kitengela community. Only about 22% of the entire population has received compensation. About 52% of the pastoral population and only 21% of agriculturalists have received compensation for loss of livestock to wildlife. The urban population suffered no losses, hence no compensation. No agriculturalist interviewed received compensation for loss of crops to wildlife. In addition, those who received compensation stated that there was bureaucracy in the payment process. Delayed compensation further discouraged the community members from supporting the existing ecosystem management programmes, since they termed wildlife as being more of a liability than as asset to them.

Currently, compensation is paid by the government and the rates, assessment and payment of claims is determined by the District Wildlife Compensation Committees. In

the policy recommendations of the proposed Wildlife Policy (2007), the government increased compensation fees for wildlife related losses. The fees were raised from Kshs. 15,000 to Kshs.50000 for injury; and from Kshs. 30, 000 to Kshs.200, 000 for deaths. However, according to KWS officials, the new terms of compensation have not been implemented since the proposed Wildlife policy has not been passed in Parliament.

In addition, a wildlife consolation scheme for compensating the Kitengela Community for losses resulting from wildlife was established in 2000 by FoNNaP, a key stakeholder in NNP's wildlife management. This programme has been operational since then, and it was seen as a move towards maintaining a good relationship between wildlife conservationists and the local community. However, although Kitengela predator consolation scheme is an innovative approach to offsetting livestock losses from wildlife predation, it is very unsustainable in the long run. Compensation only provides a short-term solution to human-wildlife conflicts being experienced in the Kitengela area. Through compensation, the Wildlife Act therefore sought to solve secondary effects of habitat change, without looking into ways in which man's intrusion into the wildlife territory could be halted, which would prevent human to wildlife conflicts.

The Wildlife (Management and Conservation) Act (1989) has also failed to ensure that wildlife related benefits trickled down to the communities living adjacent to national parks. About 40% of the population interviewed in Kitengela, especially those living on the interior parts of Kitengela, felt that they had not received any tangible benefits from the government for accommodating wildlife on their land. Still, they observed that there

was inequitable distribution of wildlife-related benefits in the area, with infrastructural developments being concentrated on the periphery of Kitengela.

4.1.5 Lack of a National Land Policy

According to Kajiado District Lands Personel, there has not been a National Land Policy in Kenya. As such, the office has not been able to control physical developments on land within its areas of jurisdiction, including Kitengela. As a result, there has been unplanned mushrooming of developments, permanent and semi-permanent, residential and business, large-scale and small-scale. As a result, of the 92% land that belonged to communal land ownership in the 1970's, only 26% remains open. The rest has been taken up by the unplanned developments. If the recommendations of the proposed land policy are not implemented soon, the remaining open land will also be converted into permanent developments. Nairobi National Park's wildlife movement will thus be completely restricted. Slowly, NNP's carrying capacity will be eroded since the park will not be able to sustain large numbers of wildlife without external food sources.

However, the officers were optimistic that with the adoption of the draft National Land Policy that was formulated in October 2006, there will be clear guidelines on land-use management such as effective regulation of land and settlement development, and transparent and democratic administration of land. Communities will be involved through out the process, ensuring that they get access to land information and understand the need for sustainable land use. Civic education will also play an important role in ensuring sustainable community development.

4.2 Effects of Habitat Transformations on Ecosystem and Communities

4.2.1 Decline in Wildlife and Tourist Numbers

The main effect of habitat transformation on NNP and Kitengela ecosystem was the significant decline in the park's wildlife and tourist numbers since 1990's. Since the early 1980's, Kitengela wildlife dispersal area has undergone numerous changes in land uses, which contributed to loss of habitat and restricted wildlife movement. However, it was not until mid 1990's that the effects of habitat change were felt as wildlife numbers declined drastically (Figure 4.5). The graph below represents an approximate total wildlife numbers including migratory species (Wildebeest, Zebra, Impala, Elands); and non-migrant species (Thomsons Gazelle, Grant Gazelle, Kongoni and Giraffe). These figures were based on averages of monthly wildlife counts conducted within each year.

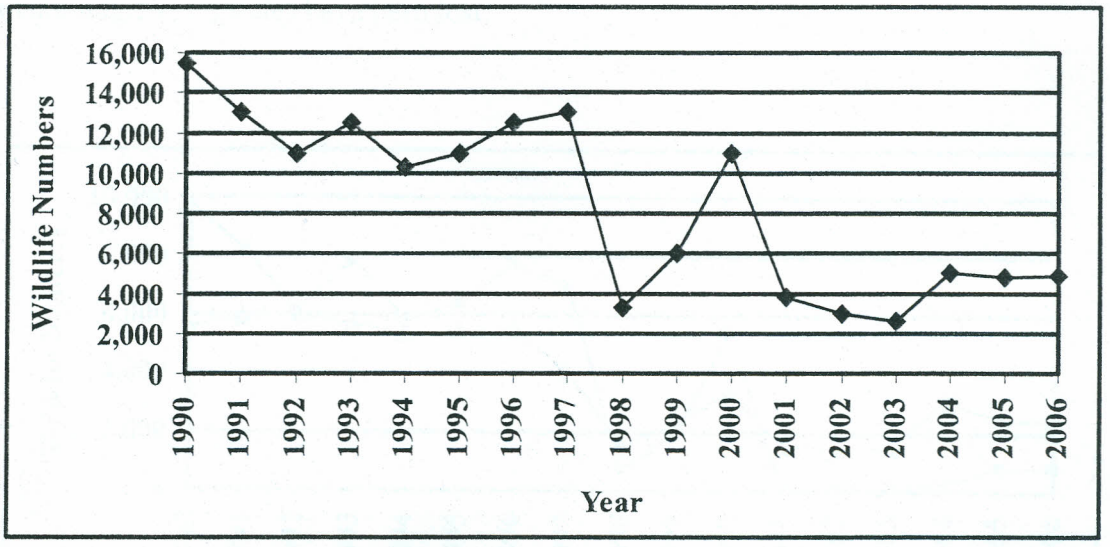

Figure 4.5 Declining Wildlife Numbers in Nairobi National Park
Source: Nairobi National Park Game Census summary from 1990 to 2006

Habitat loss and fragmentation is to blame significantly for these changes in wildlife numbers. The changes cannot be blamed solely on natural calamities such as drought

since they do not occur frequently. For instance, major drought that affected Nairobi National Park were only experienced in 1960/61, 1973/74, 1983/84, 1994, 1999/2000 and March 2006. A sharp decrease in wildlife numbers was recorded in 1998, and from 2000 to 2001. Wildlife numbers have not recovered to the abundant counts of early 1990s. Not only is wildlife numbers declining due to blocked migratory routes, but also due to increased bush-meat hunting, increased environmental pollution and degradation, reduced forage, and increased open quarry wildlife accidents among others.

The author further examined the trends of Nairobi National Park's two major migratory species namely wildebeests and zebras (Figure 4.6). The two species also constitute over half the total wildlife population in NNP. Between 1990 and 2006, about 70% of the two major migratory species have been lost.

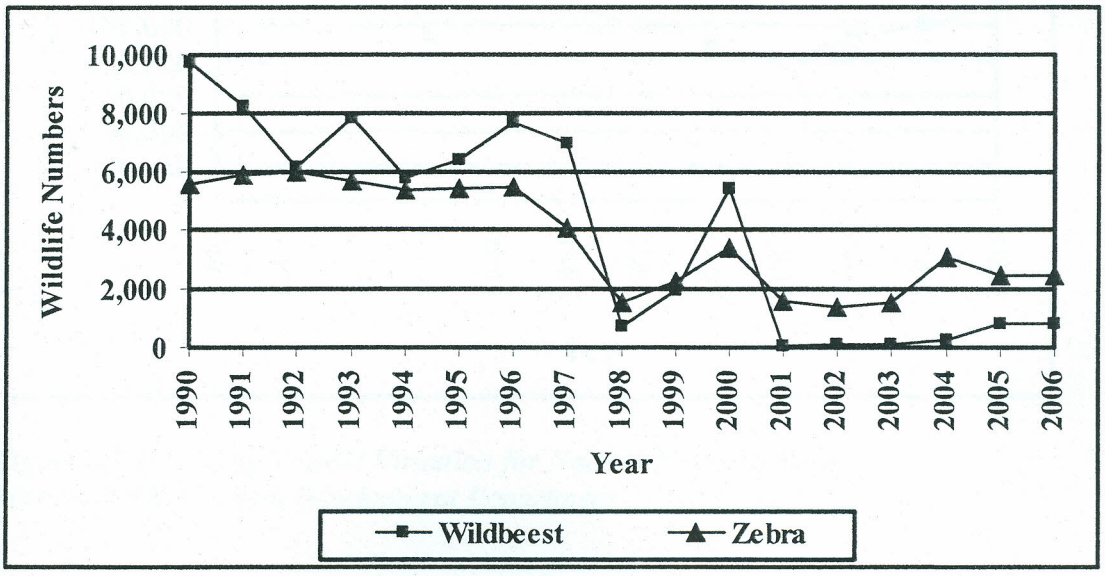

Figure 4.6 Declining Number of Nairobi National Park's Migratory Species
Source: Nairobi National Park Game Census summary from 1990 to 2006

According to the KWS Veterinary Department's bush-meat testing section, the wildebeests, zebras and impalas are the species targeted most by illegal poachers in Kitengela and Isinya. According to Evelryn Oroni, NNP Management and Administration officer, there has been an increase in illegal poaching of wildlife in these areas over the last decade. KWS Veterinary Service Department is working closely with its Security and Community Wildlife Service Departments to curb bush-meat hunting.

The number of tourists visiting NNP has been declining over the last ten years (Figure 4.7). Decline in wildlife numbers was strongly related to decline in tourist visitation in 1996 to 2006 ($r=0.86$, $n=11$, $p=0.01$).

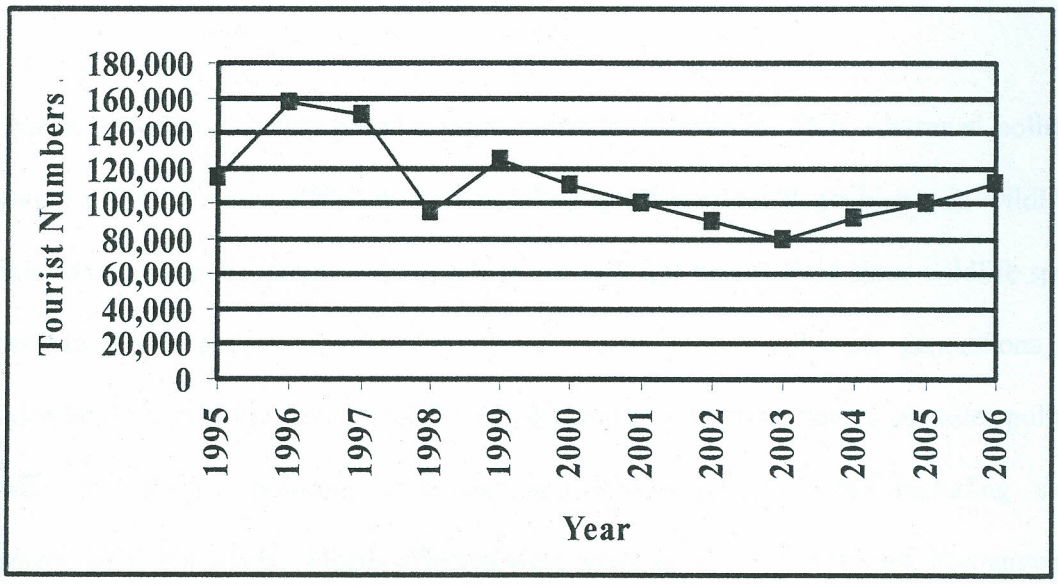

Figure 4.7 Declining Tourist Visitation for Nairobi National Park
Source: KWS Tourism Development Department

Reduced tourism revenue translated into fewer ecosystem benefits at the community level as discussed earlier.

4.2.2 Effects of Habitat Transformation on Wildlife in Nairobi National Park

Transformation of the Kitengela/ NNP habitat has also impacted on wildlife indirectly. This is through adversely affecting other environmental parameters that wildlife depends on. The most seriously affected environmental parameter was the wildlife habitat range (Table 4.3). There has been a significant loss of wildlife habitat as a result of establishment of agricultural, urban industrial and residential developments. As discussed earlier, about 68% of the initially open wildlife habitat has already been lost to private ownership. The areas most affected are to the East, South and West of Kitengela. Only the Northern area and the central area of Kitengela, which borders NNP is not encroached. The researcher observed numerous land fragmentations as initially large pieces of land have been sub-divided and sold.

Water pollution has also posed a great threat to wildlife in NNP. Chemical pollutants found in liquid waste efffluents have resulted to adverse health problems on wildlife. If this trend continues, sustainable development will not be achieved since wildlife species will be fewer and of poor quality, thereby denying future human generations from adequately benefiting from wildlife related benefits. The main source of water pollution was the heavily polluting industrial and residential premises (including slums) surrounding Kitengela. Mostly affected were areas along Mombasa road, Namanga road, and Nairobi to Kiserian road. Alien vegetation species such as *Ipomoea species* and *lantana camara* have also been introduced, which according to NNP's Administrative Officer, has significantly reduced the regenerative capacity of indigenous vegetation in Nairobi National Park.

Table 4.3 Effects of Habitat Transformation on Other Environmental Parameters.

Environmental Parameter	Location and the Main Drivers of Habitat Change	Effect on Wildlife
Loss of Wildlife Habitat Range	-Agriculture in: Ololoitikoshi, Oloosirikon, Ereteti, Emakoko -Horticulture in Kisaju -Industries, residential and business developments	-Reduced wildlife habitat range -Loss of vegetation -Restricted movement -Reduced wildlife numbers
Water Pollution	Orbit Chemicals Industry, Alpha Lama Tarneries	-Effluents pollute Donga Stream and Athi basin Dam
	-Lang'ata army barracks, Otiende estate	-Effluents pollute Hyena Dam in Nairobi National Park
	-Hardy estate, Brookehouse school, Wildlife Clubs of Kenya , Bomas of Kenya	-Effluents pollute Nagolomon Dam in Nairobi National Park
	-Tangaza Institute, Banda school, Park place hotel	-Effluents pollute Kisembe Stream in NNP
	-Alpha lama Tarneries Industry	-Effluents pollute Mbagathi river
Land Degradation	Quarrying of building stones -Emakoko, Noonkopir, SholinkeEreteti, Enkurunka	-Loss of biodiversity -Induced desertification -Accidents to wildlife in NNP.
	Gypsum mining: -Athi river, Olturoto, Noonkopir	-Loss of land cover -Induced desertification
Air Pollution	Industries in Athi river: -Bamburi and EA Portland Cement, Devki Steel makers, Orbit chemicals, Stone Athi	-Wildlife respiratory disorders and biological defects -Acid rain causes vegetation to wither and die out

Source: Field Survey, 24-6-2007

Water resource in Kitengela and NNP has suffered a double tragedy. Besides being polluted, surface and ground water levels have been lowered. This was attributed to numerous boreholes, which have been dug in Lang'ata, Ongata Rongai, Kiserian and Kitengela to meet water needs of the ever increasing human population. Further, deforestation and heavy logging activities in Ngong forest, the main water catchment area for NNP, has also lowered surface and ground water levels, making it inadequate for daily wildlife consumption. The proposed Southern road by-pass is also likely to affect Hyena dam, situated on the Northern side of NNP.

Mining and raw material excavation activities have caused land degradation in Kitengela. This has resulted in loss of vegetation/ fodder for wildlife consumption, soil erosion and gradual desertification. Wildlife accidents were also reported to have occurred in open excavation areas. This led to death, and increased chances of illegal capture and poaching of incapacitated wildlife, thereby contributing to significant decline in wildlife resources. Areas mostly affected by extensive quarrying were Emakoko and Enkurunka.

4.2.3 Effects of Habitat Transformation on the Pastoral Community

Approximately 95% of the pastoralists complained of lack of adequate water resources all year round (Table 4.4). This was because there are no permanent water resources in Kitengela. Further, the existing boreholes were either non-functional, or inadequate due to increased human population. They blamed this on the lack of adequate investment on infrastructure such as boreholes, shallow wells, piped water and earth dams; and lack of community capacity building on management of the existing water resources.

Table 4.4 Effects of Habitat Transformation on the Pastoral Community.

Nature of Effect	Magnitude			
	None %	Low %	Medium %	High %
a) Lack of adequate water resources	2	3	0	95
b) Loss of pasture to wildlife	0	7	25	68
c) Loss of pasture due to farming	2	15	23	60
d) Loss of livestock to wildlife	20	10	20	50

Source: Field Study, 24-6-2007

About 68% of the pastoralists felt that loss of pasture to wildlife was a serious occurrence in the area. Although Kitengela area only serves as a wet season (March – May) habitat to wildlife, which then returns to NNP during the dry season (June – November), prolonged drought forces wildlife to spend more of its time outside the protected areas, thus competing for pasture with the pastoral livestock. Still, approximately 60% of pastoralists felt that loss of pasture due to increased crop farming was serious. They stated that their grazing range has been significantly reduced, not to mention restricted movement of the community and their livestock. Most areas along Kiserian-Isinya road such as Ereteti, Olooloitikoshi and Kisaju have been converted to agricultural land, with immigrants still settling further into the open pastoral area.

Approximately 50% of pastoralists felt that loss of livestock to wildlife was serious, with the lion being named as the most common predator. They reported having lost at least a goat or a sheep to wildlife. Other effects identified by the pastoral community, though not

of high magnitude included: loss of pasture due to rapid urbanization and population growth; and transmission of East Coast Fever disease from wildlife to livestock.

4.2.4 Effects of Habitat Transformation on the Agricultural Community.

About 56% of agriculturalists interviewed felt that loss of crop to livestock was the most serious effect of habitat change (Table 4.5). Crops grown, mainly through irrigation includes kales, tomatoes, cabbages and onions. This was especially common during extremely dry periods, when pasture was inadequate. Some pastoralists pulled down fences around farms in order to allow their livestock to graze in. Due to the fact that Kitengela is a dry place, it is naturally fit for pastoral land-use, which requires vast tracks of open land. Agriculture was therefore termed as an unsustainable/ uneconomical enterprise in Kitengela.

Table 4.5 Effects of Habitat Transformation on the Agricultural Community.

Nature of Effect	Magnitude			
	None%	Low%	Medium%	High%
a) Loss of crop to livestock	14	7	23	56
b) Lack of water for livestock	14	12	19	55
c) Transmission of wildlife/ livestock diseases	21	19	5	55
d) Lack of water for irrigation	14	5	29	52
e) Soil erosion	17	19	12	52
f) Loss of crop to wildlife	38	21	0	41
g) Loss of livestock to wildlife	40	24	0	36

Source: Field Study, 24-6-2007

About 55% of the agricultural population felt that there was a high rate of transmission of wildlife diseases to livestock through ticks. This made animal husbandry an expensive enterprise. Also, about 52% of agriculturalists felt that soil erosion was a serious problem, though most of them had dug gabions and terraces to control erosion. Approximately 52% of agriculturalists felt that lack of water for irrigation and livestock was high. This was because Kitengela is an arid area with few water resources, and also due to competition because water in this area is a riparian resource. However, 14% did not experience the problem since they had dug boreholes in their compound, which enabled them to irrigate vegetables and start up water vending businesses.

4.2.5 Effects of Habitat Transformation on the Urban Community.

About 96% of the urban population felt that there was a sharp increase in demand for land (Table 4.6). This they attributed to improved incomes of urban residents, making land affordable to a larger population. Kitengela was also named as being a convenient area of residence for many workers in Nairobi and its environs.

Table 4.6 Effects of Habitat Transformation on the Urban Community.

Nature of Effect	Magnitude			
	None %	Low %	Medium %	High %
a) High demand for land	4	2	0	93
b) Nuisance due to livestock grazing in the urban surrounding	8	16	4	71
c) Lack of water due to irrigation	13	16	18	53
d) Loss of water to wildlife	13	38	24	24
e) Loss/ injury to human by wildlife	98	2	0	0

Source: Field Study, 24-6-2007

About 71% of the urban population termed livestock grazing in the urban surroundings as a nuisance since it disrupted motorists and pedestrians, leading to accidents. Baboons were also named as being a menace to the urban population.

About 53% of urban developers complained of lack of water due to stiff competition between the numerous land-uses namely industries, horticulture, urban agriculture and pastoralism. They felt the problem existed because the Elkejuado and Mavoko county councils had failed to provide piped water to their individual households. In order to meet their water requirements, the Athi-river and Kitengela community had proposed to construct a dam in Nairobi National Park in December 2006. The dam would yield 36,500 cubic metres of water daily. Proponents of the dam argued that it was central to addressing water needs in the suburbs of Mavoko, Kitengela and Athi River, where the number of residents and industries is growing at an alarming rate.

However, this move was rejected by KWS conservationists due to its potential adverse environmental impacts. While the dam was to cover 3.5 square kilometres of NNP's surface area, it risked introducing significant ecological changes to the park. Conservationists maintain that proponents of the dam should be exploring other ways of addressing their water needs, such as sinking more boreholes and harvesting rainwater.

4.2.6 Change in Pastoral Cultural Attributes

Approximately 50% of the Maasai boma visited during this study had only one or two households (Olmarei), contrary to a study by Grandin (2001), whose findings indicated that Kitengela's Maasai boma had four to six households. This trend shows how the

pastoralists have become increasingly sedentary, moving towards individualisation of production. One household was divided into sub-households called houses (Nkaji) of each wife and her children, which was the unit of analysis for the pastoral community. Still, about 60% of the boma visited were built of iron sheets, a move from the traditional manyatta houses. The population attributed this shift as a result of influence by immigrants, increased incomes for the pastoral community, and the lack of raw materials (cow dung and water) required for making manyattas.

Over 70% of the Maasai population has embraced contemporary modes of dressing, though partial for most of them. For instance, Maasai men wore a trouser, but still retained their 'Lesso/ Shuka'. Also, with the influx of other communities, intermarriages have occurred and as such, today's young Maasai generation cannot be termed as purely Maasai. Also, about 96% of the Maasai community interviewed are educating their children. The girl child is especially being empowered through formal education. Education is playing a great role in phasing out cultural practices that undermine their well-being such as young girl child marriage and female genital mutilation.

4.3 Analysis of existing NNP and Kitengela Habitat Conservation Approaches

4.3.1 Management of NNP/ Kitengela Ecosystem by Kenya Wildlife Service

The overall custodial ownership of wildlife is vested in the state with Kenya Wildlife Service as the designated national institution responsible for the implementation of the wildlife policy. KWS has already fenced three sides of NNP, in order to control human/wildlife conflicts. Only the southern side (Kitengela) remains open to allow

dispersal of wildlife. According to KWS officials, the organization is managing the Nairobi National Park and Kitengela ecosystem by employing various approaches such as Science (conducting monthly wildlife censuses, continuous monitoring of the ecosystem's parameters namely water, vegetation, air; and Environmental Impact Assessment on proposed projects in the area). Through science, KWS is also seeking ways through which wildlife can spend the entire year inside Nairobi National Park. Here, the issue of fencing of the park is being debated upon, with savanna scientists opposing the idea on the scientific basis that retaining wildlife inside the park will cause in-breeding, thereby passing on recessive genes, hence future wildlife species will be of poor quality breeds. Also, wildlife numbers are likely to increase resulting to overpopulation of the park, which is only $117km^2$, hence the park's forage will be depleted; leading to death due to lack of adequate food sources.

Through the Community Wildlife Service Department, KWS is seeking ways through which all the stakeholders are involved in decision making concerning the ecosystem. The department is also using conservation education to create awareness among policy makers, landowners and local communities who are involved in wildlife conservation and management. Further, the organization is granting wildlife user rights to individuals or groups, especially ranches, to benefit from wildlife tourism through the establishment of sanctuaries, and conservancies. Also, to mitigate human to wildlife conflict in Kitengela, KWS is compensating for wildlife losses, and deploying game rangers to patrol the conflict areas.

In order to foster a good relationship and encourage appreciation for wildlife conservation among the Kitengela community, KWS has been giving back to the community. According to Mark Yobesia (KWS Tourism Department), through pulling together part of the annual revenue generated from NNP, a provident Kitty was set up under the sponsorship of the Wildlife for Development Fund. Through it, KWS has been supporting viable community projects in Kitengela. The fund has been going on since 1994 when the Government of Kenya, the World Bank and USAID set up this kitty. Part of this fund is generated from the annual tourism revenue generated from NNP.

When asked whether they had received any tangible benefits accruing from NNP, about 60% of the entire Kitengela population interviewed felt they had. These benefits were mostly provisional such as development of the community's social amenities and infrastructure (Table 4.7). Urban developers benefited from cultural benefits such as recreational and educational, while pastoralists benefited from cultural tourism.

Corporate Social Responsibility (CSR) is a positive move towards creating o positive attitude and trust between Kitengela community and wildlife conservationists in order for them to support wildlife conservation. However, it is only effective when combined with other approaches such as conservation education and actual community empowerment with skills that will enable them to be self-reliant. Still, more revenue should be channelled to community projects annually in order to cater for the felt needs of the community.

Table 4.7 KWS Corporate Social Responsibility Projects in Kitengela

Nature of Benefits	Community benefits derived from Kitengela and Nairobi National Park Management
Infrastructural projects	-Constructing Eretete and Ebenezer primary schools -Constructing teacher's houses in Eretete and Oloosirkon area -Fencing of Kitengela primary school -Boreholes dug at Erankau, Olooloitikoshi, Kisaju -Establishing tree nurseries -Construction of Kiserian river bridge at Oloosirkon -UNESCO, USAID and WWF Educational Scholarships, and International Exchange Programmes
Cultural benefits	-Establishment of Olmakao Cultural Village-showcasing their rich culture to tourists -Sale of cultural artefacts -Cross-cultural Exchange visits -Recreational and Educational benefits -Recreational, Aesthetic, Spiritual and Educational benefits

Source: Field Study, 24-6-2007

4.3.2 Kitengela and Isinya Land Use Master Plan

According to Lekishoni Kenana (KWS Senior Scientist-Savannah), after evaluating all possible ecosystem management options for Kitengela, KWS, together with other interested organizations, has identified two solutions to the Kitengela problem. These are compulsory land acquisition and the Wildlife Lease Programme, which are being assessed under the proposed Kitengela and Isinya Land Use Master Plan. However, a consensus has not been reached as to the way forward, especially on the issue of compulsory land acquisition. Consultation meetings are still being held with a wide array

of stakeholders to discuss key critical issues. Currently, the Kitengela- Isinya Land Use Master Plan has been put on hold due to the forth-coming general elections.

On the proposed Kitengela Master Plan, Zone A will include areas around Nairobi National Park (5 km from the park boundary) up to the sheep and goat ranch and areas around the Kitengela-Isinya and Isinya-Kiserian roads. This zone has existing developments and has relatively small parcels of land. Developments will be controlled through compulsory land acquisition. The rest of the interior of Kitengela contains relatively large parcels of land and has little developments. This has been categorized as Zone B and will be controlled using Wildlife Conservation Lease Programme.

When asked whether they would support the Government's plan to reclaim back their land compulsorily, 96% of the respondents rejected the idea. They expressed fears of losing their land and other property. About 99% of the pastoral population were concerned that they would lose their identity through losing their ancestral land and their way of life. Still, 98% of the agricultural population expressed that they would lose productive land, expressing fears that most likely they would be relocated to infertile areas. About 91% of the urban population felt that they would be inconvenienced through being relocated to areas away from Nairobi city.

On a Focus Group Discussion held on February 2007, the author met with some community representatives of various sub-locations in Kitengela, and discussed various issues (Appendix 3), including the Kitengela Master Plan. Sharp divisions emerged

among the members, with some opposing the Government's move to reclaim back the corridor, as others supported the idea. However, they were wiling to work together with KWS and other stakeholders, with the hope of exploring all possible alternatives.

From a scientific point of view, the author feels that the only long-term and most sustainable way to ensure the continuity of Kitengela as a wildlife corridor will be to reclaim it back compulsorily. Although KWS has expressed fears that it would evict individuals living within the wildlife migratory corridor, the Master Plan indicates in part that: "Without securing this section of land, no migration can take place. In order to secure this land, there is needed to negotiate with the land owners to sell their land." However, the process of negotiating with landowners will be lengthy and very expensive, which might delay the implementation of the plan. As a result of lack of land use constraints, more open wildlife habitat will have been lost to developments.

4.3.3 The Wildlife Conservation Lease Programme

Kitengela Wildlife Lease Program, which will be integrated in the proposed Kitengela-Isinya Land Use Master Plan discussed above, was officially inaugurated at the launching of the Nairobi National Park Migration Appeal in November 2000. Atleast 63% of the pastoralist population interviewed is already registered under the Wildlife Lease Programme (Figure 4.8). They are receiving approximately Kshs. 300 (approximately US$ 4) per acre per household annually, as a direct payment in return for not fencing, quarrying, cultivating or subdividing their land. However, no agricultural and no urban population has signed up for this programme.

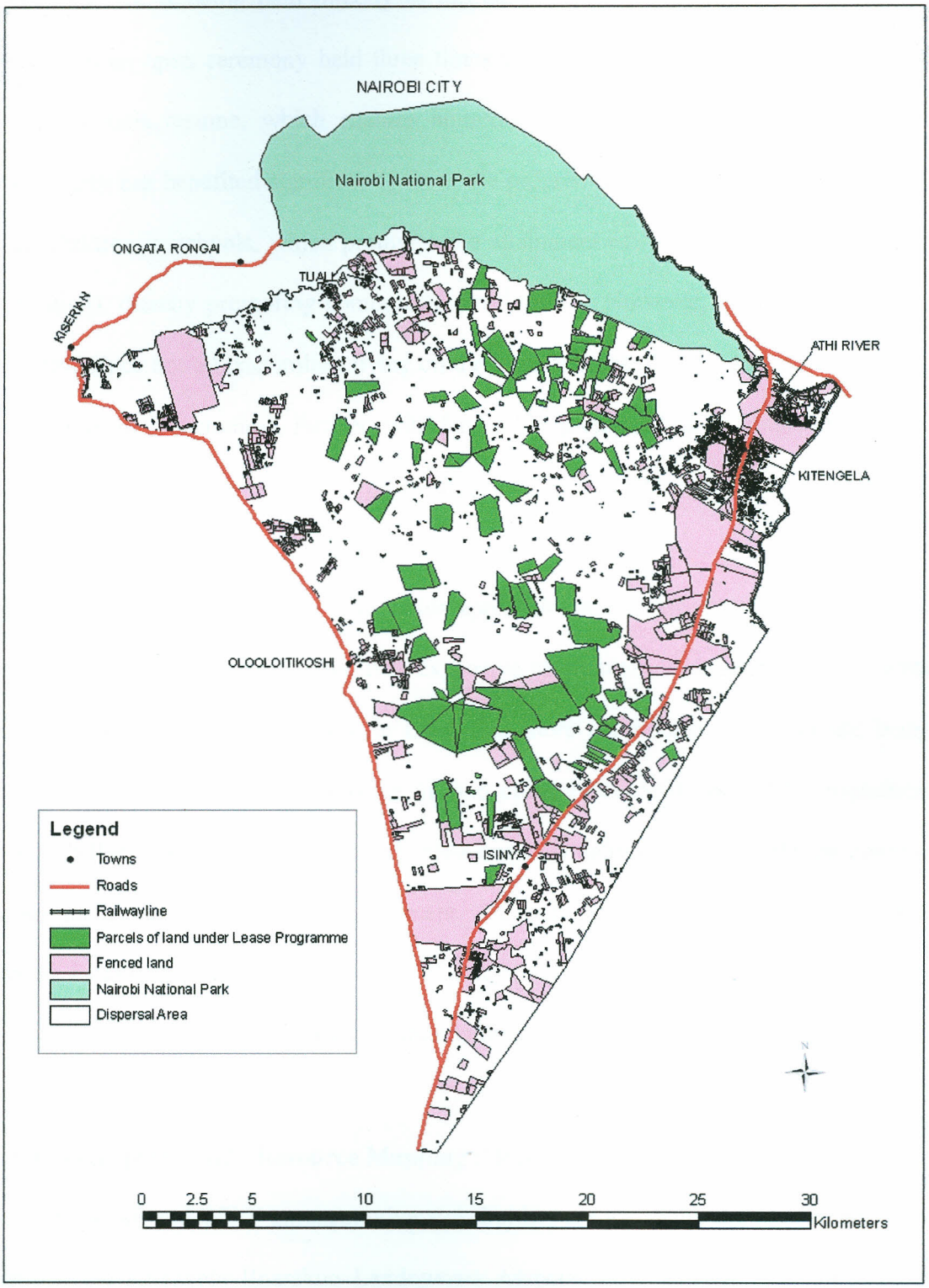

Figure 4.8 Land Parcels under the Wildlife Lease Programme in Kitengela
Source: KWS GIS Section, Research and Planning Department, 2005

The WCL fee is being paid directly to the landowners, and is being issued in three phases, in an open ceremony held three times a year. This is during the last weekend before schools resume, which enables households to pay school fees. The pastoral community has benefited significantly from the programme's benefits through enrolling their children in schools, which promotes the attainment of MDG 2 (universal primary education), thereby promoting community development. However, the WCL cannot be effective since not all pastoralists living on the interior areas of Kitengela have agreed to sign up for the programme. Further, with fences being established on almost all plots at the periphery of Kitengela, hence wildlife movement will still be restricted.

The WCL is an unsustainable conservation approach since it only provides a short-term solution to habitat transformation. It is expensive to maintain such enormous payments for long periods of time, bearing in mind that more community members are being registered, thus increasing the acreage of land under lease. Still, the WCL Programme would collapse once external financial assistance is withdrawn. Further, the programme offers no actual community empowerment, and only creates a dependency syndrome among Kitengela community members. The most sustainable option therefore would be to reclaim back all the critical areas, including the areas under the lease programme.

4.3.4 Participatory GIS Resource Mapping ("Reto-a-Reto")

ILRI, FoNNaP and WWF amongst other stakeholders are involving the local community through the Kitengela Ilparakuo Landowners Association (KILA) in decision-making concerning their land. This is through a programme named Reto-a-Reto, which translates

to "I help you, you help me" in the Maasai language, which aims at mapping out resources in Kitengela. The local communities are being trained on mapping using conventional methods (Global Position System and Geographic Information System), which is being incorporated with the community's traditional knowledge systems.

While asked if they would consider joining the mapping programme, 98% of the pastoral community agreed they would. They noted that this exercise would create a level-playing field for them, and would give them a voice against powerful groups wanting to develop their traditional land. These include government officials, shopping mall operators, building contractors, stone quarry companies, politicians and ordinary people who may be in the process of grabbing the pastoral land.

The ILRI mapping exercise is an on-going activity. The pastoralists identify and note down fences, water sources, roads, towns, open pastureland, and quarries in Kitengela and Isinya divisions. The mapping technology shows where the fences block migratory routes, and has enabled the pastoral community to identify land fragmentation as a major constraint to their way of life. Because of their participation in the mapping process, the pastoral community are being empowered in gathering information and thus seem confident that mapping will help them plan their land uses and avoid future human-wildlife conflicts in their area.

This programme will therefore ensure that the pastoral community, in collaboration with other stakeholders, make more sustainable, equitable and productive land-use choices. It

is also designed to help local institutions develop and implement pilot action plans for new land management strategies partly based on the information that is synthesized and developed by the programme and its co-partners. The land use plans will legislate the use of land, protect important landscape such as swamps, riverine, water catchments areas, open wildlife corridors (through land lease schemes) and rehabilitate degraded areas such as quarries, thereby ensuring proper management of natural resources. However, Reto-a-Reto programme is not involving the agricultural and the urban populations, hence is likely to be ineffective. The agriculturalists especially should be taken onboard since they have settled on the interior areas of Kitengela where the programme is being implemented.

4.3.5 Community Based Natural Resource Management Initiatives

a) The Kitengela Maa Community Trust

This is an initiative in Kitengela which involves mobilizing and sensitizing community members of the significance of resources, thereby persuading individual land owners of critical resources such as swamps, salt lick, dry and wet grazing areas to hand over their title to community for public use. This is through registering such resources under communal land use. About 15% of pastoralists have registered, while about 66% of them are willing to register for the community trust. Individual ranch owners however were not ready to give up such rare resources because they rely on them for tourism benefits. Still, the trust does not involve other populations such as agriculturalists and urban developers, although it would be unlikely for them to surrender their individual resources. Pulling

together of individual resources for the common good would be beneficial to both livestock and wildlife management in Kitengela.

b) The Kitengela Conservancy Initiative

The Kitengela Conservancy Initiative is a collaborative effort between KWS, ACC, KILA and ILRI with the main aim of allocating land and space for wildlife within the communal area. These ideas are still in the early stages, with KILA spearheading these activities. About 8% of pastoralists interviewed are already being involved in the initiative. The local community will therefore be able to benefit from wildlife tourism, while at the same time preventing further habitat loss. Therefore, the environment will be conserved, and the community members will achieve their development targets.

c) The Enkurunka Quarries Rehabilitation Project

Enkurunka quarries have been degraded through extensive excavation of raw materials such as building stones and gypsum, a raw material for making cement. To rehabilitate these open quarries, local NGOs, the Osupuko le Narresho local organization and private companies has come together. Bamburi Cement Factory is playing a crucial role in this project by providing technical support in the rehabilitation. The Company is also helping in tree planting in 4 primary schools in the Kitengela area. About 55% of the Kitengela population stated that they were willing to participate in quarry rehabilitation exercises, since some of them own the quarries in the area. However, some respondents would not welcome the idea, stating that those who excavate raw materials should take responsibility. Open quarries left after excavation of raw materials pose a great danger to

not only to the local community and their livestock, but also to wildlife in Nairobi National Park. The quarry owners should protect wildlife, the community, and their livestock by putting perimeter fences around operational quarries and fully rehabilitate obsolete quarries.

4.4 Sustainable ecosystem management options for the conservation of the Nairobi National Park and Kitengela ecosystem

In Kitengela, sustainable wildlife habitat management will be achieved through balancing short-term human socio-cultural and economic needs and long-term ecological needs (Figure 4.9).

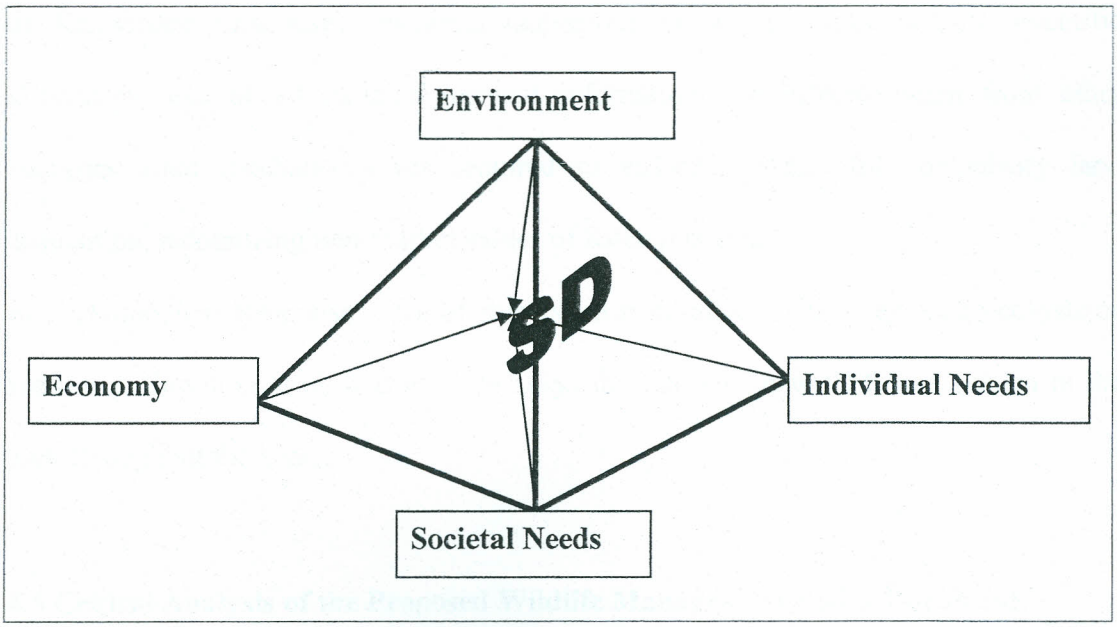

Figure 4.9: Sustainability Pyramid
Source: Author, 2007

Application of Integrated Ecosystem Approach to the Nairobi National Park and Kitengela Ecosystem will be achieved through:

a) Changes in institutional and environmental governance frameworks: proper formulation and implementation of the proposed land and wildlife policies, public participation.

b) Use of economics and incentives: adequate and equitable revenue sharing, establish more conservancies and wildlife sanctuaries

c) Social and Behavioural Responses: ILRI should empower the pastoral community through ensuring proper livestock management to reduce over-reliance on land sale for income. Conservation education will also provide understanding and more appreciation of the great role Kitengela plays in ensuring the continuity of the ecosystem.

d) Knowledge Responses: Integrate indigenous knowledge systems with scientific knowledge, use of all existing relevant information for instance learn from other countries what mechanisms are required to ensure s successful compulsory land acquisition, recognizing non-market values of Kitengela area.

e) Technological Responses: use of science to restoration of the degraded ecosystems such as pollution control, and look for ways through which wildlife can remain in the park throughout the year.

4.5 Critical Analysis of the Proposed Wildlife Management Policy Document

The goal of the proposed Wildlife Management Policy is to provide a framework for conserving, in perpetuity, Kenya's rich diversity of species, habitats and ecosystems for the well being of its people and the global community. This will be achieved through

promotion of partnerships, co-management, synergy and benefit sharing between the protected area authorities and the local communities, increased compensation rates and increased civic education on how best to live harmoniously with wildlife.

One of the guiding principles of the proposed Wildlife Management Policy is that wildlife conservation will be recognized and promoted as a land use option, especially outside protected areas within the broad national and regional land use and development plans, respectively. However, this will only be achieved when the proposed National Land Policy is implemented simultaneously. This way, important wildlife unprotected areas such as Kitengela will be legally designated for conservation purposes.

The wildlife policy further proposes that benefits accruing from wildlife will be shared equitably among stakeholders, especially paying due regard to communities living within wildlife areas. However, this principle existed even in the older Wildlife Management Act, Cap 376, and on the contrary, communities living in wildlife unprotected areas have not received adequate benefits. For this principle to be realised, changes in institutional governance are required to ensure that a significant percentage of NNP's annual revenue is ploughed back to the community in a transparent manner.

The wildlife policy also proposes that positive attitudes and perceptions towards wildlife among Kenyans will be cultivated in order to enhance effective wildlife conservation and management. However, KWS and other wildlife managers should realize that the most important entry point in this regard will be to fully involve the local communities, not

only when implementing policies, but from the initial stages of policy formulation. Still, compensation for wildlife losses should be prompt and adequate. Also, more resources should be set aside for conservation education to change social behaviours towards wildlife and their habitats.

4.6 Critical Analysis of the Proposed National Land Policy Document

In the proposed national land policy, the government shall put in place mechanisms for extinction of land rights in the interest of sustainable management of land-based natural resources. It will also make provision for prompt and adequate compensation to communities and/or private entities whose land rights are extinguished in the interest of sustainable natural resource management. However, this will be a difficult task now that large human populations have already settled on critical land resources such as the NNP/ Amboseli National Park migratory corridor. It will require the government to convince landowners to surrender their land, which will be time consuming, and very expensive, given the late response of the government to solve such issues.

According to the proposed land policy, discharge of untreated industrial and domestic waste, gaseous emissions and unsafe quarries are some of the common urban environmental problems (GOK, 2006). The government shall prohibit discharge of untreated solid and liquid waste into rivers and lakes by individuals and local authorities by providing waste dumping sites, sewerage treatment and incineration facilities. However, this will be impossible in slums, such as those next to NNP. This is because they are unplanned, and have no drainage/sewage systems. Further, NEMA is the body

given the mandate to oversee the implementation of pollution policies. NEMA has been operational since 2000, and the slums and industries have mushroomed with its full knowledge. Therefore, due to NEMA's weak enforcement of regulations contained in EMCA 1999, the proposed policy might not be implemented effectively.

The national land policy has also proposed that informal settlements shall be dealt with through implementation of the following principles: Development of a slum upgrading and resettlement programme under secure system of tenure for existing slums; and Putting in place measures to prevent further slum development. However, the government should avoid shifting the slum problem to wildlife areas. During the up-grading process in Kitengela, the slum inhabitants should be temporarily resettled away from wildlife corridor or water bodies used by wildlife in NNP. Still, the existing slums should not be granted permanent tenure on areas likely to impact negatively on wildlife.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

Approximately 68% of Kitengela wildlife dispersal habitat had been transformed from communally owned open land to individually owned highly fragmented and fenced land. As a result, wildlife dispersal from Nairobi National Park to the larger Athi Kapiti plains is restricted and habitat lost. This threatens the sustainability of NNP.

The main driver of NNP and Kitengela habitat transformation was the rapid increase in human population, estimated to be growing at a rate of 3.8% per annum. There was also a high rate of industrialization in Kitengela and Athi River. This has led to the introduction of new land-uses, which are incompatible with wildlife management such as urban residential, industrial and commercial premises and agricultural land uses. Further, about 48% of pastoralists had not acquired formal education, thereby having fewer employment and income opportunities. This led to distress land sale. The above drivers had further been fuelled by the lack of a national land policy in Kenya, and a poorly formulated Wildlife Act, which further lacked proper enforcement.

The main effect of Kitengela/NNP habitat transformation was the loss of NNP's wildlife dispersal route and restricted movement of wildlife due to heavy land fragmentation. This was because as human population increased, the land sizes became smaller ($r=-0.81$, $n=127$, $p=0.01$). Wildlife numbers had declined by at least 70% since the early 1990s, especially the two major migratory species namely the wildebeest and the zebra. The species also constitute over half NNP's wildlife population. Decline in wildlife numbers

was strongly related to decline in NNP's tourist visitation from 1996 to 2006 ($r=0.86$, $n=11$, $p=0.01$). As a result, only about 60% of the entire Kitengela community members interviewed felt that they had received benefits accruing from NNP, including its annual tourism revenue collection.

Further, approximately 95% of the pastoralists experienced lack of adequate water resources all year round due to stiff competition by the large population. About 56% of the agriculturalists complained of loss of crop to the pastoral livestock as grazing land became smaller. Over 96% of the urban population experienced an increased demand for land in Kitengela, which had attracted large human population from Nairobi city.

The most promising habitat conservation approach identified was the proposed Kitengela/ Isinya Land Use Master Plan. If implemented, it will ensure conservation of all the critical wildlife migratory and dispersal areas through integrating both compulsory land acquisition and the Wildlife Conservation Lease Programme. However, 96% of the respondents rejected the government's plan to reclaim back their land compulsorily. At least 63% of the pastoralist population interviewed was already registered under the WCL programme. However, for the sustainability of NNP, compulsory land acquisition was viewed as the most effective approach to conserving the entire migratory corridor. WCL only provides a short-term solution, because it is very expensive to maintain paying the ever-increasing number of registered pastoralists for long periods of time. Further, the WCL Programme is only applicable on open pastoral land, leaving out critical areas

inhabited by agriculturalists and urban developers, hence was not considered a comprehensive approach to conservation.

Other approaches being applied to conserve Kitengela migratory corridor had been embraced differently by community members. Though wildlife conservationists have used Corporate Social Responsibility projects as one way of winning support from the community, only about 60% of the population felt they had received tangible benefits. Community Based Natural Resource Management Initiatives in Kitengela mostly comprise of the pastoral community, thereby excluding the key players, namely the agriculturalists and urban developers. They are therefore sectoral, hence ineffective in managing the ecosystem.

5.2 Recommendations

An immediate solution is required to halt the processes of habitat transformation. In line with the provisions of the Physical Planning Act CAP 286, the Physical Planning Department should provide an appropriate spatial framework for sustainable land development through preparation of short-term and long-term regional physical development plans for the entire Kajiado area. This should provide zoning for all major land uses including wildlife conservation. Key areas of focus as stipulated in the proposed land policy include: land use planning principles (peri-urban planning); sustainable production systems (mitigate land use conflicts, control land subdivision and indiscriminate sale of land). The proposed Kitengela/ Isinya Land Use Master Plan should also be finalised and implemented in order to clearly designate areas to be

acquired through Wildlife Lease Programme and areas to be reclaimed back compulsorily.

NNP and Kitengela ecosystem management approaches should be guided by the Integrated Ecosystem Approach Framework. The success of this approach would require among others changes in institutional and environmental governance frameworks, promoting the use of economics and incentives, dealing with social and behavioural responses, and integrating indigenous systems into conventional scientific knowledge systems. The three major land-uses namely pastoralism, agriculture and urban developments should be incorporated when designing and implementing conservation approaches to ensure a holistic approach to habitat management.

Once the proposed Wildlife Conservation and Management Policy has been tabled in parliament, Kenya Wildlife Service should put in place mechanisms to ensure proper implementation its recommendations applicable in Kitengela. This includes: full community participation in wildlife management, ensuring that wildlife as a land use has direct economic value to the local communities, prompt compensation for wildlife losses, and use of conservation education. This will create a peaceful coexistence between wildlife managers and local communities.

National Environment Management Authority should ensure that environmental management principles are harmonised through implementation of EMCA guidelines. All projects proposed in Kitengela and its surrounding areas should undertake an

Environmental Impact Assessment (EIA) in accordance with EMCA (1999) guidelines before being implemented. This will prevent further habitat transformation. Environmental audits must be conducted annually on all large-scale industries and residential premises, in order to ensure that their activities do not cause water, air and land pollution, which are detrimental to wildlife health. As part of Environmental Audits recommendations on raw material manufacturing industries, open quarries should be rehabilitated. There is also need for KWS to collaborate with NEMA and Department of Mines and Geology to develop regulations for sustainable mining in Kitengela.

Key Organizations in Kitengela such as International Livestock Research Institute should empower the pastoral community with beneficial programmes such as improving livestock management in order to provide alternative income sources. This will help prevent distress land sale by the pastoralists, which has contributed significantly to land fragmentation. Also, organizations such as KWS, EAWLS, ACC, FoNNaP should provide programmes that will create general awareness on the value of land for long-term self-development. KWS should promote the establishment of viable wildlife user rights, more joint ventures and partnerships in wildlife conservation. Such includes community trusts, sanctuaries and conservancies. This will ensure sustainable wildlife management and promote sustainable Kitengela community livelihoods.

In the event that Compulsory Land Acquisition will be implemented in Kitengela area, the Kenya Wildlife Service should through participatory approaches seek to re-claim the most critical wildlife migratory areas to ensure the sustainability of Nairobi National

Park. Where such approaches may not yield desired effects, other coercive measures within the law may be invoked for the common good. The affected populations should be compensated as provided for in Section 8 of the Land Acquisition Act, Cap 295.

5.3 Recommendations for Further Study

In the event that the Government decides to claim back the most critical wildlife migratory areas in Kitengela, this will result to socio-economic and cultural implications on the surrounding community. Further research in this area could therefore focus on the potential social, cultural and economic implications of compulsory land acquisition. Also, there is need for a comprehensive study on the sustainability of the WCL Programme. There is also need for further research on other possible habitat management approaches in order to enhance the ones already being employed.

6. REFERENCES

ACC (2005). Will Kitengela Die? , African Conservation Centre, Nairobi, Kenya.

Alcamo, J., Ash, N. J., and Butler, C D. (2003). Ecosystems and Human Well-being. A Report of the Conceptual Framework Working Group of the Millennium Ecosystem Assessment. Island Press, Washington.

Aneshensel, C. (2002). Theory Based Data Analysis for the Social Sciences, UK.

EAEN (2003). Lions of the Nairobi National Park: East African Environmental Network, NJIWA Magazine: Volume 10 No. 2. Nairobi, Kenya.

EAWLS (2004). A Survey to Determine the Availability of Land for Wildlife Migration and Dispersal: The Case of Kitengela Wildlife Corridor and the Kapiti Dispersal Area, East Africa Wildlife Society, Nairobi, Kenya.

Egerton University (2000). Egerton Participatory Research Appraisal Field Handbook, Third Edition,The PRA Programme, Njoro, Kenya

Else, J. (1993). Kenya Wildlife Service Research Priorities for Key Parks and Reserves, Nairobi, Kenya.

Esikuri, E. (1998). Spatio-Temporal Effects of Land Use Changes in a Savannah Wildlife Area of Kenya, PhD Thesis, Virginia Polytechnic Institute and State University, Virginia, USA.

GEF (2000). Achieving the Millennium Development Goals: A Global Environment Facility progress Report, Washington DC, United States of America.

GEF (2004). Land Use Change Analysis as an Approach for Investigating Biodiversity Loss and Land Degradation, Global Environment Facility Medium-Sized Project Brief, Nairobi

Gichohi, H. (1996). The Ecology of a Truncated Ecosystem: The Athi-Kapiti Plains, PhD Thesis, University of Leincester, USA.

Gichohi, H. (2000). Functional Relationships between Parks and Agricultural Areas in East Africa: The Case of Nairobi National Park, Kluwer Press, London.

Gichohi, H. (2003). Direct Payments as a Mechanism for Conserving Important Wildlife Corridor Links between Nairobi National Park and its Wider Ecosystem: The Wildlife Conservation Lease Program, African Wildlife Foundation, Nairobi.

Gorard, S. (2003). Qualitative Methods in Social Science: The Role of Numbers Made Easy, U.K., Cambridge.

Government of Kenya (1984). Kajiado District Development Plan 1984 –1988. Ministry of Finance and Planning, Rural Planning Division., Nairobi.

Government of Kenya (1989). The Wildlife (Conservation and Management) Cap 376 Revised 1989 (Amendment) Act, Nairobi, Kenya

Government of Kenya (1998). Kenya Demographic and Health Survey, National Council for Population and Development, Central Bureau of Statistics, Nairobi.

Government of Kenya (1999). The Environmental Management and Coordination Act, 1999, (No. 8 of 1999), Nairobi, Kenya.

Government of Kenya (2001). Statistical Abstract. Central Bureau of Statistics, Ministry of Planning and National Development. Government Printer, Nairobi.

Government of Kenya (2003). Economic Recovery Strategy for Wealth and Employment Creation 2003-2007, Nairobi, Kenya.

Government of Kenya (2004). National Tourism Policy, Ministry of Tourism and Information, Kenya.

Government of Kenya (2006). Ministry of Lands: Draft National Land Policy. National Land Policy Secretariat, Nairobi, Kenya.

Grandin, B. (2001). The Maasai: Socio-Historical Context and Group Ranches, Nairobi.

Hoagland, S. (1993). International Environment and Development: Kenya briefing book, Washington D.C.

ILRI (2002). Valuing Alternative Land-use Options in the Kitengela Wildlife Dispersal Area of Kenya. A joint International Livestock Research Institute (ILRI) and African Conservation Centre report undertaken for the Kitengela community.

ILRI (2005). Can the Lion Lie Down with the Lamb? John Dawson, International Livestock Research Institute Nairobi, Kenya.

IPS (2006). Oldest National Park Confronts Industry and Urban Sprawl, Joyce Mulama, (Inter Press Service) and IFEJ (the International Federation of Environmental Journalists) News Article, Nairobi, Kenya.

Kameri-Mbote, P. (2005). Land Tenure, Land use and Sustainability in Kenya: Towards Innovative Use of Property Rights in Wildlife management, IELRC Working paper 2005-4, International Environmental Law Research Centre, Switzerland.

Khisa, K. (2001). Testing of Techniques for Resolving Conflicts in Natural Resource Management: The case of Nairobi National Park in Kenya, UNESCO (MAB) Young Scientists Award Programme for the year 2001, Nairobi, Kenya.

Kimani, C. (2006). Urban Planning the Maasai Way, Science and Development Network News, Nairobi.

Kimani, K. (1998). Implications of Group Ranch Sub-division: Recent Trends and Implications of Group Ranch Sub-Division and Fragmentation in Kajiado District, Kenya Journal article by The Geographical Journal, Vol. 164, I

Kireria, A. (2000). Community Wildlife Strategic Framework 2000-2004, Economic Finance and Development Consultant, Nairobi, Kenya

Korir, W. (2006). Isinya - Kitengela Master Plan, KWS Assistant Director, Southern Region, Nairobi, Kenya.

Kristjanson, P., Radeny D., Nkedianye D., Kruska R., Reid R., H. Gichohi H., Atieno F., and Sanford R. (2002). Valuing Alternative Land-use Options in the Kitengela Wildlife Dispersal Area of Kenya. ILRI Impact Assessment Series 10. Nairobi

KWS (1995). Nairobi National Park Management Plan for 1995-2000, Research and Planning Department, Nairobi, Kenya.

KWS (2005). Nairobi National Park Ecosystem Management Plan for 2005 to 2010. Research and Planning Department, Nairobi, Kenya.

Mango, C. (2003). Challenges and Opportunities for Sustainable Wildlife Conservation in Kenya: A Case of Nairobi National Park and Kitengela Dispersal Area. Master of Environmental Planning and Management Thesis, Kenyatta University.

Mendenhale, S. (1979). Elementary Survey Sampling. Second Edition, Boston, Massachusetts.

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

Mungai, N. (2003). Nairobi National Park Threatened by Human-Wildlife Conflict, Nairobi, Kenya.

Ndung'u, J. (2005). An Overview of Transformation in Land Tenure in Kitengela, African Conservation Centre, Nairobi, Kenya.

Ngare, O. (1996). Socio-economic Impacts of Wildlife Fencing on Adjacent Communities: The Aberdares, Kenya. Master of Philosophy Thesis, University of Nairobi.

Nkedianye, D. (2004). Testing the Attitudinal Impact of a Conservation Tool Outside a Protected Area: The Case of the Kitengela Wildlife Conservation Lease Programme for Nairobi National Park. Master of Arts Thesis, University of Nairobi, Kenya.

Nkedianye, D. (2005). Payment for Biodiversity Gains and Challenges from Kitengela, ILRI, Nairobi, Kenya.

Onywere, S. (2006). The Status of Disaster Management in Kenya: The Need for Training Programmes, Kenyatta University, Department of Environmental Planning and Management, Kenya.

Radeny, M., Nkedianye D., Kristjanson, P., and Herrero M. (2005). Livelihood Choices and Returns among Agro-Pastoralists in Southern Kenya

Reid, W. (2000). The Millennium Ecosystem Assessment (MA) Synthesis Report, London.

Rodriguez, C, Luis C., Henson D., Moran D., Nkedianye D., Reid R., and Herrero M. (2004). Private Farmers Compensation and Viability of Protected Areas: The Case of Nairobi National Park and Kitengela Dispersal Corridor, Nairobi, Kenya.

Shepherd, G. (2004). The Ecosystem Approach: Five Steps to Implementation, Ecosystem Management Series No. 3. IUCN, Gland, Switzerland and Cambridge, UK.

UNEP and SCOPE (2000). Emerging Environmental Issues for the 21st Century: A Study of the GEO-2000. (Ted) Munn, Anne Whyte and Peter Timmerman (eds), Nairobi, Kenya.

USAID (2006). From Lions to Leases: The Kitengela Community, Nairobi, Kenya.

Western, D. (1989). Conservation Without Parks: Wildlife in the Rural Landscape, Oxford Universtiy Press, Oxford.

7. APPENDICES

7.1 Questionnaire Guide for the Local Community.

Questionnaire number----------

Name of respondent---------- Location----------

Section A: General Information.

Q1: Household socio-economic details

House Hold Member	Sex	Age	Education	Occupation
1				
2				
3				
4				
5				
6				
7				

Q2. When did you migrate to Kitengela? ----------

Q3. Where did you migrate from? ----------

Q4. Why did you migrate to Kitengela? ----------

Q5. What is your monthly household income group? Specify the amount.

(1) 1001 to 3000 [ ] (2) 3001 to 5000 [ ]
(3) 5000 and 10,000 [ ] (4) 10,000 to 20,000 [ ]
(5) 20,000 to 30,000 [ ] (6) 30,000 and 60,000 [ ]
(7) 60,000 and above [ ]

SECTION B: Assessing the drivers of habitat transformation in Kitengela.

Q6. How much land do you own? ----------

Q7. Under which land tenure system does your land belong to?

Number	Land tenure system	Tick here
1	Communal land	
2	Trust land	
3	Government land	
4	Freehold land	

Q8. How did you acquire the land?

Number	How land was acquired	Tick here
1	Inheritance	
2	Purchased	

3	Squatter	
4	Donation	

Q9. Do you have a title deed for your land? ----------

Q10. Which socio-economic activities are you involved in? ----------

Section C: Assessing the effects of habitat transformation on ecosystem and community's well being

Q11. How have land use changes in Kitengela affected your livelihood? Tick where applicable and give your comments? Note: Multiple entries are allowed.

(1) Question to the Pastoralists

No	Nature of conflicts	Magnitude (None, Low, Medium, High)
1	Loss of pasture due to rapid urbanization and population growth	
2	Loss of pasture to wildlife	
3	Loss of pasture because of increased crop farming	
4	Loss of livestock to wildlife	
5	Lack of water resources	
6	Transmission of wildlife diseases to livestock	
7	Loss/ injury to human life	

How can the above identified problems be solved----------

(2) Question to the Agriculturalists

No.	Nature of conflicts	Magnitude (None, Low, Medium, High)
1	Loss of crop to wildlife	
2	Loss of crop to livestock	
3	Loss of livestock to wildlife	
5	Loss of pasture to pastoralists	
6	Loss of pasture to wildlife	
7	Lack of water for irrigation	
8	Lack of water for livestock	
9	Transmission of wildlife diseases to livestock	
11	Loss/ injury to human life	
12	Soil erosion	
13	Others	

How can the above identified problems be solved----------

(3) Question to the Urban Developers

No.	Nature of conflicts	Magnitude (None, Low, Medium, High)
1	Loss of /injury to human life by wildlife	
2	Nuisance due to livestock grazing in the surrounding	
3	Lack of water because of irrigation	
4	Lack of water because of livestock	
5	Others	

How can the above identified problems be solved----------

SECTION D: Assessing the Effectiveness of habitat conservation approaches being employed in the NNP/ Kitengela ecosystem

Q12. How have you benefited from Nairobi National Park? ----------

Give reason for your answer above----------

Q13. Are you involved in decision-making regarding management of migratory wildlife found in Kitengela? Please tick where appropriate.
(1) Yes [ ]
(2) No [ ]

If the answer above is Yes, state how you are involved and which organizations you work with----------

Q14. How does KWS respond to the problems you encounter in the wildlife migratory route? ----------

Q15. Does the Government compensate for your losses?
(1) Yes [ ]
(2) No [ ]

If the answer above is Yes, how much compensation have you received and for what losses? ----------

Q16. In your opinion, what is the future of Nairobi National Park? Please tick where appropriate.
(1) Done away with [ ] (2) Retained [ ]

7.2 Key Informant Interview (KII) Guide

1) **Kenya Wildlife Service (KWS)**

i. Who owns the Kitengela area?
ii. How have the Kitengela land uses changed over the years, what factors have contributed to these changes and what are the effects to wildlife?
iii. Which benefits does the local community derive from wildlife management in Nairobi National Park?
iv. Which Problems does the organization experience in attempts to conserve wildlife in Kitengela, a non-park wildlife area.
v. Do you involve the Kitengela local community when making decisions about the Kitengela area?
vi. Which criterion is used to compensate for them and how much compensation are they given?
vii. Which Kitengela habitat conservation approaches is your organization employing and how effective are they?

2) **National Environment Management Authority (NEMA)**

i. Has any EIA study been done on any proposed new developments being put up in Kitengela? Give specific studies done if any and results.
ii. What are the potential effects of the mushrooming slum developments next to Nairobi National Park on the wildlife therein?

3) **International Livestock Research Institute (ILRI)**

i. How does livestock benefit from the Kitengela habitat?
ii. How have land use changes impacted on the livestock management?
iii. Which Kitengela habitat conservation approaches is your organization involved in and how effective are they?

4) **Elkejuado County Council and Provincial Administration**

i. Which criteria is used to allocate benefits to the local community
ii. Does the local community receive the stated 2.5 % revenue from wildlife benefits through the local authorities?

5) **Physical Planning Department**

i. Has horizontal land-use zoning been done to assess the compatibility of the news land-uses being introduced in Kitengela area?
ii. Is there a limit beyond which land cannot be sub divided?

6) **NGO's involved in the conservation of Wildlife resources.**

i. Which Kitengela wildlife migratory route conservation approaches is your organization involved in and how effective are they?

8) **Group Ranches and Local CBO's**

i. Who owns the Kitengela land?Which human wildlife conflicts are being experienced in the area and?
ii. Which Kitengela conservation approaches are you involved in?

7.3 Focus Group Discussion Guide

i. How important is Kitengela to you?
ii. What benefits have you derived from Nairobi National Park?
iii. Which problems do you encounter for co-existing with wildlife in Kitengela?
iv. How are they resolved, and who is involved?
v. Do your community members receive compensation for losses from wildlife?
vi. Which organizations are involved in wildlife related issues in Kitengela, and which functions do they play?
vii. Which Kitengela habitat conservation approaches are being applied in your area?
viii. Which ones are you involved in, and what are the results?
ix. Are you involved in the Wildlife Lease Programme?
x. What is your opinion on compulsory land acquisition being proposed o some areas of Kitengela?

7.4 Data Summary

a) Kitengela Household's Family Size

Number of Children	Frequency	% Frequency	Cumulative %
1	5	3.9	3.9
2	8	6.3	10.2
3	21	16.5	26.8
4	24	18.9	45.7
5	31	24.4	70.1
6	15	11.8	81.9
7	13	10.2	92.1
8	10	7.9	100.0
Total	127	100.0	

b) Education Status for Kitengela Population

Level of Education	Frequency	%Frequency	Cumulative %
No Education	19	15.0	15.0
Primary	24	18.9	33.9
Secondary	29	22.8	56.7
Tertiary	55	43.3	100.0
Total	127	100.0	

c) Human Migration Periods for Kitengela Population

Migration Period	Frequency	%Frequency	Cumulative %
<1960	20	15.7	15.7
1961-1970	7	5.5	21.3
1971-1980	10	7.9	29.1
1981-1990	9	7.1	36.2
1991-2000	49	38.6	74.8
>2001	32	25.2	100.0
Total	127	100.0	

d) Districts of Origin for Kitengela Population

District	Frequency	% Frequency	Cumulative %
Original Immigrants	21	16.5	16.5
Kajiado	15	11.8	28.3
Murang'a	7	5.5	33.9
Kiambu	29	22.8	56.7
Thika	4	3.1	59.8
Nairobi	31	24.4	84.3
Other areas	20	15.7	100.0
Total	127	100.0	

e) Monthly Household Incomes for Kitengela Population

Income in Kshs.	Frequency	% Frequency	Cumulative %
1001-3000	2	1.6	1.6
3001-5000	5	3.9	5.5
5001-10,000	6	4.7	10.2
10,001-20,000	15	11.8	22.0
20,001-30,000	33	26.0	48.0
30,000-60,000	59	46.5	94.5
60,000-100,000	4	3.1	97.6
>100,000	3	2.4	100.0
Total	127	100.0	

f) Land Tenure Systems in Kitengela

Land Tenure System	Frequency	%Frequency	Cumulative %
Communal	33	26.0	26.0
Government	7	5.5	31.5
Freehold	87	68.5	100.0
Total	127	100.0	

g) Modes of Land Acquisition in Kitengela

Mode of Acquisition	Frequency	%Frequency	Cumulative %
Inheritance	37	29.1	29.1
Purchased	74	58.3	87.4
Squatter	7	5.5	92.9
Donation	4	3.1	96.1
Rented	5	3.9	100.0
Total	127	100.0	

h) Population that has Benefited from Nairobi National Park

Status	Frequency	% Frequency	Cumulative %
No	51	40.2	40.2
Yes	76	59.8	100.0
Total	127	100.0	

i) Population Involved in Management of NNP/ Kitengela Ecosystem

Status	Frequency	% Frequency	Cumulative %
No	99	78.0	78.0
Yes	28	22.0	100.0
Total	127	100.0	

j) Status of Compensation for Wildlife Losses

Status	Frequency	%Frequency	Cumulative %
No	99	78.0	78.0
Yes	28	22.0	100.0
Total	127	100.0	