

**POTENTIALS OF LAND USE PLANNING IN RESOLVING LAND USE  
CONFLICTS AROUND PROTECTED AREAS IN KENYA –THE CASE OF  
NAIROBI NATIONAL PARK**

**GRACE A. MWENDWA**

**A THESIS SUBMITTED TO THE SCHOOL OF ENVIRONMENTAL STUDIES  
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE  
OF MASTERS OF SCIENCE IN ENVIRONMENTAL PLANNING AND  
MANAGEMENT, UNIVERSITY OF ELDORET, KENYA.**

**NOVEMBER, 2019**

## DECLARATION

### Declaration by the student

This project is my original work and has never been presented in any other university for a Masters degree or any other degree award.

Signature .....Date .....

**Grace A. Mwendwa**

**SES/PGPM/005/15**

### Declaration by the Supervisors

We confirm that the candidate, under our supervision, independently carried out the work presented in this research report.

Signature .....Date .....

**Dr. Andrew Kiplagat**

Department of Environmental Monitoring, Planning and Management,  
University of Eldoret

Signature .....Date .....

**Dr. Job K. Ng`etich**

Department of Environmental Monitoring, Planning and Management,  
University of Eldoret

## **DEDICATION**

I dedicate this work to my parents, Mr. and Mrs. Simon Mwendwa, without whose caring, support and love, this work would not have been completed.

## ABSTRACT

Although land cover and land use changes are important processes that affect the ecological integrity of conservation areas, there are still gaps on how their planning is implemented so as to address the endless land-use conflicts that bedevil them. The purpose of this study therefore was to assess the potentials of land use planning in resolving land use conflicts around Nairobi National Park (NNP). Specifically, the study sought to (i) document different land use conflicts around NNP, (ii) assess trends of land use and land cover changes in the areas around NNP, (iii) examine the relationship between land use conflicts and land use/land cover changes around NNP and (iv) assess the impact of land use control systems on land use conflicts around NNP. A mixed method research approach involving use of qualitative and quantitative techniques was adopted. Through analysis of conflict maps of 2008 to 2016 and a household survey of 334 households, information on land use conflicts was elicited. Sets of Landsat images on land cover/land use for the period 1984 to 2016 were utilized to understand the spatial-temporal dynamics of land cover/land use changes in the areas adjacent to the NNP. Analysis of land cover/land use and conflict maps was done using ERDAS IMAGINE 2015. Key informant interviews were utilized to acquire data on land use control systems which included land use conversions and land sub-divisions. Analysis of data acquired through survey and interviews was done with the assistance of IBM Statistical Package for Social Scientists. From the results, the main type of conflicts were the human-wildlife conflicts emanating from human activities being carried out in areas adjacent to the park which ultimately interfered with the park's ecosystem. These activities were mainly residential and commercial uses of land. Most areas that experienced conflicts were found to be the areas south of the park, comprising the larger Olekajuado Trust Lands and in areas which fall under the wildlife dispersal areas. It was also observed that the rates of land use conflicts occurrences were higher during the rainy season. Moreover, findings revealed a cause-effect relationship between land use change and land use conflicts. There was significant reduction of agricultural lands with an increase in commercial and residential areas in the rangelands and into the buffer zone of the park both in Machakos and Kajiado Counties in the years 2012- 2014. During this time, conflicts around the park were on the rise too. Furthermore, proposed land use planning policies were not readily implemented and hence their inability to address challenges around protected areas. The study concluded that while conflicts were as a result of human interference with areas around protected areas, land use and land cover changes and inadequate land use policies on the other hand, acted as catalysts and could be mitigated through planning and enforcement of the plans. The study recommends the adoption and integration of active and adaptive management to help protected area managers and policy makers reconcile environmental challenges.

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**LIST OF ABBREVIATIONS**

CAMPFIRE	Communal Areas Management Programme for Indigenous Resources
FoNNAP	Friends of Nairobi National Park
ICDP	Integrated Conservation and Development Projects
IUCN	International Union for the Conservation of Nature
KFWG	Kenya Forest and Wildlife Guide
KWS	Kenya Wildlife Services
NEP	National Environment Policy
NNP	Nairobi National Park
PAs	Protected Areas
SGR	Standard Gauge Railway
UN	United Nations
UNEP	United Nations Environment Programme

## OPERATIONAL DEFINITION OF TERMS

<b>Adjacent lands</b>	Means land located next to or near protected area
<b>Conflicts</b>	Refers to a form of resistance by a subset of the group as a result of divergent interests
<b>Land use conflicts</b>	Refers to disagreements on management, control and decision-making processes regarding activities on land
<b>Land use planning</b>	Is a general term referring to various policy guides on land use
<b>Protected Area</b>	Is an area set aside for the protection and conservation of nature
<b>Protected Area Managers</b>	Refers to persons in-charge of protected areas

## ACKNOWLEDGEMENTS

I thank the Almighty God for His grace and mercy in my academic endeavor.

My sincere gratitude to my supervisors Dr. Andrew Kiplagat and Dr. Job Ng'etich for their support, motivation, patience, immense knowledge and guidance. Thanks for your dedicated involvement throughout the process of conducting this research project. I would not have imagined having better advisors and mentors for my study.

I would also like to thank the Staff at Kenya Wildlife Service Headquarters, Nairobi National Park and the Planning Departments at the Counties of Kajiado and Machakos who provided insight and expertise that greatly assisted this research and also gave me access to their library facilities.

My sincere thanks also go to National Research Fund for providing me with a grant which assisted me immensely in my field work. My deepest appreciation also goes to my employer, The Department of Administration Police Service with whose permission I was able to complete this project. Last but not least, my gratitude also goes to the people of Machakos and Kajiado counties who participated in this survey.

Special thanks to my Dad, Simon and Mum, Florence for their prayers and continuous encouragement. This study is a testament of your unconditional love and support.



## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the study

With the overriding goal of preserving natural resources various ecosystems, religious and socio-economic benefits, many protected areas have been established in different areas of the world (Butchart *et al.*, 2012; Floren & Linsenmair, 2005). In 1872, the Yellowstone National Park in the USA became the second Protected Area (PA) to be established (Crabtree & Sheldon, 1999) after Tobago Main Ridge Forest Reserve which was established in 1776. The main aim was to preserve its natural wonders, scenery and wildlife while enabling visitors to view and enjoy nature. Unfortunately, the establishment of the PA involved displacing indigenous people to create space for preservation of environmental resources (Joppa *et al.*, 2008; Nigel & Solton, 2007; Field, 2000). This approach, also known as displacement model, set precedence on how other protected areas around the world were created.

It must be noted, however, that although the goal for the creation of these protected areas was noble, the manner in which it was created appears faulty since depended on excluding man from nature (Smith, 2013; Ervin, 2003) and this has been seen as the genesis of conflicts between the locals and protected area managers (Weladji & Tchamba, 2003). PAs established using this approach have continuously experienced resistance to conservation activities by local communities and this has been manifested through hostility and resentment to conservation activities (Mora & Sale, 2011; Neumann, 2000).

In the Koshi Tappu Wildlife Reserve in Nepal, for instance, local people were displaced to create the park but were not compensated adequately. As a result, the people rebelled by encroaching and destroying the reserves' resources despite tight government measures put in place to safeguard it (Bajracharya *et al.*, 2007; Zhang *et al.*, 2005). Other examples are the attempted resistance and the clash between the Maasai and the Serengeti Park administration in Tanganyika (now Tanzania) in 1948 (Benjaminsen *et al.*, 2012; Neumann, 2002:34). Also, these type of unrests have been experienced in Bunaken National Park in Indonesia (Parr *et al.*, 2005; Christie 2004) and Rajaji and Carbalt National Parks in India where locals have encroached and settled in elephant migratory corridors (Chaiyarat *et al.*, 2015).

Societal dynamics have also contributed to endless conflicts being witnessed around PAs (Reading *et al.*, 2006). This is mostly experienced in developing countries where demand for land by other land uses accentuated by the growing human population has led to encroachment, destruction of resources such as water catchment and forests. Consequently, this increasing competition between the utilization and sustainable management of land resources has underlined the need to manage land use activities (Mbau, 2013).

In the recent past, human encroachment has also extended to low potential rangelands which, coincidentally, are the prime wildlife ecosystems in pursuit for agricultural activities (UN, 2012; Kiringe & Okello, 2007). The Kenya Forest Service and the Kenya Wildlife Service, for example, have been recently faced with a new challenge of regulating and containing human influx into high potential areas and low potential areas

as a means of minimizing habitat degradation, loss and subsequent extinction (KWFG, 2008; Kameri, 2005).

It is even worse in those PAs around high human density areas such as cities as the challenges are unique mainly because of competition for land, which apparently is the same land the PAs is fighting hard to preserve (Darly & Torre, 2011). These challenges include encroachment into protected spaces which has led to diminishing sizes of protected zones, illegal disposal of wastes in protected habitats, wildlife killings along roads adjacent to protected areas, among others (Gichohi *et al* 2013; Kiringe & Okello, 2007; Gichuhi, 2003). There is therefore need to explore means by which protected areas and adjacent lands can be reconciled to minimize on conflicts between them.

## **1.2 Statement of the Problem**

Although the importance of national parks in Kenya as biodiversity repositories and as the major driver of the tourism industry cannot be overemphasized, this importance is under serious threat emanating from land use conflicts with the adjacent land uses. The Nairobi National Park, a National Park adjacent to a city, is experiencing unique land use conflicts that have continued to threaten its existence.

When the park was created in 1946, a wide buffer zone was provided to separate it from the city. Then, the city was less populated. However, there has been gradual but steady increase in the city's population. Currently, it hosts a population of over 4 million with a density of over 8,900 persons per km<sup>2</sup> (Murphy *et al.*, 2016).

As expected, this increase in city's population has seen the reduction in the size of initial buffer - which was unfortunately not gazetted - and this has brought in new problems including emergence of human settlements in Kitengela and Rongai areas that have blocked previous wildlife migratory corridors.

Subsequently, attacks on livestock and humans by wildlife have become common. Furthermore, effluent and industrial wastes from oil and cement factories in Athi River North location, agricultural farms, mines and quarries in Ngurunga and Tuala areas makes the NNP increasingly vulnerable to irreversible land use/ land cover changes. Other activities like the construction of Southern and Northern by-passes and the Standard Gauge Railway (SGR) have severed several hectares of the park and further amplified the threats to the protected area (Ngunyi *et al.*, 2017). This is at the backdrop of the existence of elaborate land use planning and related policies in Kenya that would ideally shield this important public purpose land use from adjacent land use pressures (KWS, 2007). As such, there is an urgent need for interventions that can help in reconciling these different land uses.

In the past, PA managers have come up with regulatory, participatory and incentive measures to reconcile land use conflicts between conservation areas and adjacent land uses (Henle, 2008). These strategies are, of course, not a panacea and conflicts continue to be unabated. Clearly thus, management of different land uses is still a challenge and there is still need for more research to establish innovative strategies that can adequately reconcile conflicts between protected areas and adjacent land uses. This calls for a deeper understanding on the underlying causes of the aforementioned conflicts between

protected areas and adjacent lands which should enable development of more effective interventions for reconciling conflicting land uses.

To contribute in filling this gap, this study investigates the potentials of land use planning in the management of land use conflicts in areas adjacent to protected areas. This is because not much has been done to determine the effect of land use control systems (land use planning) on management of land use conflicts especially around protected areas (Wamicha, 2000).

The main purpose of this study therefore was to assess the potentials of land use planning – the main source of land use control systems - as a means to reconcile land use conflicts around protected areas in order to promote sustainable management and Nairobi National Park and its adjacent areas shall be taken as a case for study.

### **1.3 Purpose of the study**

The purpose of this study is to assess the potentials of land use planning in the resolution of land use conflicts around Nairobi National Park.

### **1.4 Specific objectives**

The research is guided by the following objectives:

- i. To characterize different land use conflicts around Nairobi National Park
- ii. To assess trends of land use and land cover changes in the areas around Nairobi National Park
- iii. To examine the relationship between land use conflicts and land use/land cover changes around Nairobi National Park

- iv. To assess the impact of land use control systems on land use conflicts around Nairobi National Park.

### **1.5 Research questions**

- i. What is the nature of land use conflicts experienced around NNP over time?
- ii. What land use changes have occurred around NNP over time?
- iii. How do land use conflicts and land use changes around NNP relate?
- iv. How have land use control systems influenced management of conflicts around NNP?

### **1.6 Justification and significance**

Protected areas are facing a number of challenges driven by land use changes especially in adjacent lands. Most of land uses including agriculture, residential, commercial, among others, are to a large extent not compatible with protected areas, but rather a source of pressure and a threat to its sustainability. As such, there is need to address these underlying pressures.

In that regard, this study is undertaken to establish the effectiveness of land use planning tools including development plans, policies and zoning in reconciling conflicts between PAs and adjacent lands. This was to enable both PA managers and the surrounding communities improve the management of the PA as a combined response to help reduce emerging environmental land use challenges. Findings from this study will therefore help

policy makers and park managers to make necessary policy interventions to address challenges in areas with persistent conflict occurrences.

### **1.7 Scope**

This study was conducted around Nairobi National Park that transverses Nairobi, Machakos and Kajiado Counties. It focused on an area within 10 km radius from the park`s edge both spatially and temporally. Studies have shown that this zone has greater influence on the park (Unruh *et al*, 2008). This study was conducted amongst households within these areas, Kenya Wildlife Services (KWS), County Government Institutions for Planning and Non-Governmental Organizations (NGOs).

### **1.8 Thesis Report structure**

This report is divided into five Chapters. Chapter One has presented an introduction of the study and includes the background, statement of the problem, statement of objectives, research questions, justification, and significance of the study. Chapter Two presents analysis of literature, conceptual and theoretical frameworks. Chapter Three details the study area and methodology used in this study and Chapter Four presents results from analysis of the field data. Chapter Five discusses findings while Chapter Six presents summary of findings, conclusions and recommendations.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

This Chapter reviews literature on evolution of conflicts especially around Protected Areas (PAs) and critiques approaches that have been adopted to resolve them. Ultimately, the chapter makes a case for land use planning as the most appropriate approach for managing land use conflicts.

#### 2.2 Understanding the concept of land use conflicts in areas adjacent to Protected Areas

Land use conflicts refer to disagreements between parties who have contradicting interests in the rights over the use of land (Urmilla, 2010; Wehrmann, 2008). It may also mean incompatibility of adjacent land uses. As is common knowledge, lands surrounding conservation areas have great influence over biodiversity protection (Benjaminsen *et al.*, 2012; Salazar & Gaston, 2010). Adjacent lands are also host to a number of parties including households, communities, investors, state actors and other non-governmental environmental organizations. Due to growing economic and social demands together with other private interests, each of these parties may have conflicting intentions whose main objective is maximizing resource use that may not augur well with the rest (UN, 2008). Within that reality therefore, PA managers have had to grapple with a number of challenges in their struggle to maintain functionality of PAs including resource scarcity, inadequate institutional arrangements for managing PAs, benefit sharing, land rights boundary conflicts and disputes over appropriateness of adjacent land uses (Henrik *et al.*,



2011; Defries *et al.*, 2007). Other challenges include pressure from population increase, compensation and decline in agricultural land and its overall productivity, political constraints, differing preferences among the rural community and urbanized community, among others (Njiru, 2016). All these factors act and counteract to yield conflicts that have been a great threat to many protected areas especially in developing countries.

As earlier noted, conflict is a form of contestation between parties with opposing beliefs, values and needs (Jaye & Amadi, 2007; Yasmi *et al.*, 2007). It can either escalate leading to non-productive results and violence or can be amicably resolved to yield long-lasting solutions. In earlier definitions, there is no consensus on the nature conflict thus it is viewed as an elastic concept that could be modeled to suit the agenda at hand for instance; antecedent conditions, emotions, perceptions and behaviors (Habib, 2016; Reisen, 2015). Major contribution in defining the concept of conflict was done by Pondy in 1967. He viewed it as a dynamic process where one unit sought to advance one's interest in a relationship with the others (Pondy, 1967). The following are some of the key drivers of conflict:

- a) Access and control of natural resources; for instance in pastoral communities where they compete over commonly shared resources like water and land. Besides, the economical values attached to natural resources has led to conflict, for instance, oils, sand, wood etc. The governance of these areas also differs across communities which has led to inherent contradiction, accusations of favoritism, exploitations and discrimination against communities.

- b) Land space –this is another outstanding factor across the countries. The overall management of land in Kenya for instance, is vested on the state and while giving minimal opportunity for local community involvement on issues about different land uses practices (Munguti, 2014; Hermunen, 2004).
- c) Poor implementation of formulated policies - over the years, there were widespread conflicts in many parts of the world over the allegations of encroachment of protected areas into indigenous people’s lands (Gichuhi, 2013; Krueger, 2009). Globally, the effects were felt in some areas where local communities were intolerant to protected areas (Liu *et al.*, 2010; Pool, 2006). This demonstrated that the many conflicts around protected areas owed their origins in the manner in which protected areas were established (Bajracharya *et al.*, 2007; Dudley & Stolton, 2007). It seemed to suggest that unless traditional resources on rights and land rights - which obviously was associated with addressing local socio-economic needs - were guaranteed, conservation areas meant less to local people and thus aggravated conflicts between protected areas and adjoining land uses (Neumann, 1998; Henrik *et al.*, 2011). Consequently, it became cumbersome to establish the extent to address the socio-economic needs of local communities’. Table 2.1 summarizes a few other examples of conflicts and their drivers

**Table 2.1: Different causes and manifestations of land use conflicts**

<b>Country</b>	<b>Key drivers of the conflict</b>	<b>Conflict resolution strategies</b>	<b>Established Agencies (PA Manager )</b>
USA	<ul style="list-style-type: none"> <li>- Globalization of industry</li> <li>- Climate change</li> <li>- Population growth</li> <li>- Urban development</li> <li>- Threats to vital natural resources</li> </ul>	<ul style="list-style-type: none"> <li>- Ecosystem service maps</li> <li>- No-take boundary design</li> <li>- Integrated valuation of environmental service and trade offs</li> </ul>	<ul style="list-style-type: none"> <li>- United States Environmental Protection Agency(USEPA)</li> </ul>
South Africa	<ul style="list-style-type: none"> <li>- Resource constraints</li> <li>- Poor conservation planning</li> <li>- Inconsistent declaration and protection procedures</li> <li>- Exclusivity approach to conservation</li> <li>- Management conundrums</li> </ul>	<ul style="list-style-type: none"> <li>- Management plans</li> <li>- Buffer zone concept</li> <li>- Co management agreements</li> <li>- CBNRM</li> <li>- Penalties</li> <li>- Incentives</li> </ul>	<ul style="list-style-type: none"> <li>- Department of Environmental Affairs and Tourism</li> </ul>
Brazil	<ul style="list-style-type: none"> <li>- Deforestation</li> <li>- Urbanization</li> <li>- Agricultural pursuits</li> <li>- Social instability</li> <li>- Mining</li> </ul>	<ul style="list-style-type: none"> <li>- State and municipal plans</li> <li>- Development of ecological corridors</li> <li>- Erection of extractive and indigenous reserves</li> </ul>	<ul style="list-style-type: none"> <li>- Amazon Regional Protected Areas Program ( ARPA)</li> </ul>
Uganda	<ul style="list-style-type: none"> <li>- Poaching</li> <li>- Illegal harvest of resources</li> <li>- Political instability</li> </ul>	<ul style="list-style-type: none"> <li>- Protected Area Management and Sustainable Use Project</li> <li>- -Penalties</li> </ul>	<ul style="list-style-type: none"> <li>- Uganda Wildlife Authority</li> </ul>
Kenya	<ul style="list-style-type: none"> <li>- Encroachment</li> <li>- Poaching</li> <li>- Illegal harvesting of wood resources</li> <li>- Pollution</li> </ul>	<ul style="list-style-type: none"> <li>- CIDPS</li> <li>- CBNRM</li> <li>- Penalties</li> <li>- sectoral plans</li> </ul>	<ul style="list-style-type: none"> <li>- Kenya Wildlife Service, Kenya Forest Service</li> </ul>

### **2.3 Evolution of land use conflicts around PAs**

Most of the land use conflicts around PAs were linked to differing interests over the use of land (Pool, 2006). According to Wehrmann (2008) and Campbell (1996), these kinds of conflicts manifested through land access and use disputes, boundary disputes, and ownership conflicts among others.

The first form of land use conflicts might be understood by a guide of the Tragedy of the Commons Theory. In the theory, resource owners sought to maximum benefits with no regard to conservation (Basurto, 2005; Hubacek *et al.*, 2005). Due to uncertainty of future resource availability (aggravated by factors such as population growth and technology), PA managers would be forced to intervene by enacting legislation to control access. This denial of rights of access via legislation was necessary so as to evade risks such as economic loss due to resource abuse such as the unsafe fishing practices carried out in Cambodia fresh water fisheries (Stern, 2008; Bob & Bronkhorst, 2011). Yet communities living adjacent to PAs were most disadvantaged because of these restrictions, since they depended on the resource for their livelihood. Consequently, these communities showed their resentment either through setting fire to property, poaching or encroachment (Basurto, 2005; Hubacek *et al.*, 2005). This happened at the Karrayu and Awash National Park in Ethiopia (Biru, 2017; Stern, 2008).

The second form of land use conflicts emanated from boundary disputes. Disputes regarding boundaries were often ambiguous and closely linked to access and use rights (Himmelfarb, 1984; Walker & Peters, 1998) and were mostly precipitated by claims of historical precedence by the locals and the rejection of enforcement conditions in form of

displacement. This gave rise to other forms of conflicts such as ownership disputes (Rousse, 2012).

The third form of conflicts around PAs regarded power relations. This led to political conflicts over the extent and nature of state's influence on the use of land. It took the form of delegation, devolution, degazettement, privatization or decentralization of PAs (Graefe, 2012; Castro & Nielsen, 2003). In all the above, policy failure, weak rule of law and institutional pluralism emerged as the main precipitating factors to the poor resource governance (Wehrmann, 2007; Earle & Zoë, 2010). However, clearer understanding of the underlying causes of land use conflicts especially around protected areas required a critical reflection on the contextual factors precipitating the land use conflicts as presented in the next section.

### **2.3.1 Procedures of creation of National Parks**

Protected areas refers to areas managed by authorized state agencies for different purposes (Worboys, 2015). These areas include gazetted landscape/seascapes that have been surveyed, demarcated to offer strict nature reserves, science, wilderness protection, national park protection, ecosystem protection, recreation national monument, conservation of specific natural features, sustainable use of natural resources etc (Brilha, 2002; Dudley & Stolton, 2007). Protected areas therefore, became the means by which people see, understood experienced and used the parts of the world that were often called nature and the environment (Toledo, 2013; Mann & Jeanneaux, 2009). Definition of protected areas therefore went beyond conservation of biological diversity to include improving the well-being of adjacent communities, providing economic benefits,

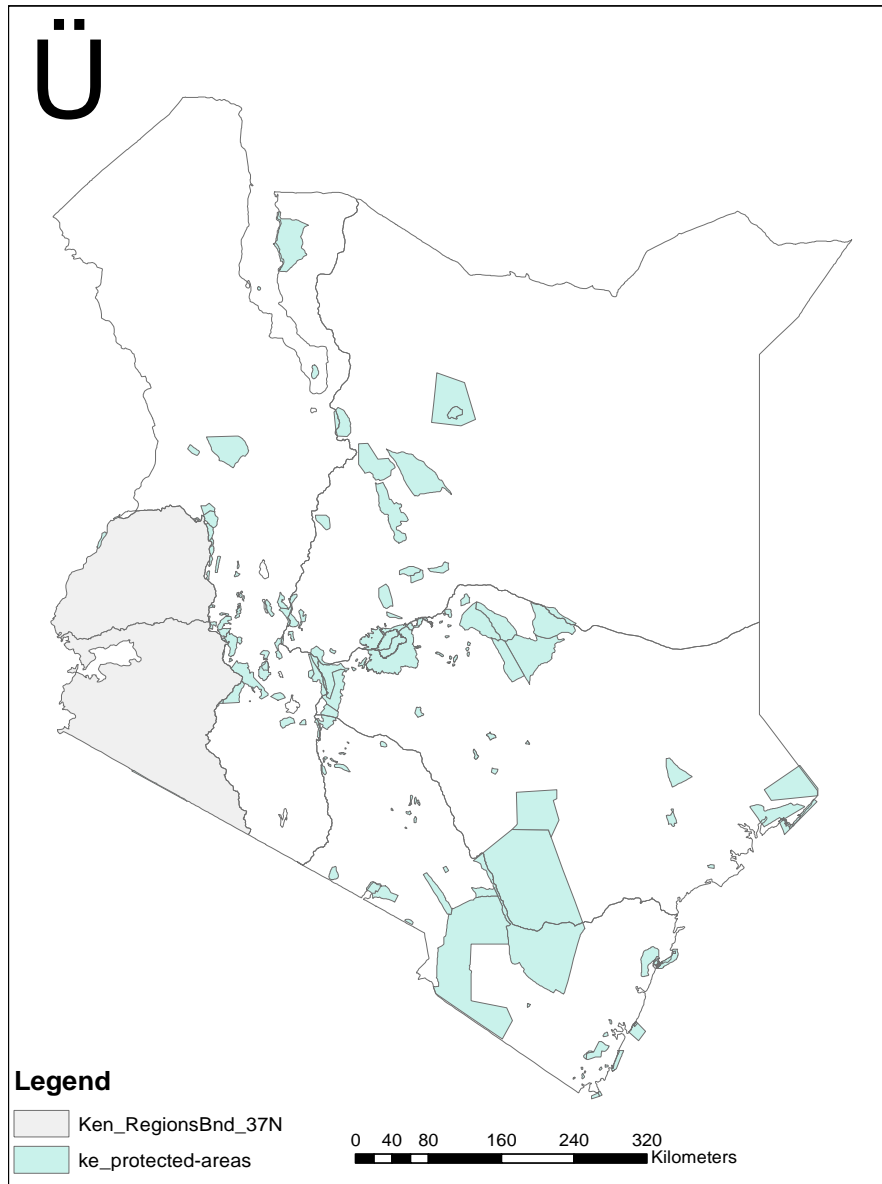
preserving indigenous cultures and mitigating conflicts (Schmidt-Soltau & Brockington, 2007).

The history of protected area is entwined with human civilization. The oldest legally protected reserve was the Tobago Main ridge forest reserve established on April 13<sup>th</sup> 1776. Then in 1778, Khan Uul in Mongolia was approved (UNESCO, 2017; Lopoukhine *et al.*, 2016). The Black Opal Spring in Yellowstone National Park became the world's second official protected area to be established in 1872 (Bergstrom, 2012; Thomas, 2000).

Since nineteenth century, massive protected areas were witnessed across the world for instance in North America, Australia, New Zealand and South Africa (Bertzky *et al.*, 2012; Chape, 2005). Despite the massive establishment of PAs around the world, it was noted to be addressing different driving forces. For instance North America was driven by safeguarding the sublime scenery, Africa to protect its game park and Europe was on landscape protections.

In Kenya, North and South Game Reserves became first Protected Areas to be established in 1896 by the British. This ensured that they continue to hunt and enjoy recreational services in the then British East Africa protectorate. The Nairobi Royal Park was established in 1946 to become the first established park in the country. For effective management of PAs, policy formulations took place. For instance in 1976, The Wildlife Conservation Act was formulated placing the state as the sole regulator of all matters of wildlife. In 1977, the state banned wildlife hunting, and established the Kenya Wildlife Service (Oluoch, 2015; Matheka, 2008). Other recent advancement in policy formulation

was marked by The Wildlife Policy and Wildlife Bill drafted in 2012 (Chongwa, 2012) and was passed into law as The Wildlife Conservation and Management Act 2013. Figure 2.1 shows protected areas in Kenya.



**Figure 2.1: Protected Areas in Kenya**

**(Source : Google maps)**

### 2.3.2 Land use policy

Many of the land use conflicts around PAs are propagated by lack of or poor enforcement of land use planning policies (Anyange *et al.*, 2012; KWS, 2007). Ideally, land use policies are supposed to provide policy guidelines on land related matters like land rights, land tenures, restitution, and resettlement (Wily, 2018; Republic of Kenya, 2012). This extends to guidelines on the control of the resource, the right to participate in decision making about its management, and on the social and environmental impacts of park development or its use between the protected areas managers and the surrounding communities (Hersperger, 2015; Romero, 2010).

Moreover, inadequate harmonization of the land policies has trickling effect of cascading inherent problems from the top most actors to the other stakeholders in the field like failure to declare gazetted boundaries between the PA managers and the local communities as to the extent of their areas of operation. Due to this, communities feel infringed upon when forced to vacate protected areas and PA managers in turn have to use lots of resources to maintain the sanctity of such areas. This is also worsened by absence or inadequate land use plans surrounding protected areas of the East African region that could also be outdated or contain conflicting information (Beale *et al.*, 2013; Republic of Kenya, 2013). In addition, previously developed land use plans have not been effectively implemented thus creating a vacuum for a land use policy in protected areas management (Beale *et al.*, 2013; KWS, 2007). PA managers thus cannot effectively address issues from adjacent areas such as access to PAs which determine the integrity of the park.



Furthermore, many of the protected area management policies put forward have failed to recognize that integrity of wildlife resources is dependent on the adjacent land uses. This failure has led to the creation of conflicts between communities and the state (Republic of Kenya, 2011; Romero, 2010). Communities and other stakeholders want to be more involved and be provided with alternative sources of income in order to conserve PAs (Andrade & Rhode, 2012; Rauch *et al.*, 2001). Consequently, there is need for a holistic land use policy that provides for the parks and areas adjacent to the park. This should be specifically tailored to meet the rapidly changing needs of these complex places. The policies should be flexible to allow for down grading, downsizing or expansion of PAs depending on economic and conservation feasibility of such places. As PAs cannot be managed in solitude, frequent environmental assessments of adjacent areas should be carried out.

### **2.3.3 Trans-boundary nature of protected areas**

Most protected area resources are also trans-boundary thus their management is complicated (Matthews & Germain, 2007; Mayoral, 2002). Trans boundary means protected areas are shared by different counties and countries. Examples of trans-boundary protected areas include the Maasai Mara in Kenya and Serengeti in Tanzania.

The major challenge that face this type of resources is management of biodiversity (Hoban & Vernesi, 2012; Foley *et al.*, 2005). Different management approaches are exerted at overlapping areas of jurisdiction hence create inter-state and intra state confusion (Okumu, 2010). Trans-boundary resource conflicts are not only determined by geographical limits, but by preferences, beliefs and norms of the population adjacent to

that resource. The Sangha River Tri-national Protected Area is a good example of trans boundary resource whose poor management led to conflicts. This resource lies in the Central African Republic, Republic of Congo and Republic of Cameroon. The high human population growth led to depletion of fish resources and water pollution (Joiris, 1998). The situation around Lake Tanganyika was also similar. The Republics of Tanzania, Burundi, Democratic Republic of Congo and Zambia share this riparian resource which was under threat from degradation, pollution and excessive sedimentation (Hoban & Vernesi, 2012; Cohen *et al.*, 1993). There was therefore need to come up with a mechanism to minimize these effects as most trans-boundary agreements formed were not sustainable over long term (Lange & Jensen, 2013; Uitto & Duda, 2002).

The interaction of unstable institutions, weak management capacities and poor devolution of management rights (Röder *et al.*, 2013) is a major cause for land use conflicts due to overlapping or absence of a legitimate institutional framework (Lee & Neves, 2009; Wehrmann, 2008). According to Robert & Thomas (2002), policies need to harmonize local land use practices with protected areas management objectives and not misinterpret PAs as ecological and social homogenous units (Robert & Thomas, 2002; Cohen *et al.*, 1993).

Conservation activities were to be expanded to allow inclusion of development projects and processes in adjacent lands in a bid to effectively address environmental problems. Therefore, to realize effective multi-sectoral management solutions, ideas from indigenous participation in such areas were not to be structured along the history of western notions. These notions aimed at state interventions targeting rangelands for development (Wheater & Evans, 2009; Mensah & Castro, 2004).

### **2.3.4 Socio- economic factors**

Human factors are also important source of conflict risks in protected areas. The factors include population increase, attitudes towards conservation, cultural beliefs, ethnicity and religious affiliation (Brown & Raymond 2013; Dickman, 2010). Adverse and radical changes in these attributes were identified as main sources of threats to conservation (Al-Subaiee, 2016).

#### **2.3.4.1 Population growth**

Population pressures is another major driver for biodiversity degradation globally (Kiplagat, 2011). Population growth exerts pressure on forest covers and vegetation stocks for wood biomass energy and electricity demand. Besides, population growth around protected areas triggers different land use and land cover changes – a driver of species extinctions (Lemke *et al.*, 2016; Davies *et al.*, 2006).

#### **2.3.4.2 Attitude towards conservation**

The underlying attitude towards conservation was more prominent where traditional forms of land use had been replaced by other economic activities. The backbone has been cultural beliefs, ethnicity and religious affiliation (Brown & Raymond 2013; Smith, 2013). Adverse and radical changes in these attributes are identified as the main sources of threats to conservation (Smith, 2013; Ellis *et al.*, 1999). This includes changing from nomadism to sedentary lifestyles, from monocropping to crop diversification, eco-tourism and accommodation. Because of the changes in land use, efforts by different conservation institutions to address these threats to species declines and even extinctions remained unsuccessful. Therefore it is important to understand the local community

perceptions on management policies and the factors that influence these perceptions in designing different Protected Areas management policies (Usongo *et al.*, 2016; Dickman, 2010).

#### **2.4 Conflicts around PAs in Kenya**

Conflicts have been reported in several protected areas of Kenya. For instance, in the conservancy lands of Elerai and Oltiyani in Amboseli, locals have encroached on wildlife areas thus reducing the total area of the private park (Okello *et al.*, 2014). As a result, human wildlife conflicts were on a rise with so many cases of livestock deaths and crop damages. Another example is the upcoming homes, settlements and government projects such as Standard Gauge Railway (SGR) on what used to be wildlife migratory corridors in Nairobi National Park. This exposes more wildlife to human activities (Glen 2013; Ogutu, 2013). As a result, human-wildlife conflicts have arisen (Thornton, 2013). In retaliation, people have resorted to killing the predators for the loss of their livestock and crops. According to UNEP (2013), wildebeest migration between Nairobi National Park and adjoining Athi-Kapiti plains has declined rapidly as a result of increasing urbanization, fencing and developments (Musimbi, 2013; UNEP, 2013). This has led to loss of habitat for wildlife. Besides continued selling, sub-division and fencing off of the remaining pieces of land has greatly contributed to wildlife straying outside the park as in the case where lions walked into the suburbs of Nairobi and caused injuries and deaths (Ellis *et al.*, 1999).

Economic activities in adjacent lands like factories discharge their wastes into the NNP and thus contaminates the park's water systems (Glen, 2013; UNEP, 2013). The

construction of the southern by-pass, northern by-pass and the standard gauge railway right through the park and its dispersal areas has also opened up the park for more complex environmental problems (Gichohi, 2013).

Ineffective implementation of a land use policy for NNP put people and wildlife at crossroads where both compete for space, food and water (Okech, 2010; Kwadha, 2009). The future of the Nairobi National Park and management of the adjacent lands is uncertain, particularly because current policies governing adjoining lands contain sporadic uncoordinated information which seem to propagate urbanization with scarce regard for environmental implications and that the policy framework is weak, inadequate and conflicting (Moses *et al.*, 2015; Kwadha, 2009).

## **2.5 Existing Approaches for addressing land use conflicts**

Various approaches for addressing these land use conflicts have been conceptualized. These approaches are grouped into three major categories namely regulatory approaches, incentives and participatory approaches (Earl & Lagards, 2015; Henle *et al.*, 2008).

### **2.5.1 Regulatory approaches**

These approaches are mainly used to regulate use of land in order to improve its physical, economic and social efficiency (Henle *et al.*, 2008; Sindiga, 1995). They are contained in land use policies and legislations and take the form of local land use plans, discretionary controls and land use restrictions. Example of land use restriction include performance zoning, planned unit development, performance standards, conservation easements and subdivision controls that regulate the intensity of use and formulation of administrative resource units.

The next section discusses the manner in which regulatory approach is applied to control use of land.

#### **2.5.1.1 Planned unit developments**

These type of land control allows for diversification of land uses on a single parcel of land like incorporating residential and agricultural land uses or recreation and forests (Galliani & Schindler, 2016; Bockstael & Irwin, 1999). They can be applied in conjunction with other regulations like leasing, zoning and subdivision. The main advantage of this type of land use planning is that it empowers the planning authority to reclassify land activities based on the resultant impact on the environment. More so, there is flexibility in choosing the size and shape of land, and thus, it allows for creativity in landscape design (Earl & Lagards, 2015). This promotes harmonious existence of a variety of mixed land uses on a single development. The main disadvantage of this method is that it takes more time and resources to come up with developments that can be approved by relevant authorities.

#### **2.5.1.2 Performance standards**

This is a land use planning method that uses set standards to regulate a site and the activity where an activity is being carried out (Santos *et al.*, 2013; Pattison, 2011). Site standards are quantifiable and includes things like land size, height and density of buildings and surface extension (Henle *et al.*, 2008; Leung, 2003). On the other hand, activity standards are standards that protect against nuisance such as dust production, noise pollution, surface run off and tremors caused by heavy machinery (Mbandi, 2017; Haar & Wolf, 2010). The standards emanate from planning authorities' discretion based on physical, environmental, social, and administrative factors past and present of an area.

The planners have the discretion to adjust performance standards and thus apply them selectively to specific projects (Santos *et al.*, 2013; Ottensmann, 2003). This helps to preserve resources from deterioration. Besides, it is easy to monitor projects with similar environmental impacts and is flexible in permitting planners to change standards of a future activity or project. However, as with many other planning tools, this method also comes with a number of demerits including lack of proper research and technical know-how can result in the application of borrowed standards which can impact local environment negatively (Mbandi, 2017; Leung, 2003). This may lead to incompatibility in land use standards escalating conflicts which may slow down development of an area.

### **2.5.1.3 Conservation easements**

These are defined as voluntary incentive based agreements protected area managers enter into with private landowners to restrict land use activities in order to meet conservation objectives (Ervin *et al.*, 2010; Virtanen, 2005). It is necessitated by fact that most areas around protected areas are private lands and PA managers have little or no control over their management. As a result, government agencies enter into agreements in order to protect the PAs and other natural habitats from deterioration (Ogutu, 2013; Basiago, 1999 ). Land owners relinquish their rights especially subdivision and development rights in exchange for income and other benefits for community good. Only activities related to the terms and conditions of the easement are permitted with the easement holder being responsible for enforcement (Verburg *et al.*, 2009). This control measure protects PAs from antagonistic events that may arise from private owners' selfish interest (McLaughlin, 2007; Virtanen, 2005). The major setback is the use of outdated forms of

easement which do not provide any room of modifications with changing land use trends (McCloskey *et al.*, 2011).

#### **2.5.1.4 Performance zoning**

This is a type of land use control method that allows or prevents land use activity in certain zones based on pre-determined performance criteria (Lambin & Meyfroidt, 2011; Kauzeni *et al.*, 1993). It is used to group land uses based on their compatibility for easy management. This is a strategy to reduce the risk of potential environmental conflicts (Goetz, 2013; McCloskey *et al.*, 2011). In addition, zones are set aside to preserve important environmental features like forests and wetlands (Tassinari *et al.*, 2013).

#### **2.5.1.5 Land use planning**

A land use plan represents a systematic projection of land use potential for current and future economic, social and environmental development (Berke *et al.*, 2006; Hermunen, 2004). Thus, planning provides for integration of multiple land uses in order to promote their harmonious co-existence (Berke *et al.*, 2006). It also creates space for future spatial and temporal changes by developing a comprehensive planning framework so as to respond to new trends in development (Röder *et al.*, 2013; Pervin *et al.*, 2013). Planning for PAs helps to also link protected areas and the surrounding areas and allows migratory wildlife to move in response to environmental changes (Hazzah *et al.*, 2013). Landscape planning takes into consideration social factors affecting the beneficiaries of the plans (Berke *et al.*, 2006). This allowed restoration of previously degraded conservation areas by harmonizing land use activities among private and public land owners (Pervin *et al.*, 2013; Zerner, 1999),



### **2.5.1.6 Biosphere reserves**

Biosphere reserves are natural areas set apart to reconcile biodiversity and its sustainable use (UNEP, 2013; Foley, 2005). They were initiated by UNESCO majorly for use in areas that had experienced adverse human interference and they play three important roles, that is: conservation, development and logistics. Examples of the success stories recorded under biosphere reserve include the Swabian Biosphere Reserve in Germany which has portrayed a perfect model for other regions aiming for sustainable development in densely Protected Areas.

The buffer zone concept applied in the biosphere reserves was developed in order to designate conservation areas for natural resources (Palomo *et al.*, 2013; Zerner, 1999). This was to ensure greater economic profitability in the land uses. It is used together with ICDPs to promote environmental protection while improving socio-economic conditions on reserves (Palomo *et al.*, 2013).

Its major shortfall, however, is that mixed land uses is not encouraged by zoning systems and areas that lie outside the legal protection of the protected areas are prone to mismanagement (Redford *et al.*, 2007; Hemson, 2003).

### **2.5.1.7 Resource management plans**

The main aim of the resource management plans is to ensure equitable and sustainable environmental resource use (Danielsen *et al.*, 2009). However, resource management execution experiences poor functioning of the planning processes. This stems from lack of knowledge on how to respond to land use changes away from the optimal state.

It is not surprising that most of the resource management plans follow the traditional decision-making processes, which are marred by lack of agreement on goals and rigidity in the planning process (Bitunjac *et al.*, 2016; Ogutu-Ohwayo & Balirwa, 2006). Moreover, institutional barriers and sectoral legislation enhance lack of coordination in execution of the plans (Wehrmann, 2007). It is due to such limitations that resource management plans developed in Kenya end up as reference materials (Hemson, 2003).

## **2.6 Incentives**

Incentives are economic initiatives intended at benefitting local residents residing beside PAs in order for them to support conservation of these areas (Wang *et al.*, 2018; Danielsen *et al.*, 2009). They range from incentives to discourage subdividing land and /or fencing it off; incentives securing priority for selling or leasing to the government in exchange for construction of schools. Others incentives include: provision of water to local livestock, paying school fees to local children and timely compensation in case of any epidemic.

Incentive programmes around many protected areas and their adjacent lands in many parts of Africa have been met with mixed success (Gichuhi, 2013; Hemson, 2003). Many of the programmes have failed as a result of lack of accountability and inequitable distribution of the park's resources (Campbell *et al.*, 2009; Chege, 2000). Also, lack of adequate incentives to motivate communities and land owners to support conservation has resulted in laxity to adapt land use practices compatible with wildlife conservation (Lewis, 2015; Okech, 2010). Even with effective mechanisms to share the revenues, there are too many loss cases to compensate and/ or systems have been manipulated to support interests of a few (Wang *et al.*, 2015; Wheeler & Evans, 2009).

In Zimbabwe for example, the CAMPFIRE project was incepted with the main objective being to share wildlife revenues with the local people in order to conserve wildlife. However, the project failed because the people's expectations were not met (Smith & Kasiki, 1999).

In another case example, the pastoral communities that reside around Amboseli National Park of Kenya mismanaged wildlife resources because they received little economic benefits (Okello *et al.*, 2014). This prompted the park's management to develop a 15-year programme that integrated use of the proceeds from the park to persuade the local people to conserve wildlife.

A study carried out by Rodriguez *et al.* (2012) around Nairobi National Park also found that the private land owners adjacent to the park were made to forgo commercial utilization of their lands in order to maintain dispersal areas in return for compensation amounting to about KES 300 per acre per year which the locals perceived to be too little. In protest, many land owners sold off their land because it attracted better return (Wang *et al.*, 2015).

### **2.6.1 Participatory approaches**

Participatory approaches attempt to incorporate resource stakeholders in their management processes. The importance of incorporating the interests and skills of the locals in biodiversity governance is recognized by International Union for Conservation of Nature (IUCN).

However, local communities residing adjacent to PAs do not feel adequately involved in the decision making processes of the conservation activities they are supposed to carry

out around protected areas (Andrade & Rhode 2012; Wehrmann, 2007). This is clearly seen in the management approaches used which lock out the participation of local people, advocate for inequality in distribution of resources and are marred by corruption claims (Republic of Kenya, 2012). Conservation and management projects of protected areas in Africa must to strive to incorporate local knowledge and values or they risk failing in their conservation goals (Gardner *et al*, 2018; Neumann *et al.*, 2015).

## **2.7 Management of land conflicts in Kenya**

As a means of managing land use conflicts, the following policies related to the use of land exist in Kenya.

### **2.7.1 Constitution of Kenya (2010)**

The Constitution of Kenya in Article 66(1) vests the authority to regulate land on the state. Under the same article, land is classified into three categories, i.e., public, communal and private land.

Public land includes all government owned land acquired through sale or any other means and includes but not limited to the land holding PAs, riparian resources and minerals and whose management is vested in both the National and County Governments on behalf of the National Land Commission as provided for in Article 62(2).

As articulated in Article 63, Community land includes trust land held by the County Government and land owned by a community either as grazing areas, community forests, ancestral lands and any other land registered by a group of representatives. Lastly, private land is land under freehold tenure which gives the owner absolute rights and the leasehold tenure where the owner has to pay yearly rates to the government (Ojwang' *et*

*al.*, 2017; Okello *et al.*, 2014). This leasehold tenure also allows non/citizens to acquire land through lease for a period not exceeding 99 years. The management of public land lies with the National Land Commission which is permitted by law to delegate its management under state bodies and statutory agencies (Okech, 2010; Hermunen, 2004). Other functions of NLC includes giving renewal and termination of leases, change of land from one category into another, acquiring land for public purposes on behalf of the National and County governments, transfer of land under public institutions to private individuals and also acquiring land for the resettlement of disadvantaged groups.

The County Government in conjunction with other relevant bodies like Land Control Boards, Director of Physical Planning and Director of Surveys regulates the administration of private land, including approval of subdivisions, amalgamation and building plans.

The Physical Development Plans for urban and rural areas in reference to public, community and private lands are prepared by the Director of Planning. As regards to any land in an area, the local planning authority has powers to control its activities on matters of subdivision, development and formulation of by-laws. Most of these by-laws have their roots in the EMCA Act 1999 revised 2012 which establishes NEMA as the sole government instrument for implementation of policies relating to environment. The Act provides general principles of land use planning and coordination. Private land use is extensively controlled by NEMA in order to protect public health and safety interests. This is mostly through undertaking of EIA/EA for any development project which may be accepted, rejected or limited depending on the type of activity and its influence on the environment.

### **2.7.2 National Land Policy- Sessional Paper No. 3 of 2009**

This policy mainly deals primarily with conservation, management and protection of critical ecosystems. It calls for sustainable and equitable use of natural resources and outlines actions to prevent their degradation and pollution. It also encourages the overhaul of current land policies and institutions in order to address frequent and chronic land tenure insecurity and inequity.

### **2.7.3 National Land Use Policy (2017) –Sessional Paper No.1 of 2017**

This policy acknowledges that there is need to review the management of natural resources due to changes in societal demands. It agrees that environmental and land use in Kenya is guided by un-harmonized multi-sectoral policies. It further states that these policies are in conflict with each other overlapping mandates which affect their operational framework. Also, changes in legal framework have not been in tandem with technological needs and population changes. In view of the devolved system of governance, this policy calls for harmonization and review of environmental management and resource legislation and policies.

### **2.7.4 National Spatial Plan (2015-2045)**

This plan is a long term plan to guide spatial development of the country. This plan runs from 2015-2045 and provides physical planning policies which are aimed at guiding micro level physical development plans. Some of the challenges in implementing this plan are as follows; inadequate timely research on current planning matters, inadequate monitoring and public participation, weak institutional structures to execute implementation of plans, too much pressure from competing land uses and inadequate

implementation mechanisms with little involvement of the private sector in the planning process.

### **2.7.5 Local development plans**

These types of plans normally apply national and regional policies to guide in development decisions within urban and rural areas. They provide framework support to regional policies in order to facilitate development and provide an opportunity for all stakeholders to have a say about where and how development within their local area should take place.

## **2.8 Protected areas management in Kenya**

Protected areas in Kenya include forests, wildlife parks, sanctuaries and reserves, marine resources and water catchment areas. Each of these resources is governed by a specific act which are- Forest Conservation and Management Act 2016, Water Act 2016, Wildlife Conservation and Management Act 2013. The overriding goal of these acts is the protection, conservation, control and management of these resources.

According to Water Act 2016, the administration of water resources is the sole responsibility of the National Government. On the other hand, The Forests Conservation and Management Act 2016 empowers County Governments to implement laws touching on matters conservation and management including community participation, lease agreements and creation of incentive activities . However, its mandate is limited as it cannot transfer, vary boundaries or degazette any land declared to be a protected area.

The Wildlife Conservation and Management Act 2013 also delegates the management and protection of conservation areas up to the County level. Its core functions include execution of user rights, preparation and implementation of management plans and to ensure equal distribution of wildlife resources. All these activities should be in conformity with EMCA, 1999. Under this Act, only the Cabinet Secretary in charge of wildlife resources has the powers to vary boundaries and upgrade or down grade PAs upon evaluation.

However, land use conflicts in adjacent lands surrounding PAs in Kenya still remain a challenge (Senior Scientist- Southern Conservation Area, 2017). It is not known if the incentive, participatory and regulatory approaches have been effective in managing the conflicts (Kajiado Departmental Head of Survey, 2017). There is need for such studies to be conducted in Kenya in order to fill this gap.

## **2.9 Theoretical framework**

This study employs two theories namely: Malthusian theory by Thomas Malthus (Malthusian Theory) and Theory of institutions by Douglass North to understand land use conflicts especially in areas adjacent to protected areas.

### **2.9.1 Malthusian Theory**

The objects of this study closely relate to the arguments of Thomas Malthus (1766-1834) in his Malthusian theory. This theory attempts to explain the genesis of conflicts by relating growth of population (geometric) to the growth of natural resources (arithmetic). The theory states that due to population increase, resources (land) will become scarce thus initiating struggle for the few available ones. This, when applied to land use



conflicts, will eventually extrapolate negatively on the environment through social outcomes like mushrooming of slums, clashes, evictions, social breakdown and eventually a breakdown in social structures. From the point of view of this study, such negative outcomes can be understood as conflicts. The theory suggests control of human population, establishing, affirming or enforcing institutions and advancement of technology as the main approaches addressing conflicts emanating from resource-human population linkages.

### **2.9.2 Theory of Institutions**

The other theory employed in this study is the theory of institutions. Institutions refer to a collection of practices with cognitive, normative and regulative structures (North, 1990; Gerald & Marquis, 2005). They consist of both formal (laws and regulations) and informal (work ethics, customs and resources) institutions (Mann and Philippe, 2009; North, 1990).

However, institutions are not static and thus are subject to changes which act as catalysts for land use conflicts (Wehrmann, 2008; Neumann *et al.*, 2015). These changes in the policies, procedures, values and routines can lead to instability (Peters, 2000; Wehrmann, 2007). For example, transitioning from one system of land use to another may lead to overlapping leading to boundary conflicts. The absence of a legitimized institutional frame, for example absence of a land use plan for an area, may also be a leeway for problems like encroachment on gazetted lands (Wehrmann, 2008; Mbandi, 2017).

It is upon the institutions as resource administrators to establish rules of interaction, and in case of disagreements, they should provide conflict-resolving mechanisms

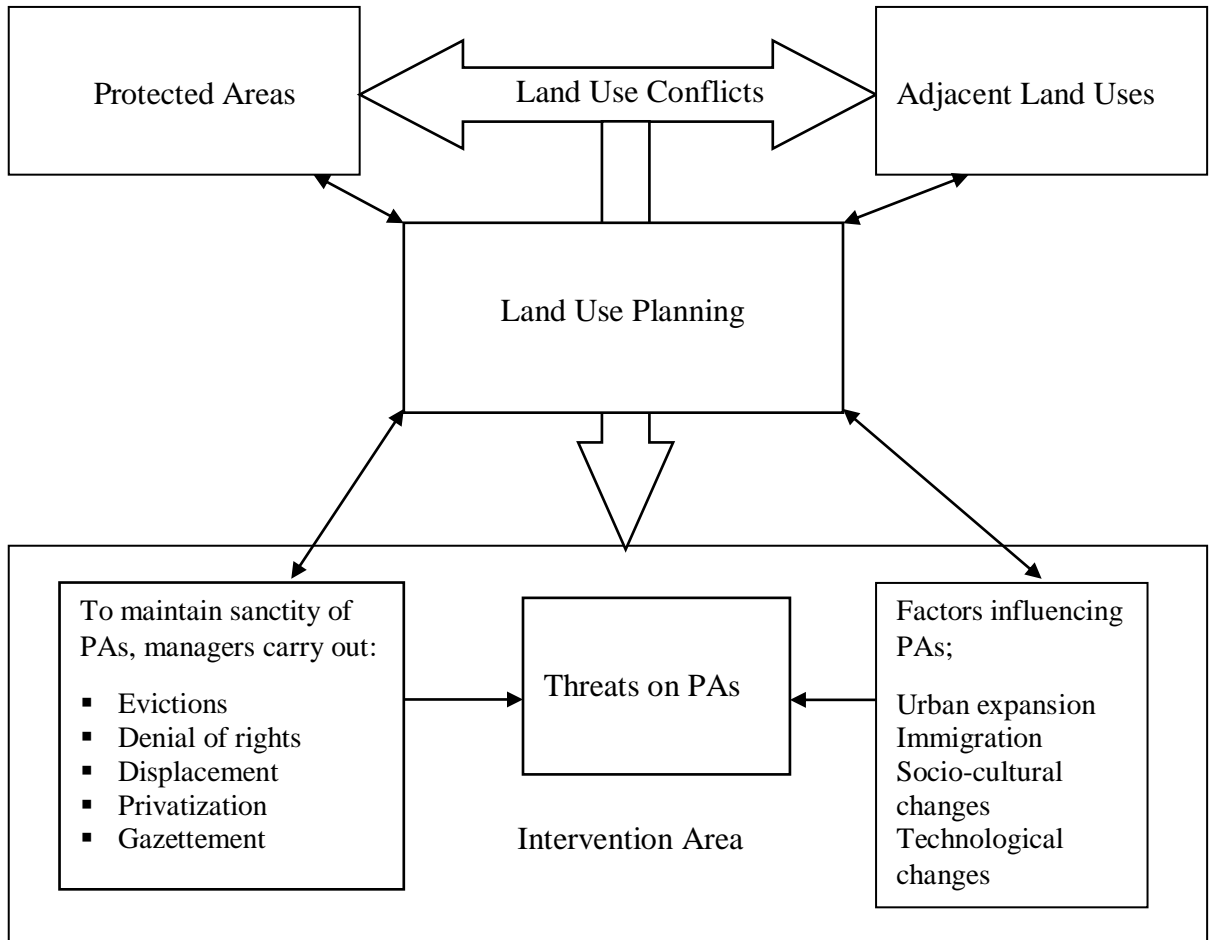
(Fredriksson *et al.*, 2015). These may include setting up of buffer zones around PAs, developing a land use plan for the PA and initiating ICDPs.

## **2.10 Conceptual framework**

The conceptual framework developed here is guided by two theories already discussed in Section 2.7. The independent variable of the study is the land use planning while the dependent variable is the land use conflicts.

PAs perform a number of functions including regulatory, carrier, production and habitat provision. However, for these functions to operate optimally, some form of order must exist from within the PAs themselves and adjacent lands. This order (denoting absence of conflict) is realized by use of land use regulatory/management policies falling under control of various actors and state agencies including planning departments, PA managers and environmental NGOs. Any form of weaknesses experienced in these land use control tools may project negatively on PAs and adjacent lands. The balance must exist in PA function and utility.

As the physical and social environment is not static, changes due population dynamics, urbanization, cultural change and land tenure change may lead to ecological, environmental and social breakdown in park and adjacent lands which may greatly interfere with PAs. This relationship is presented in Figure 2.2.



**Figure 2.2: Conceptual Framework**

## CHAPTER THREE

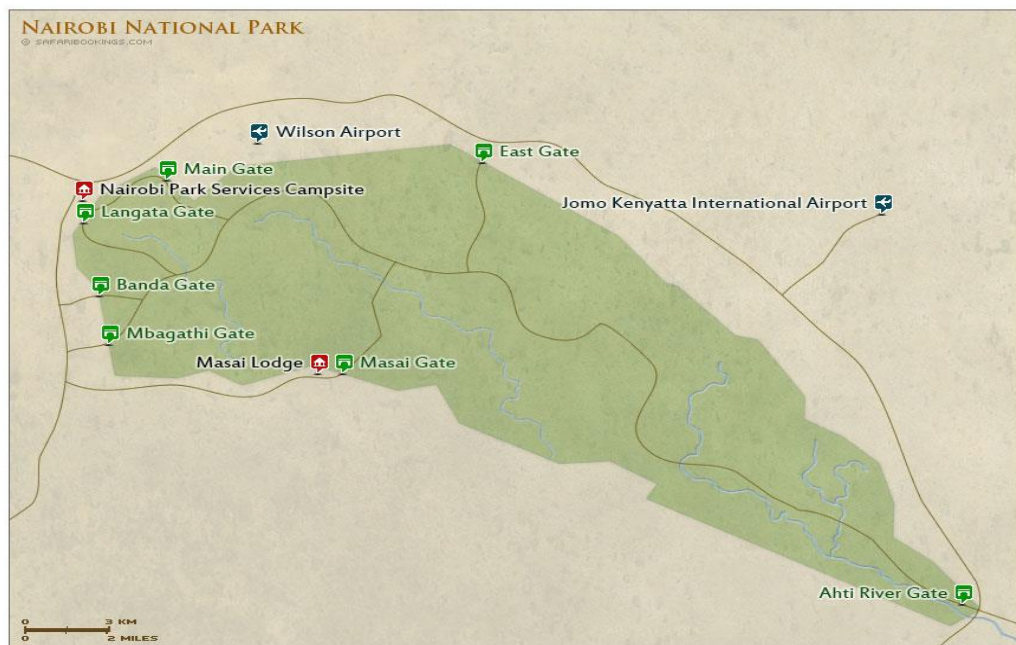
### RESEARCH METHODOLOGY

#### 3.1 Introduction

This chapter describes the research methods adopted in this study. This includes the description of the study area, research design, sampling and methods of data collection, data analysis and presentation.

#### 3.2 Study area description

Nairobi National Park is one of the oldest national parks in Kenya. It encompasses an area of about 117km<sup>2</sup> and is located about 7km from the city centre of Nairobi at 1° 21' 46.3068"S and 36° 50' 4.4988" E. Figure 3.1 shows the location of NNP.



**Figure 3.1: Nairobi National Park**  
**Source: Google maps (2016)**

### **3.2.1 History of Nairobi National Park**

Nairobi National Park was created with the aim of protecting wildlife from poaching and conserving it as a status quo for the tourism industry. It was gazetted in 1946 as the first national park in East Africa. In 1976, the government handed over the management of the park to Kenya Wildlife Service (Gichuhi, 2003).

However, the earlier government policies like the first National Development Plan (1964-1970) and the Second National Development Plan (1970-1974) treated the park as a homogenous self regulating ecological unit and did not take into consideration the management of the lands adjacent to the park (Omondi, 1984).

Consequently, changes in the adjacent lands started gradually in the early 1970s when people began acquiring individual title deeds. Group ranches were formed but these were not to last long. However, the ranches were also subdivided and parcels allocated to members (Kimani & Pickard, 1998). This trend set precedence in the entire area and Maasai landowners began to sell land to other people from outside the area.

The land sales encouraged settlement of people in the area which led to the growth of urban centers like Kitengela and Athi River. Industries, quarrying activities and horticultural farms also sprung up restricting the movement of livestock and wildlife dispersal between the park and the Athi-Kapiti plains (Reid et al, 2008). Consequently, the park's management was forced to construct an electric fence covering a total of 34 kms to the northern, eastern and western sides to curb encroachment and reduce other conflicts (Personal Communication with the Deputy Warden KWS, 2016). This

disconnected the park from adjacent land uses. This area currently has few incidences of conflicts.

### **3.2.2 Geographical location and climate**

Administratively, Nairobi National Park is in Nairobi County and borders Kajiado County to the South and Machakos County to the East which together form the Nairobi Metropolitan Area. Nairobi National Park has an altitude that ranges between 1533 meters and 1577 meters above sea level. The area has a dry climate with annual rainfall ranging between 500mm in the Southeast to 800mm in the Northwest. The average temperature is 24<sup>0</sup>C (Bett *et al.*, 2006).

### **3.2.3 Fauna and flora**

The ecosystem is home to 24 species of large mammals. They include cape buffaloes, gazelles, zebras, Coke`s hartebeest, hippopotami amongst others. Other types of wildlife include the leopards, baboons, lions, ostriches and vultures (Mutuga, 2009).

However, owing to the small size of the park, herbivores such as the wildebeest and zebra use the Kitengela area in the wet season (March-May) and return to the park in the dry season occurring between June and November (Mutuga, 2009).

The plains are also home to the Maasai whose main economic activity is pastoralism. The pastoralists keep cattle, sheep and goats. The NNP ecosystem is mostly grassland (*Themeda*, *Digitaria* and *Cynodon* species) with a few scattered *Acacia xanthophloea*, *Olea africana* and *Croton dichogamus* trees. The soils are volcanic clayey soils which become clogged during rainy season (Maria, 2016; Kiriga, 2010).

### **3.2.4 Adjacent land uses**

The park is surrounded by city commercial activities, irrigation schemes, quarries, farms, settlements, schools and industries (Maria, 2016; Osore, 2015). The employment opportunities provided by these utilities have over time, attracted a large population of people. Due to this, residential settlements have sprung up to accommodate the rising population. Poor solid and liquid domestic waste disposal, urban sprawling, poor disposal of wastes from the industries and expanding mega infrastructures within the park's ecosystem has impacted negatively on the park and thus raising an alarm for intervention measures.

### **3.3 Research design**

According to Kothari (2004) a research design refers to a method of exploration employed in a research to obtain answers to research questions. A mixed method research approach employing both qualitative and quantitative techniques of inquiry was adopted in the study. Specifically, case study and survey techniques were applied.

### **3.4 Nature of data required**

This study sought qualitative and quantitative information including land use conflicts - types of conflicts, parties involved, issues in the conflicts and seasonality of conflicts and land use changes in the areas adjacent to the park (present land uses, past land uses land use systems, land use conversions and land sub-divisions).

### **3.4.1 Sources of data**

Both primary and secondary sources of data were used. Primary sources included key informants from KWS (as a the PA manager) and environmental NGOs, Kajiado County staff and Machakos County staff. They provided data on land use conflicts, land use changes and land use control systems whereas secondary sources consisted mainly of published information such as books, journal articles and reports.

### **3.5 Sampling procedures**

Multi stage sampling was primarily used to select sample for study in the areas around Nairobi National Park.

In the first stage, all conflict data around NNP was gathered from archived information held by KWS. This approach was chosen because KWS was the only place where records of conflict around NNP could be found. The conflict information included GPS coordinates. These were used to locate the approximate position of the identified places of conflicts on a map (see appendix v).

Upon analysis of this data the study proceeded to stage two sampling where selection of study sites based on the prevalence of conflicts was done. The study was interested in studying one area with high conflict experience and comparing with another with low conflict experience. Consequently, case study approach was employed to pick the two extreme cases for study. Based on this criteria and using the conflict distribution map generated in stage one, Empakasi/ Ngurunga areas of Athi River North Sub-location in Machakos County was selected as the area with most conflicts while Tuala/ Oloosirkon areas of Oloosirkon Sub-location in Kajiado County was selected as the areas with least



conflict occurrence. These areas were chosen for comparative analysis. The outliers around Lang`ata Road and Nairobi West areas were left as the area had few recorded conflicts mainly due to the fact that it was fenced.

Stage three sampling involved systematic sampling for household survey. The first household was picked randomly then the next were picked by skipping one household due to the sparse distribution of settlements. This process was repeated throughout the exercise. This method was adopted because it allows for flexibility in the number of possibilities for convenience purposes and is less time consuming (Shayib, 2013).

Non-probability sampling (purposive sampling) was also employed to select key informants by virtue of the information they held. These informants included KWS officials, officials from Government Departments of Survey and Planning in Kajiado and Machakos Counties, local NGOs, Chiefs and elders of the study area. Table 3.1 gives a list of the key informants interviewed.

**Table 3.1: List of key informants interviewed**

<b>Key informant</b>	<b>Organization</b>	<b>Information Sought</b>	<b>Date and venue of interview</b>
Head of Ecosystem Planning Department	Kenya Wildlife Service	-Available plans -Challenges faced by the park	13 <sup>th</sup> February, 2017 at KWS head quarters
Senior Scientist-Southern Conservation Area	Kenya Wildlife Service	-Enforcement of management plans -Implementation of land use policies -Planning process review	13 <sup>th</sup> February, 2017 at KWS head quarters
Deputy Warden	Nairobi National Park	-Conflict details -Challenges facing the park -Conflict solving mechanisms	15 <sup>th</sup> February, 2017 at NNP
Head of Community Wildlife Department	Nairobi National Park	-Conflict hotspot areas -Troublesome wildlife -Conflict solving mechanisms -Compensation issues	15 <sup>th</sup> February, 2017 at NNP
Head of Physical Planning Department	Mavoko Town	-Land use control tools -Current land use systems -Land use plan review/approval process - Land conversion/change of user data -Land use changes/approvals/extension of user/amalgamations data -Challenges faced in planning -Mechanisms for addressing challenges	16 <sup>th</sup> February, 2017 at Mavoko Physical Planning Office
Chief	Athi River North location	-Demographic information -Administration issues/infrastructural and socio-economic issues -Present land uses -Issues with park`s management -Conflicts among present land uses -Sharing of park`s proceeds	17 <sup>th</sup> February, 2017 at Kitengela town.
Head of Physical Planning Department	County Government of Kajiado	-Land use control tools -Current land use systems -Land use plan review/approval process - Land conversion/change of user data	20 <sup>th</sup> February, 2017 at the Kajiado County Physical Planning Office

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		-Land use changes/approvals/extension of user/amalgamations data -Challenges faced in planning -Mechanisms for addressing challenges	
Head of Survey Department	County Government of Kajiado	- Land subdivision data -Challenges faced	20 <sup>th</sup> February, 2017 at the Kajiado County Survey Office
Head of Survey Department	County Government of Machakos	- Land subdivision data -Challenges faced	21 <sup>st</sup> February, 2017 at the Machakos County Survey Office,
Head of Department	African Wildlife Foundation	-Enforcement of management plans -Implementation of land use policies	23 <sup>rd</sup> February, 2017 at Karen, Nairobi.
Area residents	Ngurunga, Tuala/Oloosirkon, Empakasi and Emakoko areas	-Planning process review -Troublesome wildlife -Compensation programmes -Land tenure systems -Economic activities -Involvement in planning activities	Tuala- 15 <sup>th</sup> March, 2017 Empakasi-6 <sup>th</sup> March, 2017 Ngurunga- 9 <sup>th</sup> March 2017

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### 3.6 Sample size

The sample size was obtained by using Slovin`s formula (Reid & Boore, 1991). This formula is mostly used when the researcher has no prior information concerning the behavior of a population to be sampled. The formula is stated as follows:

$$n = \frac{N}{1 + N\{e\}^2}$$

**where:**

**N** =No. of persons, **n**=sample size, **e**=confidence level [0.05]

Thus, the sample for Athi-River Ward within Machakos County with a population of 51,293 (Census, 2009) was estimated as follows:

$$\text{Sample size} = 51,293/[1+51,293\{0.05\}^2]$$

$$= 401$$

Since the ward has two Sub-locations, one adjacent to the park and another further, the 401 was divided into two to distribute to the two Sub-locations. Therefore, the sample studied in Athi River Ward was 201.

On the other hand, the sample for Oloosirkon Ward in Kajiado County with a population of 34,175 (Census, 2009) was estimated as follows:

$$\text{Sample size} = 34,175/[1+ 34,175\{0.05\}^2]$$

$$= 399.98$$

$$= 400/3 \text{ (N/B 3 is the number of sub location in the Ward)}$$

$$=133$$

Therefore, a total of 334 households were selected from both study sites within a 10km buffer. That is 201 from Athi River ward in Machakos and 133 from the Oloosirkon in Kajiado County.

### **3.7 Data Collection**

The following techniques and tools were employed for data collection:

#### **3.7.1 Household Survey and Key Informant Interviews**

A total of 334 questionnaires were administered to the households; that is 201 for sub locations in Machakos and the rest for sub locations in Kajiado County. The key informant interview techniques was also employed and heads of Physical Planning Department, Survey Department, Chiefs, Deputy Warden, heads of Community Wildlife Department, Ecosystem Planning Department, Senior Scientist- southern conservation area and area residents were picked as key informants and interviewed using a key informant interview schedule (refer to Appendices 2 and 3).

#### **3.7.2 Land cover and land use data**

Landsat satellite images representing a spatial period of 33 years from 1984- 2016 were acquired and analyzed to provide land use and land cover change data. The characteristics considered in choosing the satellite images included cloud cover, seasons and dates. Ancillary data included ground-truth data for the land cover/use classes and topographic maps. The ground-truth data was in the form of reference data points collected using GPS for image analysis and classification results. The identity of the LANDSAT satellite imagery is as shown in Table 3.2.

**Table 3.2: Landsat image used in the study**

<b>Landsat Imagery</b>	<b>Path/Row</b>	<b>Platform</b>	<b>Bands</b>	<b>Sensor</b>	<b>Spatial Resolution, Bands 4,5,2/5,6,3</b>	<b>Date of acquisition</b>
LandsatTM5	P168R061	Landsat 5	7	Thematic Mapper (TM)	30m	01/03/1984
LandsatTM5	P168R061	Landsat 5	7	Thematic Mapper (TM)	30m	06/02/1995
LandsatTM7	P168R061	Landsat 7	7	Thematic Mapper (TM)	30m	01/12/2002
LandsatTM7	P168R061	Landsat 7	7	Thematic Mapper (TM)	30m	02/01/2008
LandsatTM7	P168R061	Landsat 7	7	Thematic Mapper (TM)	30m	02/03/2010
LandsatTM7	P168R061	Landsat 7	7	Thematic Mapper (TM)	30m	02/01/2012
LandsatOLI8	P168R061	Landsat 8	8	Operational Land Imager (OLI)	30m	28/01/2014
LandsatOLI8	P168R061	Landsat 8	8	Operational Land Imager (OLI)	30m	29/03/2016

### **3.7.3 The secondary data**

The secondary data sources included published materials such as books, journals, maps, government publications, KWS journals, Kajiado Land Subdivision Draft and the Registry Index Map (RIM) for Machakos County which were used to supplement the primary data.

### **3.7.4 Limitations to data collection**

The data on conflict occurrence for the years before 2008 was scarce and incomplete and therefore could not be used to give a clear trend on conflict occurrence. In addition, there was very little institutional interest on this area until the mid-2000s when subdivision of the rangelands became rampant. This affected the conflicts record-keeping. Moreover,

due to the complex nature of the conflicts, it was very difficult to classify and maintain records on the same.

### **3.8 Data analysis and presentation**

Data analysis involved both qualitative and quantitative techniques. In particular, the analysis process was as follows:

#### **3.8.1 Characterization of different land use conflicts around Nairobi National Park**

Conflict maps for the years 2008, 2010, 2012, 2014 and 2016 obtained from KWS database were geo-referenced using ERDAS IMAGINE 2015 to show conflict distribution within the study areas. Socio-economic data acquired from the household surveys together with the secondary data was analyzed using IBM statistical package for social scientists (SPSS) to generate tables, graphs and charts for cross-tabulating to come up with findings, cause-effect relationships and interpretations to show trends in conflicts over a period of time from 2008 to 2016.

#### **3.8.2 Analysis of the impact of land use control systems on land use conflicts around Nairobi National Park.**

Spatial planning interventions within KWS, Machakos and Kajiado Counties were obtained and used to compare with conflict prevalence in the same study areas. These included the plans, if any, that were in use and other planning instruments like zoning.

### **3.8.3 Analysis of land use and land cover change around Nairobi National Park**

Landsat satellite images were analyzed using ERDAS IMAGINE 2015 version software to provide geo-referenced information on spatial temporal changes in the areas adjacent to the National Park. With the unavailability of data for some parts of the seasons, there was need to use images from multiple sensors for effective spectral and spatial calibrations to yield correct land cover and land use change. Unsupervised classification was used for spatial analysis of land cover and land use changes to generate classes for the years 1984, 1995, 2002 and 2016. Land cover was classified into forests, rangelands, croplands, wetlands, water bodies and built up areas. Land uses were classified as residential, recreation, commercial, transport, deferred lands/agricultural.

### **3.8.4 Examination of the relationship between land use conflicts and land use/land cover changes around Nairobi National Park**

Land use conflicts maps and land use /land cover maps were correlated through superimposition. Independent data that was qualitative was first converted to quantitative data then distance calculations and regression performed to demonstrate the variation of land use conflicts around NNP.

## **3.9 Validity and reliability checks in the study**

Validity refers to how well results of a study correspond logically from inferences drawn from the study. First, by using key informants, the research aimed at obtaining information from reliable and relevant sources. Also, questions administered in questionnaires and interview schedules formed part of the general relevant content.



Reliability refers to consistency of results produced. To achieve this, piloting of the tools was done to check for their appropriateness. This was to ensure they were relevant to the study areas and the information given by key informants and other sources was correct.

### 3.10 Ethical considerations

Consent to conduct the study was sought by the researcher from National Commission for Science, Technology and Innovation (NACOSTI) and KWS (refer to Appendix iv).

The researcher was under obligation to keep the identities of the participants' confidential and in cases of vulnerable groups; caution was exercised to prevent them from coming into harm. Confidentiality was maintained in cases where the researcher gained access to personal information and social life of the participants.

### 3.11 Summary of the data collection protocol

Table 3:3 summarizes data collection protocol:

**Table 3.2: Data collection protocol**

Objectives	Nature of data	Sources of data	Methods of data collection	Variables	Methods of data analysis
To analyze land use conflicts	-Data on land use conflicts  -Data on conflict trends and patterns	- KWS archives -City administration -Media sources --Key informants	- Desktop reviews -Analysis of recorded information - Questionnaires -Interview schedules	-No. of conflict cases, where they occur and description of the event -Identity of land use problems like encroachment	- Descriptive statistics
To assess trends of land use change	-Land use change data -Data on current land	-Regional centre for mapping -Physical	-Satellite images -Book reviews -Interview	-Area covered -Land use changes over time	- Analysis using ERDAS software

	use systems -data on land conversions -Data on population dynamics	planning dept -Population census reports -Physical planners -Key informants	schedules - Questionnaires	-No. of buildings erected -No. of settlements	-Desk reviews
To examine relationship between land use changes and land use conflicts	-Data on land use conflicts -Data on land use changes -Data on land use control systems	-KWS archives -Physical planning department -Population census reports -Key informants -satellite images	-Interview schedules -Desk reviews -Satellite images	-Areas experiencing land use conflicts  - Land use changes (approved/not approved)	- Desk reviews - Analysis using ERDAS software
To assess the impact of land use control systems on land use conflicts	- Data on land use plans, -Land subdivisions data -Data on land use plan approvals -Legislation policies	- Administrative records -KWS records -Focus Group Discussions	-Key informants -Photography -personal observation -Interview schedules	-No. of projects with EIA compliance -No. of land subdivisions -No. of conflict cases recorded	-Desk reviews - Descriptive statistics

## CHAPTER FOUR

### RESULTS

#### 4.1 Introduction

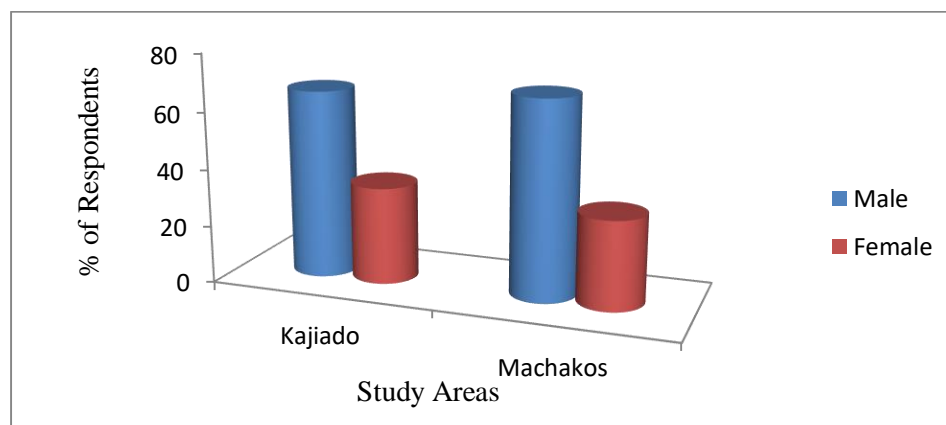
This Chapter presents field findings. First, findings from the analysis of the respondents' background is presented after which findings on conflicts in the areas adjacent to the Nairobi National Park and on land use/land cover changes are presented. Thereafter, findings on land use control systems and its effect on conflicts in the study areas is presented.

#### 4.2 Socio-economic Characteristics of the respondents

The following is an account of the respondent's socio-economic information:

##### 4.2.1 Gender of the respondents

Majority of the respondents who participated in the study were male with 66 % in Kajiado and 69 % in Machakos County as can be seen in Figure 4.1.



**Figure 4.1: Gender of respondents**

### 4.2.2 Age of the respondents

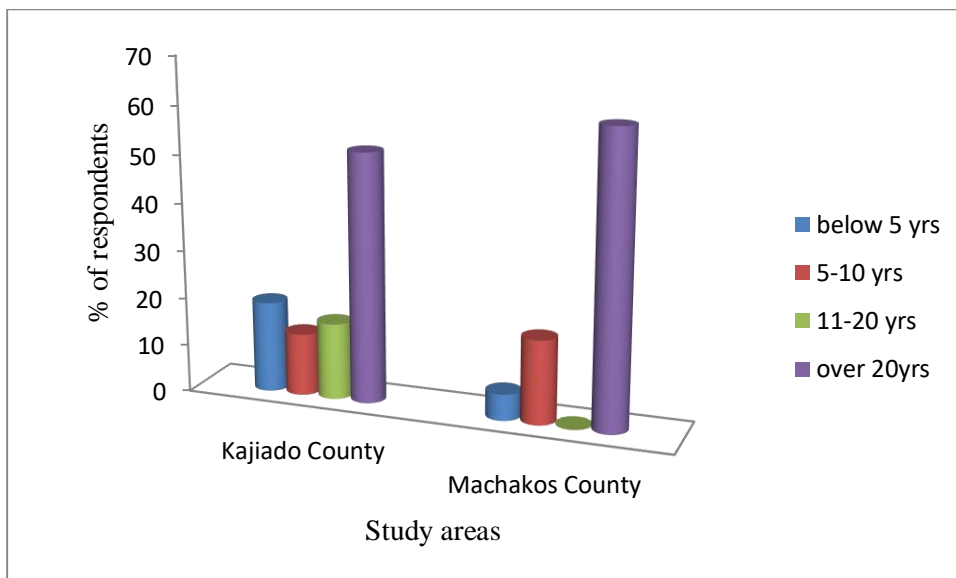
Majority of the respondents (34%) and 42.5% were aged between 31-50 years and 20-30 years in Kajiado and Machakos Counties respectively as shown in Table 4.1.

**Table 4.1: Age of respondents**

<b>Kajiado County</b>			<b>Machakos county</b>		
<b>Age</b>	<b>Frequency</b>	<b>%</b>	<b>Age</b>	<b>Frequency</b>	<b>%</b>
20-30years	14	13	20-30years	85	42.5
31-40 years	46	34	31-40 years	50	25.0
41-50 years	42	31	41-50 years	27	13.5
51-60 years	13	9	51-60 years	17	8.5
60 years and above	18	13	60 years and above	22	10.5
<b>Total</b>	<b>133</b>	<b>100</b>	<b>Total</b>	<b>201</b>	<b>100</b>

### 4.2.3 Period of stay in the County

The study sought to investigate the number of years respondents have stayed in the two sampled counties in order to find out how familiar they were with land use conflicts especially the human-wildlife conflicts. Findings indicated that 58% of the respondents in Machakos County and 50% from Kajiado County had stayed in their respective counties for over 20 years as shown in Figure 4.2.



**Figure 4.2: Period of stay in the Counties**

This suggests most of the respondents have stayed long enough to be aware of events that may have occurred in the past in the areas adjacent to the protected area.

#### **4.2.4 Respondents family size**

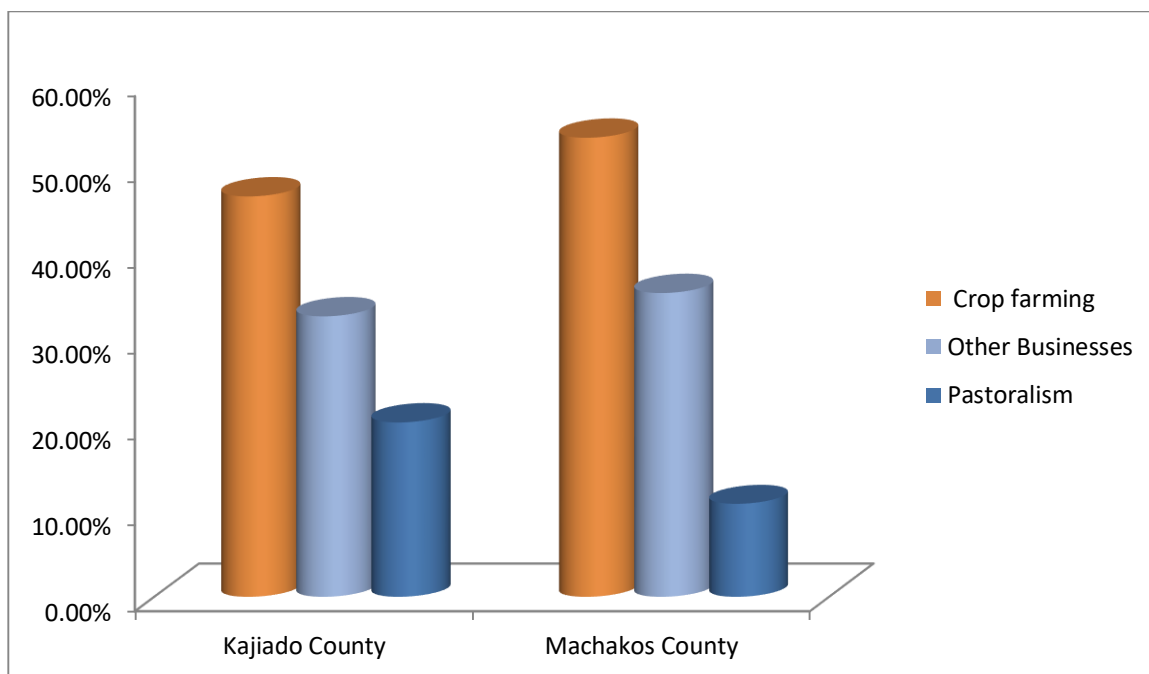
Household population dynamics, being one of the drivers of land cover changes and land subdivisions was an important variable this study sought to establish. Comparison of household sizes in the two counties (see Table 4.2) reveal that 56.4% of the respondents from Kajiado County had family size of between 5-8 while Machakos County had 44% in the same category.

**Table 4.2: Respondents` family size**

<b>Kajiado County</b>			<b>Machakos County</b>		
<b>Family size</b>	<b>Frequency</b>	<b>Percent</b>	<b>Family size</b>	<b>Frequency</b>	<b>Percent</b>
1-4	40	30%	1-4	65	32.5%
5-8	75	56.4%	5-8	88	44%
9-14	10	7.5%	9-14	33	16.5%
Over 15	8	6%	Over 15	15	7.0%
<b>Total</b>	<b>133</b>	<b>100</b>	<b>Total</b>	<b>201</b>	<b>100</b>

#### **4.2.5 Respondents` economic activities**

The study sought to find out the main economic activities the respondents were involved in as this could paint a picture on land use types and subsequently conflicts in areas adjacent to the park. The findings as presented in Figure 4.3 revealed that respondents engaged in agricultural activities. Specifically, 46.7% and 53.5% of the respondents in Kajiado and Machakos Counties respectively engaged in crop farming with only 20.5% and 11% engaging in pastoralist activities in the same counties respectively.



**Figure 4.3: Respondents' economic activities**

### 4.3 Land characteristics

The study further embarked on finding out about household land characteristics in Kajiado and Machakos Counties in order to relate them with land use conflicts around the park.

#### 4.3.1 Size of land owned

It was necessary to find out the size of land owned by the respondent's household in order to understand the land size change over time as a result of activities such as subdivision. The findings as presented in Table 4.3 revealed that majority of the respondents (75.1% and 63% in Kajiado and Machakos respectively) owned between 0-25 acres of land while very few have land spanning over 100 acres. This suggests that

land is continually reducing to an average of 3.5 if one was to divide 25 acres by average household size of 5-8 people in a household.

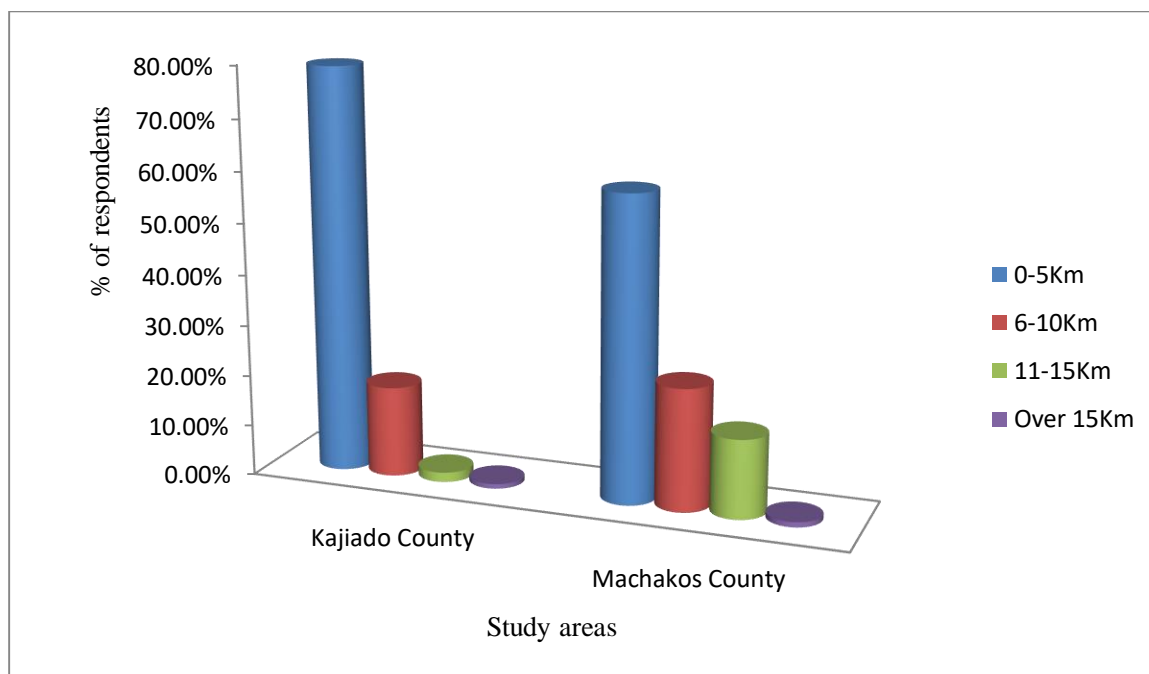
**Table 4.3: Size of household land owned**

<b>Kajiado County</b>			<b>Machakos County</b>		
<b>Land size</b>	<b>Frequency</b>	<b>Percent</b>	<b>Land size</b>	<b>Frequency</b>	<b>Percent</b>
0-25 acres	100	75.1	0-25 acres	127	63
26-50 acres	23	17.2	26-50 acres	28	14
51-75 acres	2	1.0	51-75 acres	15	7.5
76-100 acres	5	3.7	76-100 acres	20	10
Over 100 acres	3	2.2	Over 100 acres	11	5.5
<b>Total</b>	<b>133</b>	<b>100</b>	<b>Total</b>	<b>201</b>	<b>100</b>

#### **4.3.2 Distance from the park**

Distance from the park was estimated to determine how proximity and the subsequent human activities had impacted on the park. The findings from Kajiado County reveals that majority of the respondents 79.4% (105) lived 0-5 Km from the park boundary while in Machakos County, the findings revealed that majority of the respondents 59.5% (120) lived 0-5 Km away from the park as can be seen in Figure 4.4. This implies that majority of the respondents lived within a sphere of influence to the park and could therefore be more knowledgeable on the issues affecting the park and conflict trends.





**Figure 4.4: Distance from the park's edge**

#### 4.3.3 Land tenure in areas adjacent to the park

The study revealed that 97.5% of the respondents in Kajiado County hold land under absolute private tenure (free hold) while 1.5 % hold under communal land tenure and 1.0% it is held under leasehold (Table 4.4).

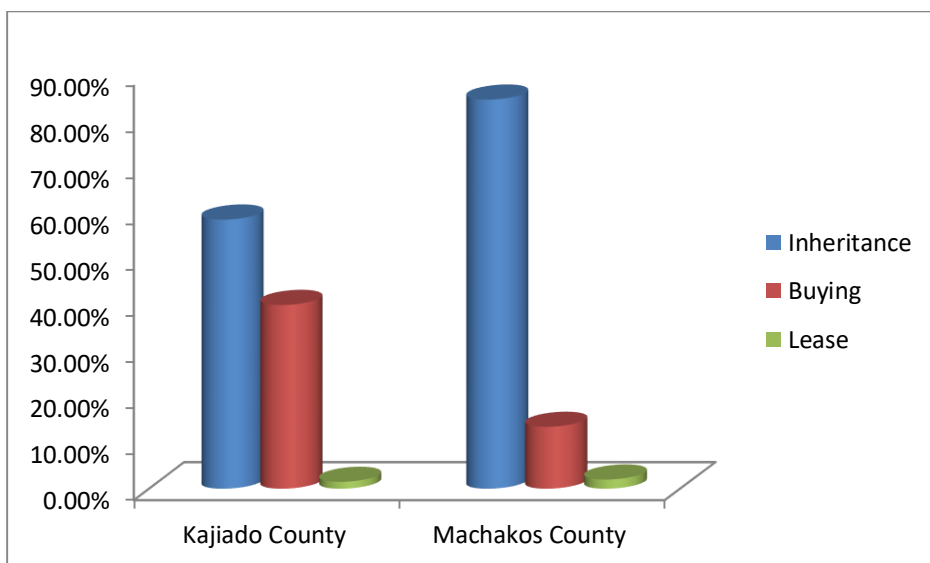
**Table 4.4: Land tenure regimes**

Kajiado County			Machakos County		
Land tenure	Frequency	Percent	Land tenure	Frequency	Percent
Communal	2	1.5	Communal	6	3
Public	1	1.0	Public	7	3.5
Private	130	97.5	Private	188	93.5
<b>Total</b>	<b>133</b>	<b>100</b>	<b>Total</b>	<b>201</b>	<b>100</b>

On the other hand, 93.5% of the population in Machakos County own land absolutely (freehold) while 3% (6) were under communal land tenure with the rest of the population who form 3.5% (7) under leasehold system (Table 4.4). Majority of the private farms took individual responsibility to safeguard their lands against wildlife as opposed to communal and public lands.

#### **4.3.4 Means of Land acquisition**

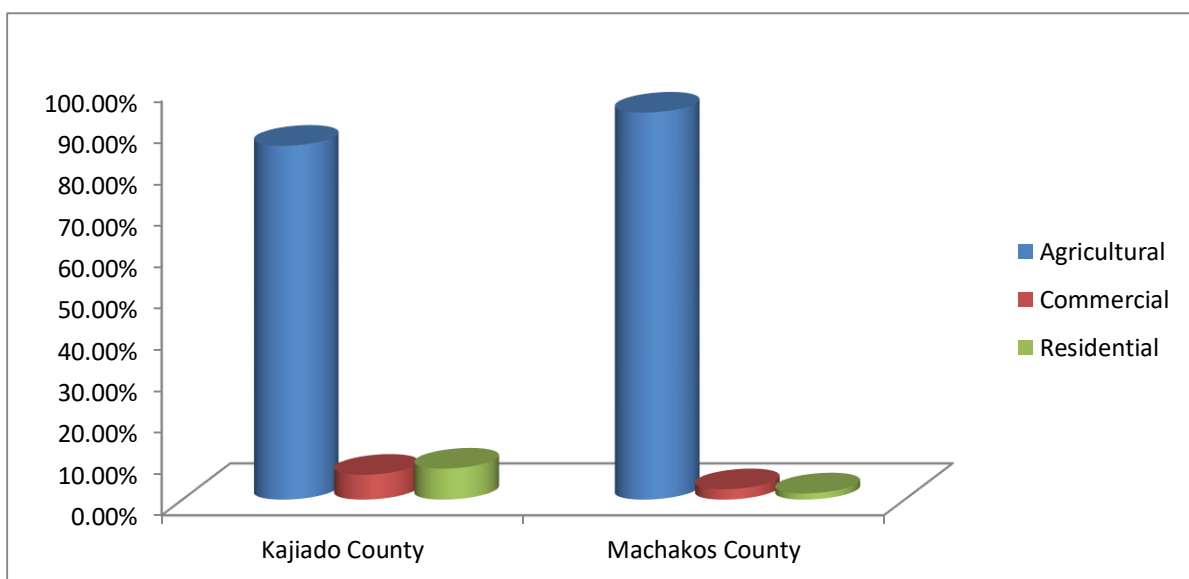
Most respondents in Kajiado and Machakos acquired their land through inheritance as presented in Figure 4.5. Specifically, 58.5% of respondents in Kajiado County acquired their land through inheritance while 40% bought the land they own. Most of the respondents who inherited the land indicated that the land sizes had reduced over time due to land sub-division. In Machakos County, 84.5% acquired their land through inheritance while 13.5% bought the land they own with only 2% being held on lease. Over forty three percent (43.5%) of the respondents who inherited the land noted that there was diminishing land holding due to rapid parcelation of land while 42.5% agreed that the land had maintained its original size since was purchase or inheritance.



**Figure 4.5: Means to land acquisition in the study areas**

#### 4.3.5 Land uses around the park

The findings in Kajiado County revealed that 85.5% of the respondents use their land for agricultural purposes with crop production being the main activity (see figure 4.6).



**Figure 4.6: Land uses adjacent to the park**

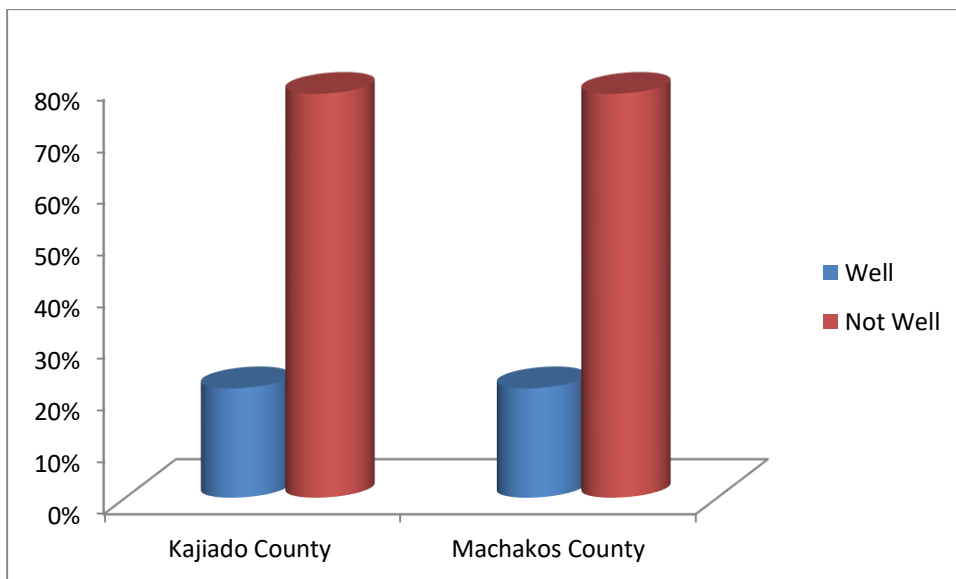
As can be seen in Figure 4.6, a few of the respondents combined crop farming and animal keeping. Land for commercial use had 6% and 2.5%, respectively in Kajiado and Machakos counties, respectively (Figure 4.6).

#### 4.3.6 Change of user

Of the people interviewed, 90.2% indicated that the land had not changed user, while 81.5% of respondents indicated that their land had not changed user since they inherited it (Refer to Table 4.10).

#### 4.3.7 Relation with park management

The findings from the two study sites revealed that most respondents (78%) did not relate well with the park's management.



**Figure 4.7: Relation with the park's management**

### 4.3.8 Involvement in land use planning activities around the park

The study in both the counties further revealed that nearly all the residents in these counties had not been involved in any form of planning for the area by the management of the park. Table 4.5 gives a summary.

**Table 4.5: Efforts for conflict resolution through planning**

<b>Kajiado County</b>			<b>Machakos County</b>		
<b>Variable</b>	<b>Frequency</b>	<b>Percent</b>	<b>Variable</b>	<b>Frequency</b>	<b>Percent</b>
% Involved in form of land use planning	3	3	% Involved in form of land use planning	1	0.5
% Not involved in form of land use planning	130	98	% Not involved in form of land use planning	200	99.5
<b>Total</b>	<b>133</b>	<b>100</b>	<b>Total</b>	<b>201</b>	<b>100</b>

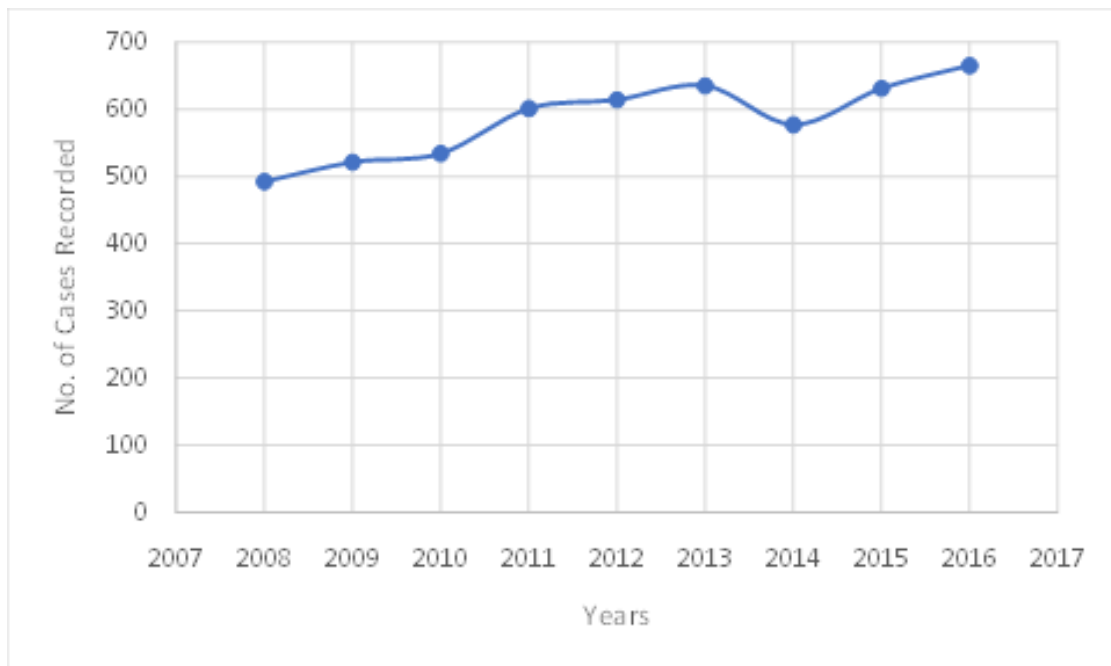
This suggests that land use plans did not exist or that if they existed, they were done exclusively by planning authorities.

### 4.4 Analysis of land use conflicts in areas adjacent to NNP

To achieve this, two methods were used. Firstly, recorded conflicts data from KWS was obtained to identify conflicts, their nature and their place of occurrence. It was however discovered that the only records of conflicts available were for the period 2008-2016. The second method was survey of sampled respondents to establish whether they had experienced land use conflicts and the nature of such conflicts. The next section presents the results.

#### 4.4.1 Identification and Characterization of conflicts in areas adjacent to NNP based on KWS records

The conflict trends and figures from the years 2008-2016 for areas adjacent to the park were as shown in Figure 4.8.



**Figure 4.8 : Conflict trends between 2008 and 2016**  
(Source: Adapted from KWS records, 2017)

There was a steady rise of conflicts from the year 2008 to 2016 with a slight decrease in the year 2014 which recorded 577 cases. The highest number of cases recorded was 665 for the year 2016. The issues under contention were predation, crop destruction, disturbance in human settlements, threats and injury to man. The common wildlife causing nuisances were lions, leopards, cheetahs, monkeys and crocodiles.

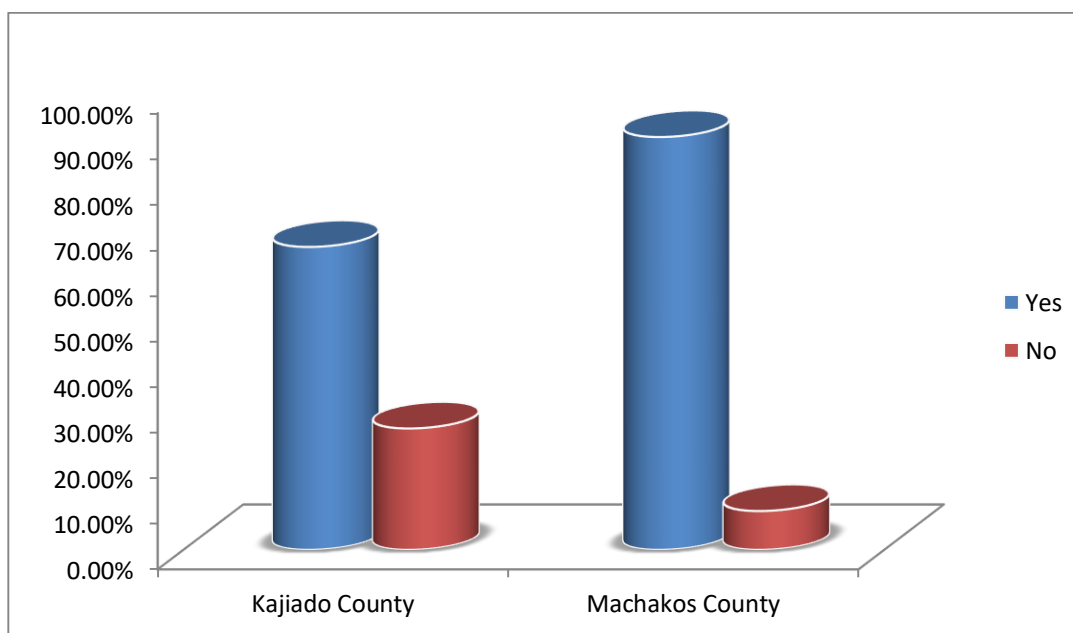
**Table 4.6: Characterization of conflicts adjacent to NNP**

<b>Year</b>	<b>Nature of conflict</b>	<b>No. of cases recorded</b>	<b>Issues under conflicts</b>	<b>Type of wildlife involved</b>
2008	Wildlife attacking humans and their properties	492	Predation Human threat Human injury Crop destruction	Lions Leopards Cheetahs Monkeys Crocodiles
2009	Wildlife attacking humans and their properties	521	Predation Human threat Human injury Crop destruction Disturbance	Lions Leopards Cheetahs Monkeys Crocodiles
2010	Wildlife attacking humans and their properties	534	Predation Human threat Human injury Crop destruction Disturbance	Lions Leopards Cheetahs Monkeys Crocodiles
2011	Wildlife attacking humans and their properties	607	Predation Human threat Human injury Crop destruction Disturbance	Lions Leopards Cheetahs Monkeys Crocodiles
2012	Wildlife attacking humans and their properties	614	Predation Human threat Human injury Crop destruction Disturbance	Lions Leopards Cheetahs Monkeys Crocodiles
2013	Wildlife attacking humans and their properties	635	Predation Human threat Human injury Crop destruction Disturbance	Lions Leopards Cheetahs Monkeys Crocodiles
2014	Wildlife attacking humans and their properties	577	Predation Human threat Human injury Crop destruction Disturbance	Lions Leopards Cheetahs Monkeys Crocodiles
2015	Wildlife attacking humans and their properties	631	Predation Human threat Human injury Crop destruction	Lions Leopards Cheetahs Monkeys

2016	Wildlife attacking humans and their properties	665	Disturbance Predation Human threat Human injury Crop destruction Disturbance	Crocodiles Lions Leopards Cheetahs Monkeys Crocodiles
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(Source: KWS, 2016)

When triangulated with household survey, it was established that majority of the respondents (66.4%) had experienced land use conflicts in Kajiado County while 90.5% of respondents in Machakos County expressed the same sentiments. The findings are presented in Figure 4.9.



**Figure 4.9: Land use conflicts**

#### 4.4.2 Conflicts encountered

In Kajiado, 19% reported damage of crops, 20% reported livestock killed by wildlife, 8% respondents reported loss of lives while 19% respondents reported on wildlife straying



into the compound. Still, another 14% respondents reported cases of injury to livestock caused by wildlife, 6% cases of injury to people caused by wildlife, as well as 14% cases of damaged property were also noted. From Machakos County, 17% was the highest frequency representing wildlife straying into compounds. Table 4.7 presents a summary.

**Table 4.7: Conflicts encountered by respondents**

Conflict manifestations	No of the cases reported			
	Kajiado County		Machakos County	
	Frequency	%	Frequency	%
Damage to crops	102	19	151	16
Livestock killed by wildlife	103	20	139	15
Human mortality caused by wildlife	41	8	79	8
Wildlife straying into compounds	100	19	160	17
Injury to livestock caused by wildlife	72	14	154	16
Injury to people caused by wildlife	30	6	132	14
Damage to property	70	14	136	14

In Machakos, 151 respondents reported cases of damage on crops, 139 cases reported on livestock killed by wildlife, 79 cases were reported on human being killed by wildlife and 160 cases reported on wildlife straying into the compound, 154 cases of injury to livestock caused by wildlife and 132 cases of injury to people caused by wildlife (Plates 4.1 and 4.2) and 136 cases of damaged properties.

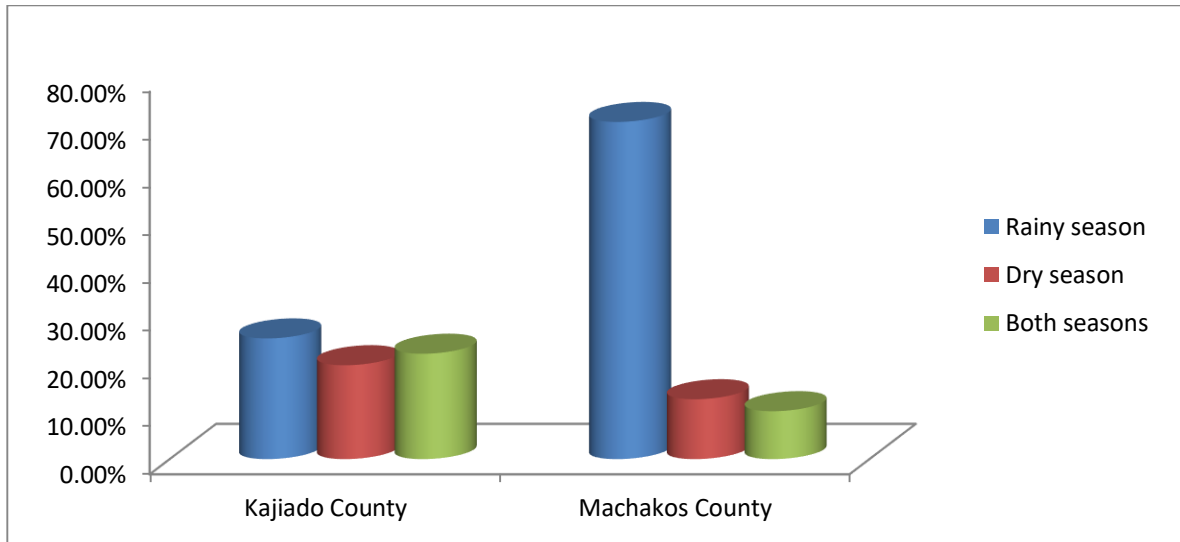


**Plate 4.1: Injury caused by wildlife**  
(Source: KWS 2017)

**Plate 4.2: Livestock deaths caused by wildlife** ( Source: KWS 2017)

#### **4.4.3 Land use conflict occurrence**

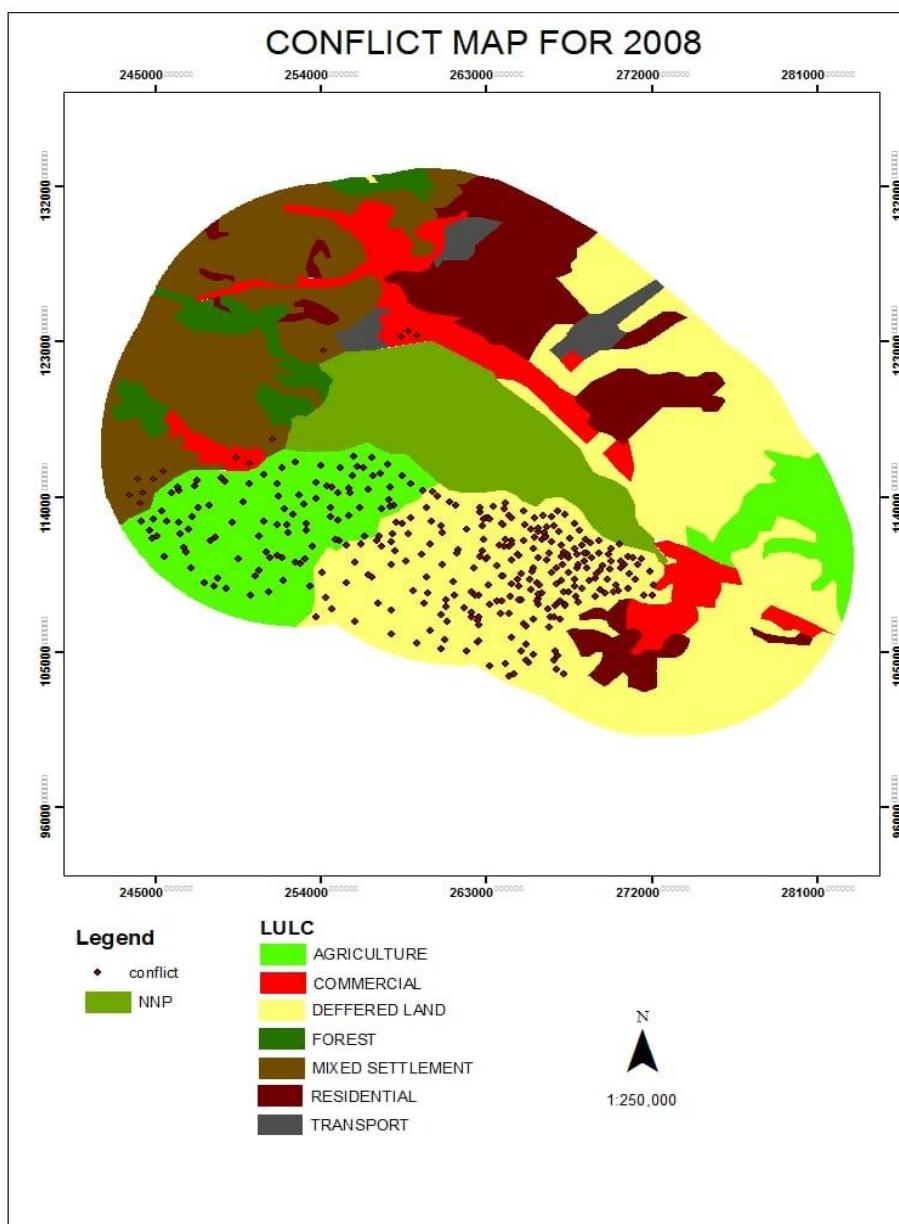
Findings revealed that human- wildlife conflicts occurred mainly during the rainy season in Machakos County (75%) with only 19.6% reporting that they occurred during the dry season. On the other hand, 30.5% of respondents in Kajiado County indicated that conflicts were common during the rainy season. This is because the park becomes waterlogged during this season because of the clay soils they contain and wildlife have to seek refuge outside.



**Figure 4.10: Seasons of conflict occurrences**

#### **4.5 Spatial Distribution of identified conflicts in areas adjacent to NNP**

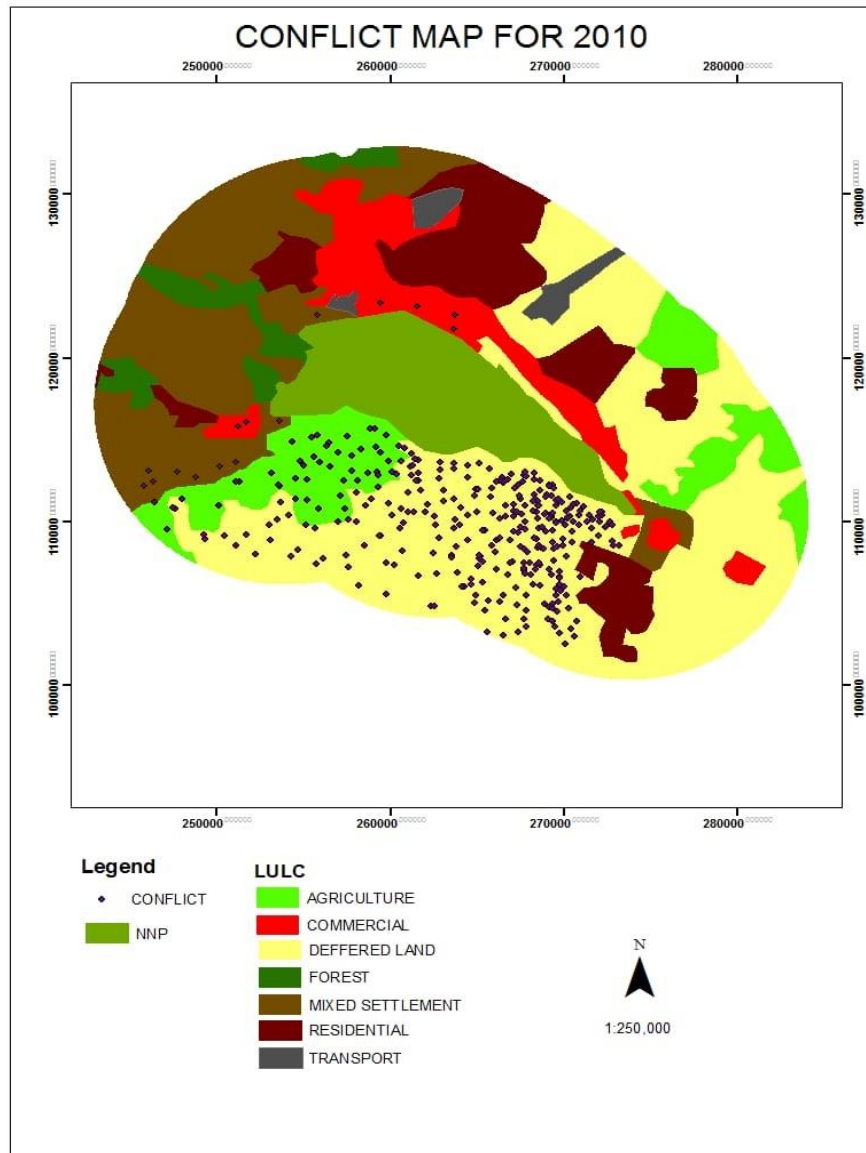
This was done by geo-referencing the conflicts in the areas they occurred. The recorded cases for the year 2008 were 492. Most of these cases were in Athi River North location of Machakos County. Some few cases were recorded in Ngong area. Figure 4.10 presents the conflict distribution in 2008.



**Figure 4.11: Conflicts distribution for the year 2008**

(Source: Author, 2017)

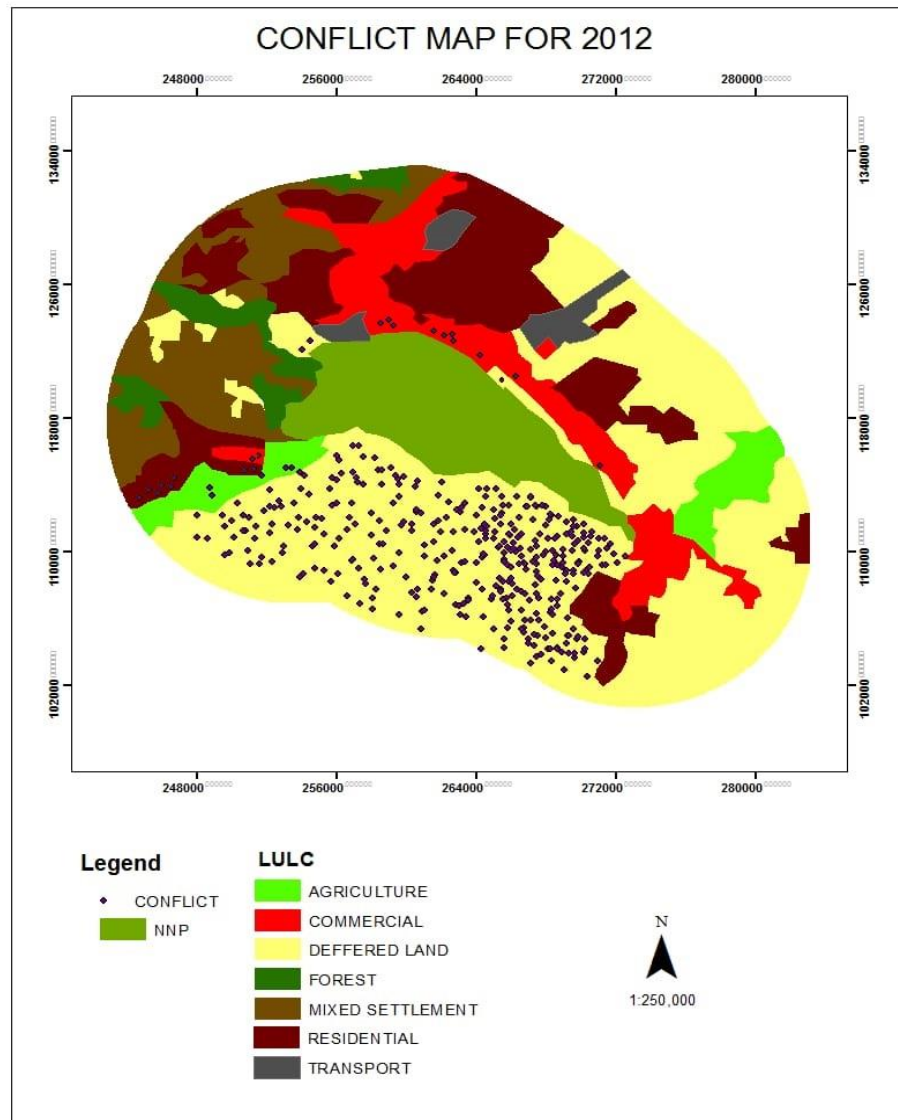
KWS records show that the number of conflict disturbances reported for the year 2010 were 534. The wildlife that were known to cause havoc included lions, leopards, cheetahs and monkeys. Complains registered ranged from disturbance, predation on livestock by wildlife, crop destruction and injuries sustained by human beings inflicted by wildlife.



**Figure 4.12: Conflicts distribution for the year 2010**

(Source: Author,2017)

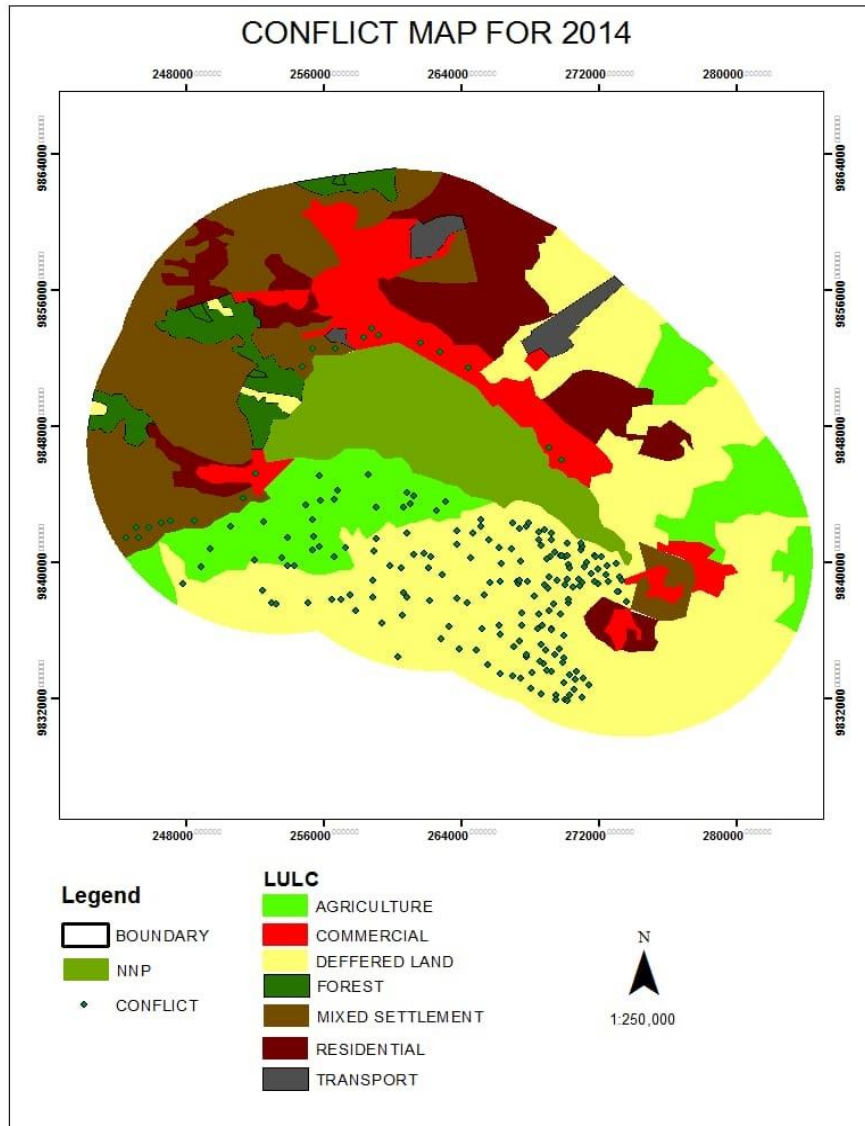
Conflicts in Kitengela, Athi River and its environs formed the major percentage recorded for that year which was 614 cases. These areas are part of the Kapiti Plains which were formerly dispersal areas for wildlife. These cases also extended southwards towards Kiserian and Isinya areas.



**Figure 4.13: Conflicts distribution for the year 2012**

(Source: Author, 2017)

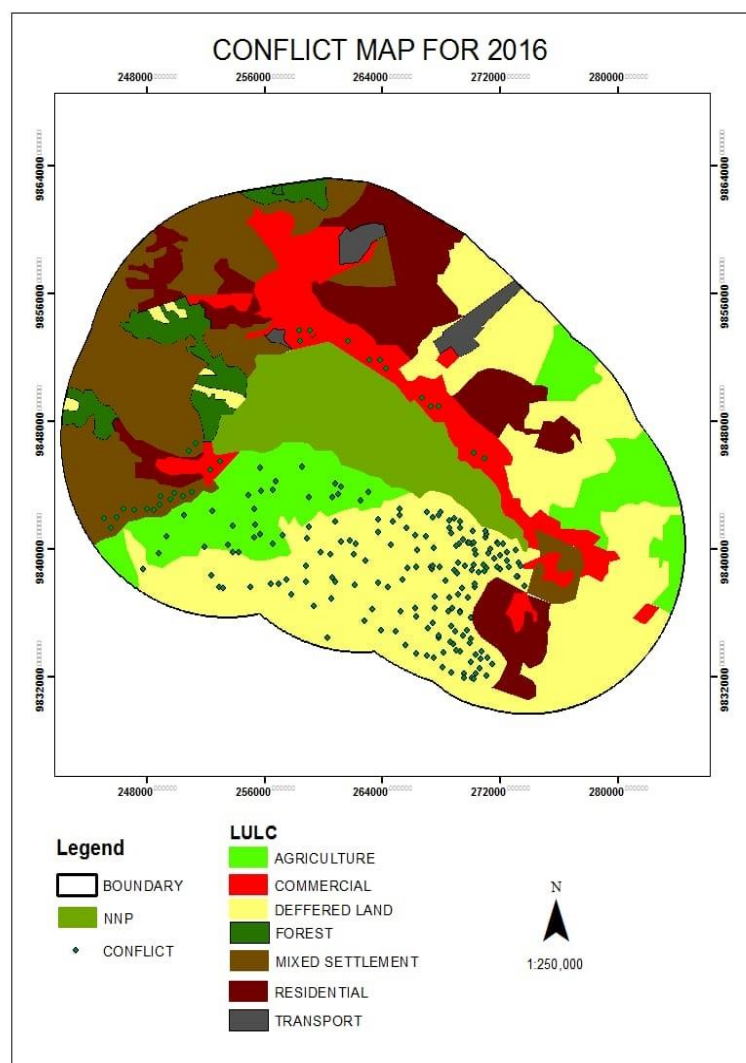
There was a slight decrease in conflict occurrence from the previous year. The cases recorded as per KWS records were 577, with Athi River North location still registering the highest number. Some cases were also witnessed in Rongai, Lang`ata Barracks and Nairobi West.



**Figure 4.14: Conflicts distribution for the year 2014**

( Source: Author, 2017)

The year 2016 recorded a total number of 665 cases which were ranging from predation, crop destruction, threat to human and disturbance on private property. These cases extended from Rongai to Kitengela. Some cases were also reported in Karen, Ruai, Carnivore and other areas of Nairobi West. Similar with other years, Athi River and Kitengela areas and their environs recorded the highest cases.



**Figure 4.15: Conflicts distribution for the year 2016**

(Source: Author, 2017)



## **4.6 Trends of land use and land cover changes in the areas around Nairobi**

### **National Park**

Images for land use and land cover changes for the years 1984, 1995, 2002 and 2016 were processed using ERDAS IMAGINE 2015. For land cover, unsupervised classification technique was used and this gave rise to seven land cover change classes. These were forests, rangelands, croplands, wetlands, water bodies, built up areas and other lands. Land use analysis also through unsupervised classification yielded the following classes, i.e., deferred lands, transport, residential, commercial agriculture, mixed settlements and forests as presented in Figures 4.16 and 4.17.

Land cover and land use for the year 1984 shows that the built up areas within the 10km radius were relatively small. There was small concentrations of human activities around Athi River and Kiserian areas but most of the southern part was rangelands which extended towards Mlolongo, Syokimau and Embakasi areas were utilized as agricultural lands/deferred lands. Forest cover was also relatively large. Areas around Ngong, Kangemi, Riruta and Kilimani had mixed settlements.

A decade later in the year 1995, there was a reduction in forest cover and there was also an increase in built up areas and commercial activities had begun springing up along the northern border of the park. Agricultural activities were also extending from Kiserian towards Kitengela.

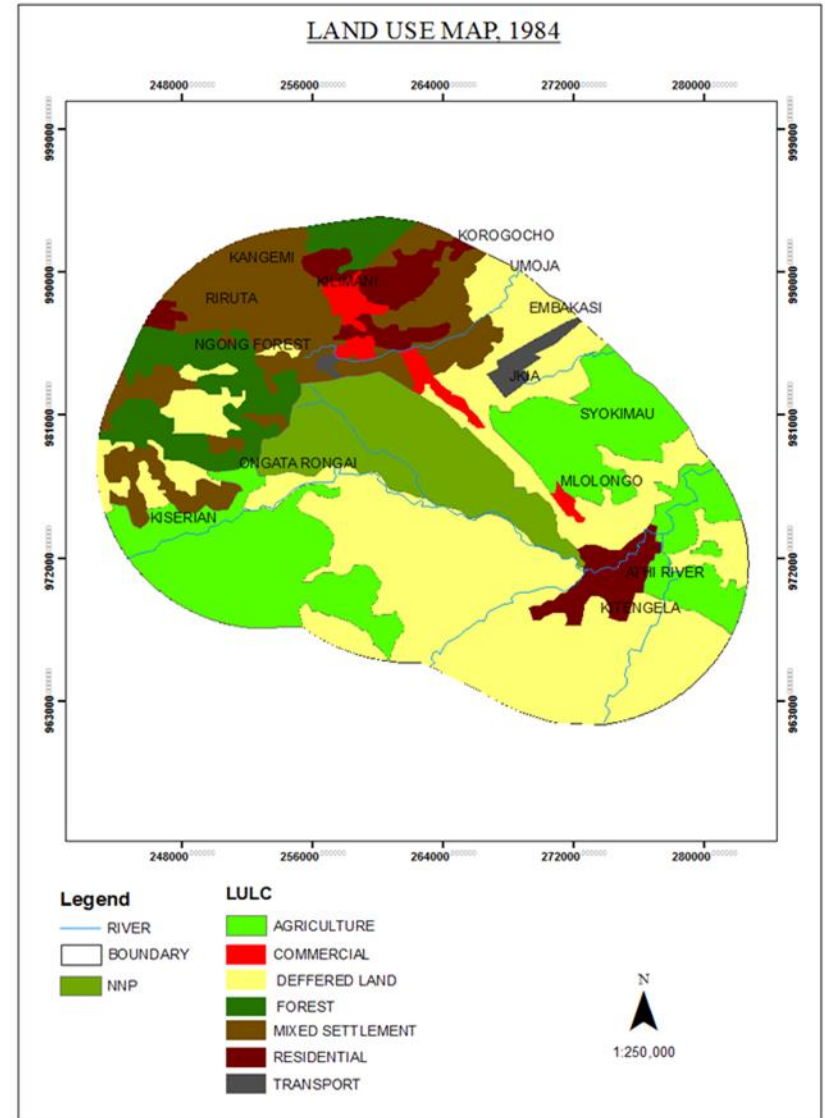
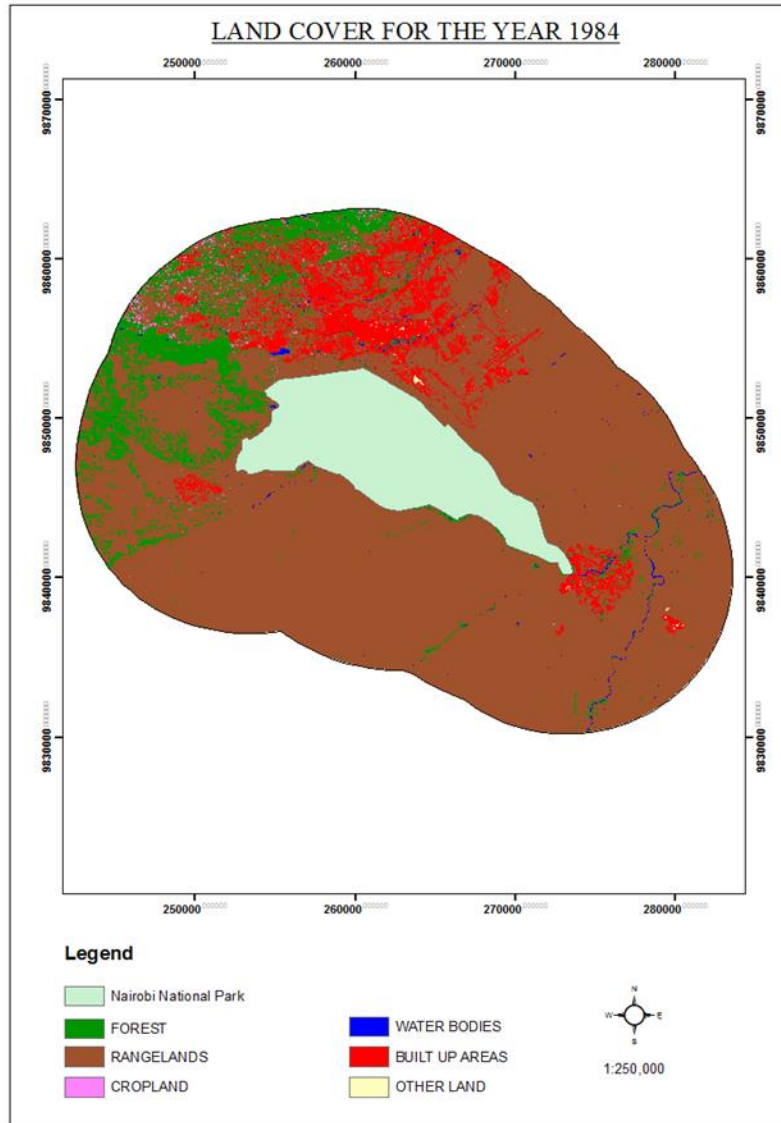
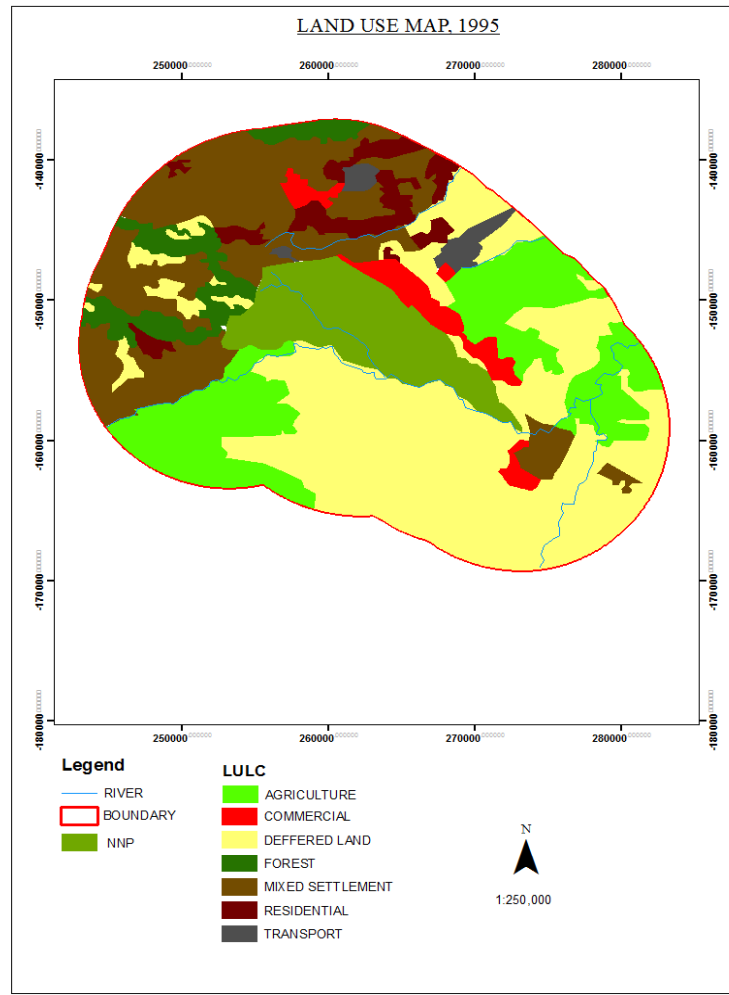
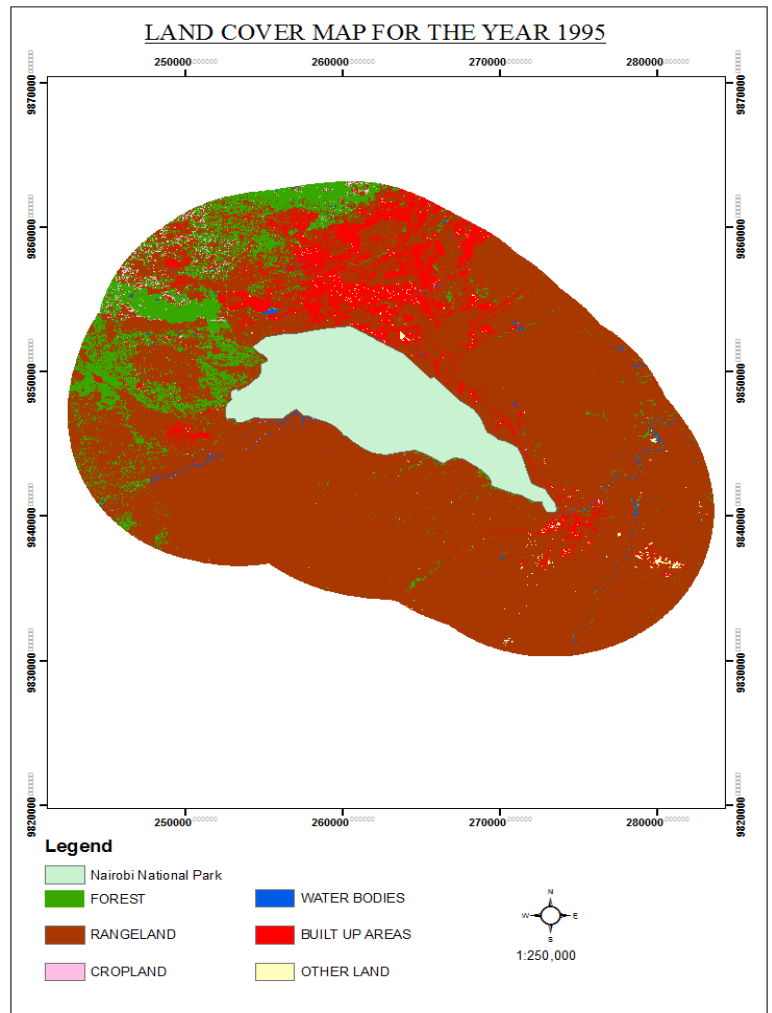


Figure 4.16: Land cover and land use maps for the year 1984 (Source: Author, 2017)



**Figure 4.17: Land cover and land use maps for the year 1995**  
 (Source: Author, 2017)

Proceeding to the year 2002, a large portion of the forest cover by mixed settlements, which were also extending towards Kiserian and Ongata Rongai areas. The northern boundary of the park was almost being blocked by commercial activities with Athi River town being fully commercialized. A large percentage of the deferred lands were also being taken up by other land uses.

In the recent past (2016), upgrade in the transport sector to accommodate increasing traffic led to development of mega infrastructures like the Standard Gauge Railway and Southern By-Pass that also interfered greatly with the park. The northern border had completely been blocked by commercial activities rendering it inaccessible by the wildlife. Kitengela and Athi River areas had also completely blocked the wildlife migratory route to the south and residential areas also had taken over Mlolongo, Syokimau and Embakasi areas.

Mixed land uses encroached into the park with most areas with commercial being the predominant activity. Recreation areas were segmented with agriculture and residential areas encroaching in these areas as seen in Figure 4.18 and 4.19 r

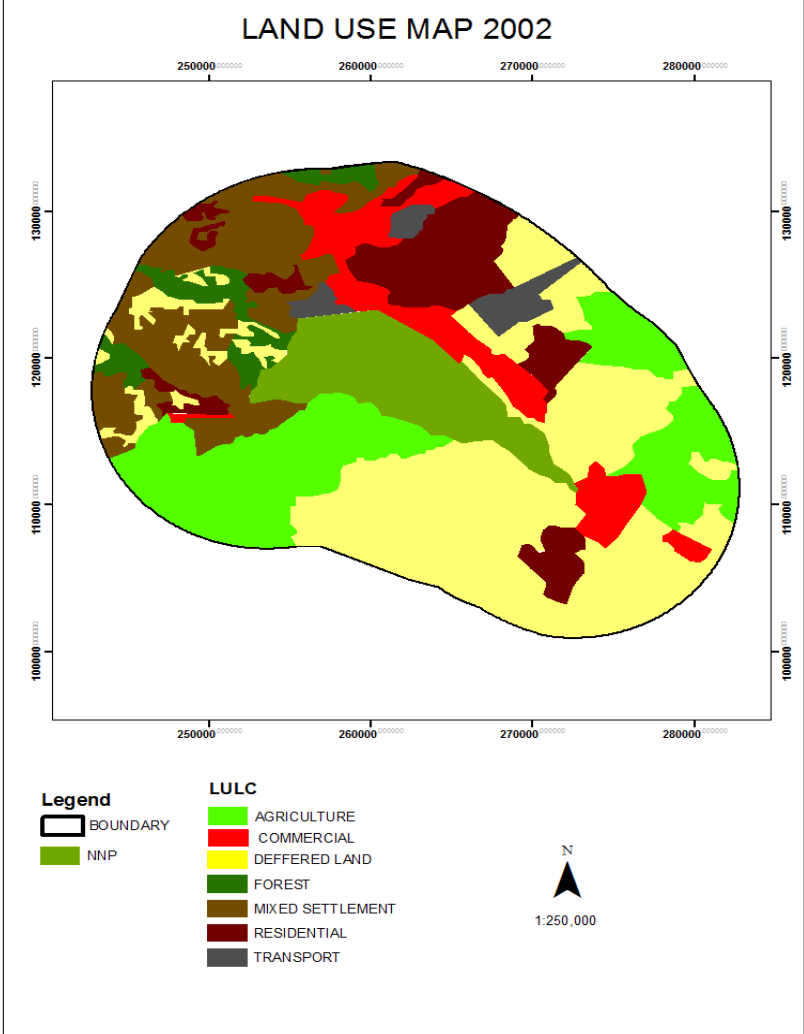
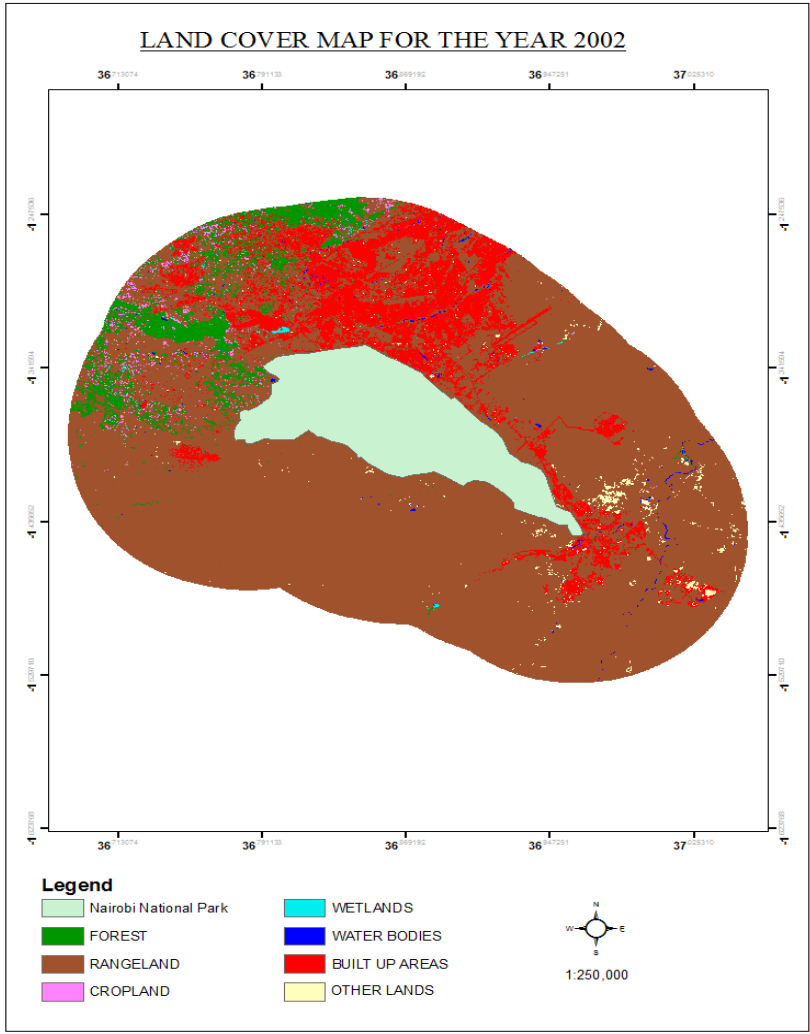
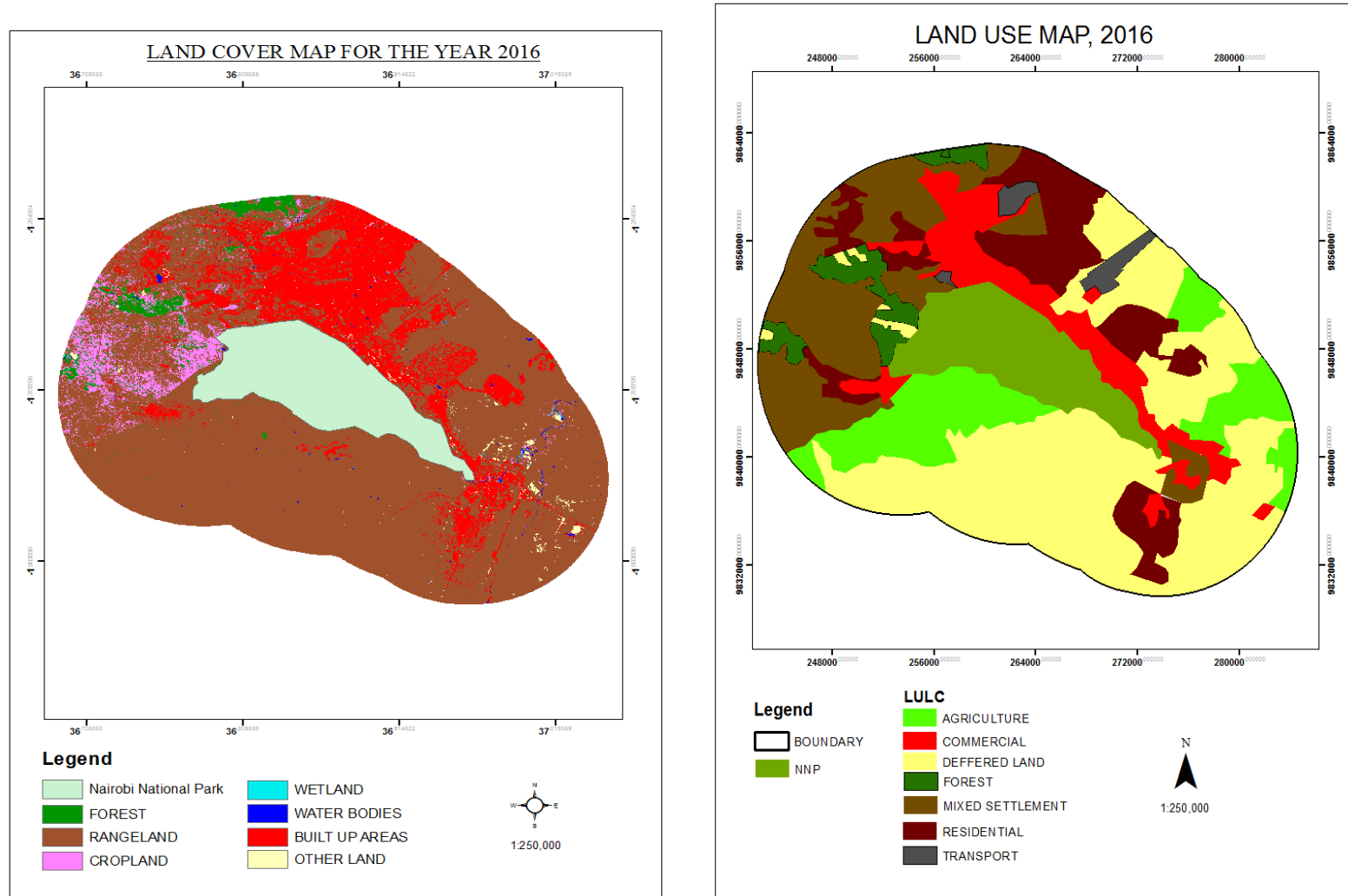


Figure 4.18: Land cover and land use maps for the year 2002



**Figure 4.19: Land cover and land use maps for the year 2016**

(Source: Author, 2017)

#### **4.7 Analysis of the relationship between land use change and land use conflicts**

The analysis of the relationship between land use/land cover change and land use conflicts was accomplished through overlaying geo-referenced data on conflicts on the land cover/ land use change layer. Conflicts maps were correlated with land cover /land use maps in GIS environment. The results are presented in Table 4.8.

Findings showed that there was a gradual decline in land size for agricultural and deferred lands by 2452 and 767 hectares, respectively from 2008 to 2016. On the other hand land sizes for commercial, mixed settlement and residential increased gradually by 1438, 2209 and 309 respectively, within the same period. It was also noted that the land use conflicts around the park steadily increased by 173 reported cases per year from 2008 to 2016. However, forest covers in the Park increased within the period by 224 ha. Table 4.8 summarizes the findings.

**Table 4.8: Land use change in Machakos and Kajiado Counties between 2008 and 2016**

Years	Land uses (Approximate coverage in hectares)							Approximate no. of conflicts recorded
	Agriculture	Commercial	Deferred lands	Forests	Mixed settlements	Residential		
2008	14215	7463	34424	3024	13012	11383	492	
2010	9888	7592	36810	3212	16318	10374	534	
% in change	30.50 (-ve change)	-1.73 (+ve change)	-6.93 (+ve change)	-6.22 (+ve change)	-25.41 (+ve change)	8.86 (-ve change)	+8.54 (%increase)	
2010	9888	7592	36810	3212	16318	10374	534	
2012	3535	8685	43680	3201	9540	15146	614	
% in change	64.25 (-ve change)	-14.40 (+ve change)	-18.66 (+ve change)	0.34 (-ve change)	41.54 (+ve change)	-46.00 (+ve change)	+14.98 (%increase)	
2012	3535	8685	43680	3201	9540	15146	614	
2014	5984	7622	41807	3959	14984	10234	577	
% in change	-69.28 (+ve change)	12.24 (-ve change)	4.29 (-ve change)	-23.68 (-ve change)	-57.06 ((+ve change)	32.43 (-ve change)	-6.03 (%decrease)	
2014	5984	7622	41807	3959	14984	10234	577	
2016	11763	8901	33657	3248	15221	11692	665	
% in change	-96.57 (+ve change)	-16.78 (+ve change)	19.49 (-ve change)	17.80 (-ve change)	-1.58 (+ve change)	-14.25 (+ve change)	+15.25 (%increase)	



#### 4.6.1 Examples of the land use mushrooming around the park

In Emakoko area, people have erected houses as little as 500m from the park`s boundary. Quarries also dominate the landscape. Lions and hyenas lions and hyenas are a menace mostly during the wet season.



**Plate 4.3: Settlements erected a few metres from the park`s edge.**

(Source: Author, 2017)



**Plate 4.4: Quarries dug few metres from park`s edge at Ngurunga area of Kajiado County.**  
(Source: Author, 2017)

Similar trends were observed at Ngurunga village, which was situated around 5 km from the park`s border. Quarrying and brick-making activities were common with deep mines dotting the area (see Plate 4.4)

People were diversifying from the traditional pastoralism farming to minimize conflicts with wildlife. In this area, homes are also located less than 1km from the park`s border. There are also other upcoming centres like Sidai within a walking distance from the park`s edge.

The situation was not different in Tuala/Oloosirkon areas where homes are erected adjacent to the park and fenced off. The land parcels had been subdivided into small portions with large storey buildings coming up. According to the key informant, most people hardly reared animals due to failure of KWS to compensate the locals, Instead flower farms were erected along Mbagathi River, which is the boundary of the park.

**(Source: Author, 2017)**



**Plate 4.5 : An upcoming centre in Sidai on the park`s border.**

## **4.7 Impact of land use control systems on land use conflicts around Nairobi**

### **National Park**

Accomplishment of this objective required that data on conflicts and planning be obtained and analyzed. This data was acquired using the methodology described in Section 3.7.2 in Chapter 3. The Planning frameworks of Kajiado and Machakos Counties for the areas adjacent to the park are summarized in Table 4.9.

Planning in Athi River ward was formerly guided by the plan for Mavoko Town only which expired in 2010. Other areas like Lukenya developed through part development plans. By 2018, they were in the process of updating the Mavoko town plan.

Kajiado County had a draft of development plan; the Kitengela-Isinya-Kipeto development plan; developed in 2007/2008 However its adoption was a challenge because of massive land subdivision that had even affected wildlife corridors. The Kajiado County Government also developed a zoning map for the area. This had a thematic subdivision component to maintain a threshold from the border of the park. It was supposed to be in use for five years from 2012-2016. However, this plan was not followed, accepted, enforced nor approved. The stakeholders failed to execute it (Head of Planning Department).

**Table 4-9: Planning frameworks in Kajiado and Machakos Counties**

<b>Planning Framework</b>	<b>Kajiado County</b>	<b>Machakos County</b>
Land use planning instruments	Zoning	Zoning
Spatial plan for areas adjacent to NNP	Land use subdivision draft (in use since 2015- Fig 4.21)	No plan yet
Planning instruments currently in use for areas adjacent to NNP	Former plan (expired in 2010 and due for revision)	Precedence/planning principles
Validity of plan approvals	10 years	5 years
Minimum lot size allowed for the areas adjacent to the park	None	1/8 of an acre (Fig 4.20)
Challenges	Political interference	Development control
	Lack of enforcement mechanisms	Enforcement of existing guidelines
		Accessibility of areas

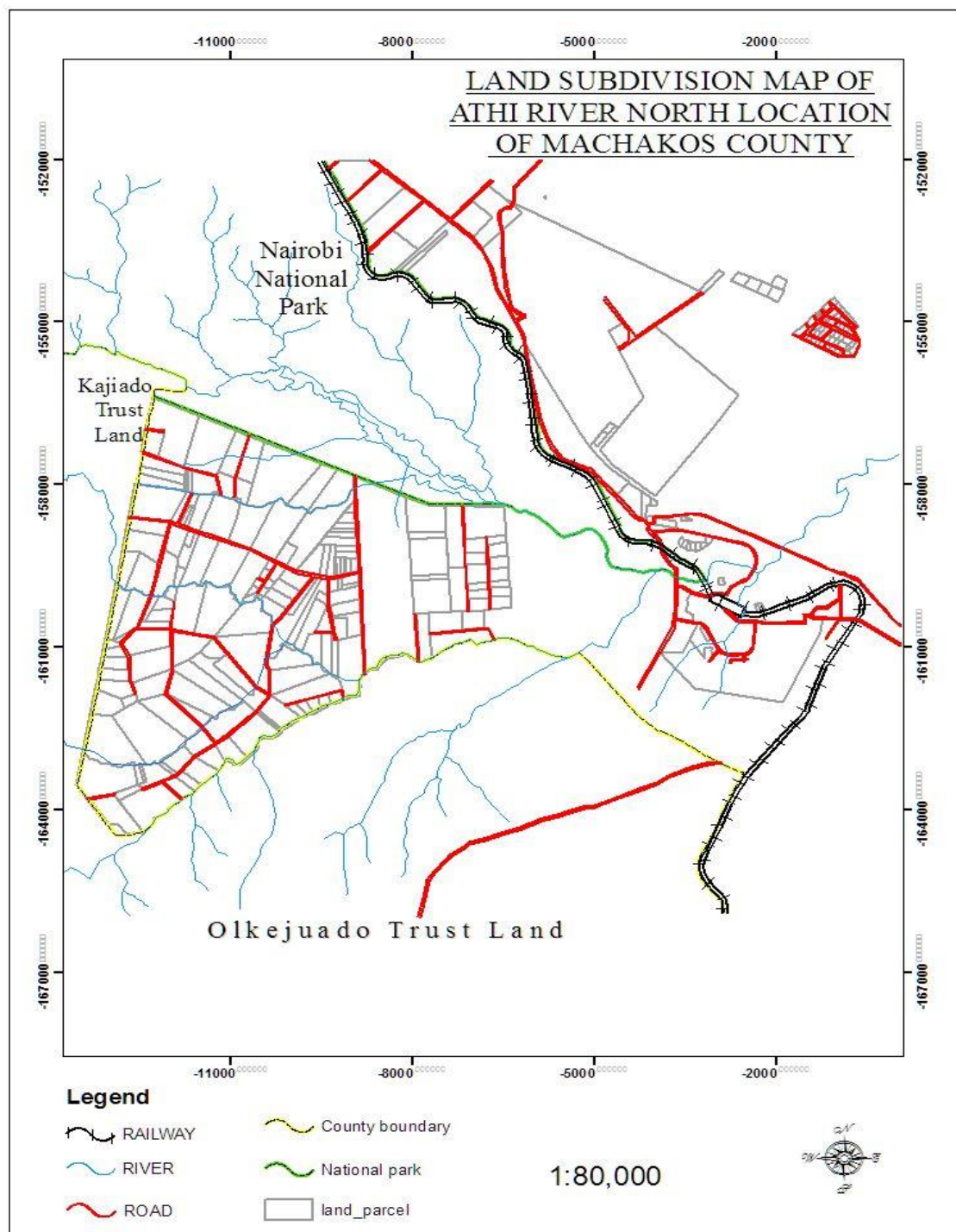
**(Source: Planning Departments of Kajiado and Machakos Counties, 2017)**

In addition, the sub-division and change of user data for both Machakos and Kajiado Counties are presented in the discussion.

**Table 4-10: Land sub-division and change of user information for Kajiado and Machakos Counties**

<b>Kajiado County(average per year)</b>			<b>Machakos County(average per year)</b>	
	<b>Sub-divisions/ Development approvals</b>	<b>Change of user</b>	<b>Sub-divisions /Development approval</b>	<b>Change of user</b>
1990-1994	23	2	6	2
1995-1999	30	5	4	10
2000-2004	87	18	18	12
2005-2009	70	20	5	7
2010-2016	60	55	25	3

**(Source: Planning Departments of Kajiado and Machakos Counties, 2017).**



**Figure 4.20: RIM for lands adjacent to NNP**

**Source: Planning Department, Machakos**

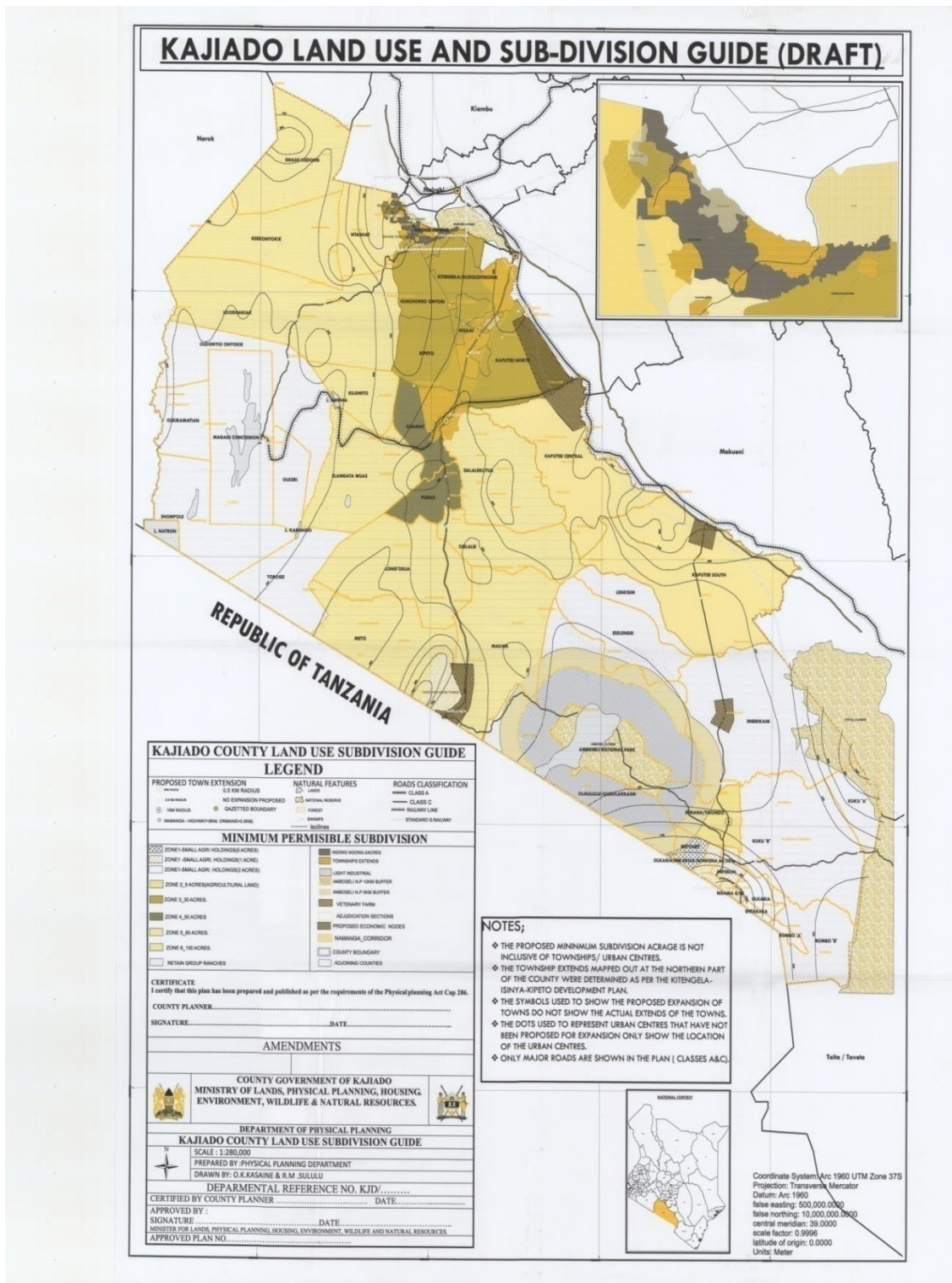


Figure 4.20: Kajiado County land subdivision guide

(Source: Survey Department, Kajiado)

For the NNP, information obtained from key informants at KWS indicates that the park's management is facing a lot of challenges which are rapidly getting out of control. These challenges are summarized in Table 4.11.

**Table 4-11: Summary of challenges around NNP**

<b>Issues</b>	<b>Description</b>
Types of conflicts	<ul style="list-style-type: none"> <li>-Livestock incursion into the park</li> <li>-Crop destruction</li> <li>-Predation and poaching</li> <li>-Retaliatory attacks</li> </ul>
Areas common in conflicts	<ul style="list-style-type: none"> <li>- Kitengela</li> <li>-Rongai</li> <li>-Empakasi and Tuala</li> <li>-Sholinke</li> <li>-Syokimau</li> <li>-Ruai</li> <li>-Karen( Mukoma Road)</li> </ul>
Factors precipitating land use problems	<ul style="list-style-type: none"> <li>-Human population increase especially in Kitengela</li> <li>-Land tenure change from Community to private.</li> <li>-Settlements encroaching in dispersal areas between Kajiado and Kitengela</li> <li>-Agricultural activities in migratory corridors</li> <li>-Immigration to dispersal areas</li> </ul>
Mechanisms for dealing with land use problems	<ul style="list-style-type: none"> <li>-Fencing off the park( currently, 38km fenced off)</li> <li>-Problematic animal control (by way of traps)</li> <li>-Lion collaring (to monitor lion movements outside the park using satellite images) and lion lighting</li> <li>-Wildlife relocation</li> <li>-Tracking through assistance of community members)</li> <li>-Compensation <ul style="list-style-type: none"> <li>-Human death caused by wildlife- Kshs. 5m</li> <li>.Wildlife injuries causing permanent disability-max. of ksh.3m</li> <li>-Other injuries caused by wildlife – max of Kshs. 2m</li> <li>-Damage to property, livestock and crops. – at market value</li> <li>-Community conservation and awareness programme</li> <li>-Community social responsibility projects in the following sectors: water, education, health, infrastructure</li> <li>-Stakeholders collaboration i.e. individuals, communities and NGOs (FoNNAP, Green Initiative, Africa Wildlife Foundation, World Wildlife, USAID)</li> </ul> </li> </ul>
Challenges faced by the park	<ul style="list-style-type: none"> <li>-Total loss and fragmentation of habitat</li> <li>-Encroachment by expanding infrastructure( SGR, Southern by-pass</li> <li>-Human-wildlife conflicts</li> <li>-Pollution (solid and liquid waste management)</li> <li>- Compensation</li> </ul>



## CHAPTER FIVE

### DISCUSSION

#### 5.1 Introduction

This chapter discusses the findings of this study as presented in Chapter Four. The presentation is made in the order of the study objectives.

#### 5.2 Reflection of findings on land use conflicts around Nairobi National Park

The main type of conflicts discovered by the study is the human-wildlife conflicts emanating from human activities being carried out in areas adjacent to the park which ultimately interferes with the park's ecosystem. Findings of the study show that some of the manifestations of land use conflicts included crop destruction, livestock predation, human predation and damage to property. Most common areas in conflicts include entire south of the park between Kitengela and Rongai areas encompassing Empakasi, Tuala, Sholinke, Syokimau, Ruai and Karen. One of the major hurdle is total loss and fragmentation of habitat especially along Nairobi-Namanga road. It should be noted that these areas contain intensive human development. Studies conducted show that population growth in Nairobi is the driver to reduction of agricultural land space and encroachment into forests thereby creating competition between people and wildlife on the use of land and other resources in protected areas (Anna *et al.*, 2012). Settlements have been encroaching in wildlife dispersal areas between Kajiado and Kitengela areas. These have diminished open areas for wildlife migration (Noe, 2003) and also make tracing of wildlife movements outside the park very difficult. The research further agrees with the assertion by Lado (1992) that human settlement in areas where animals disperse

has led to an increase in the number of human wildlife conflict cases. Thus, land is no longer accessible to wildlife which opt to migrate at night. This has been blamed largely to stakeholders of Kitengela-Isinya-Kipeto plan who failed to implement the plan. Encroachment by expanding mega infrastructure has also been cited as another major challenge. The southern by-pass destroyed 89.1 acres whereas the SGR cut off the park into two (Senior Scientist, Southern Conservation Area, 2017). These areas are no longer accessible and thus wildlife is moving out of the park without following migratory routes and venturing into calm areas like Karen away from noise. These constructions, according to the key informant, were not featured anywhere in the NNP Management Plan, which has since expired (1995-2000). Among other challenges cited were discharging of raw sewage from Rongai area, Banda School and Military Barracks into Mbagathi River which is the main source of water for the park. Moreover, wastes from mines, quarries and explosives are diminishing the value of the park. The Planning Department has also failed in reviewing of the NNP Ecosystem Management Plan which also expired long ago. Also from the findings, the rates of land use conflicts occurrences were higher during the rainy season in Machakos County. This agreed with Gichuhi (2003) who attributed this to the fact that herbivores tend to avoid the park during the rainy season and opt for pastures outside the park hence triggering human wildlife conflicts. The incompatibility of these activities, which have sprout up within the proximity of the park, goes against the core mandate of the park that is conservation, and has led to the degeneration of the dispersal areas.

### 5.3 Assessment of trends on land use change in the areas around Nairobi National Park

The findings of land use changes from 1984 to 2016 revealed that land use changes are transforming natural habitats into modified systems of land cover mainly through habitat destruction. It was evident that the prominent land use changes around protected areas were between agricultural, residential and commercial against PA management. The results from land use changes revealed that during the 1980s, the area around the park was predominantly agricultural lands. These were largely open grass lands where the Maasai community practiced pastoralism and co- existed with wildlife (Agrawal and Gibson 2009). Within the 10km buffer, residential area was much smaller hosting the city's population of nearly 1.3 million persons then according to Census 1989. Most of the other lands north of the park were non-urban lands, with the total forest cover occupying nearly 10,000 ha of the land cover within the former Ngong District. Agricultural lands extended to include areas like Syokimau, Mlolongo and Kiserian. Key informants interviewed noted that during the 1980s, the area now forming Athi River North location used to be large open pastoral lands. Thereafter, subdivision started with the establishment of group ranches which were given free hold titles. During those years, conflicts were rare.

With the onset of the 1990s, there was a reduction in agricultural lands in Kitengela and Athi River areas. These were taken up by commercial activities like flower farms and cement manufacturing industries. The diversification of livelihood to include these activities were also noted by Maitima *et. al.* (2009) and Sibia (2004). Areas around

Rongai registered an increase in mixed settlements which saw a decrease in total forest cover (Physical Planner Machakos, 2017).

By the 2000s, mixed land uses had begun taking shape in most of the agricultural areas. Urbanization activities were also witnessed along infrastructural developments like roads and airports. Most of these took place without development control measures which quickly went out of control. This was also the era where there was continued residential and commercial expansion in Athi River and Kitengela areas with signs settlement showing up along the Park's border. The large part of this area was the government-owned sheep and goat research farm. With the collapse of the farm, management of the area was left entirely to the new land owners. The area was volatile and under contention between Machakos and Kajiado counties, each claiming ownership. And thus the area was sidelined in matters of planning with other areas like Athi River taking priority (Machakos Physical Planner, 2017). Fragmentation of forest cover was also being experienced around Ngong and its environs.

Over the course of the following years, the demand for land led to the spread of commercial activities along the park's northern border completely blocking it up. This agrees with Wamicha and Mwanje (2000) who assert that competition for land by different land uses was slowly confining wildlife into smaller spaces. In Ngong and Kiserian areas, mixed land uses continued to take shape overshadowing agricultural pursuits. The same trend was also observed in areas proxy to Kitengela and Athi River where commercial and residential activities were noted to be extending southwards. These areas had all the land uses located within the proximity of each other.

## **5.4 Relationship between land use changes and land use conflicts around Nairobi**

### **National Park**

Results obtained revealed a cause-effect relationship between land use change and land use conflicts. There was significant reduction of agricultural lands with the exception of the years 2012- 2014 during which there was a slight decrease in the number of conflicts recorded. This trend can also be observed with forests whereby a decrease in forest cover leads to an increase in the number of conflicts observed. For the case of deferred lands, the larger the area under grassland, the lesser the conflicts associated with it. As the area started declining in 2012-2016, this was the time conflicts started gradually increasing. Mixed settlements posted mixed reactions that alternate between a decrease or increase in conflicts through various times.

These changes in land use over time were the determinant factors for the prevailing land use conflicts around Nairobi National Park. Changes from pastoralism to agriculture, residential and commercial pursuits affected to great extent, wildlife movements, a large percentage of which resides outside the park. Conflicts can also be linked to people's direct interference due to the fact that locals perceive wildlife outside parks as a nuisance and a liability (Sibia 2010).

The magnitude of these land use changes can easily be inferred basing on spatial data such as frequency of land subdivisions leading to wildlife habitat fragmentation, transformation in land tenure patterns from communal to private, increase in human settlements in dispersal areas, expansion of socio-economic activities in the rangelands, the buffer distance between the park and human activities amongst others. As a result of

all these, conflicts between people and wildlife have intensified in recent years leading to losses in wildlife and humans, as well as property. The park's management further alluded that these changes have a lot of social and political challenges because the lands lying outside the park are privately owned limiting the extent of their policy enforcement as noted by Wondolleck (2013).

### **5.5 Impact of land use control systems on land use conflicts around Nairobi National Park**

While purposely mandated to bring spatial order, the land control systems had failed to curtail serious issues like discharging of raw sewage, wastes from mines and quarries into Mbagathi River and total loss and fragmentation of habitat of NNP and surrounding areas. Conflicts have also been increasing over time (although minimal increase was observed in Kajiado County) threatening the survival of the park. Human activities have been on the rise and institutions mandated to regulate have not been keen on enforcement. Hotel facilities, houses and other buildings have not been subjected to any development regulations. Planners who previously had approved schemes rarely had concrete mechanisms to address conflicts.

In Kajiado County, where the least number of conflicts was observed, a former plan was still in use although a spatial plan for areas adjacent to the park draft was on its final stages of preparation. This was a move in the right direction despite the challenges of lack of enforcement mechanisms the County Planners faced. However, the draft had no restrictions on the minimum lot size allowed for lands next to the park. In addition, for the subdivision and development controls, the County had an average of 54 per every

four years which translates to 14 per year. While change of users recorded were only 5 yearly.

On the other hand, Machakos County had yet to come up with a plan for areas adjacent to the park. The areas adjacent to PAs had also not been considered very much in planning system of the country and had been left for the local planners to come up with provisions for land uses in such areas as they deem fit. Currently, as cited by The Physical Planner of Machakos County, planning is done by use of instincts because what ought to make planning decisions has been disregarded and is no longer in use by the County management, sentiments echoed by Arthur et al (2007). The planners relied solely on planning principles in which they allowed subdivision upto the minimum of an eighth of an acre to lands next to the park. Although this was the county where most conflicts were recorded, subdivision figures were a paltry 3 per every 4 year while change of user averaged 7 per every 4 yrs. Due to lack of a regulatory framework, there exists sporadic information or decisions which are not coordinated because some are fostered by pressure groups like FoNNAP and neighbourhood associations like Ole Kasasi Neighbourhood Association. Also, contradicting policies from different planning organs was a recipe for confrontation (Unruh, 2008).

As noted by The Senior Scientist at KWS, the lands outside PAs are privately owned and thus PA managers had no rights to manage such lands.. This notion agreed with Wondolleck (2013) who pointed out that decision making on public lands surrounding PAs was not sustainable in cases where people depended so much on the resources for sustenance. Rosan (2007) also pointed out that power-stripped planning authorities often faced a myriad of challenges relating to its efficiency to deliver.

In addition, research findings indicated weak conflict and compensation management mechanisms that had contributed to the un-ending land conflict between users of adjacent lands and park management. Cases brought forward requiring compensation had not adequately been resolved. These concerns were raised by Head of African Wildlife Foundation, who works together with other stakeholders in helping resolve conflicts in these areas. In retaliation, the locals staged retaliatory attacks towards wildlife and anything wildlife-related directly or indirectly creating a vicious circle of unending conflicts.

There was also lack of clear demarcation of boundaries among land users living in proximity of PAs simply due to the lack of proper land use plans. This prompted the park's authority to fence off part of boundary to limit continued interference and boundary conflicts. These shortcomings have provided a loophole for the locals to violate park regulations.



## CHAPTER SIX

### CONCLUSIONS AND RECOMMENDATIONS

#### 6.1 Conclusions

The study makes the following conclusions:

- That land use conflicts around PAs are largely driven by socio-economic activities in areas adjacent to the park. These conflicts are part and process of land use changes in these areas. These are site-specific with seasonal characteristics which determine their frequency and distribution.
- Land use and land cover change trends around PAs are rapid. The most frequently occurring was land parcelization leading to habitat fragmentation. This was due to availability of vast open lands in the past. Land use analysis depicts a general increase in developed spaces with residential and commercial areas having increased dramatically over the past years.
- Land use and land cover changes in areas adjacent to the PA have contributed greatly to the increase of conflicts. The more the conversion of rangelands into other forms of land cover, the more the conflicts were witnessed. Though land use changes were unavoidable, conflicts on the other hand could be mitigated through proper planning in these adjacent areas. It was also noted that these areas receive little planning attention. The presence of planning institutions also did not deter the occurrence and recurrence of conflicts. In fact, with many stakeholders, conflicts were still on the rise. In selected areas where the planners had come up with control systems like maps and land use plans, conflict

management had not been achieved fully due to one or a combination of the following: failure to use the tools as reference planning materials, and/or they were completely ignored and forgotten till they have been overtaken by time and events till they become obsolete.

- Land use control systems have had some little impact in keeping land use conflicts around PAs under control. The regulatory frameworks needed to be reviewed from time to time because changes around protected areas keep changing with changes in technology. In addition, regulatory approaches could not operate alone unless reinforced accordingly. This was made worse by inadequately equipped planning stakeholders who were mandated with planning for large areas. They also lack support to implement policies and laws. Planning for these areas should be tailored to deal with localized problems as opposed to planning for protected areas as a whole. This is to discourage pasting of planning ideologies from one area to another because each PA has its own unique challenges that require approaches tailored to meet its demands. Finally, the institutions responsible for such areas are to be integrated into one for easy co-ordination.

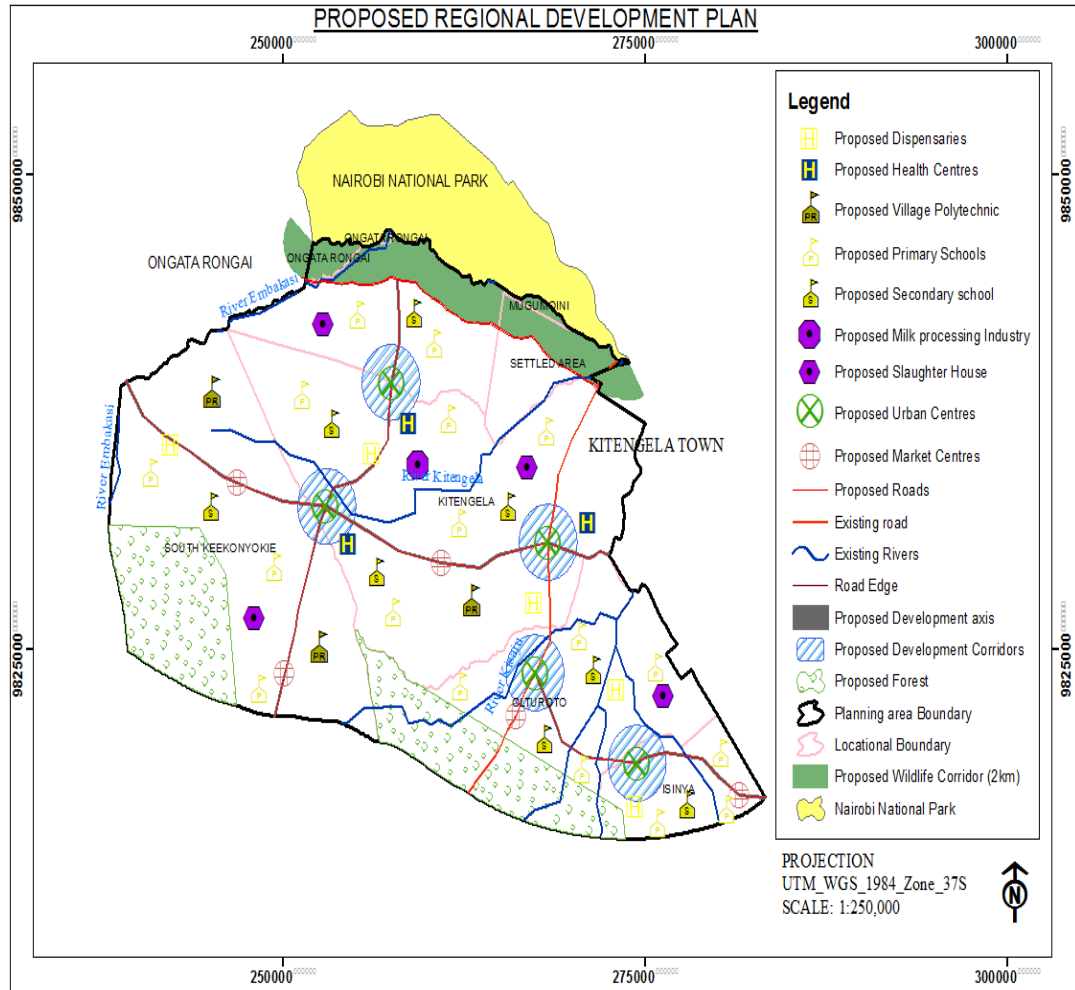
## **6.2 Recommendations**

The study makes the following general recommendations:

- Comprehensive integrated land use planning that integrates conflict anticipation and mitigation should be adopted to reduce conflicts in NNP and its surroundings. The plan should encourage settlement of people away from wildlife migratory routes and riverine areas in order to secure these delicate areas. This would reduce

overlap between areas of human-wildlife interaction and thus minimizing conflicts. Communities should be involved in the making of the plan from the onset. This should be complemented by use of indigenous knowledge based on conflict mitigation strategies in order to attach a sense of ownership to the locals.

- A master plan should be developed with the intention of bringing spatial order and sustainability by providing opportunities for integration of mixed land uses while at the same time preserving open spaces and critical environmental areas. Subsequently, if well implemented, this master plan should also provide directions for multi-functional management while allowing for flexibility in future development decisions. There should be timely review of planning instruments in order to be up to date with issues affecting PAs. This could only be achieved if PAs are clearly demarcated and gazetted through written laws and conflicts are treated as part of the planning frame work.



**Figure 6.1: Proposed Spatial Plan**  
(Source: Author, 2017)

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## 5 APPENDICES

### 6 APPENDIX I: HOUSEHOLD QUESTIONNAIRE

My name is Grace Mwendwa pursuing Masters degree at University of Eldoret, You have been randomly selected in this research on `Effectiveness of land use planning in resolving land use conflicts around protected areas- case of Nairobi National Park`. The information you will provide will be confidential and is meant for academic purposes only.

#### SECTION A – PERSONAL DETAILS

1. What is your gender
  - a. Male ( )
  - b. Female ( )
2. Age
  - a, 20-30 yrs
  - b. 31-40 yrs
  - c, 41-50 yrs
  - d, 51-60 yrs
  - e, over 60 yrs
3. How many years have you lived here
  - a. Below 5 yrs( )
  - b. 5-10 yrs ( )
  - c. 10-20 yrs
  - d. over 20 yrs
4. What is your family size?
  - a. 1-4
  - b. 5-8
  - c,8-14
  - d. over 15
5. What is your current economic activity .....

#### SECTION B – LAND CHARACTERISTICS

6. What is the size of your land?
7. How far is it from the park?
8. What type of land tenure do you practice?
  - a, community
  - b. public
  - c, private
9. How did you acquire it



- a. Lease                      b. inheritance                      c. buying

10. If by lease, for how long is the land under lease?

11. If by inheritance, has it maintained its original size?

12. What is the user of the land?

- a, residential                      b. commercial                      c. educational                      d, agricultural

13. Has the land changed users since you acquired it?

- a. Yes                      b. No

14. Has any part of the land been sold since its ownership?

- a. Yes                      b. No

15. Can you provide approximate distance to the following infrastructure

Distance to tarmac road	
Electricity	
Water	
Distance to nearby town/centre	

16. Have you ever experienced land use conflicts with wildlife ?

- a. Yes                      b. No

17. If yes, how did you deal with it ?

18. When do the conflicts commonly occur?

- a, rainy season                      b, dry season                      c, rainy./ dry season

19. What type of conflicts have you encountered with wildlife

Damaged crops	
Livestock killed by wildlife	
Humans killed by wildlife	
Wildlife straying into compounds	
Injuries to livestock caused by wildlife	
Injuries to people caused by wildlife	
Damage to property caused by wildlife	

20. How well do you relate with the park`s management?

21. Is there any compensation programme by the park`s management?

### **SECTION C- EFFECTIVENESS OF INSTRUMENTS**

22. Have you ever been involved in planning of the area?
23. If yes, give explanations
24. Have the buildings you undertake been approved?

### **APPENDIX II**

#### **INTERVIEW SCHEDULE FOR PHYSICAL PLANNERS**

1. What are the land use systems?
2. What are the land use control tools?
3. Is there any land use plan for the area surrounding NNP?
4. How long does the planning review process take?
5. How long is the plan approval valid for?
6. What is the minimum lot size allowed for areas adjacent to the park?
7. What are the challenges faced in planning for areas around NNP?
8. What are the mechanisms for addressing these challenges?
9. What measures can be put in place to improve planning of the area?

### **APPENDIX III**

#### **INTERVIEW SCHEDULE FOR KWS STAFF**

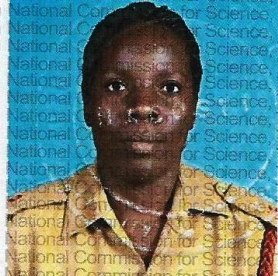
1. What are the challenges faced by the park?
2. What are the mechanisms for addressing these challenges?
3. What are the common types of conflicts experienced?
4. What are the factors precipitating these conflicts?
5. How do you respond to conflicts in the areas adjacent to the park?
6. How do you prioritize the conflicts received?
7. How do you engage the locals and other stakeholders in conflict management?
8. What tools do you use to manage conflicts?
9. How have the changes outside affected the integrity of the park?
10. Is there a plan for the area under NNP?
11. IF yes, how long does the review process take?

APPENDIX IV

RESEARCH PERMITS

**THIS IS TO CERTIFY THAT:**  
**MISS. GRACE ALIVISTA MWENDWA**  
**of UNIVERSITY OF ELDORET, 1175-50300**  
**MARAGOLI, has been permitted to**  
**conduct research in *Kajiado, Machakos***  
**Nairobi Counties**  
**on the topic: *EFFECTIVENESS OF***  
***SPATIAL PLANNING IN RESOLVING LAND***  
***USE CONFLICTS AROUND PROTECTED***  
***AREAS: THE CASE OF NAIROBI***  
***NATIONAL PARK***  
**for the period ending:**  
**6th March, 2018**

**Permit No : NACOSTI/P/17/63801/15554**  
**Date Of Issue : 6th March, 2017**  
**Fee Received :Ksh 1000**




**Applicant's Signature**


**Director General**  
**National Commission for Science**  
**Technology & Innovation**

**CONDITIONS**

- 1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.**
- 2. Government Officer will not be interviewed without prior appointment.**
- 3. No questionnaire will be used unless it has been approved.**
- 4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.**
- 5. You are required to submit at least two(2) hard copies and one (1) soft copy of your final report.**
- 6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice**



**REPUBLIC OF KENYA**



**National Commission for Science,**  
**Technology and Innovation**  
**RESEACH CLEARANCE**  
**PERMIT**  
**Serial No.A 13011**  
**CONDITIONS: see back page**



ISO 9001:2008 Certified

KWS/BRM/5001

10 February 2017

Ms Grace A. Mwendwa  
P.O.Box 1175-50300  
**MARAGOLI**  
e-mail: [tracygee526@yahoo.com](mailto:tracygee526@yahoo.com)  
mobile: 0725605584

Dear *Grace*

**PERMISSION TO CONDUCT RESEARCH IN NAIROBI NATIONAL PARK AND ENVIRONS**

We acknowledge receipt of your letter dated 27<sup>th</sup> January 2017 requesting for permission to conduct research on a project titled: '**Effectiveness of land use planning and resolving land use conflicts around protected areas: the case of Nairobi National Park**'. The study will generate data and information to enhance sustainable conservation and management of Nairobi National Park and adjacent community land.

You have been granted permission to conduct the study from **February 2017 – February 2018** upon payment to KWS academic research fees of **Ksh. 6,000** (Masters Study). However, you will abide by the set KWS regulations and guidelines regarding acquisition and dissemination of information and that the information acquired will be used for research and education purposes only. You will distribute the research questionnaires to the officers listed below for administration.

You will submit a bound copy of your MSc thesis to the KWS Deputy Director, Biodiversity Research and Monitoring on completion of the study.

Yours *Sincerely,*

**DR. THADEUS OBARI, PhD**  
**FOR: DEPUTY DIRECTOR**  
**BIODIVERSITY RESEARCH AND MONITORING**

Copy to:

- Head, Lands Management
- Head, Environmental Planning and Compliance
- Head, GIS and Information Services
- Senior Warden, Nairobi N. Park
- Senior Scientist, SCA

## 7 APPENDIX V

## 8 GRID CO-ORDINATES FOR CONFLICT POINTS

PLACE	2009 Eastings	Northings
	261529	9859080
	254485	9846592
	245612	9861494
	262339	9870840
	259121	9363144
	274595	9840496
	265577	9862370
	258579	9845138
	239118	3627836
	237880	9861056
	261387	9865528
	273046	9840000
	254492	9856620
	262781	9826516
	267900	9838960
	268928	9845710
	264415	9843924
	246834	9852730
	273167	9859054
	264821	9847150
	267320	9846020
	273798	9846380
Emakoko	263967	9844080
Rimpa Estate	246419	9842038
Enkamuriaki	255860	9844531
Lonchani	273742	9813236
Sholinge	255685	9836912
Ngurunga	271400	9844921
Sholinge	255805	9837308
Empakasi	268543	9841543
Empakasi	267404	9842464
	2010 Eastings	Northings
	262417	9854773
	267987	9848453
	271109	9844793
	258352	9868582

	251786	9867179
	262509	9866485
	255483	9853501
	262486	9855871
	252364	9856761
	269233	9840787
	267693	9838355
	271358	9833760
	272507	9838442
	267740	9824002
	260523	9832218
	262385	9838189
	259138	9838945
	253892	9844962
	251166	9846608
	250021	9844624
	248616	9841066
	251165	9841854
	254984	9842343
	256494	9843035
	257115	9844357
	255771	9844449
	256632	9845872
	254565	9846560
	253113	9846583
	251441	9846708
	255100	9839014
	253109	9837265
	258115	9839303
	254314	9835799
	253320	9831287
	247290	9828384
	245584	9823554
	252253	9823824
	245930	9855672
	242042	9857166
	256485	9861109
	250526	9850084
	247039	9852744
	243690	9850511
	259637	9861013
	263344	9818111

	261910	9819868
	256525	9821504
	256561	9824744
	270785	9834648
	261540	9834822
	260161	9838022
	261914	9842398
	268424	9841190
	272953	9839780
	272941	9840288
	272007	9840535
	271394	9840786
	271013	9841264
	269314	9838918
	268594	9839112
	268648	9838574
	268189	9839997
	267292	9839477
	268319	9841152
	267320	9840871
	264313	9841977
	266819	9842353
	266611	9842785
	265582	9843138
	266338	9841840
	267160	9840677
	265893	9841130
	264006	9842112
	264001	9840960
	<b>2011 Eastings</b>	<b>Northings</b>
	255989	9845348
	255908	9845926
	256635	9845906
	256684	9844708
	255627	9844478
	256446	9844467
	257139	9844371
	255617	9843841
	253550	9843100
	252331	9844471
	252730	9846227
	258273	9842470



	262342	9843890
	260454	9845689
	263613	9842615
	261152	9841152
	258874	9838138
	252330	9838728
	242694	9838927
	245981	9829956
	257476	9827230
	255742	9825682
	255863	9823961
	253350	9823602
	260058	9821228
	271920	9821054
	269293	9829654
	269961	9827566
	264525	9832770
	270592	9835499
	270056	9838672
	270709	9839545
	270556	9840260
	268667	9839721
	268614	9839125
	268178	9839202
	267903	9838969
	267746	9839777
	268654	9840456
	269975	9841093
	270975	9841220
	270641	9841526
	268467	9842009
	268040	9842131
	268221	9841642
	268005	9841095
	267371	9840832
	267248	9840396
	267716	9840401
	267506	9839871
	267762	9839732
	268173	9839174
	268594	9839098
	268508	9840200

	268663	9840456
	267897	9838981
	266707	9838664
	266402	9839078
	265932	9839313
	272029	9840505
	272787	9840441
	271691	9840886
	271223	9841413
	270990	9841212
	272042	9842306
	273502	9844482
	269576	9845845
	273581	9850466
	250374	9848472
	251717	9847393
	251474	9846422
	252791	9846465
	254596	9846668
	249647	9844153
	251129	9852212
	246062	9854787
	254739	9863040
	257894	9855264
	262537	9852225
	254056	9868239
	248401	9862106
	261292	9866175
	261345	9854803
	260612	9837141
	260523	9841325
	260531	9833123
	260156	9825489
	<b>2012 Eastings</b>	<b>Northings</b>
Muthaiga	257545	9861991
Kitengela	272455	9837283
Empakasi	266070	9838945
Kitengela	271799	9837921
Lang`ata Barracks	253434	9852604
Kipeto	250855	9836825
Kitengela	269446	9838493
Athi River	275312	9838630

Rongai	251782	9846011
Kipeto	244119	9826252
Muthaiga	258695	9861876
Bomas	251894	9852106
Rongai	249322	9845185
Kabete	251894	9861778
Maasai Lodge	256655	9846745
Maasai Lodge	256878	9847003
Multi Media	251738	9847134
Kileleshwa College	253972	9858466
Emakoko	259275	9846289
Ngurunga	271003	9844875
Ruaraka	264083	9861682
Kitengela	270765	9838567
Embakasi	265989	9853108
Mukoma	250439	9848037
Karen	243354	9854212
Embakasi	264828	9851830
Kitengela	2700396	9837665
Peponi Preparatory School	272218	9869375
Kitengela	272131	9836169
Empakasi	268067	9840951
Kipeto	2476841	9830608
Empakasi	268581	9840671
Empakasi	266869	9836991
Kitengela	277901	9838097
Runda	258973	9864569
Ruai	277351	9860737
Old Kitengela	272847	9835586
Kiambu	260015	9866859
East Gate	265265	9854293
Sholinge	255858	9837309
Mukoma	250319	9847572
Swara Area	258325	9855191
Oloosirkon	255634	9844876
Kiserian	243528	9842178
Kiserian	246379	9842725
Kipeto	247172	9826808
Kipeto	242988	9829611
	<b>2013 Eastings</b>	<b>Northings</b>
Kipeto	248560	9834185
Kipeto	237172	9843845

Kitengela	270219	9835105
Sholinge	254941	9838240
Embakasi	266411	9851908
Parklands	257737	9859906
Peponi Road	254637	9862077
Kitengela	271736	9833299
Empakasi	268531	9841203
Sholinge	252413	9838201
Athi River	274017	9838522
Laiser Hill	247896	9845090
Muthaiga	257422	9861992
Central Workshop	252277	9874112
Empakasi	269681	9841655
Emakoko	264022	9844041
Kiambu	263776	9872475
Empakasi	268061	9842129
Lifespring Academy	253777	9854363
Sholinge	254305	9835223
Old Kasasi	246231	9842635
Muthaiga	259322	9860817
Kipeto	237021	9829449
Ruai Jonah School	276563	9859950
Rongai	252521	9846280
Emakoko	264306	9843692
Muthaiga	256405	9861505
Kari Kabete	249401	9860353
Ngurunga	271386	9844813
Nhguruhga	271510	9844635
Tuala	255699	9845451
Emakoko	265301	9843895
Kitengela	268154	9836626
Kitengela	266773	9838890
Muthaiga	258441	9861167
Tuala	255824	9844280
Ngurunga	271608	9844883
South C	258081	9854170
Imara Daima	261864	9853436
Ngurunga	271072	9844933
Kitengela	269600	9832348
Empakasi	269300	9841595
Kitengela	273616	9833151
Cheetah Gate	273333	9840724

Kipeto	244280	9830042
APZ	274465	9837161
Multi Media	251751	9847146
Rongai	252081	9842860
Muthaiga	258520	9860194
Sholinge	259223	9834867
Carnivore	255361	9852835
Kiambu	255600	9868695
Runda	259405	9864810
Muthaiga	259077	9861177
Kiambu	259965	9872201
Kiambu	255782	9875469
Ngoroi	248984	9845574
Maasai Lodge	256581	9846759
Banda Gate	251638	9848755
IUCN	251335	9847754
Kiambu	247583	9869988
Kitengela	265731	9834332
Kipeto	253478	9829915
Tuala	256345	9844439
Empakasi	270980	9841207
Rimpa	246361	9841881
Muthaiga	259606	9860584
Ngoroi	248750	9847278
	<b>2014 Eastings</b>	<b>Northings</b>
Olooikitosh	255655	9824905
Kitengela	273229	9836393
Kitengela	273327	9836463
Empakasi	269935	9841126
Empakasi	269599	9841383
Kipeto	249167	9825907
Emakoko	259534	9846485
Biuble School	257278	9855263
Karen	243137	9853436
Kipeto	246185	9829246
Kitengela	272254	9836394
Emakoko	258800	9846435
Emakoko	258883	9845772
Rimpa Estate	246419	9842035
Kipeto	251501	9822070
Kitengela	272040	9837257
Kariobangi North	264272	9861341

South Mayfair Hotel	256107	9860281
Mukoma Road	250267	9848039
Kitengela	272842	9831547
Maasai Lodge	256654	9846745
Kitengela	270806	9836781
Kiambu	255896	9868901
Ruaka	253741	9866196
Kitengela	270778	9838145
Kipeto	238860	9827377
Empakasi	260975	9841515
Empakasi	268654	9841087
Empakasi	271006	9841241
Sholinge	255848	9837307
Mukoma	250361	9847968
Garden Estate	262073	9864598
Kasarani	266884	9863935
IUCN	251228	9847685
Spring Valley	254868	9861107
Kitengela	271208	9837589
Memorial Hospital	266510	9855623
Empakasi	270832	9840712
Kitengela	269843	9836080
Mukoma	250269	9848115
Njiiru	269374	9861349
Njiiru	268885	9861533
Kitengela	269804	9838316
Old Kitengela	268410	9836744
Brookhouse	251178	9851071
Kitengela	269589	9839489
Ruai	278721	9859280
Emakoko	257920	9845020
Ruai	275784	9860269
Tinganga	258329	9874101
Kitengela	274307	9835262
Premier School	258169	9859843
JKIA	267599	9850323
Olookitosh	252752	9831084
Rongai	250745	9845604
Empakasi	270604	9839728
Kitengela	268849	9834666
Bomas	252013	9852087
Karen	244368	9853807

Bomas	251948	9857834
Oloosirkon	255767	9844922
Wasaa Road	251576	9847943
Puyangati	254793	9863185
	<b>2015 Eastings</b>	<b>Northings</b>
	259546	9830464
	253113	9846570
	239945	9858246
	254082	9862012
	268341	9840272
	260380	9830082
	247792	9857012
	260191	9868450
	264686	9843759
	255597	9830502
	256580	9836087
	268431	9842064
	269049	9841560
	266969	9841906
	250999	9822198
	276959	9839728
	275358	9325462
	270673	9841592
	249164	9848758
	253931	9861894
	268431	9842064
	269049	9841156
	266969	9841906
	250999	9822198
	276959	9839728
	275358	9325462
	270673	9841592
	249164	9848758
	253931	9861894
	268924	9841428
	267018	9843684
	261224	9843932
	249929	9826340
	249696	9826380
	268921	9845922
	265168	9850000
	249926	9826298

	249585	9826356
	<b>2016 Eastings</b>	<b>Northings</b>
	257818	9842301
	257302	9842262
	257725	9842517
	257869	9843326
	257534	9843250
	257259	9843992
	256794	9843671
	266831	9811587
	261529	9859080
	254485	9846592
	245612	9861494
	262339	9870840
	259121	9363144
	274595	9840496
	265577	9862370
	258579	9845138
	239118	3627836
	261387	9865528
	273046	9840000
	254492	9856620
	262781	9826516
	267900	9838960
	265395	9842772
	263361	9841504
	265247	9842807
	265152	9842760
	265143	9842758
	265078	9842840
	265104	9842621
	265132	9842290
	265127	9842321
	265132	9842290
	265127	9842321
	261106	9842495
	260545	9842810
	260463	9842974
	261390	9843908
	261381	9843910
	261339	9843869
	261365	9843955



	260443	9843123
	260484	9843274
	260457	9843287
	259962	9843432
	259556	9843271
	259717	9843446
	259424	9843209
	259708	9843460
	259426	9843235
	259438	9843272
	260342	9844625
	264986	9836365
	264986	9836365
	257783	9846429
	257838	9846115
	257849	9846069
	257875	9846032
	257945	9845642
	258347	9846208
	258566	9846194
	258229	9845630
	258598	9846082
	258675	9845807
	258735	9845606
	258726	9845327
	258741	9845128
	257917	9842095
	257916	9842095
	257785	9842128
	257818	9842301
	257302	9842262
	257725	9842517
	257869	9843326
	257534	9843250
	257259	9843992
	256794	9843671

## 9 APPENDIX VI

### 10 SIMILARITY REPORT

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