LAND USE CHANGE AND ITS IMPACT ON LIVELIHOODS:

A CASE STUDY OF KALOKOL DIVISION,

TURKANA COUNTY, KENYA

By

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DECLARATION

This thesis is my original work and to the best of my knowledge has not been presented for a degree in any other University.

Signed…… Date…….

Mark Ewesit Ewoi

This Thesis has been submitted for examination with my approval as University Supervisor.

Signed …… Date…….

Dr. Fridah W. Mugo

DEDICATION

This Thesis is dedicated to my late parents Mr. and Mrs, Ewoi, my wife Margaret Ewesit and our children: Gift, Abigail, Gideon and Joshua.

ACKNOWLEDGEMENT

I do acknowledge intellectual guidance and advice of my supervisor Dr. Fridah Mugo in the research and report writing process. Urban and Regional Planning master's students – class of 2010, for their moral and comrade - support spirit. David Samal, Nanok Benedict, Seline Esinyen and Echip Obed for assistance during data collection stage of the research. Above all, I, give God all the Glory for strength and wisdom offered to me during the entire research process of data collection, analysis and compilation.

ABSTRACT

Land use in Turkana County has been punctuated by radical disruptions, caused by the containment policy during and after the colonial period and recurrent droughts coupled with intertribal conflicts during the post-Independence period. This study was undertaken to determine the land use change that has occurred and its impact on livelihoods in Kalokol division, in Turkana County.

The study aims were to determine the type of land use change, examine impacts of land use change on community livelihoods, assess the resultant effect of land use change on gender roles, determine community coping strategies of land use change and recommend measures and strategies to minimize negative impacts of land use change on Kalokol community livelihoods.

The study adopted a survey design and purposively selected two of the three locations in Kalokol division which has a total population of 42,172. One sampled location is situated on the Lake shore while the second one is about three kilometres away from the lake shore for comparison. The data collection methods adopted by the researcher were documents review, face to face interviews, focus group discussions, observations and photography. The research instruments used included a semi-structured questionnaire, an institutional and focus group discussion guide, an observation form and a camera. Respondents from 90 households and 5 key informants were interviewed. Two focus group discussions one for men and another for women were held.

The findings show that the main land use changes are: declining nomadic pastoralism and increasing permanent human settlement, fishery and business enterprises. They depict a strong positive correlation (r= 0.989) between land use change and decline in the major sources of livelihoods in Kalokol. The findings further indicate a significant change in both men and women's roles in Kalokol as a result of land use change. Nomadic-pastoralism and basket/mat weaving are Key community coping strategies employed for survival. Research recommends formulation of comprehensive policies and plans by the government in conjunction with development agencies to promote, protect and enhance pastoralism as a land use and a source of livelihoods. In addition, the pastoral community needs to embrace diversification of livelihoods and gender roles to enhance food security in Kalokol division.

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ABBREVIATIONS AND ACRONYMS

ASAL	Arid and Semi-arid Lands
CFCs	Chlorofluorocarbons
DDAs	Discrete Development Areas
EIA	Environmental Impact Assessment
FAO	Food and Agricultural Organization
FoLT	Friends of Lake Turkana
GIS	Geographical Information System
GoK	Government of Kenya
Gt	Gigaton
HH	Household
IPC	Intergovernmental Panel on Climate
KFSSG	Kenya Food Security Steering Group
KNBS	Kenya National Bureau of Statistics
NEMA	National Environment Management Authority
SPSS	Statistical Packages for Social Scientists
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change

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CHAPTER 1: INTRODUCTION

1.1 Background to the research problem

Brown (1971) in his research records that land use by pastoral nomadic communities is usually characterized by livestock accumulation which consequently leads to overgrazing, environmental degradation and eventual famine. This implies that pastoral development has tended to emphasize so much on livestock rearing, pasture and water demands at the expense of sustainable spatial land use and sound environmental management principles. This endangers the resilience of the system and it is therefore important that development works with, and not against environmentally - sound practices in order to make pastoral land use activities environment friendly and more sustainable in the long term.

According to the Intergovernmental Panel on Climate Change-IPCC (2001), climate change hence land use change is expected to present serious challenges and sometimes opportunities to food security. Food and livestock forage production is influenced by availability of water, nutrients, as well as by temperature (IPCC, 2001). It also increases the risk of heat or drought stress in other areas. For example, livestock are all susceptible to heat stress and drought (IPCC, 2001). Some plant and animal species may be seriously affected or even disappear because they might be unable to adapt (IPCC, 2001). Climate change is only one of the components of a set of global - scale environmental changes affecting ecosystems. Global change includes changes in land use - which are driven by economic, demographic, and social forces (Sala *et al.*, 1996). Global change may also include change in composition of atmospheric gases such as the observed increases in the concentration of carbon dioxide (CO2), methane (CH_4), and Chlorofluorocarbons (CFCs) (Sala *et al.*, 1996). These changes in atmospheric gas composition may have direct impacts on vegetation and by extension livestock or herbivores that feed on vegetation.

The IPCC (2001) reports that major impacts of climate change on livestock production in the rangelands are mediated through changes in net primary production of pasture. The committee states that increased variability of rainfall and temperature is likely to affect the phenology of plant and animal species. It also would affect animal numbers and feeding behavior and would be critical for some pests and diseases and availability of forage for livestock and other mammals. Species composition changes could also occur. Regional climate change and elevated CO^2 may change the balance from more herbaceous species (grasses and herbs) to more woody species (mainly shrubs), subsequently affecting productivity, decomposition, and fire frequency of the system, as well as forage quality. As a result of land use change and possible changes in plant community composition, structure, and forage quality the net primary production and therefore feed availability will change as well.

In Kenya, livestock production (largely through pastoralism) is a production strategy in which people raise herd animals as a means to earn a livelihood, particularly in arid and semi-arid lands (ASALs). Livestock production accounts for 26% of total national agricultural production, over 70% of the country's livestock and 75% of wildlife are in the ASALs (GoK, 2005). Pastoralism relies on the availability of water, pastures and labor to thrive with water as the limiting factor. This shows that the contribution of the arid and semi-arid areas to the national economy is crucial for the development of the country.

Northwestern Kenya is purely an arid and semi-arid (ASAL) region which is occupied predominantly by the Turkana who mainly engage in nomadic pastoralism. However, due to global climatic change and its consequent land use changes, Turkana County inhabitants are massively caught up in the dilemma posed by challenges emanating from land use change. In order to sustainably maintain traditional livelihoods, the pastoral community has to cope and or diversify its livelihoods in future.

KFSSG (2006), reports that due to continuous land use change, fragile semi-arid ecosystem and increasing aridity, most of the people living in Arid and Semi-Arid Lands (ASALS) are on the brink of starvation and nearly all communal coping strategies have been inadequate to reduce vulnerability. This has greatly diminished the impact of food relief efforts taken to mitigate widespread effect of prolonged drought and diminishing livelihoods.

1.2 Problem statement

According to Stave *et al.* (2005), the history of land use in the County has been punctuated by radical disruptions, caused by the containment policy of the colonial period, recurrent droughts and by the intertribal conflicts during the post-independence period. Insecure borders have led to abandonment of more dependable pasture lands, while the more secure areas are over-used. As a consequence, livelihoods all over the County are threatened leading to food insecurity and associated problems in administrative divisions such as Kalokol.

Despite the regular food relief supply and other humanitarian aid interventions from both Governmental and Non-governmental agencies to minimize the problem, this intervention strategy has not resulted into sustainable enhancement of livelihoods, hence the problem of food insecurity continues. In addition, no meaningful research has been carried out to establish the relationship between the observed land use change and impact on livelihoods in the county and in particular Kalokol Division which comparably is at close proximity to Lake Turkana with a lot of fishing potential. It is on this basis that this study seeks to examine the impact of land use change on livelihoods in Kalokol division, Turkana County.

1.3 Purpose of the study

The purpose of the study was to examine the types and impact of land use changes on livelihoods as well as their effect on gender roles in Kalokol division.

1.4 Research questions

The study was guided by the following questions:

I. What type of land use change has occurred in Kalokol division?
II. What are the current Kalokol community livelihoods?
III. How has land use change impacted on Kalokol community livelihoods?
IV. How has land use change impacted on gender roles of the community?
V. What are the community's coping strategies/mechanisms to land use change impact?
VI. What sustainable mitigation measures can minimize negative land use change impacts on the community?

1.5 Objectives of the study

The research objectives were:

- To determine the types of land use change that have occurred since independence
- To examine impacts of land use change on community livelihoods
- To assess the effect of land use change on gender roles in the community
- To determine community coping strategies as a result of land use change
- To recommend sustainable mitigation measures to minimize possible negative impacts of land use change on Kalokol community livelihoods.

1.6 Research hypothesis

The research undertook to test the following hypotheses:

Hypothesis 1

Research hypothesis (**H*a***): There is significant change in land use in Kalokol Division

Null hypothesis (**H*o*)**: There is no significant change in land use in Kalokol Division.

Hypothesis 2

Research hypothesis (**H*a***): There is significant correlation between change in land use and change in livelihoods in Kalokol division.

Null hypothesis (**H*o*)**: There is no significant correlation between change in land use and change in livelihoods in Kalokol division.

Hypothesis 3

Research hypothesis (**H*a***): There is significant change in men and women's role as a result of land use change.

Null hypothesis (**H*o*)**: There is no significant change in men and women's role as a result of land use change.

1.7 Justification of the study

Kalokol is one of the divisions in Turkana County which is along the shores of Lake Turkana which also happens to be one of the largest permanent desert lakes in the world. Despite its proximity to the Lake with fishing potential, Kalokol has constantly attracted internal and external humanitarian relief aid such as food assistance and livestock restocking programs to reduce pangs of hunger and malnutrition among the residents. These interventions have failed to sustainably meet the needs of the community as traditional livelihood-

enhancing strategies keep on diminishing day after day while dependency on relief food aid increases year after year.

It is therefore, imperative to undertake this study as a precursor to generating information necessary to plan for sustainable land use, livelihoods and enhanced food security in Kalokol community. The information would be fundamental to governmental, non-governmental and community based agencies wishing to undertake their projects in Kalokol division for sustainable planning and development.

1.8 Significance of the study

The study was expected to benefit the stakeholders as follows:

- Guide community based organizations, non-governmental organizations and government ministries concerned with formulating policies related to land use change and impact to livelihoods.
- To sensitize various stakeholders on importance of embracing sustainable land use practices and sound environmental management and conservation measures so as to avert possible future negative impacts of land use change on livelihoods.

1.9 Assumptions

I. Land use and climate change has had impact on livelihoods hence gradual change of socio-economic lifestyle of Kalokol community.
II. Traditional livelihood-enhancing strategies keep on diminishing day after day and dependency on relief food aid increases year after year.

1.10 Scope of the study

Geographically, the study covered impact of land use change on livelihoods in Kalokol Division, with an approximate area of 2139.9 km^2 and total population of 42,172 according to the Kenya National Bureau of Statistics (KNBS)

population census of 2009. Conceptually, it covered aspects of land use change that have direct bearing on socio-economic and cultural performance of the community.

1.11 Definition of operational terms

The following terms were used in the study as follows:

Land use change in this research refers to alteration of natural, physical character of land over time by human action through human settlement patterns, migration pattern, in light of social, economic, environmental and technological developments over space.

Livelihoods - Refers to the source of living, revenue or income. This in the study focuses on nomadic pastoralism, fisheries and agro-pastoralism.

Ecosystem- Refers to the spatial network of interactions among living things, the environment and residents of the area.

Land cover – This is the physical material on the surface of the earth. Land covers include grass, asphalt, trees, bare ground and water.

CHAPTER 2: LITERATURE REVIEW

2.1 Background information

For the past several thousand years, human beings have played an increasingly large role in modification of the global environment (Ojima, et al., 1991). In the past century human population has increased more than fivefold to 5.3 billion and atmospheric concentrations of carbon have increased by 25% (Ojima, et al., 1991). Water quality and soil fertility in many regions of the world have been severely degraded and the biotic systems dissected, depleted and endangered by increasing human demands (Ojima, et al., 1991).

To understand the cause and effect of global land change, the scientific community must focus greater attention on the social context (i.e. cultural, political, demographic and economic factors) influencing human impact on the global environment. Human activities are a major factor contributing to global change and overriding natural changes to ecosystems brought on by climate variation of the past few thousand years (Turner, *et al.*, 1990). Further, agricultural (including livestock rearing) and other land uses have modified landscapes and altered plants and animal communities of many ecosystems all over the world. Similarly, land management practices such as fire, grazing and tillage affect ecosystem composition, cycling of nutrients and distribution of organic matter.

Land-use change can be a factor in CO_2 (carbon dioxide) atmospheric concentration, and is thus a contributor to climate change. The Intergovernmental Panel on Climate (IPC, 2001), estimates that land-use change (e.g. conversion of forest into agricultural land) contributes a net of 1.6 ± 0.8 Gigaton (Gt) carbon per year to the atmosphere. For comparison, the major source of CO_2, namely emissions from fossil fuel combustion and cement production amount to 6.3 ± 0.6 Gt carbon per year. This decision sets out the

rules that govern how Kyoto Parties with emission reduction commitments account for changes in carbon stocks in land use, land-use change and forestry. It is mandatory for Annex 1 Parties to account for changes in carbon stocks resulting from deforestation, reforestation and afforestation and volunteer to account for emissions from forest management, cropland management, grazing land management and re-vegetation (UNFCCC, 2011).

In Kenya, pastoralists have depended on the rangelands for their survival and livelihoods. The livelihoods of pastoralists are directly linked to their livestock, and thus to the environment in which they live. The shrinking land base and the changing climatic conditions further worsen availability of pasture in the already dry pastoral regions. This calls for better interventions in livestock production systems to make the best out of their environment and changing land use. The diet of pastoral communities is mainly milk and meat but with the degradation of the rangelands, recurring droughts and increasing incidence of livestock diseases, their herds are diminishing. They can no longer count on their once plentiful supply of milk and meat and have to supplement their energy intake with cereals, sugar and non animal oils. More and more of the pastoralists have been forced into a cash economy transaction of their businesses. When their herd numbers are decreasing and livestock prices poor they resort to unsustainable exploitation of the rangeland resources such as land fragmentation for sale to speculators, for subsistence farming, woodland clearing for charcoal and timber, poaching and sand extraction from dry river beds among others. These practices essentially become their businesses and enterprises as alternative sources of livelihood (County livestock Development Plan for Turkana,Pokot,Samburu and Baringo, 2013-2017; Gok,2008).

Turkana County being one of Kenya's Arid and Semi-Arid Lands (ASAL) County situated in the northwest part of Kenya bears the effect of global climatic change and thus land use change. The County lies west of Lake Turkana and borders Ethiopia to the northeast, Sudan to the northwest, Uganda to the west,

Baringo and West Pokot to the south, Samburu to the southeast and Marsabit to the east. It is the largest County in Kenya and comprises of seventeen divisions, fifty-six locations and one hundred and fifty six sub-locations. The County covers a landmass of 77,000 square kilometers and has an estimated population of 855,399 with the major livelihood being pastoralism. The other livelihood groupings are agro-pastoral, fisher folk and formal employment (KNBS, 2009).

The County, although largely marginal, contains pockets of high potential rangelands which are crucial to land use patterns. The mountains, hills, plains, streams, rivers, Lake Turkana and valleys create a highly heterogeneous ecosystem, but the marginal nature of the environment creates survival risks, which the pastoralists must cope with by multi-resource exploitation. In contrast to many East African pastoralists, the Turkana employ diverse food-procuring strategies which include fishing, farming, and gathering of wild foods, in addition to multi-species pastoralism. It is, however, the latter which dominates their economy.

Little (1985) narrates that mobility is the principal mode of resource use in the county, in response to the patchy rainfall distribution and concomitant patchy vegetation productivity. To take the best advantage of the diverse land resources and environmental variability, the Turkana manage multiple species of livestock, comprised of camels, goats, sheep, cattle and donkeys. Since each species has distinct dietary needs, the Turkana are able to exploit different expanses of the range during any period of the year. Cattle are confined to mountain areas and river courses during the dry season, and moved to the plains during the wet season, while the plains are endowed with sufficient browse for sheep and goats and camels during the wet and the dry season as well.

Pasture and water resources seldom reoccur from year to year with any uniformity; rather, their distribution is characterized by patchiness. Thus, movements between different pastures are varied; firstly because of variable fodder and water supplies, secondly, because of poor security and thirdly, because of the particular requirements of each species (McCabe *et al.*, 1985). To contend with these three factors, the Turkana pastoralists have evolved a highly flexible social system. The basic management and social unit is the *awi (family)*, consisting of a man, his wives, children and other dependents. Each *awi* manages the multiple livestock species - sheep, goats, cattle, camels and donkeys - by dividing the management and labour requirements between different sub-family units. The *awi* unit is autonomous from any other family, but each *awi* forms part of a flexible neighborhood (*adakar*; plural *ngadakarin*) composed of members from one territorial group, who negotiate rights for pasture and water rights with neighbouring groups. The association of *adakar* is therefore a strategy to get access to insecure pastures, when mobility is required (Jagt, 1989; Akabwai, 1992).

Four territorial Turkana groups, inhabiting different pastoral land use areas in the county are compared; the *Ngisonyoka* (south Turkana) the *Ngiyepakuno* and the *Ngilukumong* (Tarach group), the *Ngikamatak* (central Turkana) and the *Ngibochoros* the lake zone group where the study is based. *Ngibocheros* inhabit a barren territory along the shores of Lake Turkana, and are quite prone to recurrent droughts and food insecurity. To cope with this stress, they employ diverse survival strategies, including gathering of wild fruits, fishing, managing small stock and reliance on famine relief aid.

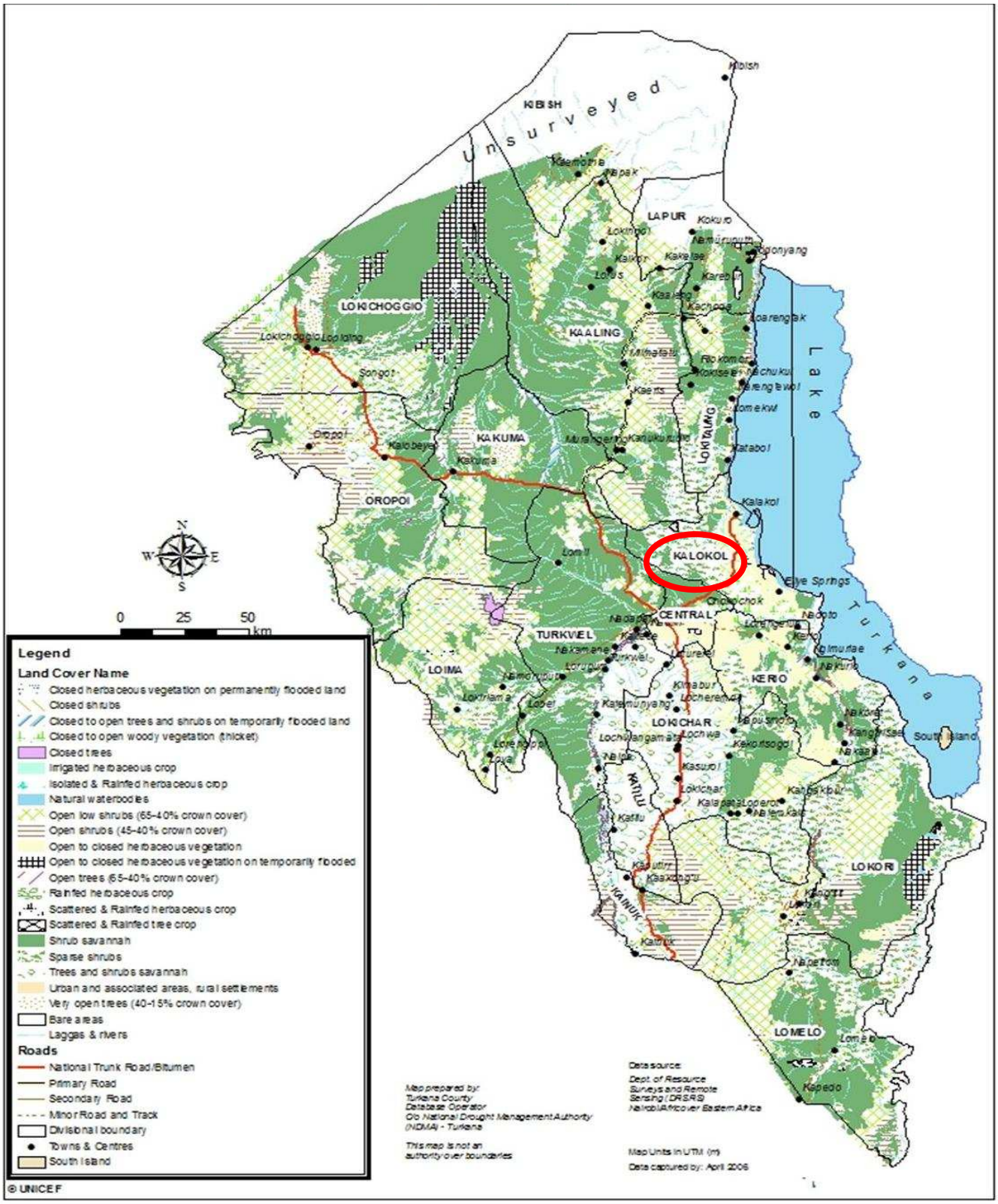
From the above examples, it is evident that mobility is necessary in deciding to temporarily exploit particular key resource patches and that such mobility therefore requires resolution of land use and management conflicts between different groups. Since the last century, however, patterns of land use have

been slowly changing, as after colonization, borders were fixed and access to key resources was curtailed. The integral Turkana tribal land area was placed under more than one political entity, which conflicted with indigenous resource use strategies. This meant that within the new fixed tribal boundaries, the environment was placed under more severe pressure causing depletion of vegetative land cover and in pastoral rangelands.

Lake Turkana is at an elevation of 360 meters while the surrounding basin ranges from 375 to 914 meters above sea level. An extinct volcano, Mount Kulal, rises 2,285 meters and is located just east of the lower section of Lake Turkana. Today the land cover and general environment around Lake Turkana is very dry, but the climate of the region was fairly wet and humid at various areas within the county in the past (Avery, 2010; Jesse, 2011). This depicts conditions that might have been favorable for rearing large herds of cattle in the county by early Turkana region inhabitants. The threat to land cover calls for effective and collective natural resource vegetation cover management from both the government and local community.

According to Olang (1984), *Vegetation* is the product of its environment. The environment includes land form, soil, climate, animal and man. Often, the present vegetation represents a stage of regression from a more highly developed or rigorous community which has been brought under stress, perhaps through use by man. *Land cover* on the other hand is the physical material at the surface of the earth. Land covers include grass, asphalt, trees, bare ground and water

Map 1: Turkana County Land Cover



Source: Turkana Arid Lands, 2012

2.2 Land use change from post independence, livelihoods and food security coping mechanisms

The history of land use in the County has been punctuated by radical disruptions, caused by the containment policy of the colonial period, recurrent droughts and by the intertribal conflicts during the post-Independence period. Insecure borders have led to abandonment of more dependable pasture lands, while more secure areas are over-used. As a consequence, the food security situation has worsened (Stave et al, 2005).

The Turkana employ diverse mechanisms to ensure food security options. Livestock are the media through which social security links are maintained. Livestock are exchanged in a reciprocal system of rights and obligations between "bond-friends" (Gulliver, 1955), in which mutual insurance is maintained over a wide range of relationships, varying from close friends to members of the same age-group or special friends (Jagt, 1989; Muller, 1989; Gulliver, 1955).

In the pre-colonial period, bond-friendships were not restricted to Turkana borders. Livestock transactions served to maintain "pathways of social interactions" which cut across societal boundaries and linked neighboring tribes (Sobania, 1990). According to Sobania, inter-societal bond friendships grew out of the mutual economic interests between two individuals who previously shared as trading partners, out of the sharing of a grazing area which brought alien herdsmen into prolonged contact or out of the hospitality extended to a neighboring traveler on a visit.

Such relationships are very beneficial in enhancing livelihoods hence sustainable individual food security in the event of disasters such as raids, droughts and diseases, provided the disaster is not widespread. However,

pauperization occurs when the system of reciprocity breaks down, which happens if the local economies of all the bond- friends are devastated by regional drought, epidemics or widespread raids.

According to Sobania (1990), during the latter part of the 19th century, following famine and epidemics, even wealthy stock-owners were reduced to a state of poverty. The worst-affected groups were forced to seek assistance among neighboring tribes. On one occasion, the *Karimojong* went to seek food among the Pokot (Dietz, 1987), while the Turkana went into the *Dassenech* country (Marille from Ethiopia) where the *Dassenech* allowed Turkana refugees to cultivate food on the Mood River delta and along the lake shore. These relationships built over many generations were, however, broken when tribal groups became separated by fixed borders during post independence periods.

Another indigenous food security measure in the Turkana region involves diverse food-gathering strategies. In contrast to many pastoral groups, the Turkana do not practice food taboos like other pastoral groups, the Turkana do not have food taboos, which is probably necessary given the limited choices they have. Although culturally predisposed towards cattle production, gathering of wild fruits is an important activity, especially during droughts. The heterogeneous vegetation presents them with diverse plant species which are utilized as food. For example, Morgan (1980) listed 53 plant species in the menu of the *Ngisonyoka*.

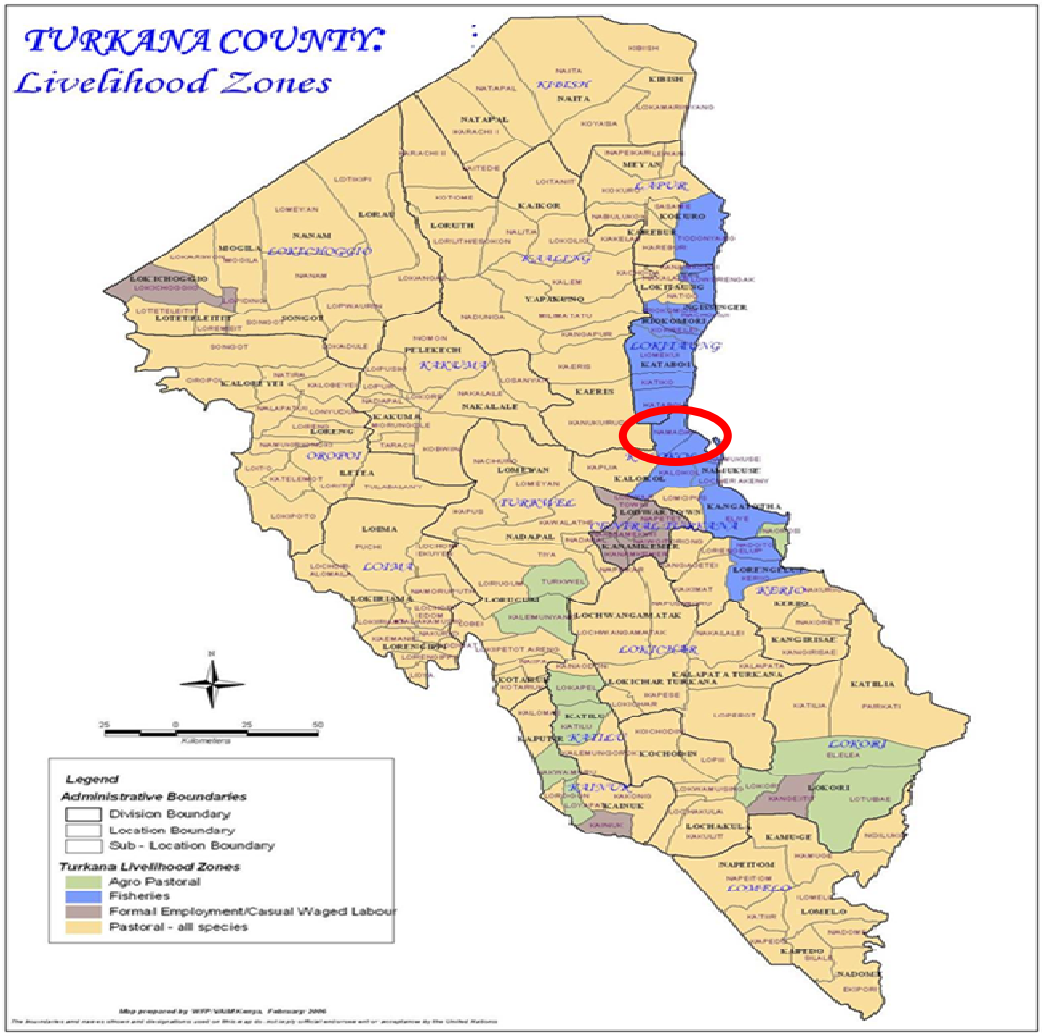
In addition, hunting has been an important means of survival for some Turkana (Clarfield and Lowe, 1991). However, colonial reports noted that the County lacked significant wildlife, which probably disappeared after the introduction of fire arms into the region by the *ngoroko*, who were reported to have carried out indiscriminate slaughter of elephants and buffaloes. The Turkana concede that "there are no animals nowadays", which can be

interpreted to mean that there must have been a period of some relative abundance in the past.

The Turkana also practice small-scale agriculture, relying on floods along the main rivers and the lake shore (Soper, 1985). However, flood-dependent agriculture is a gamble, as crops are washed away whenever floods are excessive, whereas inadequate floods produce insufficient harvests. In spite of its important supplementary role, traditional agriculture does not provide enough surpluses to feed people during the periodic droughts. Furthermore, those groups inhabiting the lake shore such as Kalokol division community are able to supplement their diet with fish from the lake.

According to Turkana arid lands report (2012), Pastoralism is the main subsistence and economic activity in the county. It is estimated that about 60% of the population derive their livelihood from livestock-based activities. Fishing is an important activity along the lakeshore where the study was based. Over the years, fish yields from the lake have been declining due to the drying of the 'Ferguson gulf' in Lake Turkana and the state of insecurity in Todonyang (the mouth of river Omo – feeding into Lake Turkana). Crop production is practiced by agro-pastoralists mainly in pockets of arable land within flood plains and along riverine areas. The harvest is dependent largely on the amount of rain realized in a good year, and the volume of water flowing in the two major seasonal rivers of Turkwel and Kerio. Indigenous fruits are important sources of food, particularly during dry spells. Of the wild fruits, doum palm is the most widely used. It is used for basket and mat making while *acacia tortilis (Ewoi in indigenous language)* is used for firewood and charcoal production.

Map 2: Turkana County Livelihood Zones



Source: Turkana arid lands, 2012

2.3 Land use change and threats to Lake Turkana dependant livelihoods

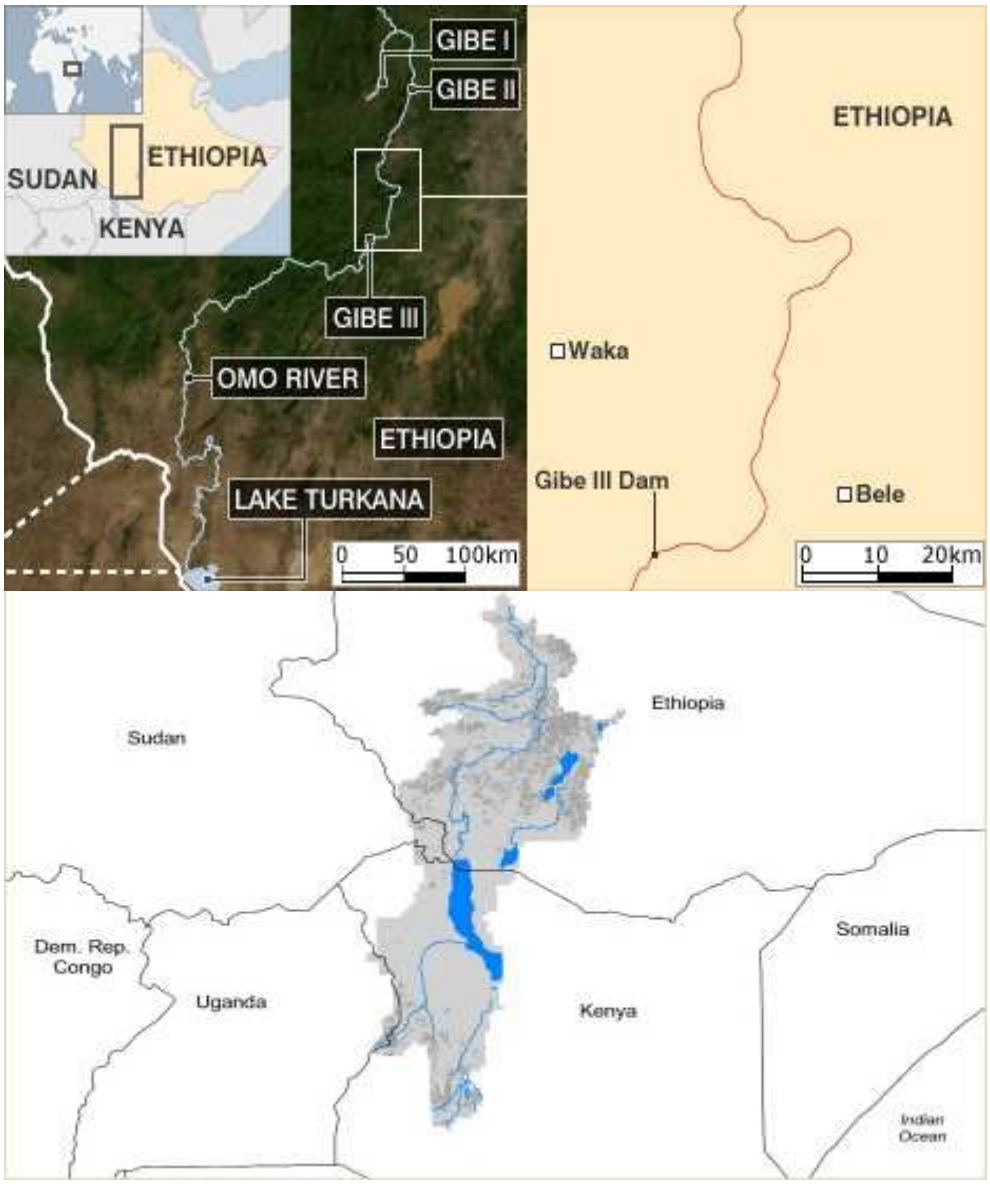
The availability of water plays a crucial role in sustainability of livelihoods around Lake Turkana because that is what determines the fish harvest from the lake, the number of livestock that households can keep and crops to be planted. The main water source in Kalokol is Lake Turkana. Over the years a decline in water levels has been experienced around the Lake.

According to Jesse (2011), Lake Turkana receives about 90% of its water from Omo River. However, over the years there has been a drastic decline in its water levels. In the 1960s Lake Turkana was around 50-60 feet higher than it is today. A picture of this decline since 1975, 2005 and 2013 is featured below in plates 2, 3 and 4. The decline in water levels is connected to climatic and land use change as a result of human activities such as hydroelectric dams and irrigation being built along the Omo River and River Turkwel.

According to Jesse (2011), controversy surrounding the Gibe III dam stems from the negative environmental and social impacts that it is likely to create. Critics claim that in their rush to complete this project, Ethiopian officials violated international standards and failed to properly assess the impacts that could arise from the addition of this dam. Impacts of this dam include reducing water flow to all areas downstream, along with affecting more than 300,000 indigenous people who depend on the rivers annual floods for cultivation and grazing land. A reduction in water flow is also said to negatively affect fish populations along the river by impacting water inflow patterns. Those who oppose the Gibe III dam claim that the dam will negatively impact societies along the river by reducing river flow and threatening food security even further.

The reduction in water flow along the Omo River will have a direct effect on Lake Turkana and the people living in the area. As mentioned earlier, Lake Turkana receives more than 90% of its water from the Omo River and supports more than eight indigenous groups. The decrease in water levels will cause the lake to become increasingly more salty resulting in altering the ecosystem and wildlife in and around the lake. By filling the Gibe III dam, the water flow to Lake Turkana is said to be reduced by more than 50% along with resulting in a 23-33 feet drop in the depth of the lake (Jesse, 2011). Lake Turkana has a mean depth of 35 metres and a maximum depth of 120 metres.

Figure 1: Gibe dam sites along the Omo River and the potential effect on Lake Turkana



According to Avery Sean (2010), Lake Turkana is a source of livelihood for over 300,000 indigenous communities who are pastoralists, fishermen and agro-pastoralists who depend entirely on the lake to sustain their livelihoods. The various indigenous communities around the Lake Basin include: Turkana, Samburu, El-molo Rendille, Dassanach (Marille), Ariaal, and Gabbra.

Any negative impacts to the lake's ecosystem would disrupt these communities' livelihoods hence their socio-economic lifestyles around the lake, leading to an increase in conflicts for survival in the region. Considering the unstable state of peace in Northern Kenya, such damage to the local economies would invoke a threat to regional stability.

Plate 1: Inhabitants of Lake Turkana

Source: Author, 2013

In 2011, Friends of Lake Turkana (FoLT) founder and director Ikal Angelei wrote to the UNESCO World Heritage Committee alerting them of the threat that the construction of Gibe III Dam in Ethiopia would pose for Lake Turkana and the Lower Omo Valley. Both areas are designated World Heritage status. Ikal's letter spelt out the catastrophic impacts the construction of this mega dam would have on the environment, wildlife, people and local economies of the people dependant on Lake Turkana (FOLT, 2011).

UNESCO World Heritage Committee held their annual general meeting and one item in their agenda was the plight of the two critical sites. At the end of discussions, members resolved that construction of Gibe III Dam was not a wise move. They thus, issued a communiqué urging Ethiopia to "immediately halt all construction on the Gibe III dam" because of the dam's potential threat to Lake Turkana and its dependent communities (FOLT, 2011). The dam's construction, however, has been on-going albeit various communiqué and efforts to halt it from concerned agencies.

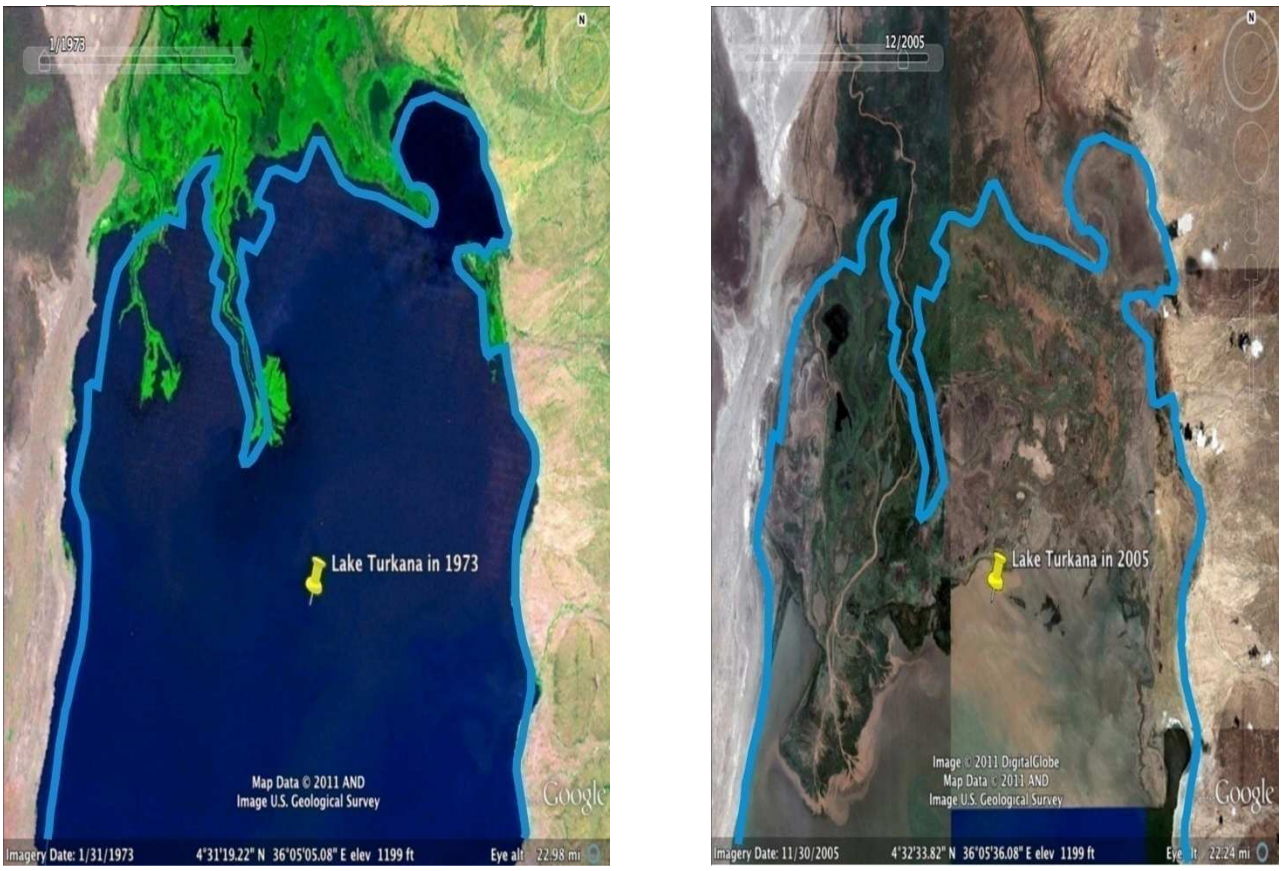


Plate 2: Lake Turkana water levels- L, 1973; R, 2005

Source: Google earth1973 and 2005

Plate 3: Gradually drying up sections of Lake Turkana

Source: Author, 2013

Plate 4: Human settlement encroachment on the drying up sections of Lake Turkana

Source: Google earth, 2013

2.4 Land use change and degradation of the environment

Increase in population was one single most important factor of degradation (Okoti & Ng'ethe, 2004). The study sited that people within the study area in Turkana made a demand mostly on the vegetation in terms of the need for browse and forage for their animals, fencing and material for constructing shelters, water resources and wood-fuel. It was seen that the demand of these resources outweighs the availability. This same phenomenon was also reported by Lusigi (1984); Ormerod (1978) and Lamprey (1983). The availability of a ready market, from within and outside the district, for charcoal, firewood, building materials, livestock, and labor had increased the pressure on vegetation resources.

The land use change in the area as a result of heavy reliance on land has culminated into deforestation and land degradation. Principal cause of deforestation in Kalokol is as a result of clearing woodlands for wood fuel and construction materials. Degradation of the vegetation in the area is as a result of over-grazing leading to soil erosion. Erosion has negative impacts on grazing land and crop productivity by removing the nutrient rich top soil and reducing the soils ability to hold water. When top soils are removed, land is eventually reduced to dry land and eventually rocks. Deforestation and degradation of land results in a reduction in grazing land as well as a decline in crop productivity.

2.5 Land use change and gender roles

Amolo (2009) reports that land use change impacts on both women and men, leading to gender variation coping and adaptation strategies. However, gender coping and adaptation strategies have further been weakened by increased land use change-induced conflicts between Turkana community and neighboring countries pastoral communities from Ethiopia, Sudan, Uganda and intertribal land use conflicts within Kenya such as the case of neighboring Pokots.

Barrow & Mogaka (2007) states that the situation of women and men in pastoral communities is not static, as incidences of drought have led to transformation in the socio-cultural and socio-economic organization of pastoral societies. Due to the loss of cattle and other livestock, women play an active role to ensure family survival through engagement in diversified income generating activities such as sales of livestock products, charcoal burning, sales of firewood, small scale business, casual labor, basket weaving and peasant farm produce.

Further, there has been an increase in the number of female-headed households in the county due to land use induced conflicts. Women are particularly vulnerable to insecurity and conflict. This is because women are responsible for their children and cannot flee during periods of raiding. According to Eriksen & Lind (2005), raiding and killing have led to several women losing their husbands leaving behind women-headed households. Culturally, a woman, once married, belongs to the husband's clan, but in some cases it happens that the clan is less forthcoming with assistance when her husband has died.

Further, Amolo (2009) reports that men dispossessed of livestock are often forced out of the pastoral sector into relief camps or into search for wage labor towns. These gradual changes threaten the hope of recovery as the crucial social ties needed to resume herding are often irrevocably severed.

2.6 Theoretical framework for sustainable livelihoods approach

FAO (2006); Umair (2009) argue that the livelihood theory approach groups' individuals into different livelihoods according to their access to assets (including both material and social resources) and their capabilities to combine

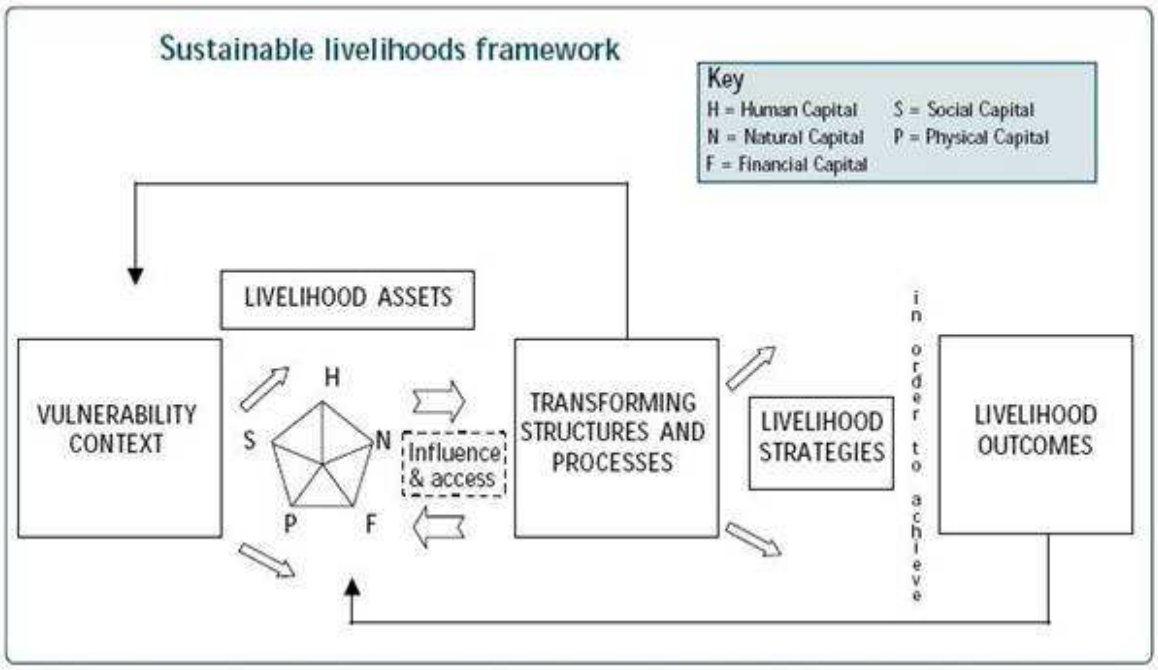
them to livelihood strategies for a means of living. The model breaks access into the five 'capitals' as follows:

a. *Human capital*: Individual skills to labour, knowledge, education and good health
b. *Natural capital*: land, physical features like water bodies and mountains
c. *Financial capital* : access to credit and sources of income
d. *Social capital* : community networks and reciprocity
e. *Physical capital*: infrastructure like markets, shelter, water supply and roads.

The ability to combine these assets to livelihood strategies is influenced by the prevailing transforming structures and institutions and the vulnerability context. The transforming structures and processes are the institutions, organizations, policies and legislations which determine access to the five different types of capital, terms of exchange between the different types of capital and the economic and other returns from livelihood strategies. The vulnerability context presents three main categories of vulnerability: trends, shocks and seasonality which affect assets and livelihood strategies and determine the level of vulnerability.

A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.

Figure 2: Theoretical frame work for sustainable livelihoods



Source: FAO, 2006

Umair (2009) explains that the livelihood framework is increasingly influencing the approach of projects ranging from emergency response, to disaster mitigation interventions. Livelihood profiles are developed to serve as baseline information. The baseline information comprises a set of information dedicated to answering the fundamental question of how people survive in most years.

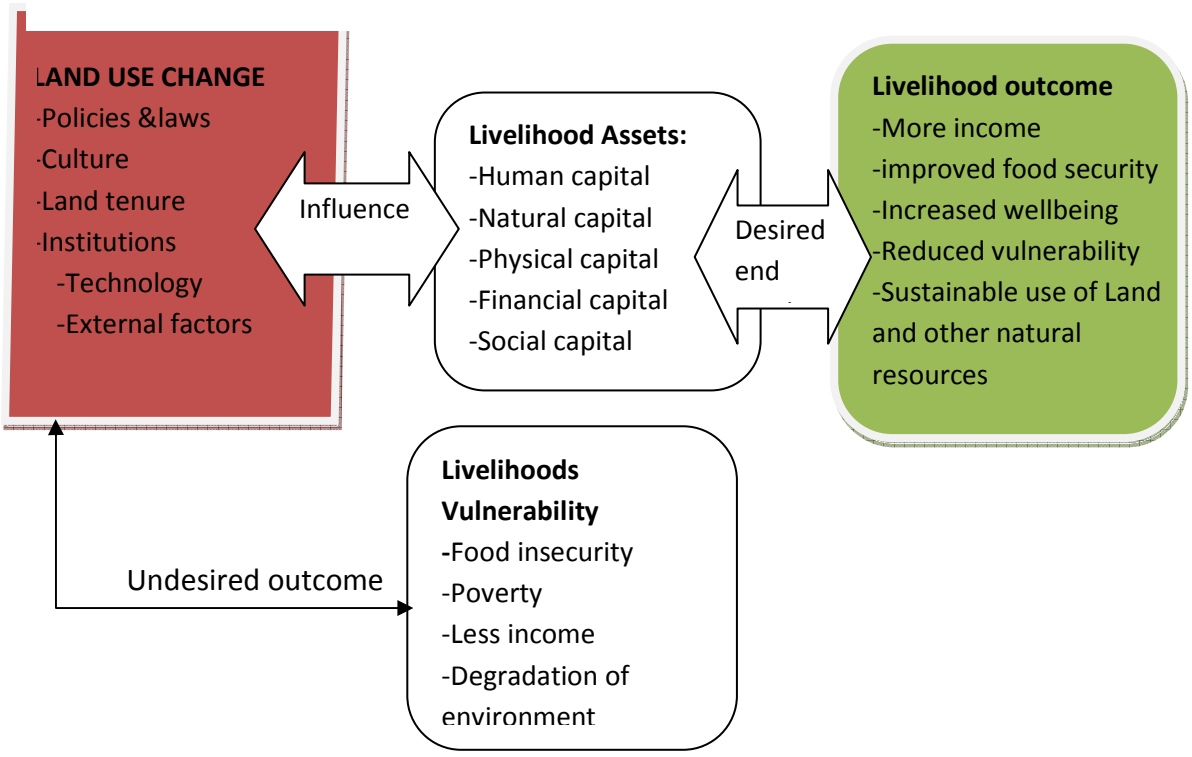
Built from the experience over the past 10-20 years, in 1992, in collaboration with the FAO Global Information and early warning system, Save the Children UK developed a methodology for famine prediction, assessment and monitoring, called the Household Economy Approach (HEA) or Food Economy Approach by translating livelihoods analysis into practical, quantified information for decision makers with a practical geography attached, this model is linking livelihood information to an analysis of the effects that a hazard will have on livelihoods and household food security.

Monitoring the food economy aims to identify livelihood groups that are food insecure or most vulnerable to become food insecure in case a hazard (e.g drought) occurs. Although it is based on foods it uses a holistic approach to get a comprehensive understanding of how people cope and how communities are internally differentiated.

2.7 Conceptual framework

The following conceptual framework is derived from theoretical framework and other theories that demonstrate influencing factors such as land use change process, transforming structures, policies, their impact on livelihoods and vice versa.

Figure 3: Impact on livelihoods conceptual framework



Source: Author, 2013

2.7.1 Land use change influence by policies and laws

Policies and laws contribute directly or indirectly to land use change. In Kenya, there are policies and laws that have over time influenced land use change. Colonial policies on containment of pastoral communities and other laws governing land uses such as trust land/community land influenced either positively or negatively supply of livelihoods assets in a given community for a given time over space. Some of the policies and laws that have been in operation in land use management and administration in Kenya after independence to date are discussed under the following:

2.7.1.1 Physical Planning Act Cap 286 of 1996

The act provides for the preparation and implementation of physical development plans to guide and organize land uses, coordinate distribution of activities and movement of people in space. The Act sets out rules and regulations for management of land as resource and allocation of space to various competing uses. It also sets out the role and duties of the Director of Physical Planning, and local authorities (county governments) in regard to physical development.

2.7.1.2 Environmental Management & Coordination Act, No. 8 of 1999

The legislation was enacted to safeguard environmental issues. The act spells out the general environmental principles aimed at sustainable protection and conservation of environment for posterity. It outlines the procedures for managing environment in the country and it also puts in place the authority (National Environmental Management Authority) to execute the and administer the Act

2.7.1.3 National Land Policy, Sessional Paper No.3 of 2009

This was formulated to reconcile the many land conflicting laws and mismanagement of land as a resource and to manage sustainable use of land. The guiding principle is *to guide the country towards efficient, sustainable and equitable use of land for prosperity and posterity.* The overall objective of the National Land Policy is to secure rights over land and provide for sustainable growth, investment and the reduction of poverty in line with the Government's overall development objectives. Section 103 set out the key issues that need to be addressed in land use planning. These include:

a) Preparation of land use plans at national, regional and local levels on the basis of predetermined goals and integrating rural and urban development;

b) Strategies for human settlement in relation to service centers, growth centers, transport and communication networks, environmental conservation and rural development.

2.7.1.4 The Constitution of Kenya, 2010

Chapter five of the constitution – Land and Environment

Article 60 (1) states that ; land in Kenya shall be held, used and managed in a manner that is equitable, efficient, productive and sustainable, and in accordance with the following principles of:

- Equitable access to land
- Security of land rights
- Sustainable and productive management of land resources
- Transparent and cost effective administration of land
- Sound conservation and protection of ecologically sensitive areas
- Elimination of gender discrimination in law, customs, and practices related to land and property in land
- Encouragement of communities to settle land disputes through recognized local community initiatives consistent with this constitution.
- Among the obligations of the state under Article 69 is to ensure sustainable exploitation, utilization, management and conservation of

the environment and natural resources and ensure the equitable sharing of the accruing benefits. Every person has a duty to cooperate with state organs or other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

2.7.2 Land tenure and culture influence on land use

According to the constitution of Kenya 2010, land is classified as public, community and private. Public land is defined as land lawfully held, used or occupied by state organs. National natural resources such as minerals, game reserves, water catchment areas, national parks are also classified as public land. Community land is any land vested and held in communities identified on the basis of ethnicity, culture or similar community interest. Private land is defined as registered land held by any person under either freehold or leasehold interest. Most of the land in Turkana County is communally owned. In Turkana County, much of the land falls under community category where two land tenure systems exist. These are statutory or formal and customary or informal. The rights to land are held customarily and access to land is determined by kinship/clan relations.

CHAPTER 3: RESEARCH METHODOLOGY

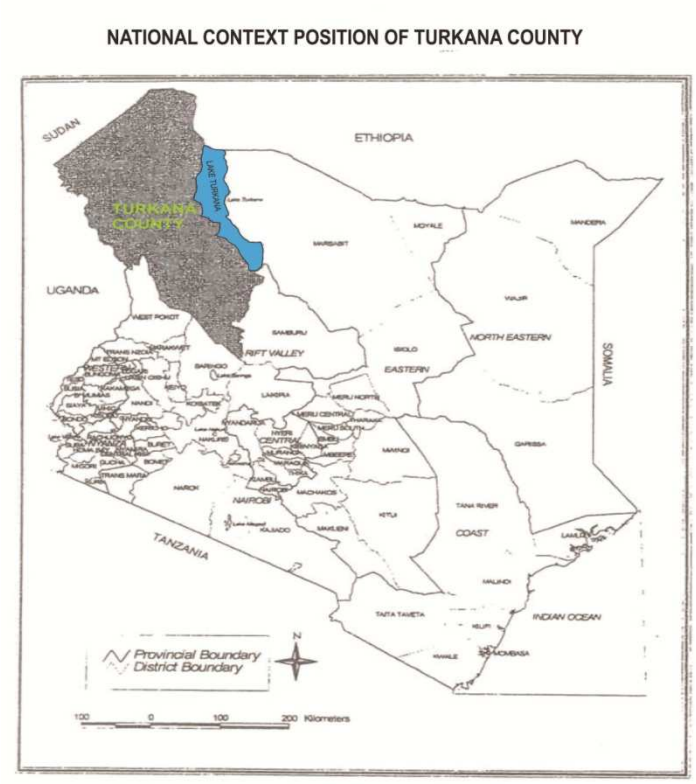
3.1 Research design

The study adopted a non-experimental survey design. This research design is appropriate because it is cost effective, it allows the use of multi-data gathering procedures, and variables comparison and the results can be generalized.

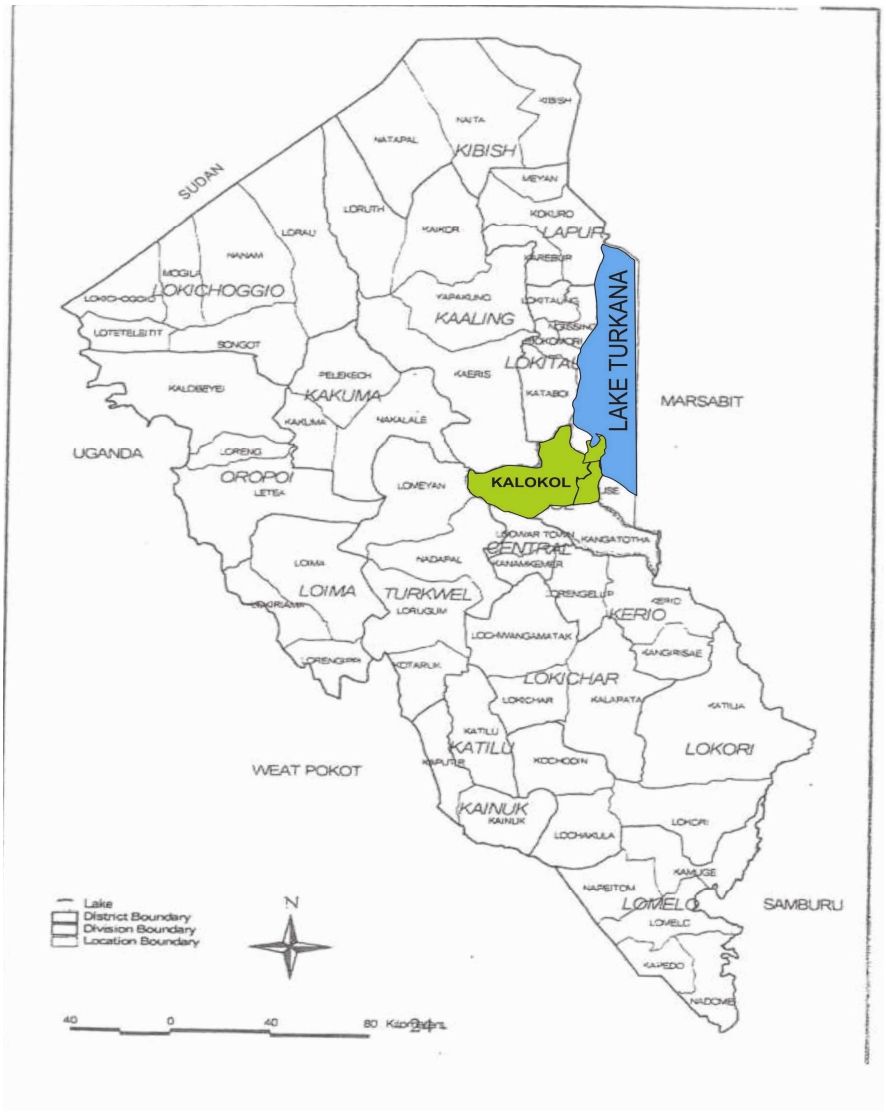
3.2 Location of study

The study was carried out in Kalokol Division, Turkana County, Kenya which is situated in North - western Kenya at E 35^0 51′34.5″ and N 3^0 31′53.75″. The area of study falls under arid and semi-arid zones with high temperatures and receives low rainfall of less than 250mm per year. Kalokol is inhabited by nomadic pastoral and fishing communities.

Map 3: National context location of Turkana County



Map 4: County context of Kalokol Division



Source: GoK, 2008

3.3 Target population and sample size

The target population of the study consisted of all households in Kalokol division. According to the population census of 2009, the division had a total population of 42,172 people (KNBS, 2009). At an average household size of 6, this translates to approximately 5, 313 households.

Sample Size

Fisher's Formula

$$n=\frac{NZ^2P(1-P)}{d^2 (N-1) + Z^2 P(1-P)}$$

n= the desired sample size (if the target population is greater than 10, 000).

N = Population size for this case Kalokol population as per KNBS (2009) is 42,172.

Z = Z the standard normal deviate at the required confidence level (statistics for 95% level of confidence).

P = the proportion in the target population estimated to have characteristics being measure (assumed to be 0.5 since it is unknown).

d= the level of statistical significance set (precision of estimated prevalence set at 5% therefore d = 0.05).

$$n= \frac{42172 \times 1.96^2 \times 0.5*0.5}{0.05^2 (42172-1) + 1.96^2 0.5 (1-0.5)}$$

$$n= \frac{42\ 172 \times 3.8416 \times 0.25}{0.0025 (42171) + 3.8416 \times 0.25}$$

$$n= \frac{40501.988}{105.4275 + 0.9604}$$

$$n= \frac{40501.988}{106.3879}$$

n = 380.70

n = 381

However, the study settled on sample size of 90 respondents as opposed to the expected 381 owing to financial limitation and time constraints on the part of the researcher. This constrain was further compounded by long time taken to

walk and reach sparsely scattered pastoral settlements in areas away from the lake shore, especially in villages such Loyoro, Katong'un and Lokipak.

3.4 Sampling procedure

The study targeted two locations selected purposively out of the total three locations in Kalokol division. That is, one location on the Lake shore and the other off the lake shore to represent two different scenarios. The study scaled down to selecting randomly two sub–locations and further, to six villages. Fifteen (15) subjects were interviewed from each of the six villages adding up to ninety (90) households. The total number of household questionnaires administered to head of households was 90 for the entire division.

Table 1: Sampling plan summary

Division	**Location**	**Sub-location**	**Villages**	**No. of questionnaires administered to household heads**
Kalokol	Kalokol (*near the Lake shore)*	Kalokol *Households (HHs) =2311*	Iprezza	15
			Natirae	15
			Nakwamomwa	15
	Namukuse (*off the Lake shore)*	Locheraikeny *Households (HHs) =598*	Loyoro	15
			Katong'un	15
			Lokipak	15
	Total questionnaires administered to household heads			**90**

Source: KNBS, 2009 and Field data, 2013

3.5 Data collection methods and research instruments

3.5.1 Key informants' interviews

Using key informant interview schedule, interviews were conducted with key informants such as Lake Turkana Fisheries Department, Physical Planning Department, environment department officials, and Lake Basin Development Authority in order to get their insight on spatial land use change and its impact on community livelihoods in Kalokol division.

3.5.2 Administering questionnaires

The researcher administered household questionnaires with the aim to collect data from the selected respondents such as household heads within Kalokol division. The purpose was to get views on the impact of land use change on livelihoods at household level, changing gender roles and possible household level coping mechanisms to the impacts of land use change.

3.5.3 Focus group discussion

The study also employed focus group discussions with the fisheries committee, one women group and one men gathering/council of elders with an aim of finding out the community insight on land use change, resultant impacts on livelihoods and possible grassroots mitigation and coping strategies.

3.5.4 Observation

The study also employed observation and photography in data collection. An observation list was used during a transect survey to physically view existing land use, vegetative land cover, human activities and people's socio-economic lifestyle.

3.6 Data analysis

The data from household questionnaires was analyzed using Excel soft ware package and the Statistical Packages for Social Scientists (SPSS) to provide

descriptive information. Data from key informants and focus group discussions was qualitatively analyzed using descriptive methods. In addition, the study relied on chi-square to infer the first and the third hypotheses while the second one was inferred using Spearman's Rank-Order Correlation.

3.7 Data presentation

Presentation of the final analyzed data is by use of tables, bar graphs, pie charts, maps and photographs.

CHAPTER 4: RESEARCH FINDINGS

4.1 Eexisting situation analysis

This chapter reports the existing situation analysis of the study area and research findings in relation to research objectives. Rapid appraisal of existing situation analysis was undertaken to identify and evaluate the physical environment, human settlement, infrastructure and socio-economic situation in light of land use change and its impact on livelihoods.

4.1.1 Physical environment

Every area has its own unique physical environment which constitutes part of its natural resource base. This directly or indirectly influences the land use development trends. These physiographic conditions may present opportunities that must be utilized to meet specific needs and enhance livelihoods of the local populace as well as overcome challenges. The ability to overcome the challenges presented by physiographic conditions of a place and translate the opportunities that come with them into economic development depends on social, economic, demographic, technological and institutional factors in play.

The general slope of the study area is towards Lake Turkana. That's from North -West to South-East, with an altitude between 0 – 500 metres above sea level. The main town of Kalokol is in the lower plains where rivers and seasonal streams (*Lagga*) such as Napasnyang drain into Lake Turkana.

The lower areas of the seasonal stream have been known to flood during the rainy seasons thereby occasionally affecting human settlement at its vicinity. The upper area of Kalokol is characterized with sandy soils, with well drained, hilly rocky- terrain while the lower part towards Lake Turkana is characterized by unstable soils which are not well drained, prone to water logging and flooding and not suitable for human settlement

Plate 5: Hilly terrain – well drained soils at the upper part of Kalokol

Plate 6: Unstable sandy soils – lower part of Kalokol (not suitable for human settlement)

4.1.2 Geology

Kalokol division in Turkana County forms part of the lower northern extension of the Great Rift Valley. It covers part of the western wall of the Rift Valley system represented by a series of North/ South running fault systems and a number of isolated hills, Hill ranges and volcanic plateau and plains dominating this North – Western section of Kenya which influence land use and livelihoods of the Kalokol. With Lake Turkana as one of the Northern Rift Valley Lakes in Kenya, the following geological characteristics which influence land use are observable at the area of study.

a. *The Quarternary sediments*

These consist of sediments of big pleistocene age. They consist of thick deposits of lacustrine and fluviatile sediments among which diatomite beds are common.

b. *Brown calcarious loamy sands and sand dunes or desert soils*

These are reddish-brown wind-sorthed horizon, it overlies a brown calcareous compated loamy sand.

c. *Shallow stony soils with rock outcrops*

These consist of various developed soils which have been subjected to geological and recent accelerated erosion and have lost their original characteristics.

Plate 7: Shallow stony soils with rock outcrops

4.1.3 Vegetation

a) Shrubs and grass

Vegetation in Kalokol is predominantly shrubs and grass. Shrub and grass consists of land sparsely covered by grass and bushes of shrub vegetation not exceeding two metres in height. The shrubs are always conspicuous but having a canopy cover of less than 20%. This covers a limited area of un-interfered pastoral grazing fields on the upper part of Kalokol. This vegetation supplies forage for Kalokol community livestock which freely graze without restrictions.

Plate 8: Shrub – grassland

b) Palm doum trees and local forest

Palm doum is the vegetation cover observable along the riverine areas and lake shores. Palm doum trees are extensively used by the local population for basket/mat weaving and thatching materials. In the recent past, palm doum trees cover has however, reduced as a result of deforestation and indiscriminate cutting of trees for fencing and construction of urban informal houses in Kalokol town.

The acacia forest locally known as *Awoi* is found along the riverine areas. It provides alternative grazing areas during drought and are a source of local building materials, wood fuel (firewood & charcoal), herbal medicine and areas of scenic beauty. In the recent past, there has been severe encroachment and destruction of these forests for domestic uses by an ever increasing human population.

Plate 9: Palm doum trees

Prompt measures on forest conservation and afforestation needs to be put in place by the county government in conjunction with the Kenya Forest Service to protect palm doum trees and local forests for sustainable forest cover.

c) Prosophis juliflora (Etirae/Mathege)

Prosophis juliflora locally known as Etirae with strong poisonous thorns and ever green has widely spread along the riverine / watershed areas, lakeshores, grazing fields and roadsides. The invasive weed which is a nuisance to livestock and fishermen is gradually spreading to almost every space displacing useful plants and vegetation cover used by livestock. However, the local population observably is making use of the unwanted plant for live fencing around their homesteads.

Plate 10: Prosopis juliflora (Etirae) cover spread

4.1.4 Socio-economic activities

Socio-economic interactions play a major role in determining the configuration of land use activities and their location in space. The spatial location of land uses further influence livelihoods that sustain the economy of a place for any given community. The functional interaction based on the flow of economic activities can occur either within or between spatial localities.

a) Livestock

Nomadic pastoralism is the predominant land use in the Namukuse location and upper part of Kalokol location. Nomadic pastoralism entails mobility of the pastoral community with their livestock in search of pasture and water as a coping mechanism especially during dry seasons. Mobility as a coping mechanism is also applied during the rainy season when there is flash floods affecting the grazing-plain area causing the need to move livestock to higher grounds for safety from livestock diseases and predators. From field findings, it was reported that during the movement from lower grounds to upper grounds or from one place to another during different seasons, some livestock die in the process of trying to adapt to the new environment and or varying weather conditions.

Plate 11: Flock of sheep under a shade during hot weather

b) Fishing

Fishing is carried out on the lake shores of Lake Turkana. Majority of fisher folk community is found in the lower part of Kalokol location near the lake shore, where the buying and selling of fish harvest is carried out between middlemen and fishermen**.** This is a departure from the past where fish selling and buying was undertaken through fisheries cooperative society in 1988 to early 1990s. The membership of the society was Kalokol fishermen. Unfortunately, Kalokol cooperative society was run down and collapsed due to poor management and occasional political wrangles between community leaders. The collapse of the cooperative society, drying of some sections of Furgersons gulf, lack of modern fishing equipment and sudden withdrawal of

funding by donors has since then affected majority of the fishermen whose livelihoods was majorly dependant on fishing.

Plate 12: Fishing in Lake Turkana

Plate 13: Fish from Lake Turkana

c) Minerals

Like other parts of Turkana County, as it is the case with Ng'amia one and Ewoi oil sites in Turkana south, prospecting of oil is being undertaken in Kalokol division. Apart from oil prospecting, sand harvesting, stone quarrying and alluvial gold mining form part of the untapped natural resources in Kalokol.

The Land mass that was previously used for communal grazing has observably been set aside for prospecting of oil in the upper part of Kalokol – Lochuga area. This change of land use has however limited nomadic pastoralism - free movement of livestock and community grazing fields. Prospecting of oil has attracted other land uses such as commercial, residential and transportation net-work around the oil drilling area. Consequently, land use configuration has

been totally altered from what it used to be a year ago in order to conform to the current socio-economic activities.

Plate 14: Oil prospecting company fence in Kalokol

4.1.5 Human settlement

The total population of Kalokol division is 42,172 people majority of who are Turkanas, mixed with other ethnic groups who have migrated and settled in Kalokol. Permanent and semi permanent human settlement in the division are found in Kalokol location, along Lake Turkana where fishing is practiced. Kalokol town is the main urban and market center with bare minimum social services, infrastructure like schools and health facilities which support human settlements and basic human life. Existing settlement patterns are characterized with congested and informal residential-cum commercial structures owing to high demand and concentration of human activities around Kalokol town.

Namukuse location which consist of Lochoreikeny and Lobolo sub-locations is predominantly inhabited by pastoral communities who live in a makeshift shelter owing to their nomadic- pastoral lifestyle of moving from one place to another in search of water and pasture for their livestock. Due to increasing human population and changing lifestyle of the pastoral community, permanent human settlements around water points such as rivers, shallow wells and or drilled boreholes are gradually replacing the makeshifts for the nomadic community. Consequently, livestock grazing fields continue shrinking day after day because of encroachment by permanent human settlements.

Plate 15: Human development encroachment in grazing area

4.1.6 Existing infrastructural facilities and services

The infrastructure in the study area consists of both physical and social facilities which support spatial distribution of goods and services within and outside the study area for sustainable livelihoods and related developments. Infrastructure includes different road networks, communication, health, education, water and energy facilities.

a) Road net work and communication

Transportation infrastructure as a land use in Kalokol is both unplanned and underdeveloped. The roads are dilapidated and in poor conditions.

Lodwar - Kalokol road that passes through the study area to the shores of Lake Turkana has a semi-tarmacked surface that has since then degenerated to potholes due to lack of regular maintenance. Other road networks within Kalokol area are not tarmacked. Most of these are earth roads which provide connectivity to the fish landing sites, residential areas, grazing areas, water spring points as for the case of Lobolo and Eliye springs. Eliye spring is a proposed site for a Resort city along Lamu Port South Sudan Ethiopia Transport Corridor (LAPSSET). Water springs provide fresh and clean water for both domestic and livestock use. Unfortunately, these springs have in the recent past been fenced off as private areas in anticipation of the proposed LAPSSET corridor.

Major means of transport in the study area include bicycle, walking, motorcycle, public service vehicles and taxis. The dominant mode of transport is by road. However, Kalokol air strip provides occasional air mode of transport for light aircrafts. Non-motorized transport system: i.e. pedestrians and handcart predominance is common in the study area.

Plate 16: Lodwar-Kalokol road

The area is served with communication masts thus providing sufficient and reliable cell phone network coverage within the study area.

Plate 17: Communication masts in Kalokol

b) Water and sanitation

The main sources of water supply for Kalokol are ground water consisting of shallow wells and boreholes from Napasnyang River and Lake Turkana. Water is pumped from the major borehole to the storage tanks and later distributed by gravity through pipes to water users for both institutional and domestic uses. The town within the study area has no conventional sewerage system and most common methods of waste water treatment and solid waste disposal is through septic tanks and soak pits, limited pit latrines and bush.

Plate 18: Water storage and supply tank

c) Energy

The major sources of energy for domestic use in the study area include; charcoal and firewood (plate 19) which are used exclusively for cooking while kerosene is used for lighting. There is no electricity supply in the study area. Instead diesel powered generators are widely used by able businessmen for lighting their premises. There is a strong need to expand electricity coverage from Lodwar to Kalokol.

Plate 19 : Fuel wood and charcoal for domestic cooking

d) Educational facilities

There are inadequate public educational facilities such as schools and colleges. The problem manifests itself through overcrowding in public schools, long distance between schools and poor learning facilities as indicated in plate 20 below.

Plate 20: Dilapidated and crowded classroom

e) Health facilities

Arising from field observations and According to Turkana Central Health report (2011), health facilities in the study area are inadequate , limited in bed capacity and inaccessible to pastoral families who walk Long distances to access health facility; average 50km between health facilities (Turkana Central Health report, 2011).

Table 2: Health facilities

Type	**GoK**	**FBO**	**NGO**	**Private**	**Total**
Hospital	1	0	0	0	**1**
Health centres	0	2	0	0	**2**
Dispensaries	17	17	0	0	**34**
Private	0	0	0	7	**7**
Total	**18**	**19**	**0**	**7**	**44**

Source: Turkana Central Health report, 2011

Table 3: Health facilities bed capacity

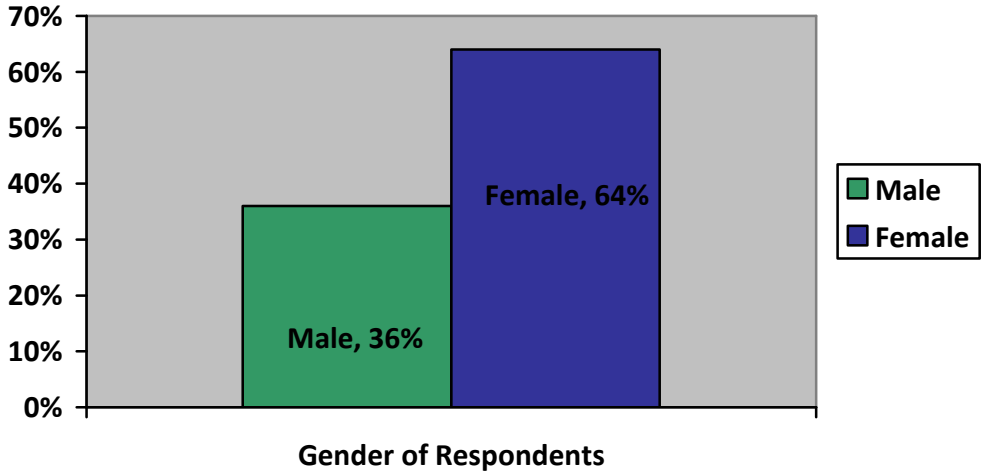
No	Facility	Beds
1	Lodwar District Hospital	168 (Authorized 270)
2	Lorugum Health Centre	20
3	Kalokol Health Centre	20
Total		**208**

Source: Turkana Central Health report, 2011

4.2 Land use findings analysis

The study interviewed ninety (90) respondents at household level with 32 being male and 58 being female. This implies that male constituted 36% of the respondents while female accounted for 64% of the respondents as shown in figure 4 below. Of the 90 respondents, 45 came from Kalokol Location and 45 from Namukuse Location. For Kalokol, Kalokol sub-location was used and for Namukuse Lochorkeny was used. Additionally, the three villages from the two sub-locations were allocated 15 respondents each.

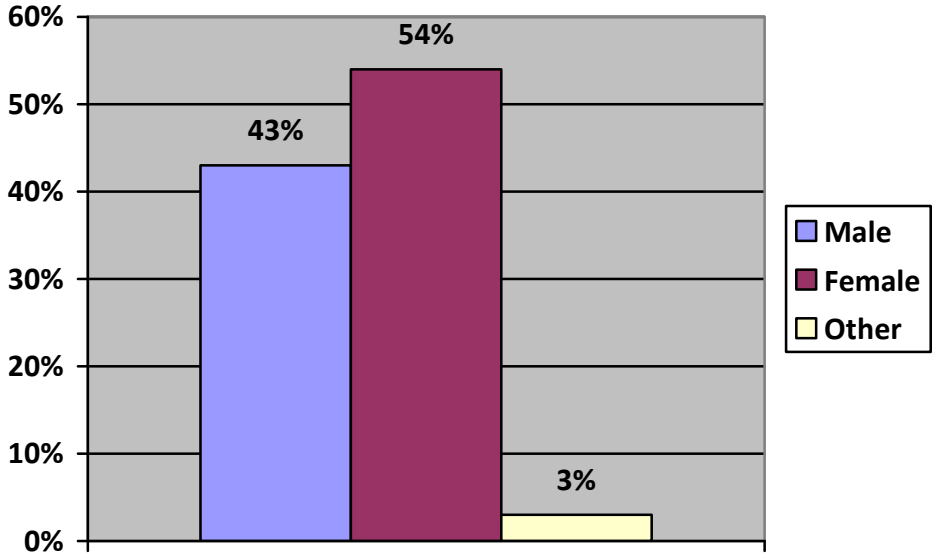
Figure 4: Gender of respondents



Source: Field data, 2013

Statistics in figure 5 below points to the changing gender roles within the communities living in Kalokol Division. Out of the 90 households randomly selected, 39 were headed by males while 49 were headed by females. This translates to approximately 43% for male and 54% for females. The remaining 3% represents missing entry. This is attributed to the security role of men which leads to their early death while defending the larger community and their households and their provider role which requires them to be outside home most of the time looking for livelihoods to sustain their families.

Figure 5: Gender of household head



Source: Field data, 2013

Marital status of the 90 respondents interviewed, 78 (86.7%) were married, 2 (2.2%) single, 8 (8.9%) separated and 2 (2.2%) did not offer information about their marital status. Equally, most of the respondents were not formally schooled. This figure stands at 77 (85.6%). For those who attended formal education, primary level accounts for 3 (3.3%); secondary 4 (4.4%); while those who did not give any response accounted for 6 (6.7%).

4.2.1 Types of land use change

4.2. 1.1 Existence of change

On the overall issue of land use change, at divisional level the response given was a close one. Up to 51% of respondents noted that there has been change in land use in Kalokol since independent to date. On the other hand, 48% of the respondents disagreed and noted that there has been no change in land use (see Figure 6). At the sub-location level, 26 (58%) of Lochoraikeny respondents said there is change while 19 (42%) said no while Kalokol sub-location, 20 (44%) said yes while 25 (56%) said no (see Figure 7).

Figure 6: Land use change at the divisional level

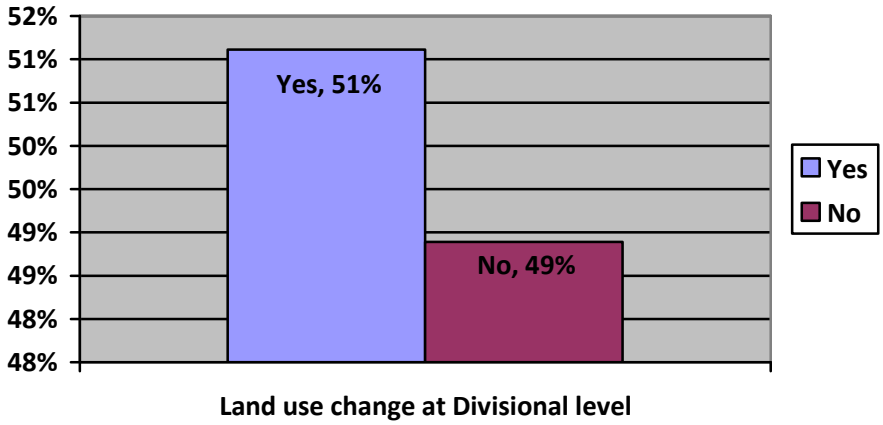
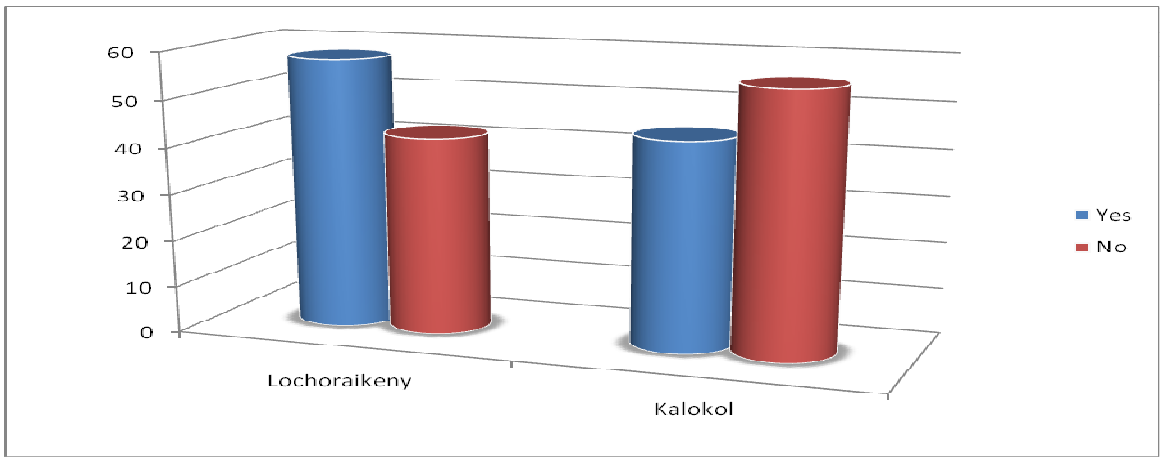


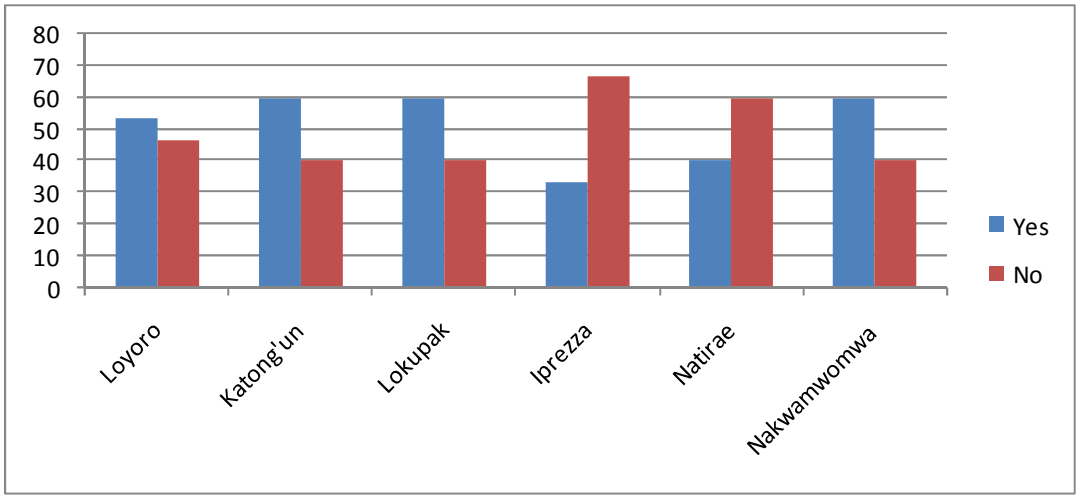
Figure 7: Comparative land use change at sub-location level



Source: Field data, 2013

However, when land use change is subjected to analysis at the village level, there is a significant change. For instance, 53% of Loyoro respondents felt that there was change while 47% indicated that there is no change. At Katong'un, 60% said yes while 40% said there is no change. At Lokupak 60% said yes while 40% said there is no change. At Iprezza, 33.3% said yes while 67%) said no. At Natirae, 40% said yes while 60% said no. Lastly, at Nakwamwomwa village, 60% said yes while 40% said no change in land use (see Figure 8).

Figure 8: Comparative land use change at village level



Source: Field data, 2013

The above findings highlight a key issue that from overall perspective at the location level, there is minimal change because Kalokol sub-location which is near the lake offered an opposing view as compared to Lochoraikeny which hosts pastoralists. In a nutshell, there is significant land use change in Lochoraikeny sub-location as compared to Kalokol. The reasoning is anchored on the fact that Kalokol residents derive their livelihood mainly from the lake and thus have minimal interaction on land as compared to residents of Lochoraikeny who depend on land for livestock grazing and thus are the most affected with the changes that negatively impact on their livelihoods.

4.2.2 Types of livelihoods

From the focus group discussion of men gathering/council of elders/chief elders, when asked to state types of livelihoods available in Kalokol community, they indicated that the types of livelihoods in Kalokol were;

- Livestock rearing
- Fishing
- Artifacts/crafts
- Business

On historical land use change in Kalokol, the elders chronologically narrated the sequence of changes in land use as a result of climatic changes of prolonged droughts and famine which adversely affected livestock and consequently the pastoral community.

Table 4: Historical chronology of land use change events

Year	Event	Event local name	Impact /effect
1960	Elnino	Akiru kirion Ekaru etop	- Green land cover - Death of livestock - Flash floods
1967	Drought /famine	Kimududu	- Mass livestock death - Dry land mass - Dry water sources - People starvation - People died of hunger, diseases and malnutrition - Migration to neighboring districts and countries
1974	Rainy year	Akwadodo	- Green land cover with sufficient grass and water for livestock - Thriving livestock - Surplus of milk - Rainfed farming became possible - Healthy population
1980	Drought /famine	Atanayenae /Lopiar	- Mass livestock death - Dry land mass - Dry water sources - People starvation - People died of hunger, diseases and malnutrition

			- Migration to neighboring districts and countries - Receding of L. Turkana Furgerson gulf to Namukuse
1983	Drought /famine	Kelejok	- Receding of L. Turkana furgerson gulf - Mass livestock death - Dry land mass - Dry water sources - People starvation - People died of hunger, diseases and malnutrition - Migration to neighboring districts and countries - Humanitarian food aid interventions
2000	Drought /famine	Logara	- Receding of L. Turkana Furgerson gulf - Mass livestock death - Dry land mass - Dry water sources - People starvation - People died of hunger, diseases and malnutrition - Migration to neighboring districts and countries in such of casual labour - Increased settlement around urban centers for alternative livelihoods; casual labor, business engagement - Humanitarian food aid interventions
2002	Drought /famine	Kichumtotan	- Continues receding of L. Turkana Fugerson gulf - Mass livestock death - Dry land mass - Dry water sources - People starvation

			- People died of hunger, diseases and malnutrition - Migration to neighboring districts and countries - Increased settlement around urban centers for alternative livelihoods; casual labor, business engagement - Increased humanitarian food aid interventions

Source: Field survey, 2013

Question 2.1 and 2.2 outline types of land use changes that have occurred in the last 50 years in Kalokol division. According to the ranking provided in descending order of importance, before independence as per the frequencies recorded were as follows: Grazing (86), crop farming (72), fishing activities (63), hunting and gathering (51) and permanent residence (1). On the other hand, presently, the respondents noted that the main land uses are permanent residence (85), commercial purpose (81), grazing (52), public purpose/ utilities (44), fishing activities (32), mining (29), crop farming (16) and finally hunting and gathering (1). Figure 9 below shows land use change before independence and the current land uses.

Land use challenges and proposed interventions

During various focus group discussion and key informants meetings in Kalokol, the following land use challenges and proposed interventions were highlighted.

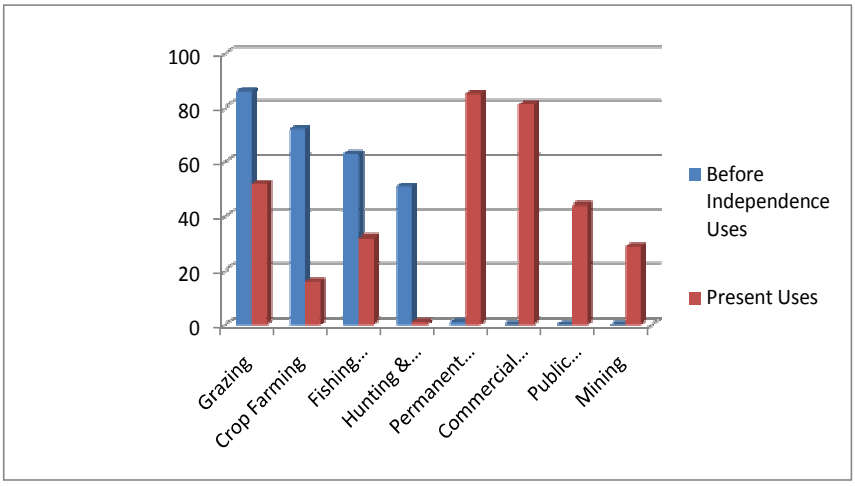
Table 5: Land use challenges and proposed interventions

Challenges	***Proposed interventions***
1. Insecurity	• Community policing and peace sensitization programs • Plan for human settlement, security location in

	the area and related land uses
2. Congestion /overcrowding of human settlement	• Undertake planning, evenly distribute police posts and security camps
3. Inadequate access roads and poor surface for the existing ones	• Plan and provide for access roads and regularly maintain existing roads • Undertake occasional bush clearing for prosopis juliflora (Etirae) obstructed roads
4. Flash Floods and lack of storm water drainage system	• Plan and provide for storm water drainage system, install disaster preparedness structures
5. Inadequate educational facilities	• Plan and provide for educational facilities: primary, secondary and college levels • Plan and provide for educational facilities for the disabled groups; blind, deaf, mental and crippled
6. Inadequate health facilities	• Plan and provide for health facilities. Equip/staff the existing ones and construct new public health centre and dispensary
7. Inadequate water supply	• Plan and install solar, wind driven systems, drill more boreholes within the planning area
8. Inadequate recreational facilities	• Plan and provide for recreational facilities: Recreational park and stadium in Kalokol
9. Lack of bus/car park	• Plan and provide for bus park in Kalokol town
10. Lack of open air market, livestock auction	• Plan and provide for open air market, livestock auction ring/sales yard

ring/sales yard	
11. Lack of designated area for public cemetery	• Plan and provide for a public cemetery site
12. Lack of dumping site	• Plan and provide for a dumping site
13. Poor sanitation/lack of public toilets	• Plan for public toilets and sensitize on the use of pit latrines at the household level
14. Encroachment on riparian reserves/lagas	• Sensitize the community on keeping off the riparian reserves/lagas when undertaking any development
15. Inadequate electricity	• Expand electricity coverage
16. Conflicting mixed land uses	• Zone and designate different land uses; residential, commercial, industrial and agro-pastoral zones
17. Impassable drifts/ Laggas during rainy season	• Build bridges
18. Low public awareness on land related laws	• Occasional sensitization of the general public on land laws and regulations by relevant agencies
19. Lack of titles deeds for land ownership	• County government, National Government and National Land Commission to undertake: Land adjudication, registration, allocation and issuance of title deeds to residents

Figure 9: Present and Past Land Uses



Source: Field data, 2013

The above trajectories are a pointer to land use change within the division. For instance, before independence, the respondents indicated that the main land use was for livestock grazing. Eighty six (86) respondents pointed to this fact. However, currently, the figure has reduced and 52 respondents stated that they use land for grazing. This implies that, they are either switching to other land uses or other economic activities as opposed to grazing.

This might be as a result of climate change leading to reduced carrying capacity, diminishing land holding per household as a result of population increase. This fact is corroborated by emergence of other systems of production/ land use such as commercial purpose which was zero before independence, but now is ranked as one of the major land use with a score of 81% as indicated in Figure 9 above.

Further, a pointer to change in land use is the response relating to permanent residence. Before independence, one respondent noted that they used land for permanent residence which is attributed to nomadic-pastoral lifestyle of the

community before independence. Nevertheless, this has significantly changed and now 85% on frequency are using the land for permanent residential purpose. The same is affirmed by growth of commercial purpose which is associated with sedentary lifestyle and increased urbanization in Kalokol division.

4.2.3 Significance of Land Use Change

Research hypothesis (**H*a***): There is significant change in land use in Kalokol Division.

Null hypothesis (**H*o***): There is no significant change in land use in Kalokol Division.

From Table 3 below, the major land uses before independence and at present in Kalokol, can be summarized and categorized into eight.

Table 6: Observed frequencies

Land Use	Frequency		
	Before Independence	**Present**	**Total**
Grazing	86	52	138
Crop farming	72	16	88
Fishing activities	63	32	95
Hunting & gathering	51	1	52
Permanent residence	1	85	86
Commercial purpose	0	81	81
Public purpose/utilities	0	44	44
Mining	0	29	29
TOTAL	**273**	**340**	**613**

Source: Field data, 2013

Expecteds (E) = (Row total x Column total) / Grand total for each cell

	Before	Present	Total
Grazing	273x138/613 =61.46	340x138/613 =76.54	138
Crop farming	273x88/613 =39.19	340x88/613=48.80	88
Fishing	273x95/613 = 42.31	340x95/613=52.69	95
Hunting/gathering	273x52/613=23.16	340x52/613=28.84	52
Permanent residence	273x86/613=38.30	340x86/613=47.70	86
Commercial use	273x81/613=36.07	340x81/613=44.93	81
Public purpose	273x44/613=19.59	340x44/613=24.41	44
Mining	273x29/613=12.92	340x29/613=16.09	29
	273	**340**	**613**

From above at least 80% of the expected frequencies are more than 5 and none of the expected is less than one i.e. of the 8 expected computed 8,(100%) have values greater than 5 and no expected value is less than one.

Computing the chi-square value

$X^2 = \sum (O-E)^2/E$

Where:

X^2= Chi square obtained O= Observed score

$\sum$= Sum of E= Expected score

O	E	O-E	$(O-E)^2$	$(O-E)^2/E$
86	61.46	24.54	602.21	9.80
72	39.19	32.81	1076.50	27.47
63	42.31	20.69	428.08	10.12
51	23.16	27.84	775.07	33.47
1	38.30	37.3	1391.29	36.33
0	36.07	-36.07	1301.05	36.07
0	19.59	-19.59	383.77	19.59
0	12.92	-12.92	166.93	12.92
52	76.54	-24.54	602.21	7.87
16	48.80	-32.8	1075.84	22.05
32	52.69	-20.69	428.08	8.13
1	28.84	-27.84	775.07	26.88
85	47.70	37.3	1391.29	29.17
81	44.93	36.07	1301.05	28.99
44	24.41	19.59	383.77	15.72
29	16.09	12.91	166.67	10.36

X^2= 334.94

Computing the degree of freedom (df)

df=(Rows -1) (Columns- 1)

df=(8-1)(2-1)=7

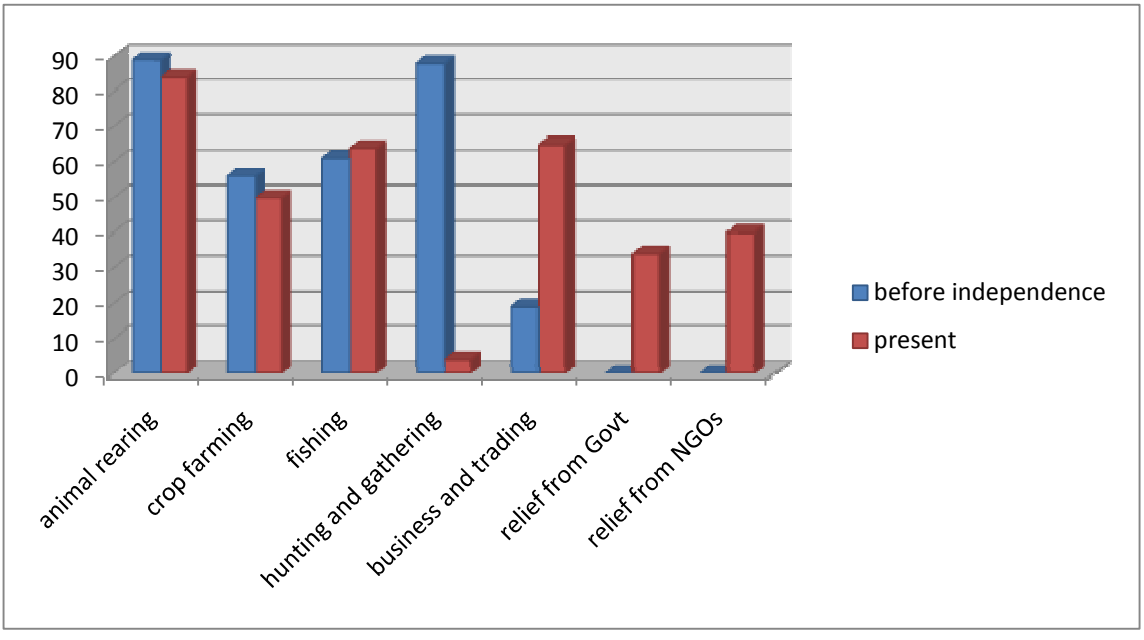
- Critical value in the chi-square table =14.067 for 7 df at 0.05 level of significance
- Reject the null hypothesis(**Ho**) if computed X^2 equals or exceeds the critical value

Decision: Ho is rejected. Computed value of X^2 exceeds critical value 14.067

Conclusion: The research hypothesis (**Ha**) is supported – thus there is significant change in land use in Kalokol Division

4.2.4 Impacts of land use change on community livelihoods

Figure 10: Comparison of livelihood source before independence and at present



Source: Field data, 2013

Table 7: Ranking of present and past land uses

Land Use	Before independence		Present	
	Frequency	**Rank**	**Frequency**	**Rank**
Grazing	86	1	52	3
Crop farming	72	2	16	7
Fishing activities	63	3	32	5
Hunting & gathering sites	51	4	1	8
Permanent residence	1	5	85	1
Commercial purpose	0	6	81	2
Public purpose/utilities	0	6	44	4
Mining	0	6	29	6

Source: Field data, 2013

Table 7 above indicates the frequency/score in order of importance of the land uses before independence and presently at Kalokol Division. The information derivable from this table is that land use change over time has impacted on the livelihoods of Kalokol residents.

Table 8 shows the scores/frequency and the ranking done by respondents in order of importance, what their source of livelihood used to be before independence and the current source of livelihood.

Table 8: Livelihoods before and at present

Livelihood	Before Independence		Present	
	Frequency	Rank	Frequency	Rank
Animal husbandry	89	1	84	1
Crop farming	56	4	50	4
Fishing	61	3	64	3
Hunting and gathering	88	2	4	7
Business and trading	19	5	65	2
Relief from government	0	6	34	6
Relief from NGOs	0	6	40	5

Source: Field data, 2013

According to the respondents, before independence, the leading land use was livestock grazing land with a frequency of 86. Presently, it is still the leading land use, but with a frequency of 52. This is equally reflected in the livelihood whereby before independence livestock rearing was the leading source of livelihood with a frequency of 89, but this has dropped to a frequency of 84 even though it is still the leading source of livelihood.

Before independence, the second ranked most important land use was crop farming with a frequency of 72. However, presently, this land use is ranked the 7th with a frequency of 16. This drop is equally reflected in the change of livelihood. For instance, before independence, crop farming was ranked as the fourth most popular source of livelihood with a frequency of 56.

Presently, it is still ranked fourth even though with a reduced frequency of 50. Before independence, preserved hunting sites were a major land use with a score of 51 making it the fourth most popular. On the contrary, at present, this land use has diminished ranking number 7 with a frequency of 4. The same

trend is exhibited in livelihood source where before independence it was ranked 2nd, but currently it is ranked 7th.

The above shift does not occur in a vacuum as such, such transition has brought new uses which were not dominant before independence. For instance, commercial use, public purpose and mining had no presence reported before independence, but presently, they have gained grounds and are ranked 2 and 4 respectively. Such change has seen commercial purpose moving up the ladder as one of the leading source of livelihood at position two.

Additionally, from the focus group and key informants discussions, it can be deduced that;

- The climatic changes in the form of drought influenced land use and consequently type of livelihoods in Kalokol community
- Interval of drought/famine occurrence is narrowing to less than five years in the recent past

When the group was asked about the most common land use induced problems and effects on livelihoods and community the following responses ensued:

Land use induced problem	**Effect on livelihoods**	**Effect on community**
Receding of Furgerson gulf	Reduced fish harvest	- Increased poverty index - Increased children malnutrition rate
Land/environmental degradation	- Increased livestock diseases/death - Reduced livestock milk	- Increased food insecurity - Increased children

	yields	malnutrition rate - Increased human disease: TB, Typhoid
Frequent drought and calamities such as flooding	- Livestock death - Reduced number of livestock - Reduced livestock products yields - Reduced fish harvest - Reduced rainfed farming	- Increased food insecurity - Increased poverty index - Increased children malnutrition rate - Increased human diseases
Conflicting mixed land use	- Reduced livestock grazing fields leading to insufficient pasture for livestock	- Land disputes - Conflict between pure pastoralists and agro-pastoralist in regard to the right to use land
Immigration	- Reduced livestock grazing fields leading to insufficient pasture for livestock	- Overcrowding on a limited space leading to overburdening of infrastructure and basic services - Increased informal human settlements - Land disputes

Source: Field data, 2013

When the group of elders was asked the factors contributing to land use problems in Kalokol, they stated the following:

- Poor leadership leading to occasional land disputes and destruction of the environment/indigenous trees which are drought resistant.
- Increased population rate leading to encroachment on grazing areas, riparian reserves and road reserves.
- Corruption both on the part of government officers and community.
- High level of illiteracy in the community – that's lack of knowledge as regards conservation of the environment and effective use of land.

4.2.4.1 Is the correlation between land use change and change in livelihood significant?

Research hypothesis (**H*a***): There is significant correlation between change in land use and change in livelihoods in Kalokol division.

Null hypothesis (**H*o*)**: There is no significant correlation between change in land use and change in livelihoods in Kalokol division.

To establish if there is significant correlation between land use change and change in livelihood, the research employs Spearman's Rank-Order Correlation. This non-parametric version / spearman correlation coefficient (p, also signified by r) measures the strength of association between change in land use and change in livelihood.

Table 9: Association between change in land use and change in livelihood

	Frequency	Rank X	Frequency	Rank Y	d (rankX-rankY)	d^2
	52	3	84	1	2	4
	16	6	50	4	2	4
	32	5	64	3	2	4
	1	7	4	7	0	0
	85	1	65	2	-1	1
	81	2	34	6	-4	16
	44	4	40	5	-1	1
∑					0	30

Formula:

$$\rho = 1 - \frac{6\sum \bar{d_i^2}}{n(n^2-1)}.$$

where *P*= *Pearsons correlation coefficient*

∑ = 30; n = 7 *n = sample size*

P= 1 – $\frac{6\sum 30}{7\,(49^2-1)}$ *d* =differences between ranks of each observation ∑ = sum of

P= 1 – $\frac{180}{16800}$

P= 1 – 0.01071428571

P= 1 – 0.011

P= 0.989

From the above, we have a p of 0.989. This indicates a strong positive relationship between the land use change and livelihood change. In a nutshell, there is strong positive correlation between land use change and change in livelihood in Kalokol Division. Conclusively, it is evident that land use change has a direct bearing on livelihoods.

4.2.5 Effect of land use change on gender roles

Before land use change, the number one role of men was herding. This is gradually changing and according to the response provided, more men are now engaging in business/entrepreneurship as their leading role. Herding has been relegated to number two role. This can be attributed to land use change especially the urbanization taking place at Kalokol which is encroaching on grazing fields/range lands that were prone to insecurity from bandits.

While provision of security role has become sophisticated from simple crude weapons to fire arms, men are relinquishing this role to the formal authorities/ security agencies. For instance, before land use change, it was ranked third and currently it ranks fifth. This is attributed to the shift in the source of livelihood where residents are now diversifying their sources outside traditional cattle rearing. For instance, mining is emerging and is currently ranked sixth and equally, fishing is offering an alternative livelihood and is currently ranked third.

Table 10: Role of men before and after land use change

Role of men	Before land use change		After land use change	
	Frequency	Rank	Frequency	Rank
Provision of security	41	3	20	5
Tending crops and fishing	34	4	29	3
Leadership role	42	2	28	4
Business entrepreneurship	0	6	43	1
Hunting and gathering	2	5	0	7
Herding	43	1	31	2
Mining	0	6	9	6

Source: Field data, 2013

Regarding the role of men in managing the impact of land use change and corresponding challenges encountered by men in overcoming the challenges, elders stated the following;

Role in management of land use impact	**Challenges**
Sensitization on diversification of livelihoods	- High level of illiteracy in the community • Limited sources of livelihoods • High levels of poverty
Migration to areas with water and pasture	- Increased desertification - Prolonged drought and famine - Changing weather patterns

	- Banditry /cattle rustling
Training young men to uphold community cultural values	- Infiltration of foreign cultures and values - Modern education and exposures to young people
Security provision	- Use of sophisticated weapons by bandits - Limited support from National government on community policing - Weak government enforcing agencies - Corruption on the part of law enforcers

Source: Field survey, 2013

From Table 11 below, before land use change, the principal role of women was to conduct household chores. This had a frequency score of 41 out of the 90 respondents interviewed. The second and third role in that order respectively was gathering and herding. This had a frequency of 40 and 31 respectively. Nevertheless, presently, there is a paradigm shift and according to field data, the leading role of women has become small scale business/entrepreneurship. Similarly, the role of the girl child has also changed from helping in the household chores to attending school.

Further, women have gained prominence in leadership roles as opposed to before land use change where leadership was not their domain. This can be attributed to empowerment from NGOs, FBOs and integral role of women in

small scale economy through self help groups. Indeed the household chore role has been relegated to number four currently in Kalokol.

Table 11: Role of women before and after land use change

Role	Before land use change		After land use change	
	Frequency	Rank	Frequency	Rank
Household chores	41	1	12	4
Gathering	40	2	0	6
Herding	31	3	15	3
Tending crops	1	4	12	4
Leadership	0	5	37	2
Business/entrepreneurship	0	5	46	1

Source: Field data, 2013

Regarding the role of women in managing the land use impact and corresponding challenges encountered by women in overcoming the challenges, the Loyoro Women Group narrated as follows:

Role in management of land use impact	**Challenges**
Land management/ Tree planting and regulation of charcoal burning business	- Drought and famine - Lack of land ownership thus reducing responsibility. - Lack of awareness creation - Climatic change

	- Lack of skills on how to utilize and improve land productivity
Lobbying for women empowerment	- Resistance from men folk anchored on restrictive cultural practices - High prevalence rates of HIV among the women - High level of poverty and illiteracy among women - Ownership of most property being restricted to men
Participation in decision making	- Lack of support from male leadership

Source: Field survey, 2013

4.2.5.1 Is there any significant change in men and women's role as a result of land use change?

Research hypothesis (**H*a***): There is significant change in men and women's role as a result of land use change

Null hypothesis (**H*o*)**: There is no significant change in men and women's role as a result of land use change

Testing hypothesis

Table 12: Observed frequencies for men's role

Role of men	**Frequency**		**Total**
	Before land use change	**After land use change**	
Provision of security	41	20	61

Fishing	34	29	63
Leadership role	42	28	70
Business entrepreneurship	0	43	43
Hunting and gathering	2	0	2
Herding	43	31	74
Mining	0	9	9
Total	162	160	322

Source: Field data, 2013

Expecteds (E) = (Row total x Column total) / Grand total for each cell

Table 13: Expecteds before and after land use change for men

	Before	After	Total
Security	162x61/322=30.69	160x61/322=30.31	61
Fishing	162x63/322=31.70	160x63/322=31.30	63
Leadership	162x70/322=35.22	160x70/322=34.78	70
Business	162x43/322=21.63	160x43/322=21.37	43
Hunting/gathering	162x2/322=1.01	160x2/322=0.99	2
Herding	162x74/322=37.23	160x74/322=36.77	74
Mining	162x9/322=4.53	160x9/322=4.47	9
TOTAL	**162**	**160**	**322**

From Table 12 above at least 80% of the expected frequencies are more than 5 and none of the expected is less than one i.e. of the 14 expected computed 14,(100%) have values greater than 5 and no expected value is less than one.

Computing the chi-square value

$X^2 = \sum (O-E)^2/E$

Where:

X^2= Chi square obtained O= Observed score

$\sum$= Sum of E= Expected score

O	E	O-E	$(O-E)^2$	$(O-E)^2/E$
41	30.69	10.31	106.3	3.46
34	31.70	2.30	5.29	0.17
42	35.22	6.78	45.97	1.31
0	21.63	-21.63	467.86	21.63
2	1.01	0.99	0.98	0.97
43	37.23	5.77	33.29	0.89
0	4.53	-4.53	20.52	4.53
20	30.31	-10.31	106.30	3.51
29	31.30	-2.30	5.29	0.17
28	34.78	6.78	45.97	1.32
43	21.37	21.163	467.86	21.89
0	0.99	-0.99	0.98	0.99
31	36.77	-5.77	33.30	0.91
9	4.47	4.53	20.52	4.59

X^2= 66.34

Computing the degree of freedom (df)

df=(Rows -1) (Columns -1)

df=(7-1)(2-1)=6

- Critical value in the chi-square table =12.592 for 6 df at 0.05 level of significance
- Reject the null hypothesis(**H*o***) if computed X^2 equals or exceeds the critical value

Decision: Reject null hypothesis **(H*o***). Computed value of X^2 exceeds the critical value of 12.592.

Conclusion: The research hypothesis (**H*α***) is supported. Thus there is significant change in men's role as a result of land use change in Kalokol

Table 14: Observed frequencies for women's role

Women Role	**Frequency**		
	Before land use change	**After** land use change	**Total**
Tending crops	1	12	13
Household chores	41	12	53
Gathering of wild fruits	40	0	40
Herding	31	15	46
Leadership	0	37	37
Business/entrepreneurship	0	46	46
Total	**113**	**122**	**235**

Source: Field data, 2013

Expecteds (E) = (Row total x Column total) / Grand total for each cell

Table 15 Expected before and after land use change for women

	Before	After	Total
Tending crops	113x13/235=6.25	122x13/235=6.75	13
Household chores	113x53/235=25.49	122x53/235=7.52	53
Gathering	113x40/235=19.23	122x40/235=20.77	40
Herding	113x46/235=22.12	122x46/235=23.88	46
Leadership	113x37/235=17.79	122x37/235=19.21	37
Business	113x46/235=22.12	122x46/235=23.88	46
TOTAL	**113**	**122**	**235**

As indicated in Table 15 above at least 80% of the expected frequencies are more than 5 and none of the expected is less than one i.e. of the 12 expected computed 12,(100%) have values greater than 5 and no expected value is less than one.

Computing the chi-square value

$X^2 = \sum (O-E)^2/E$ where :

X^2= Chi square obtained O= Observed score

$\sum$= Sum of E= Expected score

O	E	O-E	$(O-E)^2$	$(O-E)^2/E$
1	6.25	-5.25	27.56	4.41
41	25.49	15.51	240.56	9.44
40	19.23	20.77	431.40	22.43
31	22.12	8.88	78.85	3.57
0	17.79	-17.79	316.48	17.79

0	22.12	-22.12	489.29	22.12
12	6.75	5.25	27.56	4.08
12	27.52	15.52	240.87	8.75
0	20.77	-20.77	431.39	20.77
15	23.88	-8.88	78.85	3.30
37	19.27	17.79	316.48	16.48
46	23.88	22.12	489.29	20.49

X^2= 153.63

Computing the degree of freedom (df)

df=(Rows -1) (Columns- 1)

df=(6-1)(2-1)=5

- Critical value in the chi-square table =11.070 for 5 df at 0.05 level of significance.
- Reject the null hypothesis (**H*o***) if computed X^2 equals or exceeds the critical value.

Decision: Reject null hypothesis **(H*o*)**. If computed value of X^2 exceeds critical value 11.070.

Conclusion: The research hypothesis (**H*a***) is supported. Thus there is significant change in women's role as a result of land use change in Kalokol Division.

4.2.6 Community coping strategies as a result of land use change

The following coping strategies were advanced by the respondents as individual and communal coping strategies on land use change that has negatively affected sources of their livelihoods:

- *Nomadic pastoralism:* Respondents reported that individual families employ a strategy of movement with their livestock from one area to another within and outside the county in search of pasture and water. In extreme drought situation, a strategy of communal group movement is applied in moving into the neighbouring counties such as west Pokot, Samburu and countries such as Sudan, Uganda and Ethiopia in search of livestock grazing fields. Community group movement is also a coping strategy for security defence in case the neighbouring communities become hostile and resistant to grazing livestock in their territory.

- *Basket and mat weaving for sale* - from locally available materials (*Ng'ang'olia*). Baskets and mats from doum palm tree leaves, locally known as *Ng'ang'olia* is gradually growing into a weaving industry in Kalokol and in extension to Lodwar town as a major market for the product. According to the respondents, this is a sustainable alternative source of livelihood and coping strategy to land use change. The secret to it is that only leaves and not the palm tree are cut for weaving materials after about three months. The doum palm trees from which the leaves are cut become rejuvenated rather than degraded.

Plate 21: Baskets made from doum palm tree leaves

- *Wood fuel sale*: Charcoal burning and collection of firewood from indigenous trees was reported as a coping strategy and alternative source of income. The respondents acknowledged that this coping strategy is not sustainable and they have had unfriendly confrontation with forest guards who in many occasion confiscate their tools.

- *Welfare group formation*: During focus group discussion, women reported that they engage in welfare groups popularly known as merry- go round as a coping strategy. In the welfare groups, members meet every month at least in one of their member's house where they unanimously contribute certain agreed amount of money or items to the group member.

- *Formation of community based organisations* (CBOs) to qualify for funding from NGOs and micro-finance institutions. In order to qualify for funding from NGOs and micro-finance institutions CBOs, women, youth, disabled and fisher folk's community based organisations are formed and registered as a strategy to access money for group business.

- Rural-urban migration after a raid or death of livestock. The other respondents observed that in the event that they are raided or there is extreme drought, they migrate to urban areas to look for other means of livelihood such as casual labor.

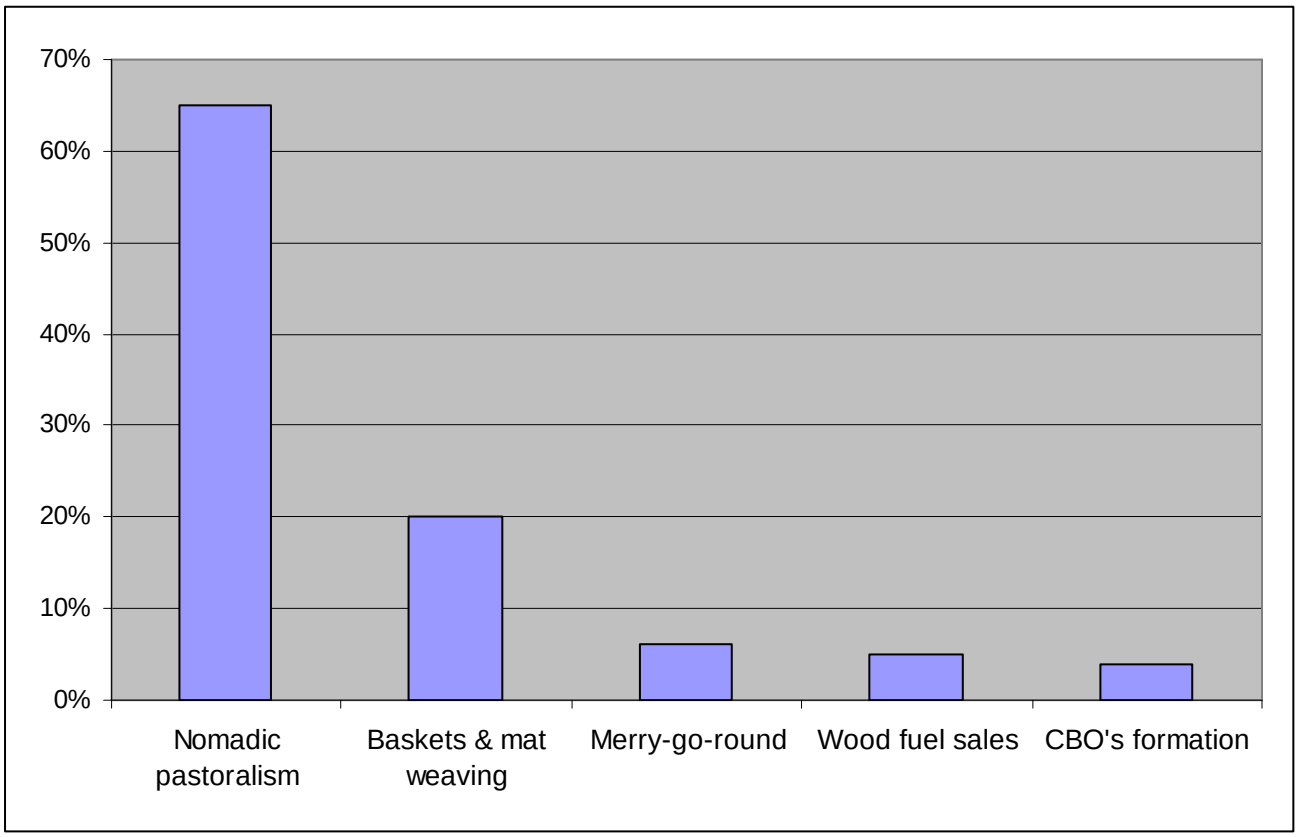
- Embracing crop farming. A section of respondents especially those close to the lake reported that as a means of cushioning them against suffering total loss in event of cattle raid or extreme drought, they cultivate crops along riverine areas.

- Shifting to safer grounds during floods. This is mostly applicable when Lake Turkana has bulged especially for respondents close to the shores of lake Turkana. In this regard, they move away to safer or higher grounds to avoid being washed away by floods.

- Resettlement around lake for easy fishing when the lake recedes during drought. This coping mechanism is the exact opposite of the above and is applied during droughts where they move closer to the lake for fishing purposes and animal watering.

From Figure 11, 65 percent of the respondents reported nomadic pastoralism as a major coping strategy used as an individual family unit and or collective community. Basket and mat weaving as a coping strategy to land use change in Kalokol was reported by 20 percent of the respondents interviewed. Merry go-round, wood fuel sale and CBOs formation are employed as a coping strategy by six, five and four percent of the respondents interviewed respectively.

Figure 11: Land use change and community coping strategies



Source: Author, 2013

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter draws conclusions of the study and the resultant recommendations given by the researcher as per the preceding chapter's research findings, data analysis and discussions. The conclusions drawn and recommendations made to the stakeholders and the potential consumers of the findings, including and not limited to Turkana county stakeholders are expected to contribute positively towards enhancement and improvement of livelihoods, hence peoples lifestyle in Kalokol division – while at the same time, sustainably manage land use change by Kalokol people, spatial planners, government and non-governmental development agencies.

5.2 Types and impacts of land use change on Kalokol community livelihoods

5.2.1 Conclusion

Based on the foregoing research findings, it can be inferred that the types of land use change in Kalokol division is noticeable in declining livestock grazing fields due to increasing human population and human settlement which has occupied greater parts of livestock grazing fields and rangelands, declining fishing sites as a result of receding parts of Lake Turkana owing to upstream development such as Gibe dam construction. Declining rain-fed farming areas as a result of changing and unpredictable weather condition forms type land use change in Kalokol.

Further, from the research findings the study has proven that, there is significant change in land use attributed to increase in population, rapid urbanization that's eating into grazing fields and changing lifestyle of the predominantly pastoral community. It is evident that there is strong positive

correlation (0.989) between land use change and change in livelihood in Kalokol Division. Land use change has a direct bearing on livelihoods.

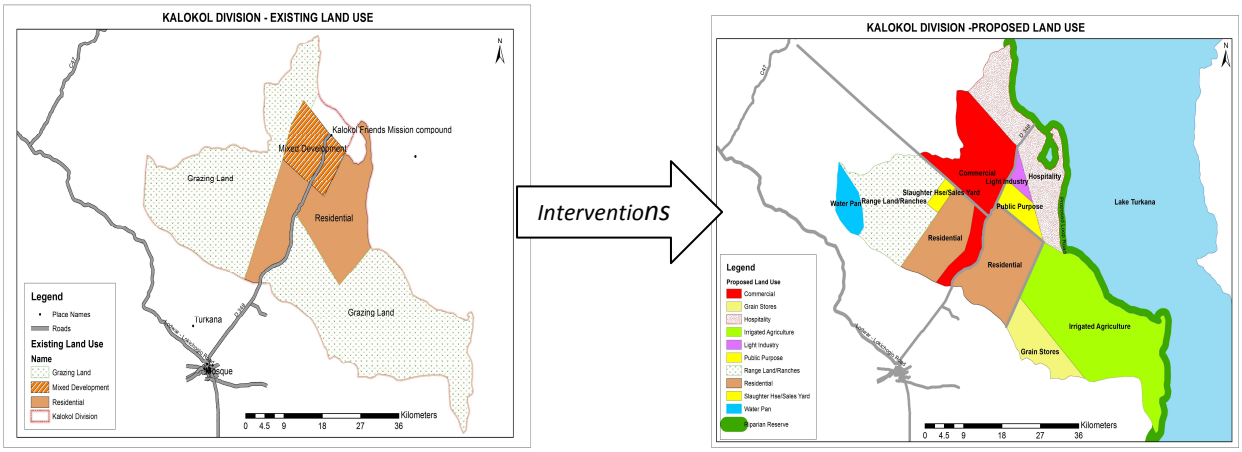
5.2.2 Recommendations

The research recommends that:

I. The government in conjunction with other development agencies should formulate plans, policies, strategies and measures that promote and safeguard pastoral grazing fields / range land in the study area and other arid lands.

II. County government through the department of physical planning should develop a spatial plan framework and model to control proliferation of human settlements which are eating into pastoral grazing land as demonstrated in the land use model below

Land use model



Kalokol Land use model

III. Spatial planners and development agencies should factor pastoralism in their plans as a land use and a way of life when making development plans.

IV. Kenya forest service through their forest warden in Kalokol and in collaboration with the community should protect and conserve indigenous trees cover from indiscriminate cutting for building and wood fuel purpose.

V. Diversification of livelihoods in the community such as livestock rearing should be promoted in order to enhance food security in Kalokol. This can be better initiated by the government of Kenya through the Turkana County government, ministry of Agriculture and Livestock, development agencies such as Kerio Valley Development Authority and NGOs operating in the area.

VI. NGOs, CBOs and government agencies such as NEMA need to vigorously campaign against and stop further damming of major rivers feeding into Lake Turkana before environmental impact assessment (EIA) is carried out to ascertain the resultant impact to the Lake ecosystem. This is to avert downstream negative impacts such as eventual drying up of the Lake, destruction of the Lake ecosystem and consequent decline in fish production thus exacerbating further poverty to the communities directly benefitting from the Lake.

5.3 Impact of land use change on gender roles in Kalokol community

5.3.1 Conclusion

From the foregoing data analysis as reflected in observed tables 10, 11, 12 and 14 it is apparent that; Men's role in Kalokol Division before land use change was predominantly herding, leadership/ decision making and security provision. However, after land use change the traditional role of men in Kalokol significantly changed in favor of business/entrepreneurship and fishing.

Women's role in Kalokol Division before land use change was predominantly household chores and reproductive role – representing a conservative traditional rural community. However, after the land use change the role of women in Kalokol changed significantly in favour of leadership/decision making and entrepreneurship/business. The change in women's roles can be attributed to changing modern women lifestyle as influenced partly by formal education and special groups empowerment programmes occasionally conducted in Kalokol division by NGOs and other development agencies including faith based organizations (FBOs).

5.3.2 Recommendations

The research recommends that;

I. The government of Kenya through fisheries department and in collaboration with other development agencies should enhance and improve fishing infrastructure in Kalokol to meet the increasing current and future fish demands.

II. The pastoral community should form and join fisheries cooperative societies in order to enhance their bargaining power and sell their fish harvest at a better price. This will be a paradigm shift from the current middle-men exploitative lake-shore method of fish selling and buying.

III. NGOs, CBOs and government agencies working in the area should aggressively sensitize the pastoral community on the importance of sustainably engaging in fishing as an alternative source of livelihood.

IV. The government of Kenya through the National Irrigation Board should promote and initiate irrigated agriculture as a viable alternative source of livelihood among the pastoral communities with the aim of promoting the role of men in farming around Lake Turkana.

V. Empowerment programs by development agencies in Kalokol community should be gender sensitive and all inclusive in their capacity building training /workshops.

VI. Empowerment programs conducted by government agencies and NGOs should be widened to cover other important areas including and not limited to socio-economic and environmental aspects for sustainable land use.

5.4 Other areas of research:

Since it is evident that there is positive correlation between land use change and change in livelihoods, the research proposes that further studies may be conducted on effect of land use change on nomadic-pastoralism lifestyle. Secondly, the other plausible area of research is on effect of damming River Omo on Lake Turkana ecosystem. Thirdly, research can also be conducted on livelihoods diversification opportunities for pastoralists.

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APPENDICES

Appendix 1: Household questionnaire

Appendix 2: Institutional questionnaire

Appendix 3: Focus group discussion guide (women gathering)

Appendix 4: Focus group discussion guide (men gathering)

Appendix 5: Research introduction letter from the University

Appendix 6: Research permit

Appendix 1: Household questionnaire

UNIVERSITY OF NAIROBI

DEPARTMENT OF URBAN AND REGIONAL PLANNING

MA (PLANNING) 2013

IMPACT OF LAND USE CHANGE ON LIVELIHOODS

A case study of Kalokol Division, Turkana County

Objectives:

I. To examine impacts of land use change on community livelihoods

II. To assess the effect of land use change on gender roles in the community

III. To determine community coping strategies as a result of land use change

IV. To recommend sustainable mitigation measures to minimize possible negative impacts of land use change on Kalokol community livelihoods.

Household Questionnaire

Disclaimer: The information collected during this survey is purely for academic purposes and will not be divulged to any other person in whatever circumstance.

Questionnaire Number _____Date_____

Name of the respondent (optional) _____Tel_____

Location _____Sub-Location _____Village_____

A1: GENERAL DEMOGRAPHIC INFORMATION

1.1 Gender of respondent: Male ☐ Female ☐

1.2 Marital Status

Marital status	Tick
Married	
Single	
Divorced	
Separated	

1.3 Household information structure

Gender of Household head (HHH)	Age (yrs) of HHH	Level of education of HHH	Occupation of HHH

1.4 What is the size of your household? ----------

1.5 How many girls do you have in your household? ----------

1.6 How many boys do you have in your household? ----------

Girl's age and responsibilities in family

Family	**Age in years**	**Main work done**
Girl 1		1. 2. 3.
Girl 2		
Girl 3		
Girl 4		
Girl 5		
Girl 6		
Girl 7		
Girl 8		
Girl 9		
Girl 10		

Boy's age and responsibilities in family

	Age in years	Main work done
Boy 1		1. 2. 3.
Boy 2		
Boy 3		
Boy 4		
Boy 5		
Boy 6		
Boy 7		
Boy 8		
Boy 9		
Boy 10		

2.0 To determine the types of land use changes that have occurred in the last 50 years in Kalkol division

2.1 What were the main land uses in this division before independence (List in descending order of importance)

Main land uses before independence	**Remarks**
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.

2.2 What are the main land uses at present? – List in descending order of importance

Main land uses at present	**Remarks**
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.

2.3. List the main sources of your livelihood before independence starting with 1 as the main source of livelihood

Main sources of livelihood before independence
1.
2.
3.
4.
5.
6.

7.
8.
9.
10.

2.4 List the main sources of your livelihood after independence starting with 1 as the main source of livelihood

Main sources of livelihood after independence
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

2.5 Based on your observation, has there been any change in the land use in Kalokol division Yes ( ) No ( )

2.6 If yes, what are the main land use changes that have occurred since independence to date? List them:

2.7 What is the severity of the impact of this change on your livelihood? Rank the impact for each land use change that has occurred:

(a) High (b) Moderate (c) Low (d) None

2.8 What was the role of men before the above land use change took place?

Main role of men before the land use change
1.
2.
3.
4.
5.
6.
7.

2.9 What was the role of men after the above land use change took place?

The main roles of men after the land use change
1.
2.
3.
4.
5.
6.
7.

2.10 What were the main roles of women before the land use change?

The main roles of women before the land use change
1.
2.
3.
4.
5.
6.

2.11 What are the main current roles of women?

The main roles of women after the land use change
1.
2.
3.
4.
5.
6.
7.

12. How do you cope with the impact of land use change on your livelihood assets? (What are these?

13. What challenges do you encounter in coping with the problems posed by land use change on livelihoods above?

14. In your opinion what are the preferred policy interventions

15. What are the main mitigation measures that can be used to redress the above land use change induced problems?

COMMUNITY FACILITIES

16. Do you have the following community facilities within your village?

Facility	**Yes**	**No**	**Providers**	**Distance (km)**	**Condition / Adequacy**
Social hall					
Play ground/ recreational facility					
Public library					
Open air Market					
Health facility					
Church					
Nursery school					
Primary school					
Secondary school					
Polytechnic					
College					
Police post					

For the providers of the above facilities, insert numbers as follows:-

NGOs (specify)

FBOs

private individuals

Government

Others (specify)

For the conditions of the facilities, insert numbers as follows:-

1) Very poor 2) poor 3) fair 4) good 5) very good

SECURITY

16. How secure do you feel in this area?

(1) Secure (2) moderately secure (3) Insecure (4) Very unsecure

Which are the most common types of insecurity?

Type of Insecurity	**Frequency**
High way robbery	
Livestock raids / theft	
Rape	
Inter- community incursion(night raids)	
Car jacking	
Assault	
Murder	
Others (specify)	

1. Frequent 2. Most frequent 3.Sometimes 4.Less frequent 5. Rare

How do you cope with insecurity issues

As a household……

As a community ……

Family social networks

19. How is your relationship with neighbouring communities?

A) Very good B) good C) fair D) poor E) very poor

Give reason(s)……

20(a) Are you a member of any social group (Chamas) in this area?

	No
	Yes

(b)Why did you choose to be a member of the Chama? ……

ECONOMICS

21. What are the main sources of your income (tick where appropriate)

Fishing

Livestock sales/products

Formal employment

Business (specify)……

Subsistence Farming

Informal employment

Remittance from family/children

Support from the government

Support from NGOs

Income from Chamas/investment

Other *(Specify)*.....

22. What is your average monthly income in Kenya Shillings?

0 - 5,000

5,001-10,000

10,001-20,000

Above 20,000

23. On a monthly basis how much does the household spend on the following?

Item	Food	Rent	Water	Fuel energy	Transport	Medical fee	School fees	Other
Amount								

24. What form of saving does the household engage in? (Indicate amount where appropriate)

Bank A/c	Chamas	Micro finance	SACCO	Others (specify)
Mount				

25. Have you or any member of your household ever accessed credit facility?

Yes ( ) No ( )

If yes;

From which source (specify).....

For what purpose? .....

INFRASTRUCTURE

Livestock and fishing enabling infrastructure

26. Do you have livestock enabling infrastructure in your village?

Yes ( ) No ( )

If yes, which ones (tick where applicable?)

	Cattle dip
	Livestock Holding grounds
	Water point
	Livestock routes
	Sales yard/marketing area
	Others, Specify

27. How far is the nearest livestock infrastructure from your village?

Infrastructure	Distance from the village (km)

28. Do you have fishing enabling infrastructure in your village?

Yes ( ) No ( )

If yes, which ones

	Fish storage facilities
	Fish factory
	mobile cooling trucks

- [ ] Fish ponds
- [ ] Fish marketing area
- [ ] Others, Specify

Transportation

29. What mode of transport is commonly used in the area?

Road [ ] r [ ] ater [ ]

30. What means of transport do you use to move from your house to service/goods delivery points;

- [ ] Matatu
- [ ] Motorbike
- [ ] Bicycle
- [ ] Walking
- [ ] Others, Specify

31. What is roads condition in Kalokol?

- [ ] Very Poor
- [ ] Poor
- [ ] Fair
- [ ] Good
- [ ] Very Good

Water

32. a) What is your source of water?

- [ ] Borehole
- [ ] Piped water
- [ ] Shallow Wells
- [ ] Rivers
- [ ] Lake
- [ ] Others, Specify

b) How long do you take to reach the water source?

- ☐ Less than 15 minutes
- ☐ Less than 30 minutes
- ☐ 30 minutes to 1hour
- ☐ More than 1 hour

c) What is your daily household water consumption?

- ☐ Less than 20 litres
- ☐ 20 to 50 litres
- ☐ More than 50 litres

Do you experience Water shortage currently as compared to the recent past?

- ☐ No
- ☐ Yes

If yes, why ?.....

What do you use water for?

- ☐ Domestic purpose
- ☐ Livestock purpose
- ☐ Gardening
- ☐ Industrial use
- ☐ Others

Energy

33. What are major sources of energy that the household uses for cooking and warming?

Source		Sufficient	Insufficient	Challenges
Wood				

Charcoal				
Electricity				
Kerosene				
Gas (LPG)				
Others				

34. What are the prices of the following sources of energy in Kalokol?

Source	Prices
Kerosene (ltr)	
Solar	
Charcoal (bag)	
Electricity (per month)	
Gas (cylinder)	
Others (specify)	

ENVIRONMENT

35. How do you rate the condition of the environment in this village? In a scale of 1-5 where 1= Very Poor 2=Poor 3=Fair 4=Good 5=Very Good

	Very Poor
	Poor
	Fair
	Good
	Very Good

36. What environmental problems do you experience in this Community?

Problems	**Causes**
Soil erosion	
Deforestation	

Water Pollution	
Air Pollution	
Others, Specify	

37. What have you done to reduce the above environmental problem in your village?

- ☐ community sensitization on environmental conservation and protection
- ☐ Livestock number reduction
- ☐ Planting of trees
- ☐ Others, Specify

38. How often do you or your community meet to discuss issues on environment affecting you and others in this village?

- ☐ Once a week
- ☐ Monthly
- ☐ Annually
- ☐ Never
- ☐ Others, Specify

39. Who organizes for these environment meetings?

- ☐ NGOs
- ☐ Government
- ☐ Individuals
- ☐ Church
- ☐

Appendix 2: Institutional questionnaire

UNIVERSITY OF NAIROBI

DEPARTMENT OF URBAN AND REGIONAL PLANNING

MA (PLANNING) 2012

IMPACT OF LAND USE CHANGE ON LIVELIHOODS

A case study of Kalokol Division, Turkana County

Institutional and focus group discussion guide

The information collected during this survey is purely for academic purposes and will not be divulged to any other person in whatever circumstance.

Name of the group ……Date…….

Location……Sub-Location ……Village…….

1. What are the livelihoods available for Kalokol community? Rank them in the order of importance e.g. Livestock, fishing etc

   Livelihoods for Kalokol community

Livelihood type	Rank

2. What is the historical land use change in Kalokol before and after independence?

Historical land use

Before	Rank	After	Rank

3. What are the most common land use induced problems experienced in Kalokol?
4. What is the impact of land use change on Livelihoods?

Impact on livelihoods

Land use change	Impact on livelihood

5. What are the impacts of these problems on the community?

Impact on the community

Land use change problem	Impact on the community

6. What factors are contributing to these Problems facing Kalokol community?

7. What are some of the strategies that the community uses to deal with these problems?

Strategies to deal with problems

No.	Problem	Strategy
1		
2		
3		
4		
5		

8. What is the role of women in managing the above land use change impact?

9. What is the role of men in managing the above land use change impact?

10. What challenges do men encounter in dealing with these issues?

11. What challenges do women encounter in dealing with these issues?

12. Are there groups or organizations that liaise with the government in reducing the problems mentioned above in Kalokol? Name them.

13. What are their roles?

14. What challenges do the groups / agencies face?

15. In your opinion, what do you think Kalokol division will be in future if nothing is done to mitigate the situation?

16. In your opinion, what are the preferred policy interventions and measures that can be used to redress the above problems in Kalokol division?

Appendix 3: Focus group discussion guide (women gathering)

UNIVERSITY OF NAIROBI

DEPARTMENT OF URBAN AND REGIONAL PLANNING

MA (PLANNING) 2012

IMPACT OF LAND USE CHANGE ON LIVELIHOODS

A case study of Kalokol Division, Turkana County

Focus group discussion guide (Women group)

The information collected during this survey is purely for academic purposes and will not be divulged to any other person in whatever circumstance.

Name of the group ……Date…….

Location……Sub-Location ……Village…….

1. What are the livelihoods available for Kalokol community? Rank them in the order of importance e.g. Livestock, fishing etc

   Livelihoods for Kalokol community

Livelihood type	Rank

2. What is the historical land use change in Kalokol before and after independence?

Historical land use

Before	Rank	After	Rank

3. What are the most common land use induced problems experienced in Kalokol?

4. What is the impact of land use change on Livelihoods?

Impact on livelihoods

Land use change	Impact on livelihood

5. What are the impacts of these problems on the community?

Impact on the community

Land use change problem	Impact on the community

6. What factors are contributing to these Problems facing Kalokol community?
7. What was the role of women before and after land use change in the order of priority, starting with 1 as the highest priority before the above land use change took place? ( ) Herding ( ) Fishing ( ) Farming ( ) Decision making ( ) Security provision ( ) reproductive role ( ) Household chores ( ) others

Role of women

Before	After
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

8. What is the role of women in managing the above land use change impact?

9. What challenges do women encounter in dealing with these land use change?

Appendix 4: Focus group discussion guide (Men gathering)

UNIVERSITY OF NAIROBI

DEPARTMENT OF URBAN AND REGIONAL PLANNING

MA (PLANNING) 2012

IMPACT OF LAND USE CHANGE ON LIVELIHOODS

A case study of Kalokol Division, Turkana County

Focus group discussion guide (Men gathering)

The information collected during this survey is purely for academic purposes and will not be divulged to any other person in whatever circumstance.

Name of the group ……Date…….

Location……Sub-Location ……Village…….

1. What are the livelihoods available for Kalokol community? Rank them in the order of importance e.g. Livestock, fishing etc

   Livelihoods for Kalokol community

Livelihood type	Rank

2. What is the historical land use change in Kalokol before and after independence?

Historical land use

Before	Rank	After	Rank

3. What are the most common land use induced problems experienced in Kalokol?

4. What is the impact of land use change on Livelihoods?

Impact on livelihoods

Land use change	Impact on livelihood

5. What are the impacts of these problems on the community?

Impact on the community

Land use change problem	Impact on the community

6. What factors are contributing to these Problems facing Kalokol community?
7. What was the role of men before and after land use change in the order of priority, starting with 1 as the highest priority before the above land use change took place? ( ) Herding ( ) Fishing ( ) Farming ( ) Decision making ( ) Security provision ( ) reproductive role ( ) Household chores ( ) others

Role of men

Before	After
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

8. What is the role of men in managing the above land use change impact?

9. What challenges do men encounter in dealing with these land use change?

Appendix 5: Research introduction letter from the university

University of Nairobi
Department of Urban and Regional Planning
School of The Built Environment
P.O. Box 30197, 00100 GPO Nairobi, Kenya
Tel: 2718548 Fax: 2718548
e-mail:durp@uonbi.ac.ke

Ref: **SBE/DURP/B63/63952/2010** **Date**: 19th September, 2013

The Executive Secretary,
National Council for Science & Technology,
P.O. Box 30623-00100,
UTALI HOUSE,
NAIROBI.

Dear Sir/Madam

RE: REQUEST FOR RESEARCH PERMISSION FOR MR. EWOI MARK EWESIT – B63/63952/2010

The above named is a Master of Arts (Planning) student in the Department of Urban and Regional Planning. He is currently conducting research on: ""**Land Use Change and Its Impact on Livelihoods: A Case Study of Kalokol Division, Turkana County, Kenya**" He will be collecting data on various land use related issues.

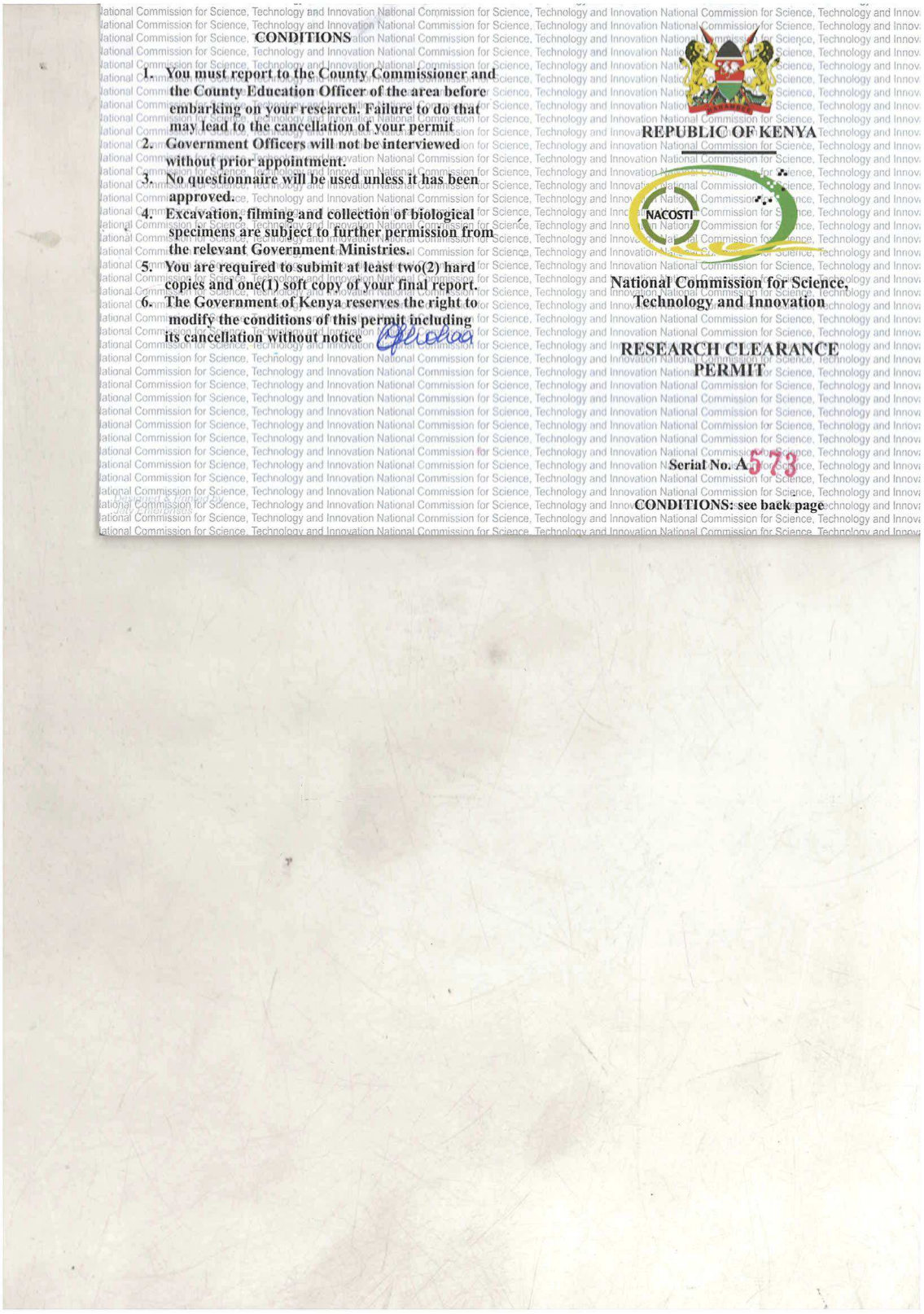
I recommend that you grant him the necessary permit to conduct his research.

Yours Faithfully

University Of Nairobi
Department Of Urban and Regional Planning.
Faculty Of Architecture, Design and Development
P. O. Box 30197 - 00100 Nairobi

Dr. S.V. Obiero
Chairman,
Dept. of Urban and Regional Planning

Appendix 6: Research Permit



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 Officers 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

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A 573

CONDITIONS: see back page