PERCEPTIONS OF PASTORALISTS ON THE ROLE OF LAND USE CHANGE ON RESOURCE USE CONFLICTS IN TURKWEL RIVER BASIN

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DECLARATION

I hereby declare that this Project is my own work and it has not been submitted for examination at any other universities or institutions for a degree or any other award.

December 4th, 2020

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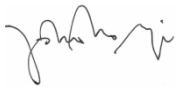
Roy Kisa Cheruiyot. **Date**

REG. NO: C50/12047/2018

This Project has been submitted for examination with our approval as University supervisors.



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ABSTRACT

In several areas around the world, dry land pastoralism is being threatened as a result of increasing land-use change and related demand on water and land whose environmental management needs to be urgently rethought in the light of land use and land cover transition (LULCC) dynamics. This research aimed to investigate dramatic land cover and land use transition in the Turkwel River Basin in Northwestern Kenya over a 55-year time-frame over which the major development process encountered a shift from pastoralism to a livestock-based agro-pastoral regime.

The primary aim of this research was to develop a better comprehension of the impacts on the environment, and livelihoods of the endless transformation towards accelerated agro-pastoral production processes in dry lands in Turkwel River Basin, with an emphasis on inland water basin areas. The research analyzed the impact of a transition in land-use on the environment and cultural livelihoods in the Turkwel River Basin from 1963 to 2018. Specifically, the study: (i) analyzed ways in which social-ecological systems of pastoralism in the study area were changing and their effects on pastoralism (ii) and (iii) analyzed the role of various development interventions in increasing the resilience of livelihoods to threats and crisis posed by land use conflict. An integrated approach combining LANDSAT images analysis, 84 household surveys using questionnaires and Participatory GIS (PGIS) were employed in the study. This approach allowed conceptualizing LULCC from both a scientific and an indigenous community perspective. Household surveys and FGDs were conducted in Kainuk, Sarmach and Amolem villages.

Study results have shown that land use and social-ecological developments have placed growing pressure on the limited resources over the years and have had detrimental effects on the ecosystem due to the diminishing resources that cause many disputes. As opposed to 1963, deforestation and the degradation of natural habitats have increased to produce more space for development. Having found a p of 0.393, analysis of the correlation reveals a positive relationship between the shift in land use and environmental effects. Due to more land being turned to cropland, urban centers and industries, there were noticeable disputes along the boundaries of the two groups along the river, where the soil is suitable for agriculture and pastoralism.

In conclusion, land use transition appears to have a negative effect on the Turkwel River Basin ecology, reinforcing the Eco-Violence Theory on Natural Resources and Conflict linked to homer-Dixon (1999) andand Gleditsch (2001) . The report recommends the need to incorporate environmental conservation policies into the development process in the Turkwel River Basin. Promoting efficient usage of natural resources is of vital significance in mitigating existing trends of use of land.

ABREVIATIONS AND ACRONYMS

ASAL	:	Arid and Semi-arid Lands
CAPE	:	Community based Animal Health and Participatory Epidemiology
CBO	:	Community Based Organization
CEWARN	:	Conflict Early Warning and Response Mechanism Unit
CJPC	:	Catholic Peace and Justice Commission
FAO	:	Food and Agriculture Organization
FBO	:	Faith Based Organization
FGD	:	Focus group discussion
ILRI	:	The International Livestock Research Institute
IUCN	:	International Union for Conservation of Nature
KNBS	:	Kenya National Bureau of Standards
KPR	:	Kenya Police Reservists
LULCC	:	Land Use and land Cover Change
NGO	:	Non-Governmental Organization
UN	:	United Nations
UNDP	:	United Nations Development Programme
UNECA	:	United Nation Economic for Africa
FIG	:	International Federation of Surveyors
GLTN	:	Global Land Tool Network

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Land is a limited resource and yet an indispensable resource for meeting the economic, social and environmental demands and targets. Due to land desires, battling for land resources is a major cause of conflict between nations and within nations and different partners, and the violent conflicts can have significant impacts on land Wehrmann (2008); Torre *et al.,* (2014). Conflicts of land use are social conflicts that occur with the intervention of governments, civil service agencies and regulatory agencies, companies, development movements, investors, nongovernmental organizations that launches development projects, which results in population resettlement from their lands (Requier Desjardins, 2009) resulting in deforestation, decline in cultivable land and pollution (Pham *et al.,* 2010). Land use competition for different projects in most countries conflict outcomes of different types is decelerating the pace of sustainable development.

Pastoralism is the production process for domesticated animals, which is based upon the widespread use of land and daily movement of some type of herd that has long been rehearsed in many parts of the world (WISP 2007). This pastoralism is practiced in more than 100 nations by an expected 100-200 million individuals according to (IUCN ESARO 2011) on 25 percent of the world's property zone (IUCN ESARO 2012). Pastoralist makes up about 5% of the entire population of some African nations, with 10-20% of the entire population in the Horn of Africa (UNECA, 2017). Pastoralists account for 40% of Africa's total land mass and contribute 10-44 % of some African countries Gross Domestic Product and also in ASALs it contributes about 12% to the overall national production (FAO 2005), with domesticated animals accounting for nearly 90% of all openings for jobs and more than 95% of family unit wages (Kaimba *et al.,*2011). The International Livestock Research Institute (ILRI) reports the livestock value chain supports 1.3 billion people (ILRI, 2013). Pastoralists are projected to contribute around 90 % of the consumed meat in East Africa and nearly 60 % of the milk products and milk consumed in West Africa. Therefore pastoralism is significant to the whole

of Africa and disruption to the livelihoods can have a negative impact on the societies in which they function because it sustains human populations, the harsh environment, the social benefits, the economical contributions to some of the least prosperous areas of the world and the long standing jurisdictions it supports (Nori and Davies 2007).

Kenya's ASALs cover roughly 84 percent of the landmass of the region, sustain 30 percent of the human and 70 percent of the population of livestock, and creates employment to about 90 percent of the indigenous residents (GoK, 2010), most of whom are nomadic people who primarily depend on livestock based livelihoods, has an exceptional capacity for extreme brutal disputes as an outcome of the on-going shift in land-use. Many Turkana and Pokot ethnic groups are predominantly migrant transhumant, who are defined by versatile structures and risk-spreading, for example, the division and breakdown of the flocks, mobility, and sharing land, large and varied livestock (Opiyo *et al.,* 2011). Therefore, conflicts are primarily over domesticated animals and their associated advantages to water, land and grazing fields. Conflicts' regarding land residency rights has become widespread, complex, increasingly conflicts, and violent activities between societies in northern Kenya (Kumssa *et al.,* 2009;Omolo 2010; Njiru 2012). Controversies over land-based residence rights have spread across Northern Kenya, which are becoming more complex, conflict-ridden and violent (Kumssa *et al.,* 2009; Mahmoud 2011; Omolo 2010).

Consequently, increasing population of the communities living around Turkwel River Basin have been left to fight each other over increasingly reducing land resources that they critically need to propagate their herding economies. Placing communal land under private ownership has led to events such as fencing, closure of livestock migration routes, and land use types that are incompatible with the tenets of free range pastoralism (Porokwa, 2000). This study therefore argues that the "scramble for land" coupled with population increase; tribal animosity ; historical settlement issues; demand for land for new development corridors (such as LAPSSET); as well as more traditional activities such as tourism and wildlife conservation threaten the quest for a sustainable future in the Turkana-Pokot economy (Dang, 1991). In particular, the study examined resource

scarcities (HomerDixon, 1995) and the constraints they impose on Turkana-Pokot historical relationship and sustainable development in a context of global environmental change (Nori and Davies 2007).

1.2 Problem Statement

Environmental change induces changes in land use that can trigger competition and conflict over land resources. Indeed, the past two decades have witnessed patterns of violent conflict in pastoralist areas of Kenya increasingly linked to land use claims (Schlee, 2011). Population increase, Building of infrastructures, Building of dams, Conversion of grazing to cropping, Installation and use of irrigation, Conversion to non-agriculture uses and Construction of industries are the factors that resulted in increasing pressure on land in Turkwel River Basin (Galvin 2009). According to Le *et al.*, 2014), this pressure on land has reported that a total of 22% of Kenya's land has deteriorated between 1982 and 2006, resulting in the emergence of political movements, local land disputes and even widespread civil strife (Daudelin, 2002).

Although pastoral societies in Turkwel River Basin have established traditional resource management regulations governing negotiated access to land by different stakeholders (Bollig and Österle 2008), they have not given a sustainable solution, particularly to conflicts related to dry seasonal grazing and water resources, and fundamental issues related to stock theft and cross-border resource use. Studies from (Homer-Dixon 1994, 1996; Hauge and Ellingsen 1998) have also shown that ASAL pastoralists ' poverty between communities can lead to conflict, especially if water and pasture supplies dramatically drop or deplete in prolonged situations of drought situations (Morton, 2006). In such environments, migrant herds could infest crop fields and prompt to conflicts among farmers and herdsmen or between nomadic herders themselves.

Growth of population from less than 5,000 to 14,104 (KNBS, 2019) and reductions in the quantity and quality of renewable resources has led to large-scale development projects that have altered access to resources which in return have led to a decreasing area for the pastoralist economy and increased chances of violent Turkana-Pokot confrontation over

land, water and pastures. Violent conflicts, whether short-lived or perennial, can bring about negative environmental effects and threaten stability and peace and frighten investment, thereby dispelling any hope of a lengthy-term, induced remedy for development.

The main focus of this study was to analyze the role of land use change in resource use conflicts in the Turkwel River Basin. While the conflict in the Turkwel River Basin has been on and off for a long time, it has risen to alarming proportions in the recent past. This has contributed to the need for further study of change of land sector that could fuel the conflict. The lower Turkwel River Basin is among the least developed areas in the world with a large area, high poverty rates and very low infrastructure, all of which intensify the sense of vulnerability and, hence, the need for self-protection through any means. Resolving such violence involves a thorough understanding of these changes with a view to fostering sustainable local development. Little consideration has really been given to the investigation of land use conflicts regardless of proof on expanding rates of such conflicts. The observations would not only advise policy debates on Pastoralism between Turkana-Pokot in a changing world but also land use planners to ensure the land use is sufficient and sustainable and does not cause unnecessary social or economic disturbance or severe environmental damage in the various regions.

1.3 Research Questions

Therefore, this research attempted to respond to the inquiries below

1. How have social ecological systems of pastoralism in the study area changed since 1963?
2. How has both human and natural land use change impacted the environment in the study area?
3. What are the new dimensions of the conflicts that can be linked to changes in the land use?

1.4 Objectives

1.4.1 General objective

The general objective of the study was to investigate on the perceptions of pastoralists on the role of land use change on resource use conflicts in Turkwel River Basin: More specifically, the study aims to;

1.4.2 Specific objectives

1. Asses how social-ecological systems of pastoralism in the study area are changing and their effects on pastoralism,
2. Investigate the environmental impacts of land use changes in the study area,
3. To determine the role of various development interventions in increasing the resilience of livelihoods to threats and crisis posed by land use conflict,

1.5 Hypotheses

To answer the primary objective of the analysis of perceptions of pastoralists on the role of land use change on resource use conflicts in Turkwel River Basin, the following hypothesis were analyzed:

Hypothesis 1

Research hypothesis **(Ha)**: There is significant change in land use in the study area

Null hypothesis **(Ho)**: There is no significant change in land use in the study area

Hypothesis 2

Research hypothesis **(Ha)**: There is significant relationship between environmental impacts and change of land-use in the study area.

Null hypothesis **(Ho)**: There is no significant relationship between environmental impacts and change of land-use in the study area.

1.6 Justification of the study

This Research intended to explain consequences of land conflicts in the Turkwel River Basin, in which these conflicts have got to the point where people kill each other, property is destroyed and development is negatively impacted (URT, 2009). The goal of the study was therefore to make significant recommendations to the regions around the Turkwel River Basin; policy makers; the Community; the Government of Kenya and the researcher. These inputs are shown here as follows:

To the Government, raise awareness of using land sustainably to avoid possible future detrimental effects of land use change on living standards. In order to accomplish Vision 2030, objectives of shaping the Kenyan economy to an all-inclusive, high-quality, centered country of life, it is important to start projects designed to harmonize traditional and modern structures of resource supervision and conflict, despite other policy steps.

To other researchers, this report is intended to be more than a reference for all the other scholars who may also be interested in the undertaking studies on land dispute studies and associated topics. And also the research enhanced knowledge on land conflicts through an analysis of different literature.

1.7 Scope and limitations of the study

The research was done in the lower Turkwel River Basin Kenya at the fringe of Turkana and Pokot, a region encountering land use change, environmental change, and resource-based conflict. And the contribution of this research was the analysis to solve problems that occur in the Turkwel River Basin. Land use research is a critical step forward for better understanding land use in the face of major economic and environmental shifts for global sustainability (Müller & Munroe, 2014). The research investigated perceptions, behaviours and values identified with land use change and strife so as to delineate contrasts among Turkana and Pokot. Despite the fact that there were other causes of social clash, the study concentrated on environmental resources, for example, pasture, land and water and human variables and biophysical factors adding to environmental change and strife were likewise explored. The goal of this research was to extend the

scientific basis for a deeper understanding of complex land use processes and it added information that enables land use to be guided towards more sustainable pathways.

The limitations of this research incorporated; insufficient time, spending plan oblige for leading this investigation and fear of COVID 19. The researcher overcame the restrictions by concentrating on three villages towns in Turkwel River Basin in order to set aside time and cash. And furthermore, insecurity interfered with the study because River Turkwel Basin is prone to conflict. The essence of the details on the stealing and raids of animals, which was generally delicate and classified due to its effects, hampered access to the right information. Language barrier and Pokot North has rugged landscape with very steep valleys and hills, with bad roads which made the roads not accessible. Lastly the researcher wore a mask when conducting the interviews and also maintains social distance.

1.8 Definition of operational terms

1.8.1 Land Conflicts

This can be defined as a social reality where, in any case, there are two events, the origins of which are completely separate preferences in the privileges of land to property; land management; the production of income from land; the removal of others from land; the redistribution of land and the luxury of making up for it. In this way, land disputes can be understood as an assault, control or disagreement on land ownership rights (Wehrmann, 2005).

1.8.2 Pastoralists

Pastoralists are individuals whose life depends on keeping of livestock. They are referred to as domesticated animals; jackasses, dogs, horses, goats , camels and cattle giving milk, meat, transport and trade . Pastoralists are somewhat referred to as migrants that adopt a normal transitory cycle that can shift to their herds. This convention is common in rangelands where, as a rule, the vegetation with the supply of forage is extremely poor and the standard of the forage fluctuates after some time FAO (1991:2).

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction and explanations of land use change and conflicts

Conflict happens when at least two groups are convinced that their interest is conflicting. Contrary, the incompatibility between two groups may emerge in light of the fact that the two of them may have various perceptions, objectives and thoughts how to accomplish them. This subsequently is a conflict of vision and failure or hesitancy to see the other party's opinion. The incompatibility objectives define extra complex conflicts that could be communal, organizational and international. Various kinds of conflicts in the community have perceived, the most essential been social in nature. Social conflict is an affair between individuals or groups with inconsistent objectives that form the starting point of conflict. Components of social conflicts are at least two rivals, who could be people or parties, in rivalry over scarce resources. The resources may include land wealth, power or other essential human needs, either perceived or actual. A decent number of these conflicts are because of competition and clamber for natural resources that are basic to human survival. Although, others are caused due to luck of poor or weak administration and authority structures, prompting corruption and breakdown of government's. A genuine case of this type of conflict is Kenya, and this part surveys the literature significant to the research issue. The study is reviewed under the accompanying sub-headings: conditions under which land use changes lead to social clash and armed strife; financial and political elements that have added to environmental degradation in Kenya and sub-Saharan Africa. After the audit, the hypothetical structure is talked about, the hypotheses are formulated and the factors operationalized**.**

2.1 How social-ecological systems of pastoralism in the study area are changing and their effects on pastoralism.

Land structure comprises complex, flexible social-ecological frameworks (Berkes *et al.*, 1998) shaped by interrelationships between the various demands and order that follow up on land, institutions, cultural practices and technologies through which social orders shape property use, and criticisms between environmental dynamics and land use

(Verburg *et al.,* 2015). Specific incentives for land-use changes plot degree happening for a short amount of time, such as deforestation or replacement of one crop by another, in relation to adjustments in the degree or future intensity of land use.

Such basic building blocks are combined with unexpected economic, physical, land-use changes (Lambin & Meyfroidt 2014) and spatial reorganization (Kastenneretal. 2014; ReyBenayasetal. 2007; Queiroz *et al.,* 2014; Levers *et al.,*. 2018) to create more complex (landscape, nations and across regions) and longer time scales.

Overusing and degradation of pastoral ecosystem on China's Qinghai-Tibetan Highlands which are the three Asian Headwaters streams, the Langcang-Mekong, Yellow and Yangtze, and are most notably secured via rangelands that were used by collective Tibetan citizen as subsistence pasturelands for browsing of domesticated animals, for example, the Tibetan sheep and the yak for centuries. Although, pastoralism practiced in the delicate and vulnerable QTP environment. It's being undermined through deterioration of the land used for grazing that is related to population increase, development, policy change and climatic warming. In recent decades, focal QTP rangelands have been abused by swiftly expanding animal and human populations (Chen and Wang 2001, Long and Shang 2005). A few researchers (Fischer 2008, Riley 2004) reveal that the rate of population growth of Kazaks and Tibetans during 1982-2000 was about twice that of Han. In 2006, a new railway was established into Tibet, additional foreigners are foreseen to make their way into this customarily peaceful location (Bauer 2005). It is possible that the overpopulation of emigrants in pastoral areas will be the same as the different places in China mostly in the west (Banks *et al.,* 2003). The increase in population in pastoral territories can be prompt to persistent overcrowding. As a comparative or even higher per capita amount of quality domesticated animals must continue, to sustain an unmodified living standard. (Harris 2010). In this manner, resources found in the pastoral territories are likely to be over-exploited by nearby indigenous tribes and outside settlers who do not pay a ton of focus to the carrying capacity of explicit grazing lands, which contributes to deterioration of generally speaking grasslands resources (Li *et al.,* 2008, Bai *et al.,* 2002).

Decrease of pastoral networks with 'modernizing' agriculture change in Andeans of South America. South America's Pastoralism is now bound to the semi-arid areas of the Andes, mainly in four nations, Bolivia, Peru, Argentina, and Chile (Westricher *et al.,* 2007). As far as land use, the pastoral population and animal production are concerned, the Andean countries (Sierra and Altiplano) of Peru and Bolivia are fundamental to the pastoralism in South America (Kuznar 1991, Westricher *et al.,* 2007). Despite the fact that pastoralist exercises are particularly huge to these countries' economies (Westreicher *et al.*, 2007), policies designed for agricultural development in both nations for the ' modernisation ' of pastoral practices in the highlands could not perceive and acknowledge the essential aspects of pastoralism, thus increasing economic, social and environmental depletion in pastoral societies all over the region (Nori 2007).

Marginalization of pastoral structures in Mongolia and Central Asia and collapse of the economy of order, the republics of Central Asia are expected to cover 250 million ha of land that structure some portion of a considerably bigger district of parched terrains including portions of China, Russia and Mongolia (FAO, 1997). Almost half or more pasture lands have spread across three countries in Central Asia, Uzbekistan, Kirghizstan and Kazakhstan. In the past, the essential land use over this vast territory was the extensive production of transitory animals, and the limits were not unbendingly characterized by the nation (Suleimenovand Oram, 2000). Underpinned by the technique of aagriculture reconstruction to attain food security and to change in accordance with showcase economy necessities, In the mid-1990s, after the break-up of the Soviet Union, pasture management was moved to accepted regular property schemes and late to privatization or leasing (Robinson *et al.*, 2010) of state-run versatile schemes.

A rapid transformation of land privatization changes has transferred land rights to wealthy people and groups from pastoral cooperatives, congesting the least fortunate portion of the population, giving rise to increased uncertainty regarding access to assets and the ability to practice a variety of versatile grazing alternatives (Nori *et al.*, 2005). Change the framework for the customary use of pasture, motivated for the most part by policy reform and population growth, has brought about increase of carbon emissions and

immense rangeland degradation in this region (Chuluun and Ojima, 2002). In spite of the fact that the results of changing property rights on rangeland just as domesticated animals the board are very extraordinary in Uzbekistan, Kazakhstan and Kyrgyzstan, numerous normal issues test their customary use during this monetary transition period to achieve food security and manageable pastoral livelihoods.

Pastoral structures have deteriorated in the European Alps and highlands with territorial development. Pastoralism in certain districts of Europe dates back to 10,000 years BP (McCracken and Huband, 2005). Numerous range of pastoral structures have been used that are identical to those rehearsed in different parts of the world, representing the topographical, climatic and social conditions that shaped them. In any case, in the course of recent years the region as a whole has been declining due to high-quality pastoralism, and these zones are located mainly in uneven and remote areas. Pastoralism is marginalized in Europe by local patterns of development, particularly the Focal Europe Alps and the mountainous regions of northern Europe. As Lichtenberger (1994) pointed out, the historical background of pastoralism in the European Alps could be dated to six thousand BP years of age. Customarily, ("alpeggio") a transhumance grazing method was designed to transfer domesticated animals over the late spring to pastures below or above the forests and then down to the bottom of the valley for the remainder of the year (Laiolo *et al.,* 2004).

The development of the economy of the Alpine Valleys and the growth of tourism in the ski areas (Lasanta *et al*., 2007) the role of managers has changed, minimizing pastoralism in such areas and attempting to make it less important or economically unsustainable. The elimination of these Alpine environments because of nearby individuals moving to the base of the valley, and the reduction in the stocking levels of the animals associated with the rest of the occupants moving to different occupations have brought about articulated changes in environment dynamics and functions (Cernusca *et al.,* 1999, Dirnböck *et al.,* 2003, for instance, individuals emerging from encroachment of the forest then invade pasture lands in the subalpine region. As a product of the conquest of the bush invasion, the open fields of living spaces have declined and the complexity of the landscape has

reduced, contributing to an evolution of habitat characteristics and populations of animals. (Pienkowski et al., 199, Laiolo *et al.,* 2004).

Degradation of the pastoral structure in Queensland of Australia, with production-oriented administration. The Rangelands have spread to about 70% of Australia, and it has been utilized for 40,000 years by indigenous hunters and gatherers (Bowler *et al.,*. 2003). Since then the Europeans settlement, the prevailing land use of these pastoral zones has been moved to rural pastoralism, so that cattle can pass across broad areas as they please (Earl and Jones 1996). The Pasteurian setting was laid down over the last two hundred years, replacing the Australian indigenous framework with exclusive dairy cattle and sheep munch of local vegetation (McAllister *et al.,* 2006). A whole new thing about this framework, vegetative land distribution has been completely eliminated by heavy grazing demand. According to (Allen Consulting Group 2001) saltiness is estimated to negatively impact approximately 5.7 million hectares of Australia because of biodiversity clearance and poor animals' management, and in the next 50 years this number is expected to ameliorate to 17 million. For quite some time, the Australian pastoral industry (Richards and Lawrence 2009) has been describing this monetarily costly and ecologically harmful circumstance. Nevertheless, the reaffirmation of Indigenous land rights and the overall development of conservation have led to the pastoral development in some regions increased considerably in the 1980s and mid-1990s (Heathcote 1994, Holmes 1994), occasionally Conflicts often occur between browsing and open interests in ecologically-saving activities (Stafford and Buxton 1996, Bellamy and Dale 1998).

Decreased pastoral systems in Africa with agricultural expansion. Sahel Located between the Sahara Desert and the sub-humid savannah zone in the semi-arid development zones, for a long time the Sahel has always been an important pastoral region in Africa due to its elements both physical and climatic conditions and related plant communities. As Brooks (2006) demonstrates, pastoral work in the Sahel evidently relied on masterful, non-exclusive water access, and the accompanying areas of acknowledgement between pastoralists and farmers. With its adaptability and willingness to respond quickly to changes in the nature of the country, this traditional structures has been adapted to the

biological and sociological circumstances that define the Sahel (Jarvis 1993, Marshall and Hildebrand 2002). Nevertheless, pastoral ability to adapt, dependent on access to water and grazing land productivity, is currently negatively impacted by unexpected degradation in the ecosystem, climate change, and the need to step up agricultural production in order to address the needs of a rapidly expanding population (Grouzis 1988; Watkinson and Ormerod, 2001). According to Ahmed *et al.*, (2000), in the 1950s and 1960s the Sahel witnessed bizarrely a lot of precipitation, as compared to the average for the twentieth century, which for some African countries ware also at the momentum time frame for freedom. During this time as Brooks (2006:4) has articulated, "Recently, autonomous Countries in Africa have concentrated on the current, centralist responses to the planned development for conveying monetary growth and the customary ways to deal with resources administrators and food security were progressively underestimated." The happenstance of economic and political transformation throughout this period led to the northern extension of crop production to the formerly negligible territories of the Sahel, which leads to escalation of clashes among pastoralists and agriculturalists significant ramifications for the two gatherings (Glantz 1996, Thébaud and Batterby 2001).

In a research article in the Shurugwi district of Zimbabwe's Midlands Province, Mark and Kudakwashe (2010) noted an increase in cultivated land.The Resettlement Program and Land Reform attributed to this increase. For various farm-related operations, such as exploring new cultivation plots, wood for fuel, poles for constructing both residences and livestock pens, among many other operations, huge areas of forested areas have been destroyed.

Encroachment of alien species. As indicated by an Article by the name " Spatial Evolution of Prosopis Invasion and its effects on LULC and Livelihoods in Baringo, Kenya" Published: 22 May 2019. Woody alien vegetation has been purposefully introduced in a number of parched and semi-dry regions, since it is capable of providing administration and services to rural poor people. In any case, a portion of these alian trees and bushes have gotten obtrusive after some time, with significant effects on ecosystem services, human well-being and biodiversity. In the 1980s, Prosopis was inaugurated in

Baringo a county in Kenya, yet from that point forward, it has spread quickly from the first estates to new zones. Prosopis inclusion expanded from 882 ha in 1988 to 18,792 ha in 2016. The presence of Prosopis increased in 2016 from 882 ha in 1988 to 18 792 ha. For prairies (6252 ha; 86 percent), irrigated farmland (849 ha; 57 percent), overgrown vegetation (3602 ha; 42%) and rain-fed cropland (1432 ha; 37 per cent), the most elevated negative LULC class changes were identified. Prosopis interference alone actually accounted for more than 30 percent of these negative changes, suggesting that Prosopis infestation be a major motivator of the LULC changes observed in Baringo County.

Effects of land use change on pastoralism

Displacement of different classes. As per Layashi Yaker former UN Secretary-General in 1994, approximately 80 percent of people displaced and refugees in Africa are children and women. Herders can cross into agricultural areas throughout seasonal migration, which can sometimes lead to conflicts with farmers outside the pastoral area. Once nomadic herders invade farmlands territory, their objectives can momentarily conflict or overlap with that of other land users. These disputes can be exacerbated as farming land users have got their properties assessed and their private property recognized, and their rights to land are confirmed. The codification of property rights removes competing interests since this establishes proprietary modes of possession of wealth (Meinzen-Dick and Mwangi, 2009), attempting to block nomadic movements fundamentally by restricting them of privileged access (Brink *et al.,* 2005).

The nomadic approach of re-negotiating fixed – term and unlimited privileged access to services is becoming more troublesome in a landscape that is already being increasingly mapped, subdivided and disbursed (Homewood *et al.*, 2004). These have contributed to a reduction in economic and social well-being among-st nomadic herders (Swallow and McCarthy 1999).

2.2 Environmental effects of land use change

Land use transition is potentially the most widespread socio-economic factor causing adjustments and destruction of habitats. Agriculture, deforestation, urban development and other human practices have greatly impacted the environment of the Globe. Such land disturbances impact critical environmental processes and resources which can have long term and wide ranging consequences.

Past research have distinguished that Asian waterways sediment heaps have been quickly expanding because of the expansion pace of inland soil disintegration for the most part brought about by population growth. This had caused a negative effect regarding diminishing soil richness, danger of glimmer or lowland mud floods siltation in reservoirs (Diyabalanage et al., 2017). The primary challenge of unsustainable agricultural rehearsals in mountainous regions of South Korea is poor soil superintendents against disintegration and burdensome application of fertilization (Lee et al., 2010). Precipitation has an impact on soil erosion, nutrient loss and runoff, mostly the case either during or in the post-monsoon time frames (Eisakhani et al., 2011; Sholagberu et al., 2016). When precipitation is heavy it broadens the downpour sprinkle and overflow disconnectedness on the slope gradient, the effects is a high load wash in the streams (Sholagberu et al., 2016; Diyabalanage et al., 2017. In Mogolia, land clashes carried some adverse effects to individuals and properties, those negative effects incorporate; loss of properties (Baatar, 2007)

Land conflict accompanied negative effects in Africa as uncovered by various analysts, for example, (Kariuki, 2005; Wehrmann, 2008). In Cameron Highlands, roughly, 66 percent of the land has slopes above 20 degree which may cause soil and avalanches. The movement of the soil increases with sandy soil and high annual precipitation (Aminuddin et al., 2001). The formation of shallow gradient soils as stated by (Khairulmaini ad Fauza 2010) began with the weathering of granite stone in the highland of Cameroon. Limiting the level of land available for farming and development purposes resulted in abrupt land clearing to meet the needs (Weebers and Idris 2016). In this manner, some weakening

that could potentially change the river system's ecological equilibrium (water catchment upstream) in Cameroon Highlands will have a significant environmental impact and the downstream waterway system operation.

Insecurity and its impression have one significant impact, unsustainable resource utilization. Prior evaluations by Morton (2001) show that somewhere in the range of 15% to 21% of the rangelands in the Turkwel River Basin have become pretty much out of reach to Turkana and Pokot pastoralists because of suffering between network ethnic strains. Local fringes between Turkana and Pokot, mostly in these areas, Sasak, Lokiriama, Lomelo and Amolem have gradually become out of reach. That's why the south of Loya rangelands, situated between both the Turkana fields and the good Pokot countries, were wealthy in the region, but neither the one nor the other are coming to the zone because of the security situation. However, under-use of the field raises the possibility of invasion on alien species that consume the landscape or make it more difficult to access it (Bollig 1990; Opiyo *et al*., 2011). Moreover, abandoned water wells could become a cause of poisoning of animal (Mbaria *et al*., 2005).

In Lake Victoria the gradual loss of natural living spaces has decreased vegetation spread exposing soils to both water and wind erosion, further exacerbating the degradation issue. Water disintegration is broad in numerous pieces of Lake Victoria basin with roughly 45 percent of the land inclined to water erosion. (Reich and others 2001) and riverbanks are demolished by gulley erosion. Siltation of dams and the expanded danger of flooding in streams and estuaries are the immediate impacts of soil erosion and other degradation powers in the basin. The closes to yearly flash floods in Budalangi and Kano fields have been connected to such forces coming from point and non-point forms (Gichuki, 2003). In Kenya, land conflicts brought negativeness like; destruction of properties (Kariuki, 2005).

The prolonged conflict in Turkana has had a negative environmental impact as per Goldsmith *et al.,* (2007:45). As populations regroup for security reasons, the burden placed on the fragile ecosystem may never be restored. The migration of large cattle in limited areas may be catastrophic. Structural violence, along with physical violence, also

places an emphasis on environmental justice, social injustice and inequality in human security statement (Schnurr and Swatuk 2012:1-14). Sustainability concerns are intertwined with human security especially with respect to environmental rights and management, land allocation, poverty and land use practices (Clover & Ericksen, 2009:53-70). In Turkana South during raids, the migration of large populations of cattle's and individuals led to the destruction of water points and grazing grounds. An interview with Turkana South Sub County Deputy County Commissioner (DCC) reported that relocations have led people to congregate in safer regions that are sometimes located along the waterways contributing to detraction of vegetation. For instance, most impacted pastoralists had relocated to Kalemungorok in Turkana South, which is safer and far from conflict zones in which led to the extinction of some plant species and the rapid destruction of the land which could quickly progress to desertification.

Environmental destruction in Pokot North is the result of the movement during raids of large numbers of people and cattle. According to Pokot North sub-county DCC, Abdirizak Jaldesa, the environment and resources in safe zones is derogated in times of conflict owing to overuse by humans and animals. The DCC also reassured the pastoral conflict in Pokot and Turkana inflicted pressure on the delicate ecosystem once the pastoralists regroup for security purposes. Also there was massive destruction of the environment, with rapid and intense deforestation in the aim of building manyattas and fences leading to water-points destruction, other pastures and grass were also quickly consumed, trampled on, and quite often destroyed and some communities cut down trees for charcoal and firewood as an income generating alternative in urban centers including Kainuk, Lokichar, Katilu.

2.3 How various Development Interventions increase the resilience of livelihoods to threats and crisis posed by land use conflict?

The approaches/strategies to encourage the commitment of pastoral individuals in alternative income producing exercises should begin from two points. From one viewpoint investment opportunities for pastoral individuals should be distinguished

trailed by the making of access to credit and training so as to empower pastoral individuals to seek after the investment opportunity. Then again, open segment interest in labor concentrated framework arrangement could make business open doors for pastoral individuals, while motivating schemes plans to train and recruit ethnic minorities including pastoral individuals may be built up for the private area.

Having acknowledged that some domesticated animals keepers ought to broaden, and that for this they need access to credit, it is important to figure out which non-domesticated animal's speculations will be worthy and effective for pastoralists. Pantuliano (2002) calls attention to that destitute pastoralists ought to be assisted to attempt exercises in which they can utilize the skills that they as of now have and of their connections with the rural pastoral economy, which for example could be the advertising of pastoral items (for example dairy items), butchering, leather processing or management of abattoirs. In Australia, the concept of productivism governs pastoral systems (Richards and Lawrence 2009), in which the model is defined by generation escalation and emphasis alongside the specialization of the element (Argent 2002, Bowler 1998). In general, this model has sought to emphasize the quality level and, as a more comprehensive structure for production of food, based on the premise that the increase in production would benefit consumers (Lang and Heasman 2004), it has contributed to fragile biological systems, e.g. the turning of long-lasting vegetation scenes into ' the breadbaskets of the earth (Lawrence and Gray 2001, Friedmann, 2005). New research and checking programs for pastoralist territories should be structured this may discuss financial and environmental inter-relationships within the CHANS program (Vetter 2009)by including a single interdisciplinary research organization prepared to investigate pastoralism at different scales, from the community to the globe (Liu *et al*., 2007)

Improving access to and accessibility of services would reduce disputes, and especially their development to a broader stage. The developing business sector of ecotourism may likewise offer new open doors for elective income producing for pastoralists (for example divers, visitor and tourism guides, cooks, tracker guides, handicrafts, campsite watches). In any event, the evaluation of the contribution of pastoralists to the maturing of elective

income plans in the Ngorongoro Conservation Area and the Serengeti National Park in Tanzania indicates that pastoralists are not prepared to let go of the full advantage of these open doors because they need expertise, credit and asset rights assurance (Goodman 2002). According to Abdirizak Nunow (2011), throughout southern Ethiopia, prosperous Boran pastoralists have begun growing crops within enclosures as a way of securing resources in an extremely fragmented environment. Although Boran has historically built enclosures to keep forage for grazing in the dry seasons, the growing of crops within enclosures is another way in which people may assert exclusive use of the paddock. The movement towards exclusive enclosures must have picked up the pace as better-off pastoralists try to fatten animals to satisfy the expanding cattle demand in Ethiopia.

According to Abdullahi Abdi Hussein e.al (2011), for some time now pastoralism in Ethiopia' and Somali region has changed and the massive increase in economic growth in small villages has been one of the signs of changes in the region. The selling of camel milk across cities is one of the inventions that have become popular. Camel herds are gaining popularity in the cities while herders are entering the city economies. In order to support ' town camels ' along with livestock that are brought for selling, cities have become much more significant in pastoral systems, so that some pastoralists and villagers often grow more food on the enclosure in the outskirts of cities. This is yet another demonstration of how vulnerable urban pastoralists react to livestock marketing processes by exploiting a niche market for livestock produce.

The formation, visible proof and development of investments are important parts of the techniques used in the Freemans *et al*., (1998) elective wage growth exercises for herders in Kenya as well as access to credit for impeccable herders. In the district of Baringo, Kenya, Little *et al*., (2004), land where there is some faculty or post-training in one portion is paid substantially better salaries, greater income, more food sales, less food aid and a larger number of domesticated animals than different households. Better training extends the chance to work in more generously reimbursed jobs.

According to Abdullahi Hussein Mahmoud et al., (2011), Maa-speaking herdsmen engaged in a discussion with the ranch managers and owners who are

located in Kenya in the laikipia plateau so as to access pastures within the farms in a situation of severe drought in 2009, where more than two thirds of the land is divided into large private commercial farmhouses. The talks were a significant break from the conflicts and clashes that dominated the Maasai and the ranch owner's relationship for a long time. Relatively small numbers of animal keepers relocated their livestock's to ranches during the emergence of prolonged drought events as a result of the talks in 2009. Such agreements provide a blueprint for how shepherds might create ties across political and social ties to sustain their livelihoods.

Abdullahi Abdi Hussein et al., (2011), a lively and profitable camel industry is increasing in the borderlands of northern Kenya / southern Ethiopia-herders, merchants, dealers and other business players are growing. Although the rewards of these new trade channels are pretty huge, market players would certainly benefit disproportionately along the supply chain. Camel trading in this border region is generally considered to be one of the main profitable for most individual investors, particularly herders.

According to Bokutache Dida *et al.,* (2011), the pastoralists were at the frontline of attempts to encourage greater relationships. Since conflict between the historically united Gabra and Boran flared up in 2004, representatives from both communities launched a dialog based on customary law to push a political agenda for peace between both communities. Through Maikona Declaration (2009) the dialogue resulted in a resolution defining the law to preserve positive relations between both the Borana and the Gabra. The dialog was productive and also praised as pastoralist development, because it draws on peace making principles accepted by representatives in both communities and cooperates with governmental legislation and agencies. In this situation, development has less to do with radical transformation rather progressive change and adjustment to the increasing demand and opportunities in existing institutions and relationships.

According to Jeremy Lind et al., (2011) In Kenya, pastoral developments offer new perspectives on how these policies and initiatives could be established. Good and bad herders are both creative for somewhat different purposes and have different impacts for the development of pastoralism throughout the area. Innovation occurs both due to the

introduction of new resources tied to marketing processes along with frustration and hence the looking for new ways to reduce losses. In pastoral areas, wealthier pastoralists that are usually the target of development strategies reap the rewards of enhanced connections with regional and national markets. Successful commercialized livestock owners can pay for manpower to transfer livestock in progressively monetized pastoral markets; buy hay and account for water tinkering throughout drought; potentially negotiate person's landowner deals to obtain high value forage.

2.4. Theoretical and conceptual framework

2.4.1. Theoretical Framework

Scholars such as Suhrke (1996), Bachelor (1998), Percival and Homer Dixon (1998), Homer-Dixon (1999) and Gleditsch (2001) have established a link between environmental resources and conflict. Homer-Dixon has put forward the **Theory of Eco-violence** that can conveniently embrace in this research. Blitt and Homer Dixon (1998) Suggested that vast communities throughout many developed countries are profoundly influenced by four main environmental resources that are crucial to trim generation: cropland, wetlands, forests and fish. The loss or depletion of these services is caused by over-use, abuse or deterioration of specific situations that provoke confrontation. According to Dixon-Homer (1999: 30) decreases in renewable resource quality and amount, land use shifts, unequal access to the resources, and population growth act independently or in multiple ways to increase the scarcity of forests, soil, cropland, and fish in certain population collections. This may decrease financial productivity, both for the lack of local meetings and for the wider local and national economies. The individuals impacted can migrate to new grounds or be expelled. Relocating communities also provoke ethnic tensions while moving to new territory, while reductions in income may cause disputes of impoverishment.

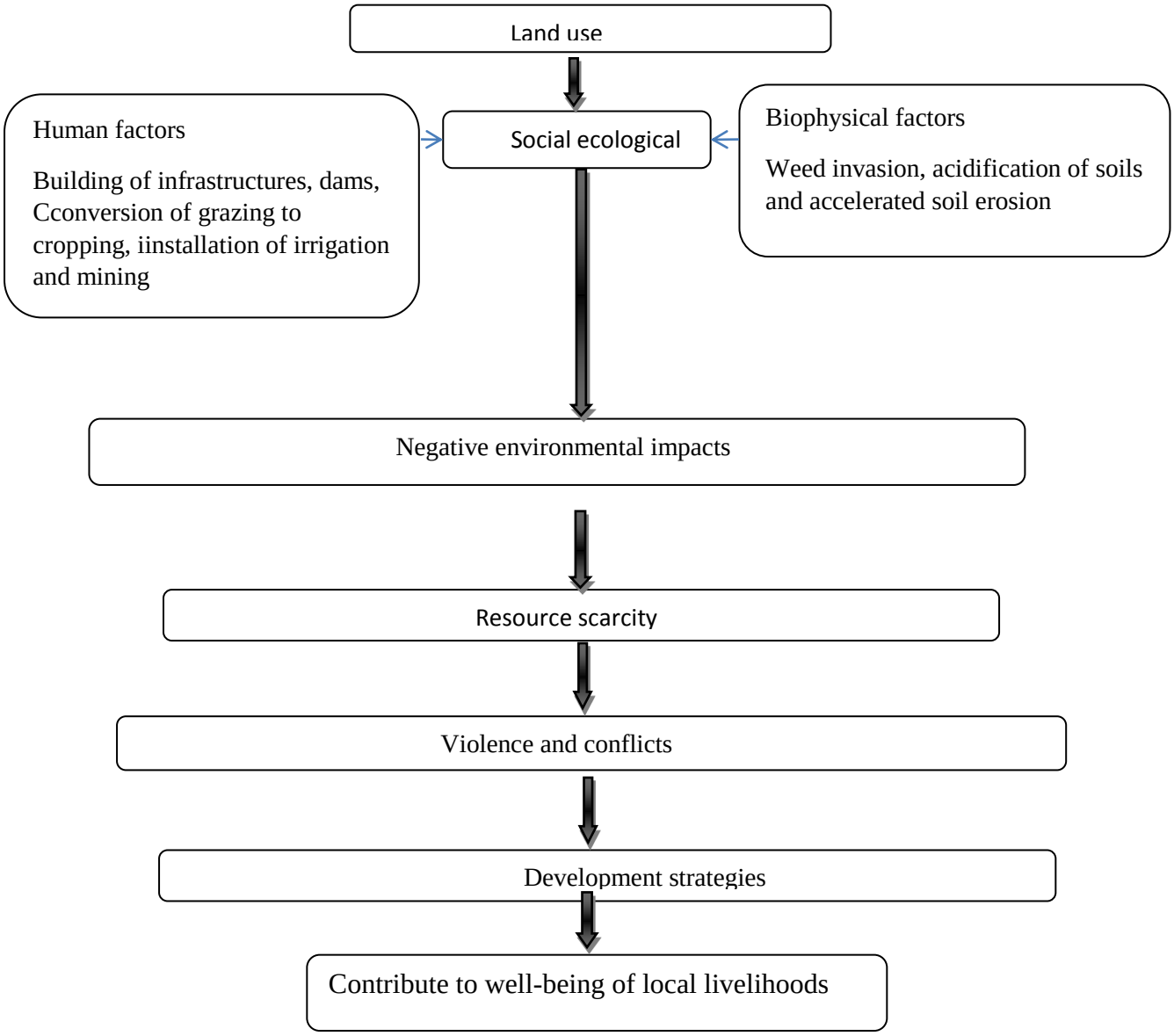
Commodity shortages are the product of an insufficient supply, excessive demand or inconsistent allocation of resources that drives certain section of the general public into a

state of hardship. Such causes of scarcity are thus caused by factors such as economic development, environmental degradation and population growth. In this way, the lack of natural resources would hinder economic productivity, agriculture, and the disruption of human livelihoods, migration and poverty.

Relocation can arise either because the environmental quality of the region is not alive or, in particular, because of violent conflict. The gaps between the gender, language and the racial division or religion of the whole population are likely to be reinforced by persuasive productiveness and intervention and thus promote a conflict (Gleditsch and Urdal 2001:286). Homer-Dixon thus presents the idea of an ecological (or resource) shortage with a pie illustrative illustration: quantitative depletion or qualitative degradation reduces the absolute pie size. An increasing population of people who ingest the pie believe every element of the pie shrinks. Lastly, if the pie is spread in pieces of inconsistent size, then some people can survive unreasonably little.

2.4.2 Conceptual framework

Figure 1: Conceptual framework



Source: Modified from Schilling et al., (2011).

Land use shifts are the outcome of dynamic socio-ecological mechanisms induced by biophysical and human driving factors and the relationship between these forces (milne et al., 2009, Lantman et al., 2011). Although affected by biophysical factors land use are influenced mostly by humans and their use of land (Turner *et al*., 2009, Rounsevell *et al*., 2012). Human variables incorporate an assortment of human land uses and exercises prompting to environmental change. In this Model they incorporate agriculture, irrigation, fishing, mining, urbanization, industry, tourism and recreation. These exercises cause; building of infrastructures, building of dams, conversion of grazing to cropping, installation and use of irrigation, conversion to non-agriculture. While biophysical process incorporate; acidification of soils, accelerated soil erosion, weed invasion, enhanced greenhouse effect, climate change and decline in biodiversity. In this way, both of these procedures negatively influence the areas around River Turkwel population and accordingly lead to drought. In the event that dry spell continues it, at that point prompts resource shortage. Resource scarcity not just diminish domesticated animals efficiency, high mortality of domesticated animals and zero calving yet additionally rivalry over scarce resources and popularity for meat in urban increases and this brings issues augmenting and compensatory cattle raiding, proliferation small firearms and commercialized cattle-raiding respectively. What's more, because of weak government organizations, powerless customary establishments and political incitements this has given an advantage in pastoral brutality and conflict.

A realistic dispute analysis based on livelihoods discussed ago-ecological circumstances, current living practices and the social-economic and political context. Pastoral development programs need to recognize their potential impacts, the successes and the losses, and the resources to reimburse the losers. Therefore they need to negotiate access to resources and resolve conflicts, improve the efficiency and productivity of existing livelihood strategies. It is important to strive to diversify the mix of livelihood choices open to societies, to improve pastoral social and cultural resources that can help societies respond to transition and transform into the larger social system, and to enhance unique and powerful connections between and within pastoral themselves, farmer and urban

dwellers, Women's participation enhanced and should strengthen and safeguard mobility and harmonization of treatment across borders. In which these development strategies would not only bring peace but also reduced poverty, better food security, improved pastoralists security and sustainable natural resource use.

2.5 Gaps in knowledge and focus of the study

The issue of land conflict among pastoralists and farmers has been scrutinize so much by different authors and researchers such as, (Odhiambo, 2008; Hussein and Mwakasangula, 2010; Kironde, 2012; Baha *et al.*, 2008; and Oki, 2013). But, the majority of them based their research on causes of conflicts but not the impacts of those conflicts on the environment. On that account, this research on surveying the impacts of land conflicts among pastoralists and farmers in pastoral zones is still contemplated important to connect the gaps left by other referenced investigations.

Even though, more proof is needed on whether effective peaceful advancement leads to a decrease in destabilizing exercises. More research is required on impacts of water conflicts on pastoral livelihoods. More work is required on the environmental benefits gains from pastoralism and also, not just from a portfolio survey of World Bank extends but additionally from the enormous number of exercises by national governments, different NGO's , and donors .

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Study area

3.1.1 Location and topography

Kenya is situated in East Africa; it depends on natural resources and agricultural sector in economic and natural resources. My research has been undertaken in the Turkwel River Basin, between both the Pokot and Turkana tribes, whereby different types of conflict have arisen. The Turkwel River Basin region, that has abundance of fertile soils, from the Marich Pass area, 194 kilometers to Lodwar and Kainuk, is the place that the NGOs considered they were seeking to encourage both tribes with sustainable agriculture. In the Turkwel River Basin, the Kainuk, Amolem and Sarmach are among the worst affected regions.

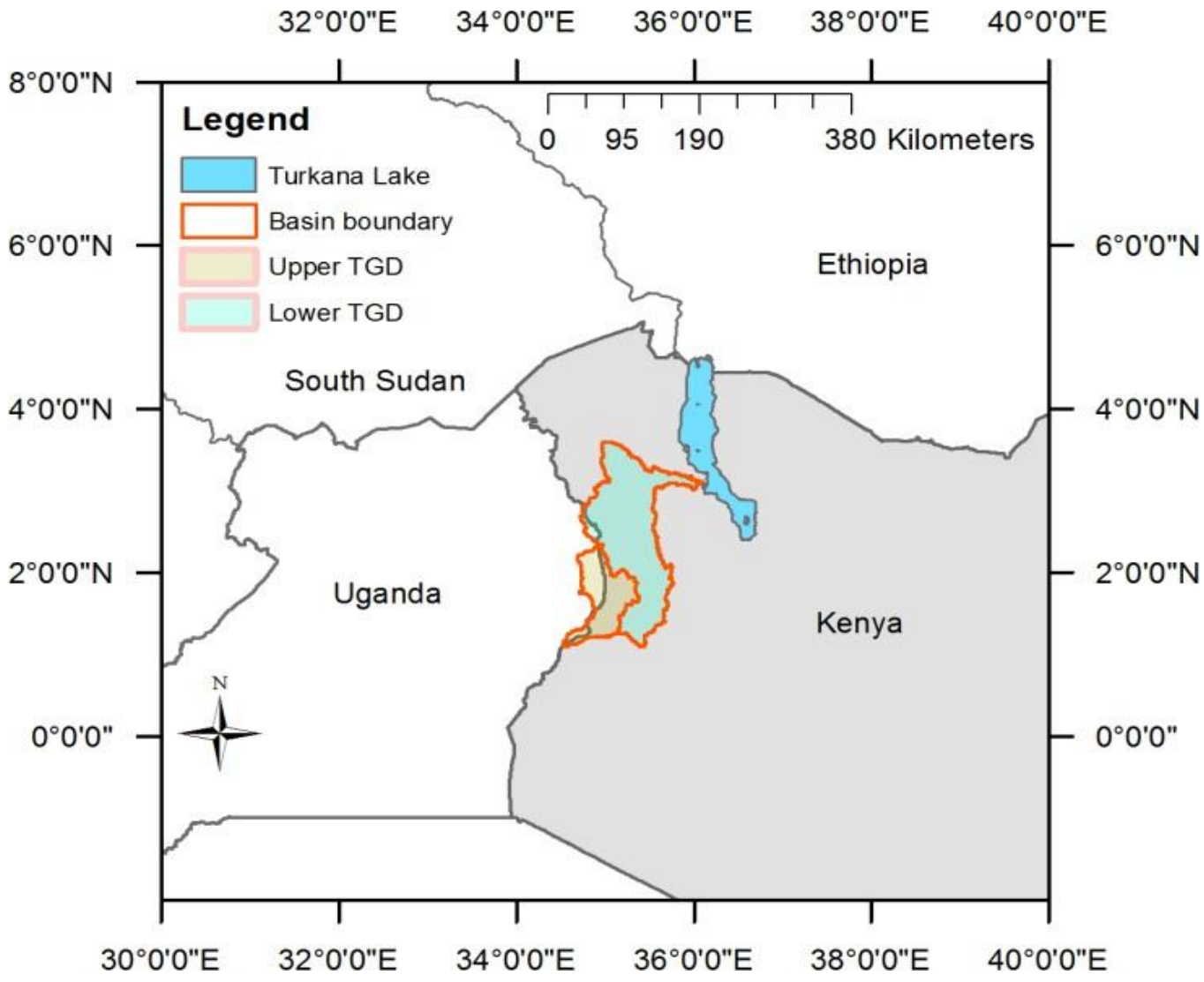
In the Northwestern Kenya is where the Turkwel River Basin is located. The River emerges from on the Ugandan side of Mt Elgon and flows into Lake Turkana, which is the biggest desert lake in the world (Avery, 2012), comprising a total catchment belt of 23,740 kilometers. The basin has a complex hydro-climate with a very diverse topography and a marked precipitation gradient from south-west to north-east. The highlands in the south were within 900 and 1749 mm per year while the inhospitable desert of the northern lowlands produces average rainfall ranging from 99 to 400 mm per year. The basin has two rainy seasons: from March to June with long rains and from October to December with short rains. The river supplies water to a number of socio-economic industries.

Turkwel Gorge Dam which is in lower Turkwel Basin covers 37 square kilometers, Lehner et al., (2011) generates 106 MW, which appears to be the third largest hydroelectric production in the country (KENGEN, 2017). Some many small-scale irrigation schemes rely on the water or deep boreholes connected to the river. The gross irrigated field was projected to be 18 square kilometres in 2013 (Maina et al., 2013), and

has steadily increased. The freshly planned Turkwel Multipurpose plan involves a 300 square kilometres irrigation project for agricultural production (KVDA, 2013).

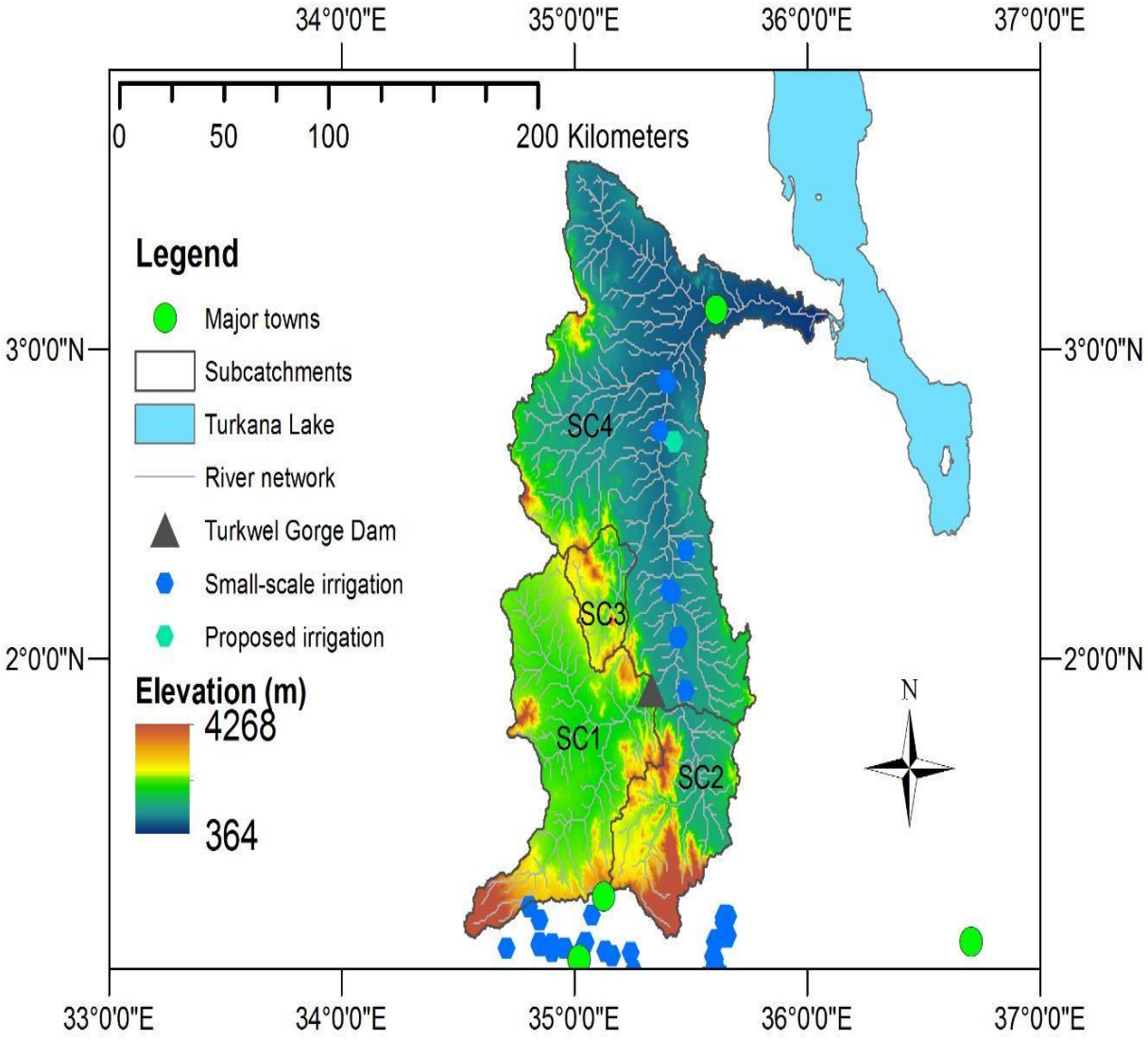
The latest oil exploration with in the basin in South Lokichar , situated southeast of Lodwar town (Kuper and Haberer, 2016) and developing industries might also theoretically harvest water from the pull water out of the river Turkwel. In Kenya environmental flow is characterized as the 5 percent flow of the natural movement. Cascade natural drainage levels from the river Turkwel and water lost and regulation flow from the reservoir can contribute to in misaddressed Environmental Flow requirements. These could intensify pressure on water and bring about conflicts among nomadic herders who make up 55% of the population of Turkwel region (Johannes et al., 2015).

Map 1: Location of Turkwel River Basin in Kenya



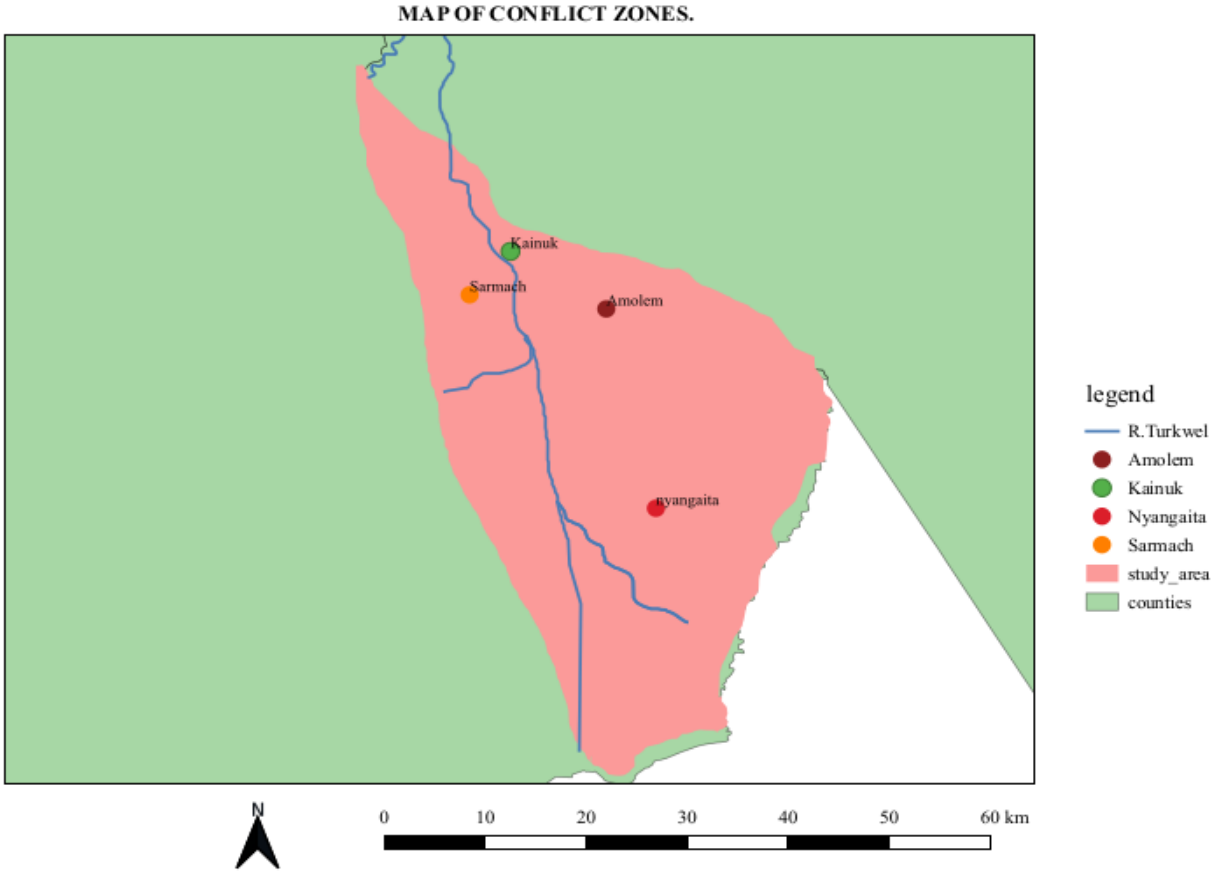
Source Dr Feyera Hirpa (2018)

Map 2: Turkwel River Basin



Source Dr Feyera Hirpa (2018)

Map 3: Conflict zones in the study area



3.1.2 Climate and rainfall

The region which was examined was located in north-western Kenya, the Turkana south and parts of West Pokot north, it is traditionally a semi-arid range land within agro-climatic zones IV and VI, where short-term climate variability, as well as adaptation to long-term shifts, is important for the sustainability of livelihoods. The weather is usually hot and dry, with average annual temperatures ranging from 28 ° C to 41 ° C, with strong evapo-transpiration levels, at a height of 38 ° C (GoK 2008). In both environments, precipitation is unreliable and inconsistent, and is dispersed bi-modularly within the year, with the long rains falling between April to May and the short rains

between Septembers to October. Annual average precipitation ranges from 120 mm in the East to over 200 mm in the region's northwest sections.

3.1.3 Water resources and vegetation

The primary source of water for both households and domesticated animals in the study area are seasonal wetlands (laghas) and flowing river Turkwel, which channel the outskirts of Turkana and Pokot regions, are the major occasional streams. The region's numerous water wellsprings are shallow wells, sandy riverbeds, drill openings, earth dams and weirs.

The majority of the vegetation consists of herbaceous and acacia shrub species. Woody plant density is increased on the hilly surface by Acacia mellifera and Acacia reficien, e.g. (Mureithi and Opiyo 2010).

Plate 1: Aerial view of River Turkwel and vegetation around it

Source: Field work (2020)

3.1.4 Economic activities

Under the troublesome natural conditions that depict Turkwel River Basin the primary source of employment for the Pokot and Turkana communities is subsistence migrant

pastoralism which tends to be the most sustainable land use system because it relies on a main resource management plan that is mindful of the rangeland environment's spatial and worldly biological heterogeneity. Be that as it may, some little scale water system cultivating is rehearsed along the streams of Turkwel and also fishing.

Plate 2: Fishing around the Turkwel dam

Source: Field Work (2020)

3.2 Research design

The research incorporated both quantitative research and qualitative research. The specific design that was utilized in this research was cross-sectional survey since time was not a variable something whose impact would have been controlled or something that would have been a piece of a dynamic instead of a static study examination of connections among variables. Cross-sectional research was intended to comprehend connections among variables that had to do with the conflict, by watching their qualities during a specific period in time. This design was utilized to discover how or why land shifted and wide running, of Pokot-Turkana rough clash by searching for proof of circumstances and logical results connections in the information.

3.3 Population and Sampling

3.4 Target Population

Population study is the sum total of the publications under scrutiny (Adam and Kamuzora, 2008). According to (Mertens, 1998) the target populace is additionally the gathering of individuals that an analyst needs to research on. The main objective for this research was to investigate the perceptions of pastoralists on the role of land use change on resource use conflicts in Turkwel River Basin among Pokots and Turkana pastoralists that included 3 villages which are; kainuik, Amolem, and Sarmach. According to the population census of 2019, Kainuk had 10, 809 people, Amolem 782 people and Sarmach 2,513 people the total population adding to 14,104 people (KNBS, 2019). This translated to approximately 2, 161 households.

3.5 Sample Size

A sample is a small piece of an observable community with dispersed properties to collect data from the entire population (Webster, 1985). The sample size is the quantity of informants used in the sample (Msabila et al, 2013). Elements that should be seen when selecting the sample size; population accessibility, money related resources and strategies for sampling (Leedy, 1980).

Fisher's Formula

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

n= the expected sample size (most likely when the target population is greater than 10, 000).

N = Population size for this case Turkwel River Basin population as per KNBS (2019) is 14,104.

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 10% therefore d = 0.1).

$$n = \frac{14{,}104 \times 1.96^2 \times 0.5 * 0.5}{0.1^2 (14{,}104-1) + 1.96^2\ 0.5\ (1-0.5)}$$

$$n = \frac{14{,}104 \times 3.8416 \times 0.25}{0.01\ (14{,}103) + 3.8416 \times 0.25}$$

$$n = \frac{13{,}545.4816}{141.03 + 0.9604}$$

$$n = \frac{13{,}545.4816}{141.9904}$$

n = 95.3972

n = 95

However, due to various reasons of insecurity, financial restriction and limited time on the researcher's part, the research was concentrated on a sample size of 84 informants unlike to the 95 projected. This constraint was further worsened by long time spent walking and reaching sparsely scattered pastoral villages in places far away from the shores of the Turkwel River, especially in villages such as Amolem and Sarmach, where roads were inaccessible. Also owing to COVID 19, the majority of community members were not willing to interact with strangers, making it even harder.

Table 1: Sampling plan summary

County	Sub-county	Divisions	Ward	Regions/ village	No. of questionnaires administered to household heads
West Pokot	Pokot Central	Sigor	Sekerr	Sarmach	28
West Pokot	Pokot Central	Sigor	Masool	Amolem	28
Turkana	Turkana South	Kainuk	Kainuk	Kainuk	28
	Total questionnaires administered to household heads				84

Source: KNBS, (2019) and Field data, (2020)

3.5.1 Non-probability Sampling Technique

In non-probability sampling methods, choice of people for the sample doesn't give everyone in the population equivalent odds of being chosen and it has these categories: (Msabila; Nalaila, 2013:38). Kerlinger's (1986) purposive sampling is a kind of non-probability sampling method depicted by a carefully orchestrated attempt to obtain representative samples by considering typical territories or groups in a sample. In addition, Msabila and Nalaila (2013) stated that purposive sampling practice involves intentionally handpicking individuals in a population wholly reliant mostly on jurisdiction of the researcher's judgment. Hence, objective survey technique was used in the selection of the participants mostly during information assortment upon this condition that it allowed the researcher to select only those informants that he/she considers could be prepared to provide the appropriate data (Kothari, 2004). For the cause that the investigator required, pastoralists, and senior official's farmers and to agree that they had the option tthat brought right data and stayed away from pointlessly information blunder.

This technique had obstacles of being very subjective nevertheless the researcher tamed it by guaranteeing that each of the 84 respondents incorporated in the sample purposively knew about land conflicts. Therefore, purposive technique was made use of in choosing respondents of this research in these classifications: 28 respondents from Kainuk, 28 respondents from Amolem, and 28 respondents from Sarmach who all together made a respondents' sample of 84. This was to ensure that the three villages were represented equally.

3.6 Data Collection Methods

Ormrod and Leedy (2001) characterized collection of data as a means of collecting empirical data from a specific report in order to comprehend reality. The collection of data is a vital part of the research analysis. Error in data collection may affect research results and contribute inevitably to false findings. There are various data collection strategies but the two main data categories which include primary data and secondary data.

3.6.1 Primary data

Primary data is data collected straight from the field by the researcher which, for about the first time, seems to be primordial in nature (Kothari, 2000); in my research primary data was acquired by a number of methods, such as: observation, filling of questionnaires, interviewing and so forth.

3.6.2 Questionnaires

This called on to information collection strategy that comprised of a lot of structured and predetermined inquiries the respondents were given the opportunity to respond to questionnaires as they were filled out by the expert (Adam, 2008). As Powell (1998:2-6) suggested, questionnaires are used as a technique to gather data about what individuals do, believe, know, perceive or need which can be arranged and addressed. There are two forms of questionnaires; open and closed. Close-ended are queries for which researchers offer an appropriate set of answers. (for example Yes/No), while Open-ended are queries

in which the scientist does not offer a definite answer to the respondent to choose from, however informants are approached to respond in words of their own principally utilized in qualitative information (Powell, 1998:2-6).

In this research the author made use of both open-ended questionnaires and Close-ended questionnaires. Open-ended questionnaires: enabled abnormal reactions to be determined; they gave the informants the space to make more elaborate and appropriate responses intelligible.

Nevertheless, open-ended hindrance was that information gathered was excessively wide and some of them probably were not required on the grounds and they were out of the fundamental issue. Although, the analyst expounded it by concentrating and breaking down the information by discarding those which appeared unnecessary, the data that was gathered by this strategy was about; instances of land conflicts, causes, actors, impacts of land use and conflict to the environment and the endeavour's done in development interventions in increasing the resilience of livelihoods among famers and pastoralists in Turkwel River Basin Kenya.

3.6.3 Interviews

In this research, the researcher picked semi-structured interview, as indicated by Martens *et al*., (1998) the procedure applied by establishing a circumstance to gather qualitative information that accepted respondents to debate their opinions on a certain subject. The researcher picked the focal point of the meeting and there were zones that the researcher was keen on investigating, additionally it gave the respondents the space for expressing their emotions and the space of giving more explanations. In any case, Mathers *et al*., (1998) contended that the semi-structured interviews had its shortcomings for example it depended upon the expertise of the interviewer, of knowing if there is a deception by the informant. Semi-structured interviews were led to: Turkwel areas include Kainuk, Amolem and Sarmach to gather data about reasons for conflict of land, how the conflicts happens, actors in clashes of land, effects of conflicts on land, the endeavors done by

local people in dealing with conflicts on land , and the proposed methodologies in solving those clashes of land among Turkana and Pokots of Turkwel River Basin Kenya.

3.6.4 Focus Group Discussion

Sounders (2000) described the focus group as a group of people associated of similar values or character traits, Sounders (2000) characterized the focus group as a set of individuals whose convictions or attributes are the equivalent, joined by a mediator who uses the selection and its relation to collect data on a given issue. Due to COVID 19 the researcher arranged the respondents into 6 groups of 14 respondents each. 3 groups comprised of just Turkanas and 3 groups were just for Pokots. The inquiries were set out for discussion. The purpose behind isolating Pokots and Turkana in various groups was to give the two groups the space to clarify their sentiments without fear. Notwithstanding the expected limitation of the picked strategy that in groups some of individuals particularly ladies from the two sides were hesitant to talk and to take part as per their traditions that they don't have anything to state before men, however the researcher attempted to overcome it by urging them to participate. The information gathered by means of this methodology was about how social-ecological systems of pastoralism in the study area are changing and their effects on pastoralism, the environmental impacts of land use changes in the study area and to investigate the role of various development interventions in increasing the resilience of livelihoods to threats and crisis posed by land use conflict in Turkwel River Basin. And this was done in Kiswahili, Pokot and Turkana depending on the community.

3.6.5 Secondary Data

This are material that have been recently gathered and used in conjunction with certain other demands, which are analyzed to a limited degree; they are found through documented review in books, from the investigation of publications from researchers who have expounded on, environment, environmental change, climate change, environmental degradation and environmental conflicts other important sources. And furthermore from other different sources like; information from other outlets are often included in

developing country research that miss a portion of the related previous databases, the Web (web pages and individual blogs), the GIS, reports, articles, office records and so on (Kothari, 2000).

3.7 Data Analysis

The research utilized both inferential and descriptive statistical techniques in information investigation. Descriptive techniques was incorporated with charts and graphs while inferential or quantitative techniques included chi-square test analysis to survey the connection of land use change in the study area and also Spearman's Rank-Order Correlation to analyse impact of land use change to the environment . Qualitative technique included logical and factual interpretation of the discoveries through, observation, interviews, focus group discussions and documents audits. Cross-tabulation tables and graphs were utilized for representations. The quantitative technique was included by getting the findings through questionnaires and prepared by means of statistical package. Information was edited, coded, classified and organized with a view of minimizing it to sensible proportions.

3.8 Ethical Issues

The researcher saw from the literature that study exercises can discuss moral problems like: guaranteeing that nobody is hurt or gives antagonistic outcomes from look into exercises like: abusing non-disclosure understanding; breaking respondent confidentiality; confounding outcomes; deluding individuals; and invoicing inconsistencies (Munhal, 1988). Researcher educated the informants for the reason of existence and inspiration behind the study.

CHAPTER FOUR: RESULT AND DISCUSSION

4.0 Introduction

This study addressed and analyses the results of the data obtained by the researcher on perceptions of pastoralists on the role of land use change on resource use conflicts in Turkwel River Basin Specifically, the study: (i) analyzed ways in which social-ecological systems of pastoralism were changing and their effects on pastoral conflicts (ii) analyzed environmental effects of land use changes and their influences on resource conflicts, and (ii) analyzed the role of various development interventions in increasing the resilience of livelihoods to threats and crisis posed by land use conflict. The entire discussion areas and data presented here were stated by the respondents during the research. That being said, the reviews have been integrated with other related secondary literature in order to make this research more credible.

Data collection was carried out by interviews, questionnaires and a documentary review. Data was interpreted and reviewed using tables and detailed discussions. There are two sections in the Chapter: the first section presents the conclusions on the socio-economic characteristics of the respondents and the second part presents the outcomes of the analysis on the basis of research goals and concerns.

4.2 Socio-economic Characteristics of the Respondents

Gender and educational status were the characteristics of the respondents studied. These features were important because they indicated the essence of the answers or the possible explanations for the answers given by the informants

4.2.1 Respondents Distribution by gender

Field results from Table 2 shows that 66 (78.6%) of the informants were male, while 18 (21.4%) of the informants were female, as shown in the graph below. This suggests that, in the study, there were more male than female respondents. Even as land struggle among farmers and nomadic herders impacts all of them, the justification for digging at these

results on the basis of sex was just to achieve the fact of ownership of land and livestock for both men and women. As per FAO (Fighting poverty by access to women's land rights, 2010), gender differences in land tenure are also an obstacle to growth in rural regions. The result indicates that the gender representation of informants was not properly representative; this means that women's ownership and understanding of land at the village level still has no social credibility and is an obstacle.

Table 2: Respondents distribution by sex

Sex	Frequency	Percentage
Female	18	78.6
Male	66	21.4
Total	84	100.0

Source: Field work (2020)

4.2.2 Respondents Distribution by Level of Education

The academic level of the informants was classified into five: Never went to school, Primary education, Secondary education, and Tertiary education and University level. The results in Table 3 illustrates that the majority 26(31.0%) had no basic education, also 21(25.0%) only reached primary level of education, while 20(23.8%) completed secondary education, 9(10.7%) completed Tertiary education and lastly 8(9.5%) University education. The results showed that majority of the informants did not go to school and so this was projected to have triggered conflict on land. Analysis conducted in Nigerian research by Adisa (2012) showed, the educational status of farmers, agro pastoralists and pastoralists determined the extent of dispute in the area (Adisa, 2012).

Table 3: Respondents Distribution by Level of Education

Status of education	Frequency	Percent
Never went to school	26	31.0
Primary	21	25.0
Secondary	20	23.8
Tertiary	9	10.7
University	8	9.5
Total	84	100

Source: Field work (2020)

4.3 How social-ecological systems of pastoralism in the study area are changing and their effects on pastoralism

Social-ecological transition is a process that entails different meanings to different people because it puts values on certain ecological or subsistence aspects, retains cultural and emotional connections on activities and places, or expresses other concerns related to livelihoods and well-being (Loring et al., 2014). Social-ecological transformation is not a new concept, it has happened in several regions of the globe, for e.g.,; China, South America, Russia, Mongolia and Central Asia, Bolivia, Peru, Argentina, and Chile Uzbekistan, European, Australia, Sahel and Kazakhstan (Westricher *et al*., 2007).

The social changes include; population increase, building of infrastructures, building of dams, conversion of grazing to cropping, installation and use of irrigation, conversion to mining while ecological changes include invasive species. Uses and Contraction of industries some attempts have been made so far to ensure that these social-ecological changes and changes in land use are minimized.

The first research objective was to identify how the socio-ecological systems of pastoralism in the study area are transforming and how they affect pastoralism. Data from

the Land and Natural Resources Department examined showed that the socio-ecological changes in the Turkwel River Basin in the villages surveyed are classified into seven separate cases as follows: population increase, building of infrastructures, building of dams, conversion of grazing to cropping, installation and use of irrigation, conversion to non-agriculture uses and contraction of industries.

4.3.1 Population increase

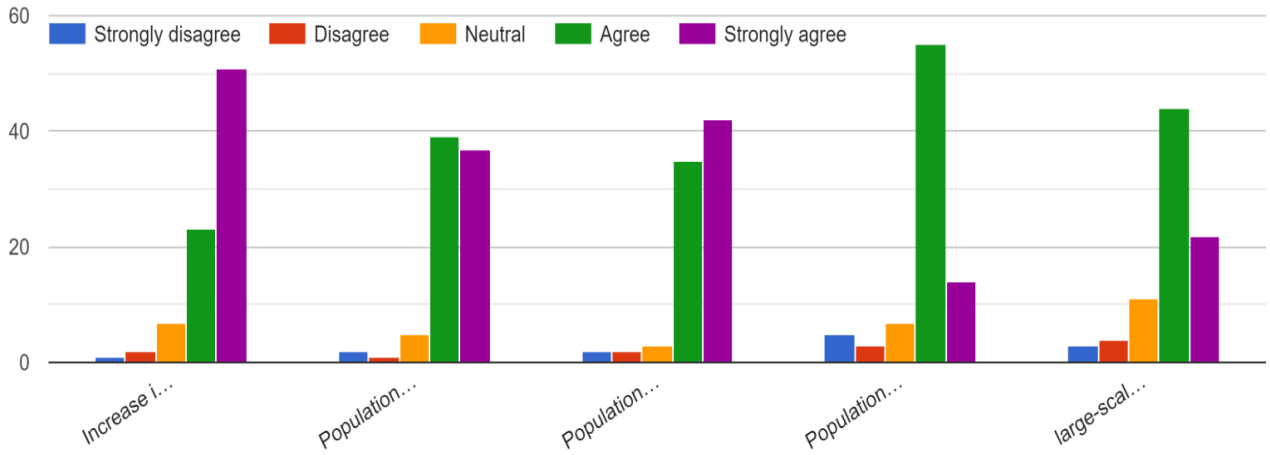
For the villages of Pokot Central and Turkana South, the average population density was 61 per km2 and 12 per km2 respectively (GoK, 2010). The types of livestock; Sheep, cattle, camels, goats and donkeys are included. Both in the Pokot and Turkana pastoral societies, goats are by far the most leading domesticated livestock followed by sheep then cattle. While the overall livestock size was significantly higher in Pokot North because the researcher concentrated on two villages, Sarmach and Amolem, and only Kinuk in Turkana South, the biggest margin was identified in the population of camels, with South Turkana accounting for more than 89% of the projected herd size in the area. Livestock population in the area of research has been observed to be spatial and temporal variations caused by mobility in humans.

During the period of research, it was recognized that these statistics are continuously variable due to the nomadic existence of local populations. During the course of the study there were regular fluctuations in the population from other places into Sarmach, Kainuk and Amolem places that are on the edge of Turkana and Pokot territory. And these have raised demand for land, water and pasture for livestock and anthropological operations, including fuel wood, cities, resulting in a deterioration of forest security with the accompanying rise of urban areas and cultivated areas. This contributes to an increased human invasion of buffer zones.

According to figure 2, 63% respondents say there is increase in population mostly in Kinuk shopping Centre, where the growth of human population is quickly leading to invasion of animal pasture fields, growing demand leads to declines of animal grassland and pastoral corridors, and increased population supply of modern arms that exacerbates

violence in the region. And also these waves of immigration have resulted to an emergence of enmity and conflict between pastoralists, agro pastoralists and farmers in the study area. (Toulminand et al., 2004; Sendalo, 2009).

Figure 2: Population increase on land use conflicts



Source: Field Work (2020)

4.3.2 Building of physical and social infrastructures,

The infrastructure of the study area comprises of both social and physical facilities which facilitate the movements of services and products within far beyond the research context of sustainable living standards and developments. Numerous road systems, communications and health, education, water and energy services are part of the system.

4.3.2.1 Road network

According to the respondents in figure it is reported 41.7% illustrates great extend in terms of land shift to roads, mostly around Kainuk shopping center, were it was reported that transport facilities as a land use in the Turkwel River Basin resulted in the clearance of vegetation, the destruction to natural livestock water supplies, both unplanned and poorly developed highways, resulted in open borrowing holes, which resulted not just in livestock injuries and deaths, but also in human deaths and an increase in the number of

livestock deaths. Pastoralists often claim that their cattle perished as a result of the use of plastic bags and litters used for road building. In addition, direct physical relocation and dispossession without sufficient land compensation would intensify land disputes in areas bordering the Turkwel River Basin.

Plate 3: Road network in kainuk

Source: Field work (2020)

4.3.2.2 Energy

Kengen being accessible in the Turkwel dam, fig illustrates 19.0% signifying very great extent of which the Kengen power plant has led to the land shift, which also appears to dominate a large part of the region in Turkwel River Basin, the rivalry between pastoralists and farmers has been increased. In the study area, there is no electricity supply. Generators with diesel power are widely used in the lighting of their facilities by businessmen. Electricity coverage needs to be increased in regions around the Turkwel River Basin.

4.3.2.3 Educational facilities

Although, according to the respondent, there is a low educational level in the study area, there are insufficient public education facilities in the Turkwel River Basin, the pressure on the land in the Turkwel River Basin is also expanding, and the more schools the more

pastoralists in these regions are forced out. 29.8% of the moderate extend of land use shift to educational facilities. The issue illustrates itself by overcrowding in schools, which poses a threat to local biodiversity, Example of schools in the study area are Sarmach Primary School and the Kainuk High School. The resources used to build schools, such as timber, which has led to the depletion of biodiversity and also wild animal's habitat loss. This has then made Pastoralists to look for other places in other regions sometimes crossing the Pokot-Turkana boundary so that their animals can graze of which it threatens to exacerbate resource conflicts.

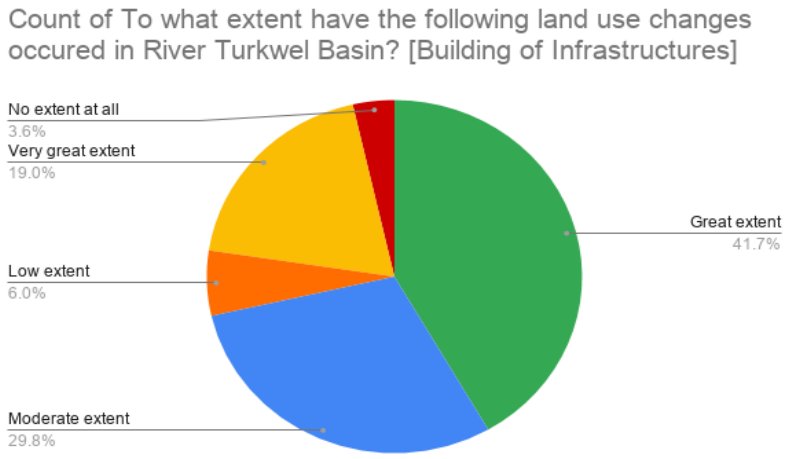
Plate 4: Sarmach Primary School

Source: Field work (2020)

4.3.2.4 Health facilities

Based on the aforementioned observations, pursuant of the Turkana Central Health Report (2011) and data from the filed 6.0% low extend of the area's health-care services of study are insufficient and are in bad condition, they intensify the burden on pastoral land, as the vegetation is destroyed for the construction of these structures, they serve as a deterrent to livestock grazing corridors and also tend to limit pastoralists. This generate conflict as competition for grazing land and also water grew. An example is the sanitation facility in Sarmach, which has occupied land that was originally used by the Pokots to graze their cattle.

Figure 3: The extend of building infrastructure on land use change

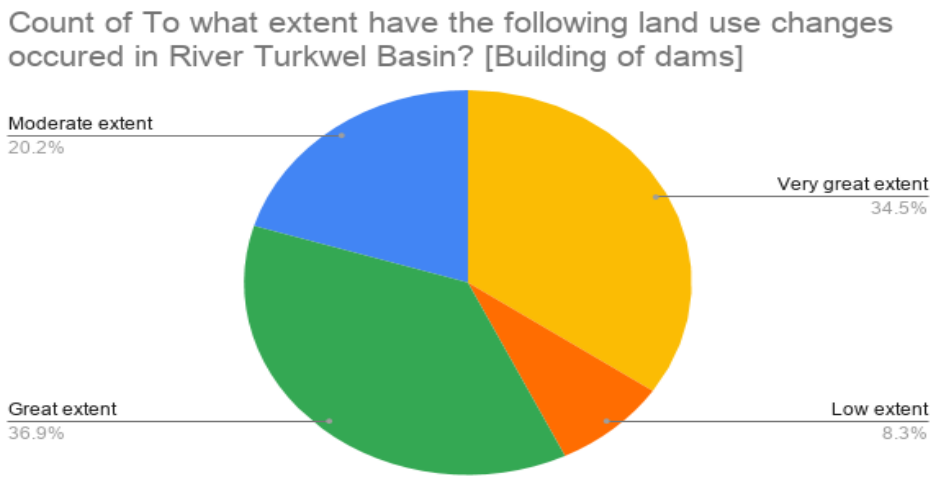


Source: Field work (2020)

4.3.3 Building of dam

According to figure 4 the respondents reported that the dam has taken a large percentage of land in Turkwel River Basin, 36.9 % of the respondents claimed that the dam took great extent followed by 34.5% of the respondents who said the dam occupied very great extent, 20.2% who thought the dam occupied moderate extent and only 8.3 % who thought it occupied low extent of the dam, the dam itself occupies an area of 6500 acres and is the largest dam in Kenya at 150 meters and has a capacity of 1.6 billion m3. The respondents also went further to explain how the construction of the dam has affected the livelihoods of communities existing around the dam by congesting the least privileged segment of the population, causing greater uncertainty over access to resources and the opportunity to practice a range of flexible grazing alternatives. Most of them have shifted from pastoralism to fishing. As reported by the respondents around the dam West Pokot Governor had increased the number of fish in the dam to increase food security.

Figure 4: The extent of building of a dam on land



Source: Researcher, 2020

Plate 5: Turkwel Dam

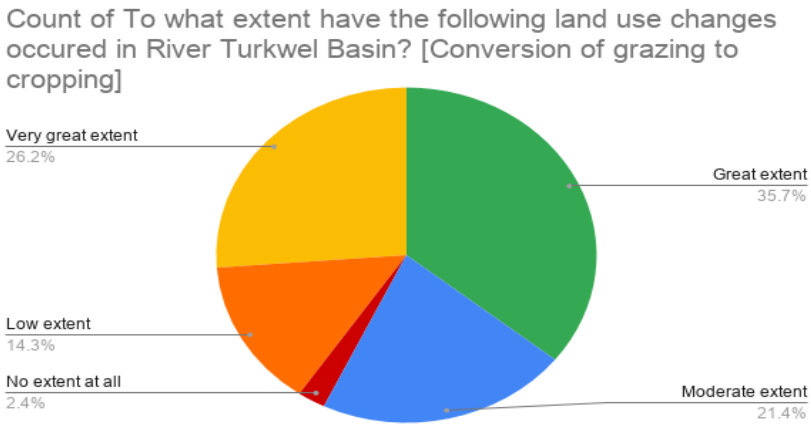
Source: Researcher, 2020

4.3.4 Conversion of grazing to cropping,

As per the respondents in the three villages 35.7 % which is the highest percentage reported that cropping has taken great extend to the land use change in Turkwel River

Basin , followed by 26.2 % which indicates very great extend and moderate extended which is 21.4 % . This shows the rate of shifting land use to cultivation which over time has triggered land use conflicts involving farmers and pastoralists. These were accelerated by the existence of land along the river, which is very fertile for agriculture and pastoral practice. As reported by the respondents, increased cropping have been substantially increased although not all of the areas have shifted to cropping as shown in figure 5 which illustrates 14.3% respondents claim low extent and 2.4 % of No extent at all to the land use. Sponsorship by NGOs, which have mainly enticed Turkana to reduce food insecurity. Herders and farmers also take credit for creating an issue in which farmers blame herders for their mobile livestock that are grazed on their fields, while herders accuse of farmers burning grasses that herders use for their livestock while preparing their fields for cultivation. Conflicts have negative effects, infrastructure degradation, such as lack of soil fertility and water supply depletion (Msuya 2009).

Figure 5: Conversion of grazing to cropping on land



Source: Field work (2020)

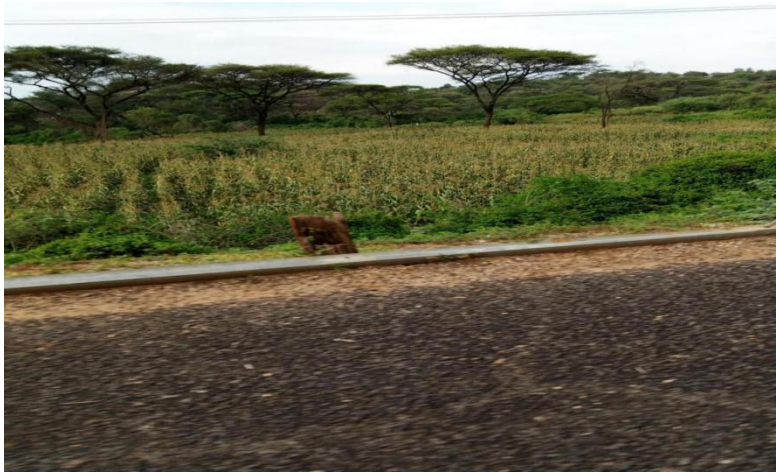


Plate 6: Maize plantation in Sarmach

Source: Field work (2020)

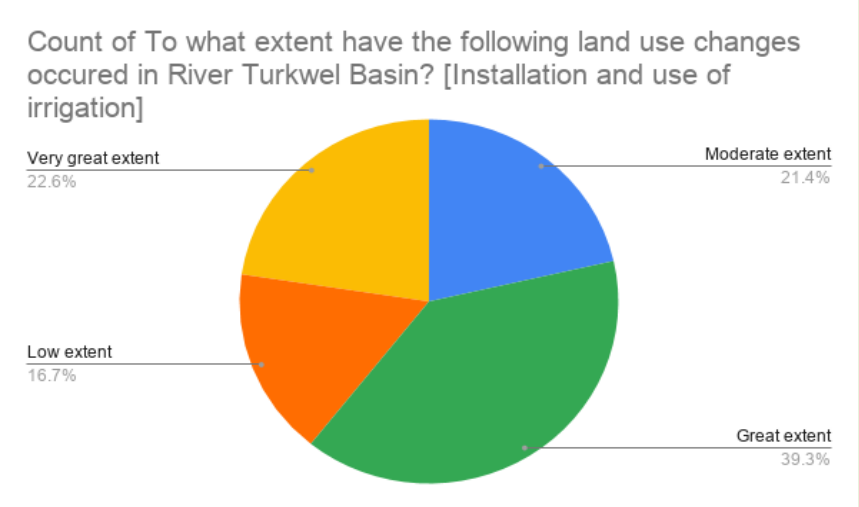
4.3.5 Installation and use of irrigation

In figure 6, 39.3% of the respondent indicated that there was great extent of land use shift into irrigation, 22.6% showing very great extent, 21.4% showing moderate extend and only 16.7% showing low extent. So this indicates high land use shift to irrigation. It is estimated that 368 km2 of land in Turkwel River Basin is irrigated cropland some of the irrigation schemes include Nadapal, loborot, Kolioro, and Nadoto (Maina et al., 2013). Over the past four decades, Kenya has experienced farmers 'and herders' disagreements over proximity to environmental assets such as pasture and agricultural land and livestock and irrigation land accessibility (Msuya, 2009). As already reported, declines in water level due to irrigated agriculture abstractions will again lead to a significant drying of the Turkwel River, resulting in fishing livelihoods being lost and worsening food security in the basin.

Changes in the amount and seasonal patterns of Turkel River inflows will have a big impact on downstream ecological regions, including Turkana Lake. River Turkwel has traditionally carried the Lower Turkwel River and Lake Turkana with elevated sediment loads and critical nutrients (Avery 2012).

The irrigation systems trap the burden of sediment but transfer suspension sediments, which minimize transport of sediment downstream total. Regulation of water distribution and drainage therefore ensures that the seasonal flood pulse is reduced. These hydro-logical changes would affect water and sediment dependent communities and flood-waters for agriculture. Regions under irrigation and irrigation production, urban extension and possible land available for agricultural use for deterrent of pastoralism, are predicted to be increased in the future.

Figure 6: Extent of installation and use of irrigation on land



Source: Field work (2020)

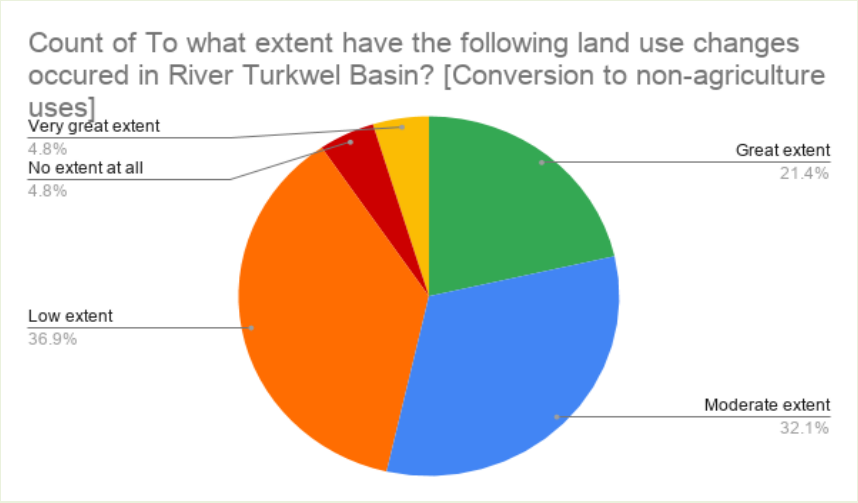
4.3.6. Conversion to non-agriculture uses

Minerals Like oil prospecting is done in the Turkwel River Basin, as is the case with Ewoi and Ng'amiaone oil sites in south of Turkana. Besides the oil prospecting phase, harvesting of sand, stone mining and gold mining in Turkwel River Basin form part of the natural untapped resources.

It is evident that the land mass historically used for communal grazing was set aside for the discovery of gold mining in the Sarmach region, primarily in Lami Nyeusi. Fig 7 reflects how the land use shift to mining is not consuming a lot of land this is evident in the pie chat because 36.9% which is the highest percentage purport that there is low extent of land shift. This is because both in Kainuk and Amolem land use change to gold mining is however in low extend. However, this shift in land use has restricted nomadic free movement of cattle to areas of grazing in the community. Consequently, in order to adapt to the new social-economic activities, the configuration of land use has been entirely modified from what it used to be years before.

In figure 7 21.4% explains the great extent of the invasive species are rampant in central Pokot: Prosopis Julifora (mathenge), Sansevieria ehrenbergii (East African wild sisal) and Lantana Camara. For livestock and agricultural property, these species have impacted pasture. This has prompted the abandonment of dry season grazing areas to end up reducing overall productivity to vegetation invasion and invasion by unwanted and troublesome species replacing primary forage species (Krätli and Swift 2001).

Figure 7: The conversion to non-agriculture uses on land



Source: Field work (2020)

Plate 7: Gold mining in Sarmach in an area called Lami Nyeusi

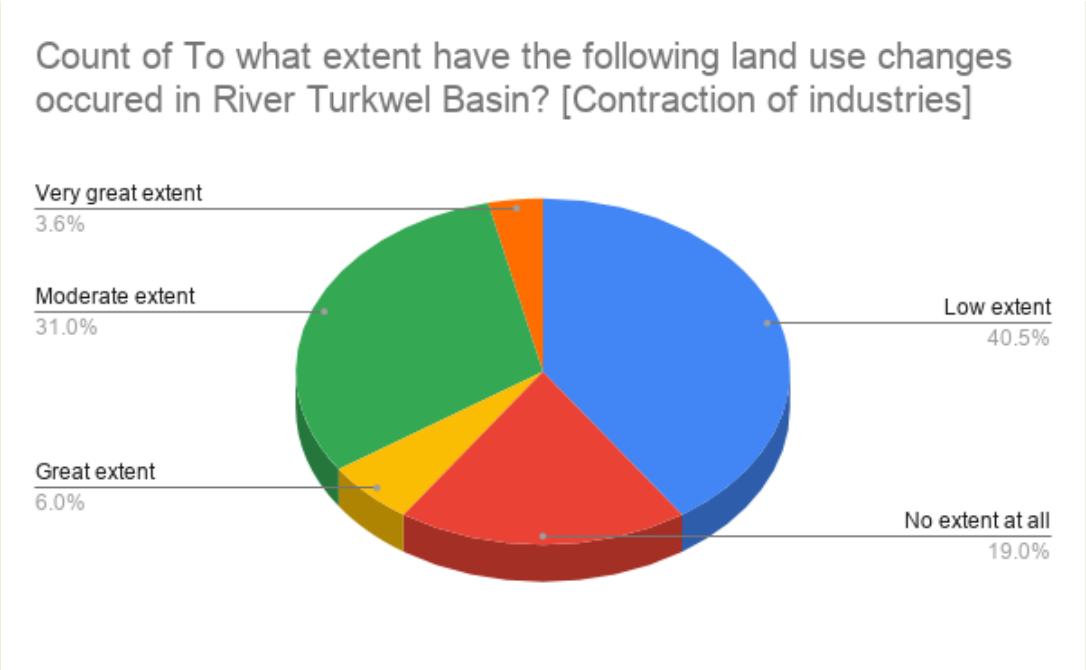
Source: Field work (2020)

4.3.7. Contraction of industries

Industries in the Turkwel River Basin are not so many; examples are Kengen and Tullow Oil. In fig 8 its evident that majority of the population 40.5% reported that land shift to industrial areas is in low extent, this is because Sarmach and Amolem are not developed in anyway.

But it's also evident in the figure 8 that the land use shift 3.6% which indicates very great extent and 6.0% which shows great extent, over the years have brought competition on land between land owning companies and pastoralists and adversely affected their livelihoods. As pastoralists continue to have restricted access to land and industries are constructed on grazing fields and pathways, there is a rise in the loss of livestock fields resulting in violent confrontation.

Figure 8: The extent of construction of industries on land



Source: Field work (2020)

How land use change affects pastoralists

Table 4 in which the researcher used multiple-response option, it explains the reasons why pastoralists are becoming more vulnerable, according to the respondents 58.3% of the respondents reported that there have been land use change in the Turkwel River Basin. Nevertheless, expanded irrigation has limited and has made it difficult to access to the river and reduction in water availability once irrigation starts, and secondly for water for drinking, as the volumes of groundwater levels changes (Avery 2013). Likewise, improvements in water supplies and access of to land for dry spells grazing would have a detrimental effect on the rearing of livestock in the Lower Turkwel River, limiting the production of animal products.

Decreased productivity of the riverine ecosystem and the loss of the forest has reduced the supply of wild food and reduced the raw material availability for fodder, wood fuel and medicinal plants to indigenous groups. The delivery of local food systems on which

they depend has also decreased. This is expected to result in a rise in food shortages, resulting in mobility and the possibility for more destruction of the ecosystem. Cultural ecological systems are non-physical services provided to humans by the ecosystem (TEEB 2010).

The redevelopment of the environment of the basin is likely to trigger the displacement of native communities, limit the physical interactions between them and their land, and displacing them from their cultural heritage, location and property. (Buffavand 2016; Stevenson et al., 2018). Stresses of this transition has however had an effect on mental and physical wellbeing (Snodgrass et al., 2016) and the tensions which are now happening and are projected to escalate will undoubtedly worsen this effect. These socio-ecological transformations have caused negative effects, loss of resources, such as land degradation, fear, and sense of hopelessness for pastoralists, food decrease, and abandonment of farmland, conflict and death. Most parts of the plateau have been susceptible to drought effects whose frequency have increased to every five years and high numbers of cattle have always succumbed to drought due to starvation and water shortages (GOK *2006).*

Table 4: Land use change over the years

Cases caused by land use conflicts	**Frequency**	**Percentage**
Conflicts	**76**	**90.5**
Destruction of Property	**75**	**89.3**
Raiding of livestock/farm produce	**76**	**90.5**
Displacement of families	**79**	**94.0**
Loss of lives (Deaths)	**77**	**91.7**

Source: Field work (2020)

Plate 8: Remains of a school/town in Sarmach

Source: Field work (2020)

Land use induced problem	Effect on livelihoods	Effect on community
Receding of lower Turkwel River	➢ Decreased harvesting of fish	➢ Increased prevalence of malnutrition among children ➢ Steadily increasing Index of Poverty
Land/environmental degradation	➢ Increased disease / death of livestock ➢ Reduced yields of livestock milk	➢ Increased prevalence of malnutrition among children ➢ Increased infectious disease: typhoid, tuberculosiss ➢ Enhanced food insecurity
Repeated droughts and crises, such as flooding	➢ Death of livestock ➢ Decreased number of livestock ➢ Reduced yield of animal products ➢ Reduced harvesting of fish ➢ Decreased rain fed farmland	➢ Enhanced food insecurity ➢ Steadily increasing Index of Poverty ➢ Increased prevalence of malnutrition among children ➢ Increased infectious disease

Conflicting mixed use of land	➢ Reduced grazing fields, leading to inadequate pasture for livestock	➢ Land conflicts ➢ Conflict among traditional nomads and agro pastoralists on the entitlement to land use
Immigration	➢ Reduced grazing fields, leading to inadequate pasture for livestock	➢ Overpopulation on a small area leading to overburdening of essential facilities and infrastructure. ➢ Intensified settlements of informal individuals ➢ Land conflicts

Source: Field work (2020)

4.3.8. Significance of Land Use Change and conflict in the study area

Hypothesis 1

Research hypothesis (Ha): There is significant change in land use in the study area

Null hypothesis (Ho): There is no significant change in land use in the study area

The major land uses was between 1963 to 2018 in the Turkwel River Basin can be summarized and classified into nine from the table below.

Table 5: Observed frequencies

Land use	Frequency		
	Before independence	**Present**	**Total**
Rearing of livestock	78	49	127
Conversion to cropping	10	56	66
Hunting and gathering	63	2	65
Fishing	55	26	81
Building of residential properties	1	74	75
Construction of industries	0	78	78
Conversion to non-agriculture uses	0	33	33
Building of Dam	0	1	1
Installation and use of Irrigation	0	12	12
Total	**207**	**331**	**538**

Source: Field data, 2020

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

	Before	**Present**	**Total**
Rearing of livestock	207x127/538=48.864	331x127/538=78.136	**127**
Growing crops	207x66/538=25.394	331x66/538=40.606	**66**
Hunting and gathering	207x65/538=25.009	331x65/538=39.991	**65**
Fishing	207x81/538=31.165	331x81/538=49.835	**81**
Settlement	207x75/538=28.857	331x75/538=46.143	**75**
Commercial purpose	207x78/538=30.011	331x78/538=47.989	**78**
Mining	207x33/538=12.697	331x33/538=20.303	**33**
Dam	207x1/538=0.385	331x1/538=0.615	**1**
Irrigation	207x12/538=4.617	331x12/538=7.383	**12**
Total	**207**	**331**	**538**

Computing the chi-square value

$X2 = \sum (O-E)\ 2/E$

Where:

X2= Chi square obtained O= Observed score

∑= Sum of E= Expected score

O	E	O-E	(O-E)2	(O-E) 2/E
78	48.864	29.136	848.906	17.373
10	25.394	-15.394	236.975	9.332
63	25.009	37.991	1443.316	57.712
55	31.165	23.835	568.107	18.229
1	28.857	-27.857	776.012	26.892
0	30.011	-30.011	900.660	30.011
0	12.697	-12.697	161.214	12.697
0	0.385	-0.385	0.148	0.385
0	4.617	-4.617	21.317	4.617
49	78.136	-29.136	848.906	10.864
56	40.606	15.394	236.975	5.836
2	39.991	-37.991	1443.316	36.091
26	49.835	-23.835	568.107	11.400
74	46.143	27.857	776.012	16.818
78	47.989	30.011	900.660	18.768
33	20.303	12.697	161.214	7.940
1	0.615	0.385	0.148	0.241
12	7.383	4.617	21.317	2.887
X2				288.093

Computing the degree of freedom (df)

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

df=(9-1)(2-1)=8

• Critical value in the chi-square table =15.51 for 8 df at 0.05 level of significance

• Reject the null hypothesis (Ho) if computed X2 equals or exceeds the critical value

Decision: Ho is rejected. Computed value of X2 exceeds critical value 15.51

Conclusion: The research hypothesis (Ha) is supported – thus there is significant change in land use in Turkwel River Basin

4.4 Environmental impacts of land use changes in the study area,

4.4.1 Environmental Impacts

One of the most significant degradation factors from 1963 to 2020 was population increases. This study suggested that participants in the Turkwel River Basin study have increased from less than 5000 to over 10,000 people living in that region and the population needed mainly vegetation and water in terms of the need for their animals to browse and forage, materials for fencing and shelter, building materials, water supplies, and wood-fuel. It has been shown that the competition for these resources overtime has begun to outweigh the accessibility. The key source of deforestation in the Turkwel River Basin is the clearance of forests for wood fuel and building materials for the building of shopping centers such as Kainuka and Sarmach. Degradation of the ecosystems and species is the result of over-grazing contributing to soil erosion. By removing the top soil which is nutrient-rich and decreasing the soil's capacity to hold water, erosion has adverse effects on grazing land and crop productivity. Eventually, ground is converted to dry land and eventually rocks as top soils are stripped. Deforestation and land degradation result in a decrease in grazing land and a decrease in crop yields.

Farmland offers open space and a suitable habitat for many species of wildlife. Intensive cultivation, though, has potentially significant implications for the environment. For example, it has long been understood that agricultural production use and activity can cause water contamination. Runoff from farm land is the leading cause of water

contamination in the Turkwel River. Conversions of wetlands to agricultural cultivation and irrigation water diversions have taken numerous animal species to the brink of extinction. Habitat degradation, fragmentation and modification related to urban development have indeed been established as the major causes of habitat loss and extinction of species (Czech, Krausman and Devers 2000; Soulé 1991). Rapid urbanization and intensive farming in river line regions and further inland areas are a major challenge to the health, sustainability and biodiversity of the aquatic ecosystem worldwide.

Forests have a variety of environmental services. They promote habitats, provide vital habitat for animals, eliminate co2 from the atmosphere, intercept rainfall, slows surface runoff, and mitigate soil erosion and flooding. This vital environmental resource has already been diminished or lost as forests are immediately transformed into farmland or urban construction in the Kainuk shopping centre. For instance, deforestation, together with urbanization, irrigation, and other anthropogenic impacts, has dramatically altered and disrupted the vegetative cover around Lodwar and Kainuk. Such disruptions were reported by respondents through questionnaires and have altered the global atmospheric level of carbon dioxide, the main heat-absorbing gas, as well as the local, regional and global atmosphere by altering the atmospheric temperature on surface of the earth (Marland et al., 2003). Urban growth, an example of the Lodwar Town and Kainuk Center in the study area, have been related to many environmental issues, namely air pollution , water pollution and the destruction of natural ecosystems. Urban runoff also comprises nutrients, sediments and harmful pollutants, which can cause not only pollution of water but also extensive range in surface water flow and temperature. Jeopardizing of soil resources by urbanization and industrialization. The loss of pasture from overgrazing, wildfires, logging, and wood for fuel in those three villages of Kainuk, Sarmach, and Amolem has been reported as factors contributing to degradation.

Goldsmith et al., (2007:42) claim that resource shortage contributes to resource pursuit elsewhere in other regions. Respondents reported that there were regular demographic influences from other areas in to Sarmach, Kainuk and Amolem of which these are areas

bordering the Turkana and Pokot territories. This group not only crosses territorial boundaries in this process, but expands the search for assets to its boundaries (Makumi, 2000). These marches lead to conflict between the new immigrants and the host population, and this leads to violent disputes and land destruction in most situations. During the collection of data from this analysis, this scenario was revealed to be the case around Turkana South and Pokot North.

The persistent conflict in Turkana has had a negative environmental effect, according to Goldsmith et al., (2007:45). For security concerns, the burden placed on the delicate environment as populations regroup can never be undone. It can be disastrous to move huge herds of animals in a small area. The concentration on systemic violence accompanying physical violence also positions human security dialogue on environmental justice, social disparity and inequality (Schnurr & Swatuk, 2012:1-14).

Sustainability issues are connected with human security, specifically in regard to the inclusive nature of environmental management and rights, ownership of land, land utilization and inequality (Clover & Ericksen, 2009:53-70). Resident's of Turkana South claim that the migration of huge groups of individuals and livestock during the raids led to the destruction of grazing fields and watering zones.

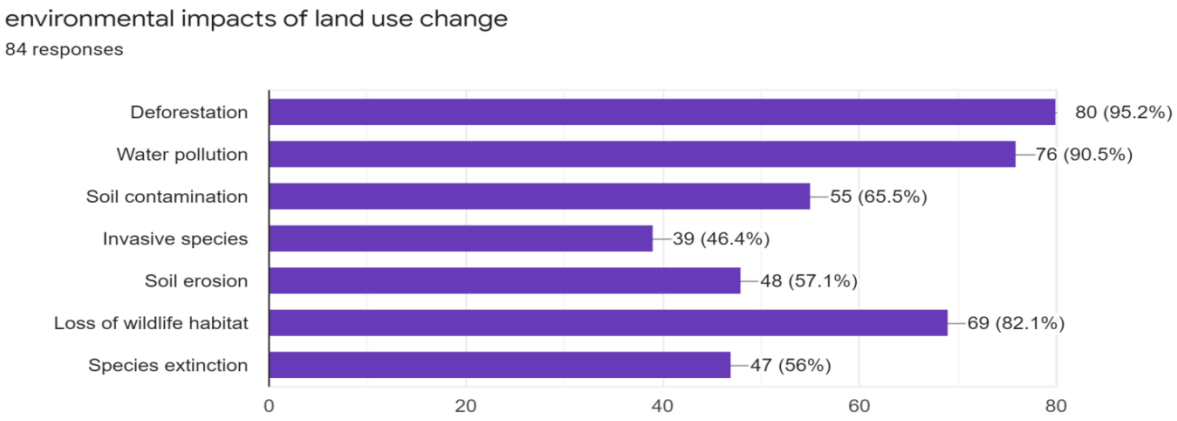
Respondents also reported that displacements have often contributed to people gathering in safer places that are often located near the waterways. This culminated in the loss of the trees along these regions. For example, many of the affected pastoralists in Turkana South had relocated to Kalemungorok, which is safer and very far from conflict zones. Many families had settled there and the accessible pastures had been surpassed by livestock numbers. This led in many plant populations being extinct and the vegetation quicker being exhausted, leading to desertification in the nearby future. But the environmental damage during raids in Pokot North was as follows. The respondents interviewed saw the degradation of the community as a result of the migration of vast numbers of persons and livestock during raids. Resources as well as the environment in Pokot North in protected areas have been degraded due to overuse by humans and animals in times of war. The respondents have also told the researcher that Turkana and

Pokot's prolonged pastoral dispute has had a negative environmental effect and the strain placed on their delicate ecology may never be reversed, if societies grouped together for protection purposes. The respondents have said that it can be extremely damaging to move huge livestock stocks in limited spaces.

Since intensified and rapid movements caused degradation of water points, cutting down trees to create fence and houses, huge motions of human and animal populations during livestock raids have caused major destruction of the environment. Expeditiously consumed, trampled upon and often destroyed grass and other pastures. Several other people sold woods as firewood or produced wood for sale in urban centres, such as Kainuk, Katilu and Lokichar, tried raising alternative revenue. Areas across the Turkwel River Basin is in danger of soil degradation and the like considering the fact that there are so many cattle invading it, and also because of a lot of deforestation and burning of vegetation and trees for cultivation for purposes of settlement. Setting up temporary tents and cow shelters, precarious and changing agriculture, more inhabitants pouring into the basin, prompting the need for more land, neglected and refused immigration processes and the like, sparking insurmountable turmoil and finally making the otherwise quiet desirable Turkwel River Basin into complete disarray.

It has also been stated that the violent conflicts that caused the Turkana to burn the settlement of Pokots in Malmalte River, Kadengoi and Amolem have resulted in the extinction of species and the degradation of the natural environment of that region. Hydro-logical shifts has had effects on riverine populations heavily reliant on sediments and floodwater for irrigation (Kolding 1993; Avery 2010), also under the post-dam hydro-logical system has reduced the fisheries productivity of Lake Turkana by more than two-thirds, possibly leading to a loss of fisheries (Gownaris et al., 2015, 2016). According to the figure 9, 82 respondents recorded a significant change in land use to agriculture that has resulted in soil failure over the years and is increasingly inadequate to maintain regeneration of vegetation as a result of sustained deterioration due to a rise in the pace of livestock migration.

Figure 9: Environmental impacts



Source: Field work (2020)

Table 6: Ranking of Environmental Impacts between 1963 to 2018

Environmental Impact	1963		present	
	Frequency	Rank	Frequency	Rank
Deforestation	22	1	80	1
Water pollution	10	4	76	2
Soil contamination	0	6	55	4
Invasive species	8	5	39	7
Soil erosion	23	2	48	5
Loss of wildlife habitat	21	3	69	3
Species extinction	0	6	47	6

Source: Field work (2020)

4.4.2 Significance of environmental impacts from the land use change

Hypothesis 2

Research hypothesis (Ha): There is significant relationship between environmental impacts and change of land-use in the study area.

Null hypothesis (Ho): There is no significant relationship between environmental impacts and change of land-use in the study area.

To assess if there is a significant relationship between environmental impacts and land use change, the researcher used Spearman's Rank-Order Correlation. The intensity of the relationship between land-use transition and environmental impacts is calculated by this non-parametric version/spearman correlation coefficient (p, also signified by r).

Table 7: Relationship between change in land use and Environmental Impacts

Frequency (Present land use change)	**Rank X**	**Frequency (present environmental impacts)**	**Rank Y**	**d (rankX-rankY)**	**d2**
49	4	80	1	3	9
56	3	76	2	1	1
2	7	55	4	3	9
26	6	39	7	-1	1
74	2	48	5	-3	9
78	1	69	3	-2	4
33	5	47	6	-1	1
∑					34

Formula:

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

where P= Pearsons correlation coefficient

n = sample size

d =differences between ranks of each observation

∑ = sum of

∑ = 34; n = 7

P= 1- $\frac{6x34}{7(49-7)}$

P= 1 – $\frac{204}{336}$

P= 1 – 0.60714

P= 0.393

We've had a p of 0.393 from the above. This reveals a positive relationship between land use change and environmental impacts. In short, there is a positive relationship between the environmental impacts and change land use and in the field of study. In conclusion, it is significant that change of land use has a significant effect on environmental impacts.

4.5 To investigate the role of various development interventions in increasing the resilience of livelihoods to threats and crisis posed by land use conflict.

4.5.1 Reduce pastoral populations

Both human and animal population in the Turkwel River Basin is now large relative to historical levels and according to respondents, 63.1% stated that there is growing population and has resulted in the depletion of their resources. The informants reported that services have deteriorated tremendously due to land grabs for agriculture and infrastructural development and also droughts and other challenges have driven many people, including mainly the poorest, to frequent migration from pastoralism. There were business opportunities to replace these refugees in other industries.

The solution to demographic tensions in the Bolivian altiplano where people were willing to find external revenues beyond the city, that's according to 'Latin American Regional paper'. And this has made much of Turkana and Pokot migrate to cities like Kapenguria, Kitale, etc. to search for jobs. This relocation to more fertile areas is no evidence that the arid territories are unproductive. Instead, it's an age-old process that has enabled income and diet to be diversified. A decline in the human pastoral population in the Turkwel River Basin will make it possible to decrease the overall live-stock numbers and increase the productivity of per animal. The pastoral development policies should be planned to slow down the population. This could be accomplished first by encouraging women's education and sustainable growth secondly by fostering economic diversification and the creation of alternative work beyond pastoralism.

4.5.2 Manage dry rangelands sustainably

In the Turkwel River Basin environmental changes include land invasion by farmers, of whom 57.1 per cent of respondents changed the use of their land parcels to farming. According to 82 of the informants have shifted from pastoralism to cultivation. The failure of the agreed legal mechanism to settle conflicts, the development of quixotic international borders, focused largely on imperial precedents, have irretrievably altered the context through which pastoralism strives to stay viable.

There is an immediate need for policy on land use and preparation in Turkwel River Basin to avoid more encroachment on pastoral land by farmers and environment conservationists, except when various land use incentives for both parties can be established. The development of projects or infrastructures that restrict pastoralists must also be avoided, while there could be creative negotiations of value to both sides. This involves income sharing from tourism that incorporates wildlife watching and immersion in a rural community, or nature conservation areas that are given up to nomadic tribes as emergency grazing in the event of drought.

Policies to encourage capital expenditure in range lands are desperately needed, such as water supply or rehabilitating deteriorated agricultural land for gazing. In areas where most of the field is cultivated, it is important to map, identify and manage seasonal corridors and links to grass and water for livestock. Emergency grazing zones, such as Amolem with water, need to be managed and gazetted. There are several instances where run-down irrigation projects or low productivity dry land agricultural areas can be turned back to high productivity pastoralism, using the agreed logic that land should be put to its greatest value use, if pastoralism would maximize its own productivity.

Negotiations on cross-border migration should take place and pursue an amicable compromise that satisfies the needs of pastoralists. The role of pastoral groups or alliances must be discussed in depth. Experience has proven that herding household associations can be effective stewards of pastures and water. In Mongolia, several groups have earned, and control successfully, formal 50-year rolling leases to main winter-spring

pastures. In the Turkwel River Basin, local environmental protection authorities and associations of water users in several pastoral areas control the migration of pastoralists to specified areas in order to minimize grazing pressure on depleted pastures and to mitigate dispute over resources. Water management contributes to grazing management in many regions. The key to these accomplishments is twofold, focused on customary systems, laws and perceptions, and officially endorsed by government authorities and local councils.

4.5.3. Clarify and strengthen pastoral tenure systems

In a world where resources are limited and widely volatile between seasons and years, nomadic pastoral subsistence schemes are a reasonable approach to life. Pastoralists in the Turkwel River Basin are shifting to enable them to use pasture and water spread around a large region of north-western Kenya. Informants seconded that between the three villages Amolem, Kainuk and Sarmach, services seem to be ample for one year in one village and sparse for the next. The rules of tenure must represent this trend.

Country tenure and management have a poor track record of environmental performance, equity and management regulations. The most efficient and profitable mechanism for major capital, such like high-capacity water points and pasture , has been one of organizational tenure in the possession of well-defined, typically kin-based pastoralist unions, which determine stocking prices, laws, obligations and management objectives among themselves. The System can maintain overall possession of such assets, while awarding long (50 years) renewable lease to nomadic herder's communities under well-defined conditions on the standard of usage, and creating an agreed legal mechanism for the settlement of conflict that couldn't be settled by the pastoralists themselves. It would be necessary to guarantee that women in general, particularly women-headed households, are allowed to engage in those kinds of leases in terms of equality with men. Leasing with a series of ecological benchmarks and an annual analysis reduces the issue of community ranches that are drifting into subdivision and privatization. Corporate leases of large assets managed by nomadic tribes associations may be paired with private

individual possession of core resources such as individual camping areas, animal shelters and winter barns in Central Asia, limited seasonal hayfields or water sources elsewhere.

In Alpine Europe, the traditional incorporation of corporately controlled mountainous pastures and privately owned or leased pastures and agricultural land has enabled grassland services to be used in an extremely responsible fashion, and remains to do so efficiently. In parts of the Andes, wales and Switzerland, entry to commercially controlled summer mountain pastures is restricted for those who already have contiguous private farm land at low altitudes. The animal's number you can place on the lease is influenced by the magnitude of your private 'base' property. These variations of private and corporate land use have been introduced in many other locations.

4.5.4 Improve pastoral productivity

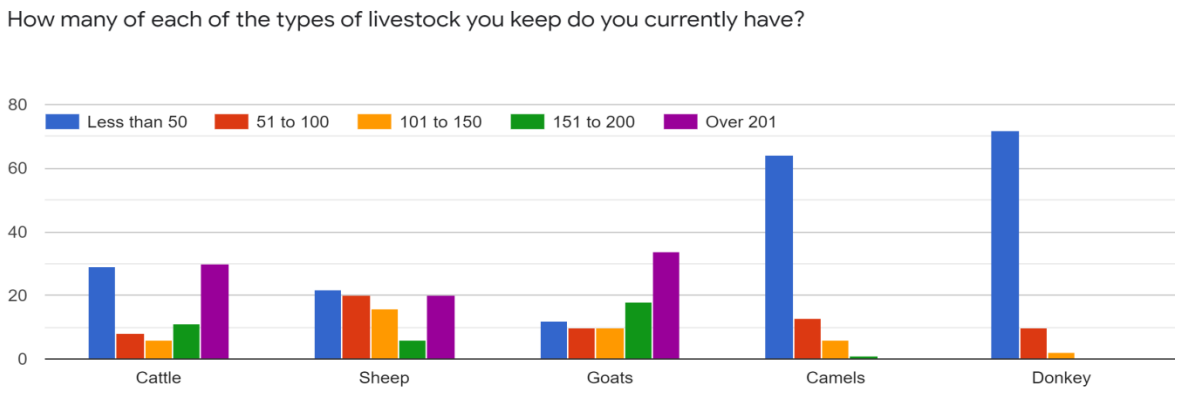
As described above, recent studies has emerged to a startling conclusion: per land unit, mobile pastoral structures are quite economically productive than northern countries' heavily capitalized ranches also as reported by respondents we have the Orwa group ranch from Marich Pass to Kainuk bridge. Productivity per unit of labor is low, but it's not a major concern, since manpower is available and short-term strategies do not attempt to replace inexpensive labour with costly capital goods, such as fences and pumps. Also, output per animal is poor and it is important to remedy this.

According to fig 10 it clearly shows the livestock population in which goats have the highest population followed by cattle then sheep. Only by reducing the overall amount of livestock in Turkwel River Basin and improving their individual production can livestock productivity gains be accomplished. Procedures to avoid: cross-breeding of races that are efficient but vulnerable, etc. Although there are strategies to sustain-ably increase livestock productivity: choosing from well-adapted domestic animals, management schemes that support these genetically superior animals, improved veterinary treatment, recognition and advancement of best local management practices, efficient awareness of grazing and variability of seasonal feed, targeted enhancement of feed, and many others.

In any efforts to increase livestock productivity, women, who also have specific roles for, and information about, sheep and goats, must be prominent. The productivity of other subsistence schemes is also boosted by pastoral livestock.

According to Africa regional article, Senegal and Mali are more so in Sahelian West Africa because chemical fertilisers are somewhat costly or literally not easily accessible in remote markets, via elaborate agreements made by primary trade amongst pastoralists and farmers, farmers are more likely to get animal manure that is a vital agricultural production input and herders obtain water and, after the harvest, are permitted to graze their animals on stubble.

Figure 10: livestock population



Source: Field work (2020)

4.5.5 Improve markets

Successive pastoralism culture relies on the markets. More successful pastoral industry must provide the resources to produce it. Market technology and information needs to be strengthened in all pastoral areas. The Research by IFPRI implies that potential future changes in demand would be beneficial to pastoralists. Rapid urbanization in Kenya and communities, and a faster growth in demand for animal products than for other basic

foodstuffs, are generating an extremely booming market for pastoral commodities. Development in agriculture sector over the next couple of decades is expected to be mostly due to certain livestock products, which will increase the quality of life of pastoralists.

Pastoral farmers in the Turkwel River Basin could perhaps recognize techniques as versatile as cow calves raising young animals for fattening beyond the semi - arid regions, raising young male livestock for mentoring as oxen plough, peri-urban dairy farming (possibly a women's specialty), or specializing in somewhat dairy products and cashmere which are of high-quality with regional level distinctive and recorded trade. An especially compelling long-term alternative will be for policy makers and herders to encourage strategies of raising livestock production in directions that are locally possible avoiding costly interventions and also to sell their goods as naturally grown, free-range natural pastures without chemical supplementation. Animal disease issues to be solved so that their products cannot be restricted from entering the market.

4.5.6 Provide services for mobile pastoralists

In the Turkwel River Basin, the scarce population of humans sometimes as limited as 1 to 10 inhabitants per square kilometre implies fewer available inhabitants in the region for infrastructure, even though the populace is sedentary. There are plenty solutions towards this twin low population density and mobility. In fig. 12 it clearly shows how land use has changed over the years and its taking a lot of pastoralists lands 58.3% of the respondents confirmed that there has been land use change and according the GOK should not flood development in Turkwel river which will have no use but rather provide mobile services that won't consume much of their lands that they largely use for grazing. Africa, boarding school education seems to have some success, and much of the new generation of educated kids of nomadic parents have gone to boarding school. That being said, African boarding schools are also violent environments for nomadic pupils.

Bullying is widespread, girls are frequently harassed, and the curriculum is meaningless to nomadic pastoral life, since nomadic culture is largely rejected by teachers and pupils

of an agricultural or urban background, and educational facilities are often seen as a means of converting nomadic children into settled adults. Drop-out and loss rates for nomadic children are high, generating a paradox: drop-out children are frequently alienated from pastoral society, but not embraced by popular culture.

In Mongolia, boarding schools have been friendly places for nomadic children until recent times, and school participation rates have been very high as a result. The key distinction from African boarding schools has always been that the cultural heritage of nomads in Mongolia was strongly respected by teachers and other students, so children and parents thought that their lifestyle was significant and respected. Curriculum has been adapted to the pastoralist economy, and the timetables of the school have been customized to the labour demands of the pastoral year. With such an illustration in mind, it is unreasonable to ignore the possibility for boarding schools for pastoralist kids as long as a separate education system that recognizes nomadic lifestyle and promotes relevant skills can indeed be developed and preserved.

Many of the countries have enacted mobile primary educational centers. In Iran, teaching staffs from the pastoralist setting are educated, wall lined with white school tents and school equipment, and they open up a community of nomadic settlements. In the summers and winters, when camps hardly ever shift, tent schools are accessible for operation. One benefit in tent schools is also that girls and boys are likely to be admitted equally, as girls live under the direct oversight in their guardians. Families prefer to camp around the portable school, which is always in the local chief's camp, ensuring there were enough kids for a mixed-age class. But literary tent schools always shifts with them. Kids who apply for high school go to regular sedentary institutions in nearby cities.

The tent educational institution and a related mobile primary health care facility have been in service for more than fifty years and have effectively taught many generations of pastoralist teenagers. Remote teaching, via radio, is a suitable choice. Radio schooling for kids in the rural countryside has a long tradition in pastoral Australia. Studies in the Mongolian have shown that radio teaching for both grown - up women and kids can be effective. Schools offer initial curriculum and occasional assistance at designated

locations, and mix it with routine radio coaching defined on written work completed at home. In the future, as more pastoral families have TV sets, satellite TV will get an increasingly significant part to play throughout this regard. Maybe the most innovative mobile service was really the mobile libraries located within summer pastures of Kyrgyzstan during or after the socialist era.

Mobile Quranic schooling typical to Muslim pastoral communities in Africa, in which a religious tutor is hired by a large number of mobile families. Majorly reliant on a well-trained instructor to be effective. Studies suggest that these educational system as well as teachers and other students view pastoralism as the most significant aspect of good schooling for nomadic herders. Such can be seen in Iran and Mongolia, with nomadic primary schooling having been successful, via a wide range of distribution mechanisms.

Other programs include animal and human health systems for nomadic herders incorporate fixed and mobile infrastructure, combining local expertise and specialization where necessary. Mobile distribution camps are a model in northern Kenya. The mobile structure offers initial capacity development, preparation and inspiration. If community employees are willing to sell drugs and run community pharmacy shops, they can pay their expenditures and earn a modest monthly salary while it is impactful. This method fits well in rural areas without additional health care. It is probable that telecommunications could play a critical role in the future, connecting patients and paramedics to highly qualified professionals through television or radio.

4.5.7 Financial services for nomadic pastoralists

Financial institutions have generally overlooked the position of nomadic pastoralists. That's because pastoral mobility is viewed as a barrier to regular banking practices and because, inappropriately, pastoralists are also seen as outside the cash economy. Restocking loans have also been implemented in several regions as a solution to the hunger and scarcity and livestock deaths. Restocking is less often a feasible way to support awfully vulnerable pastoral nomads out of poverty, but it allows capable pastoralists to raise their livestock to a sustainable rate if they are strategically aimed at

those with expertise, skills, labour and social platforms to effectively maintain their livestock. There is no knowledge with cash savings between nomadic herders or savings and loan activities, even though these could be of concern to poor pastoralists as a means to finance capitalization and preparation for alternative employment.

Some expertise occurs in hire purchase agreements between nomadic herders, for example, where pastoralist members procure broad lumpy acquisitions such as mobile dips under hiring purchase agreements. Entrepreneurship among nomadic herders to allow them to manage loans effectively is necessary. Women also face serious challenges than men in creating pastoral businesses; however pastoral women's entrepreneurship groups in northern Kenya have been much more active than men's. At first, such businesses sometimes cannot manage to borrow at commercial bank credit, but may do so once they've been developed.

There seems to be a new interest in the development of insurance among nomadic herders. While there's very little expertise, index insurance, which has so far been used primarily in crop farming, really does have a possible use for livestock-based economies. Index insurance operates by providing insurance against defined environmental risks whereby the area index is readily accessible: annual or seasonal runoff, animal mortality or plant production as measured by remote sensing. Every new form of financial service for herders would be easier to handle if the pastoralist communities are responsible for bargaining, handling and paying back on behalf of the victims. Efficient availability of loans, hire purchase and insurance is likely to be a good motivation for pastoralists to think towards creating groups.

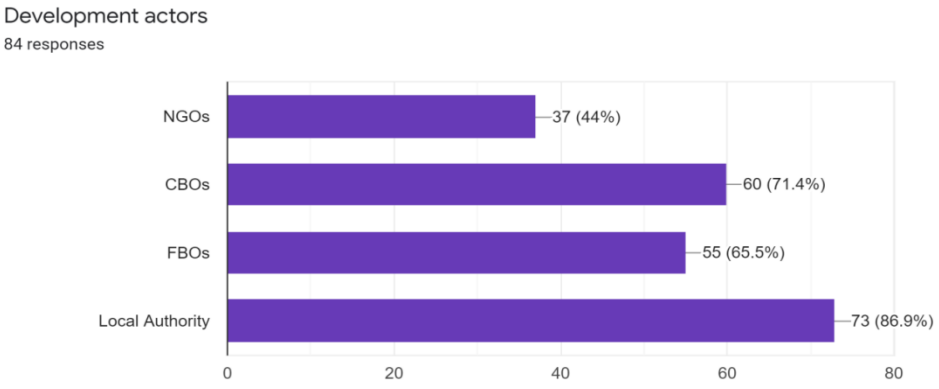
4.5.8 Reduce and manage risks

Since nomadic herders use marginal and highly volatile resources in the River Turkwel Basin, they face elevated threats. Alterations of land usage cause extreme environmental instability. To ensure that life is not lost and also that living conditions are not affected, in Kenya, effective early warning and rapid response programs have been designed exclusively for pastoral communities.

In pastoral areas, violence is now endemic. Common local livestock raiding has been made into a significant source of insecurity and risk by the quick proliferation of modern weapons, commercial interests of raided cattle as a profitable asset, and political maneuvering. As traditional management mechanisms are disrupted, disputes over pasture and water are intensifying, and no systematic structure replacements them.

Recent experience, however, shows that there are appropriate strategies for mitigating and resolving certain tensions. Fig. 11 illustrates some of the actors who play a big role in Conflict resolution Local Authority has the highest and this include the NRPs if they are well equipped and fully functional, they significantly played a big role in resolving Sengwer/ Pokot land conflicts. Followed by CBOs then FBOs which according to the respondents should be increased as they play a big role in conflict reduction. Lastly we have the NGOs e.g. the KVDA which over the years helped ameliorate peace among the communities. The key is to include all the different bases of power and control, including numerous state arms (administration, security services, and politicians) and common local power (chiefs, leaders, communities of women or youth associations). The established legal framework must encourage and improve conventional municipal methods of handling land and resources.

Figure 11: Developmental actors



Source: Field work (2020)

4.5.9 Security in pastoral zones

In regions where boundaries are contested and where mobile groups can easily pursue guerrilla warfare and the inaccessibility of pastoral territories in the Turkwel River Basin makes them common. Pokot and Turkana dispute related to access to grazing and cattle raiding was prevalent prior to the establishment of nation-states, especially in Northern Kenya (Hendrickson, Armon & Mearns 1999).

Since 1963, however, boundary wars and political influence conflicts have ensured that armed conflict has been rampant in the country. Increasingly advanced weapons, such as the popular AK47, have penetrated the area, allowing raiders to achieve their goals and objectives with even more deadly repercussions. According to the NPR representative in Sarmach, he claimed in 2020 that the NPR's disarmament has left them totally vulnerable, which is why the Turkana group is attacking them causing family eviction, property damage, raiding livestock or farm produce, and loss of life. The Kenyan government should implement security by building police stations in those regions, according to the informants. The Kenyan government should also raise awareness and inform people of peace and harmony in this area of interest.

Incidents from Kainuk Police Station Reports

The Table below shows incidents reported to Kainuk Police Station in 2008 and 2009. Kainuk

Police Station is the closest station to the conflict area and that was the reason that information

Was collected there. Efforts to obtain recent records failed.

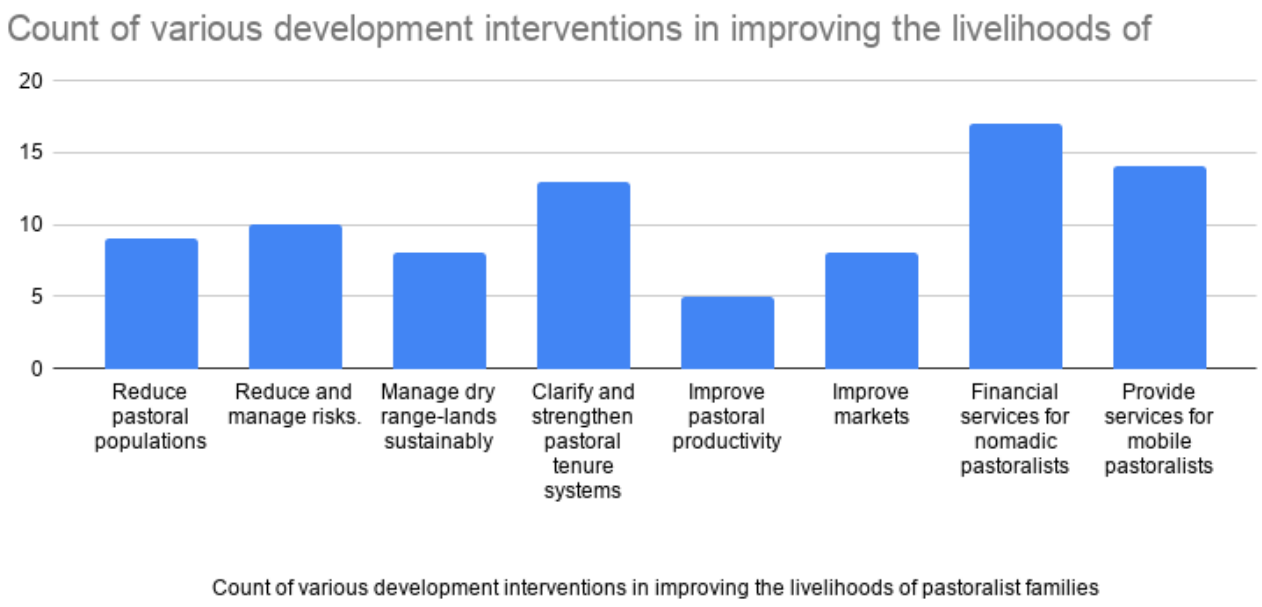
Table 8: Kainuk Police Station Report

Date	Location	County	Incident
23.2.2008	Kainuk	Turkana	4 Turkana boys shot dead
17.3.2008	Sarmach	West Pokot	bandits attacked but were repulsed
21.5.2008	Sarmach	West Pokot	Turkanas raided and took away 10 herds of cattlel
15.2.2009	Kainuk	West Pokot	24 calves stolen by Turkanas
8.3.2009	Kainuk	Turkana	About 100 pokots attacked turkana herdsmen and took away 2039 goats/sheep. 1 female lady shot dead
10.3.2009	Kainuk	Turkana	Pokots shot dead Turkana adult male and injured 1 adult female
14,4.2009	Sarmarach	West Pokot	Skirmishes between Pokot and Turkana. Turkanas killed a number of pokot cattle
8.5.2009	Kainuk	Turkana	Shootout between pokot and Turkana. Male Turkana Short on Thigh
8.4.2017	Amolem	West Pokot	4 killed. Goats stolen

Source: Field work (2020)

From Figure 12, 20.2% of the informants approved financial services for nomadic pastoralists as the major developing interventions in improving livelihoods of pastoralist families. Provide services for mobile pastoralists as a developing intervention was reported by 16.7 percent of the informant interviewed. Clarify and strengthen pastoral tenure systems, reduce and manage risks, reduce pastoral populations,improve markets, manage dry range-lands sustainably, improve pastoral productivity are employed as a development interventions by 15.5, 11.9, 10.7, 9.5, 9.5, and 6 percent of the respondents interviewed Respectively,

Figure 12. The various development interventions in improving the livelihoods of pastoralist families.



Count of various development interventions in improving the livelihoods of pastoralist families

Source: Field work (2020)

4.6 Discussion of Findings

The main purpose of this article would be to make a significant contribution to research regarding land use disputes in Turkwel River Basin, which plays a fundamental role in social science literature. From the research findings it's evident that land use change in Turkwel River Basin is one of the causes that trigger conflicts. The two main livelihoods of pastoral and Agro pastoral are threatened as they are natural resource base. Despite the appreciated development in most parts of the Turkwel Basin, it's sad to note that this has happened at the expense of the environment. Through these social-ecological changes it's evident that this change continues to impact negatively in Turkwel River Basin ecology. Thus making the natural resources that pastoralists largely depend on diminish very fast.

The **Theory of Eco-violence**, which can establish blurring links between living conditions, scarcity of natural resources and disputes, is diagnostically beneficial in the sense of study areas within the Turkwel River. Conflicts in the regions around the Turkwel River, where converging ecological patterns and rapid development and population growth contribute to increasing rangeland degradation, are likely to worsen dramatically as scarcity of resources works together or other social factors linked to clashes. (Contrary to the study in Machakos by Tiffen where technological innovations were reported to have impacted positively on the ecology (Tiffen 1994). Turkwel river Basin ecosystem is threatened.

A new thinking therefore needs to be put in place to facilitate a paradigm shill in development process cycles, where environmental concerns should form basic part of developmental agenda in the River Basin. There is need to have environmental responsive society with a new vision of caring capacity in planning (*Savory 1999).* This should help a society to achieve an enhanced quality' of life through several strategies such as promoting equality and promoting sustainable use of resources. Equitable access and control by all community members will go a long way in ensuring concerted efforts in conservation of the available natural resources in the critical ecosystems in Turkwel River Basin.

Zimmerman (19.13) introduced a functional interpretation of resource which is still relevant. The transition process of the pastoralists to sedentary lifestyle in the plateau is a good example of the above interpretation by Zimmerman. Resources exploitation is taking place rapidly, accelerating the fragile ecosystems degradation in the River Basin. Land use disputes are also an outcome of competition for potentially significant land use, and could have an increased probability of conflict.

Study thus intervenes in field work to reduce conflicts and to deeply understand the nature of conflicts, which can further lead to the factual mitigation of conflicts. This theory has also been used in different studies by Alexander Lemarkoko (2010) and Ekoja, Oyole Samuel et al., (2019), among others. The initiative was also designed to ensure that developing regions or countries thrive economically.

4.7 Summary of the Chapter

The chapter addressed the overview and analysis of findings gathered during the research that analyzed the perceptions of pastoralists on the role of land use change on resource use conflicts in Turkwel River Basin The study findings were based on socio-economic characteristics of the respondents and addressed five specific objectives. The study was directed by three specific objectives which were; The first objective identified to asses how social-ecological systems of pastoralism in the study area are changing and their effects on pastoralism and seven cases were identified; Population increase, Building of infrastructures, Building of dams, Conversion of grazing to cropping, Installation and use of irrigation, Conversion to non-agriculture uses and Contraction of industries.

The second to investigated the environmental impacts of land use changes in the study area which were; Deforestation; Water pollution; Soil contamination; Invasive species; Soil erosion; Loss of wildlife habitat and Species extinction and thirdly the objective investigated the role of various development interventions in improving the livelihoods of pastoralist families and communities and conflict reduction which were; Structure of the pastoral economy; reduce pastoral populations; manage dry range-lands sustainably; clarify and strengthen pastoral tenure systems; improve pastoral productivity; improve

markets; provide services for mobile pastoralists; financial services for nomadic pastoralists and reduce and manage risks. The data was gathered through interviews and questionnaires were conducted and data interpretation was carried out in systematic discussions through documents.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides an overview of the research on perceptions of pastoralists on the role of land use change on resource use conflicts in Turkwel River Basin. The observations presented and analyzed in Chapter four form the foundation of the conclusions and recommendations.

5.2 Summary of the findings

The main focus of the research was the perceptions of pastoralists on the role of land use change on resource use conflicts in Turkwel River Basin. The study is based exclusively on the three objectives which were; to asses how social-ecological systems of pastoralism in the study area are changing and their effects on pastoralism; to investigate the environmental impacts of land use changes in the study area and to investigate the role of various development interventions in increasing the resilience of livelihoods to threats and crisis posed by land use conflict.

The samples of 84 informants were selected using purposive sampling approach. The researcher used both primary and secondary data collection approaches to accomplish the research objective. The data obtained was evaluated using direct quotation and tables. The following conclusions were taken from the study of the data collected:

With regard to the first objective, the research was focused at assessing social-ecological systems of pastoralism in the study area are changing and their effects on pastoralism. The findings from documentary review revealed that social-ecological changes in the area are as follows; Population increase, Building of infrastructures, Building of dams, Conversion of grazing to cropping, Installation and use of irrigation, Conversion to non-agriculture uses, Contraction of industries and invasive species.

The second objective, the research aimed to investigate the environmental impacts of land use changes in the study area. The results of the interviewees showed that land use in Turkwel River Basin has brought different environmental impacts such as Deforestation, water pollution, wildlife extinction, habitat destruction, biodiversity decline and species extinctions.

In the third objective, to investigate the role of various development interventions in increasing the resilience of livelihoods to threats and crisis posed by land use conflict and the results revealed that a range of attempts have been made at the level of the community and government to minimize risks brought up by disputes over land use. The attempts involved: Reducing pastoral populations, Security in pastoral zones Reduce and manage risks, financial services for nomadic pastoralists Provide services for mobile pastoralists, Improve markets, Improve pastoral productivity, Clarify and strengthen pastoral tenure systems and Manage dry rangelands sustainably

5.2 Conclusion

The significant proportion of the influence of the land dispute between pastoralists and farmers is from the extreme peace deterioration. This suggests that people are more influenced by disputes between pastoralists and farmers over the use of land. The effects of land use change conflicts includes decrease in food production, Deaths and injuries of which as indicated by the researcher deaths don't occur much opposed to other negative effects, but they impact victims, as well as the notion that humans have the right to live. Therefore in this situation a lot of funds are invested on settling disputes and planning ways to prevent conflicts in the future. The study concluded that, based on the above results, land disputes brings a lot of damages to the population and has huge impact on the environment and economies of the people, the Council and the government as a whole.

Deaths are not much happening compared to other impacts, but they affect people despite the fact that human beings have the right to live. This indicates that when conflicts happen, a lot of money is used to solve them and also to plan strategies in preventing them to occur in the future. Based on all the findings above, the study concluded that land conflicts bring no good rather than harm to the people around and affects the economy of the individuals, council and the government at large.

5.3 Recommendations

In light of these observations, the author was able to generate backing recommendations to expand the understanding of the land conflict issue that affects the population and the nation's economy in general. Here are the recommendations of the researcher:

5.3.1 Recommendations for government (national government and county government)

5.3.1.1 The Need for Serious migration Control

key source of land dispute among Pokots and Turkana farmers and cattle herders and the high rate of immigration in the Turkwel River Basin is because of the good road networks. Reasonable steps need to be taken to monitor undocumented immigration in the Turkwel River Basin by guaranteeing there is no entry of cattle in both counties without written approval from the County Council Authority. All who unlawfully help foreigners to invade the county, as well as those who take bribery, should also be punished.

5.3.2 Recommendations for international development agencies

5.3.2.1 The Need of Having the County Land Tribunal

Therefore, in both counties there is a requirement for a regional tribunal to support the administration of the River Turkwel Bassin land cases in a brief period that would be beneficial. Agri-industry investors benefit from improved land access, and there is great profit opportunity, but there is no evidence to date for significant investment returns

(Kamski 2016). This can be attributed to the still poor infrastructure for transport and communication. In future, commercial agriculture should increase feasibility and profitability; a greater participation by this actor organization in the making decision process will also result in a more favourable sharing of benefits.

An on-going research indicates that the Social Tenancy Domain Model (StdM) (Lemmen et al., 2009) can accommodate conflicting land rights. Currently explored and developed by FIG, UN-Habitat and GLTN, the STDM is a LA instrument. The STDM ought to retrieve the entire land rights when they occur in reality, according to Lemmen et al., (2009). STDM does provide framework for recording and securing temporal rights of land for pastoralists by collecting database of rights of land as they occur naturally, namely the geographical and temporal dimensions of nomadic rights of land disclosed during report.

5.3.3 Recommendations for Local communities

5.3.3.1 The Need to Provide to those Victims of the Conflict

Research suggests that survivors of land the disputes between nomadic herders and farmers should receive counselling in order to eliminate fear. Until fear is taken away from members of the community, individuals would be in a spot to bring about development.

5.3.3.2 The Need of Reviewing Village Land Demarcations

Demarcations of Land under the land use plan should then be evaluated. In the case of borders, the assessment of village demarcations will help to minimize land disputes and will determine the precise usage of the common parcel of land. Together with the provincial and village authorities, the Ministry of Settlement, Land and Housing and must also work shoulder to shoulder to find sustainable and outstanding solutions.

5.3.4 Recommendations for further research

This study was mainly conducted in the Turkwel River Basin to explore the effects of the land use transition and how it results in tension with the use of resources. However, more studies are required to identify attempts to mitigate land disputes; the other potential area of research is the effect on the ecology of Lake Turkana of damming the Turkwel River and, thirdly, the research of possibilities for pastoralists to diversify livelihoods.

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APPENDICES

Appendix 1: Household questionnaire

Appendix 2: Research introduction letter from the University

Appendix 3: Research permit

Appendix 1: Questionnaire to the Head of House Hold

My name is Roy kisa Cheruiyot. I am carrying out a study on 'perceptions of pastoralists on the role of land use change on resource use conflicts in Turkwel River Basin: The case of Turkwel River Basin resource conflicts: The case of Turkwel River Basin resource conflicts'

Kindly answer the following questions by ticking the appropriate response in one of the boxes provided. Please, be as honest as possible.

Section I: General Characteristics of the Informants:

1) Gender

a) Male [ ]

b) Female [ ]

2) Marital status

a) Married [ ]

b) Separated [ ]

c) Single [ ]

d) Widowed [ ]

3) How old are you?

a) 18----------25 years [ ]

b) 26----------35 years [ ]

c) 36----------45 years [ ]

d) 46----------55 years [ ]

e) 56----------65 years [ ]

f) 66---------- Above [ ]

4) Main occupation ……

5) Level of education

a) Primary School [ ]

b) Secondary school [ ]

c) Diploma [ ]

d) Basic degree [ ]

e) Postgraduate Masters [ ]

f) Postgraduate PhD [ ]

g) No formal education

6) How many people live in your households?

a) Less than 3 [ ]

b) 3 to 5 [ ]

c) 6 to 8 [ ]

d) more than 8 [ ]

7) How long have you lived at the current place?.....

8) Where did you live before coming to the current place?.....

9) Why did you migrate from where you previously lived to the current location?.....

Section 2: changing of the social-ecological systems of Pastoralists

10) What is the size of you land?

a) Less than half an acre [ ]

b) 1 acre [ ]

c) 2 acre [ ]

d) 3 acre [ ]

e) 4 acre [ ]

f) 5 acre [ ]

g) more than 5 acres [ ]

h) others (specify)

11) What are the uses of your land parcel?

a) Rearing a heard of livestock [ ]

b) Growing crops [ ]

c) Rearing livestock and, Raising crops [ ]

d) Conservation of wildlife

e) Other (specify)

12) Have land uses in River Turkwel Basin changed over the years?

a) Yes [ ]

b) No [ ]

13) What land use changes have occurred on your land in the period 1963-2018?
    a) Pastoralism to cultivation
    b) Cultivation to pastoralism
    c) Pastoralism to conservation
    d) Conservation to pastoralism
    e) Other (specify).....

14) Have you ever changed the use of your parcel of land?.....

15) What is the reason why you changed the use of your land?
    a) Be able to raise more animals
    b) Be able to raise food crops
    c) Be able to raise more cash crops
    d) Increase household income
    e) Undertake soil conservation measures
    f) Conform to what most people in my area were doing
    g) Conform to my tribal culture
    h) Other (specify).....

16) To what extent have the following land use changes occured in River Turkwel Basin? Where 5=very great extent, 4=great extent, 3=moderate extent, 2=low extent, 1=no extent at all

	1	2	3	4	5
Building of residential houses					
Building of dams					
Conversion of grazing to cropping					
Installation and use of irrigation					
Conversion to non-agriculture uses					
Contraction of industries					

17) Do you think population or people where you live has been increasing or decreasing (1963-2018)?

a) Yes [ ]

b) No [ ]

c) What do you think has caused the change?.....

18) How has the population change affected the following statements on population increase and land use conflicts in River Turkwel Basin? where 5=strongly Agree; 4=Agree; 3=Neutral; 2=Disagree; and 1=Strongly Disagree

	1	2	3	4	5
Increase in human population is rapidly leading to encroachment of livestock grazing fields					
Population increase leads to increasing demand for land, food production leading to land use change into agrerian areas					
Population increase leads to reduction of livestock grazing field and pastoral corridors					
Population increase has lead to increased availability of modern weapons					
large-scale migration of people from rural areas to rapidly					

expanding cities

Section 3: Pastoralism

19) What types of livestock do you keep?

1) Camel [ ]

a) Goats [ ]

b) Sheep

c) Cattle [ ]

d) Donkey

e) Chicken

f) All the above specie [ ]

g) None [ ]

20) How many of each of the types of livestock you keep do you currently have? Where 6=more than 250; 5=201-250; 4=151-200; 3=101-150; 2=51-100; and 1 less than 50.

Type	Number
Cattle	
Sheep	
Goats	
Camels	
Donkey	

21) What crops do you grow?

a) Maize
b) Sorghum
c) Cowpeas

22) Effects of land use change over the years on pastoralists?

Section 4: Environmental impacts of land use conflicts

23) Have you heard any land use conflicts in your village?

a) Yes

b) No

24) Environmental effects of land use changes in the study area?..... .....

25) What are the Environmental impacts of those conflicts?

Section 5: Questions On Aspects of Land use conflicts, Natural Resource-based Conflicts and Conflict Resolution:

26) In the area where you have lived before or where you currently live, have there ever been conflicts over the following resources?

a) water

b) forests

c) land

d) pastures

27) Has land ownership system changed since 1963 to 2018?

a) Yes

b) No

c) If yes, what is the type of land ownership type?

28) Which years were the conflicts, who were the parties in each conflict, and what were the parties contesting about?

a) ……..

b) ……..

c) ……..

29) Considering conflicts over resources that have occurred in the area where you previously lived and where you live now, can you say such conflicts were as a result of land use changes?

a) [ ] Yes : Explain your answer ……

b) [ ] No : Explain your answer ……

c) [ ] Don't know ……

30) Have conflicts over resources caused any of the following cases in Turkwel River Basin? (Please tick only one choice)

i. Clan wars/ conflicts [ ]

ii. Destruction of property [ ]

iii. Raiding of livestock or farm produce [ ]

iv. Displacement of families [ ]

v. Loss of lives (deaths) [ ]

Other (specify)

……
……
……..

31) Is there any organization which dealing with solving land use change conflicts?

a) Yes [ ]

b) No [ ]

c) If yes can you mention them?

….……
……

32) What are the procedures used in solving land use change conflicts?

33) Are you satisfied with decision made?

a) Yes [ ]

b) No [ ]

c) If no give a reasons;

…….

……

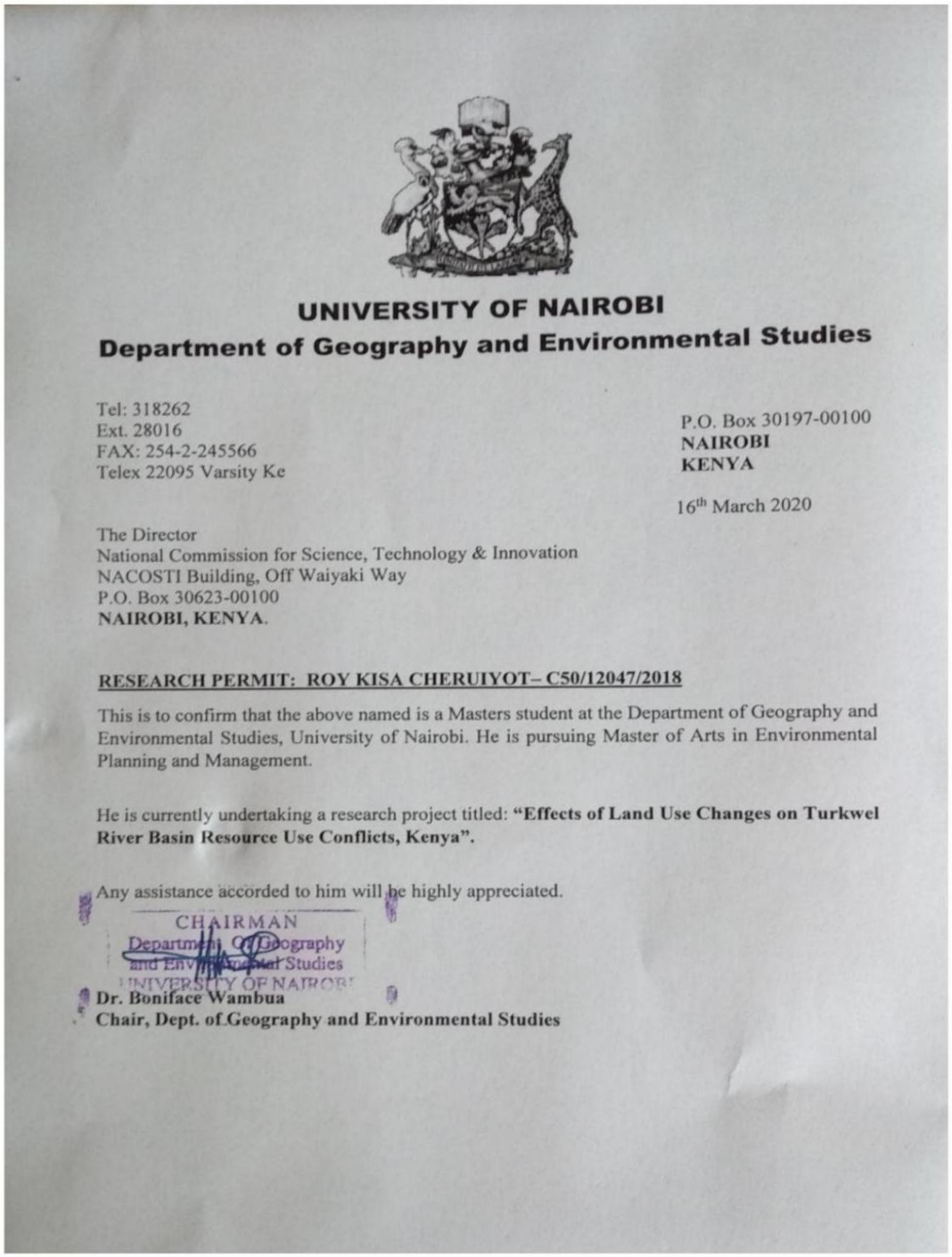
……

34) Are there any other issues about land use change that you wish to bring to our attention?

.....

Thank you

Appendix2:



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16th March 2020

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RESEARCH PERMIT: ROY KISA CHERUIYOT– C50/12047/2018

This is to confirm that the above named is a Masters student at the Department of Geography and Environmental Studies, University of Nairobi. He is pursuing Master of Arts in Environmental Planning and Management.

He is currently undertaking a research project titled: **"Effects of Land Use Changes on Turkwel River Basin Resource Use Conflicts, Kenya".**

Any assistance accorded to him will be highly appreciated.

CHAIRMAN
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Dr. Boniface Wambua
Chair, Dept. of Geography and Environmental Studies

Appendix3

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