IMPACT OF INVOLUNTARY RESETTLEMENT ON LIVESTOCK PRODUCTION AND PERFORMANCE AMONG THE MAASAI PASTORALISTS OF RAPLAND VILLAGE, OLKARIA KENYA

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DECLARATION

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

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DEDICATION

This work is dedicated to my entire family for the material and moral support, perseverance, and courage they have shown. To my wife, Awur Majur Nhial, for the lead she took in taking care of the family while I was pursuing what is being concluded in this write-up. To my sons, Thiong and Ajak, who both came to this world when I was undertaking this particular study, with whom their present gives our life new dimensions.

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ACRONYMS/ ABBREVIATIONS

AfD	French Development Agency
ASALs	Arid and Semi-arid Lands
AU/IBAR	African Union/Inter-African Bureau for Animal Resources
CAHWs	Community-based Animal Health Workers
EJ	Exajoule
EIB	European Investment Bank
FAO	Food and Agriculture Organisation of the United Nations
FGD	Focus Group Discussions
FO	Field Observation
GDP	Growth Domestic Product
GoK	Government of Kenya
IFAD	International Fund for Agricultural Development
JICA	Japan International Cooperation Agency
KenGen	Kenya Electricity Generating Company Limited
KfW	German Development Agency
KII	Key Informants Interview
KPLC	Kenya Power and Lighting Company
KWS	Kenya Wildlife Service
Manyatta	Traditional Maasai homestead
PAPs	Project Affected Persons
RAPland	Resettlement Action Plan Land
RAPs	Resettlement Action Plans
SPSS	Statistical Package for Social Sciences
TLU	Tropical Livestock Unit

UNDP	United Nation Development Programme
USAID	United States Agency for International Development
WB	World Bank

GENERAL ABSTRACT

After securing funding to expand geothermal energy generation at Olkaria area, the Kenya Electricity Generating Company (KenGen) relocated 155 Maasai pastoral households into a new area-RAPland village after impact assessment and negotiations. Resettlement Action Plans (RAPs) are inadequately planned and executed, PAPs are impoverished due to loss of livelihoods. Effect of relocation on livestock production and performance among the resettled pastoral communities was achieved by assessment of livestock populations and productions, livestock production challenges, coping mechanisms before and after the relocation, and evaluation of rangeland resources in RAPland village. A household questionnaires were administered to 105 households, three focus group discussions (FGD), six key informants (KII) interviews, and field observation were conducted. Livestock populations, cows and youngstock, and daily mean milk yield were significantly (P<0.05) affected by the relocation. Household means livestock holding (TLU) decreased from 75.74 ±8.83, 15.49 ±1.78, 5.83 ±0.67, 1.46 ±0.22, and 0.14 ±0.02 to 26.37 ±8.30, 4.62 ±1.70, 2.5 ±0.63, 0.34 ±0.21 and 0.3 ±0.02 before and after the resettlement for cattle, sheep, goats, donkeys, and poultry, respectively. Mean daily milk yield decreased from 3.8 ±0.19 to 2.4 ±0.19 litres per cow. Communal land reduced by 60%, pastures, water became insufficient in RAPland village. In conclusion, the relocation affected livestock production and performance among the resettled Maasai pastoral communities through reduced livestock populations and milk production, which consequentially affected household food and nutrition security. Future resettlement programs involving pastoral communities should factor in the carrying capacities of the areas being considered for the relocations.

Key words: Pastoralism, KenGen, RAPland village, livestock, involuntary resettlement

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

About a quarter of the world landmass is occupied by pastoralism, majorly in the continents of Africa, South America, Asia, and mountainous regions of western Europe, with a total herd of over billion heads of livestock (Dong *et al*., 2016). The common pastoral herds include cattle, camelids, small ruminants, yaks, horses, and reindeer, among other ungulates. Pastoral herds supply about 10% global meat and support over 200 million households globally (FAO, 2006; Davies *et al.,* 2013; FAO, 2016; Dong *et al*., 2016; Struelens *et al.,* 2017). Besides its contribution to national economies of the states with considerable herd sizes, pastoralists depend on livestock for food (milk, meat, blood), incomes, raw material (hides, skins, wool, mohair), draught power (transportation, ploughing), and socio-cultural uses such as include religious, dowry, and fines (FAO, 2013; Dong *et al.,* 2016).

In term of distribution, Africa has the highest number of pastoral communities at 60% - 70% with Sudan at first, Somalia and Ethiopia second, and Tanzania at third ranking with highest pastoralists (Kiondo *et al*., 2019), representing about 268 million individuals (FAO, 2018). As a justification for the importance of pastoralism, an estimated 16% of people in Sub-Saharan Africa rely upon pastoralism for livelihoods and sustenance (Kiondo *et al*., 2019). In Kenya for instance, some 60 - 70% country 's national livestock herds are kept by the pastoralists (Davies *et al.,* 2013; Omollo *et al.,* 2018), contributing per annum 10% and 50% of overall gross domestic product (GDP) and agricultural GDP, respectively (Davies *et al.,* 2013).

However, pastoralists are faced with rapid land encroachment by large-scale development projects such as dams, geothermal, highways, airports, agricultural, and conservancy, which on average, globally, displaces about 15 million people annually (Cernea and Mathur, 2007; Abbink *et al*., 2014). In the instances where people are resettled into a new area, project

affected persons (PAPs) have been impoverished due to loss of livelihoods (Abbink *et al*., 2014; World Bank, 2016).

In the early 1950s, Kenya Power and Lighting Company (KPLC) and United Nations Development Programme (UNDP) undertook geothermal explorative work within Kenya's Greater Rift Valley system. It identified Olkaria, Suswa, Longonot areas, among others, with potential (Mariita, 2011; Axelsson *et al*., 2013; Wamalwa, 2017). Drilling and constructions were done later between 1973 and 1985 (Axelsson *et al.,* 2013; Wamalwa, 2017). The inhabitatants were subsequent displaced without any compensations or planned resettlement. Besides, a 1984 executive order for the establishment of Hell's Gate and Longonot National parks on a 6800 and 5200 hectares respectively led to more displacement of the Maasai Pastoralists.

Just like in the previous displacements, there were neither consultations nor compensations and thus, the same pastoralists lost colossal tracks of land (Mariita, 2011; Koissaba, 2018; World Bank, 2015). Driven by the need of cheaper and clean energy, Kenya Electricity Generating Company Limited (KenGen)-governmental parastatal company tasked with electricity generation through development, management and operations of power plants in the country secured funding of one billion Euro from the Kenya government and international funders that include the World Bank (WB), European Investment Bank (EIB), Japan International Cooperation Agency (JICA), French Development Agency (AFD), and German development agency (KfW) in 2010 to expand geothermal production at Olkaria I and IV (Patel, 2015). The expansion caused more displacements among the Maasai pastoralists who had settled over time in different villages, notably OlooMayana Ndogo, OlooNongot, OlooSinyat, and the Cultural Center. Being pastoralists, the Maasai were dependent on their livestock that includes cattle, sheep, goats, and donkeys for livelihoods and sustenance. However, unlike in the previous displacements, this time, the evictees were

considered for land compensation. In effect, 155 Maasai pastoral households were resettled into a standard communal piece of land in the year 2014 (Schade *et al*., 2014) code-named RAPland village (Resettlement Action Plan land) after impacts assessment and negotiations. Of the displaced and resettled households, forty-five (45) were from the cultural centre village, forty-seven (47) from OlooNongot, twenty-four (24) from OlooSinyat, and thirty-nine (39) came from OlooMayana Ndogo.

1.2 Research problem statement

Most development-induced displacement and resettlement (DIDR) projects failed severely in resettling the projects affected persons (PAPs) fully, in that most people lose their livelihoods and are impoverished (Scudder, 2005; Cernea and Mathur, 2007; Maldonado, 2012; World Bank, 2016). Involuntary displacements remove people into new areas, and such changes requires livelihood modification beyond their traditional systems. In the new areas, the ability to manoeuvre through difficult times (drought, famines, and insecurity) is compromised, and the resettled communities face the difficult task of reconstructing their livelihoods in a new and unfavourable environment (Scudder, 2005; Cernea and Mathur, 2007).

Also, there are limitations and inadequacies in the planning of the resettlement project action plans (RAPs), including the lack of continuous monitoring and evaluation of livelihood impacts. Thus, resettlement is not an end in itself (World Bank, 2016). There is a need, therefore, to evaluate resettlement impacts on pastoral herds performance. The RAPland village, a newly created village to accommodate the KenGen project relocatees in Olkaria Area, was the case study for this evaluation.

1.3 Research objectives

1.3.1 General Objective

To assess the impact of involuntary resettlement on the production and performance of livestock of the resettled Maasai pastoralists in RAPland village, Olkaria Area.

1.3.2. Specific Objectives

a) To assess the impact of relocation on livestock populations and production owned by resettled persons in RAPland village.
b) To evaluate resettled area resources, livestock production challenges and their coping mechanism before and after the resettlement;
c) To assess the impact of relocation on pastoralists knowledge, attitudes and perceptions on common herds management approaches

1.4 Research questions

This study aimed at answering the questions below;

a) How does displacement and relocation affect livestock populations and the performance of the resettled persons of RAPland village?
b) Is RAPland village suitable and sufficiently endowed to support and sustain extensive pastoralism?
c) How have pastoralists' knowledge, attitudes, and perceptions on herds management approaches been transformed by the resettlement?

1.5 Justification of the study

As the human population is on the rise globally, there is a significant reduction on the available land because of competition among various projects such as real estates, crop farming, roads, conservancy, energy-driven projects like geothermal and the dams, among

others. In as much as these projects are endeavoured and perceived to be developmental projects, and as often justified by the concern authorities as being of national interest and useful for all, they affect the displaced persons and communities in several ways. Some of the effects are loss of both communal and individual lands, disruption of livelihood means, disruption of social networks and kinships ties, and cultural and economic erosion even where there are resettlement action plans (RAPs) in place to resettle the project affected persons (PAPs).

Failures to adequately address the aftermath of resettlement constitute a significant problem, especially among the people that entirely depend on vast extensive land like the pastoralists for the productivity of their herds. Large development projects are being implemented, and so will the displacement and disruption of peoples' livelihoods. An understanding of the consequences of such developments on pastoral households would be useful in the planning of future developments. This case study has outlined the critical impacts of resettlements of Maasai pastoralists, on the performance of their livestock productivity.

1.6 Scope of research

The research sought to evaluate the impact of involuntary resettlement on livestock production and performance among the Maasai pastoralists of the RAPland village, Olkaria in Naivasha. Data collection took place between the month of May and June 2019. Data analysis and writing of this report later followed.

1.7 Limitations of the study

RAPland village is remote and with minimal transportation means. It also has bad terrains, limiting access, thus prolonged data collection. Because of researches and assessments conducted in the area, some residents were reluctant, uncooperative to participate in the survey with some demanding for immediate benefits.

CHAPTER TWO: LITERATURE REVIEW

2.1 Pastoralism in the World

Pastoralism is a subsistence food production system of grazing herbivores on extensive rangelands (Blench, 2001), for purposes of providing food (milk, meat, blood); raw material (hides, skins, hair, wool); income; and social uses (communal ceremonies, religion). Pastoralism occupy 25% of world landmass and is commonly practised under extensive marginal rangeland where other forms of agriculture like rain-fed crop cultivation are less likely to succeed due to low and unpredictable rainfall pattern, low precipitation and extreme temperatures (Dong *et al*., 2016; Haan *et al*., Jenet *et al*., 2016; Struelens *et al*., 2017). It is characterised with flexibility, adaptability, herds' diversification, and herds' mobility (FAO, 2016; Struelens *et al*., 2017). Using herds mobility to classify pastoralism, nomadic - varying seasonal migratory routes in such water and pastures; transhumant - involves cyclical migration pattern; agro-pastoralism - herding livestock with the crops in a settlement; enclosed ranching pastoralism are recognized (Msuya, 2015; Dong *et al*., 2016; Tamou, 2017). Pastoralism goes far than just keeping livestock. It is a way of life, a culture, and an identity (Jenet *et al*., 2016

2.2 Pastoral Species, Comparative value, and Productivity

The common livestock species within most pastoral systems include cattle, camel, sheep, goats, donkeys, yaks, llamas, and reindeer (FAO, 2000; Msuya, 2015). Species distribution among pastoral groups varies widely with customs, climates, environment, pastures, and water availability as well as other natural resources (Dong *et al.,* 2016). Most African pastoral communities' herds comprise of mainly the cattle, camelids, sheep, goats for food and donkey and horses for draught power (transportation, ploughing) (FAO, 2000). The growth of the herds is an essential aspect of the pastoral household, as meeting household

food security depends on the size of herds. Besides, numbers are buffers against droughts, diseases, and other shocks and stresses. Pastoral herds' productivity directly relates to immediate and measurable benefits that include milk products, offspring produced, and offtakes (Catley *et al*., 2013).

2.3 Land use under pastoralism and competition due to alternative land uses

Pastoral rangelands are common resources/fuzzy land with no clear demarcations; thus, individuals or groups have equal rights of accessing, managing, controlling, and decision-making (Jonckheere *et al*., 2017). Pastoral communities require sufficient rangeland for grazing their vast livestock herds, as most of these rangelands have low pasture productivity (Kimiti *et al*., 2018). Reduction in pastoral rangelands has been on the rise due to poor land policies that encouraged settled pastoralism (sedentary and agro-pastoral pastoralism), human population pressure, expansions of agricultural projects and conservation projects (Muriuki *et al*., 2005; Sulieman *et al*., 2012; Basupi *et al*., 2017; Kimiti *et al*., 2018). For instance, in East Africa, pastoralists have lost 8%, 28%, and 21% of their land to wildlife conservation projects in Kenya, Tanzania, and Uganda, respectively (Boyd *et al*., 1999).

2.4 Settlement arrangements under pastoralism

2.4.1 Household arrangements

Among most pastoral communities globally, the clan is the basic unit where pastoral groups are assembled. A clan could comprise of several sub-clans. Households are related patrilineal to common ancestry. However, the Tuareg pastoralists-habitants of Sahara to West Africa have been reported to practice matrilineal lineage while groups like the Saami, the Chukchi, and the Koryak that have no marked genealogies (FAO, 2001). These clans/households vary in numbers as others could have many while others have few. In the

Horn of African and among most pastoral groups, notably the Maasai of Kenya and Tanzania and the Boran of Ethiopia, practised the age-set system where members born within a set time frame are described as a generation (FAO, 2001).

2.4.2 Villages

Related families found patrilineal units, which always vary in sizes and numbers influenced by ecological sustainability (pastures and water) and security. Generally, the average number of persons constituting a village has been reported between 50-200 persons. Maasai pastoral group live in villages, made up of several families, as a security strategy and as a way to complement individuals' skill for the wellbeing of the village and community at large.

2.4.3 Grazing range and reach

As rangelands constitute nearly half of Africa landmass, the most notable economic activity practised within these rangelands includes extensive pastoralism and conservation of wild. Kimiti *et al*. (2018) reported that pastoralism occupied about 70%, 50%, and 40% of Kenya, Tanzania, and Uganda, respectively. Pastoralism has been thriving well within the rangelands because of herds' mobility in search of better pastures and watering points. The quality and quantity of vegetative cover within East African rangelands are highly dependent on rainfall. This has always led to variations in pastures quality and their location (Brottem *et al*., 2014).

Research on East Africa Maasai pastoralists show that they cover an average distance of four and eight kilometres to access water but vary between wet and dry seasons and cover distance of nine kilometres during the dry season to obtain forages, and could reduce to two kilometres during wet seasons. Development of watering points and sources reduces the

distances covered by herds besides accelerating the resettlement in areas that were not occupied before (Wooden, 2007).

2.4.4 Land ownership

Most pastoral lands are communally owned, however, some few resources found on the rangelands are individually owned including a piece of land, trees and watering points of which overall community principles of sharing and reciprocating are adhered to, thus ensuring that everyone has access to all resources within the communal territory including those resources controlled and managed by other households. However, there are few cases among the American ranchers and the Australian sheep producers who controlled large track of lands as a risk management tool (FAO, 2016). Because of the high mobility nature of pastoral communities, they utilized various areas at different times, and pastoralists have claimed over rangelands that are located at far distances (FAO, 2016).

2.5 Measuring performance and productivity under a pastoral system

Pastoral livestock management depends and characterized by an adaptation environment for survivability herds and herders against drought, diseases, or pastures scarcity. Other adaptive practices are keeping of multi-species with varying levels of hardiness, splitting of herds into various classes, institutional adaptation like regulating communal grazing such that certain grazing fields are used during that specific time with rest preserved for future use (Sangeda and Maleko, 2018). Pastoral livestock performance and productivity are based on the number of indicators such as livestock offtake rates, (livestock sales), mortality rates, age at first calving, parturition rate, prolificacy, milk yield in each lactation, lactation length, and the growth rate (Bekure *et al.*, 1991; FAO, 2002; Majekodunmi *et al.*, 2014).

2.6 Valuation of pastoral production systems

Extensive livestock grazing is efficient in utilizing rangelands characterized by low, erratic rainfall, severe evapotranspiration, and rarely supportive of any other agricultural activity, especially crop-oriented production. Pastoralists adapt by being mobile, thus protecting their herds against drought, diseases, and insecurity (Sangeda and Maleko, 2018). Most pastoral studies that aim at determining and establishing the economics of agricultural system uses methods which focus mainly on productivity and commercial while ignoring non-monetary products and services (Davies *et al*., 2013). Pastoral systems produced a range of products and services that include food (milk, meat, blood), manure, draught power (transport, ploughing), food storage, capital reserves besides safeguarding against calamities of drought, flooding, diseases, and inflation (Niamir-Fuller, 1999; Nyariki, 2004; Davies *et al*., 2013). Pastoralism also provides indirect benefits to other sectors that include inputs to agricultural, tourism, and environmental sectors. Within the region of Sub-Saharan, most countries' policies have geared toward increasing meat and livestock offtake despite the significance of milk in the economy of most pastoral production systems (Davies *et al*., 2013). Nyariki (2004), Davies *et al*. (2013) reported that Kenya's pastoral economy milk contribution double that of meat and direct livestock sales while in the Afar region of Ethiopia, the production is four times. In Ethiopia, Kenya, and Uganda, 19%, 13%, and 8% of GDP, respectively, is from pastoralism (MacGregor and Hesse, 2013; Nyariki, 2017). In terms of agricultural GDP, 50%, 30%, 19% for Kenya, Tanzania, and Uganda, respectively was from pastoralism during the year 2004 (Nyariki, 2004). Among the developing countries, about 30% of agricultural gross domestic comes from livestock and is projected to increase to about 40% by the year 2030 (Ahmed., 2019).

2.7 Large Development Projects

2.7.1 Types and nature of large development projects

Large-scale development projects require large tracts of land and have always led to the displacement of inhabitants of those areas. These displacements could be physical or disruption of economic activities, especially livelihood ones (Vanclay, 2017). Some of the developmental projects that require considerable land include dams, airports, mines, estates, conservation, agricultural projects, forestry, and geothermal development, roads, bridges, railway, pipelines and transmission lines (Bartolome *et al*., 2000; Coa *et al*., 2012; Vanclay, 2017). In the last four decades, India for instance, displaced about 15.5 million people through dams, mining, urban sites, and thermal plants, while China displaced over 10 million through dam's construction in the previous three decades and more than 100,000 were displaced in both Egypt and Sudan during the development of the Aswan dam (Lidahuli, 2015).

Developmental projects have varying impacts on those they displaced. These impacts could include social effects that could be both negative and positive (Mathur, 2011). Most involuntary resettlements have recorded many negative implications in the form of physical displacement, loss of physical assets like land, loss of livelihood means and income sources (Mathur, 2011; World Bank, 2014). As sustainable energy is an essential requirement for macroeconomic development and growth for most countries, the drive for geothermal energy is on increase of late. In the year 2008, the total geothermal energy produced globally was only 0.1% of the global energy supply, which is estimated to account for 5% of aggregate global energy demand by the year 2050 (Shortall *et al*., 2015). However, in as much it's being regarded as a sustainable energy source, its construction and development have been implicated as multi-dimensional sustainability grounds (Shortall *et al*., 2015).

2.7.2 Demand on land

During the last twenty years, about 300 million people have been displaced (Abbink *et al*., 2014). Land being a leading factor in production is limited in most places and countries due to competing uses such as food production, settlements, production of raw material and bioenergy, tourism and recreational activities, transportation projects as well as conservation initiatives (Rösch *et al*., 2010; Gashu *et al*., 2018). Land availability is crucial for meeting human being needs that include energy generation, housing, transportation, food production, and the establishment of industries (Gashu *et al*., 2018).

With increasing human global population, over 50% of such population live in urban centre and is expected to reach 66% by the year 2050, this called for the provision of urban-related services which should include housing, energy, roads among others especially in Asia and Africa where 90% of such population is expected to be based (Zhang *et al*., 2013; UN, 2014). Such an increase in human populations and the expansion of urban centres are anticipated to take over more productive lands and ecosystems (Gashu *et al*., 2018). Land usage being a territorial surface modification by human activities has an impact on various ecosystems, notably on water, climate, soil, and the quality of air and the available land for pastoral activities (Lu *et al*., 2004; Muriuki *et al*., 2011). Ayele *et al*. (2012) reported that livestock is supporting a population of 1 billion people globally through food and nutritional security, employment, income besides its enormous contribution to Gross Domestic Product, thus a vital sub-sector in fighting and alleviating poverty among the resource-poor pastoralists and pastoralist-dependent industries.

FAO, (2012) stated that eradication of hunger and alleviation of poverty as well the sustainable use of the environment is vested on people, communities' access and control of the land, as well as the fisheries and forest resources. Any project that competes for the land with the rural poor/ livestock keepers poses a threat to livestock production through reduced

grazing area and interference with social, cultural, and religious practices as land is a crucial factor for economic growth and sustenance (FAO, 2012).

2.7.3 Contribution to national and local communities

Most developmental projects have negative and positive attributes. The level and benefits are dependent on the type of projects being implemented (Cao *et al*., 2012). Developmental projects benefit people or countries differently based on the nature of the project. Some of these benefits include increased access to clean energy, improved food security, enhance access to drinking water, providing water for other industries, development of infrastructures, building education, and health facilities (Shortall *et al*., 2017; Nguyen *et al*., 2017). Developmental projects thus improve living standards and alleviate poverty among those beneficiaries. Energy-related developmental projects like geothermal and hydroelectric are essential to the national economies as well as the individual in that they provide electricity that drives the growth of many sectors (Komurcu *et al*., 2009).

2.8 Displacement of communities by large projects

2.8.1 The need for displacement

With the increasing human population, there is a need to provide services and if possible, in a sustainable way, thus the cause for such movements globally through dams, geothermal, major roads, railway, mining, and agricultural projects (Cao *et al*., 2012; Vanclay, 2017). Energy is recognized as one of the leading and essential factors for economic growth and development that drive prosperity for most human basic needs (Shorfall *et al*., 2015). Fridleifsso (2001) reported that the global energy consumption is estimated at 400 Exajoules (EJ) in a year, with about 80% coming from fossil sources while the remaining 14% from other sources including hydro, geothermal, wind, nuclear, and traditional biomass.

According to World Energy Council, energy consumption is anticipated to shut up by 50 - 75% by the year 2050, with renewable sources estimated to for 20 - 40% of the primary energy by that year (Fridleifsso, 2001). Production of geothermal energy and generating electricity has been in use since 1913 (Fridleifsso, 2001; Lund *et al*., 2016). According to Fridleifsso (2001) and Lund *et al.* (2016), there is a remarkably increased in utilization and as well as the discovery of more geothermal potential area in the last thirty years. Thus, a record of over 80 countries with potential and 58 reported be harnessing it. As energy is driven from both renewable and non-renewable sources, there have been shortcomings with non-renewable sources that related to costs and their environmental implications. Global attention has been focussed on sources that are sustainable and have minimal direct effects on the environment. Such sources include energy from geothermal, hydropower, ocean, solar, wind, and biomass, among others (Komurcu *et al*., 2008; Gorjian, 2017).

World human population has been expanding, as shown by South America and Sub-Saharan Africa, with the highest growth rates and urbanization, thus the need for services and resources (Ginkel *et al*., 2001). Such current fold of events posts new challenges on environmental, social, and economic issues which can only be achieved by planning in some sustainable ways like the need to have more energy whose supply is guaranteed and affordable to most people as the energy demand for most developing will be enormous by the year 2050 (Ginkel *et al*., 2001; Fridleifsso, 2001).

2.8.2 Resettlement and compensation

Involuntary resettlement is defined as economic and physical displacements that lead to shelter loss, relocation, assets loss, or disrupting asset accessibility causing loss of livelihoods (GoK, 2007). Xiao *et al* (2018), through analysis of Impoverishment Risks and Reconstruction model (IRR), eight impoverishment indicators due to resettlement that

included food insecurity, loss of homes, land, jobs, and collective property accessibility as well as underdevelopment, accelerated morbidity and mortality, and kinship disconnections are identify. The compensation varies with the agreement reached between the project developer and those to be affected by the project (PAPs). However, the commonly applied benefit is land-for-land (World Bank, 2012; Vanclay, 2017).

Pastoral displacement and resettlement effects on PAPs include loss of land, houses, sources of income, and livelihoods, exceptionally when resettlement action plan (RAP) is poorly planned and executed. However, when well-planned and implemented, RAPs can improve people life (World Bank, 2012). RAP could be chaotic and achieve less, mainly when the process is not inclusive and does not involve the active participation of PAPs and negotiation (World Bank, 2012). Although the relocatees can benefit in terms of materials that could improve their living standard, besides social impacts, relocation causes social impact and emotional pains among the PAPs (Vanclay, 2017). Relocation processes are complicated and complex due to their multi-factor, multi-scalar, multidimensional, multi-actor, and multilevel in nature, necessitating in-depth assessments, planning, and implementation (FAO, 2012; Vanclay, 2017).

2.8.3 Evaluation of traditional communal livestock livelihood and cultural activities

Livestock has an essential role among the pastoral communities for food, nutrition, income generation, asset savings, enhancement of soil fertility (organic manure), provision of draught power (cultivation and transportation) among others (Moyo *et al*., 2010; Varela *et al.,* 2015). Maburutse *et al.* (2012) and Munyai (2012), stated that livestock productivity among the communal production system is low in the tropics due to a host of factors including insufficiency of pastures in dry seasons, overgrazing, inadequate rainfall causing/seasonality of fields, poor soil fertility, low-quality feed leading to poorly

performing animals. Stocking rates among most communal grazing systems are always extremely high, resulting in degradation of rangelands which only support few stocks thus reducing the carrying capacity, lower efficiency and poor herd performance like lower weaning percentage, late maturity, susceptibility to diseases (Munyai, 2012; Muburutse *et al*., 2012).

2.8.4 Replication of traditional communal livestock livelihood and cultural activities

Most of the East African landmass (Sudan, Ethiopia, Kenya, Uganda Djibouti, and Somalia) are regarded as arid and semi-arid land (ASALs), ranging from 60-100% in each country. Such an area is ideally suitable for pastoralism as climatic conditions are unpredictable, rainfall is unreliable and temporal, and resources are patchy (pastures and water) (FAO, 2008). As a way of securing fields and watering points, avoiding risks associated with diseases, raiding, and conflict over natural resources and access to the market, pastoralists tend to occupy extensive rangeland (Skinner, 2010). Establishing a suitable pastoral system that matches pastoralist livelihoods lies in meeting the basic features of suitable pastureland that allows for mobility and flexibility among the pastoral communities.

2.8.5 Replication of pastoral lifestyle

Pastoralists'' lifestyle revolves around their herds, and accessing sufficient rangeland is necessary to support their herds stock. However, in most parts of the world, herders are challenged by hosts of problems that undermined extensive pastoral systems production, these include encroachment of grazing land by sedentary farming/expansion of cropland and wildlife conservancies as noted by Reid et al., (2004). As example, The Maasai pastoralists lost grazingland to conservation projects during establishments of Maasai Mara and Samburu National Parks in Kenya and Serengeti in Tanzania. Other challenges are

disruptions of water sources for the livestock, the imposition of restrictions on the movements at international borders, denial of traditional and communal land ownership and lack of investment in pastoral areas.

2.9 Resettlement support for livestock-based livelihoods

2.9.1 Estimation of land needs

Kurniati *et al* (2013) on the resettlement of the people affected by dam construction in Indonesia stated that the deal placed for the relocation of PAPs has both economic (livelihoods) and environmental impacts. World Bank (2012), on its resettlement standards, recommended that PAPs whose livelihoods are land-based should be resettled in the land that has productive potential, locationality advantages, as well as other factors which give the current land better status than the previous one or equivalent value. While PAPs whose livelihoods are natural resource-based should be allowed to have continued free access if not restricted by the project, health and operation requirements or alternative resources are provided to that effect. Grazing is practised on more than half of the world landmass 34.8 million KM^2 or (26%) as grassland (grasslands, shrublands, and Savannah), having access to suitable rangeland (pastures, salt licks, and watering points) throughout the year important factor when resettling pastoralists. Such rangelands should allow for mobility, communal ownership, diverse species (cattle, camels, sheep, goats, and donkey among East African pastoralists), and colossal herd numbers are typical features of herders under extensive production (FAO, 2006; Yonas *et al*., 2013). With most pastoral activities being carried out in marginal areas where moisture or temperature is limited, feed availability and quality thus become the most limiting factor to livestock production (Chand *et al*., 2015). The carrying capacity - the maximum possible number of grazing animals' rangeland can support, depends mainly on the quality and amount of pasture available, which are

determined by land size, precipitation receives soil fertility as well as the health of the rangeland (Mulindwa *et la.,* 2009). Grazing/stocking rate is based on an estimate of daily dry matter requirement of 2.5%- 3.0 of animal body weight (FAO, 2005; Dida, 2017).

According to Dida (2017), grazing capacity on rangeland within the tropics is determined through two methods; Tropical Animal Unit Month (TAUM) where all livestock are converted to the same unit of Tropical Livestock Unit (TLU) that represent feed requirement of 250 kg animal (Mulindwa *et al*., 2009). The other method is Average Animal Weight (AAW), which uses one conversion factor, metabolic rate requirements of a cow with calf (Dida *et al*., 2017). With water as the most limiting factor within most pastoral rangelands, resettling pastoralists in an area with adequate rainfall can enormously increase the productivity of livestock, and as such, the rain has always had a severe effect on rangeland productivity and subsequentially on the carrying capacity (Mulindwa *et al*., 2009; Cheng *et al*., 2017). However, various agro-ecological zones have a varying carrying capacity, with the highlands estimated at carrying capacity of up to 40 TLU per km^2, then the sub-humid and semi-arid areas (Pica-Ciamarra *et al*., 2007). Furthermore, to meet the yearly forage requirement for the pastoral herds, the grazing land should be abundant in or in to sustain productivity and avoid overgrazing. When planning resettlement for pastoral communities, carrying capacity should be varied as pastures vary yearly due to rainfall variations (Mulindwa *et al*., 2009).

2.9.2 Recreating the grazing range and reach

Pastoralism is both economically viable and friendly to the environment, but its development is undermined by the most current political, social, and economic policies marginalizing pastoralists (Davies *et al.,* 2013). The quality of land being considered for pastoral livestock production is the most crucial aspect, and factor as this varies among

various agro-ecological zones and with moisture as a limiting factor is most semi-arid and arid rangelands (Pica-Ciamarra *et al*., 2007). Sandhage-Hofmann (2016) stated that the best way of determining the appropriate pastures is through the use of carrying capacity/stocking rate as this affect the overall productivity of the rangelands, herd composition, individual performance, and rangeland degradation through soil erosion and compaction due to the insufficiency of forage and precipitation in most pastures. Appropriate stocking rate among communal land should consider social parameters like prevalent norms, current perceptions, and historical context; thus, the stocking rate should be adaptable and flexible. Forage requirement for livestock depends on size, age, species, and physiological condition like pregnancy, lactating, or being dry.

Sustainability of rangeland is paramount; degradation of rangelands has been blamed on pastoralist mismanagement coupled with the 'tragedy of the commons.' Concerning pastoral characteristics such as mobility, varying herd composition and structures, large herds and communal land tenure system, and pastoral requirement of rangeland that is capable of providing palatable forages and water resources, these are the most important factors when considering resettlement (Adriansen, 1997).

2.9.3 Effects of compensation on healthy livestock-based activities

Developmental projects, as well as any other business that limits pastoralists movements, include the advancement of agricultural production into pastoral lands, states sponsored boundaries and administrative favouritism of policies targeting pastoralists. As Vanclay (2017) observed that of factors facing resettlement action plans is lack of quality land for resettling in people as highly populated areas lack unutilized property and trying to relocate the displaced populace would cause more displacements while the vacant lands require in most cases the agronomic quality, water, far from markets and lack most public services.

Nguyen *et al*. (2017) observed that the number of people engaged in animal husbandry reduced by 38% after relocation during dam construction in Vietnam.

Land for land compensation is the most ideal for the most pastoral system. For such area to fully support pastoralism, it should allow for mobility, adaptability, secure tenure and exploration for alternative grazing and watering (Inter-Réseaux Development, 2012). Nyariki *et al*. (2009) observed that changes in land used have within the ASALs from nomadic pastoralism to sedentary, agro-pastoralism or pure crop cultivation, this has adversely affected the performance of rangelands and the overall livestock productivity and performance. Resettlement of pastoralists in southern Ethiopia changed the land use as land under crop cultivation increased, thus affecting the available area for grazing and livestock (Yonas *et al*., 2013).

2.10. Knowledge Gaps and Research Needs

World Bank guiding principle on involuntary displacement and resettlement is that involuntary displacement of populations should be avoided or minimised. If there is no alternative, then the resettlement process should be adequately planned, executed, and monitored such that evictees are both physically and economically fully settled (World Bank, 2016). Based on the literature review, the following knowledge gaps have been identified

a) Resettlement action plans (RAPs) are informed by inadequate knowledge to anticipate planning implementation and monitoring needs. Also, most RAPs are scheduled as a one-time event such as no continuous reinvestment on the resettled people's livelihoods, thus causing an impoverishment of the involuntary resettled individuals.
b) Equally serious, modifications of lifestyle and livelihood requirements needed in the newly resettled areas are difficult to predict in light of the above, the consequences of such ill-informed and advised resettlement on livestock performance have never been studied.

CHAPTER THREE

IMPACT OF INVOLUNTARY RESETTLEMENT ON LIVESTOCK PRODUCTION AND PERFORMANCE AMONG THE MAASAI PASTORALISTS OF RAPLAND VILLAGE, OLKARIA KENYA

ABSTRACT

With the drive for clean and sufficient energy to boost the general economy of the country, Kenya Electricity Generating Company (KenGen) displaced 155 Maasai pastoral households in the year 2014 and relocated them new area- RAPland village. The study aimed at assessing the impact of relocation on livestock population, cattle herds' composition, and performance. A questionnaires were administered to 105 household heads. Data were collected on livestock populations, cattle proportions, and performance (age at first calving, calving interval, lactation length, milk yields) before and after the resettlement. Data were summarised using excel and analysed with statistical packages for social scientists (SPSS) to obtained means and average. The results indicated that livestock populations were significantly (P<0.05) affected by the relocation. The mean population in TLU reduced from 75.74 ±8.83, 15.49 ±1.78, 5.83±0.67, 1.46 ±0.22 and 0.14 ±0.02 before resettlement to 26.37 ±8.3, 4.62 ±1.7, 2.5 ±0.63, 0.34 ±0.21 and 0.3 ±0.02 after relocation for cattle, sheep, goats, donkeys, and poultry, respectively. Cows and youngstock proportions were also significantly (P<0.05) reduced from 44.62 ±7.17 and 23.55 ±3.99 to 17.87 ±3.66 and 5.83 ±0.83 before and after the resettlement, respectively. Besides, milk yield was also significantly (P<0.05) affected by the resettlement as it decreased from a mean of 3.8 ±0.19 to 2.38 ±0.19 litres. In conclusion, relocation reduced livestock populations and milk yields.

KEYWORDS: Pastoralism, Involuntary displacement, project-affected persons, livestock/herds, RAPland village

3.1 Introduction

Pastoralism is a natural-resource oriented management accustomed to marginal ecosystems that are unsuitable for other intensive agricultural productions due to water, soil, and climatic condition limitations (Nori, 2019). Extensive pastoralism occurred on 25% of the Earth's landmass and is practised in over 100 countries (Dong *et al.*, 2016). There are about a billion pastoral herds that include cattle, camelids, sheep, and goats mainly, contributing 10% of global meat production. Pastoralism is a mainstay for over 200 million pastoral households (FAO, 2001; Dong *et al*., 2016). In Africa, it's practised on 43% of the landmass, mainly in the dryland areas and supporting about 268 million people (AU, 2010; FAO, 2018). With 56% of Sub-Saharan Africa under ASALs (Burian *et al.,* 2019), pastoralism remains the only viable food production system in such areas. Among the East Africa countries of Kenya, Tanzania, Uganda, pastoral systems occupied 70%, 50%, 40% of the landmass, respectively (Kimiti *et al.,* 2018) and 40% in Ethiopia (Elias, 2008). Pastoralism provides animal-based protein (milk, meat, blood), raw materials (hides, skins, fibre, mohair), draught power (transportation, farming), transaction means (exchange, loans, income gift), savings, insurance and investment (FAO, 2018; Nori, 2019). Based on their degree of involvement in agricultural production, pastoralism is of two types, namely the pure pastoralism (maintain only livestock herds) and the agro-pastoralism (livestock rearing with crops cultivation) (Kabote *et al*., 2012). By using mobility to codify them, there is nomadic pastoralism -moving on irregular routes with herds in search of pastures and water points, transhumant pastoralism - moving through regular routes and times in search of grazing fields and the sedentary pastoralism that is practised around settlements/villages (Kabote *et al*., 2012). Pastoral communities keep mixed-species herds, which are, in most cases, divided into separate grazing units depending on labour availability and animal's needs. Rearing mixed-species is essential in the utilization of different plants available in

the rangelands, production of comprehensive products and service, and maintenance of sufficient milk production (Nkedianye *et al*., 2011; Homewood, 2018). Mixed-species herds of considerable sizes to enhance survivable during natural catastrophes such as droughts and diseases as the risks are spread (Nkedianye *et al*., 2011). Small ruminants (sheep, goats) are used at times of immediate family needs like for food, school fee, or hospital bills, while larger ones (cattle, camels) are stored wealth (Homewood, 2018). Besides keeping mixed-species, most pastoral species are local breeds, adapted to local conditions of droughts and diseases due to exposure.

Globally, pastoralism faced myriad of challenges emanating from land fragmentations, rangeland encroachments, changes in land use, population growth, climate change, livestock diseases, and discriminate land policies that impact negatively on the rangeland (FAO, 2007; Mwanyumba, 2014). In this regard, the discussion focused on how pastoralists lose their land or access to grazing areas they have been accustomed to as a result of evictions. Displacement According to Lepcha, (2018), fall into three categories that include, natural disasters related (droughts, floods, earthquakes, cyclone), conflicts related (where people fled their homes), and developmental projects related such as thermal power plants, dams, industries, mines, roads, airports, and railways (Vanclay, 2017; Lepcha, 2018). For this readership, the discussions are narrowed to the development-induced displacement and resettlement arising from the developmental projects. According to Terminski (2014) and Abbink *et al*. (2014), globally and annually, developmental projects displace 10 to 15 million people. Involuntary displacement could be physical or economical or both (Ayele, 2014) that is, removes people from their original areas, or limits them in accessing and using specific resources. Presently, involuntary displacement has been acknowledged as the most critical forced migration (Ayele, 2014). Among the risks and impoverishment affected people faced are landlessness, joblessness, marginalization, food insecurity, increased

morbidity, loss of shared resources, and loss of community social-cultural resilience. However, loss of livelihood and disruption of agriculture have been reported as being the higher risks effect of resettlement (Lepcha, 2018). These effects have not been exhaustingly discussed, and thus planning for displacement is challenged by inadequate information on its probable consequences. Using the case of Olkaria Geothermal developments, this study set out to assess the impacts of involuntary resettlement on livestock production among the Maasai pastoralists in Kenya.

3.2 Materials and methods

3.2.1 Location and description of the study area

The study was undertaken in the RAPland village - a newly created resettlement area by KenGen to accommodate geothermal project evictees, and located within the Greater Olkaria Area. It's located south of Lake Naivasha, adjacent to Hell's Gate National Park, and at 120 km northwest of Nairobi. Administratively, RAPland village is in Longonot ward, Naivasha Sub-county, Nakuru County (Axelsson *et al.,* 2013). According to Wamalwa, (2017), the Olkaria area generally falls under Agro-ecological zone V or semi-arid climate and thus receiving 634 mm rainfall annually in a bimodal pattern: long rains in March-May and short ones in October-November. The elevation of Naivasha sub-county is 1,829 m above sea level with minimum and maximum daily temperatures of 11.4^0C - 16.6^0C and 25.4^0C - 35.5^0C, respectively, with an average temperature of 18.4^0C for the area with July and February as the coldest and hottest months respectively (Wamalwa, 2017). The commonly identified soil types around the Olkaria area are lacustrine (lake sediments), and volcanic originated from quaternary deposits.

Study Area

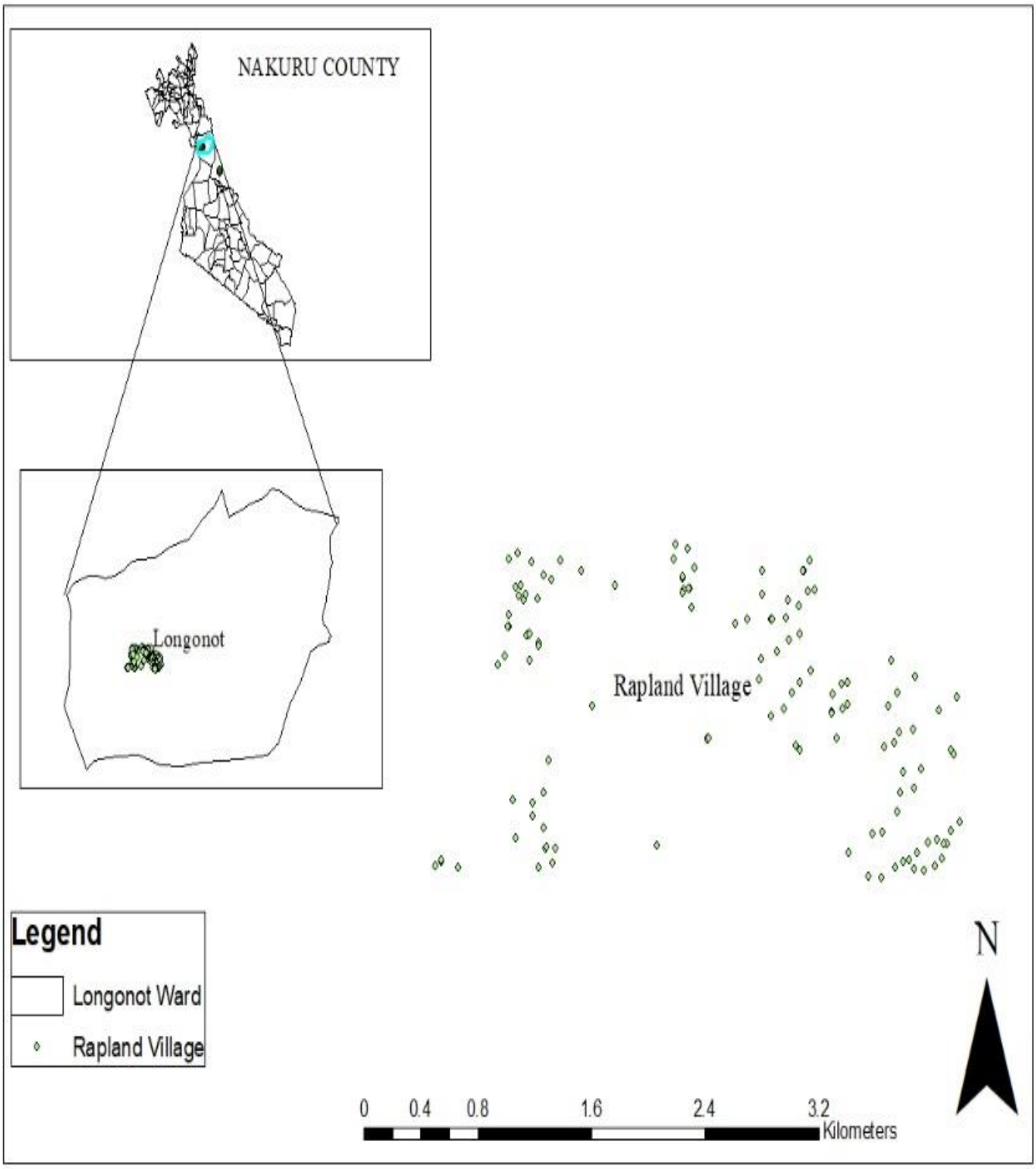

Figure 3.1: Map of RAPland village: The map was extracted using coordinates collected during the survey.

3.3 Research methods /approaches

The research was carried between May and June 2019. Data were collected among the inhabitants of RAPland village. The study a census in nature, as it aimed at interviewing the displaced and resettled 155 Maasai pastoralists in the RAPland village; however, only 105 households were willing, owned livestock and participated in the survey. A pretested and structured-household questionnaire (appendix 1) was administered to the selected respondents/household heads. The questionnaire contains data on livestock owned, cattle proportions that include bulls, cows, youngstock, and cattle production in terms of age at first calving, calving interval, lactation length, and milk yield before and after the resettlement.

3.4 Data Analysis

The quantitative data collected through the use of a household questionnaire were checked for inconsistency, organised, and summarised using Microsoft Excel 2019. The summarised data were later then imported into the Statistical Package for Social Scientist (SPSS, version 21). Inferential statistics that include tables, means, averages, as well as the ANOVA for the populations and performance were obtained (appendix II). The analysed data demonstrated trends and suggested associations between variables.

3.6 Results and discussion

3.6.1 Demographic characteristic of interviewed household heads

Of the 105 household heads interviewed, 31%, 26%, 22%, and 21% originated from the Cultural Centre, OlooNongot, OlooManyana Ndogo, and OlooSinyat villages, respectively. To maintain social links and relations, the resettled households were put together in the same area. Pastoral communities value family life a lot and this is manifested through

responses on marital status where most respondents (86.7%) were married, with only 13.3% as unmarried. A viable pastoral household should have a husband- who owns and decides on livestock matters, wife to do the milking and children who performed numerous functions including grazing livestock (Mgongo *et al*., 2014). Women constituted a higher percentage of the household heads surveyed at 68%, while men were 32%. This doesn't mean that women were responsible to for most decisions pertaining livestock as Maasai just like most pastoral communities are patrilineal, thus led by men (Blench, 2001; Otte and Chilonda, 2002). At times of this study, most men in the RAPland village were engaged in regular employment activities at the geothermal production sites e. g. with security companies, among others, this was later revealed by discussants of the focus group discussion (FGD). Although the majority of the interviewed individuals were women, they have minimal control and access over primary pastoral resources that include the livestock and the land as their roles and ownership are defined by men (Maeda-Machangu *et al*., 2000; Ngowi *et al*., 2008; Tadesse *et al*., 2015). However, both men and women play essential roles in pastoral production systems. Most of the household heads surveyed fall within the youth age category, that 18 – 45 years, and formed 72%, while those above 45 years constituted the remaining 28%. Being youth means they are able and physically fit to handle and provide a require labour for pastoral livestock production. This also signified that labour division, allocation of functions, and roles among pastoralists is based on age (Blench, 200).

The majority of the household heads had never been to school, as 54% couldn't read and write. Those who have attained primary, secondary, and tertiary education represented 19%, 22%, and 5%, respectively. The high illiteracy level is a characteristic of the most pastoral communities. According to Elhadi *et al*. (2012), the education level attained by the household's head influences decision making, income, access to information, and livelihood

security for the household. While in old villages (Manyattas), most households at 77% relied on hired labour with 23% using family labour. In RAPland village, the situation didn't change as 75.2%, and 24.8% of households used hired and family labour, respectively. The summary of the demographic characteristic of household heads interviewed is presented in Table 3.1.

Table 3.1: Demographic characteristics of interviewed household heads

Main Variables	Categories	Frequency	Percentage
Gender	Male	34	32
	Female	71	68
	Total	105	100
Marital Status	Married	91	86.6
	Unmarried	14	13.4
	Total	105	100
Village	OlooMayana Ndogo	23	22
	OlooNongot	27	26
	OlooSinyat	22	21
	Cultural Centre	33	31
	Total	105	100
Age Group	18-30	50	47
	31-45	27	25
	46-60	19	19
	Above 60	9	9
	Total	105	100
Educational Level	No Formal Education	57	54
	Primary Education	20	19
	Secondary Education	23	22
	Tertiary Education	5	5
	Total	105	100
Labour Source			
Before Resettlement	Family	24	23
	Hire	80	77
	Total	104	100
After Resettlement	Family	26	24.8
	Hire	79	75.2
	Total	105	100

3.6.2 Livestock species composition before and after the resettlement

The commonly reared livestock species both before and after the relocation include cattle, sheep, goats, donkeys, and indigenous chicken. Pastoralists keep multi-species as a way of optimising various herbage in rangeland and risk reduction strategy (FAO, 2007). There are more cattle than there are any other species, both before and after the resettlement at 77.2% and 78.9%, respectively (Table 3.2). The high proportion of cattle among the Maasai communities of the RAPland village implies that they are cattle pastoralists, this contrasted other production systems were camels and small ruminants are the preferred species (Blench 2001). Also, it shows the importance of cattle to the livelihoods of resettled pastoral households (Mgongo *et al*., 2014). Daodu *et al.* (2009) observed similar high cattle composition among pastoralists of the Oyo area of Southwest Nigeria. Higher composition of cattle among pastoral herds signified its importance among most pastoral societies for the provision of milk for households (Kaimba *et al.,* 2011). There were more sheep than the goats among the small stock, both before and after the relocation, this could have been due the fact that sheep are easier to manage than the goats, and also being grazers, can be herded together with the cattle (Daodu *et al.*, 2009). Interestingly, goats are less affected by the relocation when compared to other species. Before resettlement, goats were 5.7% of the livestock populations, and this increased to 7.1% in RAPland village. Goats are browsers and are easily adapted to bushy rangeland like that of RAPland village and its surroundings.

Among most rural communities in Africa, donkeys are used as pack animals, especially for transportation during the long walks (Marshall and Weissbrod, 2009). Before the Maasai pastoral communities were resettled into RAPland village, donkeys were primarily used for fetching and transporting water from various collection points around the settlements. After the relocation, water was piped near residential houses. Thus, many people sold or gave

away theirs as they were of less use. This could have contributed to the reduction in donkey' numbers after the resettlement.

Although poultry/indigenous chicken are not regarded as being a pastoral species- as they cannot be grazed together with other species, were included in the survey to assess the community's adoption of such species. The indigenous chicken was the only reared poultry species, as observed during the study, primarily for home consumption. Although being the least kept livestock among the RAPland village pastoral communities, indigenous chicken is gaining popularity, especially among the less mobile women. Thus, the presence of poultry/indigenous chicken could be an indication of change from nomadism to sedentary pastoral production, an observation reported by Daodu *et al.* (2009).

3.6.3 Livestock populations before and after the resettlement

The findings revealed a significant ($P<0.05$) decreased in mean livestock holdings expressed in tropical livestock unit (TLU) after the relocation from 75.74 ±8.83, 15.49 ±1.78, 5.83 ±0.67, 1.46 ±0.22 and 0.14 ±0.02, 26.37 ±8.3, 4.62 ±1.7, 2.5 ±0.63, 0.34 ±0.21 and 0.3 ±0.02 , cattle, sheep, goats, donkeys, and poultry, respectively. While in their old villages (Manyattas) and before being resettled into RAPland village, the total livestock populations were 8383 TLUs; however, this reduced to 3124 TLUs after the resettlement. A similar reduction in livestock populations after the relocation was reported by Koenig and Diarra (1998); Brockington (1999); Elias and Abdi (2010); Tashi and Foggin (2012); Yonas *et al*. (2013); Msigwa *et al.* (2014); Kura *et al*. (2015); and Nguyen *et al*. (2017).

The decrease in livestock populations after the resettlement could be attributed to several factors that include shrinkages in grazing land, unproductive grazing fields, insufficient pastures, water, droughts, and high prevalence of livestock diseases, wildlife predations, and destocking/selling part of the herds among other production challenges.

Livestock populations reduced after relocations among the people of Tibet region (Tashi and Foggin, 2012) and Central Loa (Kura *et al*., 2015) as a result of losing access to productive grazing land and probably due to reduced access to water (Koenig and Diarra, 1998; Elias, 2008; Tilt *et al*., 2008; Elias and Abdi, 2010; Eguavoen and Tesfai, 2011). Summaries of total livestock populations and livestock mean householding before and after the resettlement are given in Table 3.2.

Table 3.2: Livestock species compositions, populations, mean holdings before and after the resettlement.

	Before Resettlement			After Resettlement		
Livestock Species	Population (Number of TLU)	Mean TLU per HH	Proportion % of Total TLU	Population (Number of TLU)	Mean TLU per HH	Proportion % of Total TLU
Cattle	6468	75.74 ±8.83	77.2	2480	26.37 ±8.3	78.9
Sheep	1298	15.49 ±1.78	15.5	412	4.62 ±1.7	13.1
Goats	481	5.83 ±0.67	5.7	222	2.5 ±0.63	7.1
Donkeys	123	1.46 ±0.22	1.4	25	0.34 ±0.21	0.8
Poultry	13	0.14 ±0.02	0.2	3	0.3 ±0.02	0.1
Total	8383		100	3142		100

Tropical Livestock Unit (TLU) is equivalent to an animal of 250 kilograms (Kg). Thus, a Cattle = 1 TLU, Sheep/Goats = 0.1 TLU, donkey = 0.5 TLU and Poultry = 0.01 TLU (FAO, 2002).

HH: Households.

In RAPland settlement area, insufficiency of pastures and water were easily observable; these were partly due to prolonged dry spells, which resulted in pastures and water shortages, occasioning the loss of livestock (Eneyew, 2012; Tegegn *et al.,* 2018). The situation is made worse when livestock have limited alternative grazing fields. Lack of access to veterinary services is highly expected in the pastoral production settings. This could have led to the occurrence of devastating livestock diseases, thus affecting livestock populations and performance. With poor livestock nutrition compelled by pasture and water insufficiency, susceptibility to diseases was highly anticipated among the herds. This could have also contributed to a reduction in livestock populations, a similar situation observed and reported by Koenig and Diarra (1998).

Wildlife predation could have contributed to the decrease in livestock population as the area was near the Hell's Gate National Park. Koenig and Diarra (1998) observed the challenge of wildlife predation among the relocatees of Western Mali. When faced with natural catastrophes like droughts or subjected to resettlement harsh realities (resettlement shortcomings), pastoralists act in various ways/coping strategies to counter and balance the situation. One of these coping strategies is selling part of the herds either to salvage livestock value or to meet the household demands. Some families in RAPland village could have sold part of their herds as a way of overcoming or coping with resettlement challenges, including reduced grazing land. Destocking/selling part of the herds after resettlement has been repeatedly used as a coping strategy for some pastoral households (Koenig and Diarra, 1998; Brockington, 1999; Yonas *et al*., 2013; Lavaei *et al*., 2019).

3.6.4 Cattle herd proportions and performance

3.6.4.1 Cattle herd proportions before and after the resettlement

After the relocation, proportion for youngstock significantly (P<0.05) reduced from 27.6 - 20%. Proportion for bulls didn't changed much, while that of cows increased from 51.7 to 60% after the resettlement. The decreased in youngstock proportion after the relocation could be attributed to livestock constraints encountered in RAPland village, these include a wild predation, livestock diseases, drought, pastures, water insufficiency, and destocking (Tashi and Foggin, 2012; Kura *et al.*, 2014; Lavaei *et al*., 2019). Given their ages, the youngstock became more susceptible to the constraints, resulting in smaller number.

Among most nomadic pastoral communities, herds vary significantly in terms of age and sex (Fre, 2018). Herds splitting/separation is a common practice among most pastoralists. For example, among Beni-Amer pastoralists of Eritrea, cattle are put into milking and non-milking/dry groups that herd separately, with milking ones kept around the settlement. In contrast, the other group is taken to far grazing fields to avoid pastures insufficiency near the village (Fre, 2018). Dry herds consist of mature cows, heifers, older calves, castrated oxen, sterile cows, and selected bulls while milking herd consists of milking cows and young calves. Summarised results for cattle proportions are presented in table 3.3.

Table 3.3: Cattle Proportions in percentage before and after the resettlement

Category	Proportion (%) Before Resettlement	Proportion (%) After Settlement
Bull	20.7	20
Cows	51.7	60
Youngstock	27.6	20

High composition of cows in a herd has been observed and reported by other studies (Roderick *et al*., 1998; Bailey *et al*., 1999; Kibiru, 2007; Daodu *et al*., 2009; Majekodunmi *et al.*, 2014; Mwanyumba *et al*., 2015; Engström, 2016; Dong *et al.*, 2016; Homewood, 2018; Fre, 2018). Homewood (2018) observed that cows represent 60% of cattle herds among most pastoral groups in sub-Saharan Africa. Fre (2018) reported higher cow and youngstock composition among the Beni-Amer and Afar pastoral groups of Eritrea, Sudan, and Ethiopia, respectively.

The higher composition of the cows in the herd compared to other categories is a typical characteristic of pastoral herds, which are oriented to milk production and herd growth. The above findings contrasted highly the animal-traction/draft-oriented cattle herds, where the proportion of male to female would be equal, or the male populations would be more than that of female (Majekodunmi *et al*., 2014). According to Nyariki and Amwata (2019), pastoralists owned over 75% and 90% of cattle herds in Kenya and Tanzania, respectively as well as supplying most of the milk and meat. Pastoral production systems besides providing meat and milk in those countries Among reasons for rearing cattle is the provision of milk for pastoral households, an essential source of nutrition and subsistence. In Kenya, for instance, 1.05 billion litres are produced from pastoral systems annually, with cattle milk contributing 0.473 billion litres equivalent in value to KES 28.5 billion (Nyariki and Amwata, 2019). Reduction in mean cows and young stock proportions implies a decrease in milk production and herd replacement, growth, and continuity, this dramatically influences and destabilises household food and nutrition security thus exacerbating poverty levels among the resettled populations.

3.6.3.2 Cows performance before and after the resettlement

The production of cattle was evaluated through age at first calving, calving interval, lactation length, and milk yield parameters. Milk yields fell from 3.8 ±0.19 to 2.38 ±0.19 with resettlement at (P<0.05). Age at first calving, calving interval, and lactation were found not to have been significantly (P>0.05) affected by the resettlement.

The drop in milk yield could be attributed to insufficient pastures and water experienced after the resettlement, which came as results losing 60% of grazing land to relocation as revealed during FGD and KII. "Since we came to RAPland, our cows are not producing enough milk, one has to milk many cows to get enough milk for our children." Livestock mobility, which allows utilization of varying rangeland resources in time and space, was impaired by the decrease in grazing land. As cattle are poorly fed (due to inadequate pasture), they become more susceptible to diseases, thus affecting their milk yield.

Table 3.4: Cows performance before and after the resettlement

Parameter	Mean Before Resettlement	Mean After Resettlement
Age at first calving in years	4.13 ±0.17	3.88 ±0.16
Calving interval in years	1.52 ±0.11	1.53 ±0.11
Lactation length in months	5.76 ±0.51	7.13 ±0.49
Milk yield in litres	3.80 ±0.19*	2.38 ±0.19*

3.7 Conclusion

a) The resettled pastoralists recorded a significant decline in mean livestock holdings and their proportions, specifically for cattle after the resettlement.

b) There was a reduction in daily milk yields, though lactation length was unaffected by the relocation.

c) The reproductive parameters (age at first calving and calving interval) were not affected by the resettlement.

Recommendation

Reduction in absolute livestock numbers and milk yields reduced the pastoralists' resilience for food security and coping with catastrophes. Therefore, future planning of pastoral community resettlements should address grazing needs and pastoral resilience.

CHAPTER FOUR

NEW HOMES NEW CHALLENGES: THE EXPERIENCE OF RESETTLED MAASAI PASTORALISTS OF RAPLAND VILLAGE, OLKARIA, KENYA

ABSTRACT

Grand development projects sometimes result in the forced relocation of people. RAPland village at Olkaria, Kenya, was created to accommodate 155 households that were relocated by the development of a geothermal electricity generation plant. The study aimed at explaining how relocation constraints resources for extensive pastoralism and how pastoralists cope through adaptation data on land, pasture and water access, livestock production challenges, and the adopted coping strategies were collected though household surveys, key informants interviews, focus group discussions, and field observations. Results showed that pastoralists experienced a 60% reduction in landholdings after the resettlement. There was a general perception that pastures and water availability were significantly ($P<0.05$) affected by the relocation. There was a reduction in absolute livestock numbers, and livestock species mix such that the proportion of cattle went down. In conclusion, reduction in pastures and water access affected livestock productivity, and despite attempts at coping, the community dependence on pastoral livestock was being threatened.

Key Words: relocation, pasture and water access, livestock production and performance, Arid and semi-arid lands.

4.1 Introduction

More than half of world landmass is under grazing in the form of ranching, mix farming, wildlife, or pastoralism systems (Jenet *et al*., 2016). Pastoralism, a livelihoods endeavour that involves grazing of pastoral herds on extensive rangelands, occupied 25% of world landmass. It is characterized by communal land ownership and use, mobile herds locally adapted breeds, and occurs mostly in arid and semi-arid lands (ASALs) (Jenet *et al.*, 2016). Because most ASALs, which account for 41% of the world landmass and hosting 40% of global populations, have few alternative economic activities, they are widely used in rearing livestock (Jenet *et al.*, 2016). In Africa, about 268 million pastoralists are recognised, occupying 43% of the continental landmass with 10 - 44 % Gross Domestic Product (GDP) contribution to national economies within the continent (Mohammed, 2014).

In the East Africa region, most lands fall under arid and semi-arid land, only suitable for pastoralism, and account for 20 - 30% of GDP and 70% of household income (Selemani, 2017). In Kenya, for instant, ASALs are home to over 60% of country national livestock herds and are supporting some 14 million people (Omollo *et al.*, 2018). ASALs are characterised with low, poorly distributed rainfall, severe aridity, and high evapotranspiration resulting in frequent droughts. This subsequently resulted in insufficient and poor-quality pastures, a major limiting factor hindering pastoral livestock productivity (FAO, 2018; Omollo *et al*., 2018).

According to FAO (2018), over the last three decades, pastoralism has undergone several changes, and pastoral production systems in various regions have shown weaken capacity in responding to shocks and changes. In the African context, limitation to adequate and secure land is a significant factor facing the pastoral communities, migrant farmers, and smallholder farmers due to commercialisation, commoditisation, and high competition. With the discovery of geothermal energy in Greater Olkaria area and subsequent development of

geothermal production stations (Olkaria I – IV), Maasai pastoral communities inhibiting the area were displaced and relocated into a new area - RAPland village in 2014. Based on the experience of previous resettlement programs, the resettled persons (PAPs) end up losing all that they possessed, especially livelihood assets before being relocated due to several factors. Developmental-oriented displacement and resettlements are known to cause impoverishment among the relocatees through loss of livelihoods, social, and cultural resources (De Wet, 2016). Impoverishment Risks and Reconstruction (IRR) model identified and described some of the commonly experienced risks by project affected persons (PAPs). These effects include loss of homes, land, property, jobs, high prevalence of diseases, food insecurity, and social disintegration (Cernea, 2007). Post-resettlement assessments conducted, indicated that loss of natural resources that include grazing land, water supplies, forest land, and arable land had been reported (Sirima, 2016; Xiao *et al*., 2018). As pastoralism is regarded as a symbiotic interaction involving the people, domestic herds and the local ecology, the focus of this study was threefold; to assess rangeland resources in RAPland village, evaluate and document pastoral production challenges hindering livestock productivity before and after the resettlement, and evaluate the effect of relocation on pastoralists' knowledge, attitudes, and perceptions on common herds management approaches and practices.

4.2 Materials and methods

4.2.1 Location and description of the study area

The research was carried out in RAPland village – a resettlement site created to accommodate KENGEN's evictees of 2014, located within the Greater Olkaria Area Bloc, which is about 120 km northwest of Nairobi (Schade, 2017). Administratively, it's in the Longonot ward, Naivasha sub-county, and Nakuru County (Getonto, 2018). Prominent

places and features near it are Lake Naivasha to the North, Hell's Gate National Park to the northeast. Generally, the Olkaria Area has geothermal energy as it's on the floor of Kenya's Great Rift Valley System (Axelsson *et al.,* 2013). Wamalwa (2014), Olkaria is categorised under Agro-ecological zone V or semi-arid climate. It receives 634 mm rainfall annually on a bimodal pattern, which is long rains in March to May, while short ones from October to November. Generally, the elevation of Naivasha sub-county is 1,829 m above sea level with minimum and maximum daily temperatures of 11.4^0C - 16.6 ^{0}C and 25.4^0C - 35.5^0C, respectively with an average temperature of 18.4^0C for the area with July and February as the coldest and hottest months respectively (Wamalwa, 2017).

4.2.2 Research Tools/Approaches

4.2.2.1 Household Questionnaire

Data collection for this research was carried between May and June 2019. A household questionnaire was developed to collect information on pastures and water (their sources, distances, and sufficiency/availability) before and after the resettlement; livestock production challenges, their coping strategies before and after the relocation; and pastoralists' standard practices on herds management approaches that include herds diversification, mobility, and splitting. After training the selected enumerators, the questionnaire was pretested, and required changes were made before embarking on data collection. Interviews were then administered to 105 households that met the selection criteria.

Using cross triangulation – which is using two or more methods in answering the same question (Catley *et al*., 2012), household heads/respondents listed and ranked livestock production constraints, their coping strategies before and the relocation and FGD discussants provided details on the occurrence of the listed production challenges.

4.2.2.2 Focused Group Discussions (FGD)

The FGD or group interview is a qualitative research methodology for collecting data using unstructured, structured, semi-structured, or interviews. The researcher gathers the information in an organise and systematic manner (Boateng, 2012; Mishra, 2016). Focus group discussion has been widely used due to its convenience, economic advantage, high face validity, and speedy results (Boateng, 2012).

Three FGD meetings were held in RAPland village, each with elders (men), women, and youth (young men and women) groups with eight (8) participants in each session. The discussions were guided by checklists' questions that include available land size (in the old and RAPland villages), livestock production challenges, and their coping mechanisms before and after the resettlement. They held deliberate and collective discussions of questions raised from the FGD guide and built a consensus on responses. Discussions counterchecked and validated information collected through the household survey, key informants' interviews, and field observations.

4.2.2.3 Key Informant study guide and Interviews (KII)

The key informant technique is an ethnographic method of researching, initially used in cultural anthropology studies, which have since spread in usage. According to Marshall (1996), key informants, or "natural observers," they are sometimes referred to provide more and more in-depth insight information on matters of concern to their communities because of their skills and or positions held in their communities. As described by Marshall (1996), a key informant should possess some characteristics, which include a role in their communities (for exposure to communal issues), knowledgeable (meaningful information), willingness to provide needed information (cooperate fully with the researcher),

communicability (convey information wholly and quickly), impartiality (objective and unbiased).

Six (6) key informants from RAPland communities (3 older men from the council of elders, two older women, and a pastor) were interviewed. The interviews focussed on available land for grazing and the quality of pasture, water availability, and livestock production constraints.

4.2.2.4 Field Observation/Transect walks (FO)

Observation is a well-organised elucidation of a phenomenon, behaviours, events or artefacts in the social setting chosen for the study (Marshall and Rossman, 2014). Through observation, the observer/researcher can quickly notice, monitor and describe the situation using the five common senses (Kawulich, 2005). As the settlement in RAPland village is arranged in a way that depicts how the former four villages of OlooMayana Ndogo, OlooNongot, OlooSinyat, and Cultural Centre were arranged, field observations were made in each of the four sub-villages in RAPland area. The observations focused on the topography of the RAPland village, vegetation cover, pastures, water sources and conditions.

4.2.3 Sampled population, identification of respondents and the interviews

With the total displaced populations of 155 households, the researcher aimed at interviewing all the displaced Maasai pastoral households as the population was relatively small. However, only 105 households participated in the survey.

4.2.4 Data Analysis

The data collected through household questionnaires were recorded, organised, summarised through the use of Microsoft Excel, 2019, imported and analysed through the use of the Statistical Package for Social Sciences (SPSS, version 21) software. Inferential statistics that include percentages, tables, frequencies and Chi square were calculated. Focus group discussions (FGD) and key informants (KII) data provided deep insights and validated the quantitative data from the household questionnaire.

4.3 Results and discussions

4.3.1 Rangeland resources availability in RAPland village

The well-being of any pastoral livestock production system is assessed through the land owned and access to natural resources. This is because land forms the bases of rangeland-based resources (pastures, water) necessary for pastoral production. Extensive and sustainable pastoralism is built on the people (including their social links), livestock assets, and natural resources that include the land, pastures, and water (Gebeye, 2016). This section will, therefore, focus on the natural resources (land, pasture, water) available to the resettled pastoralists.

4.3.1.1 Land and Pasture Availability in RAPland village.

Before being resettled into RAPland village, the inhabitants of four villages (OlooMayana Ndogo, OlooNongot, OlooSinyat, and Cultural Centre) collectively owned and managed a total area of 4200 acres through the communal arrangement. However, RAPland village has a total area of 1700 acres, as revealed during focus group discussions (FGD). By comparing the land sizes owned before and after the resettlement, the community has lost about 60% of the initial land they owned. Elias and Abdi (2010), Yonas *et al*. (2013) observed a similar

decrease in the communal area (grazing fields) after the resettlement. The decline in grazing land has been reported severally to impact negatively on rangeland vegetation productivity due to overgrazing pressure (constrained livestock mobility) as livestock are grazed continuously in the same area when there are alternative grazing fields which subsequently affects livestock production and performance (Yonas *et al*., 2013).

According to Maasai pastoralists, "land is not just for us alone-we the present generation, but also for our great-grandchildren that are to come after we are gone." An extract from one elder during the FGD. Pastoralists all over the world hold the same feeling about the land. A Nigeria herder had this to say, "Land belongs to a vast family of which many are dead, few are living, and countless members are still unborn" (Tilahun *et al*., 2016). Before being resettled into RAPland village, the project affected persons (PAPs) occupied four villages, in separate locations with combined land ownership of about 4200 acres. However, they were resettled into an area of 1700 acres, demarcated from other lands; the pastoralists recorded about 60% reduction in total communal land as revealed by FGD and KII discussants. Cook, (1994) Himmelfarb (2006), Tolera and Abebe (2007), Elias and Abdi (2010), and Kimiti *at el* (2018) reported a similar reduction in grazing land among the pastoralists after being relocated into a new area. Establishing boundaries on rangeland confined pastoralists' herds into restricted grazing fields.

Results of pasture sources, distance, and sufficiency showed that pasture sufficiency and distance were significantly ($P<0.05$) affected by the resettlement, while pasture types/sources were not significantly ($P<0.05$) affected. Most households (99% and 97%) relied on natural pasture before and after resettlement, respectively. Only a small proportion reported the use of purchased feeds before and after the relocation. Pastures became insufficient after the relocation for 65.7% of the households. Herders and their herds had to

cover longer distances to access pasture than they used before the resettlement. The results showed an increase in mean distance from 3.2 ±0.29 to 8.1 ±0.41 kilometres.

Pastures insufficiency reported by respondents could be due to several reasons including a reduction in grazing land and productivity, bushy vegetation cover (that is less useful to grazers like cattle and sheep), erratic rainfall pattern (affects the quantity and quality of pastures) and presence of gullies which has reduced the land available for pastures growth. In their former villages, the PAPs had vast grazing areas with more suitable forage cover and fewer gullies, thus ensuring pasture sufficiency. Cook (1994), Koenig and Diarra (1998), Gitunu (1999), Tamir (2000), Desta and Coppock (2004), Himmelfarb (2006), Tolera and Abebe, (2007), Elias and Abdi (2010), and Kimiti *at el* (2018) observed pasture shortages due to reduction in grazing land as a result of being denied access to the pastureland after the resettlement. Recurrent droughts, overgrazing, and bush encroachment could have also contributed to pasture shortages in RAPland village (Admasu *et al*., 2010; Kimiti *at el*., 2018; Fenetahu *et al*., 2018).

Table 4.1: Pasture types, availability, and distances in Old and RAPland villages.

		Before Resettlement (N = 104)		After Resettlement (N = 105)			
Pasture		**n**	**(%)**	**n**	**(%)**	**Chi-Square**	**P Value**
Type	Natural	103	99	102	97.1	3.015	0.083
	Purchased	1	1	3	2.9		
Availability*	Sufficiency	92	88.3	36	34.3	63.917	0
	Insufficiency	12	11.7	69	65.7		
Distance in (km)*		3.154 ±0.288		8.114 ±0.411			0

Loss of grazing land resulting in pasture shortages forced the pastoralists to walk longer distances to find pastures and water for their herds (Elias and Abdi, 2010). Pasture insufficiency in both quantity and quality throughout the year has been reported as a significant livestock production constraint affecting pastoral herds' production and productivity (Nyangito, 2005). Lack of pastures reduced livestock nutritional status, thus affecting animal's health, growth rates, reproduction (age at first calving, calving in lactation & lactation length), milk yield, body size, and weight, among others (Alejandro, 2016).

Another limitation that could have caused pasture shortages in RAPland village is the presence of gullies. During transect walks, numerous and deep gullies were observed, as shown in figure 4.1. Besides causing injuries and loss of lives to both human beings and livestock (Konana, 2017), gullies reduced available land for pasture growth, distracting accessibility of other grazing fields and caused soil erosion when filled with water during heavy downpours. Sloped or inclined terrain affects livestock performance in that livestock use much energy in accessing pastures and ponds located in steep slopes, unlike when they are grazed in flat rangeland where most of the energy would be channelled into other use like fattening. Keno and Suryabhagavan, (2015) reported that sloped areas are not suitable for livestock grazing because of their impassability and high energy usage by livestock in searching for pastures and water. Besides gullies effect, the effect of the hills is the same as that of gullies, high-energy usage in climbing (Elias and Abdi, 2010). Through observation made during transect walks and FGD participants; RAPland village is unsuitable for extensive pastoral livestock production where livestock depend entirely on natural pastures for grazing due to the presence of numerous gulleys and hills.

Gullies/Valleys in RAPland Village

Figure 4.1 (A and B): Gullies/Valleys in RAPland Village. Source: Researcher's photos gallery.

Vegetation covers in RAPland village

Figure 4.2 (A and B): Common Vegetation Cover in RAPland Village. Source: Researcher's photos gallery.

4.3.1.2 Water Availability in RAPland Village

Water sources and distance were not significantly (*P>0.05)* affected by the resettlement, while it availability/sufficiency was significantly (*P <0.05)* affected. For most respondents (92.3%) and 92.4%, piped water was the primary water source before and after relocation, respectively. With other sources being trucks (4.8%) and rainwater (2.9%) before and after the resettlement, respectively. Before the resettlement, the pastoralists had sufficient water supply for their livestock, as reported by 86.4% of the respondents in table 4.3. After being resettled into RAPland village, water shortages became rampant, as reported by 75% of the surveyed participants. This was due to reliance on one source-pumped water from Lake Naivasha. Koenig and Diarra (1998), Elias and Abdi (2010) observed severe water shortages among the PAPs of Western Mali and Karrayu rangelands of Ethiopia, respectively, after being resettled into a new area. Most of the studies on Africa's pastoral extensive livestock production reported a reduction in grazing land and water scarcity as significant constraints affecting rural livestock production.

The water supply in RAPland area is through piped water that comes from Lake Naivasha. Water is pumped from Lake Naivasha into a big collection tank near the village 1-2 times weekly, after which it is then injected into water kiosks/containers allocated within the village. There are four (4) water collection tanks/booths, with a capacity of 5,000 litres each, such as in Figure 4.4. These water kiosks/tanks are located within the village. Two of such water kiosks have water troughs for watering livestock. During the time of data collection, the central pumping system that supplies the whole village had broken down; thus, there was a severe water crisis. Such breakdowns have been reported to occur many times since they were resettled into RAPland village. At the household level, each homestead has a 2,000 litres water tank, use as back up for rainwater harvesting and storage for later use when there is a system breakdown. The collected water is used for domestic purposes as

well as watering livestock that is kept at homes such as the milking and the sick ones. There is no surface water in the form of rivers, streams, or ponds in the whole RAPland village; this has often resulted in severe water shortages, especially during the dry seasons

Table 4.2: Water sources, Availability and Distance before and after the resettlement

		Before Resettlement (N = 104)		After Resettlement (N = 105)			
Water		**n**	**(%)**	**n**	**(%)**	**Chi Square**	**P Value**
Sources	Pipe	96	92.3	97	92.4	3.015	0.083
	Truck	5	4.8	5	4.8		
	Rainwater	3	2.9	3	2.9		
Availability*	Sufficiency	90	86.4	26	25	79.032	0
	Insufficiency	14	13.6	79	75		
Distance in (km)	3.56 ± 0.340			3.46 ± 0.36			0.841

Water trough in RAPland village

Figure 4.3: Water trough at the yard for watering livestock in RAPland Village
Source: From Researcher's photo gallery.

Rainwater Harvesting in RAPland village

Figure 4.4: Water Tank for rainwater collection. Source: From Researcher's photos gallery**.**

4.3.2 Livestock production challenges and coping strategies before and after the resettlement.

4.3.2.1 Livestock Production Challenges Encountered in old villages and RAPland Village.

Three categories of constraints to pastoral livestock production are recognised; these include disasters, regular, and long-term restrictions. Long term ones are changes like loss of pastoral land and population growth pressure. Hazards and usual constraints have been in existence within the production systems, and pastoralists have developed coping strategies against, while long term constraints are new. Herders have no control over them (Schwartz, 2005). During the interviews, the pastoralists energetically narrated livestock production challenges before and now in RAPland village.

Livestock diseases (27%), drought (27%), lack of pastures (23%), wildlife predation (11%), conflict (7%), and water shortages (5%) were the leading livestock production constraints before the resettlement, these have been reported elsewhere as some of the commonly observed production constraints hindering pastoral livestock productivity (Nyariki *et al*., 2009; Opiyo *et al*., 2011; Onono *et al*., 2013; Ahmed *et al*., 2019). After being resettled into RAPland village, water (21%), lack of pastures (19%), lousy terrain-gullies (15%), wildlife predation (13%), drought (12%), and livestock diseases (11%), conflict (6%), lack of market access (2%), and labour hiring cost (1%) by the residents as indicated in table 4.3. Although challenges before and after resettlement look the same, their severity and importance have changed; thus, their impacts on livestock productivity and performance have increased. For instant in the old villages, livestock diseases and drought were the leading constraints, while after being relocated, lack of access to water and pastures became the leading ones. After the resettlement, access to pastures, water, and lousy terrain (gullies) became the prominent production constraints in RAPland village. In both states (before and after the resettlement), the community relied on pump water from Lake Naivasha. However, shortages became

severe after relocation due to lack of surface water (in forms rivers, streams, ponds), unlike in the old villages besides frequent breakdown of pumping systems as reported by the FGD discussants. The chronic water shortages in RAPland village was also worsened by being barred from accessing watering points located within Hell Gate's National park, a commonly observed feature with most development projects (Elias and Abdi, 2010). Before being resettled, pasture shortage was due to natural causes like prolonged dry spells mainly or due to competition from other grazing communities.

Table 4.3: principal causes of challenges encountered before and after the relocation

Challenge	**Cause of Challenge in the old village**	**Cause of challenge in the RAPland**
Water	-Water pumping system failure	-Lack of surface water in RAPland village to supplement piped water
	-Drought	-Loose volcanic soil that loses water quickly in ponds and valleys
		-Arid and semi-arid nature of RAPland
		-Frequent pumping system breakdowns
		- Droughts and Inadequate rainfall
Pastures	-Drought	-Arid and semi-arid nature of the area
	-Rainfall insufficiency	-Insufficient grazing land & fields
	-Competitions for grazing fields	-Bushy/Unsuitable vegetation cover
		-Restricted access to some potential grazing fields, e.g., Hell Gates Park
Wildlife	-Presence of many predators	-Presence of many predators
	-Poor herding during grazing	- Bush area with numerous valleys/hills where predators hide
	-Restricted killings of wildlife	-Proximity to the game park
		-Inadequate fencing around the homestead
Drought	-Climatic changes	-climate changes
	-Rainfall variability	-Erratic rains
Diseases	-Lack of extension services and extension providers, e.g., CAHWs	-Poor and inadequate veterinary services
		- Lack of/Poor vaccination coverage
		-Poor diseases surveillance
Conflicts	-Livestock theft	-Livestock theft
	-Competitions for pastures and water	-Insufficiency of pastures and water
		-Absence of police
		- Restricted access to Hell's gate park
Gulleys		-The natural topography of the area
		- Loose volcanic soils that are easily washed away runoff during rains
Remote area		- Livestock Markets are in far locations
		-Hiring cost of herders has hike since resettlement
		-Reduction in labour availability after resettlement

Table 4.4 Ranking of challenges and coping strategies in the Old and the RAPland villages.

Production Challenges	Old village Ranking	RAPland Ranking	Coping strategies	
			Old village	**RAPland village**
Livestock diseases	1	6	-Migration	-Use of herbal
			-Use of natural herbs	-Vaccination
			-Treating -Deworming	-Injection
			-Vaccination	-Spraying
			-Spraying	-Deworming
Drought	2	5	-Migration	-Migration
			-Herds splitting	- Herd diversification
			-Selling part of herds	-Herd splitting -Destocking
Pasture access	3	2	-Migration	-Migration
				-Buying feeds/pastures
				- Herd diversification
				Herd splitting
Water access	4	1	-Migration	-Migration
			-Buying	-Buying water
			-Water in the Ponds	-Harvesting rainwater
Wildlife predation	5	4	-Poisoning	-Poisoning
			-Trapping	-Trapping
			-Reporting to Kenya Wildlife Services	-Migration
				-Fencing
				-Reporting to Kenyan Wildlife Service
				-Tight herding
Conflicts (Human conflicts)	6	7	-Mediation by elders	-Mediation
			- Reporting to Elders	-Reporting to Elders
				-Reporting to police
Bad terrain/ Gulleys	0	3		-Migration
				-Herds separation
Market Access	0	8		-Walking longer distances to access livestock market
				-Dig deeper into pockets to afford herders

However, in RAPland village, shortages according to the relocatees are attributable to loss of grazing area, bushy vegetation cover, and unsuitable terrain. Reduction in grazing land experienced after the resettlement caused pastures shortages in the RAPland area (Koenig and Diarra, 1998; Gitunu, 1999; Elias and Abdi, 2010; Worku, 2011; Tashi and Foggin, 2012; Alem and Senbeta, 2019). According to Brockington (1999), land dispossession is a significant cause of pasture insufficiency in East Africa. Based on FGD participants, RAPland village was more prone to droughts than their formers villages, this reduced quantity and quality of pasture as well as water (Tolera and Abebe, 2007). With reduced grazing land and reduced livestock mobility, livestock is continuously grazed in common areas, thus causing range degradation and resulting in pasture shortages (Lkhagvadorj *et al*., 2013; van Dijk and Bose, 2016). Bad terrain was ranked a third major constraint affecting livestock production in RAPland village. Terrains in former villages were fairly level as gullies/valleys were not reported. The presence of ditches in rangeland reduced the area available for grazing livestock. Gullies caused injuries or loss of life to both animals and herders. It also reduced the space open for pasture growth.

Wildlife predation (13%), drought (12%), livestock diseases (11%), conflict (6%), lack of market were the other challenges. With regards to wildlife predation challenge, although it was reported too in old villages as one of limiting factors to pastoral livestock productivity, it was not very severe as it was mainly during the first and second years of moving into RAPland village. According to the discussants, the severity was due to massive bushy coverage, presence of gullies, and hills, which were hiding sites for the wild animals. The proximity of RAPland village to the Hell Gate's National Park, coupled with inadequate fencing around the homestead, was believed to have led to wildlife menace by the residents. Wildlife predation on pastoral herds has been identified as a limiting factor to pastoral herds' growth by other studies (Gitunu, 1999; Karanth, 2007; Hogan, 2010). The common

predators in the area were the hyenas that killed and ate cattle, sheep, and goats; cheetahs/leopards that targeted the small ruminants; baboons/monkeys for lambs and kids. Similar predators were reported by Gitunu (1999) among the resettled agro-pastoralists of Makueni District, Kenya.

Before their relocation, livestock disease occurrence was the leading challenge affecting livestock production. Although it wasn't the foremost challenge in the new area (RAPland), it was still affecting the pastoral herds. Based on the narratives of the relocatees, lack of veterinary extension services (veterinary personnel, drugs, infrastructures) was blamed for the outbreaks and occurrence of livestock diseases, this corroborated work by Maingi and Njoroge (2010); Wesonga *et al*. (2010); Onono *et al.* (2013). Epidemics could have contributed to a reduction in livestock populations witnessed in RAPland village, as observed by Koenig and Diarra (1998) among the resettled pastoral communities of Western Mali. There was no difference in terms of livestock diseases encountered before and after the resettlement. Some of the reported infections include Contagious bovine pleuropneumonia (CBPP), Foot and Mouth Disease (FMD), Anaplasmosis, Trypanosomiasis, East coast fever (ECF), Lumpy skin disease (LSD), black quarter (BQ), Endoparasites, Ectoparasites for cattle (Onono *et al*. (2013). Contagious caprine pleuropneumonia (CCPP), Peste des petit ruminants (PPR) for small ruminants. According to the FGD discussants, they were promised a cattle dip in RAPland village to aid in the control of ticks, and this was never achieved at the time of this study.

While in their former villages, conflicts over access to pastures, livestock theft, and wildlife predation involving other pastoral groups, livestock rustling, and wild animals were reported. Although the causes of conflicts remained similar, they became more intense. Due to the reduction in the grazing area, competitions over pasture worsen. This was also catalysed by being barred from accessing grazing and watering points within the park.

According to the FGD discussants, they are fined by the Hell's Gate park administration in case they (herders) trespassing into the park. Similar competitions over grazing fields and pasture have been observed by Himmelfarb (2006) among the inhabitants of Mt Elgon in Uganda; Elias and Abdi (2010) in Southern Ethiopia; Tashi and Foggin (2012) on people Tibet region, China. Wildlife predation is more severe in RAPland village than before, especially during the period of a prolonged dry spell and droughts when livestock are taken near or into the park. The livestock-wildlife conflict has been reported in places where pastoralists live next to game reserves, parks, and forest areas (Koenig and Diarra, 1998; Karanth, 2007; Hogan, 2010).

One of the new challenges being faced by the residents of RAPland village is livestock market destabilisation. The effect of resettlement on the market is twofold; lack of markets for live animals and hiking of hiring prices for herders. There are no nearby livestock markets for selling livestock, the available ones are located in distant places, and pastoralists had to walk long distances to reach them. Most RAPs involving pastoral communities failed to look into this issue of the pastoral livestock market (Worku, 2011). When they (herders) walked longer distances to markets, their livestock loses conditions and are sold at lower prices because of losing bargaining power and are forced to sell their livestock at any cost to avoid walking back with the animals. It also exposes pastoralists to attacks either before or after selling their animals (Nyariki *et al*., 2009). The location of markets in faraway places could have affected the number of live animals sold, a trend reported elsewhere (Brockington, 1999). Immediate buyers for milk, milk products, and meat were few or unavailable in RAPland village, unlike before they were resettled. Another aspect of the market affected by the resettlement is labour hiring cost. According to RAPland village residents, relocation has caused labour shortages, thus hiking the cost of hiring. This is due to fewer people's availability in RAPland village, unlike in their old communities that are

competed upon by the pastoralists and security companies working at geothermal sites. A similar observation of labour shortages after resettlement was reported by Bauer (2015). Generally, livestock market structures were not established at the time of this study, supporting the arguments by other researchers that resettlement breaks apart the social fabric and disrupts the occupations of the communities (Jackson and Sleigh, 2000; Olawepo, 2008; Agba *et al*., 2010).

4.5.2.2 Coping strategies against encountered livestock production

Historically, pastoralists possessed relatively high adaptive capacities that enabled them to make use of the arid and semi-arid areas they occupied (Herrero *et al*., 2016). To reduce or mitigate against encountered livestock production challenges, the Maasai pastoralists used strategies such as seasonal herd migration, herd splitting, and destocking – selling part of herds to cope and minimise the effects due to water, pasture, and droughts challenges (Herrero *et al*., 2016; Mowlid *et al*., 2018; Hassan *et al*., 2018). Herds' diversification, mobility, and splitting are considered as traditional adaptive and herd management practices that are key in keeping pastoral herds since time memorial and are thus considered as part of the socio-culture of most pastoral groups including the Maasai community. For households with financial capacities and accessibility, water and feeds shortages were supplemented through buying. However, this was only limited to a few families and livestock, especially the milking or sick ones. According to the discussants, destocking/selling parts of livestock, especially during a prolonged dry spell, reduce the negative impact of drought. However, this depends on the availability and accessibility of the livestock market, as well as the duration and the severity of the drought (Speranza, 2010).

One of the new challenges encountered in RAPland village and affecting both herders and livestock was the bad terrain. According to the discussants, this was avoided by moving

livestock out of the areas perceived to have most valleys, especially the large ruminants like cattle, as they were the most affected due to their sizes. Challenges due to livestock diseases were managed through the use of ethnoveterinary medicines (herbs) and conventional approaches. Focus group discussants revealed that they used their traditional knowledge of rangeland to identify herbs that would treat certain diseases. The use of conventional methods of livestock disease control such as vaccination, deworming, and spraying, was also reported. However, this was limited by the accessibility of the veterinary products (drugs, acaricides), infrastructure (cattle dip), and trained personnel like Community-based Animal Health Workers (CAHWs). Wildlife menace was controlled by poisoning the predators using traditional herbs or trapping them. Others erected scarecrows to scare away the predators, especially at nights. With hopes of being compensated for livestock loss to wild predators or some control, some people reported to Kenya Wildlife Services (KWS), but this didn't help as the KWS had limited control or no methods to control the predators. Compensation for livestock lost to predators by KWS was a tricky and challenging undertaking, as revealed by the FGD discussants. Conflicts involving members of RAPland village were referred to the community elders for settlement. Mediations after cases have been determined were sought. Intricate and complex issues (livestock theft) challenging to be the handle of the elders, especially if it involves members of neighbouring communities, were referred to the police.

4.5.3 Influence of resettlement on pastoralists' knowledge, attitudes and practices on herds management approaches

4.5.3.1 Herds Diversification

While in their old villages (OlooMayana Ndogo, OlooNongot, OlooSinyat, Cultural Centre), most people (97%) kept various livestock species, comprising mainly cattle, sheep, goats, donkeys, and poultry. This changed after being resettled into RAPland village, with 52% of the respondents reported a reduction in species kept, as shown in table 4.3. Pastoral production systems utilised the rangelands which are diverse in forage compositions (herbaceous and woody in nature) through herds' diversification as different herds have a distinct preference for forages. In terms of diseases, keeping more than one species reduced the chances of losing all herds due to similar disease or during outbreaks. Herds' diversification is thus a management tool for wealth accumulation and risk reduction through spreading.

The reduction in the number of species kept could have been due to livestock production challenges faced in RAPland village. This is true in that pastoralists' choice of the species to keep is determined and influenced by factors that include socio-demographic; optimal and economic benefit; risks; and uncertainties involved (Megersa *et al*., 2014). FGD discussants revealed that each livestock species had its challenges affecting its adaptability and suitability in the RAPland village. Livestock species have varied tolerance and resilience for environmental factors such as pastures and water shortages, drought, and heat stress (Seo *et al*., 2009; Speranza, 2010; Megersa *et al*., 2014). Bushy vegetation/bush encroachment, frequent droughts, climatic changes (Seo *et al*., 2010; Lesnoff *et al*., 2012), and gullies were cited to be affecting cattle more than any other species in RAPland village. Bushy vegetation is less useful to grazing livestock (cattle and sheep). Also, frequent droughts due to climatic changes affected pastures and water availability.

Small ruminants, especially goats are better adapted in terms of pasture selection and utilisation than the cattle as they can feed on bushy, leafy plants, and invasive shrubs that could be poisonous and unpalatable to animals (Rutter, 2010). Because of their weight, cattle were falling into gullies more than the small ruminants, thus injuring or killing them. Another special vulnerability exhibit by animals is the shorter watering interval. According to Tolera and Abebe (2007), cattle have the shortest watering range of 2-3 days, small ruminants with 4-5 days while camels with the longest of 15 days. Shorter watering interval limits foraging distance and on patchy vegetation that is scattered in grazing fields and distant from watering points. With water as the leading challenge hindering livestock productivity in RAPland village, this might have prompted some households to reduced cattle within their herds.

Although the discussants did not report it during FGD, longer recovery time after a disaster for cattle, especially after the droughts, might have influenced some households to drop or reduce the cattle in favour of other species with shorter recovery time like the small ruminants. On average, cattle take 10 – 15 years to recover from the disaster (Megersa *et al*., 2014). In terms of environmental adaptability, camels have been chosen over cattle (Faye *et al*. 2012), goats over cattle (Seo *et al*. 2009), and sheep over cattle (Seo *et al*. 2010). Among pastoral livestock species, camels are more resilient to environmental stresses such as droughts, water, and; pastures insufficiency, followed by the small ruminants and the cattle (Oseni and Bebe, 2010; Catley *et al*., 2013).

Table 4.5 Respondents (%) on pastoralist knowledge, attitudes and Practices on common herds' management approaches.

Statements on herd diversification, splitting, and mobility	% Respondent N = 105		
	Agree	Neutral	Disagree
Herd diversification			
I kept various livestock species in old village	97.3	1	1.7
I have removed some livestock species in RAPland	52.5	3	44.5
RAPland is suitable for various livestock species	12.5	1.5	86
Herds Splitting and Mobility			
I was splitting my herds in old village	60.2	1.9	37. 9
I'm able to split my herds in RAPland village	18.1	1	80.9
I was moving my herds freely in old village	86.5	1	12.5
I'm able to move my herds freely in RAPland village	29.8	1.9	68.3

Another factor that might have affected species composition in RAPland area is labour availability. Species diversification and the number of livestock are mainly dependent on the vast labour force (Yi *et al*., 2008; Næss, 2010). In RAPland village, most households relied on hired labour which was, however, reported to be insufficient as the bulk of those that used to provide the required workforce were never resettled. With limited access to the labour, some pastoral households could have adjusted their herds' compositions to suits labour available in the area. Majority of the respondents (86%), table 4.3, felt that RAPland village is not ideal for keeping and maintaining multi-species of livestock. This could be due to challenges encountered in rearing them as each livestock species response heat stress, drought; water; and pastures shortages. Seo *et al*. (2009); Speranza (2010), such variations create an opportunity of choosing species that are better adapted to changing environmental conditions.

4.5.3.1 Herds Splitting and Herds Mobility

Herds' mobility involves moving herds across the rangelands in search of pastures and watering points. This could be in forms of daily movements of the herds, seasonal migration, or transhumance. Besides being used in pursuit of pastures and water, it's also useful in avoiding and escaping livestock diseases outbreaks and livestock raiding. Herds splitting are where livestock owners divide their herds and have them grazed in different areas. Other forms of herds splitting include livestock loans, gifts, and donations, which are compensated in one way or another later when needs arise. Herds splitting helps avoid pasture shortages, diseases, and livestock raids. Before being resettled, most people (60%) practised herds splitting, while those practising herds mobility were 86%, while after the resettlement, only 18% and 30% of the respondents were using herds splitting and mobility, respectively as shown in table 4.3.

While in their old villages, the Maasai pastoralists had access to sufficient grazing land, and individuals had the privilege of moving their herds within wider rangelands. However, this changed after being resettled into RAPland as land became limited as they were confined into a smaller area compared to the ones they occupied before resettlement. The reduction in grazing area constrained most households from engaging in their ordinary herds' management approaches like herds splitting and mobility within the RAPland area. This is in support of the statement by Koenig and Diarra, (1998) that resettlement usually resettled more people onto fewer resources, especially among those that had access to shared resources such as pastures and forest lands.

By looking at leading livestock production constraints in RAPland village that includes water, pastures, gulleys, wildlife, drought, and diseases, they all related to constrained herds mobility. According to Motta *et al*. (2018), the essence of herds' mobility among pastoral communities is to cope with local environmental constraints and fully exploit seasonal availabilities of grazing and water resources. Niamir-Fuller and Turner (1999), herd mobility is an efficient and adaptable strategy in managing extensive pastoral production in the rangelands. Herds' mobility allows optimal utilisation of rangeland resources, thus keeping pastoral herds in the right conditions as well as maintaining ecological biodiversity. Megersa *et al*. (2014), pastoralists have accumulated the wealth of knowledge on livestock-based livelihoods sustenance in arid and semi-arid environments over the generations.

4.6 Conclusions

From this research, it can be deduced that;

a) The resettled pastoral communities lose about 60% of their communal land after being resettled into RAPland village. This affected pastoralists' access to quantity and quality pastures.

b) The resettled pastoralists encountered more and severe livestock production constraints in the form of water and pasture access, bad terrain, wildlife predation and drought, among others, unlike in their old village.

c) Pastoralists' knowledge, attitudes, and practices on common pastoral herds' management approaches that include herds' diversification, splitting and mobility have been impaired in the new homes, this has an effects on livestock production and performance.

CHAPTER FIVE

5.0 GENERAL DISCUSSION, CONCLUSION, AND RECOMMENDATION

5.1 General Discussion

The study assessed the impact of relocation on livestock production and performance among the resettled Maasai community of RAPland village. This was achieved through the evaluation of rangeland-based resources (land size, pasture, and water access) availability in RAPland village, assessment of livestock populations and performance before and after resettlement, evaluation and documentation of livestock production constraints, coping strategies and evaluation of pastoralists' knowledge, attitudes and perceptions on herds' management approaches.

The displacement and relocation of the Maasai pastoralists households were necessitated by the government of Kenya's desire to produce more and renewable energy through an expansion of existing and development of new geothermal energy generation sites at Olkaria area, which are located within the Great Rift Valley System, thus enriched with geothermal energy. As most governments justify development-induced displacement and resettlement (DIDR) for the greater good that warrants some loss, Kenya Electricity Generation Company (KenGen)-a governmental agency tasked with electricity generation in the country, displaced some 155 households and relocated them into a new area (RAPland village) with last families moved out in September 2014.

The findings on pastoral rangeland resources availability indicated that RAPland village is smaller in size, about 1700 acres as compared to the former communities that had a total area of about 4200 acres. A decrease in communal landholding means a reduction in the grazing area; thus, the pastoral herds can only access limited grazing and watering points. Pastoral production systems rely on extensive open lands that allow herds mobility that serves as an ecological and herds management tool. Because of competing for land-use

projects, pastoralists have always been the losers as they are allocated smaller land after resettlement that does not much their requirement based on herds sizes they owned (Elias and Abdi, 2010; Yonas *et al*., 2013). Because of reduced grazing area and other reasons that could include droughts, herds immobility and rangeland degradation, pastoral households' access to pasture and water was negatively affected by the resettlement. Impaired herds mobility denies the herders and herds the leverage of accessing other grazing and watering points. Residents of RAPland village depend on pumped water from Lake Naivasha, which sometimes broke down, causing severe water crisis. This situation is worsened by lack of surface water in forms of rivers, streams among others, which would provide an alternative source for watering livestock.

Because of the production constraints experienced in RAPland village, the resettled pastoralists incurred a significant loss in terms of livestock populations and cattle milk production after the resettlement. Livestock populations reduced from 8383 to 3124 TLU, while milk production drops from 3.8 to 2.4 litres per day/cow after the resettlement. The decrease in livestock populations after resettlement has always been witnessed among relocations that involve pastoral communities primarily due to lack of access to pastures and water (Tashi and Foggin, 2012 in Southern Ethiopia; Yonas *et al.*, 2013, Southwest Ethiopia; Msigwa *et al*., 2014 among the people of Ihefu Basin, Tanzania; Kura *et al*., 2014, People of Central Loa; Nguyen *et al*., 2017). There could be other reasons that contributed to the reduction in livestock populations after the resettlement. This includes destocking/selling parts of herds to provide for the immediate family needs arising due to relocation challenges, as observed by Koenig and Diarra (1998) among the people of Western Mali; Brockington (1999); Yonas *et al*. (2013); and Lavaei *et al*. (2019). Wildlife predation, as revealed by Koenig and Diarra (1998), could have also contributed to a

reduction in life populations among the residents of RAPland village. Livestock diseases and droughts prevalence could have also caused a decline in livestock herd populations.

With regards to livestock production constraints, diseases (27%), drought (27%), luck of pastures (23%), and wildlife predation (11%) were the leading challenges affecting pastoral productivity before the resettlement. However, after being resettled, access to water (21%); access to pasture (19%); bad terrain (15%); wildlife predation (13%); drought (12%); and diseases (11%) became the leading livestock production constraints hindering pastoral livestock productivity in RAPland village. Shortages in pastures and water after the resettlement could be attributed to the shrinkages in the grazing area, confinement of herds, bad terrain, and arid nature of the RAPland village. As livestock production challenges are not new, pastoralists have always aspired to maintain their livestock productivity despite the difficulty. Droughts, pastures shortages, water shortages, and bad terrain challenges were countered through migration, herds' separation, selling parts of the herds, herds' diversification, buying of pastures, and water. Diseases challenge was mitigated against the movement, use of herbal plants, and convention methods (deworming, vaccination). Although it was against Kenya Wildlife Service rules as revealed by the FGD discussants, the pastoralists used poisoning/trapping to tamed or eliminated the wild predators. Night's attacks by predators were prevented or minimised through proper fencing of night shelters and vigilant herding during grazing. Some victims of wildlife predation report to the Kenyan Wildlife Service, but this was only with the hope of being compensated for the loss incurred, which never materialized as reported by the participants.

Despite applying the coping strategies against livestock production challenges encountered, the pastoralists did not inspire that confidence in overcoming those constraints or were not responsive enough. This is manifested in the significant loss of portions of herds and of the

feeling that RAPland village was unsuitable for extensive pastoral-based livestock production.

5.2 General Conclusion

Resettlement has negatively affected the livestock-based livelihoods of the resettled Maasai pastoralist community through reduced livestock populations and milk production. This effect was due to poor endowment of RAPland village with rangeland-based resources that include pastures and water, besides reduced grazing fields.

5.3 Recommendations

a) There is a need to finds alternative grazing fields and watering points to avoid losing the resettled pastoralists into extreme poverty as RAPland village smaller in size compared to old villages and inadequate in pastures and watering points. World Bank (2012) on its resettlement standards recommended that PAPs whose livelihoods are land-based be allocated a better land or an equivalent.

b) There is a need to assess the possibility of constructing rainwater harvesting mini-dam, to mitigate against acute water shortages hindering livestock productivity in RAPland village.

c) As RAPland village lack veterinary infrastructures like cattle dips, concerns authorities need to intervene and construct some to help in controlling livestock diseases. Also, it's highly recommended that training of some herders on community-based animal health worker system (CAHWs) that will aid in addressing the Para-veterinary personnel shortages in the area.

d) As part of resettlement process, there should have been sensitization meeting between Hell's Gate National Park (KWS) administration and RAPland leaders to sensitize them on restricted use of park resources, the wildlife/livestock conflict, predation compensation mechanisms, and conflict resolution mechanisms between the RAPland community and park administration.

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APPENDICES

Appendix I: Household Questionnaire

HOUSEHOLD QUESTIONNAIRE

INTRODUCTION

My name is Abraham Biar Gai, I'm a graduate student from University of Nairobi, Animal Production Department. I'm researching on ***Impact of Involuntary Resettlement on Livestock Production and performance among Maasai pastoralists of RAPland village, Kenya***. I'm carrying out this research among the RAPland residents who were displaced from the former villages of the OlooManyana Ndogo, OlooNongot, OlooSinyat, and cultural centre. The findings will only be used internally for academic purpose – enabling me to achieve a master degree as well as contributing knowledge on future resettlement action plans (RAPs) initiated to accommodate development projects.

Any information you provided will be kept confidential. Your participation is voluntary and your corporation will be highly appreciated. Should you wish to withdraw from the interview or withhold any information, please let me know and your wishes will be honoured. Thanks

Name of Enumerator ……..

Questionnaire Number…….

Village ……

Household Identity.....

Number…….

Date……

Coordinates ----------

SECTION A (Demographic Characteristics of Household Heads)

1. Head of Household (a) Male (b) Female
2. Age of the respondent (a) 18 – 30 (b) 31 – 45 (c) 45- 60 (d) Over 60
3. marital status? (a) Married (b) Unmarried) (c) Others
4. Level of education of the respondent
   (a) No formal education (b) Primary (c) Secondary) (d) Tertiary
5. Source of labour for your livestock in
   i) In Old Village (a) Family labour (b) Hire labour (c) Others ……..
   ii) Rapland Village (a) Family labour (b) Hire labour (c) Others ....……

SECTION B: Livestock species composition, populations, and performance before and after the relocation.

6. Fill in the table below livestock populations

	Old Village				**RAPland Village**			
Species/ Class	Male Adult	Female Adult	Young Stock	Total	Male Adult	Female Adult	Young Stock	Total
Cattle								
Sheep								
Goat								
Donkey								
Poultry								

7. Cattle herds performance before and after the relocation

Species	**Production Indicators**	**Old Village**	**RAPland Village**
Cattle	Age at first calving (Years)		
	Calving interval (Years)		
	Lactation length (Months)		
	Milk Yield (Litres)		

SECTION C: Pasture and Water availability and their distances before and after the relocation.

8. Pastures and Water sources for livestock

- Tick appropriate box for the pasture and water sources
- Use Sufficient and Insufficient to indicate the availability of Pastures and water
- Fill in the exact distances in Kilometres (Km)

Resource	**Sources**	**Old Village**			**RAPland Village**		
Pasture		**Rank**	**Distance (Km)**	**Availability**	**Rank**	**Distance(Km)**	**Availability**
	Natural Pastures						
	Planted fodder						
	Purchased Feed						
Water	Pipeline						
	Trucks						
	Ponds						

SECTION D: Livestock production challenges facing pastoralists and coping mechanisms in Old and RAPland village.

9. Tick and rank the challenges facing livestock production in the old and RAPland village**.**

	Old Village		**RAPland Village**	
Challenge	**Rank**	**Coping Strategy**	**Rank**	**Coping Strategy**
Pasture access				
Water access				
Conflicts (Neighbours)				
Wildlife predation				
Livestock diseases				
Livestock theft				
Drought				

SECTION E: Pastoralists knowledge, attitudes and Practices on common Practices

10. Tick appropriately on the box on the right, against each statement.

Tick using: 1 = Agree, 2 = Neither agree nor disagree 3 = Disagree

Common Pastoralists Practices	**RANK**		
Herd Diversification	1	2	3
I was keeping various livestock species in the old village			
I have removed some species in my stock in RAPland village			
RAPland is suitable and can support many livestock species			
Herds Splitting and Mobility			
I was splitting my livestock in the old village			
I'm able to split my herds in RAPland village			
I was moving my herds freely in the old village			
I'm able to move freely with my herds in RAPland village			

Thank You for Your Cooperation

FOCUS GROUP DISCUSSION GUIDE (FGD)

a) Communal land size in Old and RAPland
b) Livestock production constraints before and after relocation
    i) Listing and ranking livestock production constraints in Old and RAPland villages
    ii) Details account on the occurrence of listed constraints

FIELD OBSERVATION/TRANSECT WALKS (FO)

a) Grazing fields
b) pasture location and conditions
c) water sources and conditions

Key Informants Interviews (KII)

a) Available communal land
b) pasture and water condition in Manyattas and RAPland
c) livestock production constraints in Manyattas
d) Causes of livestock production constraints

Appendix II: ANOVA Tables

(A) ANOVA Table for Livestock Populations

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Cattle TLU	191058.658[a]	4	47764.665	7.296	.000
	Sheep TLU	7069.169[b]	4	1767.292	6.676	.000
	Goats TLU	1030.787[c]	4	257.697	6.785	.000
	Donkeys TLU	61.889[d]	4	15.472	3.729	.006
	Poultry TLU	.954[e]	4	.238	6.052	.000
Intercept	Cattle TLU	454406.350	1	454406.350	69.409	.000
	Sheep TLU	17607.951	1	17607.951	66.511	.000
	Goats TLU	3020.596	1	3020.596	79.525	.000
	Donkeys TLU	142.169	1	142.169	34.262	.000
	Poultry TLU	1.246	1	1.246	31.622	.000
STATE	Cattle TLU	111056.539	1	111056.539	16.963	.000
	Sheep TLU	5384.827	1	5384.827	20.340	.000
	Goats TLU	504.938	1	504.938	13.294	.000
	Donkeys TLU	57.118	1	57.118	13.765	.000
	Poultry TLU	.584	1	.584	14.816	.000
Village	Cattle TLU	78721.678	3	26240.559	4.008	.009
	Sheep TLU	1701.685	3	567.228	2.143	.097
	Goats TLU	531.151	3	177.050	4.661	.004
	Donkeys TLU	5.136	3	1.712	.413	.744
	Poultry TLU	.373	3	.124	3.155	.026
Error	Cattle TLU	1165330.369	178	6546.800		
	Sheep TLU	47123.304	178	264.738		
	Goats TLU	6760.930	178	37.983		
	Donkeys TLU	738.605	178	4.149		
	Poultry TLU	7.013	178	.039		
Total	Cattle TLU	1793912.000	183			
	Sheep TLU	70173.030	183			
	Goats TLU	10489.240	183			
	Donkeys TLU	929.250	183			
	Poultry TLU	9.198	183			
Corrected Total	Cattle TLU	1356389.027	182			
	Sheep TLU	54192.473	182			
	Goats TLU	7791.717	182			
	Donkeys TLU	800.495	182			
	Poultry TLU	7.967	182			

(B) ANOVA Table for cattle performance

			Sum of Squares	df	Mean Square	F	Sig.
Cattle Age at First Calving * State	Between Groups	(Combined)	1.644	1	1.644	.947	.332
	Within Groups		220.581	127	1.737		
	Total		222.225	128			
Cattle Calving Interval * State	Between Groups	(Combined)	.008	1	.008	.011	.917
	Within Groups		97.682	127	.769		
	Total		97.690	128			
Cattle Lactation Length * State	Between Groups	(Combined)	55.999	1	55.999	3.660	.058
	Within Groups		1943.016	127	15.299		
	Total		1999.016	128			
Cattle Milk Yield * State	Between Groups	(Combined)	64.614	1	64.614	29.698	.000
	Within Groups		276.316	127	2.176		
	Total		340.930	128			

(C) ANOVA Table for Pasture and Water Distances

		Sum of Squares	df	Mean Square	F	Sig.
Pasture Distance	Between Groups	1285.632	1	1285.632	97.405	.000
	Within Groups	2732.167	207	13.199		
	Total	4017.799	208			
Distance to Water sources	Between Groups	.528	1	.528	.040	.841
	Within Groups	2709.711	207	13.090		
	Total	2710.239	208			