CHARACTERISATION OF LIVESTOCK PRODUCTION SYSTEMS AND ITS CONTRIBUTION TO THE FOOD SECURITY IN KITUI COUNTY, KENYA

BY

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DECLARATION

I, Augusta Ndungwa Kivunzya declare that this thesis is my original work and has not been presented for the award of a degree in any other university or any other award

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

We confirm that the work presented in this thesis was carried out by the candidate under our supervision and has been submitted with our approval as university supervisors.

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DEDICATION

This research project is dedicated to my sister Elizabeth Kivunzya, “You have given me a reason to smile through your constant encouragement and support”. To my dear parents, Mr. Antony Kivunzya and Mrs. Benedetta Kavata, you have lived to celebrate my achievements. To my daughter Joan Wairimu, you are the best gift I have ever received in life. Lastly, to all my family members and friends I thank the Almighty God for making me one of your own.

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ABBREVIATIONS AND ACRONYMS

AAME	Active African Man Equivalent
AEZ	Agro-Ecological Zone
AgGDP	Agricultural Gross Domestic Product
ASALs	Arid and Semi-Arid Lands
ASDS	Agricultural Sector Development Strategy
CALPI	Capitalization of Livestock Programme Experiences India
CBAHWs	Community Based Animal Health Workers
CEC	Cations Exchange Capacity
EMPS	Extensive Mixed Production System
ERPS	Extensive Ruminant Production Systems
FAO	Food and Agriculture Organizations
FGDs	Focus Group Discussion
GDP	Gross Domestic Product
GoK	Government of Kenya
ILRI	International Livestock Research Institute
KM	Kilometer
KNSB	Kenya National Bureau of Standards
LIRPS	Low Intensive Ruminant Production System
LIMS	Low Intensive Mixed Production System
LUCID	Land Use Change, Impacts and Dynamics
NGOs	Non -Governmental Organization
NRPS	Non Ruminant Production System
GOK	Government of Kenya
TLU	Tropical Livestock Unit

DEFINITIONS OF TERMS

Arid pastoral zone, refers to dry areas that only sustain marginal crop production and are maily considered as livestock zone.

Dependency ratio refers to the ratio of dependants; people younger than 15 years and those older than 64 years of age in relation to the working-age population

Extensive mixed production refers to households keeping both ruminants and non-ruminants and feds them mainly by grazing in the fields

Extensive ruminant production refers to households keeping ruminants mainly grazed in the grass fields.

Farming systems refers to groups of farms which have similar structures and function and can be expected to produce on similar production functions.

Land-use change is defined as an alteration of the land uses, partly or totally over a given period of time.

Livestock production systems it is defined as a production system where livestock are kept having similar resource base, enterprise patterns, household livelihood strategies, farming practices and constraints and for which similar development strategies and interventions can be applied.

Livestock refers to cattle, sheep, goats, pigs and chicken kept within Kitui County

Low intensive mixed production refers to households rearing both ruminants and non-ruminants species and are feds within the household compound

Low intensive ruminant production refers to household keeping ruminants only and are fed within the household compound.

Non-ruminant production this refers to households with poultry as the main livestock species kept

Ruminant refered to cattle,sheep and goats species

Vulnerability is the inability of communities or households to cope with contingencies and stresses to which they are exposed.

ABSTRACT

Livestock production is critical in poverty reduction through food security improvement and rural development. Demographic characteristics, agro-ecological zone and market structure influences the the different livestock production systems. In order to plan for suitable interventions by Kitui County to enhance livestock production, this study aims to identify and document existing livestock production systems,and assessed household vulnerability to food insecurity in identified livestock production systems. The study targeted farmers in Kyangwithya East and Mutomo Wards of Kitui County. Multistage sampling was conducted, and two Wards selected. Sample size of 64 households in Kyangwithya East and 46 households in Mutomo were selected through proportionate to human population for administration of questionnaires. Systematic random sampling was used to identify households to be interviewed. Descriptive and regression analysis were done using Statistical Package for Social Sciences software,version 21.

This study identified five livestock production system namely; a) low intensive ruminant, b) low intensive mixed species, c) Extensive ruminant, d) extensive mixed species, and e) non–ruminant production. Mutomo primarily practice extensive mixed species while Kyangwithya East had three different livestock production systems. In Mutomo, 23% among which 70% practiced extensive mixed ruminant production systems were food secure while in Kyangwithya East, 22% of the households among which 80% practised extensive mixed species and extensive ruminant at equal measure were food secure. Feed shortage,water supply during dry spell, livestock marketing, poor access to extension services, unimproved livestock productivity, poor health services and poor packaging of information on weather to the farmers were the major constraints to livestock production system. Multiple linear regression model showed that TLU owned and age of household head significantly influence food security in Kyangwithya East and Mutomo at $p \leq 0.05$.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND INFORMATION

Agriculture is the backbone of Kenya's economy and its central to the country's development strategy. Kenya's agriculture sector employs more than 75% of the workforce and accounts both directly and indirectly for approximately 51% of Kenya's Gross Domestic Product (GDP), (GoK, 2008). In Kenya, agriculture has six sub-sectors namely industrial crop, foodcrop, horticulture, livestock, fisheries and forestry (GoK, 2010a).

Kenya's population is growing by approximately one million people per year (GoK, 2008). Increased population leads to increased demand for food in terms of livestock products and grains. Therefore, in absence of increased livestock production, there will be reduction in the number of livestock numbers per person hence reduced supply of meat and milk increasing the need to supplement household diet.

About 80% of Kenya's total land mass is ASAL with about 10 million people that have the lowest human development indicators and keep livestock as the main source of livelihood (GoK, 2007). These areas, receives low and erratic rainfall and have the largest number of the poor and marginalized people, with over 60% living below the poverty line subsisting on less than a dollar per day and with 2 to 4 million people receiving food aid annually (GoK, 2007).

Livestock production systems in Kenya are defined by agro-ecological (AEZ), social-economic and market access (Kyalo,2009; Mburu *et al.,* 2007). Agro-ecological zones are influenced by latitude, altitude, temperature, seasonality, amounts and distribution of rainfall. Livestock production systems are classified based on the species kept, breed, grazing acrage, herd size, breeding methods and feeding management. Dairy production is mainly found in the highlands with suitable climate and high density. Meat production is in the arid and semi-arid areas (Mburu *et al.,* 2007). Again, livestock production may be classified as intensive, semi-intensive or extensive system (Kyalo, 2009). Intensive are characterized by small herd size on small piece of land mainly

feeding animals on stalls and using artificial insermination for breeding.This system is mainly commercial oriented. Semi intensive system animals are fed in the field and supplemented and the resources and level of investiment is less compared to intensive form of farming. Extensive livestock production are found in areas with large tracks of land with high number of animals mainly grazing freely (Kyalo, 2009). Integration of crops and livestock is an important characteristic of agricultural intensification and has been a major driver of economic growth in rural areas of many African countries.

To address the food insecurity in ASALs, the Government of Kenya has recognised the critical role of livestock subsector as the potential areas to enhance the country's food situation as documented in the country's development blue print, Kenya's Vision 2030 (GoK, 2013). Studies have shown that livestock is an integral component of rural development contributing to enhanced agricultural productivity, improving rural livelihoods as well as ecological services (CALPI, 2005). Again, livestock form a major capital reserve for households, providing social security, fuel, and transport as well as an important basis for generating cash through value addition multiplier effect. Importantly, livestock is a tool for poverty reduction and improving livelihoods of resource poor farmers (Devedra and Thomas, 2002)

Livestock producers face several constraints in achieving a satisfactory standard of living from this livelihood (Kavili, 2013). This is often attributed to political marginalization and weak institutional frameworks within the Ministry of Livestock (Kavili, 2013).). It has been shown that, if the living standards and food security are to be improved in the arid and semi-arid lands (ASALs) including Kitui County, then livestock productivity must be increased (Nyariki *et al.,* 2009; Amwata *et al.,* 2015) considering changes taking place such human population growth, climate change, policies and livestock markets.Therefore, Agriculture being one of the devolved functions, it is critical that each county conducts its own specific studies on livestock production management in terms of types, systems distribution and agro-ecological zonation in order to devise relevant interventions based on sound knowledge. This study explains the opportunities and challenges that need to be tackled to ensure livestock contributes optimally in improving food security of the people and county as a whole.

1.2 PROBLEM STATEMENT

Agriculture remains critical for pro-poor economic growth, with livestock as the main source of livelihood in the rural areas, either directly or indirectly (GoK, 2008). However the role of livestock in promoting socio-economic development has not been fully exploited and counties in the arid and semi arid zones which also have large number of livestock record the highest poverty levels despite this great opportunity. Even though the importance of livestock in determining state of ecosystem and sustaining livelihood is known, there is limited information on livestock production systems, and factors contributing to food security at household level. To understand the overall role of livestock in food security in Kitui County, it is important to understand the different livestock production systems that exist, factors that influence food security in order to generate information to guide policy makers in developing policies which aims to improve livestock production and food security.

1.3 OBJECTIVES

1.3.1 Main Objective

The main objective of this study was to describe livestock production systems used and the role of livestock in household food security in Kitui County.

1.3.2 Specific Objectives

1. Characterise the existing livestock production systems in Kyangwithya East and Mutomo Wards.
2. Compare the household vulnerability to food insecurity in Kyangwithya East and Mutomo Wards
3. Establish factors influencing food security at household level in Kyangwithya East and Mutomo Wards.

1.4 RESEARCH QUESTIONS

1. What are the features of the different livestock production systems in Kyangwithya East and Mutomo Wards?
2. How does vulnerability to food insecurity differ across the two Wards
3. What factors influence food security in the two study area?

1.5 JUSTIFICATION

Kitui County is one of the ASAL counties in Kenya, characterized by unreliable rainfall with livestock being the main source of livelihood (GoK, 2008). Poverty levels are high as high as 63% (GoK, 2010a). Therefore Kitui County needs to devise, appropriate interventions and measures to ensure enhanced agriculture and food security for sustainable economy of the county. This cannot be achieved without a clear understanding of existing livestock production systems and their contribution to food security. Information generated in this study will enlighten the policy makers and planners of development programmes in the county on opportunities and challenges that are specific to different categories of livestock producers and production systems. This will also help in to formulating policy intervention and support evidence for the revision of Kitui County Integrated Development Strategic Plan in the future, with overall goal of reducing poverty levels and engineering economic growth in the County.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

About 10% of the population of Sub–Saharan Africa is primarily estimated to depend on their animals while another 58% indirectly dependent on varying degree on livestock (Ouma, 2003). Livestock plays an important socio-cultural role such as. dowry payment and other traditional/religious ceremonies, and has been considered an important indicator of household wealth and status quo (Ouma, 2003).

In the Kenyan economy, livestock goes beyond direct food production; sale of livestock provides direct cash income, livestock are a living bank for most of the people and have direct role in agricultural intensification through provision of capital hence livestock has multipurpose contribution to food security, agricultural production and social-cultural obligation (Nyariki *et al.,* 2009).

The livestock sub-sector contributes to the food and cash needs of the farmers, provides employment to about 10 million people, contributes 7% to the GDP and 17% to the agricultural GDP and provides 50% of the agricultural labour (GoK, 2008). The livestock industry has a high degree of vertical links with upstream and down-stream players. It is a significant user of products from feeds, drugs, vaccines and equipment manufacturing industries and provides raw materials for agro-processing industries. Therefore, any shock in the industry will affect the entire supply chain (GoK, 2010b). The key components of the livestock subsector include beef, dairy, sheep, goats, camel, hides, skins, poultry, eggs, pig production and emerging livestock species (GoK, 2010b).

2.2 FACTORS INFLUENCING THE LIVESTOCK PRODUCTION SYSTEMS

Livestock production systems it is defined as a production system where livestock are kept having similar resource base, enterprise patterns, household livelihood strategies, farming practices and constraints and for which similar development strategies and interventions can be applied.

There are several factors that influence the livestock production systems in Kenya namely altitude, temperature, soil condition, level of reliable rainfall, ecology, feed ability and diseases. This factors are defined by agro-ecological (AEZ) and different regions have varying AEZ.

2.2.1 Altitude

Altitude determines soil organic carbon (Keshab, 2016) which inturn influence the livestock production system indirectly through the kind of the pasture and fodder crops that grow in a certain location (Keshab, 2016). Arable farming is associated with humid and sub humid areas. In the highland, rainfals are fairly good.characterised by high human populations with small fertile pieces of land hence intensive dairy farming is practiced while rangelands are rich in forage which is favorable for extensive ruminant production (Ning *et al.,* 2013) these ares are also less populated.

2.2.2 Ecology and feed availability

Individual breeds have feed preferences which make them appropriate for certain environment and not others. Two or more breeds can exploit the same eco-zone by making different use of feed resources "interlocking" distribution. As vegetation gradually changes, due to climate and anthropogenic factors, producers must adapt the breed they use or bring new ones. Animals with a capacity to digest a wide range of feeds are more widely distributed than those with a restricted diet. For example, in Nigeria Sokoto Gudai cattle breed originated in arid zone of North Sokoto and is reported to be specialized in browsing (Davies, 1977). These cattle breed can digest woody vegetation, that other breeds find extremely unpalatable. These animals can thrive in regions that other pastoralists would consider overgrazed.

2.2.3 Diseases

Trypanosomiasis is usually considered to be a major factor in determining livestock distribution especially cattle (Glover, 1960;Davies (1977) studied the presence of disease carrying tsetse flies in Nigeria that he noted to greatly affect the distribution of domestic animals. He said that the cattle population of Africa could be doubled if tsetse flies were eradicated. There is little doubt that zebu cattle are progressively threatened by diseases in most humid areas. It is reported that as cattle press further down into

humid regions they became susceptible to other types of potentially fatal diseases. In Nigeria, it was reported that, when a zebu herd passed through an area with Muturu breed, the later fell sick while the zebu herd remained healthy (Glover, 1960). The Zebu presumably frequently harbors sub-clinical pathogens which infect the Muturu breed (Glover, 1960).

2.2.4 Rainfall patterns

Livestock production systems are determined by rainfall levels. For example, in the Kenya highlands, small holder dairy are found intergrating livestock with crops while agropastoralist are found in low rainfall area. Rainfal variability also affects the species kept. For instance, in agropastoralist areas, years of low rainfall farmers shifts to small ruminants while in years of good rainfall, more cattle are kept (Amwata, 2015)

2.3 LIVESTOCK PRODUCTION SYSTEMS CHARACTERIZATION

Sere and Steinfeld (1995) classified livestock production systems globally into five: landless, mixed farming, rain-fed mixed farming and irrigated mixed farming. The difference in these systems are attributed to: degree of integration with crops, land size and availability, agro-ecological zones, intensity of production and type of livestock kept. In their study, cattle, buffalo, sheep, goat, pigs and chicken were the main species kept under the different livestock production systems.

According to Boyazoglu (1998) and Philip (2010), livestock production system can be classified depending on mode of feeding degree of market and intensity of stocking. These three livestock production systems are grazing system, crop-livestock mixed system and industrial system These systems have evolved overtime due various factors such as increased consumer demand for livestock products and technological advances resulting from research (Boyazoglu,1998; Philip, 2010). These technological advances have led to improved feed conservation, better milking and feeding techniques and expansion of intensified livestock farming stimulated by genetic improvement. The global trend of increased population and increased income combined with urbanization have led to increased demand for animal products, thereby stimulating intensification of systems to increase production and productivity and shortening of production cycles.

These factors combined with resource scarcity and declining farm sizes continue to drive the evolution of different livestock production systems (Kyalo, 2009).

The grazing impact on the environment through soil compaction, overgrazing, loss of pasture biodiversity and decrease in soil fertility linked to increased soil erosion and low water infiltration. Livestock grazing is main cause of non-point pollution to water resources. Secondly, mixed crop-livestock production is the largest and the most recommended by agriculturists and environmentalist (FAO, 2001). It facilitates proper nutrient balance and retention since all the waste (manure and crop residue) is recycled within the system. Assisting nutrient balance is the method commonly used to measure impact of mixed livestock production system on environment, taking into account the nutrient deficit or surplus systems (FAO, 2001). The major challenge has been to balance between mixed production and conservation of natural resources. Lastly is the industrial system which is used in production of monogastric livestock and contributes to 43% of global meat production (FAO, 2007). The impact of this system on the environment is usually directly on land, water, air and biodiversity through emission of waste, use of fossil fuels and substitution of animal genetic resource.

Livestock contributes to food production and at the same time causes resource degradation such as water pollution, soil erosion and deforestation (Bellaver and Bellaver, 1999) if not well managed. According to Thapa and Rusul (2005) in the hill tracts of Bangladesh
agricultural systems were characterized based on 12 variables; proportion of area under shifting agriculture, horticulture, paddy cultivation, annual cash crop, number of trees, number of wood trees and number of cattle, pigs, goats, poultry and proportion of produce used for household consumption. They further established that even with similar topographical features and climatic conditions, farmers tend to have different farming systems. This was attributed to land scarcity, land tenure, household resource base, levels of institutional support, access to market and agricultural infrastructure. In support, Ali (1995) reported that physical environment and resource base are the major determinants of agricultural systems.

Also, Waithaka *et al*. (2002) characterized dairy systems in western Kenya and used principal component and cluster analysis based on biophysical variables and other farm specific variables such as mode of feeding and the type of livestock breeds kept. They concluded that intensification and enhancement of crop and livestock interactions are critical for increased livestock productivity.

Using Principal Component and Cluster Analysis, Mburu *et al.* (2017) also classified smallholder dairy farms in terms of risk management strategies, level of household resources, dairy intensification and access to services and market in the highlands of Kenya. They further clustered farmers on the basis of risk strategy, access to market, farm size, age, milk marketing channels and on farm/off farm fodder production. The dairy production system that included majority of farmers was characterized by consumption smoothing as a risk management strategy through high participation in cooperatives, limited reliance on farm produced fodder, nearness to the market centre, low milk prices and small farm sizes. In addition, land cover; human population and agro-climatology were found to determine the preference for a particular livestock production system in a given area by Kruska *et al.* (2003).

According to Kyalo (2009), using Principal Component and Cluster Analysis he, characterized livestock production systems, in River Njoro Watershed into intensive, semi-intensive and extensive livestock production systems. Intensive system was characterized by highly diversified and commercial oriented farmers and with high expenditure on concentrates. Production was described as stall feeding (zero grazing) and was in all zones of the study with feeding source being a mix of commercial feeds and the breeds were pure breeds and their crosses. Semi-intensive livestock production constituted the lowest number of households in the area of study and farmers had the lowest number of livestock holding. Their expenditure on concentrates and acaricides was lower compared to that of intensive system. Extensive livestock production system had the highest number of households spreading all over the area of study and with high number of livestock holdings. Large part of land was under pasture and had large parcels of land compared to the other systems.

2.4 LIVESTOCK PRODUCTION SYSTEMS

2.4.1 Livestock production systems in Africa

In Most African countries the livestock sector is categorized into in two: small scale and large scale production systems. Small scale production includes pastoralism and mixed small holder farming, which implies extensive or wide use of livestock in open range and intensive use of livestock as a productive asset, subsistence oriented and the most food insecure in Africa. Large scale production system includes ranching, large scale commercial farming and formal cooperative farming characterized by use of concentrates and profit maximization.

2.4.1.1 Pastolarism and Agropastoralism

Pastoralism can be defined as households that gains more than 50% of their income from livestock managed on natural pastures; and depend heavily on dairy and livestock products while agropastoralist are households who gain more than 50% of their livelihood from cultivation; and rely on both livestock and agriculture products (Bonfiglioli, 1992). An agropastoral production system is where more than 50% of household gross revenue comes from farming, and 10-50% from pastoralism (Noor *et al.,* 1999). The pastoral production systems are characterised by migration of both human and livestock in search of sufficient grazing. In terms of livestock species, camel is a key livestock species in drier areas. Some of these dry areas in Africa include, Somali, Gabra, Redille and Turkana. Pastoral mobility is changing and the definition between pastoralism and agropastoralism is blurred as pastoralist practice spontaneous sedentarization as pastoralist mobility decreases, their access to market increases allowing household to sell livestock and livestock related products easily without significant transport cost and purchase other household items. Close proximity to town enables households to access local market thereby making sound and informed decisions on their livestock holdings (Otte and Chilonda, 2002)

2.4.2 Livestock production systems in Kenya

In Kenya, Livestock production are defined by climate conditions, type of products and services and market access. Kenya has a wide diversity of agro-climatic conditions due to variations in altitude, temperature, soil conditions and level and reliability to rainfall.

Dairy production is concentrated near consumers in areas such as Nairobi-Kiambu and in the highlands with suitable agro-climate and human population density while meat production is dominant in arid and semi-arid areas of Kenya (Mburu et al., 2007). Ruminants are the major species kept in Kenya and are distributed across all production systems. The total population of ruminants was estimated at about 67 million, of which 3.4 million were dairy cattle, 14.1 million zebu cattle, 27.7 million goats, 17.1 million sheep, 2.9 million camels and 1.9 million donkeys (GoK 2010a).

Smallholders farming forms 80% of the farming system in the country and it involves livestock and crops as the main component of the system (Njarui *et al.,* 2009; Njarui *et al.,* 2016). This farming system cuts across different climatic conditions; from humid and sub-humid; central highlands around Mt Kenya and Aberdares, Rift Valley, western highlands and a narrow strip along the coastal lowlands) to semi-arid in the eastern Kenya and parts of central Rift Valley (Njarui *et al.*, 2016).

Zero grazing or stall feeding were confimed and feed delivered due to limited land sizes and high population density (Mburu *et al.*, 2007). Besides, grazing is preferred in areas with large tracks af land with large herd size such that, farmers can set aside land for grazing and land for crop production. Under **semi intensive system**, animals are grazed on pastures during the day and stall-fed with more feeds in the evening (Njarui *et al.,* 2009).

2.5 FOOD SECURITY

Food insecurity was used as proxy for livelihood in this study. Food security may be defined as access by all people at all times to adequate food for active life (Kigutha, 1994; Nyariki and Wiggins, 1997; Amwata 2004, 2014). Food security encompasses food availability through production, storage or import; and the access that people have to food through their purchasing power in the markets (Amwata *et al*., 2015). Food access derived from the entitlements a household has to food, either through its own production of foodstuffs or through command over food in markets or other circuits, decisions over the amount and kind of food produced or bought, the internal distribution of household food amongst residents, and the health of individuals which affects the ability to secure nourishments from food, (Nyariki *et al*., 2002). Therefore, food

security issues are important for planning and managing range resources to improve livelihoods. This is because they underscore the complexity of ever changing rural livelihood, especially in terms of charging access to physical resources essential for survival (FAO, 1989).

2.5.1 Food Security in Kenya

The current food situation in Kenya is drastically different from that of the mid-1970s. Much effort has been geared towards increasing food production in order to cope with the massive food shortages faced due to a rapidly growing population. Policies aimed at increasing agricultural production were stressed and many of the modern improved agricultural technologies have gone a long way in reducing hunger (Kennedy and Haddad, 1994). Reduction in hunger has been attained through increased agriculture production, employment, as well as indirectly through lower food prices and off-farm employment. The concept of "sustainable livelihood security" has been suggested as a replacement for "food security" (Chambers, 1987). This is because poor rural people seldom limit themselves to agriculture in constructing a living; the concept of "livelihood security", therefore, should more accurately reflect the needs and concerns of the rural poor than food security".

2.5.2 Poverty Incidence

Poverty incidence is the ratio of food poor households in relation to all households in the community (Amwata, 2004). This gives the food poverty status of community under investigation (Amwata *et al.,* 2015). This has been used by researches to determine food security status of households by collection of day to day data on household food consumption. Total calorie consumption per household per day divided by the sum of Active African Man Equivalent (AAME) gives the food security status of a household (Nyariki *et al*., 2002).

Food security index is derived by calculating the proportions of household's cash spend on various food items and non-food items, and then minimum cash required per AAME can be worked out (GoK, 2000b). There are standard units to compare the nutritional requirement of people of different ages and gender. The daily caloric intake by members

of households is used as a measure of household food security (Nyariki, 1998). The assumption is that the daily food energy requirement of one AAME is 2,250 kcal (Nyariki and Wiggins, 1997). The consumption weights by ages are 0-4 years, 0.24 AAME; 5-14 years, 0.65 AAME and above 15 years, 1.00 AAME (Amwata *et al.*, 2015). Child nutrition has also been reported to be essential in determining household food security, especially when the security of intra-household nutrition is a concern raised in literature on food security. Attention is given to women and children, the most vulnerable members of the poor households. Such households discriminate among its members in distributing food, when food supply is inadequate, but declines with plenty supply (Tangka *et al*., 2000).

Several methods have been used to estimate nutritional measurements. Parameters such as Weight-for Age (W/A0, Height-for-Age (H/A), Weight-for-Height (W/H), Head circumference and mid-arm circumference for different age groups have been used as a bases for assessing malnutrition and evaluating effects of dietary treatment in children. Weight, height, head circumference and mid-arm circumference for age are the percentages of adequacy of each of these measurements based on the respective standards for the children's chronological age (Tangka *et al*., 2000). Drought, poor infrastructure and lack of organized markets have affected food security for pastoral people (Sunya, 2003) and has been exacerbated by increased desertification, high population growth and conflict.

Drought reduces crop yields per hectare and milk yields from flocks and herds, and increases livestock mortality rates (Amwata, 2004). For example, in Ethiopia mortality during drought is as high as 68% and as low as 11% during bad and good rainfall years rspectively (Nyariki *et al*., 2002). Loss of flexibility to grazing land due to establishment of social amenities such as schools, police posts which has attracted people to settle permanently has also affected food security. In addition, introduction of free education in Kenya in 2003 has reduced herding labour and this coupled with poor infrastructure leads to exploitation by middlemen (Amwata, 2004).

2.6 EFFECTS OF CLIMATE CHANGE ON LIVESTOCK PRODUCTION

Livestock production systems are modified by extreme weather events such as high leves of carbon dioxide (CO_2), changing rain patterns or high temperatures. Climate change may also the enhance rate of vector-borne diseases development, accompanied by emergence and increased transmission of new diseases (Nardone *et al.,* 2010).

Drought may threaten pasture and reduce feed supplies and reduce the amount and quality of forage available to grazing livestock. Some areas could experience longer, more intense droughts, resulting from higher summer temperatures and reduced precipitation. Lack of water will place increased demands on available water resources affecting water quality and quantity on a seasonal basis (IPCC, 2001)

Increases in carbon dioxide (CO_2) may increase the productivity of pasture and fodder but may also decrease their quality. However, studies indicate that the quality of some of the forage found in pasturelands decreases with higher CO_2. As a result, cattle would need to eat more to get the same nutritional benefits (IPCC, 2001; Amwata *et al.,* 2015).

2.7 LIVESTOCK PRODUCTION AND FOOD SECURITY

2.7.1 The Role of Livestock to Household Food Security

The role of animals in food and agricultural development programmes is underestimated almost everywhere in the world, especially in the developing counties (Nabarro and Wannous, 2014). The contribution of the animal to both agricultural and economic development has not been adequately evaluated. In most studies, non-food outputs which are difficult to quantify in monetary terms are excluded.

Livestock is a source of high quality food and source of income for many rural households in developing countries (Charlotte *et al.,* 2002). At National level, livestock food product represent 27% of the total agricultural output in most of these countries, while at farm level, cash can be generated from sale of live animals, meat, milk, hides, fee from draught power and transport services (Kavili, 2013).

Livestock acts as cash buffer by providing economic stability; livestock acts as capital reserves and deterrent against inflation. Further, livestock reduces the risk associated

with crop production. In mixed farming systems, it also represents liquid assets that can be realized at anytime and this bring stability to production (Charlotte *et al.*, 2002). Cattle and donkey provide draught power such as pulling of the plough, fetching of water and ferrying of farm produce, charcoal and firewood to markets and homesteads.

Integration of livestock and crops allows efficient nutrient recycling. Animal use the crop residues as feed (straws, maize and sorghum stover and ground nuts) while the manure produced by animals can be recycled directly as organic fertilizers. One tonne of cow dung contains about 8 kilograms(kgs) of nitrogen, 4 kgs of phosphate and 16 kgs of potassium oxide (K_2O) (Ange, 1994). Poultry manure is a more efficient fertilizer than cow manure because of the nature of their diet. Manure also provides important organic matter to the soil, maintaining its structure, water retention and drainage capacity. The value of manure is so well recognized such that some farmers keep livestock primarily for it (Mucheru *et al*., 2003).

Financial services such as banking, insurance and credit are non-existent in rural areas of many developing countries hence livestock play an important role as a means of saving and capital (Kavili, 2013). Combinations of small and large livestock can be sold to meet petty-cash requirement to cover seasonal deficit or to finance large expenditure (Nyariki *et al.*, 2002). Also livestock has a significant role in social and cultural events of many communities and it's not possible to attach value to many of these roles (Kavili, 2013).

2.7.2 The Role of Policy in Livestock Production

Livestock interacts positively with environment by enhancing soil fertility and nutrient balance (Kyalo, 2009). On the other hand, livestock causes water and air pollution and loss of biodiversity due to overgrazing. In support, Gumpta (1995) and Mearns (1996) recognize the roles policy and institutions play in influencing livestock-environment interactions for sustainable utilization of resources in the process of development.

The policy makers have a challenge of developing and implementing policies which can enhance the interaction between livestock and natural resources for sustainable development (Kyalo, 2009). Government legislation can have direct or indirect impact on the way economic agents (household, individuals or firm) make and implement

decisions. Livestock constitutes a household asset which can easily be liquidated if economic incentives to keep them are lacking *ceteris peribus* (Jarvis, 1993).

The government through policies can strongly impact on livestock production through protection of property rights especially land ownership, agricultural extension, infrastructure, access to and terms of credit, and input and output prices facing farmer (Kyalo, 2009).

Policy interventions can enhance adoption of sustainable farming systems and reduce pressure on natural resources. One of the driving forces of environmental degradation has been population pressure and it can only be addressed through alternative livelihood that helps to reduce agricultural population to a level that the land can sustain. Besides mechanization offers potential for improved productivity per unit area of land.

CHAPTER THREE

MATERIALS AND METHODS

3.1 STUDY AREA

3.1.1 Location and Size

Kitui County is one of the 47 counties in Kenya located in south eastern part of the Country It borders Machakos and Makueni Counties to the West, Tana River County to the East, Taita-Taveta to the South, Embu and Tharaka-Nithi Counties to the North. It is located between latitudes 0 ^{o} 10' and 3^{o} South and Longitude 37^{o} 50'and 39 ^{o} East. It covers 30,496.5km^{2} including 6,290.3km^{2} occupied by the Tsavo National Park (GoK, 2013). It is divided into eight sub counties namely, Kitui Central, Kitui South, Kitui west, Kitui rural, Kitui East, Mwingi North, Mwingi East and Mwingi. Figure 3.1 Shows location of study sites; Kyangwithya East and Mutomo Wards, Kitui County.

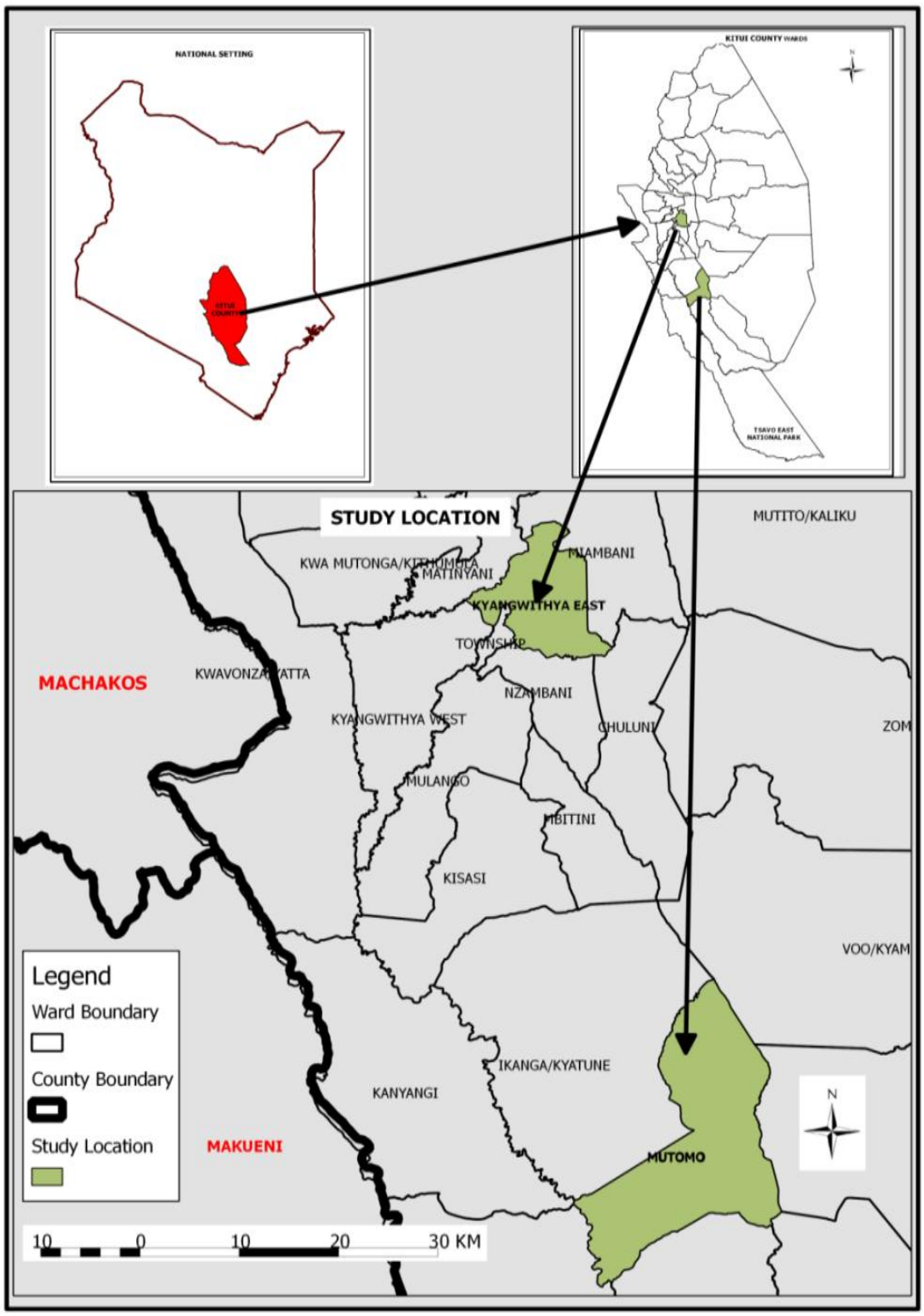

Figure 3.1: Map of Kitui county showing the two study sites; Kyangwithya East and Mutomo Wards

3.1.2 Physical and Topographic Features

Kitui County lies between the altitude of 400 metres and 800 metres above sea level. It is divided into eight sub counties and 40 Wards, Mwingi north, Mwingi East, Mwingi west and Kitui Central having five Wards each. Kitui rural and Kitui west have the lowest number of Wards (four) while Kitui south and Kitui East have the highest number of Wards (six). The central part of the county is characterized by hilly ridges separated by wide low lying areas and has slightly lower elevation of between 600 meters and 900 metres above sea level. Kitui Central, Mutitu Hills and Yatta Plateau are the highest areas, receiving more rainfall than other areas in the county and are the most productive areas. Yatta Plateau is the main relief feature in western side of the county, stretching from north to south of the county and lies between river Athi and Tiva. The plateau is characterized by plain wide shallow spaced valleys (GoK, 2013a; GoK, 2013b)

3.1.3 Geology

The county is composed of basement metamorphic rocks whose various gneisses are exposed in the few hills found in the county. The soils type include loamy sandy soils, patches of black-cotton soils and red sandy soils with the latter being dominant. The western part of the county has black cotton soils which are generally of low fertility. River valleys have saline alluvial soils of moderate to sometimes high fertility. In general, soils of the county are of low fertility and are prone to erosion (GoK, 2013a)

3.1.4 Agro -Ecological Zones

The County has four agro-ecological zones. Semi-arid farming zone, which has good potential for agricultural development and is currently either cultivated or under woodlands. Semi-arid ranching area is less fertile and currently used for drought resistant crops and livestock keeping. The arid agro-pastoral areas are generally suitable for grazing, though due to population pressure, the land is being put under crop production. Finally, arid pastoral zones are only suitable for rearing of livestock (GoK, 2013a).

3.1.5 Climatic Conditions

The climatic condition varies across the county in terms of rainfall and temperature**.** The mean annual rainfall ranges between 300mm - 1050mm per annum with varying distribution. The rainfall is bi-modal with long rains falling in the months of March to May and has a reliability of 40% while the short rains fall between October and December with a reliability of 66%. Temperatures are high throughout the year and ranges between 14^{o} C to 34^{o}C. The hot months being mid-July and September,and January and February. The maximum mean annual temperature range between 26^{o}C and 34^{o}C. Minimum mean annual temperature ranges between 14^{o}C and 22^{o}C. July is the coldest (14^{o}C) month while September is the hottest month (34^{o}C) (GoK, 2013a; GoK 2013b).

3.1.6 Population

According to 2009 census, the population of Kitui County was 1,012,236 persons and was expected to grow to 1,077,359 persons in 2012, with growth rate of 2.1%, a figure slightly lower than national rate of 2.6% and over 50% of the population lives in rural areas. Population density is 33 persons per km^2 while 63% of the population live below the poverty line (Population Action, 2014).

3.1.7 Economic Activities

Kitui County natural resources are arable land, livestock, forests and wildlife. The area is predominantly a livestock rearing area with crop production. Livestock enterprise is one of the major sources of livelihoods (GoK, 2013b), and the livestock species and breeds kept being zebu, boran, sahiwal, freshian, and ayrshire for cattle, goat (the small east african, galla, torgenberg) sheep (black headed persia, red maasai). Poultry and bee keeping have high potentials if fully exploited. The farmers also grow both food and cash crops for subsistence and income. The crops grown include maize, green grams, beans, cowpeas, peas, millet, sorghum, tobacco, cotton, coffee, and mangoes (GoK, 2013a).

3.2 STUDY DESIGN

The study was cross-sectional study conducted in Kyangwithya East and Mutomo Wards in Kitui County between December 2014 and March 2015.

3.3 TARGET POPULATION

This study targeted households in Kitui.The study population was all households in Kyangwithya East and Mutomo Wards, both livestock owning and non-livestock owning households.

3.4 SAMPLE SIZE

The sample size for this study was 110 households. The population of the study area was 1,012,709 persons comprising of approximately 205,491 households (KNBS, 2010). A proposed sample size was calculated based on the formula used by Israel (1992) and assuming 95% confidence level and p = 0.05

$$n= \frac{N}{1+N(1e^2)} = \frac{1012709}{1+1012709(.1^2)} = 99$$

Where:

n= was the sample size

N= was the population Kitui County

e =is the level of precision/sampling error 10% was used.

Additional 10% respondents were included to cater for attrition, thus the total number of respondents was 110. These sample sizes have been used in other studies and produced meaningful results, for example (Nyariki *et al*., 2009).

3.5 SAMPLING DESIGN

The sampling design for this study was multistage sampling design. In the first stage, all sub-Counties were listed and two sub-Counties randomly selected. All the Wards in the two selected sub-Counties were listed and one Ward per sub-county randomly selected. Total number of household sampled in each Ward were determined proportionately to size. Final stage was systematic random sampling to identify households to be sampled in each Ward.

3.6 DATA COLLECTION

Data was collected through observations, photoghraphs and a semi-structured questionnaire. Prior to the actual data collection, a reconnaissance survey was carried out to pre-test the questionnaire. Data was collected at household level. Consent was sort and each respondent was guided to fill the questionnaire.

3.7 TYPE OF DATA COLLECTED

The information collected to achieve study objectives include; household sizes, age of household head, gender of the household head, marital status and level of education of household head, livestock holdings, feeding methods, breeding methods, expenditure on livestock, livestock cash income, crop cash income, gifts, market information, livestock production challenges, extension services and access to climate information.

3.8 DATA ANALYSIS

Descriptive statistics was done to get the frequencies and percentages for qualitative variables and measures of central tendency and dispersion for quantitative variables and stratifications were used to compare the data from both Kyangwithya East and Mutomo Wards. Multiple linear regression was conducted to determine factors influencing food security in the two study sites.

3.8.1 Descriptive Statistics

Descriptive statistics on livestock owned, monthly incomes and expenditure on livestock were derived for each of the household in the study sites. Different sources of incomes such as livestock sales, monthly remittances were compared between Kyangwithya East and Mutomo Wards. Contribution of each source of income to the total income was calculated and then compared between the two Wards.

Mean land size holdings, income per hectare, mean TLU owned and mean distance to source of water were compared across the different livestock production systems. Besides household size was standardized to adult equiveivalent (AE) . The concept of AE is based on the differences in nutritional requirements per age and sometimes sex. It assumes the life-cycle stages have an important influence on the needs of members or individuals of the same household (Kristjanson *et al*., 2002). Various consumption weights have been proposed over time.

Livestock holdings were standardized into Tropical Livestock Units (TLU) in order to understand livestock production systems and the factors influencing them. The data was evaluated with a view to characterize different production systems in the two study areas. Tropical Livestock Units converts different ages and species of livestock into homogenous unit for livestock owned across species. One TLU is equivalent to 250 Kgs and equals to 0.7 cattle, 0.5 donkey, 0.1 goat/sheep, 0.2 pigs, 0.01 chickens, 0.01 rabbits (Njuki *et al.*, 2011). Herds were categorized into three groups based on livestock units, "small" "medium" and "large". Small herds were those with < 5 TLU, medium with >5 to ≤10 TLU while large households were those owning > 10 TLU.

3.8.2 Regression Analysis

Multiple linear regression analysis was used to determine the effect of a number of variables on food security in Kyangwithya East and Mutomo Wards. The regression analysis involves one dependent variable (γ). In this study, household monthly income/AE was the dependent variable (γ). This model requires the dependent variables (x_i) to be quantitative and continuous while the independent variable may be both quantitative and qualitative. The assumption is that the relationship between the (y) and x_i is linear. The model is as follows

$$\gamma = \alpha + \beta_1\ x_1 + \ \beta_2\ x_2 + \beta_3\, x_3 \ldots\ldots + \ \beta_n\, x_n + \ \epsilon n$$

Where

α = constant term

ϵ = Error term

$\beta_1\, \beta_2 \ldots\ldots\ldots\ldots\ldots\ \beta_n$ = regression coefficient

$x_1\ x_2\ \ldots\ldots\ldots\ldots\ldots x_n$ = Independent variables

The specified model used;

$$\gamma = \alpha + \beta_1\, x_1 + \beta_2\, x_2 + \beta_3\, x_3 + \beta_4\, x_4 + \beta_5\, x_{n5} + \beta_6\, x_6 + \epsilon$$

Where γ

γ = Household monthly income/AE

ϵ= Error term

X_1=Gender of household head

X_2=Herd size in TLU

X_3=Age of the household head

X_4=Access to extension services

X_5=Access to climate information

X_6=Member of a group

3.8.3 Measurement and Definition of Variables Used in the Model

3.8.3.1 Food security

According to Nyariki *et al. (*2002) and Amwata *et al*. (2015), food security is defined as the availability of adequate diet all year round. Food requirement are better assessed using Active African Man Equivalent (AAME). The number of household members were converted in to AEs energy requirements per day based on ages (GoK, 2000a). This study used income per adult equivalent approach to estimate household vulnerability to food insecurity. This approach involves collection of data on household total income and the number of individuals present. Total income refers to an aggregate value of livestock, crop and any other source income in a given time period (Amwata *et al.,* 2015). In addition, the number of members present in a household was standardized into adult equivalents (AE) based on the differences in nutritional requirements according to age (Kristjanson *et al*., 2002). Depending on the size and ages of the household members, adult equivalent (AAME) was derived. Poverty lines for Kenyans in rural and urban areas are Kshs 1,250/month/adult equivalent and Kshs 2,648/month/per adult equivalent respectively (GoK, 2000b). Kenyans living below these standards are thus considered to generate inadequate income to meet basic needs for their families. Total income per household per month divided by the sum of AAME

gives the income per adult equivalent per month. For the calculation of household vulnerability to food insecurity, the equation below was used:

VFIt= Ya/Yr

Where ;

VFIt = Vulnerability to food insecurity at a time

Ya =Actual average income per AE/month for a household

Yr = Required average income per adult equivalent/month for that household

This was then in turn compared in relation to the Wards and livestock production systems. Households with a ratio falling below one were termed as food insecure while those at one or above one were considered food secure.

3.8.3.2 Sex of the household head

Studies have shown that households headed by females are likely to be more food secure than the male headed households (Nyariki *et al.*, 2002). This is so because female headed households give priority to food purchase in their budget rather than non-food items. In addition, Mencher (1985) and Gulati (1980) established that men give priority to purchase of more cattle and other non-food items.

3.8.3.3 Herd size

Livestock can be moved in response to variable rainfall conditions and can be purchased or sold in response to changing marketing conditions, thereby contributing towards food security and households survival during difficult times such as droughts. Therefore, livestock owned by a household is expected to influence household food security (ILRI, 2000).

3.8.3.4 Age of the household head

Age is the number of years an individual has lived. The age of the household head is likely to affect the household food security status. Food production increases with increase in age due to more wisdom and experience in farming over time (Amwata, 2004)

3.8.3.5 Access to extension

It is believed that farmers accessing extension services are more likely to adopt intensive production systems which inturn would improve food availability (Kyalo, 2009).

3.8.3.6 Membership to organizationed groups

Farmers being member to a certain group have the prevelage to credit facilities and excess to extension and hence are said to be food secure (Kyalo, 2009).

CHAPTER FOUR

RESULTS

INTRODUCTION

This chapter describes the study area and the data collected. The section describes the respondents household demographic characteristics, livestock production systems and respondents' perception regarding factors affecting livestock production and lastly details of factors contributing to livelihoods.

4.2 MUTOMO WARD

Mutomo is a semi-arid and arid zone with unpredictable, irregular and unevenly distributed rainfall of about 400 mm annually and temparature of 30^0C . It lies the in arid pastoral zone. Due to erratic rain received, plant life can only be supported for less than 90 growth days (DAO Mutomo, 2012). This prevents sustainable cropping in most years. Therefore, this area is mostly used for grazing. The few crops grown include millet, sorghum, cowpeas, maize and pegion peas. The vegetation cover mainly consists of annual grasses, shrubs and trees.

Lack of clean water is one of the primary problems of the area. Residents get water from dams, seasonal rivers, boreholes and rock catchments. Equator is 200 km to the North and temperatures are consistently high contributing to frequent periods of drought. Poverty is prevalent with the area being among the poorest in Kenya (DAO Mutomo, 2012)

4.2 KYANGWITHYA EAST WARD

This Ward is one of the six Wards in Kitui Central sub-County. It lies in semi-arid farming zone with annual rainfal of 450mm and temparature ranging between 15^oC and 28^oC (DAO Kitui Central, 2012) . The area is hilly with several water catchment areas, among them Museve/Kavonge and Wanzua/Kwamutheke. The population density is high than that of Mutomo Ward. Residents get water mainly from boreholes The area has two semi permanent rivers, Kalundu and Nzee. Other water sources include shallow wells. Pasture is mainly natural grass with some farmers growing nappier grass.

4.3 LIVESTOCK PRODUCTION SYSTEMS

The livestock production systems in the study area were characterized into five based on species of livestock kept, Number of TLU owned, method used to feed livestock, and intensity of stocking. The five systems were identified include; low intensive ruminant production, low intensive mixed species production, extensive ruminant production, extensive mixed species and non-ruminant production system. However, poultry was kept across all production systems.

4.3.1 Low Intensive Ruminant Production Systems (LIRPS)

Farmers in this system keep primarily ruminants, that is, cattle, goats and sheep. This system is practiced by 11.8% of the respondents of whom 61.5% and 38.5% were from Kyangithya East and Mutomo Ward respectively. On average, TLUs owned were 3 with a median of 3 and range of 1 to 8 TLUs. Figure 4.1 shows the distribution of species kept in low intensive ruminant production systems in the study area.

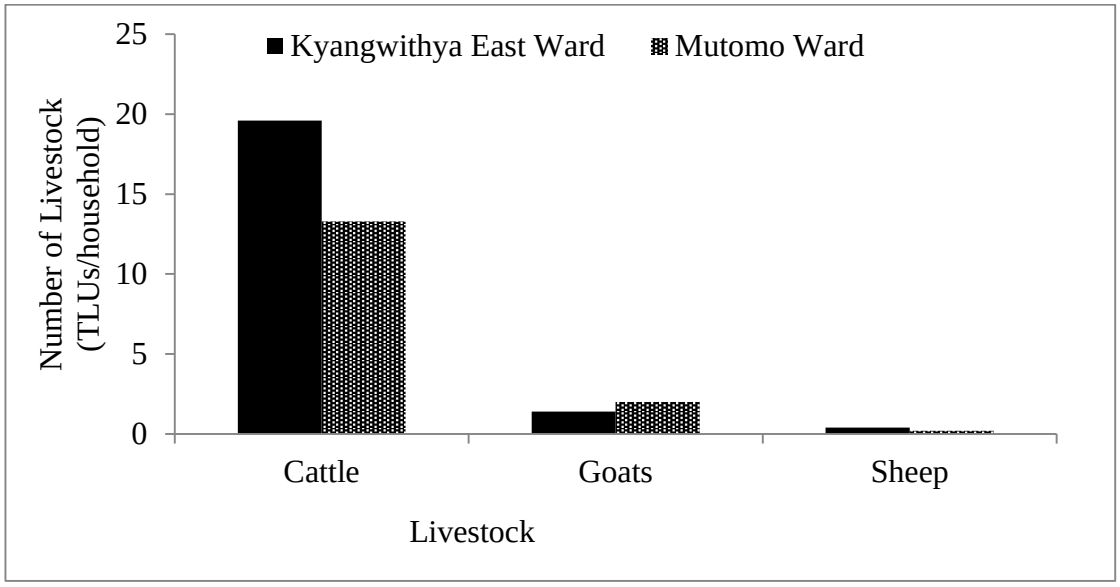

Figure 4.1: Distribution of livestock species in low intensive ruminant production systems

From figure 4.1, more cattle and sheep were kept in Kyangwithya East than Mutomo with the latter having more goats than the former.

The carrying capacity was 2.23ha/TLU. Livestock in this system are mainly stall fed with farmers purchasing supplements for their livestock at an expenditure of Ksh.1881 per household per year. Income was estimated as 879 Ksh/ha/month while the mothly income was Ksh 991/month/AE. The household size was 3.9 adult equivalents with standard deviation of 1.6. The main breeding method was artificial insemination (AI) with majority, 84.6% reporting to have used AI. Farmer easily access water at their compound during rain seasons. However, during dry season, they travel to an of approximately 40 km to get water.

4.3.2 Low Intensive Mixed Production System (LIMPS)

Under this production system, the livestock kept include cattle, goats, sheep, donkey, rabbits, and pigs. These system is practiced by about 10% of all the respondents, of whom 80% were from Kyangwithya East Ward and 20% from Mutomo Ward. The average TLU was 2.8 with a median of 2 and range of 1 to 7. The adult equivalent was 4.4 with a median of 4 and ranged from 2.54 to 6. Figure 4.2 shows the distribution of livestock species per household in Kyangwithya East and Mutomo Wards.

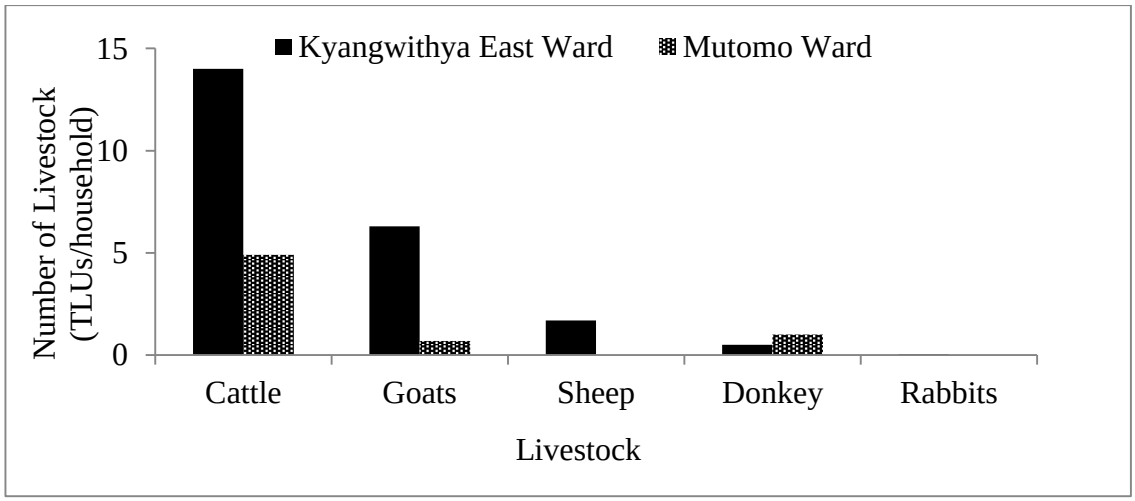

Figure 4.2: Distribution of livestock species in low intensive mixed production system.

From the Figure 4.2, cattle, goats and sheep were reared in larger numbers in Kyangwithya East while donkeys and rabbits were maily reported in Mutomo Ward though in low numbers. The feeding system is mainly zero grazing, with farmers providing supplements to their livestock. Mean expenditure on livestock supplements was high compared to low intensive ruminant production systems; at Ksh.4,845. The

system livestock productivity was estimated as 568 Ksh/ha/month with income of 912 Ksh/month/AE. Size of land is larger than in the low intensive ruminant production at 3.125 ha/TLU. During the wet seasons farmers do access water easily at their farms however during dry seasons, they travel a distance of an average of 40 km to get water. Bee keeping is practiced by 6.25% of the respondents all from Kyangwithya East.

4.3.3 Extensive Mixed Production System (EMPS)

These were the main livestock production systems in the study area and was practiced by 38% of the all the farmers. Among these 61.9% and 38.1% were from Mutomo and Kyangwithya East Wards respectively. The system is characterised by different livestock species namely cattle, goats, sheep, donkey, rabbits and beekeeping. Livestock in this system are fed by grazing the animals in the fields with standing hay and browse as the main feed component. Bulls are used for breeding as reported by 83% of the farmers while the other farmers used AI (17%) The mean TLU was 7.8 with a median of 6 and a range of 1 to 31 with an evarage of 0.693ha/TLU, income of 1742 Ksh/ha/month and income estimate of 931 Ksh/month/AE. Majority, 95% of the respondents had never purchased supplements for their livestock thus reporting a mean expenditure of Ksh.177 per year/household. Adult equivalent in these systems had a mean of 5.5 with standard deviation of 1.8. Figure 4.3 shows number of livestock kept in extensive mixed species production system in Kyangwithya East and Mutomo Ward.

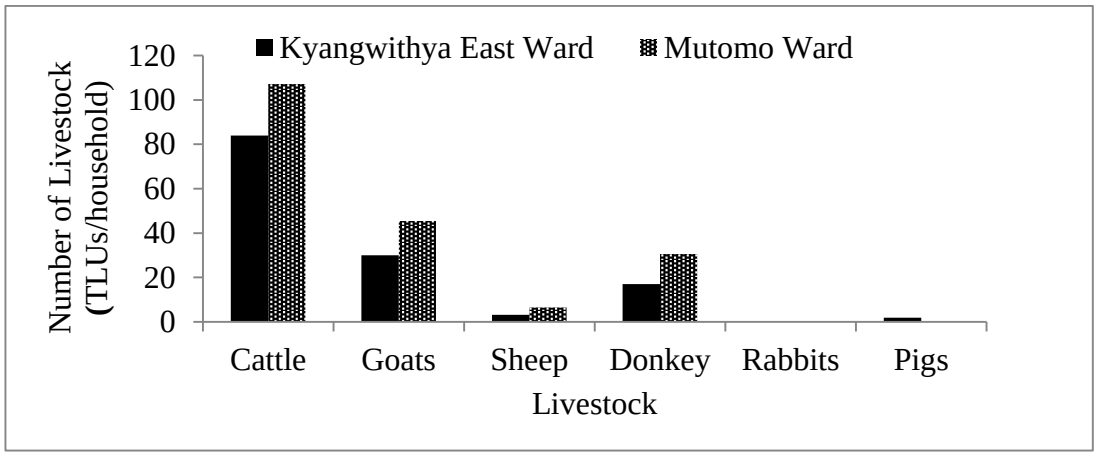

Figure 4.3: Distribution of livestock species in extensive mixed production system

Of all the donkey reported in the study, 94.9% were found in this system. Besides, 70% and 58% of goats and cattle are found under in this system respectively. Most sheep 48.8% were found in this livestock production sytem.

Distance to water sources varied with season. During wet season, water was easily available in both Kyangwithya East and Mutomo while during the dry season, farmers would travel for an average of 47 km in Kyangwithya East and 50km in Mutomo looking for water. Beekeeping is practiced by a few respondents (35.5%) of which 70% are found in Mutomo Ward and were mainly using traditional log beehives.

4.3.4 Extensive Ruminant Production System (ERPS)

These systems are the second most practiced after the extensive mixed production systems. Cattle, goats and sheep are the main livestock species kept. The systems are practiced by 34.5% of the respondents of which 78.9% were from Kyangwithya East and 21.1% from Mutomo Ward. The main feeding method is grazing on standing hay. Some farmers planted fodder for their livestock depending on the species kept that is nappier grass planted by 50% of the respondents, Lucaenna by 23.7% and Calliadra by 52.6%. Lucaenna and callliadra were mostly found in farms with milk goats. Most spondents (70%) use artificial insemination for breeding cows. Figure 4.4 shows distribution of livestock species in ERPS.

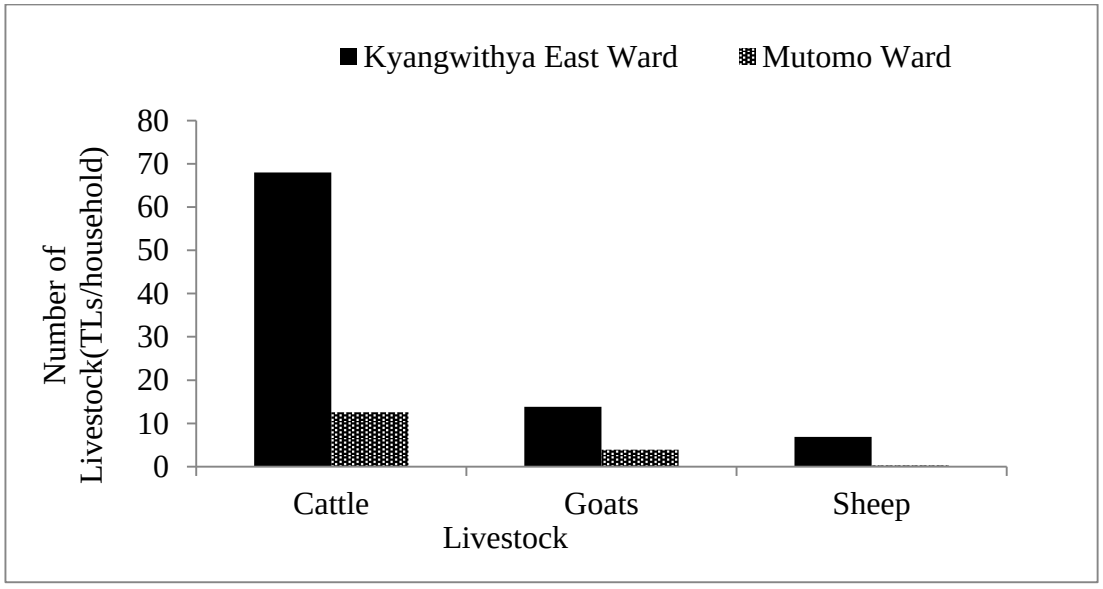

Figure 4.4: Distribution of livestock species in extensive ruminant production system

The above figure (4.4) demonstrate that Kyangwithya East Ward has the highest number of livestock. In these systems, average TLU was 3 with a median of 3 and arrange of 1 to 12. The carrying capacity was 1.74ha/TLU and average adult equivalent of 4.7 with a standard deviation of 1.8. Income was estimated as Ksh 978/month/ha with an average income of ksh 663/month/AE.

A majority of the households (81.6%) primarily used bulls for breeding cows. Beekeepering was also practiced and 48.3% of all the beekeepers were found in this systems of which about 80% were from Kyangwithya East Ward and used Langstroth bee hives. Figures 4.5, 4.6 and 4.7 shows examples of fodder gown in the study area.

Figure 4.5: *Calliadra calothyrsus* in Kyangwithya East Ward

Figure 4.6: *Leucaena leucocephala* in Kyangwithya East Ward

Figure 4.7:*Pennisetum purpureum* (Napier grass) in Mutomo Ward

4.3.5 Non-Ruminant Production Systems (NRPS)

In these systems the respondents kept free range indigenous chicken as the main livestock. The systems are practiced by only 6.3% of the farmers among which 40% were from Kyangwithya East and 60% from Mutomo Ward. The adult equivalent is 4.2 with a standard deviation of 1.8 and TLUs of one. Income was estimated as ksh 232/ha/month with a mean income of ksh 51month/AE. The ratio of grazing land to TLU was highest in this system at 22ha/TLU while only 0.9% of the respondents kept bees.

4.3.6 Summary of the livestock production sytems and their characteristics

From table 4.1 below, it was evident that grazing land decrease as the TLU increased; Extensive mixed with a mean TLU of 7.8 had the smallest carrying capacity followed by extensive ruminant. Productivity was highest (Ksh. 1742/ ha/month) in extensive mixed production and lowest in non-ruminant production system at Ksh.232/ha/month. Bee keeping was mainly done in the extensive forms of production. Table 4.1 shows a, summary of the various types of livestock production systems in the study area.

Table 4.1: Summary of the livestock production systems and their characteristics

Characteristics	Low Intensive Ruminant systems	Low Intensive Mixed Systems	Extensive Ruminant Systems	Extensive Mixed Systems	Non-Ruminant Systems
Percent of respondents involved	11.8	9.3	34.5	38.1	6.3
Species kept	Cattle Goats Sheep	Cattle Goats Sheep Donkey Rabbits Pigs	Cattle, Goats Sheep	Cattle Goats Sheep Donkey Rabbits	Chicken
Mean TLU	3	2	3.1	7.8	1
Grazing land ha/TLU	2.23	3.125	1.74	0.66	22
Average mothly income/AE	911.3	911.9	663.2	931.4	51.9
Household size In AE	3.9	4.4	4.7	5.5	4.2
Main breeding method	A.I	Bulls	Bulls	Bulls	-
Percent of respondents practising bee keeping n=31	6.45	6.45	48.4	35.5	3.2

4.4 DESCRIPTION OF HOUSEHOLD CHARACTERISTICS IN EACH LIVESTOCK PRODUCTION SYSTEMS

4.4.1 Age of the Household Head

To understand age distribution among household heads in the study area, age was grouped into three; ≤ 35 years, 36-50 years and >50 years. Among the respondents, 4.5% were aged 35 year and below, 40.9% were between 36-50 years while the majority (54.5%) were above 50 years. Table 4.2 shows the distribution of respondents in relation to age in each of the identified production systems.

Table 4.2: Respondents age distribution in each of the identified relation to production systems

Wards	Age (years)	Low Intensive ruminant	Low Intensive mixed	Extensive ruminants livestock	Extensive mixed	Non-ruminant system	Total
Kyangwithya East (n=64)	≤ 35	0(0)	0(0)	1(1.6)	3(4.7)	0(0)	4(6.3)
	36-50	4(6.3)	5(7.8)	14(21.9)	4(6.3)	1(16)	28(43.7)
	>50	4(6.3)	3(4.7)	15(23.4)	9(14.0)	1(1.6)	32(50)
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(3.1)	64(100)
Mutomo (n=46)	≤ 35	0(0)	0(0)	0(0)	1(2.2)	0(0)	1(2.2)
	36-50	3(6.5)	2(4.3)	0(0)	9(19.5)	3(6.5)	17(36.9)
	>50	2(4.3)	0(0)	8(17.4)	16(34.7)	2(4.3)	28(60.8)
Total		5(13)	2(4.3)	8(17.4)	26(56.5)	5(10.8)	46(100)

NB: Figures in brackets are percentages

The mean age of respondents in Kyangwithya East was 53.6 years while for Mutomo was 51.8 years. Table 4.2 shows that, extensive production sytems were the most preferred livestock production systems by those who had >50 years. The youth did not practice any form of intensive production systems. Intensive livestock production systems were mainly practiced by respondents who were above 35 years in both Wards.

4.4.2 Marital Status of household head

In Kyangwithya East, 92.2% were married, and 7.8% single while in Mutomo,85% were married and 15.2% single. Table 4.3 shows distribution of marital status in reach of the livestock production systems.

Table 4.3: Distribution of marital status of household head in each livestock production system

Ward	Marital status	Production system					Total
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminant livestock	Extensive mixed	Non-ruminant system	
Kyangwithya East (n=64)	Married	8(12.5)	8(12.5)	28(43.8)	14(21.9)	1(1.6)	59(92.2)
	Single	0(0)	0(0)	2(3.1)	2(3.1)	1(1.6)	5(7.8)
Total		8(12.5)	8(12.5)	30(46)	169(25)	2(3.2)	64(100)
Mutomo (n=46)	Married	4(8.7)	2(2.6)	7(15.2)	22(47.8)	4(8.7)	39(85)
	Single	1(2.2)	0(0)	1(2.2)	4(8.7)	1(2.2)	7(15.2)
Total		5(11.1)	2(2.6)	8(17.4)	26(56.5)	5(10.9)	46(100)

NB: Figures in brackets are percentages

It was eveident that many single respondents did not practice intensive production systems as show in Table 4.3 above. Non ruminant livestock production systems was found in both Wards but were greatest in MutomoWards.

4.4.3 Education of the Household Head

In this survey, education level was classified into no formal education, primary, secondary and post-secondary levels. Approximately 9% had no formal education, 40% had attained primary education, 31.8% secondary while only 19.1% had attained post-secondary education. Table 4.4 shows distribution of education in each of the household head.

Table 4.4: Distribution of education in each of the livestock production system

Wards	Education Level	Production System					Total
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants livestock	Extensive mixed	Non ruminant system	
Kyangwithya East (n=64)	None	0(0)	0(0)	4(6.25)	1(2.1)	1(2.1)	6(9.3)
	Primary	4(6.25)	4(6.25)	14(21.9)	6(9.4)	0(0)	28(43.8)
	Secondary	3(4.6)	2(3.1)	11(17.2)	5(7.8)	1(2.1)	22(34.4)
	Tertiary	1(1.6)	2(3.1)	1(2.1)	4(6.25)	0(0)	8(12.5)
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(4.2)	64(100)
Mutomo (n=46)	None	1(2.1)	0(0)	1(2.1)	2(4.3)	0(0)	4(8.6)
	Primary	0(0)	1(2.1)	3(6.5)	10(21.7)	2(4.3)	16(34.7)
	Secondary	1(2.1)	0(0)	2(4.3)	9(19.5)	1(2.1)	13(28.2)
	Tertiary	3(6.5	1(2.1)	2(4.3	5(10.8)	2(4.3)	13(28.2)
Total		5(10.9)	2(4.2)	8(17.4)	26(56.5)	5(10.9)	46(100)

NB: *Figures in brackets are in percentages*

Table 4.4 indicates that, those who had no formal education did not practice any form of intensive livestock production in Kyangwithya East Ward. A similar trend was noted in MutomoWard where only few respondents who had no formal education practiced the intensive production system.

4.4.4 Gender of the Household Head

The household was majorly lead by male with 92.7% of households being headed by men. However, it was evident that, intensive systems were practiced more by the women in Kyangwithya East while in Mutomo Ward they were practices by men. Table 4.5 shows gender of the household head in each livestock production system

Table 4.5: Gender of the household head in each livestock production systems

Ward	Gender	Production system					Total
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants livestock	Extensive mixed	Non-ruminant system	
Kyangwithya East (n=64)	Female	7(10.9)	3(4.6)	10(15.6)	9(14)	1(1.5)	30(46.9)
	Male	1(1.5)	5(7.8)	20(31.2)	7(10.9)	1(1.5)	34(53.1)
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(3)	64(100)
Mutomo (n=46)	Female	3(6.5)	1(2.1)	5(10.8)	13(28.2)	3(6.5)	25(54.3)
	Male	2(4.2)	1(2.1)	3(6.5)	13(28.2)	2(4.3)	21(45.7)
Total		5(10.9)	2(4.2)	8(17.3)	26(56.4)	5(10.9)	46(100)

NB: Figures in brackets are percentages

Low intensive ruminant was mainly practiced by female in the two Wards.

4.4.5 Household Size

In this analysis, household size was grouped into two; those with less than five persons as small households and those with more than five persons (large households). Mean household size was 4.2 and 5.5 in Kyangwithya East and Mutomo respectively. Table 4.6 shows household size in each of livestock production systems.

Table 4.6: Household size in each of the livestock production systems

Wards	Household size	Livestock production system					
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants livestock	Extensive mixed	Non ruminant system	Total
Kyangwithya East (n=64)	Small	8(12.5)	6(9.4)	19(29.7)	8(12.5)	1(1.6)	42(65.6)
	Large	0(0)	2(3.1	11(17.2	8(12.5)	1(1.6)	22(34.4)
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(3)	64(100)
Mutomo (n=46)	Small	3(6.5)	1(2.1)	2(4.3)	5(10.9)	3(6.5)	14(30.4)
	Large	2(4.3)	1(2.1)	6(13)	21(45.7)	2(4.3)	32(69.6)
Total		5(10.9)	2(4.2)	8(17.4)	26(56.4)	5(10.9)	46(100)

NB: Figures in brackets are percentages

Most (65.6%) households in Kyangwithya East had asmall families, while in Mutomo 69.6% had large families. Extensive ruminant livestock production system were preferred by small and large families in Kyangwithya East followed by extensive mixed species. However, large families did not practice the low intensive ruminant production systems. In Mutomo, extensive mixed species was the most preferred by small and large households.

4.4.6 Land Size per household

Land size in this study was grouped into two; small land size; farmers with < 5ha small land size and while farmers with ≥ 5 ha had large land sizes. Table 4.7 shows land size holding for each of the livestock production system.

Table 4.7: Land size of households in each of the livestock production systems

Ward	Land size	Production systems					Total
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants	Extensive mixed	Non ruminant system	
Kyangwithya East (n=64)	Small	1(1.6)	1(1.6)	11(17.2)	6(9.4)	0(0)	19(29.7)
	Large	7(10.9)	7(10.9)	19(29.7)	10(15.6)	2(3.1)	45(70.3
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(3)	46(100)
Mutomo (n=46)	Small	2(4.3)	0(0)	5(10.9)	10(21.7)	1(2.1)	18(39.1)
	Large	3(6.5)	2(4.3)	3(6.5)	16(34.8)	4(8.7)	28(60.9)
Total		5(10.9)	2(4.3)	8(17.4)	26(56.4)	5(10.9)	46(100)

NB: Figures in brackets are percentage

Of the respondent, 66.4% of the households had a large piece of land among which 70% and 60% were from Kyangwithya East and Mutomo Ward respectively. Respondents with large land sizes preferred extensive forms of livestock production systems in both Kyangwithya East and Mutomo Wards. Low intensive ruminants were also practiced by respondents with large pieces of land.

4.4.7 Herd Size in each of the Production Systems

To show the distribution of herd sizes in this survey, herd sizes were grouped into three. Households with ≤ 5 TLU were considered small, those with >5 but ≥10 TLU, as medium while those with > 10 as large. From the study, 71.3% of the households owned small herds, 19.4% owned medium herdsize while 9.3% owned large herd sizes. The mean TLU was 4.48 and 5.04 for Kyangwithya East and Mutomo Wards respectively. Table 4.8 shows distribution of herd size each of the to production systems.

Table 4.8: Herd size each of the livestock production systems

Wards	Herd Size	Low Intensive ruminant	Low Intensive mixed	Extensive ruminants	Extensive mixed	Non ruminant system	Total
Kyangwithya East	Small	8(12.5)	7(10.9)	29(45.3)	8(12.5)	2(3.1)	54(84.3)
	Medium	0(0)	1(1.5)	0(0)	3(4.7)	0(0)	4(6.25)
	Large	0(0)	0(0)	1(1.5)	5(7.80)	0(0)	6(9.4)
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(3.1)	64(100)
Mutomo	Small	3(6.5)	2(4.3)	8(17.4)	10(21.7)	4(8.7)	27(58.7)
	Medium	2(4.3)	0(0)	0(0)	12(26)	1(2.2)	15(32.6)
	Large	0(0)	0(0)	0(0)	4(4)	0(0)	4(8.7)
Total		5(10.9)	2(4.3)	8(17.4)	26(51.7)	5(10.9)	46(100)

NB: Figures in brackets are percentages

Intensive system was more preferred by small households in Kyangwithya East than Mutomo. No large herd size households practiced any form of intensive production system in both Kyangwithya East and Mutomo Wards. However, small herd size were practiced in different production systems across the study area.

4.4.8 Support Systems for Livestock Production

These services include extension services, credit, veterinary services and breeding services.

4.4.8.1 Extension services

In the two study areas, 63% of the respondents had received extension services within the past year in Kyangwithya East Ward and all respondents (100%) in Mutomo received these extension services. Table 4.9 shows distribution of access to extension services and production systems.

Table 4.9: Access to extension services in each of the to production systems

Ward	Extension Services	Production system					Total
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants	Extensive mixed	Non ruminant system	
Kyangwithya East	No	6(9)	2(3)	16(25)	0(0)	0(0)	24(37)
	Yes	2(3)	6(9)	14(22)	16(25)	2(3)	40(63)
Total		8(12.5)	8(12.5)	30(47)	16(25)	2(3)	64(100)
Mutomo	Yes	5(10.8)	2(4)	8(17)	26(56.5)	5(10.8)	46(100)
	Yes	5(10.8)	2(4)	8(17)	26(56.5)	5(10.8)	46(100)

NB: *Figures in brackets are in percentage*

Most of those who had received extension services in both Wards were practicing extensive form of livestock production system.

4.4.8.1.1 Source of extension services

The source of extension services to the respondents include government officers, community based organisations (CBO), Non-govermental organization (NGO) and other farmers. Table 4.10 below shows distribution of extension services providers to each of the livestock production sytems.

Table 4.10: Extension services providers in each of the livestock production sytems

Ward	Extension Services sources	Production system					
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants	Extensive mixed	Non ruminant system	Total
Kyangwithya East (n=40)	GoK	2(5)	6(15)	13(33)	8(20)	1(2.5)	30(75)
	CBO	0(0)	0(0)	4(10)	0(0)	0(0)	4(10)
	NGO	0(0)	2(35)	24(60)	4(10)	0(0)	30(75)
	Other farmers	1(2.5)	1(2.5)	12(30)	2(5)	0(0)	16(40)
Mutomo (n=39)	GoK	0(0)	0(0)	5(10.8)	10(21.6)	0(0)	15(39)
	CBO	1(2)	0(0)	1(2)	4(8)	0(0)	6(15)
	NGO	2(4)	0(0)	1(2)	6(13)	0(0)	9(23)
	Other farmers	4(8)	1(2)	7(15)	18(39)	3(6.5)	33(85)

NB: Figures in brackets are in percentage

In Kyangwithya East, intensive form of production sytems received extension services from agricultural officers across all production systems while in Mutomo Ward, they received from CBOs, NGOs and from other farmers (16%)**.**

4.4.8.1.2 Channels of extension information

The radio was the most common method of extension dissemination channel followed by field days, seminars and agricultural shows in both Kyangwithya East and Mutomo Wards. Table 4.11shows channels through which extension services is disseminated.

Table 4.11: Extension dissemination channels in each livestock production sytems in Kyangwithya East and Mutomo Wards

Ward	Channels of information	Production system				
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants	Extensive mixed	Non ruminant system
Kyangwithya East (n=40)	Radio	8(20)	8(20)	30(75)	16(40)	2(5)
	Field day	6(15)	6(15)	17(43)	1(2.5)	0(0)
	Agricultural show	2(5)	5(12.5)	19(47.5)	10(25)	1(2.5)
	Seminar	6(15)	4(10)	20(50)	4(10)	0(0)
Mutomo (n=46)	Radio	5(10.8)	2(3)	8(17)	26(40.6)	5(10.8)
	Fieldday	4(8.6)	1(2)	5(10.8)	24(52)	3(6.5)
	Agricultural shows	1(2)	0(0)	1(1.5)	0(0)	0(0)
	Seminar	1(2)	1(2)	4(8.7)	6(23)	2(3)

NB: Figures in brackets are in percentage

Radio was the main source of extension channel across all the production systems (100%). Fielddays were the mainly used by the extensive form of livestock production system in both Kyangwithya East and Mutomo Wards while seminars were used more by the intensive livestock production sytems in Kyangwithya East.

4.4.8.1.2 Extension information received by farmers

Among those who had received extension services on livestock production issues, 41% and 50% had received information on fodder/pasture management in Kyangwithya East and Mutomo Wards respectively with >55% in the two Wards receiving information on feed utilization. Besides, about 44% of respondents in Kyangwithya East and 56% in Mutomo had received information on feed conservation. In addition, 14% and 6% had receive information on milk value addition for Kyangwithya East and Mutomo Wards respectively. Information on milk handling and preservation was received by 6% in Kyangwithya East and 17% in Mutomo. Information on breed selection had been received by 28% in Kyangwithya East and 17% in Mutomo respectively. Table 4.12 shows the various forms of extension services given in to livestock keepers Kyangwithya East and Mutomo Wards.

Table 4.12: Extension services received by livestock keepers in Kyangwithya East and Mutomo Wards

Type of extension advice received	Kyangwithya East	Mutomo
Soil/Water Conservation	55(86)	6(13)
Feed utilization	48(75)	26(57)
Water harvesting	46(72)	10(22)
Feed Conservation	28(44)	29(56)
Pasture/Fodder management	26(41)	23(50)
Health Care	26(41)	5(11)
Breeding selection	18(28)	8(17)
Farm management	18(28)	6(13)
Food crop management	14(22)	17(37)
Milk Value Addition	9(14)	4(9)
Milk handling and preservation	4(6)	8(17)

NB: Figures in brackets are in percentage

In Kyangwithya East Ward, extension was received on soil and water conserversion, feed utilization, water harvesting, feed conservation and pasture and fodder management as shown in the table 4.12 above. On the other hand, in Mutomo Ward, extension services focused on feed utilization, feed conservartion, pasture and fodder management, food crop management and water harvesting in as above.

4.4.9 Access and Source of Credit

Those having access to credit in the two Wards were 54.4%, among which 63.3% were from Kyangwithya East and 36.6% from Mutomo Wards. Table 4.13 below shows access to credit in each of the livestock production systems.

Table 4.13: Access to in each of the livestock production systems

Ward	Credit Access	Production system					Total
		Intensive ruminant	Intensive mixed species	Extensive ruminants	Extensive mixed species	Non-ruminant system	
Kyangwithya East(n=64)	No	1(1.6)	1(1.6)	10(15.6)	13(20.3)	1(1.6)	26(40.6
	Yes	7(10.9)	7(10.9)	20(31.3)	3(4.6)	1(1.6)	38(59.4)
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(3)	64(100)
Mutomo (n=46)	No	2(4.3)	1(2.2)	5(10.9)	11(23.9)	2(4.3)	21(45.5)
	Yes	3(6.5)	1(2.2)	3(6.5)	15(32.6)	3(6.5)	25(54.5)
Total		5(10.9)	2(4.4)	8(17.4)	26(56.4)	5(10.9)	46(100)

NB: Figures are in percentages

More respondents had access to credit in Kyangwithya East (59.4%) than Mutomo (47.8%). However, a majority of those having access to credit were practicing extensive production systems in the two Wards; 35.9% and 32.6% in Kyangwithya East and Mutomo Wards respectively.

Among those with access to credit, 63% in Kyangwithya East received it from commercial banks while Mutomo depended on other sources. Table 4.14 shows credit sources for farmers in Kyangwithya East and Mutomo Wards.

Table 4.14: Credit sources for farmers in Kyangwithya East and Mutomo

Access and source of credit		Wards	
		Kyangwithya East	Mutomo
Source of credit	Commercial banks	19 (50)	2 (9.1)
	Cooperatives	1 (2.6)	0 (0)
	Micro finance	5 (13.1)	7 (31.8)
	Table Banking	13 (34.2)	13 (59)
	Total	38 (100)	22 (100)

NB: Figures in brackets are in percentages

4.4.10 Farmer Groups/Cooperatives

In this study about 63.6% of the respondents had no membership to group or cooperative. In Kyangwithya East, 35.9% were members of self-help groups and 9.4% were members to cooperatives as compared to Mutomo where only 36.9% of the respondents were members of a self-help group. Groups were beneficial to the residents in different ways. Groups were used by 31% in Kyangwithya East and 11.7% in

Mutomo to buy farm inputs. In Kyangwithya East, marketing was the main benefit reported by 25.2% of the respondents while providing credit to farmers and extension was by 6% and 5% respectively. In Mutomo, extension services was the main benefit for having a group as reported by 10% compared to marketing (7%) and provision of credit (5%) to farmers. Table 4.15 shows membership to a group benefits respondents in each livestock production sytems.

Table 4.15: Benefit received from group membership in each of the production sytems

Ward	Benefits of the group	Production system					Total
		Low intensive ruminant	Low intensive Mixed	Extensive ruminant	Extensive Mixed	Non-ruminant system	
Kyangwithya East (n=64)	None	2(3)	3(5)	10(16)	11(17)	1(1.5)	27(42)
	Farm inputs	2(3)	1(1.5)	6(9.4)	0(0)	0(0)	9(14)
	Marketing	4(6)	2(3)	9(14)	1(1.5)	0(0)	16(25)
	Value addition	0(0)	1(1.5)	2(3)	0(0)	0(0)	3(5)
	Extension services	0(0)	1(1.5)	0(0)	1(1.5)	1(1.5)	3(5)
	Collaboration	0(00	0(0)	2(3)	0(0)	0(0)	2(3)
	Credit	0(00	0(0)	1(1.5)	3(5)	0(0)	4(6)
Mutomo (n=46)	None	3(5)	2(3)	4(8.7)	16(34.7)	4(8.7)	29(45)
	Farm inputs	1(1.5)	0(0)	0(0)	1(2)	0(0)	2(4)
	Marketing	1(1.5)	0(0)	2(4)	0(0)	0(0)	3(7)
	Value addition	0(0)	0(0)	0(0)	1(2)	0(0)	1(2)
	Extension services	0(0)	0(0)	0(0)	5(10)	0(0)	5(10)
	Collaboration	0(00	0(0)	1(2)	1(2)	1(2)	3(7)
	Credit	0(0)	0(0)	1(2)	2(4)	0(00	3(5)

NB: Figures in brackets are percentages

The main benefit for being in a group was marketing in Kyangwithya East, (25%) and access to extension services (10%) in Mutomo Ward.

4.4.11 Animal Health Care Providers

From this study it was noted that respondent received veterinary services from different service providers, depending on who is available at that particular time. Community based animal health workers (CBAHWs) were the main providers of veterinary services to farmers as reported by 94.5% of the respondent.

4.4.11.1 Kyangwithya East Ward

About 91% of farmers in Kyangwithya East received veterinary services from government officers while 14% received the services from private veterinarian. In Kyangwithya East, equal proportion of respondents reported neighbours and herbalist each at 13% as their veterinary service providers while 14% of the respondents treated their own animals.

4.4.11.2 Mutomo Ward

In Mutomo, there was no difference in the proportion of farmers using government officers and private, both were at 56.5%. Approximately 20% of farmers in Mutomo Ward treated their own animals, 9% by neighbours and 7% by herbalist. Table 4.16 shows proportions of respondents based on veterinary service providers in each livestock production sytems in Kyangwithya East and Mutomo Wards.

Table 4.16: Veterinary service in each of the livestock production system

Ward	Veterinary Services	Production system					
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants	Extensive mixed	Non ruminant system	Total
Kyangwithya East (n=64)	Private vets	0(0)	0(0)	1(3)	1(6)	0(0)	2(3.1)
	GOK vets	6(9.4)	7(10.9)	22(34.4)	16(25)	2(3.1)	53(82.8)
	CBAHWS	0(0)	0(0)	9(14.1)	3(4.7)	1(1.6)	13(20.3)
Total		6(12.5)	7(12.5)	32(	20()	3()	64(100)
Mutomo (n=46)	Private vets	0(0)	0(0)	1(12.5)	3(612)	2(40)	6(13)
	GOK Vet	2(40)	1(50)	3(38)	25(96)	4(80)	35(76)
	CBAHW	4(80)	1(50)	7(88)	23(88)	3(60)	38(82.6)
Total		5(100)	2(100)	8(100)	26(100)	5(100)	46(100)

NB:Figures in brackets are in percentages

Table 4.16 shows that extension services in the study area were mainly provided by CBAWS in Mutomo Ward. In Kyangwithya East, most respondents (>75%) practicing intensive systems used government officers to treat there animals.

4.4.12 Livestock Breeding Services

About 35.9% of farmers in Kyangwithya East bought their initial breeding stock from markets, 21.9% bought from breeders, 20.3% selected from their own livestock and 21.9% from neighbours. In Mutomo, 48% of the farmers bought their breeding stock

from markets, 37% from breeders, 13% from neighbours and 2% selected from their own livestock. Table 4.17 shows sources of initial breeding stock in each of the livestock production systems.

Table 4.17: Sources of intial livestock for breeding in each of the livestock production systems

Ward	Initial breeding stock	Production system					Total
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants	Extensive mixed	Non ruminant system	
Kyangwithya East (n=64)	Market	4(6)	4(6)	10(16)	3(5)	2(3.1)	23(36)
	Breeders	3(5)	1(2)	7(11)	3(5)	0(0)	14(22)
	Own farm	1(2)	2(3)	10(16)	0(0)	0(0)	13(20)
	Neighbour	0(0)	1(2)	3(5)	10(16)	0(0)	14(22)
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(3.1)	64(100)
Mutomo (n=46)	Market	2(4.3)	0(0)	1(2)	19(41.3)	0(0)	22(47.8)
	Breeders	2(4.3)	2(4.3)	3(6.5)	5(10.9)	5(10.9)	17(37)
	Own farm	0(0)	0(0)	0(0)	1(2.2)	0(0)	1(2.2)
	Neighbour	1(2.2)	0(0)	4(8)	1(2.2)	0(0)	6(13)
Total		5(10.9)	2(4.3)	8(17.4)	26(56.5)	5(10.9)	46(100)

NB: Figures in brackets are in percentages

No respondent practicing low intensive ruminant or non ruminant system received initial stock from neighbours in Kyangwithya East Ward.

4.4.13 Livestock Marketing

From the study, livestock marketing was seasonal with most sales done in December, January, May and September. This was the period when the schools were opening. It was clearly evident that, schooling in the study area depended on livestock. Mutomo Ward sold more livestock compared to Kyangwithya East. Figure 4.8 shows the trend of selling livestock in Kyangwithya East and Mutomo Wards.

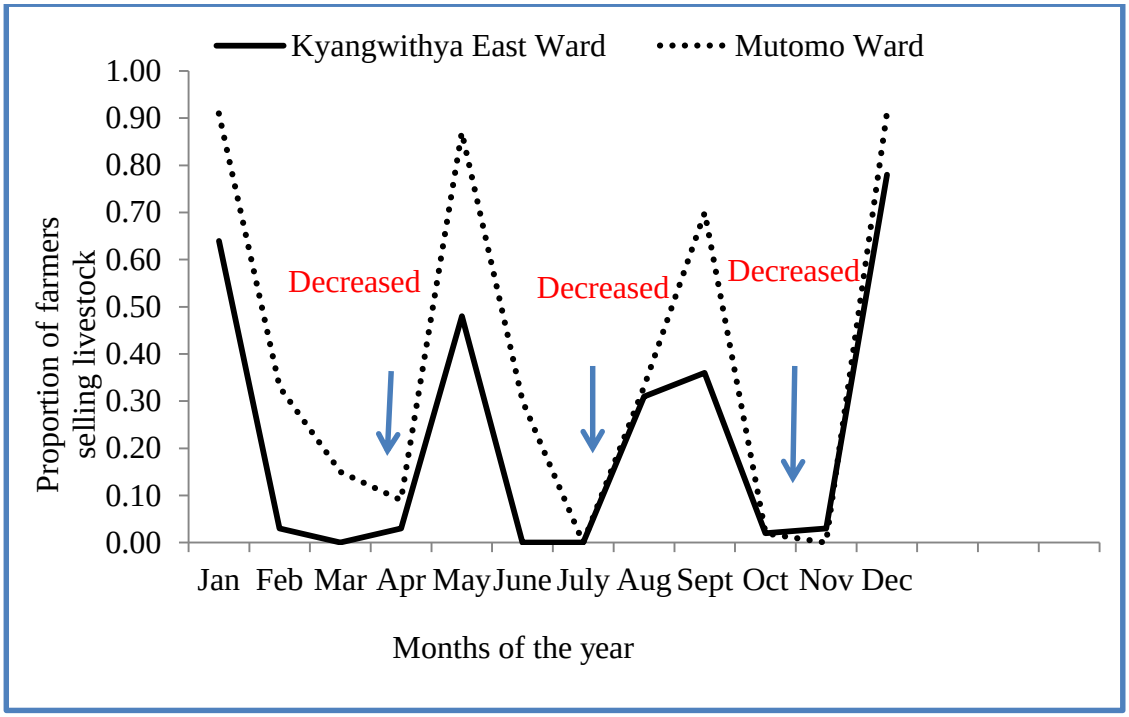

Figure 4.8: Monthly livestock sales by respondents in Kyangwithya East and Mutomo Wards

Figure 4.8 demonstrates that farmers sell their livestock during school openings eg January and May and during dry seasons (August and September). However, livestock sells drops during rain seasons when farmers anticipate a lot of pasture(see figure 4.10 below).

4.4.13.1 Reason for selling livestock

In Kyangwithya East, 75% and 96% in Mutomo Wards respondents reported that that they sold livestock for school fees, during festive seasons, in times of drought, to buy food due to hunger or in cases of sickness. Figure 4.9 shows reasons for selling livestock in both Kyangwithya East and Mutomo Wards

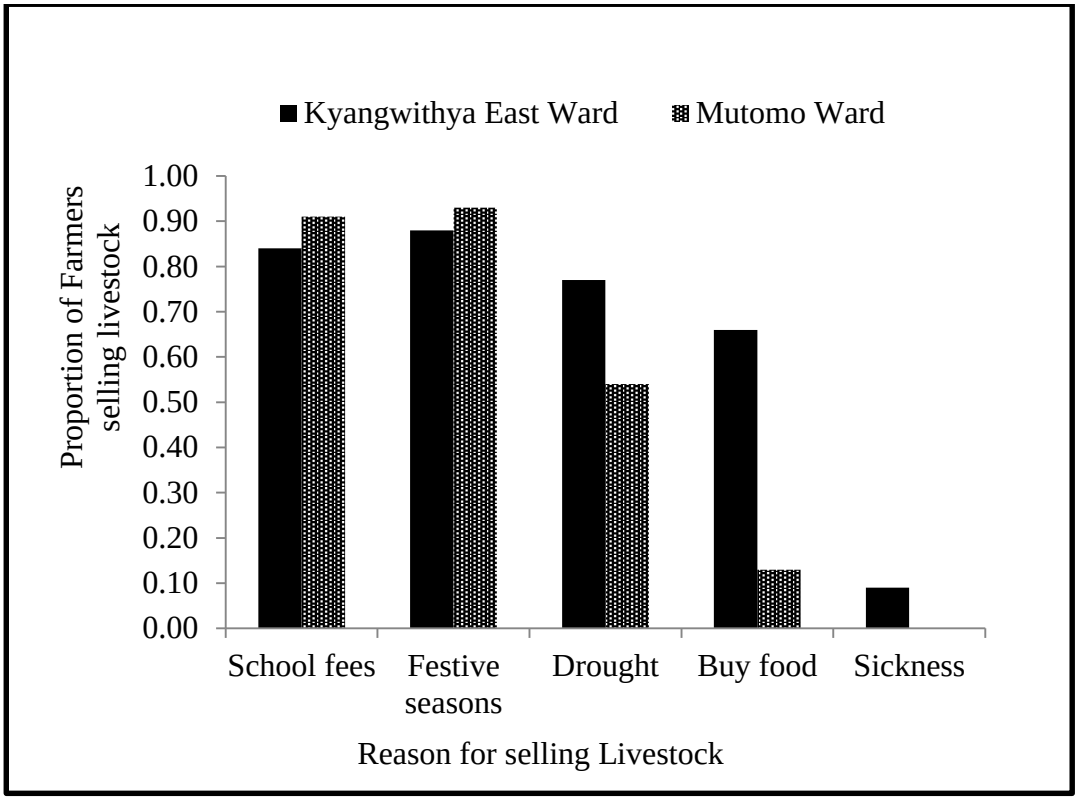

Figure 4.9: Reasons for Selling Livestock in Kyangwithya East and Mutomo Wards

Different challenges were reported to hinder livestock production. Drought was reported as a major problem by 100% of respondents in Kyangwithya East and Mutomo Wards. Also, high cost of treatment played a major role as reported at 54.7% in Kyangwithya East. Table 4.18 shows livestock production challenge in Kyangwithya East and Mutomo Wards.

Table 4.18: Livestock production challenges in each of the relation to livestock production systems

Ward	Livestock production challenges	Production system					Total
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants	Extensive mixed	Non ruminant system	
Kyangwithya East (n=64)	Drought	8(12.5)	8(12.5)	30(47)	16(25)	2(3)	64(100)
	Pest& diseases	7(11)	2(3)	17(11)	2(3)	0(0)	28(43)
	Low prices	8(12.5)	8(12.5)	29(45)	16(25)	2(3)	63(98)
	High input cost	8(12.5)	8(12.5)	29(45	16(25)	2(3)	63(98)
Mutomo (n=46)	Drought	5(10.8)	2(4)	8(17)	26(56.5	5(10.8)	46(100)
	Pest & diseases	3(6.5)	1(2)	6(13)	13(28	3(6.5)	26(56)
	Low prices	2(4)	1(2)	3(6.5	25(54)	3(6.5)	34(74)
	High input cost	4(8.7)	2(4)	4(8.7)	26(56.5)	5(10.8)	41(89)

NB: Figures in brackets are in percentage

Drought and high cost of input were the main challenges to livestock production across all the production systems in Kyangwityha East and Mutomo Wards. Pest and diseases were mainly a problem of low intensive ruminant livestock production systems in both Kyangwithya East and Mutomo wards.

4.4.15 Climate Information and Livestock Production

From the analysis, about 92.7% of the respondent acknowledged that climate was changing overtime, drought being the extreme event. Approximately 95.5% of the respondents received climate information. Table 4.19 show weather information different production systems

Table 4.19: Accessibility to weather information in differnt livestock production system in Kyangwithya East and Mutomo Wards.

Ward	Weather Information	Production system					
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants	Extensive mixed	Non ruminant system	Total
Kyangwithya East (n=64)	Yes	8(12.5)	8(12.5)	30(46.9)	16(25)	2(3)	64(100)
	No	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(3)	64(100)
Mutomo (n=46)	Yes	4(8.7)	2(4.3)	7(15.2)	23(50)	5(10.9)	41(89.1)
	No	1(2.2)	0(0)	1(2.2)	3(6.5)	0(0)	5(10.9)
Total		5(10.9	2(4.3)	8(17.4)	26(56.5)	5(10.9)	46(100)

NB: Figures in brackets are in percentages

Weather information was received across all livestock production sytems in Kyangwithya East and Mutomo Wards.

4.4.15.1 Sources of weather information

Radio was the main source of climate information reported by 97% of the respondents in Kyangwithya East and 89% in Mutomo Wards. Agricultural officers as a source of climate information was reported by 1.5% in Kyangwithya East Ward. About 10.8% had not received climate information in Mutomo Ward. No respondent in Mutomo reportedhaving received weather information from the agricultural officers. Table 4.20 shows sources of climate information to farmers in Kyangwithya East and Mutomo Wards.

Table 4.20: Sources of climate information in different livestock production sytems in Kyangwithya east and Mutomo Wards

Ward	Sources of information	Production system					
		Low Intensive ruminant	Low Intensive	Extensive ruminant	Extensive mixed	Non ruminant system	Total
Kyangwithya East (n=64)	Radio	8(12.5)*	8(12.5)	29(45.3)	16(25)	2(3)	63(98.3)
	Agriculture officers	0(0)	0(0)	1(1.5)	0(0)	0(0)	1(1.5)
Mutomo (n=46)	Radio	4(8.6)	2(4.3)	7(15.2)	23(50)	5(10.8)	41(89)
	No information	1(2)	0(0)	1(2)	3(6.5)	0(0)	5(11)

**Figures in brackets are in percentages*

Radio was the main source of weather information across all livestock production systems. Agricultural officers were not reported in Mutomo Ward however, they provided weather information to extension ruminants livestock production in Kyangwithya East Ward.

4.4.15.2 Importance of weather information

The respondent receiving information from various sources where asked if they had trust in the source of information and if it was useful. About 28.2% of the respondent trusted the climate information while 71.8% did not trust it. Even though majority of the households received climate information, only 20.9% reported the information was useful in planning their livelihood activities in the two Wards. In Kyangwithya East, water conservation (8%) and fodder conservation (5%) were the benefits from weather information. Water preservation (15%) was the main benefit reported in Mutomo, followed by destocking (13%) and fodder conservation (5%). Table 4.21 shows how farmers use climate information for planning in each of the livestock production systems.

Table 4.21: Use of climate information for planning in each of the livestock to production systems

Ward	Importance of climate information	Production system					Total
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminant	Extensive mixed	Non ruminant system	
Kyangwithya East (n=64)	Water preservation	4(6)	0(0)	1(1.5)	0(0)	0(0)	5(8)
	Fodder conservation	1(1.5)	1(1.5)	1(1.5)	0(0)	0(0)	3(5)
	No help	3(5)	7(0)	28(41)	16(0)	2(0)	28(44)
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(3.2)	64(100)
Mutomo (n=46)	Water preservation	0(0)	0(0)	3(6.5)	0(0)	4(8.7)	7(15.2)
	Fodder conservation	1(2.2)	0(0)	0(0)	1(2.2)	0(0)	2(4.4)
	Destocking	0(0)	1(2.2)	0(0)	5(10.9)	0(0)	6(13.1)
	No help	4(8.7)	1(2.2)	5(10.9)	20(43.5)	1(2.2)	31(67.5)
Total		5(10.9)	2(4.4)	8(17.4)	26(56.4)	5(10.9)	46(100)

NB: Figures in brackets are in percentage

Extensive mixed farming sytems used the information for destocking (10.8%) in Mutomo Ward. Some few respondents in intensive livestock production system used the information to conserve fodder. However, most respondents across the production systems reported that weather information was of no help.

4.4.15.3 Water availability

Respondents were asked where they get water during rainy season and during dry season. Table 4.22 shows sources of water in Kyangwithya East and Mutomo Wards.

Table 4.22: Sources of water in Kyangwithya East and Mutomo Wards

	Source of water during rainy season Nov, Dec, April &May		Sources of water during dry season (Jan, Feb, Mar, Jun, July, Aug, Sept, Oct)		
Ward	Rain water	River	Rain	River	Borehole
Kyangwithya East (n=64)	62(96.9)	2(3.1)	0(0)	22(34.4)	42(65.6)
Mutomo (n=46)	37(80.4)	9(19.6)	4(8.7)	29(63)	14(30.4)
Total (n=110)	99(90%)	11(10%)	4(8.7)	51(46)	56(50.9)

NB: Figures in brackets are in percentages

In Kyangwithya East, 96.9% of the respondents trap rain water during rainy season and the remaining 3.1% obtain water from rivers while in dry season, more than 87% of the households get water from boreholes and the others from rivers. Average distance to get water during wet season is 1.5 minutes while during dry seasons, the distance increases to almost 40 times (of 39 ±15 minute). Average cost of water was Ksh. 23 with the highest amount paid being Ksh. 200 for both livestock and domestic use. In Mutomo during rainy season, 80.4% trap rain water while 19.6% get water from rivers. In dry spell, 63% get water from the rivers, 30.4% from borehole and 8.6% use stored rain (water tank) water. When buying water, farmers in Mutomo use an of Ksh. 66 daily to buy water, with Ksh. 300 being the maximum amount of money per day for livestock and domestic use.

4.4.15.4 Human resilience to drought

Respondents were asked what their source of food was during drought. More than 95% of the respondents in both Kyangwithya East and Mutomo Wards bought food from stores and shops. Table 4.23 show households adapted to food shortages.

4.23: Households adaptation to food shortages during drought in each livestock production sytems.

Ward	Resilience during drought	**Production system**					Total
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants	Extensive mixed	Non-ruminant system	
Kyangwithya East (n=64)	Borrow	0(0)	0(0)	1(1.6)	0(0)	0(0)	1(1.6)
	Buy	8(12.5)	8(12.5)	29(45.3)	16(25)	2(3)	63(98.4)
	Relief	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(3)	64(100)
Mutomo (n=46)	Borrow	0(0)	0(0)	1(2.2)	2(4.3)	1(2.2)	4(8.7)
	Buy	5(10.8)	2(4.3)	7(15.2)	24(52.2)	3(7)	41(89.1)
	Relief	0(0)	0(0)	0(0)	0(0)	1(2)	1(2.2)
Total		5(10.9)	2(4.3)	8(17.4)	26(56.4)	5(10.9)	46(100)

NB: Figures in brackets are in percentages

In both Kyangwithya East and Mutomo Wards, no respondents practising intensive ruminant borrowed food, received relief and when food was missing, most of them were able to purchase from the shops. Households borrowing food practised extensive form of livestock production in Kyangwithya East (1.6%) and Mutomo (4.3%) Ward. Borrowing food in Mutomo Ward was five times more than in Kyangwithya East Ward.

4.4.15.5 Livestock resilience to drought

Respondent from both Kyangwithya East and Mutomo reported having experienced ffeed shortages. This study shows that livestock feed was available only during rainy season; April, May, June, November, December and January. Figure 4.10 shows the seasonality of feed shortages in a year.

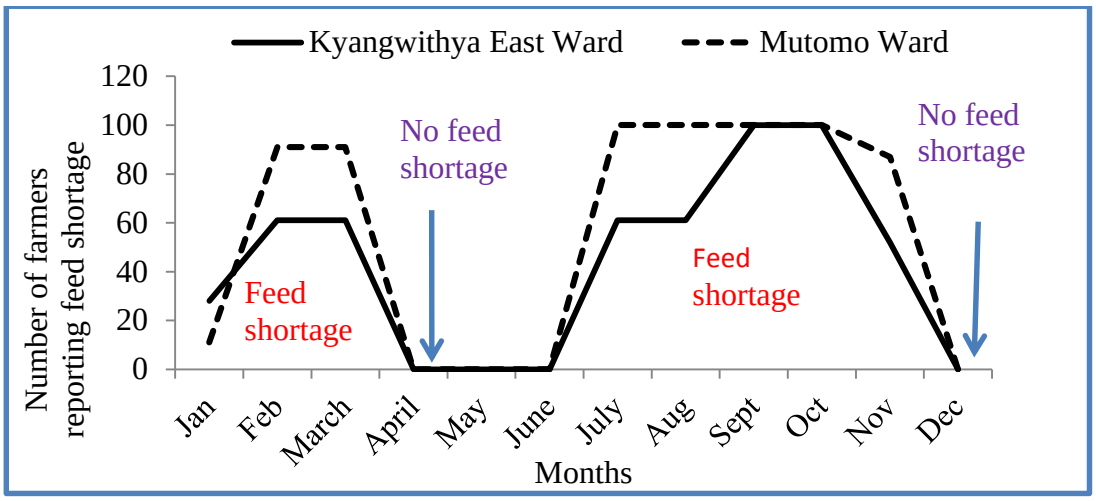

Figure 4.10: Seasonality of feed shortages in Kyangwithya East and Mutomo Wards

Household heads were asked what strategies they apply to adapt to feed shortages in terms of priority, though households would also apply more than one strategy to cope with the drought. Table 4.24 shows livestock adaptation to drought.

Table 4.24: Household livestock adaptation to feed shortage in each of the livestock production systems

Ward	Adaptation strategy	Production system					
		Low Intensive ruminant	Low Intensive mixed	Extensive ruminants	Extensive mixed	Non ruminant system	Total
Kyangwithya East (n=64)	Feed less	7(11)	7(11)	29(45)	16(25)	2(3)	61(95)
	Rent grazing land	7(11)	5(7.8)	19(29.6)	1(1.5)	0(0)	32(50)
	Destock	7(11)	8(12.5)	29(45)	14(22)	2(3)	60(93)
	Buy fodder	7(11)	2(3)	17(27)	2(3)	0(0)	28(44)
Mutomo (n=46)	Feed less	2(4)	0(0)	3(7)	24(52)	3(7)	32(70)
	Rent grazing land	5(11)	2(4)	8(17)	26(57)	5(11)	46(100)
	Destock	2(4)	1(2)	2(4)	18(39)	1(2)	24(52)
	Buy fodder	3(7)	1(2)	6(13)	7(15)	3(7)	20(43)

NB: Figures in brackets are in percentages

Farmers used different adaptation strategies to feed shortages concurrently. Most farmers fed livestock less as reported by 95% and 70% in Kyangwithya East and Mutomo respectively. In addition, 93.6% in Kyangwithya East would sell their

livestock, and reduce provision of the available feeds to the remaining animals, with purchased fodder (44%) rented grass in the fields (50%) while in Mutomo farmers would sell their livestock (52%), while others would purchase fodder (44%) and 43% in Kyangwithya East and Mutomo Wards respectively. In extensive form of production respondents preferred feeding less in both Kyangwithya East and Mutomo Wards. In Kyangwithya East, intensive ruminant form of system, tried all means at equal measure.

Although in extensive methods grazed their livestock, some areas were preserved to graze during the dry seosons. It was in this areas, where animals were grazed for limited time to ensure that the pasture would last for long.

4.4.16 Cash Income

In this study, income was mainly from livestock while other sources including crops and non-farm business such as salary and gifts. In Mutomo, the mean income for a year was Kshs 38,194 or Ksh. 3,183 per month while Kyangwithya East was kshs 48,639 or 4,053 per month. Figure 4.11 shows sources of income from Kyangwithya East and Mutomo Wards.

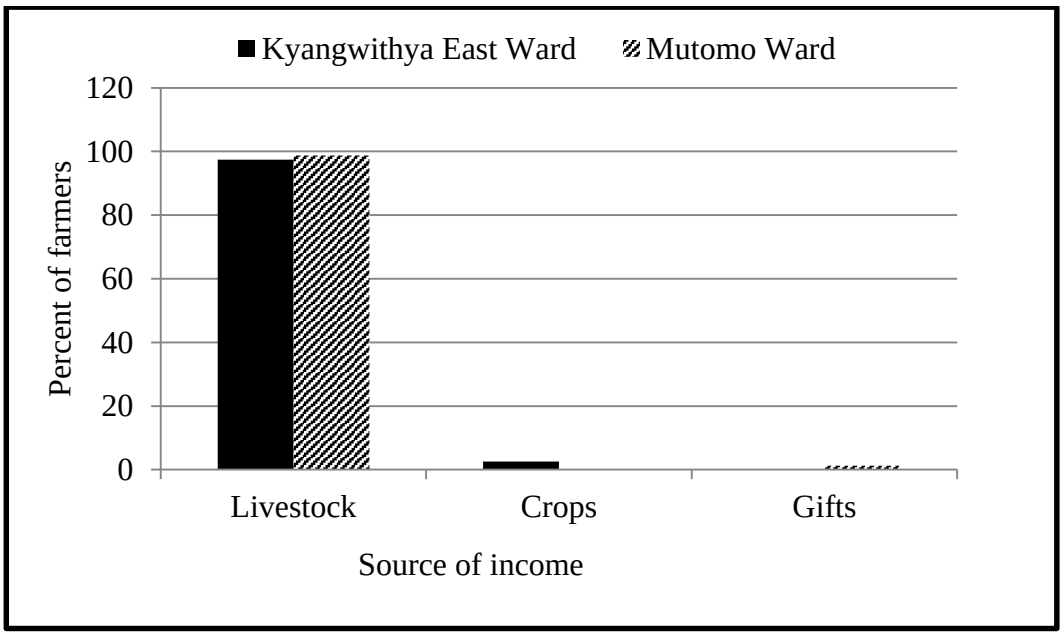

Figure 4.11: Sources of income in Kyangwithya East and Mutomo Wards

Income from livestock included; livestock sales, milk sales, eggs sales ,chicken sales, sale of honey and sale of manure/skin/hides/ghees. Figure 4.12 shows sources of livestock income in Kyangwithya East and Mutomo Wards

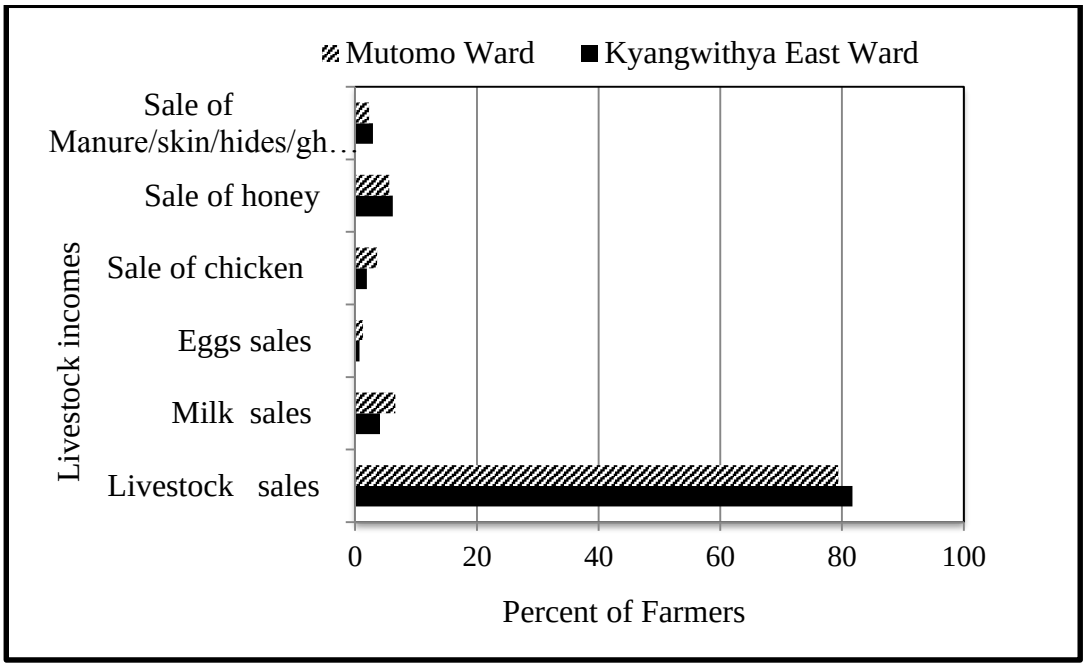

Figure 4.12: Distribution of income from livestock and livestock products

In order to understand how income levels are distributed across different production systems, income was divided by AE per household and grouped in the intervals of Ksh.1,000. More than 70% of the respondents in Kyangwithya East and Mutomo earned less than Ksh.1,000/AE per month. In Kyangwithya East Ward, households earning more than Ksh 3,000/AE per month were practising the extensive form of livestock production. No household earned more than Ksh.3,000 per/AE in intensive form of livestock production in Kyangwithya East Ward. Table 4.25 shows income levels in each of the livestock production systems.

Table 4.25: Income levels in each of the livestock production systems

	Production Sytem					
Income levels Kyangwithya East n=64	Low Intensive ruminant	Low Intensive	Extensive ruminants	Extensive mixed	Non ruminant production	Total
0-1000	6(9.4)	6(9.4)	23(35.9)	10(15.6)	2(3.1)	47(73.4)
1,000-2000.	1(1.6)	1(1.6)	3(4.7)	2(3.1)	0(0)	7(11)
2000-3000	1(1.6)	1(1.6)	2(3.1)	1(1.6)	0(0)	5(7.9)
3000-4000	0(0)	0(0)	1(1.6)	1(1.6)	0(0)	2(3.1)
4000-5000	0(0)	0(0)	1(1.6)	2(3.1)	0(0)	3(4.7)
Total	8(12.5)	8(12.5)	30(46.9)	16(25)	2(3.1)	64(100)
Mutomo n=46						
0-1000	3(6.5)	1(2.2)	7(15.2)	17(37)	5(10.8)	33(71.7)
1000-2000	1(2.2)	0(0)	1(2.2)	6(13)	0(0)	8(17.4)
2000-3000	1(2.2)	1(2.2)	0(0)	3(6.5)	0(0)	5(11)
Total	5(10.9)	2(4.3)	8(17.4)	26(56.5)	5(10.9)	46(100)

NB:Figures in brackets are in percentages

4.5 FOOD SECURITY

4.5.1 Household vulnerability to food insecurity under different livestock production system

It was considered that, households earning less than Ksh. 1250 per month per AAME were food insecure (GoK, 2000b). From the study generally, only 22.7% were food secure of which 60% were from Kyangwithya East while 40% were from Mutomo Ward. More than 75% of the households in Kyangwithya East and Mutomo Wards were food insecure with majority practising extensive forms of livestock production system. Less than 5% of the household practising intensive form of livestock production was food secure. Most of the households who were food secure practised extensive form of production system 18% in Kyangwithya East and 15% in Mutomo Wards. Table 4.26 shows food security status in each of the livestock production systems.

Table 4.26: Food security status in each of the livestock production systems

Ward		Production systems					
		Intensive ruminant	Intensive mixed	Extensive ruminants livestock	Extensive mixed species	Non ruminant system	Total
Kyangwithya East (n=64)	Food insecure	7(11)	6(9)	24(37.5)	10(16)	2(4.5)	49(77)
	Food secure	1(1.5)	2(3)	6(9)	6(9)	0(0)	15(23)
Total		8(12.5)	8(12.5)	30(46.9)	16(25)	2(3.1)	64(100)
Mutomo (n=46)	Food insecure	3(6.5)	1(2.2)	8(17.4)	19(41.3)	5(10.8)	36(78)
	Food secure	2(4.3)	1(2.2)	0(0)	7(15.2)	0(0)	10(22)
Total		5(10.8)	2(4.4)	8(17.4)	26(56.5)	5(10.8)	46(100)

NB: Figures in brackets are in percentages

4.5.2 Determinats of Household Food Security

Regression model was used to show the contribution of various variables to food security (household size, household income, gender of the household head, herd size, education level of household size, land size, occupation of household head and land size). Pooled multiple linear regression for both Kyangwithya East and Mutomo was used to investigate the effect of the independent variables on food security. The Correlation analysis was conducted to help choose among the variables highly correlated, then uncorrelated variables included in the model. The results were based on the objective addressing the factors determing farmers vulnerability to food insecurity. Table: 4.27 and 4.28 shows correlation coefficients and results of the multiple linear regression.

Table 4.27: Correlation coefficients matrix for variables used in Kyangwithya East and Mutomo Wards multiple linear regression model

	Extension availability	Age of household head	Gender	Climate information	TLU owned	Member of a group
Extension availability	1.000					
Age of household head	.016	1.000				
Gender	.073	-.020	1.000			
Access to climate information	.081	.049	.039	1.000		
TLU owned	-.242	.025	-.018	.054	1.000	.056
Group member	.208	-.075	.101	-.079	.056	1.000

Table 4.28: Results of multiple linear regression

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.089	.232		.384	.702
Gender	.100	.055	.161	1.834	.069
Age of household head	-.094	.047	-.176	-2.019	.046*
TLU owned	.165	.042	.352	3.883	.000*
Access to information	.173	.132	.115	1.310	.193
Group member	-.097	.057	-.154	-1.699	.092
Access to extension	-.055	.070	-.073	-.785	.434

**Significance at 95%, level of confidence; n=110*

R^2 Adjusted =0.177; F=4.901

NB: The regression coefficients were standardized and therefore the constant value is absent from the regression results.

According to the results, age of the household head and TLU owned had a positive and significance influence on food security status at $p \leq 0.05$. However,this results explains for only 17.7% of the population hence its is difficulty to extrapolate this to the population of Kitui County.

CHAPTER FIVE

DISCUSSION

Livestock remain central to livelihoods in the ASAL areas. Livestock production systems have been classified in different areas based on the agro-ecological zone, farm sizes, integration with crops, intensity of production and type of product (Sere and Steinfeld 1995). However, in this study, livestock production systems were classified based on the species of livestock kept, TLU holdings, mode of feeding/intensification and intensity of stocking. Five livestock production systems were identified in this study that is; low intensive ruminant production, low intensive mixed species production, extensive ruminant production, extensive mixed species and non-ruminant production systems. Generally, across the production systems, it was observed that Mutomo Ward reported greater mean TLU compared to Kyangwithya East Ward. This difference could be due to agro-ecological zones variation in the two study sites. Kyangwithya East being semi-arid farming zone, this could have led to influx of people, increasing demand for cultivating land while Mutomo being semi-arid and arid, farmers kept a larger herd size comprised of different species in large numbers, utilising available resources thus the large TLU reported.

Both low intensive ruminant and low intensive mixed systems were concentrated in Kyangwithya East Ward. In low intensive ruminant and low intensive mixed systems, zero-grazing was the main feeding method with low concentrate use. This was evident through low annual investement in purchase of supplements for the livestock. Farmers owned livestock individually and depended mostly on natural pastures. The everage TLU in the these systems was three hence there was no difference in TLU owned.

Extensive ruminant and extensive mixed livestock production system was primarily reported by farmers from Kyangwithya East Ward. Farmers in this group managed livestock on natural pasture with supplementation on concentrates and fodder crops. Generally, we could say that, Kyangwithya East Ward, farmers are specialized producers, they inhabit high potential area and fortunately they are near a urban market. Extensive mixed production was largely found in Mutomo characterized by goats, and donkeys in addition to cattle and sheep. Farmers depended primarily on livestock. Land

holdings were the least in this sytem and this contradicted study done in Njoro, Kenya where extensive systems reported big land holdings (Kyalo, 2012).

Land per TLU was highest in non-ruminant production system. Although the respondent did not have ruminants this doesn't mean they did have land. So their land was under-utilised. Generally, the goat was the dominant ruminant in the study, reported in high numbers compared to other ruminants. This agreed with a study in the South Eastern dry lands, Kitui and Makueni where goats were found to be the dominant species (Kanui *et al.,* 2016). Short cycle livestock were reported by a small proportion of the farmers. It is believed that rabbits and beekeeping can empower farmers to have high production ability (Kanui *et al.,* 2016).

Household characteristics, social-economic factors, natural and physicals characteristics, institutional frameworks all influences production sytems to be adopted. In this study, youth were less involved in livestock farming in both kyangwithya East and Mutomo Wards and for the few reported no one practiced intensive form of livestock sytems. This may be because, the youth could have migrated to search for employment in towns and cities (urban areas) after school. This agrees with studies done in Nigeria, where 50% of farmers were between 50-60 years of age and 5% of farmers were below 30 years of age (Adesehinwa *et al.*, 2004). In addition, most household heads in the two Wards were within active working age, and it is believed that older people accumulated knowledge, wisdom and experience over the years hence they can focus more effort on farm production. Similar findings have been reported by Amwata, (2004), in Kajiando and Kyalo, (2012) in Njoro, Kenya.

Education levels were low in Kyangwithya East and Mutomo Wards and there was great difference in the production systems. For example, among the few who did not have any formal education, they did not practices any form of intensive livestock production systems.

Although households with small size practiced different production systems, intensive systems were primarily done by small holding livestock households.

Men dominated the household heads as found in a study conducted inNigeria (Adesehinwa *et al.*,2004) and in Njoro Kenya (Kyalo, 2009) where men dominated

livestock production households. However, intensive form of production was mainly practiced by women while extensive production system was by men in both Kyangwithya and Mutomo Wards.

Livestock support services can enhance the role of livestock in rural livelihoods by determining the quality of animals kept by farmers, hereafter improving the quality and quantity of livestock products and high prices in market (Kyalo, 2012; CALPI, 2005). In this study, drought, pests and diseases and high cost of treatment were the main challenges to livestock production in Kyangwithya East and Mutomo Wards across all the livestock production sytems. Drought decreases livestock liveweight, increases suscetability to diseases and hence increased death rates. Livestock mortalities and monies used to treat sick animals reduces livelihood support to the households (Kanui *et al.,* 2016).

Although few respondents in intensive form of livestock production used government officer in Kyangwithya East Ward, for veterinary services, majority used CBAHWs across all the production systems in Kyangwithya East and Mutomo Wards. Similar results were reported by Kanui *et al.,* (2016) in Makueni and Kitui. This could be because, CBAHWs are easily available and their services are cheaper. Besides, the government of Kenya privatized veterinary services in early 1980's and even in cases where the farmers received the services from the government veterinary officers, they are mostly on private duty. This means that, there are no proper veterinary services in Kyangwitha East and MutomoWards resulting to livestock farmers using unqualified people to treat livestock and this may lead to animal losses leading to negative effects on livelihoods or inappropriate use of drugs which could lead to drug resistant strains in livestock which can then be passed to human through food chain. Similary this was reported by Kyalo, 2012 and Kanui *et al.,* 2016. Proper delivery of livestock health services, can help to decrease the threat of zoonotic animal diseases.

Extension services by government officers were reported by few respondents in Mutomo and and Kyangwithya East Wards and was mainly through field days.This

was also available mostly to the extensive forms of production system. Feed utilization, water harvesting and soil conservation was the main extension services information disseminated to Kyangwithya East while in Mutomo feed conservation and utilization were the key extension messages. This creates a gap in livestock production and hence there is a great need to focus extension services on livestock production related issues especially livestock health, breeding and nutritional management.

Livestock prices are usually high during rainy season because pasture and water are in plenty and farmers are not willing to sale their animals. During dry season there is reduced available grazing forage and scarcity of water, farmers sell livestock . This reduces prices in the market due to over supply. This agrees with a study by Dillon *et al.*, 2013 in Utah state where he found that selling of steers was highest in April and November and low in June. In addition in the two study sites, > 80% of the respondents sold their livestock for school fees and during festive seasons. That is; December during holiday season, January, May and August when schools usually open.

Farmers in intentisve and extensive forms of livestock production access credit in Kyangwithya East Ward while in Mutomo Ward credit was accessible by farmers in the extensive mixed production system. Increased access to credit has been associated with indirect benefits to agriculture. Therefore, there is need for farmers to be sensitized on the importance of credit and credit access to boost their livestock production in the two study areas.

Few repondents were members to farmer groups most of who practiced intensive ruminant production system in Kyangwithya East Ward and the groups helped members market their product while in Mutomo most respondents belonging to farm group had extensive form of production systems and were important in accessing extension services and marketing. It is therefore important to inform farmers on formation of groups and cooperatives for easy access to markets, resources and farming services as well as extension services in order to improve production.

Climate information to farmers was received primarily through radio across all livestock production sytems. The results differed with finding in Kajiado were most

residents received information from traditional observations however, agreed with findings in Makueni where radio was the main source (Amwata, 2014). Climate information is a useful tool for minimizing climate risk among rural households. Although, most of the households had access to climate information, it was noted that access does not necessarily mean being useful. Four fifth (4/5) of the respondents felt that the information was not useful in making appropriate household farming decisions. This could be because the media being most source of information, the information could not have been packaged clearly and understandable to recommend specific adaptation and at the same time they could not ask questions where they could not understand. These results were agreed with finding in Makueni and Kajiado were more than 80% of the respondents did not trust the forecast (Amwata, 2014).

Majority of the people from Mutomo depended on rivers as their source of water as compared to Kyangwithya East where boreholes were the main source of water during the dry seasons. This shows that, water points vary depending on the season. This agreed with a study done in Makueni and Kajiado (Amwata, 2014) that show access to different water sources changes with drought, during dry seasons, people obtain water from more permanent sources such as borehole and river. This study showed that, Kyangwithya East can access water more easily; hence they have more time for other economic activities compared to Mutomo.

Livestock feed are seasonal in Kyangwithya East and Mutomo Wards (during wet season). Therefore, respondents across all the production systems would try a number of things:for example, in Kyangwithya East Ward, respondents would feed less and destock the animals across all the production systems. However, intensive ruminant production sytem purchase fodder for their livestock. In Mutomo, respondents preferred renting grass for their livestock and only few would destock. A study done in Nepal, showed that farmers would reduce there livestock during challenging times and restock when conditions are favourable (Dhakal *et al.,* 2012)

Majority of the households in Kyangwithya East and Mutomo were food insecure. For the few,food secure household reported, most of them were practicing extensive mixed

production as opposed intensive production sytems. Households with high income are usually expected to be food secure for they have improved food production and increased ability to purchase food (Timmer *et al.,* 1985

According to the results, age of the household head and the TLU owned had a positive and significance influence on food security. Wisdom and experience in farming increases with increase in age, increasing food security at household level. The more TLU own, the more income you have when translated into monetary terms. Besides, increased income improves household purchasing power and hence increases food security. This outcome supports the finding of Islam (1989), Asambu (1993), Katabarwa (1994) and Amwata (2004), that food security in developing countries can only be achieved by increasing household income besides, wisdom and experience in farming. In African setting, TLU shows economic status of a person. It is believed that one can only access enough food if he or she can produce it or if they have adequate income to purchase the food. This was different from studies done in Africa by Pankomera *et al*., 2009 who found that the main determinants of household food security were household size and educational level of the household head. Education is influenced by income levels. A study in Makueni found that,vulnerability to food insecurity increased with increase with the number of livestock owned (Amwata, 2015). In this study,she argued that, the population is increasing leading to decrease in the grazing areas resulting to lose of livestocks.

The study was done only in two Wards and therefore it would be difficult to generalize the results to the rest of the county. Besides, during the study, some farmers were not willing to answer some questions; farmers were not willing to disclose their assets hence such questions were not analyzed.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

1. Livestock production systems in Kyangwithya East and Mutomo Wards were classified and characterized into five namely, low intensive ruminant production, low intensive mixed production, extensive ruminant production, extensive mixed production and non-ruminant production. A majority of farmers in Kyangwitha East were in extensive ruminant livestock production system while in Mutomo, extensive mixed livestock production sytem was the most preferred by farmers.
2. Interms of food security, both Kyangwithya East Ward (77%) and Mutomo Ward (78%) had similar food insecurity levels
3. The factors that were found to influence household food security were mainly, livestock numbers in TLU owned by a household and the age of the household head.

6.2 RECOMMENDATIONS

From this study, the following recommendations were suggested to help improve livestock production and reduce household food insecurity in Kyangwithya East and Mutomo households. There is need to develop strategies that influence the number of livestock owned at household level specifically targeting farmers aged <35 years with emphasis on promoting extensive livestock production and diversification of livestock species. Farmers in other systems such as the intensive ruminant, intensive mixed and non-ruminant production sytems need to be supported to improve their production because this systems will keep on coming up.

REFERENCES

Adesehinwa A O K , Okunola J O and Adewumi M K, (2004). Socio-economic characteristics of ruminant livestock farmers and their production constraints in some parts of South-western Nigeria. *Livestock Research for Rural Development* 16 (8) 2004

Ali, S. (1995). Pastoral Systems of Ethiopia and Sustainable Development, the Case of Afar in the Awash Valley of Ethiopia. *Paper presented at Pastoral Information Network Programme (PINEP) Regional Workshop, Department of Range Management, University of Nairobi, Kenya.*

Amwata D. A., Nyariki D. M., and Musimba N.R.K., (2015). Factors Influencing Pastoral and Agro- pastoral Household Vulnerability to Food Insecurity in the Drylands of Kenya: A Case Study of Kajiado and Makueni Counties. *Journal of International Development* DOI: 10.1002/jid.3123

Amwata, D. A. (2004). Effects of communal and individual land tenure systems on land-use and food security in Kajiado District, Kenya. MSc Thesis, University of Nairobi, Kenya

Amwata, D. A. (2014). The influence of climate variability and change on land use and livelihoods in Kenya's Southern Rangelands. A Thesis submitted in fulfillment of the requirement for the degree of doctor of philosophy in Range Management. Department of Land Resource Management and Agricultural Technology, University of Nairobi, Kenya

Ange, A. L. (1994). Intergrated plant nutrition management in cropping and farming system; A challenge for small scale farmer in developing countries. Food and Agriculture Organisation, Rome, Itally

Asambu, F. K. (1993). Farmers' Perceptions and Economic Analysis of Factors Affecting Farm Level Maize Enterprise Performance and Adoption of Agricultural Technological Innovations in Semi-arid South Eastern Kenya: M.Sc. Thesis University of Nairobi, Kenya

based on literature and field experience. http: //www .fao.org/ docrep/ 004 /Y0501E/ y0501e03.htm

Bellaver, C. and Bellaver, I. H. (1997). Livestock Production and Quality of Societies'.Life in Transition economies. *Livestock Production Science* 59:125-135

Bonfiglioli, A. M. (1992). Pastoralists at Crossroads: Survival and Development Issues in African Pastoralism. NOPA, UNICEF/UNSO Project for Nomadic Pastoralists in Africa, Nairobi, Kenya.

Boyazoglu, J. (1998). Livestock Farming as a Factor of Environment, Social and Economic Stabilitywith Special Reference to Research. *Livestock Production Science,* 57:1-14.

CALPI (2005). Livestock Environment and development in watersheds. Inter-cooperation Indiaprogramme delegation report Series 1

Chambers, R. (1987). Sustainable Livelihood, Environment and Development: Putting Poor Rural People first. *Institute of Development Studies Discussion Paper 240.* University of Sussex, Institute of Development Studies Briton, England,UK.

Charlotte N., Diane M. H., Lisa M. R. (2002). Contributing of animal source foods in improving diet and function in children in the developing world. Nutrition Research 22(2002)193-220.

Davies, H. (1977). Tsetse flies in Nigeria. Ibadan: Oxford University Press; 1977

Devendra, C., and Thomas, D., (2002). Crop–animal Systems in Asia: Importance of Livestock and Characterization of Agro-ecological Zones. Agricultural Systems 71:5–15.

Dhakal B. , Devkota N. R. , Upreti C. R, Sapkota M. (2012). Fodder production and livestock rearing in relationto climate Change and possible adaptation measures in Manaslu Conservation area. Nepal. www.ncckmcnast.org.np

Dillon M. Feuz, Bridger Feuz and Ryan Feuz, (2013). Livestock Marketing and Risk Management. Utah State University. AG/AppliedEconomics/2013-01pr

District Agricultural Officer (2012). Updated District Profile, Kitui Central District, Kenya.

District Agricultural Officer (2012). Updated District Profile, Mutomo District, Kenya.

FAO (1989). Household Food Security and Forestry: An Analysis of Socio-Economic Issues. FAO, Rome, Italy

FAO (2001). Mixed crop-livestock farming. A review of traditional technologies

FAO (2007). FAOSTAT (computerized database). Rome

Glover, P. E. (1960). The Tsetse problem in Northern Nigeria. Patwa News agency, Nairobi, Kenya.

Government of Kenya (2000a). The 1999 Population and Housing Census. Central Bureau of Statistics. Government Printer, Nairobi, Kenya.

Government of Kenya (2000b). Second Report on Poverty in Kenya. Welfare Indicator. A Report Prepared by Central Bureau of Statistics and Human Resources and Social Services Department. Government Printer, Nairobi, Kenya.

Government of Kenya (2002). National Development Plan 2002-2008. Nairobi Government Printer

Government of Kenya (2005). Economic survey 2005. Goverment Printer, Nairobi.

Government of Kenya (2007). National Policy For the Sustainable Development of Arid and Semi-arid Lands of Kenya. Office of the President, Special programmes, Nairobi

Government of Kenya (2008). Ministry of Livestock Development, Sessional paper No.2 of 2008 on National Livestock policy. Nairobi.Kenya

Government of Kenya (2010a). Kenya Central Bureau of Statistics, Ministry of Planning and National Development, Statistical Abstract. Government Printers, Nairobi.

Government of Kenya (2010b). Agricultural Sector Development Strategy2010-2020. Goverment Printer Nairobi.

Government of Kenya (2013a). Kitui County Development Profile. Ministry of Devolution and Planning Government Printer, Nairobi Kenya

Government of Kenya (2013b). Kitui County Short Rains Food Security Assessment Report, 3rd to 13th February 2014. Kitui, Kenya

Gulati, L. (1980). Profile of a Female Agricultural Labourer. In Economic and Politically Weekly, March 25

Gumpta, A. (1995). Rethinking policy options for water management by local communities: Combining Equity, Efficiency and Ecological-Economic viability. Indian farming, 1995 44(10), pp. 3-14

IPCC (Intergovernmental Panel on Climate Change), 2001). Climate variability and change 2001: Impacts, adaptations and vulnerability report of working group II. Synthesis report. Cambridge University Press, Cambridge. www.ipcc.ch/./climate-changes-2001/.../wg2-summary-policymaker

Israel, D.G. (1992). Determining Sample Size, Fact Sheet PEOD-6. University of Florida, USA.

Jarvis, L.S. (1993). Sustainable animal Agriculture: The role of economics in recent experience and future challenges. *FAO Animal Production and Health paper,* No.107, FAO Rome

Kanui, T. I. Kauti, M. & Murangiri, M. R. (2016). The Status of Livestock Livelihood Support System in the South Eastern Dry lands of Kitui and Makueni Counties, Kenya. *International Journal of Livestock Research,* 6 (4), 73-82. doi: 10.5455 /ijlr. 20160322124111

Katabarwa, N. (1994). Agricultural Supply Response and Prospects for Food Security for Uganda. Unpublished PhD Thesis, Department of Agricultural Economic, University of Nairobi, Kenya.

Kavili, A. K. (2013). The influence of livestock keeping on food security of agro pastoral communities in Mutomo district, Kitui county. Master of Arts research report, University of Nairobi, Kenya.

Kennedy, E. and Haddad, L. (1994). Are Pre-schoolers from Female headed households less Malnourished? A Comparative Analysis of Results from Ghana and Kenya. *The Journal of Development Studies,* 30(3): 680-695.

Kenya National Bureau of Statistics (2010). The 2009 Kenya Population and Housing Census. Volume II. Population and household distribution by socio-economic characteristics. 438p.

Keshab S. (2016). Variation in Soil Organic Carbon within Highland Grasslands of Langtang National Park, Nepal. *International Journal of Environment* ISSN 2091-2854

Kigutha, H. N. (1994). Household Food Security and Nutrition Status of Vulnerable Groups in Kenya: A Seasonal Study among Low Income Smallholder Rural Households. Ph.D. Thesis, Wageningen University, The Netherlands

Kristjanson, P., Rademy, M., Nkediane, D., Kruska R., Reid, R., Gichoni, H., Atieno, F. and Sanford, R. (2002). Valuing Alternative Land-use Options in Kitengela Wildlife Dispersal area of Kenya. ILRI Impact Assessment Series 10, ILRI, Nairobi, Kenya

Kruka, R. L., Reid, R. S., Thornton, P.K., Henninger,**N. and Kristjanson, P. M. (2003).** Mapping Livetock Oriented Agricultural Production System for the Developing World. *Agricultural Systems*, 77(1):39-63

Kyalo, D. K. (2009). Impact of policy and social economic factors on spartial distribution of livestock production system in River Njoro watershed, Kenya.Master of science thesis, Egerton University,Kenya.

Mburu, L. M., Wakhungu, J., and Kangethe, W. (2007). Characterization of smallholder Dairy Production Systems for livestock improvement in Kenya highlands. *Livestock research for rural Development 19(8):24-30.*

McSherry, B., Brass, J. N. and Leonard, D.K. (2008). The political economy of pro-poor livestock policy reform in Kenya. IGAD LPI Working Paper 04-08. Addis Ababa, Ethiopiai: IGAD Livestock Policy Initiative. http:// hdl.handle .net/10568/24974

Mearns, R. (1996). Balancing Livestock production and environmental goals. Paper presented in the World Bank/FAO workshop on Balancing livestock and the environment, held in Washington DC 27-28 Sept, 1996

Mencher, J. P. (1985). The Forgotten Ones. Females Landlessness Labourers in Southern India. In Women Creating Wealth: Transforming Economic Development. Gallin, R. S., and Spring, A. (eds). Association for Women in Development Conference, Washington DC.

Mucheru-Muna, M. Mugendi, D. Kangai ,R, Kungu, J. and Mugwe, J. (2003). Soil productivity improvement technologies for increased food production in

Meru. School of Agriculture and Enterprise Development, Department of Agricultural Resource Management, Kenyatta University, Kenya. http://ir-library.ku.ac.ke/handle/123456789/10320

Nabarro D & Wannous C. (2014). The potential contribution of livestock to food and nutrition security: The application of the One Health approach in livestock policy and practice. United Nations System Influenza Coordination (UNSIC), Geneva, Switzerland. *Rev. sci. tech.* Off. int. Epiz., 2014, 33(2), 475-485

Nardone A., Ronchi B, Lacetera N, Ranieri M.S., and Bernabucci U. (2010). Effects of climate changes on animal production and sustainability of livestock systems. Italia DOI: http://dx. doi.org/10.1016 /j.livsci. 2010. 02.011.

Ning, W U, Rawat G S, Joshi S, Ismail M, and Sharma E. (2013). High-altitude rangelands and their interfaces in the Hindu Kush Himalayas. Kathmandu: ICIMOD

Njarui D M G, Gatheru M, Wambua J M, Nguluu S N, Mwangi D M and Keya G A (2009). Dairy Cattle Value Chain Assessment: Characterization of Milk Production in Semi-Arid Kenya. Kenya Arid and Semi-Arid Land Programme (KASAL). pp 60, KARI, Kenya.

Njarui D M G, Gichangi E M, Gatheru M, Nyambati E M, Ondiko C N, Njunie M N, Ndungu-Magiroi K W, Kiiya W W, Kute C A O and Ayako W (2016). A comparative analysis of livestock farming in smallholder mixed crop-livestock systems in Kenya: Livestock inventory and management. *Livestock Research for Rural Development*. Volume 28, Article #66. Retrieved June 27, 2017, from http://www.lrrd.org/lrrd28/4/njar28066.html

Njuki, J., Poole, J., Nancy, J., Isabelle, B., Pamela, P., Zaibet, L. and Mburu, S. (2011). Gender, Livestock and Livelihood Indicators, ILRI, Nairobi, Kenya.

Noor, A. A., Farah, K. O. and Musimba, N. K. (1999). Socio-Economic Impact of Small Holder Irrigation Schemes on the Pastoral Nomads of Garissa District, North Eastern Kenya. African Pastoral Forum, Working Paper Series 19, PINEP, Department of Range Management, University of Nairobi, Kenya.

Nyariki, D. M. (1998). The Role of Livestock as Capital and in *Ex-Ante* and *Ex-Post* Management of Food Security in Sub-Saharan Africa: The Case of Agropastoralists in Southeast Kenya. *African Pastoral Forum, Working Paper Series 13*, PINEP, Department of Range Management, University of Nairobi, Kenya.

Nyariki, D. M. and Wiggins, S. (1997). Household Food Insecurity in Sub-Saharan Africa:Lessons from Kenya. *British Food Journal*, 99 (7): 249-262.

Nyariki, D. M., Wiggins, S. L. and Imungi, J. K. (2002). Levels and Causes of Household and Nutrition Insecurity in Dryland Kenya. *Ecology of Food and Nutrition,*41(2): 155-167.

Nyariki, D.M., Mwang'ombe, A.W. and Thompson ,D.M.(2009). Land-use change and livestock Production Challenge in an integrated System: The Masai-Mara Ecosystem, Kenya.Univerity of Nairobi, Kenya.

Otte M. J. and Chilonda P. (2002). Cattle and small ruminant production systems in sub-Saharan Africa: A systematic review. Livestock Information Sector Analysis and Policy Branch, Food and Agriculture Organization of the United Nations, Agriculture Department, Rome 2002

Ouma, E. A. (2003). An analysis of the economic value of cattle in smallholder livestoc production systemin Western Kenya. Master of Science thesis, Egerton University, Kenya

Pankomera, P., N. Houssou and M. Zeller (2009). Household food security in Malawi: measurements, determinants and policy review. Conference on international research on food security, natural resource management and rural development, University of Hamburg, Tropentag, October 6-8, 2009, Hamburg.

Philip K. T. (2010). Livestock production: recent trends, future prospects. Philosophical Transactions of the Royal Society. doi:10.1098/rstb.2010.013

Population Action (2014). Population Dynamics, Environment, and Sustainable Development in Kitui County 2014.https://pai.org/wp-content/ uploads / 2014/07/PAI_Kitui

Sere, C., and Steinfeld, H. (1995). World livestock production system: Current status, issues and Trends. *FAO, Animal Production and health paper* 127, Rome.

Sunya, O. (2003). Marketing of Sheep and Goats and its Role in Food Security among Pastoral Communities in Marsabit District. M.Sc. Thesis, University of Nairobi, Kenya

Tangka, F. K., Jabbar, M .A. and Shapiro, B. I. (2000). Gender Roles and Child Nutrition in Livestock Production Systems in Developing Countries: *Critical Review Paper series 27*, ILRI, Nairobi, Kenya.

Thapa, B. G. and Rusul, G. (2005). Patterns and determinants of agricultural system in the Chitagong Hill Track of Bangladesh. *Agricultural system* 84:255-227

Timmer, C. P., Falcon, W. P. and Pearson, S. R. (1985). Analysis of Food Consumption and Nutrition: In Food Policy Analysis. John Hopkins Press, Baltimore, U.S.A.

Waithaka, M. M., Nyangaga, J. N., Staal, S. J., Wakobi, A.W., Njubi, D., Muriuki, K. G., Njoroge, L. N. and Wanjohi, P. N. (2002). Characterization of Dairy system in the Western Kenya Region. A DFID Report of Dairy and crop characterization. Activity in Western Kenya, December 2002.

APPENDICES

Appendix 1: QUESTIONNARE

CHARACTERISATION OF LIVESTOCK PRODUCTION SYSTEMS AND ITS CONTRIBUTION TO THE FOOD SECURITY IN KITUI COUNTY, KENYA

Hello. My names are Augusta Ndungwa Kivunzya. I am a student in South Eastern Kenya University (SEKU) located in Kitui rural sub county. In order to understand what motivates farmers to keep livestock and how these animals contribute to their quality of life in Kitui county, and especially this Ward, we are collecting data of households. Your household has been selected by chance from all households in this area. I would ask you questions on livestock farming, as well as your livelihood.

The information will be useful in determining what motivates farmers to keep livestock and how livestock is important in improving quality of live in Kitui County. The data will be used in future to plan on how livestock farmers can be supported fully to improve their living standards, and improve economy in both County and national Government.

All the information you give will be confidential, and will be used to write a paper for academic purposes but will not include any specific names.

Participation in this exercise is voluntary, and you can choose not to take part.

If you have questions about this exercise you can ask me.

Signature of the interviewer :……

Date: …….

Respondent agreed to be interviewed 1.Yes 2.No

A: GENERAL INFORMATION ON THE HOUSEHOLD

A 1: Household Identification

Ward ……..Location……..Sub Location……..

Village ……..

A 2. Particulars of the Respondent

A2i) Name of Respondent……..

A2ii) Gender 1 Male. 2. Female.

A2iii) Age……

A2iv) Occupation……

A2v) Contact (Tel.No…….

A3i) What is the name of the Household Head?……

A3ii) What is the gender of the household? 1 Male 2 Female.

A3iii) What is the age of the household? ……..

A3iv)What is the primary occupation of the household? 1.Farming 2.Civil Service 3.Business 4.NGOs/CBOs 5.Others (specify)…….

A3v) What is the marital status of the household? 0) Single 1)Monogamous 2)Polygamous 3)Divorced 4)Widowed 5)Separated

B: CHARACTERISTICS OF THE HOUSEHOLD

B1 Housing type (Enumerator to observe) 1. Mud 2.Permanent 3.Any other (specify)

B2 Roof type (Enumerator to observe) 1.Thatch 2.Tiles 3.Iron sheet

B3Floor type (Enumerator to observe) 1.Mud 2.Plastered cement

Fill in the information of Household characteristics in the columns of the table below

*Coding for the Answers shown in the second Row (Where possible).

Family Size (For all members of Household) ***Tick the Choice as appropriate***	Number of the Member in Household (Exclude Employee) ***List order of the members**	Gender of the Number of the Member? ***Fill the choice as appropriate for the Member**		Relationship of the number to Household Head ***Fill the choice as appropriate for the Member**	Age of the Number? ***Fill the choice as appropriate for the Member**	Highest level of Education attained by the Number? ***Fill the choice as appropriate for the Member**	Occupation of the Number? ***Fill the choice as appropriate for the Member**	Number of the member who provides family labour (Tick)
B 4	**B 5**	**B 6**		**B 7**	**B 8**	**B 9**	**B 10**	**B 11**
1. 2. 3. 4. 5. 6. 7. 8. 9. 0		1.Male (M) 2.Female (F)		1.Spouse 2.Child 3.Relative 4.Orphan 5. Other		1.None 2.Primary 3.Secondary 4.Post-Secondary 6.Adult 7.Others(specify)	1.Below Schooling age(<4 yrs) 2.Schooling Age 3.None - old age(>70yrs) 4.Farming 5. Employed 6.Others(specify)	
		M	F					
	1.							
	2							
	3							
	4							

B9. State the number of employed personnel in your farm

1 One 2. Two 3. Three 4. Four 5. Five

6. Others (Specify)

C : LIVESTOCK PRODUCTION

C 1.What livestock type do you own?(Fill table)

Livestock type	Code C1-i	Number (No.) owned in the last one year.	
		Owned C1-ii	Entrusted C 1-iii
Cattle	1		
Goats	2		
Sheep	3		
Donkey	4		
Rabbits	5		
Pigs	6		

C1 i) What is your main system of keeping livestock?

1.Only grazing(free range or tethering) 2.Grazing with some stall feeding 3.Stall grazing (zero grazing) 4 Others(specify)

C1 ii) Has there been a change in the way you keep you livestock in the past 10years? 1.Yes 2.No

C1 iii)If yes,Why? 1.Part of the land sold 2.Change of land tenure 3.Squired exotic breed 4.Shortage of pasture 5.any other(specify)

C1 iv)Do you source any animal supplements? 1.Yes 2.No

C1 v)If Yes in C1 (iv) above, how much have you used in the last 12months in Ksh……..

C 2 For each livestock category, how many where born and how many died in the last one year and what cause the deaths if any?

Livestock type	Code	No. born in last one year.	No. died in last one year.	Reason for death.
Cattle	1			
Goats	2			
Sheep	3			
Donkey	4			
Rabbits	5			
Pigs	6			
Chicken	7			

C 3. For each of the category, how many did the household sell in the last one year?

Livestock type	Code	Number sold in last 12 months					
		No. sold	**price (ksh)**	**Total earnings (Ksh)**	**Reason for selling**	**Time of the year when you do the selling**	**Problems encountered when selling**
Cattle	1						
Goats	2						
Sheep	3						
Donkey	4						

Rabbits	5						
Pigs	6						

C 4.Please fill the table below.

Type	**Code**	**No**	**Liters of milk produced per day**	**Liters of milk consumed per day**	**Liters sold per day**	**Income from milk per month (ksh)**	**No. of animals sold per year**	**No. of animals slaughtered per year**
Local cows	1							
Improved cattle	2							
Local goats	3							
Dairy goats	4							
Sheep	5							
Dairy cattle	6							
Donkey	7							
Rabbits	8							

C5 Poultry

Type	Code	No	No of eggs Per month	No. of egg consumed per month	No. of eggs sold per month	Income from eggs per month (ksh)	No. of chicken sold per months	No. of chicken consumed per month	Income from sell of chicken per month(ksh)
Kienyenji	1								
Layers	2								
Broilers	3								
Others(specify)	4								

C6 Bee keeping.

Type	Code	No.	Amount of honey produced per year(kgs)	Amount of honey sold per year (kgs)	Amount of honey consumed per year(kgs)	Price per(kg)	Total earnings
Langstroth hives							
Kenya top bar							
Traditional hives							

C **7.**What are the three most common diseases and pest that your livestock suffer from?

Type of livestock	Code	diseases	pests
Cattle	1	1	1
	1	2	2
	1	3	3
Goats	2	1	1
	2	2	2

	2	3	3
Sheep	3	1	1
	3	2	2
	3	3	3
Donkeys	4	1	1
	4	2	2
	4	3	3
Chicken	5	1	1
	5	2	2
	5	3	3
Rabbits	6	1	1
	6	2	2
	6	3	3
Pigs	7	1	1
	7	2	2
	7	3	3

C 8**.** Apart from the information captured in (C7) above ,list the key challenges faced in livestock production in this area(start with the most important challenge).

1……2……

3……4……

C 9. Who attends to your livestock when sick?

1. Goverment veterinary officers 2.Private veterinarian 3.Community based animal health Workers (CBAHW) 4. Neighbor 5.Yourself 6.Traditional herbalist 7.Any other (specify)

C 10. In case of CBAWHs attending to your sick animals, were you satisfied with the service Provided?

1. Yes. Give reason……
2. No . Give reason……

C11 i)Are there established livestock markets? 1.Yes 2.No

C 11 ii) If yes list the market where you normally sale your livestock

	Name of market	Distance to market in Kms? time taken to Market	Type of transport used
1			
2			
3			

C11 iii) Are there specific times of the year when livestock are sold? 1. Yes 2.No.

C11 iv) If yes, when and why?

	When	Why

C11 v) What other livestock product do you sell?

	Product	Estimated value for the last 12 months
1	Manure	
2	Hides and skins	
3	Fermented milk ghee	
4	Any other(specify)	

C12 i) Do farmers access market information such as prices, customer requirement? 1. Yes 2.No

C12 ii) If yes above, How? 1.Radio 2.Newspapers 3.Visit to the market 4. Mobile phone 5. Ministry of Agriculture 6. NGOs 7 other traders 8.others (specify)

C 13 i) Are there livestock marketing committees? 1. Yes 2.No

C13 ii) If yes above, what is their role?

1……..

2……

C14 i) Which months of the year do you experience pasture shortages?

1…….2……

3…….4……

C 14 ii) What type of animal feed do you use?

1……..2……

3……4……

C14iii) What challenges do you encounter in accessing the animal feeds?

1……..2……..

3……4……

C14 iv) In periods of feed shortages, what strategies do you apply, choose strategies in terms of importance1,2,3…..

Strategies	Importance 1,2,3…..
Feed less to all animals	
Feed less to some animals	
Rent grazing land	
Reduce herd size	
Purchase fodder	
Feed tree leaves	
Purchase concentrates	

C 14 v)In case you have excess feed, what do you do to extra feed? 1.Make hay 2.Preserve as standing hay 3.Sell as raw form 4.Others (specify)

C15 i)How do you get your initial/breeding stock from? 1.Buy from market 2.Buy from breeders 3.From your farm 4.From neighbours

C15 ii) How do you improve your livestock? (multiple response)

1. Use of bulls/Cockrels/He Goats

2. Use of artificial insemination

3. Cross breeding

C 15 iii)Do you select animals for breeding stock? 1.Yes 2.No

C 15 iv) Have you received any training on livestock improvement? 1.Yes 2.No.

C 15 v) If yes by who? And when?

	By who	When (Year)
1		
2		
3		

C 16 i)What support systems are there in your area?

1……2……

3……4……

C17 i). Are there challenges in livestock production? 1.Yes 2.No

C17 ii) If Yes, list them

1……2……

3……4……

C17 iii)What are the solutions to C17ii above(in your opinion)

1……2……

3……4……

C18 i) Do you practice value addition on your livestock products? 1. Yes 2.No

C18ii)If yes in C18i) above ,give examples……

C19 i) Do you plant crops or practice any agricultural activity? 1.Yes 2.No

C19ii) If Yes in C19 i) above what was the total income in the last 12 months from;

Crops	Income in the last 12months
Legumes	
Cereals	
Vegetables	
Fruits	

C19iii) Estimate the acreage of crop and livestock enterprises in your farm

Crops…… Livestock ……

D. EXTENSION SERVICES / INFORMATION SOURCES IN LIVESTOCK FARMING

D 1Are extension services available? 1.Yes 2.No

What are Sources of Information	What are the Channels used for dissemination of Technologies	Which Areas/Sections of innovations are included during dissemination	What is the Frequency of the Dissemination of Technology(Fill in the Blank spaces)
D2 ***Tick the Choice(s) as appropriate***	**D3** ***Tick the Choice(s) as appropriate***	**D4** ***Tick the Choice(s) as appropriate***	**D 5** **Fill in the Value in the space provided below as appropriate**
1.Government officer	1. Field Days	1.Pasture/Fodder management	_____
2.Research Centres	2. Visits to Source	2.Feed utilization	_____
3.NGOs	3. Seminars	3.Feed Conservation	_____

4.CBOs	4. Workshops	4.Feed Preservation	_____
5.Other Farmer	5. Conferences	5.Water harvesting	_____
6.Agro- Vets	6. ASK Shows	6.Soil/Water Conservation	_____ ____
7.Manufacturers	7. Others(Specify)	7. Health Care	_____
8.Private Practitioner		8. Milk handling and preservation	_____
9.Radio		9.Milk Value Addition	_____
10.Newspapers		10.Breeding selection	
11.Tvs Shows		11.Farm management	
12.Others(Specify)		12.Food crop management	

D6. Did you apply the skills learnt from the extensions? 1.Yes 2. No

D7.State the major constraints in the dissemination of technology in livestock farming

1……2……

3……4……

D8.Where do you get credit facilities to improve your operational capital?

1. None 2. Commercial Banks 3. Micro-financial institution 4. Other farming activities

5. Other Non-farming activities 6.Co-operative society 7. Others (Specify)

D 9i). Which farmer group organizations /movement do you belong to? When did you join?.

1.None 2.Farmers Co-operative society 3.Farmer self- Help group 4. Others (specify)

D 9ii) For how long have you been into the group?

D 9iii.How is the farmer group organization/ movement beneficial to you?

1. None 2. Sourcing of inputs 3.Marketing of milk 4. Value addition of milk.
5. Extension Services 5.Collaboration ` 6. Credit to farmers

D10 i)Do other livestock move into your village? 1.Yes 2.No

D10ii) If yes where do this livestock come from? Name the areas.....

D10iii) When do this livestock usually came?.....

D10 iv) Do they cause conflict? 1.Yes 2.No

E LAND TENURE AND FARM UTILIZATION

E1 What is the land tenure system practiced by your household?

1) Private 2) Communal 3) Customary 4) Others (specify)

E2 What was the land size for your household

E2 i) 20 years ago?.....

E2ii) 10 years ago?.....

E2 iii) 5years ago? ……

E 3What is the current land size for your household?

……..

E4 Do you keep animals? 1.Yes 2.No

E 5 In case of change in land size, what are likely causes of change in the land sizes?

……

E 6 How has the land size influenced the livestock you keep?.....

E7 How do you currently cope with changes in land size in managing livestock?

……..

F OFF FARM ACTIVITIES/WELFARE

F1. How many members of your family were actually engaged in paid labour in the last one year

F1 i) How many?.....Total income (kshs) ……

F 1 ii) If no, why ……..……..……

F2Did your household receive any remittances or gifts in the last six months? 0) No 1) Yes,

F3 If yes, from whom ……and what was the value in Kshs…….

F4 Do you participate in any other economic activity? 1.Yes 2.No

F5 If yes ,specify the activity and income earned monthly?.....

F6Did your household receive any aid during the last one year? 1.Yes 2.No

F6 i)If yes what type of aid?.....value Ksh……

G CLIMATE INFORMATION

G1 In your opinion, has weather of this area been changing over the years? 1Yes 2.No

G 2 Which climate extreme event is the most frequent?.....

G3 How did you respond to this extreme climate event? .....

G4 Do you get weather related information? .1.Yes 2.No

G5 From which source?.....

G6 Do you trust the information?.....

G7How does the information help you in planning your farming activities?

H HOUSEHOLD ASSETS OWNERHIP AS A MEASURE OF WELFARE

Please fill this table about the assets you own.

s/no	Item	No.	Unit value	Total current value	s/ no	Item	No	Unit value	Total current value
	Ox plough					Fence for paddocks			
	Food store					Chuff cutter			
	Water trough					wheelbar row			
	Milking shed					Vehicle			
	Sprayer pump					Radio			
	Ox cart					Spade/sh ovel			
	Feed troughs					Solar panel			
	Milk buckets					Farm house			
	Tractor					Furniture			
	Tractor trailer					Panga			
	Bicycle					Jembe			
	motorc ycle					Water tank			
	Televisi on					Posh mill			

	Cereal sieve					Well			
	Power saw					Mobile phone			
	Irrigation equipment					Bore hole			
	Geneator					Anyother (specify)			