ASSESSING THE FACTORS INFLUENCING FOOD AND LIVELIHOOD SECURITY AMONG PASTORAL COMMUNITIES IN TURKANA COUNTY, KENYA

BY

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DECLARATION AND APPROVAL

I hereby declare that the work contained in this Thesis is my original work and has never been submitted for a degree in any other University.

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DEDICATION

This thesis is dedicated to my wife Dorcus Ouma, my daughter Rose Valarie, my son Gerald John; my parents John and Rose Ouma, and all my brothers and sisters.

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ABBREVIATIONS & ACRONYMS

AAME	:	Active African Man Equivalent
AE	:	Adult Equivalent
AIDS	:	Acquired Immuno Deficiency Syndrome
ASALs	:	Arid and Semi Arid Lands
CBO	:	Community Based Organizations
CBPP	:	Contagious Bovine Pleuro Pneumonia
FAO	:	Food and Agriculture Organization
FGLS	:	Feasible Generalized Least Squares
GDP	:	Gross Domestic Product
GPS	:	Geographical Positioning System
GOK	:	Government of Kenya
H/A	:	Height for Age
HIV	:	Human Immunodeficiency Virus
IGAD	:	Intergovernmental Authority on Development
ITK	:	Indigenous Technical Knowledge
L/F	:	Livelihoods Framework
LTK	:	Local Technical Knowledge
NGOs	:	Non-Governmental Organization
ODI	:	Oversees Development Institute
OLS	:	Ordinary Least Squares
OXFAM	:	Oxford Committee for Famine Relief
SPSS	:	Scientific Package for Social Scientists

TLU	:	Tropical Livestock Unit
UN	:	United Nations
UNESCO	:	United Nations Education, Science and Cultural Organization
USD	:	United States Dollar
VIF	:	Variance Inflation Factor
W/A	:	Weight for Age
WFP	:	World Food Programme
W/H	:	Weight for Height
WLS	:	Weighted Least Squares

ABSTRACT

Efforts to achieve food and livelihood security at household level in the pastoral areas of Kenya date back over 30 years. For the Turkana pastoralists, food security is perceived to have been achieved when there is adequate income from livestock and other sources to guarantee sufficient purchase of foodstuffs for the household. The design and implementation of effective measures to reduce food and livelihood insecurity depends on an in-depth understanding of the separate and combined roles of socio-economic, ecological, climatic and cultural factors. This study sought to unravel this nexus by assessing location-specific factors influencing food and livelihood security of households in Turkana County, Kenya. The assessment was based on survey data gathered from randomly selected households (N=158) complemented by literature review.

A multiple regression model was employed to identify factors influencing household-level food security using Income/Adult Equivalent/Month (IAEM) as a proxy. A total of eleven explanatory variables were included in the empirical model. The results revealed that gender, household size, access to natural resources, diversification of livelihoods, education and access to relief food were statistically significant. The coefficient of gender was positive and statistically significant at 5%. In terms of household size, it was evident that large households were more food insecure than the small ones. As expected, the results of this study indicated that households with better access to natural resources such as water, forests as well as land had higher chances of being more food secure.

The results also showed that, households with more diverse income sources (positive coefficient of livelihood diversification) were more food secure than those with fewer revenue

streams. In terms of education, our results showed that households with fewer members who were educated had a high probability of being food insecure (negative coefficient on education). Finally, our results indicated that pastoralists with access to relief food were less food secure. According to the Pseudo R-Square value, the aforementioned explanatory variables explain at least 50% of the variability in the dependent variable; implying that the model fits well to the data.

The findings imply that access to credit and training, access to education, livelihoods diversification, empowerment of women, access to other social amenities and access to natural resources are key to securing household-level food and livelihood security among Turkana pastoralists. These findings provide entry points for policy intervention to reduce food and livelihood insecurity.

CHAPTER ONE

INTRODUCTION

1.1 Background

The Arid and Semi-Arid Lands (ASALs) cover a huge percentage of global landmass. In sub Saharan Africa, ASALs cover 60 percent of the area while in Kenya 80 percent is ASALs (FAO, 2015). These lands are inhabited by pastoral communities who are very likely to be vulnerable to food insecurity in Kenya. A pastoralist is any individual whose main economic activity is principally tending grazing livestock (Nyariki et al., 2002). The term livelihood refers to the main economic activities performed by the household to satisfy its primary and secondary needs. Pastoral production system has a close relationship between people, livestock and land resources. The relationship existing among the three, make pastoral production system different from other forms of economic activities in ASALs. They are politically and economically neglected (Noor et al., 1999). The National Poverty Eradication Plan of 1999-2015 recognizes that a high rate of poverty incidence in Kenya is in the ASALs, where the poor pastoralists account for 80 percent of the county populations. The poor in the ASAL are not only economically neglected, but have limited access to basic goods, services and poorly developed infrastructure, and rely on scarce natural resources for their livelihood (Nyariki et al., 2002).

Understanding the vulnerability of food and livelihood insecurity problem areas among pastoral communities has continued to generate debates in economic and policy fora worldwide. The 1996 World Food Summit discussed the issue of food insecurity in many countries of the world. The target was to reduce the number of poor population who are

affected from extreme hunger and have income less than $ 1 a day (FAO, 2015) by half between 1990 and 2015. Whereas approximately 14 percent of the world population face hunger, over 60 percent of the population in Sub-Saharan Africa as a whole is undernourished (FAO, 2015). In many Sub-Saharan African countries, food insecurity at both the national and household levels is still below expectations although Kenya has made achievements in reducing vulnerability to food insecurity. In the recent past, the challenge is still critical in pastoral areas where more than 50 percent of the households are food insecure. The most affected are those who live in ASALs including those whose main economic activity is livestock production under extensive system (Pinstrup-Andersen, 1994; Carter, 1997; Nyariki et *al.*, 2002, FAO, 2015). Food security as defined is relative; depending on majority economic preferences in a given area. For the Turkana pastoralists, food security is perceived to have been achieved if there is adequate income from livestock, the county's main economic activity, and other livelihood sources to guarantee sufficient purchase of foodstuffs for all household members. This county has one of the highest poverty indices in Kenya (GoK, 2013). Pastoralism in this county is characterized by a strong relationship with the environment through many adaptation strategies to counter environmental uncertainties and variability (Behnke et al., 1993). Herlocker (1999) reported that increasing pressure on resources in the ASALs is due to rapid population growth high stocking rate and climate change and variability, threatening food security and pastoral livelihood.

Pastoralists derive their subsistence needs from consumption of animal products especially milk, meat and blood; in addition to purchased foodstuffs (Salih, 1990). Small stocks are easily sold compared to large stock, which are sold when there is no other alternative. Both animal

products and purchased grains contribute to pastoral household food security. Food security is therefore defined as the availability of adequate food, their accessibility and affordability by household members at all the times for an active and comfortable life (Nyariki et al., 2002). Over the years, Sub-Saharan African governments have been addressing national food self-sufficiency, yet it is evident that, from the outset, perennial hunger could coexist with adequate food supply at national, regional and international levels (Islam, 1989). The quantities of food at the national or regional levels do not correspond to the food security status at each household in the society. This is because households cannot produce sufficient food for themselves and do not have monetary power to bridge the shortfall through purchases.

Naturally, pastoral communities are expected to improve their food security status by improving livestock production and marketing strategies, as well as improved income through diversification and intensification of income-generation activities. Improved livestock production requires an understanding of the pastoral environment and production goals. Therefore, most pastoralists adopt livestock mobility in search of scarce water and pasture resources. In some cases, where mobility if not well managed along specific routes, can cause a definite effect on the natural resources. However, the use of these resources by pastoralists depends on property rights, regime and sustainable management to support their socio-economic livelihood (Scoones, 1994; McCabe, 2003). To cope with these uncertainties in pastoral livelihoods, diverse and flexible strategies through a number of social, economic, environmental and political mechanisms are necessary. These may include improving market outlets, livestock diversity, and monitoring the impact of mobility on natural resources, key site management and establishing small scale businesses (Akabwai, 1993). To complement

these strategies, appropriate policies related to pastoral development including infrastructure and adequate social amenities are needed (de Bruijin and Van Dijk, 2003). Even though most researchers argue that the adoption of mobility paradigm provides new insights into social, political and environmental dynamics of pastoralists, the main concern is how it affects natural resource use and the pastoral livelihood and food security (Niamir-Fuller, 1998; Anderson et al., 1984). An explicit environmental assessment of livestock movement and other development initiatives and their subsequent effect on natural resource uses has been an effective tool for properly designed and implemented pastoral developments to boost food security and pastoral livelihoods (Pratt and Gwynne, 1977).

1.2 Problem Statement

Vulnerability to food insecurity is a function of socio-economic, political, ecological and climatic conditions. Despite numerous efforts by governments and other development agencies to improve food and livelihood security in Kenya, Turkanas are increasingly becoming more and more vulnerable to food insecurity with majority surviving on a monthly income per Adult Equivalent (AE) of below USD 14.40 (GoK, 2013). Therefore, diversification of the economic base becomes essential for pastoral livelihoods to increase household income (Kigutha, 1994; Ngugi and Nyariki, 2005). One of the major factors that threaten food security and livelihood in Turkana County is the sudden decline of livestock production and trade which is largely attributed to prolonged droughts and land transformation for more commercial activities like agri-business (green houses, hydroponics, drip-irrigation, aeroponics, etc.), agro-industries, horticulture, and other informal businesses (GoK, 2013). This happens regularly in a weakly diversified pastoral economy. Issues related to resource utilization and management need to be

addressed to improve food security and livelihood. The concentration of livestock and wildlife in certain range site during wet or dry seasons searching for water and pasture is one of the major causes fuelling natural resource degradation, making the grazing resources available insufficient to satisfy livestock needs (Lusigi, 1984; Ngugi and Nyariki, 2005). Other challenges of food and livelihood security include disease transmission amongst cattle and human beings due to concentration at grazing points, cattle rustling, inadequate market outlets, poor prices of animals and their products, recurrent drought, inappropriate pastoral policy and poor infrastructure. All these challenges have a direct contribution to high food insecurity index among Turkana pastoralists (Behnke et al., 1993).

1.3 Justification of the Study

A detailed socio-economic assessment of the factors that affect food security and pastoral livelihood in Turkana has not been conducted. Studies which have been conducted before are not reliable given the rapid changes on land uses and effects of climate change. This analysis is a first step towards understanding the best strategies of tackling food insecurity in this arid county, as well as substantially reducing poverty. The study provides critical information needed by the county and national governments to address food and livelihood insecurity in the county. In addition, the findings would complement the national government efforts in achieving Vision 2030 in reducing poverty amongst its citizens. This study would also add to the much needed scientific information on food and livelihood security amongst pastoral communities in other arid and semi arid areas.

1.4 Overall Objective

The overall objective of this study is to assess factors that influence food and livelihood security among the Turkana pastoralists in Turkana County.

1.4.1 Specific Objectives

The specific objectives are to:

a) Characterize natural and physical resource availability among Turkana pastoralists.

b) Analyze factors influencing food and livelihood security among Turkana pastoralists.

1.4.2 Hypothesis

The following hypothesis was tested:

Socio-economic, climatic, ecological and cultural factors influence food and livelihood security among pastoral communities in Turkana County.

CHAPTER TWO

LITERATURE REVIEW

2.1 Food and Livelihood Security in Pastoral Areas

Food Security is one of major factors of development and poverty reduction for many international and national public institutions. Food security is so important that in reference to the state of food insecurity in the world report of the Food and Agricultural Organization (FAO) of 2015, approximately 870 million people were undernourished in the period 2010-2012. Over 90% of these undernourished people are in the developing countries. Although the word "Food Security" is being used more often, its definition and concept is not clear and has evolved with time. Defining food security precisely is very difficult. According to FAO (2015), there are approximately 200 definitions and over 450 indicators of food security worldwide. According to World Food Summit (1996), food security exists when a population, at all times, have economic access to adequate, safe and nutritious food that meets their normal dietary needs and food preferences for an active, comfortable and healthy life. At community level, food security has been defined as a situation where all citizens have safe, socially acceptable, nutritious diet through a sustainable food system that optimizes healthy choices, community self-reliance and equal access for every community member.

From these definitions, attaining food security seems to be a challenge with no single country being able to actually achieve it. Therefore, for specific national programs definition of food security should be carefully contextualized; ever endeavoring to aptly capture the local situations within a given period of time and space for it to be achievable and measurable.

However, it seems like, no matter how we define food security, having adequate food regularly for active and healthy life is the most essential human need. Many developing countries, especially in South Asia and Africa, have not been able to achieve this basic and important need even today. Thus, a household is food secure when it has access to the adequate food needed for all its members (adequate in terms of quality, quantity, and safety and culturally acceptable) and when there is no undue risk of losing such access. Food security at global, regional or national level cannot actually address the household-level food security challenge. This relationship is not clearer in Sub-Saharan countries than in developed ones. Therefore, specific economic policies are required to address household-level food insecurity and these policies should be specific to each area.

Globally, the 1975 UN understanding of food security in the context of the arid and semi-arid areas seems to have reflected today's thinking, which focuses on adequate production of food at the household level (Maxwell, 1990; GoK, 1997; FAO, 2001; Nyariki and Ngugi, 2005; FAO, 2005; Amwata, 2013). Food insecurity is not simply as failure of crops and livestock to produce adequate food at household level, but as the inability of livelihood to guarantee availability and access to sufficient food, social amenities, health services, education, infrastructure and healthy environment at household level (Amwata, 2013). In other studies, food security may be defined as access by all people at all times to adequate food for an active life (World Bank, 2001; Nyariki et al., 2002). Although food is the key factor, it is not all that matters. Issues pertaining to proper storage, cheap imports; accessibility through purchasing power, etc., play a vital role (Nyariki and Wiggins, 1997). Household access to food is either through its own livestock/crop production of foodstuffs or by command over food in markets

or other strategies; decisions over the quantity and kind of food produced or bought, the local distribution of household food amongst residents, and the state of health of individuals which affects the ability to secure proper nourishment from food. Other studies (Amwata, 2004 and Nyariki and Wiggins, 1997) define food security as the timely availability of sufficient diet at all times for an active, comfortable healthy life (i.e., 2250 kcal/AAME/day). Food security is thus, achieved when sufficient growth in food crops and livestock is attained not only to sustain output per individual, but also to reduce food calorie deficits and reduced food imports (Nyariki and Wiggins, 1999). In some empirical literature, food security refers to food grains alone, which is a very narrow view. Nyariki and Wiggins (1999) found out that this definition is misleading especially to households where livestock production is the main economic activity, and hence major source of income and food. In pastoral areas with the greatest risk of food insecurity, foods other than cereals, contribute almost 40% of the total food energy for households (GoK, 2000).The potential contribution of livestock to food security and economic development is therefore, much higher than what is normally accounted for. Therefore livestock production in pastoral communities should be integrated fully in any food security analyzes activity, whether at regional, national or household level. They contribute to food security through, increased output of milk and other by-products such as butter, cheese, yoghurt, ghee, etc.; as well as employment and income generation, all of which can enhance food access (Nyariki and Wiggins, 1999). It has been debated that the main cause of food insecurity in pastoral areas is poverty or lack of a diversified source of income from livestock or its products to secure sufficient food for a household.

Rampant food crisis in ASALs, is caused by a wide range of factors ranging from droughts and unpredictable weather patterns, resource use conflicts, unfavorable policies, environmental degradation, diseases such as HIV and AIDS, and other natural hazards. All these affect household incomes through reduced livestock and/or crop productivity. No single factor can account for food insecurity (FAO, 2001) in any community. Regular droughts in the ASALs of the Greater Horn of Africa are a major confounding factor into food security analyses. Not only do they reduce crop and livestock productivity, but also affect other sectors of the economy, including reduction and pollution of water and air, which people drink and breath, resulting in elevated incidences of water- and air-borne diseases. A morbid community is not productive and hence food and livelihoods insecure. Turkana County is a food insecure county, having been the biggest recipient of relief food since 1970s (GoK, 2013). It represents a complex situation where a multitude of socio-economic, cultural and climatic factors, acting in concert culminate in given food security situation at a given time (Nyariki, 2000; Ngugi and Nyariki, 2005; Amwata, 2013). The scenario changes now and then as the weather changes. This is the challenge that food security experts need to identify to be able to tackle the problem of food and livelihoods insecurity.

2.2 Challenges and Strategies for Food and Livelihood Security in Pastoral Areas

Looking at the drivers of pastoral livelihood strategies, participating in market-based non-pastoral economic activities, pastoralists not only improve their food security, but also sustain their pastoral activities. Many pastoralists in Africa have overcome the vagaries of weather in dry-lands through trade in animals and engagements in non-animal activities. They separate domestic herds from the commercial herds with the latter being grazed separately and fattened

for eventual sale; while the former are dedicated to supply of meat, milk and cash for the household. The income from sale of these animals, in addition to other non-animal commercial activities, such as retail shops and culinary services, are used to stabilize household food security and sometimes can elevate the household to more prestigious livelihood statuses. With improved food security status, some members of the family might take formal education, then get secular employment with government or private sectors and hence increase their income per month. The extra income is used to make-up for food deficits within households. In a study to look at the process of household decision-making processes to engage in non-farm activities in rural Mozambique, Cunguara et.al (2011) found that income, climatic shocks, education, household size, gender and market access were important factors. In another study, Cunguara et.al (2011) found that differential access to markets and resource endowments or livelihood assets are important determinants of the choice a household makes in hedging itself against food insecurity. Butcher (1994) using household data from central and western Kenya found geographical location, household size, years of farming experience, ease with access to credit facilities and remittances from members of the households to be significant determinants of livelihood choices.

Due to many past years of economic and political marginalization, coupled with inappropriate development policies, the ASALs are today the most underdeveloped areas in Kenya (Sunya, 2003; Julius, 2013).Taken together, pastoralists experience the highest incidences of poverty, food insecurity, low access to credit, basic services and amenities, etc., of any nature in the country (Ngugi and Nyariki, 2005). Economic survey reports indicate that over 70 percent of the Turkana people live below poverty line, against the national average of 53 percent (GoK,

2000). Recent studies have shown that pastoralists' wealth within the ASAL counties have declined by more than 60 percent over the last ten years (GoK, 2013). This is attributed to stresses experienced by the communities which are related mostly to climate change, droughts, water shortage, increasing human and livestock population and general mobility of both human beings and livestock (GoK, 2009; Nyariki et al., 2002). Among the policy related challenges, the communities that are migratory, especially the Turkanas of Kenya, face constant pressure to sedenterize. Their mobility is often seen to be in conflict with official plans to modernize the nation. In all the communities, the traditional system of leadership and governance has also come under increasing pressure as new systems of national and county government become more powerful, usually at the expense of traditional system (Vedeld, 1990; Elhadi et al., 2015). Other challenges emanate from resource use conflicts, cattle raids from neighboring countries and lack of organized management committees to protect natural resources (Readon and Vosti, 1995). It is from these exigencies that Turkana community derives its adaptive strategies. Today, there is a growing debate that the 'poor' are their own 'agents' of development guided by their own experience and economic strategies which could lead to sustainable livelihood and food security (Kigutha, 1994; Neumann, 1998). Therefore, most pastoralists have adaptive strategies, which can lead to sustainable livelihood. David et al. (1999) noted that these economic strategies have evolved from an interaction between scientific and technical indigenous knowledge. These strategies should be diverse and involve adaptation to various factors including ecological, social, political and cultural risks.

Documentation of adaptive strategies of Turkana pastoralists reveals that they have evolved complex strategies to deal with their environments in a sustainable way (Lane, 1989).Various

challenges are forcing an ever-increasing rate of food insecurity, necessitating the adoption of new strategies for survival. The adaptive strategies, which need close monitoring, are the ones that are entrenched in the traditional pastoral system, because, as compared to modern statutory systems, they are explicit in terms of the norms and guidelines, which regulate people in their daily interactions with the available natural resources (Chambers et al., 1992). Chambers et al. (1992) suggested some of the key adaptive strategies used by Turkana pastoralist to improve their livelihood. They include:

- Multi species composition of livestock to withstand various stresses and improved production.
- Dry land farming where possible includes growing drought resistant crops like millet, sorghum etc.
- Community regulation for the maintenance of ecosystem health, conservation and management of various pastoral resources.
- Use of modern veterinary services where opportunities permit to improve livestock health.
- Diversified livelihood systems to improve food security.
- Communal decision making about movement and use of pastoral resource, raids and conflicts.
- Reliance on food aid but to an extent community do not over depend on it.
- Increasing market outlets for livestock products.

In terms of resource utilization, there has been a great concern and many governments have been working on best strategies on utilization of range resources to improve their welfare (Sunya, 2003). Sub-Saharan Africa specifically has been singled out as the worst hit by droughts resulting in scarce resources, and hence high rate of food insecurity. However, many rangeland development projects by government fail due to unrealistic policies, which are not based on pastoralists' economic models and ways of life (Rutten, 1992; Musimba and Nyariki, 2003). Most of them tend to undermine the traditional management of natural resources and coping strategies of pastoralists, and hence conflict with their social, cultural and economic fabrics (Mogotsi et al., 2011; Degefa, 2001).

Opportunities for increasing livestock productivity in rangelands are diminishing fast and the pressure being exerted on the land is gradually 'pushing' more and more people to other livelihoods systems (Amwata, 2004; Ngugi and Nyariki, 2005). Ngugi and Nyariki (2005) found out that in pastoral areas, there are sustainable and unsustainable livelihoods. They suggested a Livelihoods Framework (LF) that distinguished two modes of extracting products and services (livelihood) from natural resources, namely, Regenerative (sustainable) extractive (unsustainable). Both livelihoods are gained through the use of natural, physical, human, and technical resources. In this framework, natural resources include land and climate; while physical resources include tools, machinery, and infrastructure. Human resources include things like physical labor, skills, and education, while technical resources include indigenous and modern farm and livestock management techniques. Land and climate-related resources comprise water, vegetation, soil, livestock, wildlife, and minerals, all of which are interdependent (Ngugi and Nyariki, 2005).

Ensuring adequate food for the inhabitants of dry lands by use of natural resources poses complicated challenges, because climate change is ravaging pastoral areas of Kenya and sub-Saharan Africa. Naturally, the productivity of arid lands is low and its improvement through technologies such as improved livestock breeds, market outlets, etc. is less than through management innovations related to natural resource use, adapted to local circumstances (Nyariki, 1997). There is also growing evidence that agricultural intensification in dry lands is possible (Pinstrup-Andersen, 1994); and that development of improved livestock production technologies through research, is getting increasingly possible. In addition, initiations of new livelihood systems are some of the long-term strategies of famine prevention and eradication of extreme poverty, associated food insecurity as well as environmental protection (Pinstrup-Andersen, 1994; Ngugi and Nyariki, 2005).

The tendency of pastoral households to engage in multiple occupations can be used to formulate rural poverty reduction policies involving natural resources governance and utilization. In the past, it has often been assumed that livestock production through use of natural resources would create multiple, income-earning opportunities in a rural economy via forward and backward linkages. However, this assumption is no longer tenable (Ellis, 1998) since, for most rural households, crop cultivation or livestock production on its own is unable to provide sufficient means of survival, and the yield differentials from new technologies are already displaying signs of leveling off (Pinstrup-Anderson and Pandya-Lorch, 1997; Jeremy et al., 2010).The adoption and adaptation of diversified livelihoods over time by rural households is now understood to be as a result of risk spreading, consumption smoothing, labor allocation smoothing, and other coping mechanisms. However, livelihood diversity results in

complex nexus among a multiplicity of factors including poverty, income distribution, farm productivity, environmental conservation, and gender relations that are not straightforward and sometimes counterproductive. Future rural poverty reduction policies need to be better informed on the nature of these interactions. For example, it is fairly well known that the low income households diversify using less advantageous labour markets than the better off (i.e., in casual, part-time, and unskilled work compared to full-time work or Self-employment. These findings are related to the asset status of the poor which is characterized by low human capital and barriers to entry resulting from low assets, e.g., need for skills, ability to go through bureaucratic processes, etc. It is possible that facilitating the low income households to gain better access to opportunities or to create their own opportunities may be more cost effective for poverty reduction than attempting to support particular sectors or sub-sectors of rural economic activity (Tangka et al., 2000; Joseph, 2004).

Diverse and flexible resource utilization strategies are some of the coping mechanisms which pastoralists employ to sustain their livelihoods through efficient resource mobilization (Nyariki et al., 2002). This should be coupled with well-planned rangeland developments to reduce incidents of land degradation due to livestock mobility. With relatively high livestock populations in Turkana County, pastures and other natural resources become limited and scarce (Swift, 1994; Musimba and Nyariki, 2003). Some pastoralists, thus, tend to diversify their livelihood by setting small business enterprises in urban centers and on the roadsides; and seeking off-farm employment and practicing dry land farming. In some areas, women groups set up natural resource-based enterprises like apiculture to augment their livelihood and food security (Turner, 1993). Other rangelands in Kenya, like Turkana County, are well endowed

with other natural resources that can reduce their vulnerability to food and livelihoods insecurity. In March 2012, the Government of Kenya confirmed the discovery of economically viable oil deposits in Turkana basin. Since then, more oil deposits have been discovered and the current reserve-estimates stand at approximately 600 million barrels. The oil exploration and extraction and the accompanying infrastructural development no doubt holds a promise for economic liberation and economic development of the hitherto marginalized County, as well as, the country (BBC, 2012). This means that there is high opportunity for improved food and livelihoods security in the county using the available resources. But there is great suspicion that the discoveries could be a source of conflict through land use transformation which could lead to less emphasis on livestock production, the main economic activity for pastoralists to-date.

More interesting, in 2013, UNESCO and the Government of Kenya scientifically confirmed discovery of huge groundwater reserves in Turkana County. The water could change thousands of lives, but only if technical challenges are overcome, and the resource managed for the benefit of local people. The discovery, which was the result of a groundwater mapping study, was massively hyped but nothing has changed in the county. People still rely on bore- holes found along dry river beds for water often walking long distances to fetch the commodity. Typically, the locals survive on 10 liters per person per day, half the globally recommended minimum (GoK, 2000). Other available natural resources in rangelands include: sand and stones for building and construction, timber products, gold, fishing in Lake Turkana and wildlife, which can attract tourists (Turner, 1993). These resources are not properly managed and utilized hence the locals are more vulnerable to food insecurity. This is epitomized by low

livestock production, few social amenities like health centers, schools, market places, and poor infrastructure. Even though livestock production remains the most viable production system in this area, other livelihood systems can thrive well to uplift socio- economic status of the Turkana people. This however is not possible until the factors hypothesized to be contributing to vulnerability to food and livelihood insecurity are well addressed in terms of policy and practice (GoK, 2000). Therefore, the main objective of this study is to establish the contribution of several socio economic, cultural and climatic factors as they relate to the use of available natural resources to reduce vulnerability to food insecurity through livestock production and other forms of livelihood systems in Turkana County. Turner (1993) argued that increasing rate of food insecurity amongst pastoralist communities is not only determined by the shifting spatial and temporal patterns of rangeland resources, but also by social, economic, political and institutional dynamics. In addition, most range land developments in Kenya, where pastoralism is the main livelihood system have been faced by unsustainable policies and lack of properly conducted environmental impact assessments of projects (Ngugi and Nyariki, 2005). If proper policies are enacted to deal with pastoralism, then food security and sustainable livelihoods can be achieved in Kenya's rangelands. Pastoralists have perpetually been caught in a vicious cycle of food-related tragedies such as low food intakes, hunger and famine but eventually have 'pulled' through. The challenge is how to effectively strengthen the livelihood security of pastoralists and adequately articulate the food-related tragedies under the various political, socio-economic, technical and environmental forces (Bollig and Schulte, 1999).

2.3 Common External and Pastoral Responses to Food and Livelihood Insecurity

To achieve food and livelihood security in pastoral areas, there is need to design pastoral development programmes in order to align them with the fast shifting paradigms of participatory development (Musimba and Nyariki, 2003). For example, an effort to increase livestock population should be accompanied by a strong effort with an aim of developing adequate and advanced marketing outlets. It is today a well-documented fact that big pastoral development projects that do not factor the local people ideas at the initial stages of planning, design and implementation have zero chances of success (Child et al., 1984; Oba and Lusigi, 2003). There is need for participatory pastoral development that involves participatory rural appraisal to assess the local needs thus; increasingly local needs are being recognized. Extension services should embrace community involvement and active participation anchored around the "bottom-up" rather than "top-down" approach is very adaptive and participatory to enhance ownership of the programmes. As Chambers (1983), Child et al. (1984) and Muriuki (1995) observed, there is growing need to emphasize small but structured projects of little capital so as to enable quick and objective evaluation of the results. This approach has been widely applied by the low-capital, action-oriented Sida-funded projects in Eastern Africa with great success. One of the principles of these projects is creating a sense of project ownership at the community level and household level. Because of the small nature of the projects, there is close interaction and much easier communication amongst key stakeholders of the project. As a result, capacity building and strengthening of community local institutions is an important pathway towards sustainable rural development.

Some of the small community groups, such as Community Based Organizations (CBOs), which are local institutions mandated with the responsibility of developing, planning and implementing such projects, have shown much success in local development initiatives. This bottom-up approach use the local technical knowledge (LTK) of the local people, who for years understand their environment well (Musimba and Nyariki, 2003). LTK is knowledge usually developed or generated locally as opposed to ITK, which is principally from outside. This, coupled with technical inputs developed through Participatory-Action-Research, tends to build confidence and ownership at the community level through participatory learning which is usually a two-way process, where development stakeholders learn from the livestock farmers, and the poor to understand their knowledge systems and vice-versa. In fact, in what he refers to as reversals in learning, Chambers (1993) suggests that there is much more for development stakeholders to learn from the livestock farmers. It has, thus, been established that Local Technical Knowledge (LTK) is very useful and should be incorporated in technological packages, which pastoralists would embrace, if successful implementation of development projects is to be achieved. As pointed out by Herlocker (1999), to make the best use of the existing LTK and to ensure that development efforts are well understood, accepted and likely to succeed, development should aim at increasing the participation of pastoralists in the identification, planning and implementation of development projects within their own communities.

The population of livestock must be reduced so as to be in line with the level of productivity of the remaining rangelands. This can be achieved by drafting pastoral friendly policies on development and by offering alternative livelihoods besides pastoralism. To improve food

security, increased productivity through improved livestock husbandry is necessary. This can be achieved through, for example, improving accessibility to veterinary services, reclamation of land lost to human settlement on lands traditionally used for dry season grazing, and improved marketing systems. Increase in access to credit by pastoralists, which they invest in value addition of their livestock products is also an open option (Musimba and Nyariki, 2003).

2.4 Pastoral Food and Livelihood Security Assessment Approaches

Food security for any community or house-hold revolves around its status of income, food supply, health and general well-being (Alinovi et al., 2010). The Humanitarian Policy Group of the Overseas Development Institute (ODI) (2009) identifies four dominant livelihood assessment strategies in ASALs across the Horn of Africa. In descending order of importance, these are: those depending on livestock alone, those combining livestock and dry land farming, those including wages and non-farm income-generating activities; and finally hunters and gatherers. According to the group, the first strategy is the most common in the dry lands. Pastoral households diversify into non-pastoral economic activities, as well as employment, as a last resort in response to dwindling herds and other untoward factors such as climate change (Ogallo, 2004; Nyariki and Abeele, 2004; Ngugi and Nyariki, 2005). Diversification of income-generating activities for the low income households is a survival strategy motivated by the consequences of unfavorable weather patterns. Distress-driven diversification into low return non-farm or non-pastoral wage activities is a safety net that cushions low-income households from sliding further into food insecurity (Reason and Visit, 1995; Joseph, 2004). Middle-income pastoralists diversify less, while the high-income diversify more to accumulate more wealth (Rutten, 1992; Cunguara et. al., 2011). Thus, while wealth provides the inputs to

diversify into non-pastoral income-generating activities with higher returns, poverty pushes pastoralist into low-return, non-pastoral activities (Barrett et al., 2001). Whether through these or any other set of factors, non-pastoral engagements serve as genuine sources of upward mobility for the diversifying households (Joseph, 2004; Fairhead and Scoones 2005; Amwata, 2013). It is also a critical points of synergy for pastoralists who depend entirely on livestock and its products (Ngugi and Nyariki, 2005). A positive correlation is usually reported between household income and non-farm or non-pastoral participation (Nyariki et al., 2002). Diversification into commercial income-generating activities generates livelihood strategies that dominate rural income and welfare (Kristjanson et al., 2002; Amwata, 2013). Non-agricultural commercial activities yield higher and steady incomes, yet many pastoral households appear to lead nomadic pastoral livelihoods exclusively. In comparison to information by Kenya Integrated Household Budget Survey conducted in 2005-06, Alinovi et al. (2010) applied Ward's cluster analysis technique to classify Kenyan households according to their livelihood strategies. They found significant differences in resilience between the six livelihood clusters that emerged across the pastoral regions of Kenya. While big farmers are the most diversified and less vulnerable, the pastoralists are the least resilient.

Generally, pastoral households pursue diversified livelihood strategies although the extent of diversification varies from household to household and from one community to the other (Kavishe and Mushi, 1993; Joseph, 2004; Nyariki et al., 2002, Ngugi and Nyariki, 2005). The activities comprise either annual or seasonal employment, informal trade, casual labor or self-employment. It is important to note that as much as livelihood diversification has been shown to affect household food security positively, it is also possible to have negative impacts. The

benefits of livelihood diversification are affected, for instance, by the form of property rights that exist; whether the natural resources are community, private, or state-owned. For the "common-pool resources" such as pastures and water among pastoralists, the concept of tragedy of the commons does not apply (Mburu, 2003).

Various methodologies have been used scientifically to determine household vulnerability to food insecurity (Amaza et al. 2009 and Tasokwa, 2011). Wolfe and Frongillo (2001), Oni et al. (2010) and Bartfeld and Hong-min (2011) used qualitative approach to determine household food and livelihood security. In both qualitative and quantitative studies, different models have been used in establishing the various determinants of household food security. Commonly reported determinants of household food security using this approach include the education level, land size owned by a specific household, number of people per household, total household income, and ease of access to credit facilities, accessibility to markets outlets and gender of household head, number of economic activities, livestock size among others. Nyariki et al (2002) used various approaches namely Ordinary Least Squares (OLS), Weighted Least Squares (WLS) and Feasible Generalized Least Squares (FGLS) models in determining the various key factors influencing household food and livelihoods security in Makueni County. The reported result was that WLS produced much better results in terms of R^2 and with a number of significant variables with income being the major determinant of household food security. Binary logit regression model has also been used by researchers to estimate the determinants of household food security (Amwata, 2004). Amwata (2004) considered gender of household head and individual land ownership as the main determinants of household food security in Kajiado County. In other different studies, child nutrition has been used to

determine and measure household food security (Kigutha, 1994; Amwata, 2004 and Pankomera et al., 2009). In this approach, he focused on female and children who are believed to be- the most vulnerable members of the households. Each of the methodologies has their own limitations in assessing food security.

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study Area

This study was conducted in the northern part of Turkana County, about 700km Northwest of Nairobi, Kenya. Turkana is the second largest county in Kenya covering approximately 77,000km^2, bordering Marsabit County to the east, Samburu County to the south-east, and Baringo County and West Pokot County to the south-west (GoK, 2013). The county also borders South Sudan to the north, Uganda to the west and Ethiopia to the north-east (see Figure 1). The name Turkana is widely believed to be a corruption of *Turkwen* which means 'cave people' in *Kiturkana*, the language of the Turkana people. The Turkana people are among the poorest in Kenya, and the county is among the ten poorest in the country. In the 2005/2006 poverty survey, Turkana was estimated at 94% compared to national average of 51%. Unemployment level, especially among the youth is high (70%). In the same report, only 29.3% of males and 7.8% of females were able to read and write, compared to a national average of 82% for males and 70% for females; and an urban average of 93.6% for males and 88.1% for females. During the same period, the survey indicated that over 35% of children in the county had not attended school (GoK, 2013).

Majority of the inhabitants of the county are pastoralists who depend almost entirely on livestock for their daily needs. They move from one place to another along definite stock routes and sometimes cross the borders to Uganda, Southern Sudan and Ethiopia looking for pasture and water for their livestock. The Turkana have a special social set up where members of one

family live in a *manyatta.* During drought, the whole family may move with livestock and settle in an *Adakar* (temporary settlement used by the pastoralists during migration with their livestock). The Kraal leader has specific functions like settling disputes, surveying grazing resources and instructing herders on how to manage livestock. In addition, the leaders conduct informal education sessions on their culture and way of life. For semi-settled pastoralists, only some members (mainly young men) of the community migrate with the livestock leaving behind the old men, women and children. Usually small stock grazes around the Manyatta while large stock moves further in search of water and pasture. Some of these pastoralists supplement livestock products with relief food provided by several aid agencies and the government. Some members of the community do fishing in Lake Turkana, while others are engaged in gold mining in Kakuma division; a few practice dry land farming in areas like Kalobeyei. Some are hunters and wild food gatherers especially in Oropoi. In towns, most Turkana people engage in various business activities to earn their living. Infrastructure and social amenities in the area are poorly developed due to neglect from the central government.

The study area falls under ecological zone IV and V, receiving 300—400mm of rainfall or less per year. Daily temperatures range from 25^{C} to 38^{C}. In Lokichoggio, Oropoi and Kakuma the dominant vegetation species are *Acacia tortilis, Acacia Senegal, Balanites egyptiaca* and *Salvadora persica*. Lokitaung and Kaleeng sub counties have *Acacia tortilis, Indigofera spinosa* and *Balanites egyptiaca*. Kibish division has vast grassland with scattered Acacia trees. There are also wide Lotikipi plains now dominated by *Prosopis juliflora*. The main soil types are sandy loams in Lotikipi plains, black cotton soils around Kibish, while the rest of the area is dominated by rocky and stony outcrops. The area has low human density coupled with

poor infrastructure, social amenities and agriculture extension services. This has increased pastoral livelihood and food security risk with continuous livestock raids affecting livestock production. In addition, livestock marketing has been adversely affected due to such conflicts, distance from the market, low demand and low market prices for livestock and the products (GoK, 2013)

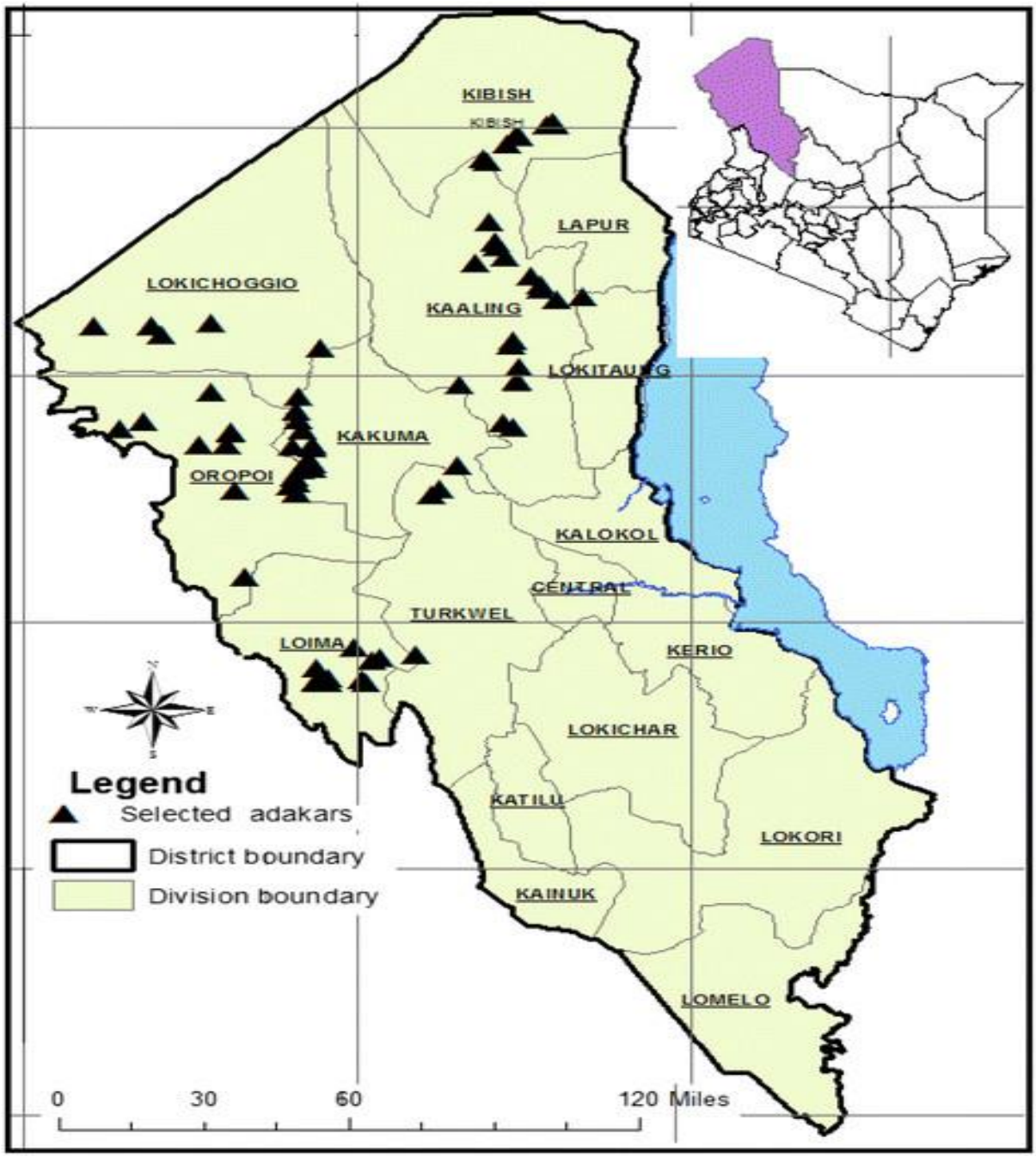

Figure1: The location of Turkana County

3.2 Data Collection

3.2.1 Resources, Infrastructure and Social Amenities Inventory

Accomplishment of the first objective of this study involved conducting a comprehensive inventory and characterizing of all resources found within the study area. These included pastures, water sources, salt-licks, wildlife, forests, income sources, livestock, etc. Each resource, facility or amenity after identification was then geo-referenced and immediately digitized in order to come up with resource map of the study area. Data collection methods included interviews with key informants including, local leaders, and county government officials, review of county reports, Focus Group Discussions and site visits.

3.2.2 Socio-Demographic Data

These data were obtained from survey interviews of 158 pastoral households conducted between March and June 2015. All the households where interviews were conducted were geo-referenced and transferred to the resource map created in the first objective (Figure 1). A multi-stage sampling procedure was adopted, where the questionnaire was administered through individual structured interviews with the heads of the households. The information about the background of the head of the household revealed the respondent's age, household size, level of education, main occupation, assets owned and gender. Selection of households heads was done along the stock routes which acted as the transect. These are routes followed by pastoralists when trekking their livestock to or from the wet or dry season grazing areas or to the markets. The routes cut across seven sub counties of Turkana North County namely: Lokichoggio, Kakuma, Oropoi, Kibish, Kaleng, Lopur and Lokitaung. Households were

identified randomly and systematically along the stock routes. The first manyatta was randomly identified while the subsequent ones were systematically identified at 5km intervals. At the end of every 5km, the closest manyatta on either side of the route was selected. In each manyatta a list of all households were numbered (1—N). Household to be interviewed was based on the systematic random sampling (Prewit, 1975). A random start was used in choosing the first household to be interviewed. Five households were then skipped to get the next household to be interviewed and so on. If the selected household did not have a household head, it was skipped and the closest adjacent next household selected until the list was exhausted. Using this approach a total of 158 households were sampled. Focus group discussions were carried out after the key informants had been identified in each Manyatta. For the focus group discussion, participants were identified randomly which included women, men and youth household heads. Each category was represented by five participants. A total of 20 Focus Group Discussion were held and 15 key informant interviews. The survey gathered qualitative and quantitative data pertaining to the social, demographic and economic aspects of the households. The study also included items related to causes of food insecurity as well as access to markets and other social amenities and incentives like credit facilities among others.

3.3 Statistical Analysis

In this study, Income per Adult Equivalent per Month (I/AE/M) was used as a proxy for food security (Amwata, 2004). Total income was derived from all the income sources including on-farm and off-farm activities which were then divided by the Adult Equivalent (AE) per month. Income per AE/month was the dependent variable analyzed against other independent variables affecting food security. Depending on the household size, the average income per

AE was set at USD 14.40 per month (GoK, 2013). Socio-economic data like age of the household head, gender of the head of household and educational level were analyzed to show how they influence the income which is directly linked to food security. Various income sources were analyzed to show how households diversify their livelihood systems and how income contributes to accessibility to foodstuffs for the households during the dry and wet seasons. Influence of distance to livestock market outlets, pasture, water, access to training and credit facilities; and social amenities were analyzed to determine their relationship to household food security status.

Different sources of income, namely, livestock, monthly remittance and other sources were compared. Analysis on how cash income contributes to household food security in comparison to famine relief foodstuffs and animal-based foods was done. Data on the number of households receiving relief food were analyzed to show how these supplements affect their daily food requirements. Data on cash income were also analyzed to determine the sources of cash that contributed most to the pastoral household food security, while data on pastoral resource availability were also analyzed at the sub county level to assess how their spatial distribution and utilization influenced livelihood diversification. In addition, key social, economic and cultural factors were analyzed to identify their linkages with the herd size and livelihood diversification, which, in turn, impact the status of household food security. Climatic factors such as droughts were ranked against non-climatic factors to show which factors pose the greatest challenge to food security. In addition the study area was 'broken down' into micro-ecological zones ranging from wet to dry ones and which were overlaid on household food security zones.

3.3.1 Statistical Model Used

This study uses multiple linear regression model because it gives opportunity to use multiple independent variables to predict the dependent variable with each controlling for the others. In addition this model is very flexible since independent variables can be numeric or categorical and interactions between variables can easily be incorporated (Amwata, 2004). In selection of the variables, multicollinearity test was undertaken using Variance Inflation Factor to ensure variables used do not correlate with each other. Further Breusch-Pagan/ Cook-Wellbeing test was conducted to eliminate any possible case of heteroscedasticity.

Income per Adult Equivalent per Month (I/AE/M) was used to estimate household vulnerability to food insecurity. This approach involves data collection on household total income from different sources and the number of individuals present. Total income refers to the sum of value of livestock, crop and off-farm income in a given time period (Kristjanson *et al.,* 2002). In addition, the number of members present in a household is standardized into adult equivalents (AE). The concept of AE is based on the differences in nutritional requirements according to age and sometimes sex. It assumes the lifecycle stages have an important influence on the needs of members of the same household (Kristjanson *et al.,* 2002). Various consumption weights have been proposed over time. This study has adopted consumption weights by age, where: 0-4 years = 0.24 AAME; 5-14 = 0.65 and over 15 years = 1.00 (GoK, 2000). Income per adult equivalent per month (I/AE/M) was calculated by dividing total income per household per month by the sum of the Active African Man Equivalent (AAME). In the descriptive analysis of food security, the figure obtained was compared to the recommended income per adult equivalent per month for the rural area of USD 14.40 (GoK,

2013).Those households with I/AE/M above USD14.40 were deemed as food secure, while those below this were considered food insecure. According to Amwata (2013), the equation below was used to calculate vulnerability to food insecurity:

$$VFI_t = Y_a / Y_r \quad \text{.....(1)}$$

Where:

Vulnerability to food insecurity (VFI_t) at time t = Total I/AE/M for a household (Ya) divided by the required total I/AE/M for that household (Y_r). The relative vulnerability of a community to food insecurity, therefore, is the proportion of households which fall below the poverty line of USD 14.40 per AE/M (GoK, 2013). The poor households are those which do not earn USD14.40 per AE/M. Households whose members earn USD 14.40 and/or above per AE are considered less vulnerable to food insecurity. The independent variables which influence household food security included social, economic, cultural and climatic factors. Socio-cultural factors include household size; age and gender of household head; economic factors are: number of livelihoods, income, relief availability and access, and distance to nearest markets; social amenities, access to credit and training; climatic factors such as ecological zones, access to water points and pasture.

Therefore, the multiple linear regression model may be expressed as:

$\gamma=\alpha+\beta_1\chi_1+\beta_2\chi_2+\beta_3\chi_3+ \ldots +\beta_\eta\chi_\eta+\in$ .....(2)

Where:

γ= Income in terms of I/AE/M (Dependent Variable)

α= Constant term

$\in$=Stochastic error term

$\beta_1,\beta_2,\ldots\beta\eta$=Regression coefficients to be estimated

$\chi_1+\chi_2,\ldots\chi_\eta$=Independent/explanatory variables

3.3.2 Variables Used in the Model

3.3.2.1 Total Income (Dependent variable)

Income is the total amount of money that a household gets from both farm and non-farm sources. An increase in household income is usually expected to improve access to food through own food production and increased food purchases (Nyariki et al., 2002). Amongst the Turkana pastoralists, income is derived from selling of livestock and its products and other livelihood sources. The income is used to purchase more food for household consumption. Nevertheless, some studies (Sunya, 2003) show that income available in the household is used differently, depending on who within the household controls the resources or income. It is known that income controlled by women, particularly in Africa, is more likely to be spent on food hence making households more food secure (Nyariki et al., 2002). The income per AE per month was calculated by adding up all the receipts from livestock, remittances and other

livelihood sources within the household divided by the number of Adult Equivalents (AE) in that particular household. Income per AE/M is used as a proxy to food security status of the household throughout the month. Those below USD 14.40 per month are considered vulnerable to food security; while those above USD 14.40 are considered food secure (GoK, 2013). Every household, therefore, must do all it can to stay above this perceived food security threshold.

3.3.2.2 Household Size

Household size refers to the number of people living together at any specific time. Large households have more people available for herding, thus increasing in income. In Turkana, large households spend little or no money hiring labour, since they can produce their own labour. Sufficient labour at household level is likely to improve security since more effort is directed towards livestock production and other income sources. It is expected that relatively larger households have higher chances of being more food secure. Small households spend extra resources hiring labour for their livestock, hence likely to experience food insecurity. Herding labour is very important especially during mobility to look for scarce grazing resources. Quality herding translates to sustained and increased livestock productivity thus food and livelihoods secure.

3.3.2.3 Herd size

Livestock size comprises both small (shoats) and large (cattle and camels) stock. Pastoralists depend almost entirely on their livestock for their needs (Nyariki et al., 2002). In most studies, herd size is converted to Tropical Livestock Units (TLU). In the tropics, Tropical Livestock

Units are the most common indices. It is expected that households with more TLUs are likely to be more food secure than those with few TLUs since they get more income from livestock products. TLUs are used as a measure of wealth in pastoral set up. This contributes directly to food for consumption especially milk and meat; so the more the TLUs, the more likely the income for the household.

3.3.2.4 Distance to Markets

This refers to the distance and accessibility of markets for livestock and its products. Pastoralists mostly sell small stock to meet daily needs like purchasing milk, flour and other foodstuffs. This is their major source of income. Households which walk longer distance to access markets are more likely to be food insecure because they cannot easily sell their small stock to raise income to purchase food.

3.3.2.5 Gender of Household Heads

Gender of the household head refers to the male or female headed household. Households headed by females are likely to be more food secure than male-headed households. This is because, in a pastoral setup, women are responsible for income from lactating cows, goats and camels. Female-headed households give priority to food purchase in their budget rather than non-food purchase (Nyariki et al., 2002). It is also expected that female headed households engage in many other economic activities like selling sugar and tobacco, thus increasing their level of income.

3.3.2.6 Distance to Social Amenities

This refers to distances covered to access basic facilities to improve lives of people. The facilities include hospitals, schools, shops, cattle dips, etc. Those living near social amenities are likely to be more food secure since people spend little time and money to look for the services. These resources can be devoted to active production to improve food production. Availability of shops makes it easy for pastoralists to easily access the food they may be lacking. Those households near social amenities are likely to be more food secure compared to those far away from the facilities (Nyariki et al., 2002).

3.3.2.7 Level of Education of Household Head

Level of education attained by the household head play a major role in an individual's decision-making on how to spend the household income and the choice of other economic activities to engage in, which have direct bearing on the relative vulnerability of the household to food security shocks. Household heads with a formal education have a better chance of securing jobs to supplement livestock production (Muia, 2012). This would be one of the ways of diversifying livelihoods, and reducing vulnerability to food insecurity.

3.3.2.8 Age of the Household Head

Lusigi (1984) noted that with increase in age, the head has more wisdom and experience on livestock production and livelihood diversification. They are capable of making good decisions on food security based on the past experiences they have had during the dry and wet seasons. This provides cautionary advice on planning for food throughout the year. Households with younger heads are believed not to have good experience in food planning and production.

3.3.2.9 Livelihood Diversification

This is the involvement of the household members in other economic activities besides livestock keeping (Noor et al., 1999; Muia, 2012; Amwata, 2013). Households involved in more than one economic activity are expected to have more income and are likely to be more food secure. Livelihood diversification plays a major role in household food security in semi-arid areas like Turkana. It reflects abundance of other natural resources which can be consumed at primary or secondary level by the household members.

3.3.2.10 Relief Food

This is the food supplement provided by the aid agencies or government institutions to improve food quantity per household. Relief food fills the food deficit required by each household especially during the dry season when milk production is very low (Jeremy et al., 2010). The major relief food provided is maize and oil. Relief food also lessens the burden of using household income in purchasing some foodstuffs. Households receiving food relief are likely to be more food secure than those not receiving since they can fill the food deficits during the dry season.

3.3.2.11 Access to Training and Credit Facilities

Access to information and credit facilities is likely to increase the propensity of a household to engage on business economic activities to improve household income. Households with access to affordable credit facilities can easily diversify their livelihoods (Muia, 2012). This is significantly boosted but access to trainings to empower households on livelihoods systems. Households with access to trainings are likely to be more food secure since their capacities are

built on issues related to livestock production, business management and coping strategies in the light of climate change (Muia, 2012).

3.3.2.12 Ecological Zones

The ecological zones have a direct bearing on vulnerability to food insecurity. It is likely that households in wet areas are food secure due to abundance of grazing resources like water and pasture for livestock hence improved production. Wetter areas do also support small scale farming as compared to dry areas (Jeremy et al., 2010).

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

Turkana County is mainly inhabited by pastoralists whose main livelihood is livestock production. This economic activity is under immense threat from climate change, other land uses and scarce resources to secure their livelihoods. Vulnerability to food and livelihood insecurity, unless addressed holistically, poses a great danger to the general development of the county. This study has used the regression model analysis to identify key factors which have strong influence on food and livelihoods security.

4.2 Resource Distribution, Abundance and Utilization in Turkana County

Table 1 below presents the natural resources, infrastructure and facilities found in the study area including their physical distribution. The county is endowed with a wide range of natural resources including pasture, wildlife, water, sand, building stones, gold among others. Some of these resources are found within specific range sites in the study area. Turkana County, unlike other arid and semi-arid counties is well-endowed with various natural resources, which are either under-exploited or over-exploited. Davis et al. (1999) reported that pastoralists who live in the dry lands of sub Saharan Africa have evolved time-tested, complex and well managed ecological strategies which are well adapted to local environments and social conditions and which enable them to utilize natural resources on sustainable basis. This applies also to the Turkana communities which have always managed their resources to improve food and livelihood security. Table 1 presents the natural resource abundance in northern Turkana.

Table 1: Natural resources in northern Turkana

Natural resources available for utilization	Division							Total respondents
	Lokichoggio	Oropoi	Kakuma	Kibish	Kaleng	Lokitaung	Lopur	
Water and pasture	0	6	0	12	0	0	2	**25**
Wildlife	0	17	0	4	1	1	1	**24**
Timber and fuel wood	6	19	1	1	4	7	2	**44**
Sand	0	0	9	0	4	0	0	**13**
Building stones (quarry)	0	0	6	0	9	0	1	**16**
Oil	0	0	4	5	0	4	0	**4**
Fish resource	0	0	0	0	0	7	6	**13**
Labor	14	0	2	0	0	3	0	**19**
Total	**20**	**42**	**22**	**22**	**18**	**22**	**12**	**158**

Source: Survey data

From Table 1, grazing resources, which includes water and pasture, are mainly found in Oropoi and Kibish sub-counties. These are wetter areas bordering Uganda, Sudan and Ethiopia. Most Turkana pastoralists graze their livestock in these regions for most part of the year. They are termed as dry season grazing areas. Oropoi Sub-County is mostly inhabited by *Themeda triandria, Cenchrus ciliaris, Cencrus siniensis* and *Sporobolus* pasture species, and *Acacia tortilis, Acacia Senegal* and *Salvadora persica* species which are browsed by camels and goats. Water is mainly from several water pans that are constructed by development agencies operating in this region. In addition, many springs are also found along the borders of Uganda but these have generated a lot of resource use conflicts among the Turkana and Karamajong

pastoralists from Uganda. Although there has been a discovery of a massive water reservoir in Turkana County, the community is yet to benefit from the resource. No water is running out through the taps for human or livestock consumption. For pasture abundance, Kibish has open grassland occupied by a mixture of *Themeda triandria* and Cenchrus species with scattered acacia species. The other parts of the study area have poor production of grazing resources due to poor soil types and massive land degradation that slow down the rate of pasture regeneration and successional processes.

As shown in Table 1, various vegetation types provide timber and fuel wood. Vegetation types supporting apiculture are mainly found in Lokichoggio, Oropoi and Lokitaung sub-counties. The dominant vegetation types are the Acacia species. These areas have high incidences of charcoal burning, bee keeping and firewood collection to refugee camps as an alternative source of income to supplement pastoralism.

Wildlife is a very important resource in Turkana County. Majority of the wildlife is found in Lake Turkana National Parks consisting of Sibiloi National Park, South Island and Central Island National Parks, covering a total approximately 161,485 ha, and located within the Lake Turkana basin whose total surface area is 7 million ha (GoK, 2000). Table 1 also shows that outside the protected area, Oropoi division is leading in wildlife abundance. This is because most of the wildlife migrate from Uganda to look for pasture and water in Kenya. Oropoi has a well-balanced ecosystem with a habitat that supports most wildlife species. The various species of wildlife include the elephant, bongo, dik, hyena, lion, and wild dog, among others. Most of the wildlife has been wiped out due to illegal hunting using firearms. Currently, only the dik are the majority in this fragile ecosystem. Other resources like sand, building stones

and gold are found in Kakuma division. Most of the young men are engaged in sand and stone harvesting to earn a living. They sell these building materials to development agencies that are implementing various humanitarian projects, which involve construction. This is a lucrative business in Kakuma at a place called Lokore. Those engaged in this business said that they sell one stone block at one hundred shillings each. Sometimes they sell so much but lack of suitable investment activity to engage in except livestock production. This also applies to sand harvesting, which takes place at Lotikipi plains. Gold is also found in Turkana and, currently, a private investor at the expense of the community is harvesting the resource. Gold harvesting takes place at Gold village at the junction to Lokitaung on Kakuma-Lodwar highway. In addition, oil has been discovered in Turkana near the borders of Uganda and South Sudan. The discovery was made but drilling might take as long as 10-20 years. The exact benefits to the community according to respondents are not yet clear, fueling much tension on its importance to improve food and livelihoods security. Of late, there have been some conflicts amongst the Turkana and the neighboring communities about the ownership of the location where oil has been discovered.

Turkana County is also endowed with fish resources in Lake Turkana. Fish is not optimally utilized in the county. Since the community is pastoral, it does not optimally utilize this resource extensively. It is reported that few people living in Lokitaung and Lopur Sub-Counties practice fishing. Some members of the communities claim that they don't have adequate fishing materials like motorboats and fishing nets. In addition, insecurity in the lake has been a problem. According to respondents, Merrile from Ethiopia have been engaging their

neighbors, the Turkana, in intense conflict over this resource. In Lokitaung, few people do fishing to improve their food security status.

Labour is another important resource in pastoral communities. It comprises mostly the young people who herd the livestock at a fee. Lokichoggio Sub-County has the highest labour force for hire. This is because majority of NGOs working in South Sudan are based in Lokichoggio. Young men migrate to this town to look for casual jobs as a means of livelihood diversification. Those households that do not have adequate labour for their livestock also hire these young men. Payment is either in cash or kind (in form of animals). In summary, the resources outlined above provide opportunities for livelihood diversification among the Turkana community to enhance food security.

Given the diverse nature of natural resources in the area of study, some pastoralists have started diversifying their livelihoods systems to improve food security. Table 2 shows various livelihood systems in the study in relation to the resource availability and abundance. Each administrative area has specific economic activities given the nature of the resources available and their abundance. This is one of the best ways of diversifying livelihoods besides livestock production. Some of the economic activities carried out as shown in the Table 2 include: Sand harvesting, gold mining, dryland farming, small scale business, firewood harvesting, hunting and gathering, beekeeping, and charcoal burning. Some also engage in employments offered by the development agencies operating in those areas.

Table 2: Complementary economic activities in Turkana County

Sub County	Economic activities besides livestock production (livelihood diversification)
Lokichoggio	Small-scale business, employment, and charcoal burning.
Oropoi	Small-scale business, hunting and gathering, bee keeping, dry land farming.
Kakuma	Firewood collection, small scale business, charcoal burning, gold mining and employment
Lopur	Small scale business, charcoal burning,
Kibish	Small scale business, hunting & gathering
Lokitaung	Small scale business charcoal burning, employment
Kaleng	Small scale business, hunting & gathering

Source: Survey data

In terms of frequencies, livestock keeping is still the main economic activity as shown in Table 3 with approximately 58% of the respondents citing it. This is followed by those engaging in self-employment, mainly in town centers like Lokichogio, Kakuma, and Oropoi selling fast moving items to earn extra income. Dry land farming is also being practiced in some of the wetter ecological sites like Oropoi where about 12% of the respondents cultivate millet, cassava, maize as subsistence crops. For those living near Lake Turkana about 5% engage in fish farming to diversify their livelihoods.

Table 3: Main economic activities in northern Turkana and relative proportions of communities involved in them

Economic activities	Frequency	Percent
Livestock keeping	100	58.5
Self-employment	20	11.7
Salaried employment	10	5.8
Crop farming	19	11.1
Fishing	9	5.3
Total	158	100

Source: Survey data

4.3 Livestock Management and Ownership Among Turkana Community

The major source of livelihood amongst Turkana people is livestock production. Most respondents confirmed that even though livestock is their main economic activity, it has been facing serious threats making others engage in other economic activities to increase their income (Table 2). Livestock production goal is subsistence especially for milk and meat. They keep both large and small stock but the majority is female livestock for the purpose of getting milk which is their main foodstuff. In most cases, small stock contribute greatly to their food security because they easily sell them out when need arises. Over 90% of the Turkana people are therefore pastoralists by the nature of their production system (GoK, 2000). They indicated that the seasonal variation of grazing resources necessitates relatively large landmass in which some parts are set aside to be used during the season of optimality (Ngugi and Nyariki, 2005). Many households exhibit mobility to take advantage of other situations such as exploitation of specific resources, i.e. water and forage. There is cyclic movement of herders in such of scarce

pasture and water. During dry season, herders move to high areas bordering Uganda, Sudan and Ethiopia. This actually facilitates resource use conflicts with pastoralists like Karamajong of Uganda, Merille of Ethiopia and Toposa of South Sudan. From the interviews conducted, it was noted that grazing resources are owned communally and this represents the most efficient way of utilizing scarce resources (GoK, 2000). Each household has a herder depending on the size of the flock. Most of the respondents reported that they use family labour but in some cases they hire labour and pay them in kind (in terms of animals). Each group settles in a mobile manyatta called *Adakar*. An elder who is responsible for surveying grazing resources before they move to another area, heads each *Adakar*. Under some circumstances the elders settle disputes that arise amongst herders. *Adakar* have informal education sessions called Alternative Basic Education for Turkana; funded by Oxfam. This education system highlights mainly their socio-cultural lifestyle. Ownership of livestock is open to all members of the household. Table 4 shows various ways of acquiring livestock by household members. The table shows that majority of the Turkana acquire livestock through raids followed by dowry. Since the Turkana are surrounded by fellow pastoralists from other countries, they usually have organized raids at least once a month to get more livestock from their neighbors or as a revenge mission following a recent raid by their "enemies".

It is against the culture of Turkana to raid fellow tribe men since they believe it discourages peace and unity amongst themselves. Raids are usually organized according to the location of the people. For instance the Turkana living in Kibish and Lopur sub-counties usually raid the Merrile community from Ethiopia, those living in Oropoi organize raids against Pokot from Kenya and Karamajong from Uganda, while those around Lokichoggio raid the Toposa from

South Sudan. Cattle rustling in this region are well embraced by the community as a way of restocking after the drought or a means by which young men acquire livestock. This activity is highly facilitated due to the availability of cheap illegal firearms, which they can easily afford from neighboring communities. Porous borders have made it possible for illegal firearms trade to thrive. Respondents reported that they exchange one mature bull for a gun while bullets are sold for as little as fifty Kenya shillings. Respondents noted that there are two types of raids in this region: normal and induced raids. Normal raids are more or less peaceful where the raiders are only interested in the livestock. They do not involve mass killing of villagers unless they try to defend themselves. Induced raids are the most common in Turkana County since several pastoralist communities surround it. It usually has political support against another community. In some cases it leads to mass massacre of innocent people while raiding.

Table 4 shows that dowry is the second source of livestock for households. In this community, households with many girls are considered potentially richer than those with boys since the girls are equated to so many heads of cattle and/or small stock. For instance, in some clans, for a young man to get married, he has to pay dowry equivalent to 20 heads of cattle, 50 camels and unknown number of goats and sheep. This number can be exceeded depending on the capability of the man. For young men from poor families, the only way to have these animals, is to organize cattle raids, otherwise they remain bachelors. Some of them may be supported by their parents, but not always. Some young men acquire the livestock for dowry through gifts, buying and inheritance. Although livestock ownership among the Turkana is a right to

every household member, the bulk of them is, however, owned by the household head, while the rest is spread among other members of the family.

4.3.1 Livestock Distribution among Turkana Pastoralists

Turkana pastoralists mainly keep cattle, goats, sheep and camels. Table 5 shows the general herd structure of typical Turkana households. The productivity of livestock is a function of reproductive efficiency, individual growth rate, cost of production and climatic conditions. Reproductive efficiency determines the marketable surplus of livestock and its products. Therefore in market-oriented societies, it is directly related to commercial off-take (Nyariki, 2008). Majority of Turkana pastoralists keep sheep and goats and female herd for milk production (Table 5). This is because they are well adapted to the harsh environment and are easily sold to raise income for food purchases. Female stock provide milk for consumption. They can also be sold off easily in case of emergency food deficit. Camels are also very important since they are kept for milk and meat production. Cattle are a major asset of the household being the main source of milk, meat and cash. In addition, cattle are associated with other socio-cultural values. Lactating female stock are kept near bomas for ease of access to the family for milk and meat supply (Joseph, 2004). Livestock population figures based on 2010 estimates show that livestock population decreased in the county after the devastating drought of 2005/2006, which caused a drastic decline in the livestock population (GoK, 2013). This had a negative effect on attainment of food security amongst the Turkana Pastoralists.

Table 4: Ways of acquiring livestock amongst Turkana Community

Acquiring of livestock	Frequency	Percent
Raids	47	29.7
Inheritance	37	23.4
Dowry	45	28.5
Gifts	18	11.4
Buying	11	7.0
Total	158	100.0

Source: Survey data

In terms of livestock population in Turkana County, sheep and goats are the majority followed by cattle and camels (Table 5). Donkeys are very few since they are mostly used for transportation of foodstuffs and water for households. Between 2008 and 2010 there was an increase in livestock population in this county which was attributed to the fact that the area had not experienced a major drought (GoK, 2013). In improving food and livelihoods security, pastoralists consider sheep and goats and the lactating cows and camels for milk on a daily basis. More resources are invested in restocking the shoats than other kinds of livestock in pastoral areas (Nyariki et al., 2002).

Table 5: Livestock Population in Turkana County

Period	Cattle	Sheep	Goats	Camels	Donkeys
2008	193200	191200	975600	14076	32640
2009	197700	1054400	172400	35160	35160
2010	197700	2021000	1054400	17240	35160

Source: GoK (2010)

The size of the household stock reflects the status of household food security. Those households with a large number of livestock and especially the female stock are considered more food secure than those with few since they can produce more milk and the surplus can be sold to purchase other basic needs.

4.3.2 Challenges Facing Livestock Production in Turkana County

Pastoralism faces many challenges, which are therefore partly responsible for household food insecurity (Nyariki et al., 2002; Amwata, 2013). These challenges range from the climatic changes, access to market outlets, raids and diseases. As presented in Table 6, respondents confirmed that those challenges are the primary causes of food insecurity in the county. Turkana pastoralists consistently lose their herds to raiders from Sudan (Toposa), Uganda (Karamajong), Ethiopia (Merrile) and central Turkana (Pokot). The proliferation of small firearms has exposed pastoral communities to frequent cattle rustling escapades. About 30% of the respondents reported that raiding is a major source of livestock especially after long droughts. It is also part of their cultural method of restocking. The heightened level of insecurity has resulted in serious restriction of prime grazing areas. Inaccessibility of dry grazing areas has made livestock susceptible to starvation during droughts; hence pastoralists

have become food insecure. Lack of markets and high veterinary costs reduce net earnings from sale of livestock.

Table 6: *Major challenges facing livestock production system in Turkana County*

Challenges of livestock production	Percent respondents
Drought	43.7
Raids	30.4
Diseases	20.3
Low prices	3.2
Market outlets	2.5

Source: Survey data

4.3.2.1 Effects of Drought on Water and Pasture Resources

Drought occurrence is the main problem limiting livestock productivity in Turkana County. Table 5 shows that most respondents (44%) considered drought occurrence as the major problem limiting flock productivity. Drought limits availability of water and pasture for livestock. This affects biomass productivity per individual species; hence the net ecological carrying capacity goes down (Amwata, 2013). Droughts decimate the flocks and when coupled with low livestock prices and high grain prices, they render pastoralists more vulnerable to food insecurity. Climate change has caused frequent droughts responsible for depletion of water in this region even though there are a number of water bodies in the county as shown in Table 6.

Water is a major resource in livestock production. In dry lands of Africa, water scarcity has been cited as a contributing factor to food insecurity (Ogallo, 2004; Musimba and Nyariki, 2003). The major source of water in Turkana County is shallow wells. Most of the shallow wells dry up during the dry season. Table 7 shows various sources of water by sub-counties within Turkana County.

Table 7: Water sources in the study area

Sub counties	Source of water	Number of water sources
Lokichoggio	Shallow wells	27
	Boreholes	6
Kakuma /Oropoi	Shallow wells	41
	Boreholes	9
Kaleng	Springs	8
	Shallow wells	9
	Boreholes	3
Kibish	Shallow wells	9
	Boreholes	1
Lokitaung	Rivers	1
	Springs	2
	Shallow wells	12

Source: Survey data

Lokichoggio sub-county has the highest number of shallow wells and boreholes. Other sub-counties like Kakuma and Kaleng, depend on springs and seasonal rivers but they are too few

to meet the requirements of all the livestock population in that area. 80% of the respondents reported that the few water sources in the area are the reason behind their movement from one area to another during drought to search for water and pasture. Mobility has also been cited as one of the strategies of managing rangeland ecosystem due to its in equilibrium nature (Amwata, 2004).To achieve food security more efforts should be invested in water development initiatives to ensure clean and healthy water is available for both human and livestock consumption (Barret et al., 2001).

4.3.2.2 Effects of Livestock Prices and Distance to Markets on Livestock Production

Relatively low prices of livestock and long distance to market outlets also present a significant challenge to pastoralists in Africa (Nyariki et al., 2002; Joseph, 2004). As a result of these factors, livestock lose weight and hence fetch very low prices. In extreme cases, livestock may also die. With low prices, households are forced to sell more livestock in order to meet their food requirements, a situation that depletes pastoral capital. A majority of the respondents preferred selling their livestock to middlemen at throw away prices than walking the long distance. Consequently, it is the middlemen who benefit from the hard labour of pastoralists. Table 8 shows the price ranges in most markets in Turkana County. These prices are what are quoted by middlemen who transport the livestock to both primary and secondary market outlets**.**

Table 8: Livestock prices

Livestock species	Price range (Kshs)	Average price (Kshs)
Cattle	8100-13000	10500
Goats	800-2000	1400
Sheep	900-1800	1250
Camels	12000-18000	15000

Source: Turkana County Agriculture Annual Reports

Pastoralists who live very far from the market fetch much lower prices for their livestock than those residing closer to the market. A majority of the markets are outside the county; making it very difficult for the pastoralist to access and bargain for better prices for their livestock. Table 9 shows the number sold in markets outlets outside the county. These markets are mainly accessed by the middlemen or livestock traders who buy livestock from the pastoralists.

Table 9: Major livestock markets outside the County and the number of animals sold through them between 2008 and 2010

Markets	Goats and Sheep			Cattle		
Year	2008	2009	2010	2008	2009	2010
Dagorreti	1550	402	182	3400	802	1035
Dandora	600	340	-	214	229	75
Eldoret	1133	1241	10	-	24	-
Bungoma	24	23	10	-	24	-
Kitale	943	129	59	-	-	1
Mogotio	400	560	-	36	35	-
Moi bridge	-	40	-	-	-	-
Mombasa	300	550	150	-	-	-
Elburgon	4	27	57	-	-	-
Kariobangi	40486	14685	25998	136	55	-
Njiru	100	800	-	238	309	709
Kisumu	208	325	868	-	-	-
Kericho	-	-	10	-	-	-

Source: GoK (2014)

Table 8 shows that sheep and goats are mostly sold outside the county. This confirms the respondents' views that they keep majorly goats which can be easily sold to get money for purchasing food deficits (Table 5). The main market outlet for the livestock from Turkana County is Kariobangi in Nairobi County. Cattle are mainly sold in Dagoretti market Nairobi County followed by Njiru and other market outlets. Access to markets is very critical to improving food and livelihoods security (Nyariki and Wiggins, 1999; Joseph, 2004).

Pastoralists prefer selling their livestock to meet food deficits only when need arises but unfortunately they don't get the best price for their livestock. This implies that, they remain food insecure until they access better markets to sell their livestock.

Currently one of the strategies Turkana pastoralist use to expedite sale of their livestock is to use primary markets within the county. Though they don't offer better prices, it saves them time and exploitation by middlemen who offer extremely low prices. Lokichoggio and Kakuma were ranked the best livestock markets within the county (Table 10).This is because demand for meat is so high given that development NGOs are based in these two towns.

Table 10: Livestock slaughtered within the County in 2005

Division/market outlet	Cattle	Goats	Sheep	Camels
Lokichoggio	104	38367	1050	50
Kakuma	376	36249	3305	405
Lokitaung	142	516	823	82
Kaikor	120	300	390	50
Total	742	75432	5568	587

Source: GoK, 2010

The decision to sell a particular species of animal is influenced by the financial needs of the household and the number of livestock owned. In support, Sunya (2003) reported that some of the household needs amongst Rendille pastoralists are food, school fees and medical services. This too applied to the Turkana pastoralists. They reported that livestock were only sold to meet immediate cash requirements as dictated by the needs of the households. In most cases Turkana sell small stock to meet small financial needs while large stock are sold to meet huge financial needs like fees and medical bills. The decision to sell small stock is made by household heads while sale of large stock only happens after consulting all household members

and when there is no alternative. Table 11 shows reasons for sale of livestock among Turkana pastoralists.

Table 11: Main reasons influencing sale of livestock by Turkana Pastoralists

Reason for sale	Percent respondents
Foodstuffs	70
School fees and medical bills	20.5
Surplus stock/buildup stock	3.5
Drought	3
Other	3
Total	100

Source; Survey data

4.3.2.3 Effects of Diseases on Livestock Production among the Turkana Pastoralists

The most prevalent disease in Turkana County is Contagious Bovine Pleuro in South Sudan and has now spread throughout the county. This disease is mostly reported in cattle. It can be controlled through vaccination and quarantine. Other diseases common in this county are anaplasmosis, heart water, liver fluke disease, and camel pox among others. The mortality associated with the disease is high. Diseases and droughts affect flock productivity by causing high flock mortality and hence food insecurity. Herlocker (1999) noted that pastoralists have wide knowledge on various ways of treating and controlling livestock diseases. Turkana pastoralists have knowledge of various medicinal plants including their nutritive value and toxicity. They avoid certain water points and swamps like those in Koyasa because they are associated with diseases like foot and mouth. Very few Turkana pastoralists graze their

livestock in Lotikipi plains during the dry season because the soil is associated with anthrax and black water. Respondents reported various ways of treating their livestock which is presented in Table 12.

Table 12: Methods of disease control used by Turkana pastoralists

Method	Percent of respondents who cited it
Ethno veterinary methods	80.6
Use of modern vet drugs	10.8
Slaughtering of sick animals	5
No action	3.6
Total	100

Source: Survey data

It is apparent that majority of the pastoralists prefer ethno-veterinary methods of treating their sick animals. The high preference was attributed to the fact that the methods are relatively cheaper and more reliable than the modern ones which involve purchase of modern drugs, which are more expensive. Among the medicinal trees used by this community are *Acacia nilotica*, *Acacia nubica*, and *Albizia antihelmintica.* Other respondents reported use of modern drugs while others slaughter the sick animals or take no action at all (Table 12).

4.4 Traditional Resource Utilization and Management

Range environments by nature have scarce resources available for utilization by pastoralists (Lane, 1989; Muia, 2012). From the Focus Group Discussions, it was reported that Turkana communities have adaptive strategies that have generally evolved from livelihood patterns and

practices over time and have strong links with local knowledge and sustainable livelihood. Their Local knowledge is one of the environmental conservation measures for sustainable livelihoods. In addition, they reported that well-managed and basically sound socio-ecologically adaptive strategies to enable them live in harmony with the environment and utilize majorly grazing resources on a sustainable basis have been developed. This management of resources evolved around their livestock grazing patterns whereby stock graze in the lowland plains of rangelands like Lotikipi and Oropoi during the wet season then gradually move to the wetter areas on the borders of Uganda, South Sudan and Ethiopia during the dry season. They traditionally set aside dry season grazing reserves called *Amaire* or *Ekapa*. The combination of grazers and browsers ensures an optimal utilization of range forage (Anderson et al., 1987; Jeremy et al., 2010). Management and ownership of forage resources in Turkana County is communal and every member of the community has a right to utilize these resources but this does not mean the tragedy of the commons exists since the rights are only extended to members of this community (Bryant, 1992; Muia, 2012). During drought, water in surface dams and pans are usually restricted to household use only. This includes family members and young animals grazing around the manyatta. The rest look for water elsewhere. Communal ownership of natural resources extends to all other available resources including harvesting of sand and stones, fishing and even gold mining (David and Davis, 1999; Muia, 2012).

4.5 Regression Analysis

4.5.1 Descriptive Statistics of Variables Used in the Regression Model

Regression analysis was conducted on data collected to assess various hypothesized factors influencing vulnerability to household food and livelihood insecurity in Turkana County. Using the results of the analysis, the variables are discussed to show how they influence food and livelihood insecurity. Table 13 presents a summary of the variables postulated to influence household food security.

Table 13: Summary of factors hypothesized to influence vulnerability to food and livelihoods insecurity in Turkana County

Variable	Unit Definition	Summary
Dependent variable		
I/AE/M	USD	0.77 (Mean)
Independent variables		
Gender of the household head (scf)	Binary: 1 for male 0 for female	140 male ; 18 female headed
Household size (scf)	Residents present (AE)	10.5 (Mean)
Herd Size (ef)	Tropical Livestock Unit	23.82
Livelihood diversification (ef)	Binary:1 diversified 0 not diversified	73 diversified; 85 not diversified
Age of the household head (scf)	Age set in years (18-30yrs),	Mode: 48
	(31-50 yrs)	Mode:70
	(Over 50 yrs.)	Mode:40
Main economic activities (ef)		
	1= livestock	100 households
	2= Self employment	20 households
	3= Salaried employment	10 households
	4= Crop farming	19 households
	5= Fishing	9 households
Education of household head (scf)	1 = Primary	128households
	2 = Secondary	30 households
Access to relief food (ef)	Binary:1= yes 0 = No	101 hhds for 1;57 hhds for 0
Distance to market outlets (scf)	the larger the longer the distance	0-5km=31hhds
		6-10km=15hhds
		>10km=112hhds

Table 14 Continued: Summary of factors hypothesized to influence vulnerability to food and livelihoods insecurity in Turkana County

Distance to social amenities (scf)	the larger the longer distance	0-5km=34hhds 6-10km = 12hhds >10kms=112hhds
Distance to water points (nare) (scf)	the larger the longer distance	0-5km=27hhds 6-10km=19hhds >10kms=112hhds
Access to credit (scf)	Binary:1= yes 0 = No	37hhds for 1;121hhds for 0
Ecological zones (cf)	Binary:1=wet 0=dry	52hhds for 1;106hhds for 0
Access to training (scf)	Binary:1=yes 0=No	30hhds for 1;128hhds for 0
Food security	Binary:1 yes 0 for No	23hhds for 1;135 for 0

Notes: hhds- households, km- kilometres, nr- Natural Resources, scf- Social Cultural Factors, ef- Economic factors, cf- Climatic factors

4.5.1.1 Food Security

For this study, I/AE/M is used as a proxy for food security. It was derived as the sum of proceeds earned from farm production, employment and business by household members each month. Also, remittances from household members residing away from their households and pension accruing to retired household members were also included. This was then divided by the number of individuals in the household in terms of adult equivalents per month for each household to obtain total income per adult equivalent per month. The household population for each month was converted into adult equivalents based on the monthly population structure (Nyariki *et al.,* 2002; Tasokwa, 2011). Other studies have also used income as a measure of vulnerability to food insecurity. For example, FAO (2012) used income and consumption

patterns as a measure of food security in Gaza and West Bank of Palestine. The study established that households with low income per adult equivalents (USD 3.1) were more vulnerable to food insecurity than households with higher income per adult equivalents (USD 12). Income/AE/M was calculated per month per AE then compared with the standard income/AE/M for Turkana County which is USD 14.40 (GoK, 2013). As presented in Table 12, 85% of the households were food insecure. Only 15% households were food secure. Further analysis shows that majority of the food secure households had access to credit and training.

4.5.1.2 Gender of Household Head

Majority of the households in the study area are male-headed (Table 13). The few households headed by females are either located in towns or their male partners have died, mostly through cattle-related raids. According to the Turkana culture, males are the household heads and therefore responsible of making key decisions related to food security at household level. In this study, only 11% of the households were female-headed compared to 89% households which were male-headed. Households headed by female were found to be more food secure then the male-headed which was largely attributed to the fact that females pay more attention to food procurement than men (Nyariki et al., 2002).This implies that majority of households in the study area are highly vulnerable to food insecurity.

4.5.1.3 Household Size

This is the number of AE per household. The average size of a household in Turkana County is 10.5 AE (Table 13). This is because many families are polygamous. Bigger households are viewed as advantageous because they have more labour to take care of the livestock. Excess

labour can also be leased to small size households at a fee which contributes to family income which contributes to food security. Households with many household members are considered less vulnerable to food insecurity since some members can engage in other economic activities to supplement livestock keeping hence increase in household income.

4.5.1.4 Education Level

Here, the study probed the ranks of formal education attained by the Turkana community. Overall, education level is still very low in this community. The main limitations cited was that children have to walk along distances to school since they are not only few but also far apart. Other reasons why parents do not send their children to school included lack of interest for education. Some parents prefer their children attending Alternative Basic Education, focusing mostly on their social and cultural way of life. Efforts by authorities, including the county government, to increase the number of both primary and secondary schools have not been easy due to limited funds, poor infrastructure and recurrent conflicts. In relation to food security, respondents confirmed that those households with members who have acquired secondary education and above have diversified their livelihoods given that they can easily secure jobs and earn income which increases their purchasing power to buy foodstuffs. Table 13 shows education levels in relation to livelihood diversification.

Table 15: Education level versus livelihoods diversification amongst Turkana pastoralists

		Level of education		**Total**
		Primary education	Secondary education	
Livelihood diversification	Diversified	17	29	46
	Not diversified	111	1	112
Total		128	30	158

Source: Survey data

From Table 13, 85% of the respondents had no formal education or had only primary education out of which only 13% have diversified their livelihoods. Only 15% of respondents achieved secondary education and above of which 96% of them diversified their livelihoods. This shows that educational level can be a major factor in food security among the pastoralists. Those with secondary education can easily adopt innovations and new technologies, and hence substantially improve their production capacity more than their contemporaries with only primary education who largely depend on their traditional way of production (Amwata, 2004). In addition, those having secondary certificates and above can easily secure jobs with the county government and development agencies operating in this area. The extra income they get from these jobs supplement milk production through purchase.

4.5.1.5 Age of Household Head

The age of the household head was grouped into three age brackets: 18-30 years were 30%; 31-50 were 44% while the rest belonged to >50 years. Further descriptive analysis showed that a majority of households within the 31-50 age group engage in other economic activities (Table

14). Households with diversified livelihoods are more food secure than those depending on livestock keeping (Amwata, 2004). Households whose heads were above 50 years were most vulnerable to food insecurity. This, according to the respondents, is mainly due to lack of zeal to invest in other economic activities like sand harvesting and other hard jobs which can only be done by young men. Table 15 presents the ages of household heads cross-tabulated with livelihoods diversification amongst respondents.

Table 16: Age of household head in relation to livelihood diversification

		Livelihood Diversification		Total
		Not diversified	Diversified	
Age group	18-30 yrs.	28	20	48
	31-50 yrs.	34	36	70
	>50 yrs.	23	17	40
Total		85	73	158

Source: Survey data

4.5.1.6 Distance to Social Amenities

From the study, most areas of Turkana County do not have adequate social services like schools, hospitals and shops. Majority walk very long distances to access these services. Out of 158 respondents, 71% households do an average of 10 kilometers and above to reach the nearest social amenities (Table 13). Closeness to social amenities is likely to enhance food security because pastoralists would spend little time and resources to access these services; hence they would devote most of the time and resources to production. Most Turkana pupils make use of Alternative Basic Education offered by OXFAM since the formal education in

most rural areas is not accessible. However, respondents living in urban areas like Kakuma and Lokichoggio access these services without difficulty.

4.5.1.7 Access to Relief Food

Relief food is widely distributed in Turkana County by agencies that include World Food Programme (WFP) of the UN, African Medical Research Foundation, Government of Kenya, Lutheran World Federation, Samaritans Purse and Oxfam amongst others. Most of the relief agencies distribute yellow maize and oil. Table 13 shows that 64% households interviewed received relief food. Over-dependence on relief food is also a factor contributing to food insecurity in Turkana County since many people do not see the sense of investing resources to secure their livelihoods. Free food has become a cycle that seems unbreakable in Turkana County (GoK, 2000). However, relief food, according to respondents is not a sustainable solution to food insecurity in this county.

4.5.1.8 Distance to Market Outlets

Market accessibility is key to achieving food security in Turkana County. Table 13 shows that 71% of the households walkover 10 kilometers to access food from the market outlets. There are two categories of markets in the county: primary markets which are around *bomas* and secondary markets found in market centers like Kakuma, Lokichoggio and Lodwar. These markets have a supply of food from other counties and are managed by the county government. A majority of the respondents thus cannot access food supplies available in the secondary markets due to long distance and unreliable transport since the market days are once a week. This contributes directly to food insecurity

4.5.1.9 Distance to Water Points

Water is one of the most important resources for a livestock supported economy. Majority of the Turkana depend on livestock for their livelihoods; hence water directly determines their food security status. Table 6 shows that Turkana pastoralists get water mainly from shallow water wells, boreholes, and springs. Many households (71%), walk over 10 kilometers searching for water for their livestock (Table 13). Livestock trekking for long distance lose a lot of weight and cannot fetch the right value. Lactating animals cannot walk long distance leaving behind calves which graze around the *bomas.* This directly affects milk production and supplies hence influence vulnerability to food insecurity.

4.5.1.10 Access to Credit Facilities

From the analysis, very few households have access to credit facilities to provide seed capital for their businesses. Only 33% households had access to business incentives while majority 77% households mainly in rural areas do not access this service (Table 13). Access to credit incentives is likely to impact on household income since households with businesses can raise more cash for food purchases (Sunya, 2003).

4.5.1.11 Access to Training Services

Empowerment of pastoral communities is key to achieving food security. Those who access training are well equipped with skills and technologies which they can use to diversify their sources of income (Sunya, 2003). According to Table 12, 81% households have no access to training; and therefore are more vulnerable to food insecurity than those having access to credit facilities.

4.5.1.12 Ecological Zones

Ecological zones reflect the health status of any given ecosystem (Assan et al., 2009). Pastoralists living in wetter ecological zones were found to be more food secure which could be largely attributed to abundance of grazing resources for livestock. Results of this study revealed that 33% of households reside in wetter areas while the majority 77% households reside in drier areas. This is because wetter areas are prone to conflicts and are demarcated for dry season grazing areas so settlements are limited. Wetter areas also provide opportunity to practice dryland farming like Oropoi, hence increases household income. Drier areas are found in Kaleng, Todonyang amongst other regions with little livelihoods diversifications. This exposes them to food and livelihoods insecurity.

4.5.2. Multiple Linear Regression Model Results

The study used Multiple Linear Regression (MLR) model to assess factors influencing food security among pastoral and agro-pastoral communities in Turkana County. MLR model has one dependent variable (I/AE/M) with more than one independent (explanatory) variable. However, having more than one independent variable may pose some econometric issues such as over fitting; a scenario where many independent variables are fitted in the MLR model. In addition, more independent variables to a MLR may create more relationships among them. This is the problem of multi-collinearity i.e. correlation between independent variables. The ideal scenario in this kind of modeling is that the independent variables should correlate with the dependent variable but not with each other. The MLR model is specified as follows:

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_p x_p + \varepsilon \quad \text{..... (3)}$$

Where Y = Dependent variable

$\beta's$ are the coefficients to be estimated and ε is the stochastic error term and p represents the number of variables included in the model. Based on this model, the estimated MLR equation can therefore be specified as:

$$\hat{y} = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + ... + b_p x_p \quad \text{.....} \quad (4)$$

Where $b_0, b_1, b_2, ... b_p$ parameters are estimates of $\beta_0, \beta_1, \beta_2, ... \beta_p$ and $\hat{y}$ is the predicted value of the dependent variable.

This study uses eleven independent variables to unpack how they explain the food security in Turkana County. The variables includes household gender (GENDER), age of the household head (AGE), and size of the household (HHSIZE), accessibility to natural resources (NAT_RESO), whether one diversifies livelihood or not (LL_DIVER), education level (EDUC), number of livestock unit owned by the household (HH_TLU), whether one is accessible to relief food or not (RELIEF-A), marketing price (MKT_PRIC) as well as major challenges to livestock production (LIVEPROD).

Table 17: Variables, description and expected signs

Variable	Description	Expected sign
Gender	Household gender [1 = male, 0= female]	±
Age	Age of the household in years	±
Hhsize	Size of the household	-
Market price	marketing prices	-
Natural resources	Accessibility to natural resources	+
Hh_tlu	Number of livestock units per household	+
Ll-diver	Whether a household diversifies or not	+
Education	Education level of the household	±
Relief-a	Whether a household is accessible to relief food or not [1 = Yes, 0 = No]	±
Livestock production	Livestock challenges facing pastoralists	-

The study carried out a Variance Inflation Factor (VIF) test to investigate the existence of correlation between independent variables. This is a test for multicollinearity; one of the most serious problems in MLR modelling. As such, a simple Ordinary Least Squares (OLS) regression model with membership to development group as the dependent variable was estimated. According to Long (1997), empirical estimation of VIF is as:

$$VIF = \frac{1}{1 - Ri^2} \quad \ldots\ldots (5)$$

Where R_i^2 is the R^2 of the artificial regression with the w^{ith} independent variable as a dependent variable. Table 17 presents the results of the VIF:

Table 18: Variance Inflation Factor Values

Variable	VIF	1/VIF
EDUC	1.96	0.51
RELIEF_A	1.76	0.572
LL-DIVER	1.52	0.656
HH-TLU	1.27	0.787
NAT_RESO	1.22	0.819
HHSIZE	1.19	0.842
MKT_PRIC	1.17	0.858
GENDER	1.10	0.909
AGE	1.07	0.936
LIVEPROD	1.01	0.993
Mean VIF	1.33	

The mean VIF is 1.33 while the explanatory variables have VIF's ranging from 1.01 to 1.96. Since the mean VIF's for the independent variables are less than five (<5), the inclusion of the variables in the MLR model is justified (Maddala, 2000).

In addition to multicollinearity test, another test was done to check out the heteroscedasticity. Heteroscedasticity refers to a scenario where the variability of a variable is unequal across a range of values of a second variable that predicts it. In regard to this, Heteroscedasticity is a major statistical problem that has to be solved. The results presented in Table 18 show that there is no heteroscedasticity, i.e., there exists homoscedasticity.

Table 19: Breusch-Pagan/Cook-Wellbeing test for Heteroscedasticity

Chi-square	82.83
Prob Chi-Square	0.000

The null hypothesis is constant variance (homoscedasticity) while the alternative hypothesis is non-constant variance (heteroscedasticity). Since the probability value of the Chi-Square test

is statistically significant at one percent, the study fails to reject the null hypothesis meaning that the there is no heteroscedasticity in the data.

Table 19 presents the results of MLR model with income per adult equivalent as the dependent variable; a proxy for food security in Turkana County. The results reveal that gender, household size, access to natural resources, diversification of livelihoods, education, and access to relief food were statistically significant. The coefficient on gender is positive and statistically significant at 1%. In terms of household size, it is evident that households with a large number of family members are more food insecure than those with small numbers. In terms of marginal effect, if the household size increases by one family member, then the income per adult equivalent would decrease by USD 5.33. As expected, study results indicate that households which have access to natural resources such as water, forests as well as land have a higher probability of being food secure. Moreover, the marginal effect results indicate that if a household had access to a natural resource, the income per adult equivalent would increase by USD 6.56. The results also show that where there is diversification of household income sources, there is a likelihood of increase in food security as indicated by the positive coefficient of livelihood diversification. Diversification is expected to increase household income by about USD 56.84. In terms of education, it is established that households that are less educated have a high probability of being food insecure as indicated by the negative coefficient on education. The marginal effects results further indicate that if a household is not educated, it earns USD 63.59 less than their counterparts that are educated. The probable explanation for this is that less educated people cannot easily engage in skilled jobs to earn a living and diversify their livelihoods, a scenario which is not common with the educated lot.

Moreover, the rate of unemployment amongst youth is so high hence the less educated group does not get white collar jobs easily at the county and national levels.

Finally, the results indicate that pastoralists with access to relief food are less food secure as shown by the negative coefficient on accessibility to relief food. This could be attributed to the inconsistency in relief food supply as well as the complacent nature of pastoralists who depend on relief food. As indicated by the Pseudo R-Square value, the aforementioned explanatory variables explain at least 50% of the variability in the dependent variable; implying that the model fits well to the data.

Table 20: Results of MLR model

Variable	Coefficient	Std. Error	p-value	Marginal effect (dy/dx)
GENDER	5568.29	2103.93	0.009***	5568.289
AGE	911.89	884.92	0.304	911.893
HHSIZE	-533.06	113.95	0.000***	-533.059
MKT_PRIC	-116.87	298.26	0.696	-116.868
NAT_RESO	656.55	297.34	0.029**	656.552
HH_TLU	13.28	31.70	0.676	13.283
LL_DIVER	5684.07	1578.91	0.000***	5684.066
EDUC	-6359.12	2275.33	0.006***	-6359.118
RELIEF_A	-5644.34	1762.47	0.002***	-5644.341
LIVEPROD	-71.59	701.62	0.919	-71.587
Constant (B_0)	17362.26	5900.24	0.004	- -
N		158		
Pseudo R-Squared		0.506		

Notes: ***, **, and * represent 1%, 5%, and 10% significance levels respectively

CHAPTER FIVE

CONCLUSION AND POLICY RECOMMENDATION

5.1 Conclusions

The objective of this study was to assess the factors influencing pastoral food and livelihood security among the Turkana pastoralists. Variables that influence household food and livelihood security were assessed and the contribution of each was analyzed. Even though livestock production is the major economic activity among the Turkana pastoralists, income raised from this activity is gradually decreasing due to the impacts of climate change, changes in land use from pastoralism to agro-pastoralism in the wet parts, agri-businesses and other enterprises. The discovery of oil is a 'game-changer' for the county; with many and varied implications. The implication is that majority of the households are now moving away from livestock keeping *per se* to other economic activities which are more likely to reinforce their livelihoods. It is evident from this study that those households with more income sources are likely to be more food secure than those depending on less. In addition, those having access to natural resources especially in wetter areas with minimum impact on climate change are more likely to be food secure than those who do not; given the abundance of grazing resources. The study shows that most households (85%) cannot afford an income of USD14.40/AE/M for them to remain food secure (Table 15).

For improved food security in Turkana County, access to training, credit facilities, infrastructure, social amenities and livelihood diversification must be highly supported. This would increase the income per household to improve their purchasing power in the markets. People should be empowered and trained on nature-based enterprises to increase their income hence food security.

The study shows that Kakuma division is fairly food secure because it has many natural resources and majority of the inhabitants have various sources of income. This division has well developed social amenities and infrastructure. Lokichoggio and Oropoi follow it respectively in terms of development. These areas represent a high concentration of projects by development agencies compared to Lopur, Kaleng, Kibish and Lokitaung sub Counties.

5.2 Policy Recommendations

From this study, the following policy recommendations are suggested to help reduce household food insecurity in Turkana County:

- The county and national governments should support a Natural Resource Management Plan and embrace Community Based Natural Resource Management (CBNRM) to guide on the accessibility of grazing resources given the current threats of competing land uses. This strategy will improve livestock production which is still the most viable economic activity given the climatic conditions of the county. A well-managed natural resources will encourage livelihoods diversification hence reduce vulnerability to food and livelihoods insecurity.

- Capacity building among the pastoral communities on issues related to livelihoods diversification, skills on livelihoods and marketing of livestock and its products would enable households to improve their income and become less vulnerable to food insecurity

- The county and national governments should improve access to market outlets, schools, hospitals, roads among other social amenities. This will provide the pastoralists with investment opportunities, thereby creating job opportunities for the youth.

- Youth and women should be supported through training and credit access to facilitate their engagement in income generating activities like nature based enterprises to ensure more contribution of this group towards access to food.

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ANNEX 1: QUESTIONAIRE ON ASSESSING FACTORS INFLUENCING PASTORAL FOOD AND LIVELIHOOD SECURITY IN TURKANA COUNTY.

QUESTIONAIRE

Sheet No……Name of the Interviewer……Date……

Sub County…….

1. Personal Information of the interviewee

i. Name of the interviewee……Age group: 18-30 { } , 31-50 { } above 51Yrs { }; Sex: M { } F){ } (Tick one)

ii. Level of Education: Primary, Secondary { }, Post-Secondary……

iii. Sex of Household Head (M/F)…… { }

iv. Household Size: No. of Female (<18yrs)…… (19-40yrs)……. (>40yrs)…….

No. of Male (<18yrs)…… (19-40yrs)…… (>40yrs)……

2. Main Economic Activities

In the table below, list the main economic activities in your area according to their perceived importance priority and their estimated annual incomes.

Economic Activities	Per annum income Estimate
1)	
2)	
4.	
5.	
6.	

i. In the table below, list the main challenges associated with each economic activity listed in Table 1.

Economic Activity	Major Challenges (in order of negative impact)
1)	
2)	
.	
.	
.	

i. Do you own Livestock? YES/NO……If Yes, in the table below, indicate the various kinds of livestock you have and their numbers?

Livestock Species	Number owned
1) Cattle	
2) Goats	
3) Sheep	
4) Camels	
5) Donkeys	
6) Chicken	
7) Other	

ii. List the ways you acquired livestock in order of priority (Inheritance, Purchase, Gifts, Dowry etc.)

1)……2)……3)……

4)……5)……6)……

iii. List the major challenges (in order of importance) of livestock production in your area?

1)……...2)……3)……

4)……5)……6)……

iv. What are the primary and Secondary Market outlets in this area? List them in order of their importance and proximity to your locality.

Primary Markets:

1)……2)……..3)……
4)……5)…….

Secondary Markets

1)……..2)……3)……..

4)……..5)……..

v. What are the main factors influencing livestock prices during dry and wet season?

1)……....2)…….…...3)……

4)……5)……....6)……

vi. Ways of acquiring livestock among Turkanas

1)…….2)……..3)……..4)…….

vii. Reasons for sale of livestock

1)……2)……3)……..4)……

viii. List the methods of livestock diseases control in order of priority

1)…….2)…….3)……..4)…….

2. List Natural Resource abundance in this area

1)…….

2)…….

3)…….

4)…….

i. List the key challenges affecting optimum utilization of these resources?

Natural Resource	Challenges affecting optimum utilization
1)	
2)	
.	
.	
.	

3. Policy regulations enhancing food and livelihoods security

I. Are you aware of any national or county policy guidelines addressing food and livelihoods security amongst pastoral communities in Turkana? If yes list them.

1)……2)……

3)……4)……

II. In your own view, what strategies should the national, county government, NGOs put in place in order to improve food and livelihood security?

1)……

2)……

3)……

4. Are there some interventions by NGOs, National and County government to improve food and livelihood security? If yes, list them.

1)……2)……3)……

4)……5)……..

Focus Group Discussions

Besides administering questionnaires, Focus Group Discussions were also held to collect more information on:

- Livestock diseases and methods of control
- Traditional resource management and challenges
- Market prices
- Relief food distribution
- Reasons for livestock sale