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Dynamics of Land Use Changes on the Livelihood of Local Communities in Baringo County: Effects of Land Use Changes

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Abstract: This paper examined the effects of land use changes on the livelihood of the local communities in Baringo County. Land is a principal factor of production, a source of life and livelihoods. It provides a means of living and a variety of uses such as agricultural, human settlement, environmental conservation, urban and industrial development purposes among others. These uses compete for space in a fixed area, hence the rising land use conflicts and degradation. The situation has threatened lives and livelihoods, making it difficult to plan for the livelihood activities in Baringo County. This is happening against the backdrop of land use policy changes including; the National Land Policy, the Constitution of Kenya 2010, the Land Act, 2012, the Land Registration Act, 2012, the Community Land Act, 2016 and the National Land Use Policy that confers sanctity on land use. Using non-experimental survey design, 323 households were randomly sampled from Baringo South, Tiaty, Baringo North and Eldama Ravine Constituencies. Cobb-Douglas production model was used to analyze livelihood assets productivity. The study found out that land use changes decreased livelihood assets productivity at varied level of significance; human by 56.1% at 1%, physical by 53.4% at 10% and financial by 65.6% at 5% level. This decrease is related with the unregistered community land in dry areas (pastoral) largely in Tiaty constituency, where livelihood assets productivity decreased by 282.4% at 5%, and in the marginal areas (agro-pastoral) largely in Baringo South, where livelihood assets productivity decreased by 9% at 1% level of significance. In contrast, land use changes increased livelihood assets productivity in the highlands, particularly, in Eldama Ravine constituency, it increased by 139.3% at 10%, and in Baringo North Constituency, it increased by 5.1% at 1% level of significance. This increase in livelihood assets productivity in the highlands was associated with security of land tenure under registered private land use. The study concluded that unregistered community land is the main cause of unstable and uncertain livelihoods in Baringo County particularly in dry areas. The effects led to severe land use conflicts occasioning deaths, displacement and distorted livelihood perpetuating uncertain conditions for future livelihood development. The government, therefore, need to recognize, protect and register the local communities' interest on community land. This will guarantee land tenure security, enhance livelihood assets productivity and secure future development for the local communities.

Keywords: Land Use Changes, Livelihood of Communities, Policy Decisions

1. Introduction

Baringo County has a total land area of 11,035 km² where 4,435 km² is arable, 5,700 km² is non-arable, urban lands, 715 km² and other lands, 165 km² [23]. The arable land is 40.26% of the total Baringo area and primarily consist of highlands surrounding the higher altitudes of the County. This region is encompassed in the modified tropical areas characterized by well-drained and fertile soils. This region experiences an average amount of rainfall, whose

range is 1000–1500mm yearly, and temperatures between 10°C - 28°C. This region is regarded to have agricultural potential and enhanced livestock development. The main economic activities include; crop cultivation of food crops (cereals) fruit trees, and horticultural crops, and cash crops such as coffee. This area comprises of intensive agriculture, forestry, plantations and irrigations. The non-arable land is 51.75% of the total land area. It comprises the lowlands characterized by semi-arid to arid climatic zones which receive 600mm annual rainfall and 28°C - 40°C

temperatures. This area has complex soils with different textures and drainage characteristics that have formed from alluvial deposits and has high salinity, characterized by volcanic ash, and lava boulders. This region has isolated dryland subsistence agriculture pockets and small-scale irrigation in Marigat -Baringo South, Barwessa - North Baringo, and Kolowa -Tiaty Constituencies. The area is characterized by recurring droughts, particularly in Marigat area, satellite images show an increase in drought intensity, vegetable depletion (see figure 1).
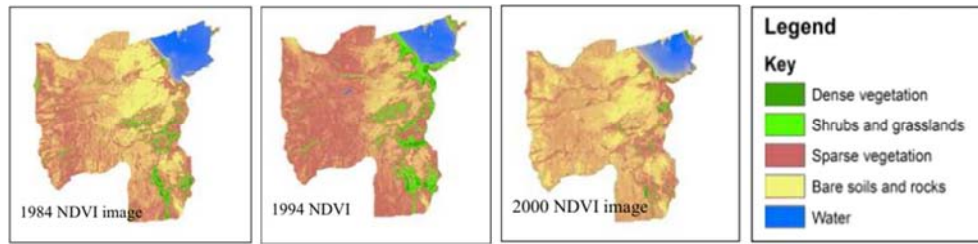

Figure 1. Satelite images of Baringo South showing trends of Drought and depletion of vegetation cover (1984 NDVI image, 1994 NDVI image and 2000 NDVI image).

1.1. Land Use Changes in Baringo County

Past studies [40], illustrate that in the last three decades, land use changes indicates that agricultural land use increased by 21.11%, 24.33%, and 26.03%, pastoralism decrease by 15.14%, 19.27%, and 23.01%, human settlement increased by 2.22%, 1.43% and 2.47%, the vegetation cover decrease by 1.75%, 2.79%, and 3.78%, water bodies decreased by 2.77%, 3.23% and 1.66%, in the 1988-1998, 1998-2008 and 2008-2018 periods

respectively. Such trends model constraints that affect the community's livelihoods. A decrease in vegetation cover implies the destruction of forests and encroachment into water towers.

These changes can be demonstrated by land cover maps of the Lembus forest in 1985, 2002, and 2015 show the magnitude of forest destruction (see figure 2).

These trends pose a worrying concern that threatens the sustainability of land use changes on the livelihood of the local communities despite government intervention.
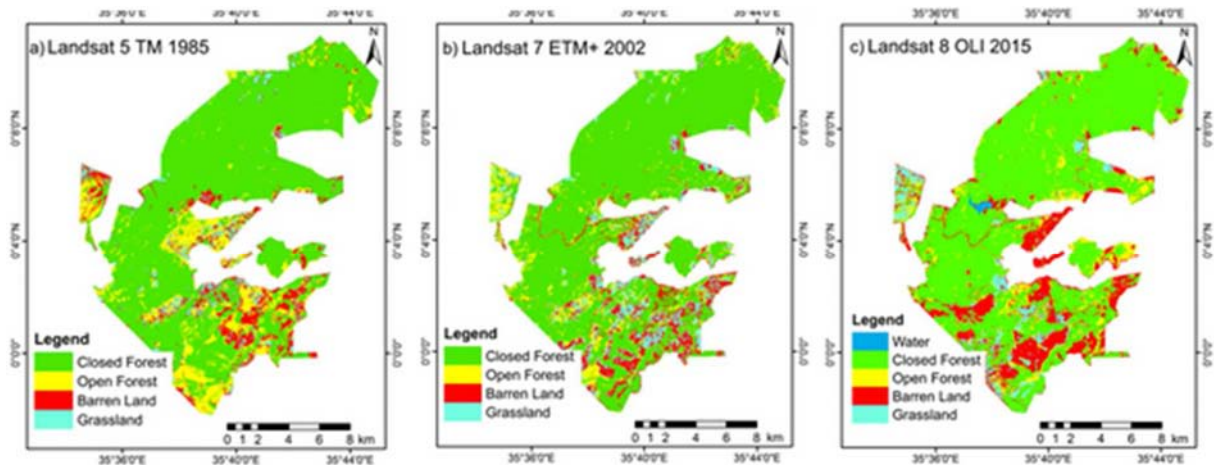
2. Land-cover maps of the Lembus Forest in (a) 1985; (b) 2002; and (c) 2015.

Figure 2. Map of Lembus Forest in Eldama Ravine Showing Forest Destruction Trends.

1.2. Effects of Land Use Changes on the Local Communities Livelihood

This study focused on three central local communities inhabiting Baringo County are Tugen, Pokot, and Ilchamus. Otherwise, there are other communities (Nubians, Ogiek, Lembus, Kikuyu, and Turkana among others) [54] who reside

in the area, but their influence on land use practice in the county is insignificant. The three (Tugen, Pokot and Ilchamus) local communities have diverse cultural beliefs on land use, occupy different geographical locations with unique characteristics in the county, and they undertake different livelihood activities hence conflicting land use. The three major communities in the county utilize various land use

methodologies which affect the dynamics of such changes as follows:

i) The Tugen Community, a subtribe of Kalenjin; is the largest and comprises of crop farmers inhabiting the highlands (Tugen Hills) which receive high rainfall suitable for the farms and crops. The four constituencies occupied are; Eldama Ravine, Baringo Central, Baringo North, and Mogotio Constituencies. These areas have a combined total area of 4822 km^2. The area comprises of 1770.4 km^2 high fertile, 2,069.6 km^2 medium fertile, 709.6 km^2 low fertile, and 267.2 km^2 other lands [23]. The area's total population is 422,312 as of 2019 [54]. The land use is largely privately-owned with land title deeds where the locals utilize modern land use operations and machinery. The livelihood activities are crop farming (food crops, fruit trees and cash crops, which are grown in small scale. Land in this area scarce resulting in pressure build-up to sub-divide the land into unprofitable units resulting in soil and water degradation. These challenges affect livelihood sustenance and the pressure causes the community to encroach water catchment regions, and forests; cause migration to marginalized regions seeking profitable opportunities.

ii) The Pokot community, a subtribe of Kalenjin; is the second largest group in the county. This community inhabits Tiaty constituency, located in the county's lowlands. The total area is 4516.8km^2 comprising of 225.8 km^2 high productivity, 451.7 km^2 medium productivity, 3834.8km^2 low productivity, and 4.5km^2 other land [23]. Livestock keeping was the main economic activity. They reared cattle, sheep, goats, camels and donkeys, and derived their products. The area has a population of 171, 027 people [54]. Approximately eighty per cent (85%) of the land has low productivity, and ranges from West Pokot County enlarging the region into Baringo County, where it borders Turkana, Samburu and encroaches into Laikipia Counties. The Pokot community migrates constantly with their livestock seeking water and pasture. This region is experiences longer drought cycles that cause famine, water and food shortages for both humans and livestock. Land use in this region circulates around the movement of animals responding to water and food scarcity [39]. The main economic activity is livestock and livestock products under an extensive pastoral lifestyle.

iii) The Ilchamus community, a subtribe of "Maa ethnic group", is the third largest local community in the County. They are agro-pastoralists inhabiting the fertile flood plains surrounding Lake Baringo. The main livelihood activities are livestock keeping and crop farming on small scale irrigation within the Ilchamus flats and subsistence fishing in the lake. Although the locals have permanent residences, they on several occasions migrate with their livestock during drier periods. They inhabit seventy-five (75%) of the Baringo South constituency lowlands whose area is 1678 km^2 with 167.8 km^2 of high productivity, 251.7 km^2 medium productivity, 755.1km^2 low productivity and 503.4 km^2 other lands [20]. The land is held in trust on behalf of the local community by the County government of Baringo. The main land use challenge is to balance livestock keeping and crop farming. This balancing act triggered stiff competition between livestock and crop farming. The competition worsened due to the invasion of the (*Prosopis Julflora*), a poisonous tree, which affects both livestock keeping and crop farming space. In addition, rampant floods as a result of the increase in lake Baringo water level [43].

1.3. The Effects of Land Use Changes on Diverse Cultures

The consequence of land use changes on the diverse cultures of the local communities were manifested by unscrupulous of land grabbing and inter-community land use conflicts. First, Ilchamus and Pokot community land use conflicts arose due to the Pokot community invading and claiming interest on the Ilchamus community land, particularly in Mukutani division through armed raids camouflaged as cattle rustling. The Pokot sustain terror thereby forcing Ilchamus community (the victims) to run away from their ancestral land. The Pokot immediately settle in the abandoned land taking advantage of the government development funds from Tiaty Constituency Development Funds (CDF). Incidentally, the government develops schools, hospitals, and forms overlapping administrative units while changing existing borders and renaming places. These actions depict crude assimilation motives and imply bias government intervention. It seems government supports Pokot community land dispossession initiatives. This situation could be attributed to the weak political status of Ilchamus community in the county and National government land use. Ilchamus community lacks politically support, and are occasionally displaced or forced to relocate, a situation that complicates land use changes and suppresses economic activities available to the Ilchamus community.

Secondly, the Tugen community invaded into the Ilchamus community's land through legal manipulation. The manipulation comprised of acquiring grazing rights (Ol arabal), creating overlapping administrative units (Endao, Arabal, Mukutani and Marigat locations), illegal registration of ranches (Marigat, Bartum, Barkibi A and B). The Tugens community cunningly legitimize their land grabbing by influencing laws and exploiting their political strength which dates back to the late president Moi's era and its legacy. In addition, the Tugens came with undesirable land use activities customized to arable areas such as cultivation of crops, and apply the same practices on dry the lowlands. This accelerated environmental degradation on the fragile marginal area. This actions not only dispossessed the Ilchamus community of their ancestral land but also bred inter- communities land use conflicts which might soon escalates to a full war.

Therefore, both scenarios seem to perpetuates land use conflicts and occasion miserable lives, and unstable

livelihood under uncertain conditions for which local community cannot plan their future development. Therefore, the motivation to undertake this study.

1.4. Statement of the Problem

Over the years, Baringo County has experienced land use changes affecting the livelihood of the local communities. These land use changes are both human-induced and some caused by natural factors. First, human-induced encompasses changes manifested by loss of forest cover due to destruction, overgrazing leading to death of cattle worth billions, and escalating land use conflicts which are manifested in the form of cattle rustling causing human death and displaced thousands of households with a trail of property destruction. Secondly, land use changes have been caused by natural factors beyond households' control, including rampant droughts and floods. The effects of natural factors are increasing in frequency and intensity with time causing the death of thousands of livestock and massive destruction of property including floods submerging several homes, schools and displacing a sizeable number of households whenever it occurs. These changes act directly or indirectly to influence the livelihood of the local communities. This is occurring at odds with government interposition to palliate the condition in terms of land use policy changes, incorporating the National Land Policy, the Constitution of Kenya 2010, the Land Act, 2012, the Land Registration Act, 2012, the Community Land Act, 2016 and The National Land Use Policy as well as subsequent legal land use changes geared to address land use and management challenges [33]. Particularly, on the rise, land use conflicts, water scarcity, insecurity, bulging internally displaced persons (IDPs) coupled with perennial natural disasters, mainly droughts and flooding. This study seeks to determine the effects of land use changes on livelihood assets productivity as an indicator of livelihood outcomes under different land use regimes.

1.5. The Objective of the Study

The study aims to determine the effects of land use changes on local communities' livelihood by measuring the productivity of livelihood assets.

1.5.1. Specific Objectives

The study-specific objective is to determine the effects of land use changes on the household livelihood assets productivity in Baringo County.

1.5.2. Research Questions

The following question was answered to realize the purpose of the research; What are the effects of land use changes on the household livelihood assets productivity in Baringo County?

1.6. Significance of the Study

The knowledge generated from the findings of this study will be useful in informing policy-making decisions organs to rethink, and devise innovative measures which are more responsive to local communities needs and aspirations. The findings will create awareness on evolution trends and existing legal instruments, and sensitization of local communities to lobby for recognition, protection and registration of their interest on community land. The findings will spur new knowledge for academia and open up new areas for further research on fundamental land use rights. This study covers the entire Baringo County. it attempts to answer land use changes question currently facing the county. the study employed randomly selected households from a sample frame household from representative constituencies in the county. the design was ideally used to capture regional ecological differences, cultural diversity of the local communities, different types of land use and livelihood activities undertaken by local communities. The data collected from households as unit of analysis was subjected to quantitative analysis to estimate the magnitude of the effects, and recommend new approaches.

2. Literature Review

Three theories relevant to this study were reviewed; the production, the sustainable livelihood framework (SLF) and the government intervention theories.

2.1. The Production Theory

The production theory is the theory underpinning the determination of land use changes on livelihood assets productivity. It explains how the level of output changes as the quantity of factor input changes. The production process entails conversion of resources (inputs) to products (output). The theory assumes that the production process follows a linear path and certain specific conditions. These conditions include the state of technology assumed to be given, and one factor of production must always be kept constant at a given level. The conditions present quantitative relationships between inputs and outputs, and it is used as a tool of analysis the input-output relationship. Various scholars have developed and reviewed these input-output relationships over time [14, 34], giving various production functions. In this respect, there are three common variants of the production function; the linear production function (perfect substitutes), the Leontief production function (perfect complements) and Cobb-Douglas production function (imperfect complements). These functions have strengths and weaknesses with underlying assumptions, making them suitable for analyzing different production-related problems.

First, the linear production function is the most basic input-output relationship. In this case, the output of a production process is simply a function of inputs based on the perfect substitution assumption; capital can be substituted for labor perfectly. However, in a real-world situation, most input -output relationships are not linear. Therefore, the function may not be appropriate for this study.

Second, the Leontief production function was named after Wassily Leontief. Leontief analyzed Input-Output connections in the entire profitable structure. The model offers an absolute

image of the entire economy. It focused on industrial association incorporated in the domestic resources and evaluation of the national output system. This kind of input-output relationship allows the computation of economic multipliers, tools to further evaluation of an economic system. Leontief input-output analysis assumed fixed input structure, fixed technological coefficients for all sectors and constant returns for primary factors of production. These assumptions are unrealistic in a real-world situation. The function also assumed that all industry products are identical or are produced proportionally, in fixed proportions, to each other. The calculation of returns to scale in production are assumed to be constant in each industry. These assumptions may lead to overestimation in the interpretation of results. Therefore, considering the strengths and weaknesses of the Leontief model, it is concluded that the model is not applicable for this study. In this study, the unit of analysis is the household at the micro-level in contrast with Leontief macro-level perspective. The approach assumed a competitive market system and non-scarce resources. This assumption may not apply to this study because livelihood activities are carried out in an imperfect markets' environment, and resources are always scarce. Leontief model may not be suitable for input-output analysis at the household level hence not appropriate for this study.

Third, Cobb-Douglas production function is another input-output relationship. It describes the technical relationship in the conversion of inputs to outputs. This study borrowed the Cobb-Douglas production function as a theory of production to analyse land use changes on livelihood assets productivity. In this study, inputs comprise human, physical, natural, social and financial capital, which constitute livelihood assets available for the households. These inputs are the independent variables used in the production process which yield outputs. The output represents the dependent variable which is the livelihood outcomes. Livelihood outcome is the sum of all production activities under different tenure regimes. In this study, the Cobb-Douglas production function was aligned to the sustainable livelihood framework and applied to examine the relationship between the capital inputs (human, natural, physical, financial and social) and the resultant output.

2.2. The Sustainable Livelihood Framework (SLF) Theory

In this study, the production theory was aligned to the sustainable livelihood approach since land use changes directly affect the local communities' livelihood. The link between the theory of production and the sustainable livelihood framework theory was conceptualized to explain better the phenomenon considering government and development partners intervention theory. The foundation of livelihood theory is the Sustainable Livelihood Framework (SLF) concept. The concept focuses on livelihood assets required by local communities for a means of living, enabling environment (policies, institutions and processes) and sustainability (livelihood outcomes) [46]. The study tires to elaborate how economic results change because of the effects of regulations, institutions and processes in a logical sequence from production to output [12]. The concept places communities at the center of the pentagon as an operating environment [8-11]. The corners of the pentagon represent livelihood assets (H-Human, N-Natural, F- Financial, P- Physical & S-Social capitals) which are influenced by policies, institutions and processes [9]. Illustrated in (figure 3).
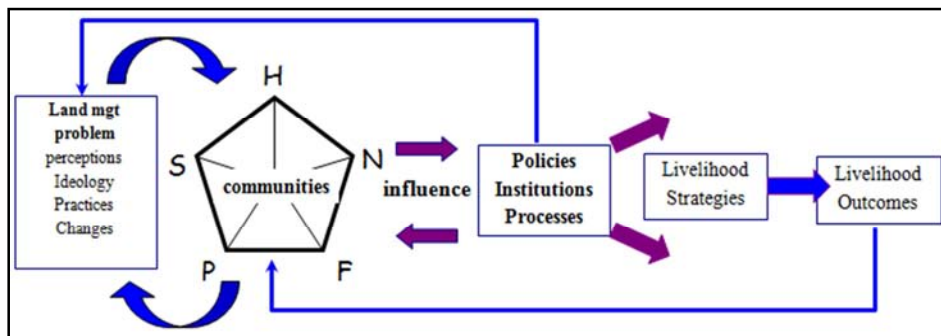

Figure 3. Modified DFID Sustainable Livelihood Framework.

The concept of sustainable Livelihood Framework (SLF) became prominent in the 1980s due to the essential necessity development discontent of the 1970s and the top-down approaches [12]. It was first acknowledged as a development policy that connects with the requirements of the present generations without accommodating the capacity of future generations meet their necessities in 1987 by the Brundtland Commission report, published under the title 'Our Common Future (The World Commission on Environment report, 1987). The report argued that sustainable livelihood requires political, social and production systems that provide secure participation of local communities in decision-making and economic opportunities. This report recommends adopting an important livelihood concept was reinforced by a paper on the Greening of Aid: Sustainable Livelihoods in Practice [15].

However, critics of the Sustainable Livelihood Framework (SLF) argue that the SLF concept relies heavily on donor development agencies such as DFID, Oxfam, CARE International, and UNDP perspectives. In a sense, the local communities are considered recipients of the donation and visualize the rich helping the poor. It portrays a prescriptive and experimental attribute that tests whether new concepts work. The framework seems to be community/people-centered, but on a critical look, it still maintains top-down

approach principles. Past studies on SLF as an analytical tool [7, 20, 46, 19] indicate that the approach has been carried out largely in Asia and Africa. This suggests doubt that the approach may not be applicable in developed economies such as Europe and USA among others with a different set of conditions. Further, the approach is practitioner-dependent with institutional arrangement and processes, which may not fit the local communities' setup. However, despite the highlighted strengths and weaknesses, the concept assumes that planned outcomes would provide feedback to enhance livelihood assets productivity and make local communities more resilient. This assumption sounds good theoretically but not realistic in the normal working conditions. Nevertheless, the concept of SLF seemed to be appropriate.

In this study, the SLF links land use by local communities with policy organs, institutions, and processes. This link is a participatory strategy centered on individual's capacities and their assets. The theory has been employed in different various settings [9]. Communities are placed at the Centre, and the concept secures the participation of local communities in decision-making processes. This study borrowed the concept of sustainable livelihood frameworks to analyze individual's and household's production processes and the outcome of the production process. The concept was visualized as the overall study environment in analysis of local communities' production process, effects of government policies & mindset of policymakers, and the resultant outcome. The concept provides a basis for analysis of livelihood outcomes changes due to changes in input levels where the livelihood production process and government decisions occur.

2.3. The Government Intervention Theory

The theory grounding government actions on land use changes is government intervention theory. Government intervention theory is based on a British economist John Maynard Keynes (1883-1946), in the 1940s revolutionary book, the general theory of employment, interest and money. Keynes emphasized the need for government intervention with the market system, and management of the economy by the government to ensure efficient allocation of resources, achieve socially optimum production and distribution patterns of goods and services, and bring stability in growth, employment, and price level and foreign exchange rates. Keynesian school of Economic thought emerged and dominated government decisions in the 1940s through 1960s. This period coincided with the colonization of the African region. The colonial government decisions were guided by the quest to gain control over land use as the source of economic and political power. In this study, land use changes in Kenya were assumed to emanate from colonial-era land use policies. The colonial-era land use policies set a precedent that influenced the formulation and implementation of policy in Kenya to date. During the colonial-era, land use policy changes were marshalled to change the traditional communal land use to the individual commercial production system.

2.4. Empirical Literature Review of the Study

The empirical literature review focused on previous studies related to the effects of the land use changes on the productivity of households' livelihood assets; studies [13] on Maasai Socio-economic conditions: cross border comparison, [37] on mobile peoples, contested border: Land use and conflicts resolution, and [22] as pastoralists settle: social, health and economic consequences of pastoral sedentarization, gave insights to the current study. Further, [51] investigated land use changes and livelihoods in pastoral areas; Kitengela peri-urban area in Kajiado County, Mara area adjacent to Maasai Mara Game Reserve in Narok County, Amboseli area adjacent to Amboseli National Park in Kajiado County, Longido in Tanzania and Tarangire in Tanzania. The study used household survey data on economic activities based on agroecological, biophysical, social and economic/ demographic variables and employed non-parametric and parametric comparisons of households' data based on clusters and other categorizations. The study found out that pastoral land use changes exert pressure on land use and enhance diversification of livestock-based economies in the pastoral areas. These findings established that the areas experienced increased resource conflicts between different land uses, increased unmanaged dryland agriculture, decreased livestock holding per capita, and intensified land tenure conflicts. It was also established that the poorest households are more dependent on agriculture, while the wealthier households were mainly responsible for expansion in agricultural production. The findings are quite relevant and give insights into the current study. However, the current study differs from the reviewed empirical literature because it focuses on the productivity of specific household livelihood assets (human, natural, physical, financial and social capitals) instead of the household economy in the empirical study.

Similar studies [13, 37, 22] used qualitative and statistical approaches to seek patterns and trajectories of land use change within an immensely diverse array of local communities, households and strategies. The studies focused on the diversification of livelihood strategies. These studies found out that livelihood diversification alters activities, the primary source of income, location, intensification of land use and changes the social identity of the local community. Further, the studies found that intensification involves increasing inputs; land clearance, fencing, soil management, tree/planting, terracing, irrigation system construction and low mobility of livestock. This may enhance land degradation, which undermines livelihood assets productivity. This study findings, therefore, points at the policy change gap with no clear policies consideration taking into account the limitations of intensification particularly in arid and semi-arid lands.

According to [37] study on mobile peoples, contested borders: land use and conflicts resolution. The study found out that land use changes arise due to increased competition for resources, land use conflicts and violence in the arid and semi-arid lands. The findings revealed that land use changes enhance land use conflicts instead of offering land use

changes solutions. Further, these studies pointed out a knowledge gap between land use policy changes and prevailing climatic conditions. Hence mismatch between the actual livelihood activities undertaken by local communities and land use policy provisions. Further,

A study [1] on livelihood and resource competition, and [3] on ideology, land tenure and livestock mobility in Kazakhstan, argued that ignoring or lack of proper knowledge about the importance of local communities' experiential knowledge has led planners and decision-makers to formulate land use policies that harm the local communities. Both studies agreed that experiential knowledge held by the local communities in a specific location is critical in securing local communities' livelihoods and ensure sustainable land use.

However, empirical studies [31] on Kenya Legal land governance assessment report, and [30] towards effective commissions of inquiry in Kenya: a review of the commissions of inquiry in the light of Kenya 2010, pointed out that the Constitution of Kenya 2010 has recognized the knowledge gap, and attempted to integrate it through public participation of the local communities in the planning, implementation and evaluation of all government land use policy decisions. The Constitution of Kenya 2010 made it legally mandatory for all public policies and government interventions to incorporate experiential knowledge. But, in practice, local communities could not engage due to illiteracy and a lack of appropriate mechanisms for effective engagement and contribution in the processes. Therefore, according to these studies, land use changes policies have always continuously maintained the status quo.

2.5. Summary of Empirical Literature Review

From the empirical literature review, land use is a critical determinant of livelihood for the local communities at the household level. Baringo County offered a good study environment for the generalization of study findings. The County comprises highlands, marginal lands and lowlands giving varied characteristics. The county is currently facing acute land use changes characterized by extreme cases of unstable livelihood under a volatile environment, making it difficult or almost impossible for the local communities to engage in livelihood activities. Therefore, they cannot plan for their future development. Past studies have concentrated on livelihood and diversification strategies in the study area. The studies overlooked the salient features that revolve around the policy, ecological, technological and knowledge gaps as key drivers of land use changes productivity. A snapshot of the empirical literature reviewed revealed gaps that perpetuate land use changes and influence the livelihood of the local communities despite government interventions.

2.6. The Conceptual Framework of the Study

The conceptual framework of this study (see figure 3) links the land use (production) with the sustainable livelihood framework (pentagon- human, natural, financial, physical

and social capital) and government decisions (policies, Institutions, processes). Production theory provides a means of determining livelihood assets productivity, sustainable livelihood framework (SLF) provides a comprehensive approach on how local communities make their living. Taking a cue from past studies; [32], understanding market-based livelihoods in a globalizing world: combining approaches and methods, government decisions ought to provide appropriate rules of the game. In the study, the sustainable livelihood framework link to the production processes of local communities represented in the pentagon of livelihood assets (human, physical, natural, financial and social capital). These assets are resources (inputs) used by local communities to obtain their livelihood [10]. Households combine the resources (inputs) at their disposal to create livelihood production activities that enable them to achieve the best possible livelihood outcomes [21, 6]. The combination of livelihood resources gives rise to a production process. The production process is explained under the production theory as the input-output relationship. Under the production theory, the production function is defined as the technical relationship between inputs and outputs. This process is guided by land use policies referred to as government intervention.

Government intervention tracing from colonial, independence and subsequent political regimes after independence provide general guidelines (rules of the game) that govern land use and link to governance institutions and processes. The institutions provide a means for local communities to access capital (human, natural, physical, financial and social) [10], and processes provide the procedures (management practices, land tenure rights and access) to undertake livelihood activities. Government decisions and actions are intended to guide land use and respond to the resultant consequences of policy decisions. The resultant effects arise from conflicting perceptions, ideologies and practices on land use between policymakers and local communities. These aspects affect local communities' livelihood assets, which influences the policies, institutions, and processes put in place to facilitate land use.

Accordingly, the local communities at the pentagon centre responded to these land use changes by developing livelihood strategies. The consequence of these changes results in two streams; first, communities developing livelihood strategies to counter the changes leading to livelihood outcomes which translate to livelihood assets and second, the backward effects in terms of government interventions.

3. Research Methodology

3.1. The Study Design

This study employed a non-experimental research design. It was preferred because of its merits in obtaining opinions, beliefs, attitudes, livelihood activities and outputs, among other relevant data from a large population. It is cost-effective, and the results can be generalized to inform

policy decision-making in Kenya. The design was suitable because it enabled the researcher to gather data from a wide range of respondents at the household level. This design is particularly useful in developing tools, pretesting and collecting data deemed adequate for realizing the study objectives given the short time available and the budget constraints to accomplish the work.

3.2. The Study Area

The study was carried out in Baringo County. The County is described in terms of geographical location, political representation, ecological conditions, land use and livelihood activities of the local communities.
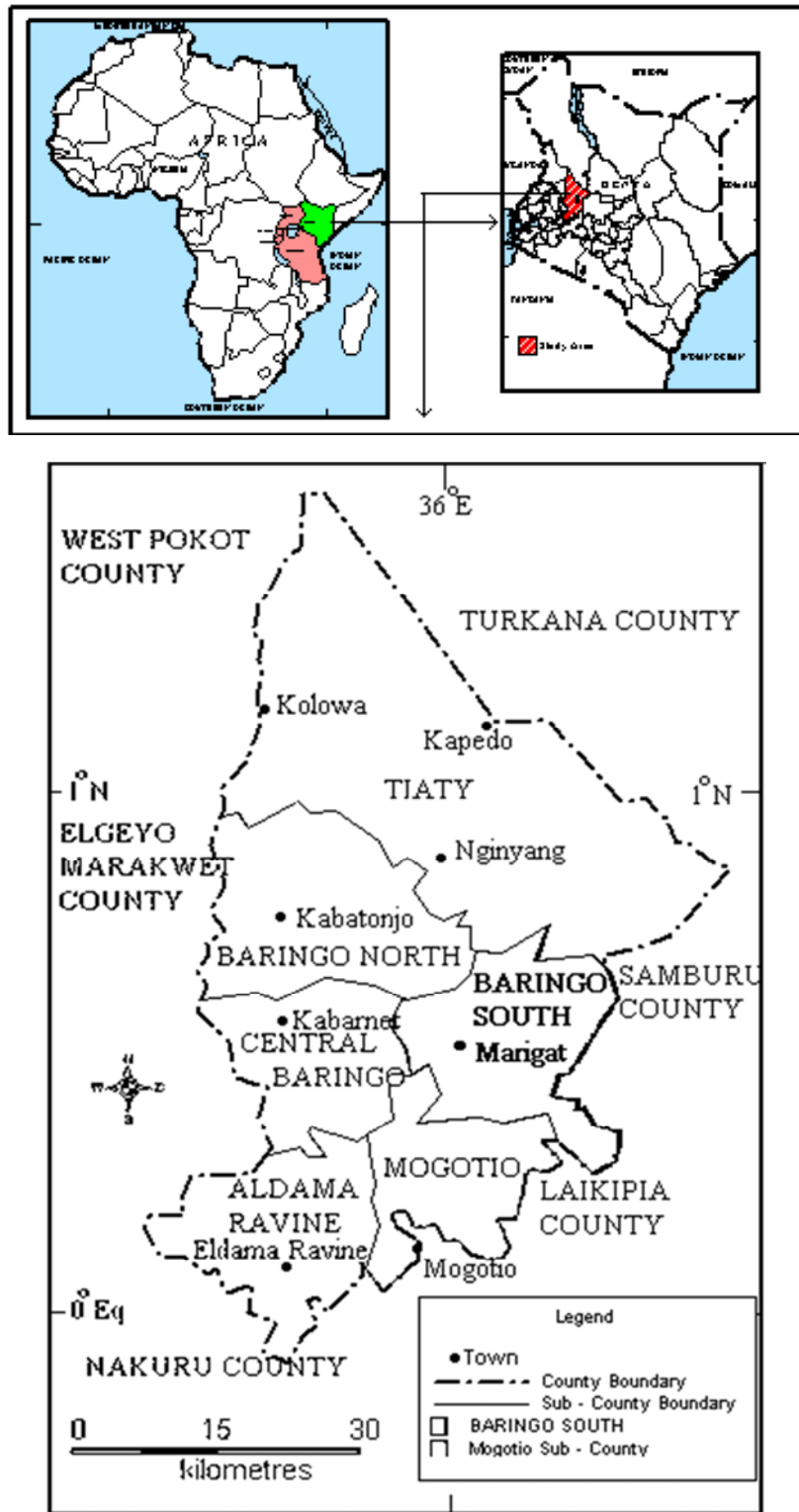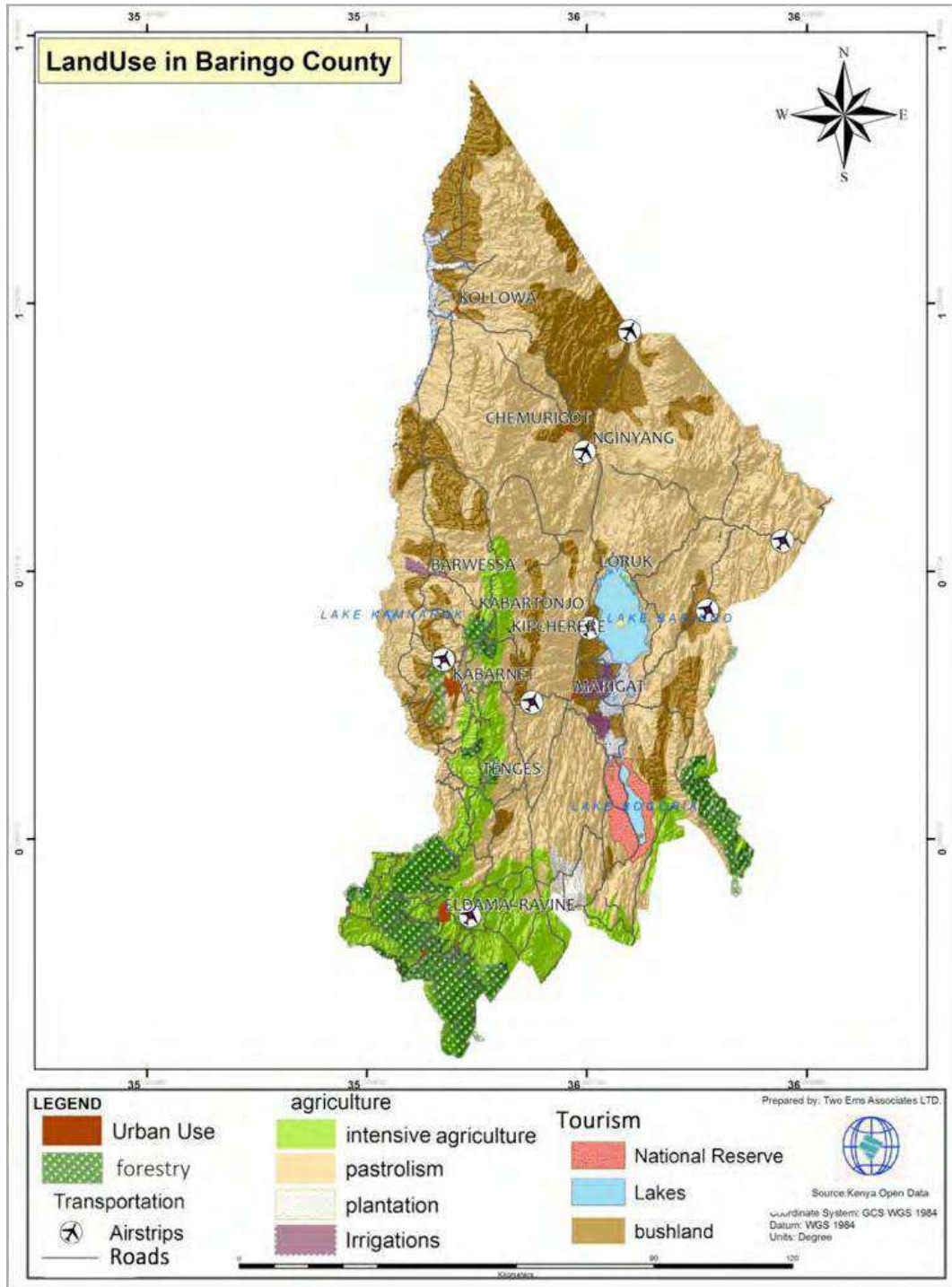

Figure 4. *Map of Baringo County Showing its Location, Neighboring Counties and Constituencies.*

Source: Kenya open data

***Figure 5.** Spatial Map of Baringo County Showing Land use.*

3.3. Geographical Location and Political Representation

Baringo County is one of the forty-seven (47) Counties in Kenya [16]. It is geographically located between longitudes 35 30' and 36 30' East and between latitudes 0 10' South and 1 40'. It comprises of six constituencies represented by Members of Parliament (MPs) in the National Assembly [23]. These constituencies include Mogotio, Eldama Ravine, Baringo South, Baringo Central, Baringo North and Tiaty. The size of these sub-counties varies as follows: Mogotio (1,314.6 km^2), Eldama Ravine (1002.5 km^2), Marigat (Baringo South) (1,678 km^2), Baringo Central (799.9 km^2), Baringo North (1,703.5 km^2) and Tiaty (4,516.8 km^2). The county has 30 wards represented by members of the County Assembly (MCA) in the County Assembly. Political representation indicates participation in land use decision-making processes.

3.4. Ecological Conditions, Land Use and Livelihood

Baringo County is sectioned into two climatic regions; the highlands and the lowlands, and a marginal zone engulfed between the two climatic characteristics. In the highlands, crop farming was the primary economic activity. The main crops cultivated are cereals (maize, sorghum and finger millet), legumes (beans, green grams and cowpeas), roots and tubers (Irish potatoes, sweet potatoes and cassava) and nuts and oils (groundnuts, macadamia nuts, coffee and cotton). The Lowlands consist of both Arid and transitional zones. The transitional zone comprises 25% of the total area. The arid region is largest of the total land area and is characterized by sparse, erratic rainfall and scarce water resources. The area is prone to land use conflicts. Ecological conditions influence by the elevation above sea level. The elevation also influences the type of livelihood undertaken by the local communities.

Land use in Baringo County is diverse, ranging from pastoralism, intensive agriculture, irrigation, forest, bushland, plantation, national reserves, urban use, transportation (airstrip & roads) and lakes. Land use determines the livelihood activities undertaken by the local communities in the County. Three main local communities are inhabiting Baringo County; the Tugen, Pokot and Ilchamus. Other communities that reside in the area include the Nubians, Ogiek, Kikuyu and Turkana. These communities have diverse cultural beliefs and land use, therefore, undertake different livelihood activities. The Tugen occupy mainly the hilly part (Tugen hills), which relatively high rainfall area that engages in intensive agriculture as the main source of livelihood. The Ilchamus are agro-pastoralists occupying the marginal area covering the flood plains surrounding Lake Baringo. Land use is communal and the main economic activities are growing crops under small-scale irrigation and keeping livestock under a free-range system. The Pokot occupy the drier rocky area in the north-eastern part of the County. Land use is mainly pastoralism as the principal economic activity. Economic activities revolve around the flexible movement of livestock in pursuit of water and pasture. These culminate to various livelihood options for the local communities in the County.

3.5. The Population

According to the Kenya National Bureau of Statistics [54] report, the human population of Baringo County was estimated at 666,763 made up 141,877 households distributed per constituency, as shown in table 1. The county is divided into Mogotio, Baringo South, Baringo North, Baringo Central, Tiaty (East Pokot and Tiaty East), and Eldama Ravine.

Table 1. *The population and number of households per Constituency.*

Constituency	Population	Area in Square KM	Density	Households
Baringo Central	96, 951	799.9	121.2	23,555
Baringo North	104,871	1,703.5	61.6	23,500
Tiaty	153,357	4,516.8	34.0	26,651
Eldama Ravine	129,535	1,002.5	129.2	30,774
Baringo South	90,955	1,678	54.2	19,854
Mogotio	91,104	1,314.6	69.3	18189
Total	666,763	11,015.3	60.5	141,877

Source: KNBS, 2019- National Population Census.

3.6. Sampling Methods and Techniques

The methods employed include:

i. Purposive sampling technique.

Purposive sampling was adopted because of the known characteristics of the sampling units as follows:

a) Tiaty Constituency consists of East Pokot and Tiaty East. The area was objectively chosen due to the ASAL climatic conditions, conservative beliefs, collective land use, livestock keeping as the spring of sustenance and increasing disputes. Changing sustenance; various pastoral communities quit livestock keeping and migration. They are chosen to settle down and set up permanent residential structures, then start engaging in crops production profitable activities.

b) Eldama Ravine sub-county was enthusiastically chosen because it experiences high amount of rainfall attributed to the highland ecological conditions, comprehensive land use combined with massive segmentation of land into unprofitable units, regional soil and water degradation, combined with forest invasion and population migration from the highlands into the transition zone seeking profitable chances, use modern technologies and individually owned land topped up with title deeds.

c) Baringo South was objectively chosen due to the transitional ecological characteristics, where land is communally managed, increase in highland and ASAL immigrants selected, and was the focal point of land-use due encroachment by pastoral livelihood dropouts from dry areas and economic immigrants from the highlands.

d) Baringo North was objectively chosen since it integrates both the highland and lowlands ecological characteristics, a combination of individual and community land use operations, thus facing land use disputes.

ii. Random sampling technique.

The households in the sample units (see table 1) were

listed and labeled with serial numbers. The sample households were picked randomly based on the serial numbers. Random sampling was adopted because it gives each household in the sampling unit an equal probability of being chosen. The households then selected using random sampling were representative of the entire population (see table 1). The respondents comprised household heads who were personally interviewed by the researcher and research assistants.

3.7. Data Collection and Processing

The data was collected from household heads at a household level between September 2018 and February 2019. The data collection was carried out simultaneously in the four sampling units within six (6) months. The data collected was subjected to initial verification every evening after the fieldwork to identify missing data and outliers. A total of three hundred twenty-three (323) household heads at the household level were personally interviewed. Data comprehensive verification was done to identify missing information and data outliers. The questionnaires were serialized to ensure there were no errors, no duplication, no miscalculation, no missing information, and then coded accordingly. Data coding was done to convert the data collected from the field into a computer-readable form. The data were categorized, consolidated, and entered into the computer. A computer software, Statistical Package for Social Sciences (SPSS) version 20, was adopted. data.

3.8. Data Analysis

The underpinning theory guiding the analysis of this study is the theory of production. This theory was aligned to the sustainable livelihood framework (SLF). Many empirical studies have used the sustainable livelihood approach (SLA) on various aspects of household livelihood, including studies on livelihood diversity [50], livelihood vulnerability [29], livelihood security [48] as well as land use and livelihood of farmers [49] among others. In the SLF, livelihood comprises five major capitals; human, physical, financial, social, and natural capital. These capitals are referred to as livelihood assets consider inputs use by households in their production process. The production process involves conversion inputs into output. The technical correlation between inputs and outputs is referred to as the production function. This function expresses the correlation between the number of inputs and the number of products made. This relationship is used as an important analytical tool underlying the theory of production.

3.8.1. The Model of Analyzing Livelihood Assets Productivity

The Cobb-Douglas production function model was preferred in this study because it has been used in many similar agricultural productivity studies. In the previous studies, [36] used the Cobb-Douglas model to calculate productivity growth rates for agriculture and other sectors of the Austrian economy. [52] used the Cobb-Douglas model to

measure each input's marginal contribution to agricultural output. [18] used the Cobb-Douglas model to measure spatial variation of agricultural productivity in different regions of Sri Lanka. In these studies, the productivity of the inputs is given by the specific input parameter concerning output in the regression model. Hence, these empirical studies guide the analysis.

In this study, it is assumed that the gross output determines the livelihood of the local communities. The livelihood outcome is assumed to be equivalent to the gross output of all household production activities, including livestock and crop production. The gross output is a function of households' capital inputs, including human, physical, natural, financial and social, referred to as livelihood assets. These livelihood assets are required for the livestock and crop production process. This input-output relationship can be written mathematically as:

$$Q = f(X_1, X_2\ldots, \ldots\ldots, X_n). \qquad (1)$$

Where Q = Gross output (all production activities-livestock and crops)

X1….Xn = inputs (human, natural social financial and Physical livelihood assets)

Therefore, modelling this case using the Cobb-Douglas production model framework follows a logical sequence. Cobb-Douglas model evolved from a simple neoclassical model of the input-output relationship as presented in a model mathematically written as:

$$Q = AK^{\alpha}L^{\beta} \qquad (2)$$

In this functional form, the model assumes the number of parameters equals one, i.e., $\alpha + \beta = 1$. Therefore, a linear homogenous production function. However, the Cobb-Douglas production function model has undergone several improvements and can be used to describe multiple input-output relationships.

Empirical studies [17] demonstrated that Cobb-Douglas could handle several inputs. Hence, the model can be used to measure technical progress in a production system represented in a mathematical function or equation consisting of two or more variables written as:

$$Y = \alpha\, X_i \beta i \ldots\ldots X_n \beta n e \mu \qquad (3)$$

Where Y stands for output,
Xi……. Xn stand for inputs
α………stand for a constant/ intercept,
βi……. βn stand for parameters,
e ……. natural logarithms,
μ …. error term/ disturbance term

Empirical studies [17] have shown that the input-output relationship represented in equation (1) is not linear, and it cannot be directly estimated by the least square regression technique. To facilitate estimation, it has to be transformed in multiple linear forms utilizing a natural logarithm (Ln).

This entails applying natural logarithms on both sides of the model and equation (3) written as:

$$LnY = Ln\alpha + \beta_1 LnX_1 + \beta_2 Ln\ X_2 + \beta_3 LnX_3 +, \beta_4 LnX_4 + \beta_5 LnX_5 + \mu \qquad (4)$$

Where Y = the dependent variable,
α = is constant term (intercept),
$X_1 \ldots \ldots X_5$ = independent variable,
$\beta_1 \ldots \ldots \beta_5$ = regression coefficients of independent variables,
μ = is the disturbance term

Transformation linearizes the relationship and compresses the bias hence enable easy and reliable interpretation. Further, study [27] pointed out that qualitative independent variables can be incorporated into the model as dummy variables. Maddalla defined the dummy variable as a numerical variable used in regression analysis to represent subgroups of the sample. It is often used to differentiate various treatment groups and is useful because they allow the researcher to use an exclusive regression equation to represent multiple groups. In this study, dummy variables were used regional characteristics of the sampling units. The equation in transformed form can be written as:

$$LnY = Ln\alpha + \beta_1 LnX_1 + \beta_2 Ln\ X_2 + \beta_i LnX3 + \beta_2 Ln\ X4 + \beta_n LnX5 + \delta_1 LnD_{1\text{-}4} + \mu \qquad (5)$$

Where Y = the dependent variable,
α = is constant term (intercept),
$X_1 \ldots \ldots X_5$ = independent variable,
$\beta_1 \ldots \ldots \beta_5$ = regression coefficient of independent variables,
$\delta_1 \ldots \ldots \delta_4$ = regression of dummy variables,
$D_1 \ldots \ldots \ldots D_4$ = dummy variables and
μ = is the disturbance term

3.8.2. Model Specification

The model was specified by inserting the dependent and independent variables into the model. Equation (5) was specified and written as:

$$Ln\ Q = Ln\alpha + \beta_1 LnH + \beta_2 LnN + \beta_3 LnP + \beta_4 LnF + \beta_5 LnS + \delta_1 LnBS + \delta_2 LnBN + \delta3 LnT + \delta4 LnER + \mu \qquad (6)$$

Where Q = Gross output of all production activities (livestock and crop)
α = is constant term (intercept),
(H, N, P, F & S) ………Human, Natural, Physical, Financial &
Social livelihood assets, respectively
(β1, β2, β3, β4 & β5) …. Regression Coefficient of Human,
Natural, physical, Financial & social
livelihood assets
(BS, BN, ER and T) … Dummy for Baringo South,
Baringo North, Eldama Ravine and
Tiaty study site
(δ1, δ2, δ3 & δ4) …… The regression coefficient of Baringo South,
Baringo North, Eldama Ravine and
Tiaty
μ……. ……………… Error term/disturbance term

The gross output includes all individual household livelihood activities in this study, namely livestock and crop production. These production activities vary from area to area within the County depending on ecological conditions, cultural beliefs of the given local community and land use status. The study sites include Baringo South (BS), Baringo North (BN), Tiaty (T), and Eldama Ravine (ER), which reflect different ecological and land use changes in the County. These sites were used as dummy variables to capture the ecological and livelihood aspects in different parts of the county. The transformed equation (6) was estimated. In the model, the parameters of the independent variables give the productivity of inputs. It is assumed that the productivity of the inputs determines the overall household livelihood outcomes. The sign of the regression parameter for each household inputs is assumed to indicate the direction of change. If the sign is negative, it implies changes in the quantity of input decrease household output, while a positive sign implies changes in the quantity of input increase household output. If the sum of inputs regression coefficients is negative, then it means that changes in combined inputs decrease the general production output of the household and vice versa when the sum of coefficients is positive. The intercept indicates the efficiency parameter.

3.8.3. Explanations of the Expected Signs in the Model

The expected signs indicate positive or negative livelihood outcomes. After the data analysis, the findings may support the expected sign or go contrary. In this study, it is expected that land use changes improve household livelihood assets productivity. Increase in the human capital (e.g., level of education), the value of physical capital, increase financial resources, i.e., savings and cash and increase in membership social groups and networks are expected to increase livelihood assets productivity. This means that land use changes were expected to increase household livelihood output and productivity of the respective livelihood assets. Whereas the expected sign for natural livelihood assets productivity is negative, which means land use changes were expected to decrease land size and productivity depending on the prevailing conditions and level of technology. Further, land use changes will be expected to decrease household livelihood assets productivity in Baringo South and Tiaty

constituencies due to escalating land resource conflicts. In Eldama Ravine and Baringo North, land use changes are expected to increase household assets livelihood productivity because of modernization of Agriculture and secure land tenure. This means that land use changes were expected to be influenced by regional variation in ecological, cultural diversity, land use and livelihood activities.

3.8.4. Diagnostic Tests

In the analysis, several diagnostic tests were conducted to ensure the predictor variables could describe the dependent variables. The difference in land use and geographical position between different regions, in this study, different households suggest the possibility of autocorrelation. Clustering of households in the study area was used to solve the spatial autocorrelation. Pearson correlation coefficient (PCC), Tolerance and Variance Inflation Factor (VIF) were adopted to test the results. The variant inflation factor (VIF) tests the classical assumption of multicollinearity. It measures how much a variable is contributing to the error in the regression. It an index $1/1-R^2$ (1- 5= small, 5- 10= acceptable, > 10 = extreme). The Glejser test for heteroscedasticity. The test was carried out by regressing the residuals on the explanatory variables related to the heteroscedastic variance. If the value sig > 0.05, then there is no heteroscedasticity and if the value sig < 0.05, then there is a problem of heteroscedasticity.

In addition, this study used dummy variables to capture regional variations in terms of ecology and livelihood activities of the sampling units. There is a likelihood of the independent variables becoming multicollinear, a situation known as a dummy trap. To avoid a dummy trap in the regression model, one dummy variable (n-1) was omitted. The omitted dummy variable becomes redundant. A quick dummy trap test was carried out by multiplying the altered independent variable (X') with the independent variable (X) and then calculate its determinant. If the determinant is zero (XX') =0, then there is a dummy trap, and if the determinant is not zero (XX') ≠ 0, then there is no dummy trap. All these diagnostic tests were done using SPSS version 20.

4. Findings, Results and Discussions

The results were based on Cobb-Douglas production function estimates. Thus;

Table 2. Cobb-Douglas model regression results on livelihood assets productivity.

Independent variable	Expected sign	B	t-test	VIF	Glejser-test
Human	+	-0.561***	-3.792	1.490	0.075
Natural	_	0.543**	1.603	8.519	0.965
Physical	+	-0.534*	5.485	7.785	2.019
Financial	+	-0.676**	-0.986	3.029	0.005
Social	_	0.613***	1.593	7.028	0.000
Dummy BS	_	-0.090*	-0.092	6.053	0.000
Dummy BN	+	0.051***	0.155	7.353	0.001
Dummy T	_	-2.824**	-3.960	2.496	0.003
Dummy ER	+	1.393*	-5.833	2.103	0.000
Intercept					1.286
F-test					73.768
Adjusted R^2					0.783
N					323

*** = Significant at the level of 1%. ** = Significant at the level of 5%. * = Significant at the level of 10%., E.S. = Expected sign. If variant inflation factor (VIF) < 10, there was no Multicollinearity. If the value sig < 0.05 using the Glejser test, there was no Heteroscedasticity. Dummies (BS-Baringo South, BN- Baringo North, T- Tiaty and ER- Eldama Ravine).

4.1. Post-estimation Tests

Post-estimation tests were conducted to ensure the predictor variables were able to describe the dependent variable. These measures include the estimation of the preciseness of the model through the adjusted R^2 testing. The hypothesizes were tested with both the F and T-test, then testing the classical assumption of multicollinearity with the variant inflation factor (VIF) and heteroscedasticity with the Glejser test. Least squares regression techniques using SPSS version 20 software package to obtain values for variables parameters. The results were based on cross-section data drawn from three hundred twenty-three (n=323) respondents shown in table 2.

The table indicates the regression coefficients for independent variables and dummy variables. The coefficients reflect the overall productivity of the livelihood assets (independent variables), that is, human, natural, physical, financial, and social capital under different study sites. The dummy variable coefficients reflect the productivity of livelihood assets of individual households on different study sites. The model was subjected to diagnostic tests, including the adjusted R^2, which indicates how the model explains the predictor variables. In this case, the model explains seventy-eight (78%) percent of livelihood assets productivity, VIF was less than < 10 indicating there was no multicollinearity between model variable, and the significance value was less than (< 0.05), indicating there was no heteroscedasticity. Therefore, these diagnostic measures confirm that the model was fit and can explain the livelihood assets productivity.

4.2. Model Results and Interpretation

The results indicates that first, human livelihood assets

productivity decreased by 56.1% at 1% level of significance. Human livelihood assets comprise of health status, nutrition level, level of education, knowledge and skills, ability to work and capacity to adapt land use changes. This means that land use changes decrease health, nutrition, education, knowledge and skills, ability to work and capacity to adapt changes by individual households. This result implies poor health status, shortage of food, low education level, lack requisite skills and weak capacity to cope with the changes. Second, the natural livelihood assets productivity increased natural livelihood assets productivity by 54.3% at 5% level of significance. It means that land use changes enhance environmental conservation. Third, the physical livelihood assets productivity decreased by 53.4% at 10% level of significance. It means that land use changes lower provision of shelter, water supply and sanitation, energy, transport and tools. This implies poor living conditions, in terms of provision of basic needs such as shelter, water supply and sanitation and access to markets. Four, the financial livelihood assets productivity decreased by 65.6% at 5% level of significance. This means that land use changes diminish financial prospects of the local communities hence perpetuate poverty. Five, the social livelihood assets productivity increased by 61.3% at 5% level of significance. this means that land use changes strengthen social relations of local communities. The local communities come together for social protection, undertake joint activities keeping livestock together, organizing fundraising for school fee, funeral among other social functions.

On regional context, the dummy variables represent land use in different parts of the county; the pastoral, agro-pastoral and private lands use. These dummies were used to capture livelihood assets productivity under different ecological zones (highlands, marginal and dry zones) and land tenure system. The coefficients were significant at different levels and the sign indicates the direction of change. Baringo County is divided into two ecological zones; lowlands and highlands with a transitional (marginal) zone between them. the results indicate that in the pastoral land use livelihood assets productivity decrease by 282.4% at 5% level of significance and in agro-pastoral land use decreased by 9% at 10% level of significance. This indicate that land use changes reduce livelihood assets productivity over 30 times compared with agro-pastoral land use and community land use. The decrease in livelihood asset productivity in agro pastoral and community land use could be attributed to rampant land use conflicts. The conflicts in these areas hinder local communities from engaging in livelihood activities. The area is prone to cattle rustling which in a way suppress individual interest and lower the overall land productivity. On the other hand, land use changes in Baringo North constituency livelihood assets productivity increase by 5.1% at 1% level of significance, and in Eldama Ravine constituency livelihood assets productivity increased by 139.3% at 10% level of significance. this increase is associated with private land use, which promoted individual interest, increasing overall land productivity.

5. Summary, Conclusions, and Recommendations

5.1. Summary

The regression results indicated that livelihood assets productivities varied from one household to another depending on the ecological zone and the type of land use. Thus, first, human livelihood assets productivity decreased by 56.1% at 1% level of significance, and it reflects an overall decrease in individual household's livelihood assets in different zones within the County. In the dry and marginal lands, which is largely communal, covering Baringo South and Tiaty. This means the productivity of human livelihood assets for individual households decreases education, the skills, experiential knowledge, ability to labor, and health to pursue livelihood strategies necessary to achieve livelihood objectives. The resultant consequence is perpetual poverty, escalating resource conflicts, degradation of the environment, and chronic food shortages amongst the local communities. Whereas in the highlands, which is largely private, covering Baringo North and Eldama Ravine. This means the productivity of human livelihood assets for individual households increases the skills, knowledge, ability to labor, and health to pursue livelihood strategies necessary to achieve livelihood objectives. The resultant consequence is sustainable livelihoods. These results imply that the dynamics of land use changes support private land in the current dispensation. This result agrees with the hypothesis expected negative sign.

Second, natural livelihood assets productivity by increased by 54.3% at 5% level of significance, and it reflects an overall increase in individual household's livelihood assets productivity in different zones within the County. In the dry and marginal lands, which are largely communal, covering Baringo South and Tiaty, the productivity of natural livelihood assets for individual households increases the capital flow and services used to derive livelihood. Most of the land had be left idle due to land use conflicts. This means regeneration of bushes and trees in the abandon land. The resultant consequence implies environmental conservation, enhanced generation of bushes, forests and improved recycling of nutrients. Whereas, in the highlands, which is largely private, covering Baringo North and Eldama Ravine, the productivity of natural livelihood assets for individual households increases environmental conservation, production assets such as forests, improved nutrient recycling, soil quality, and reduce water pollution. This result agrees with the hypothesis expected positive sign. the finding gives falls explain world situation.

Third, physical livelihood assets productivity decreased by 53.4% at 10% level of significance, and it reflects an overall decrease in individual household's livelihood assets productivity in different zones within the County. In the lowlands, which is largely communal covering Baringo South and Tiaty, the productivity of physical livelihood assets for individual households decrease infrastructure, producer

goods, tools and equipment, means of transport, shelter and buildings, water supply, and sanitation, energy, access to information needed to support livelihood. The resultant consequence implies deterioration of local communities' livelihood. Whereas, in the highlands, which is largely private covering Baringo North and Eldama Ravine, the productivity of natural livelihood assets for individual households increase infrastructure, producer goods, tools and equipment, means of transport, shelter and buildings, water supply and sanitation, energy, access to information needed to support livelihood. The resultant consequence is improved of local communities' livelihood.

Four, Financial livelihood assets productivity decreased by 65.6% at 5% level of significance, and it reflects an overall decrease in individual household's livelihood assets productivity in different zones within the County. In the lowlands, which is largely communal covering Baringo South and Tiaty, the productivity of physical livelihood assets for individual households decreases financial resources such as savings (cash, bank deposits), liquid assets such as livestock, credit providing institutions, and inflows (pensions, transfer payments, remittance) that local communities use to achieve their livelihood objectives. The resultant consequence implies diminishing financial resources to support the livelihood of the local communities. Whereas, in the highlands, which is largely private covering Baringo North and Eldama Ravine, the productivity of natural livelihood assets for individual households increases financial resources such as savings (cash, bank deposits), liquid assets such as livestock, credit providing institutions, and inflows (pensions, transfer payments, remittance) that local communities use to achieve their livelihood objectives. The resultant consequence improves financial resources to support livelihood objectives. This could be associated with the security of tenure.

Five, Social livelihood assets productivity increased by 61.3% at 1% level of significance, and it reflects an overall increase in individual household's livelihood assets in different zones within the County. In the lowlands, which is largely communal, covering Baringo South and Tiaty, the productivity of social livelihood assets for individual households increased social resources which local communities draw in pursuit of their livelihood, social networks and connectedness, membership in groups, the relationship of trust, reciprocity and exchanges. This means that land use changes facilitate cooperation, influencing social transaction costs and provide the basis for informal safety nets and strategies chosen to achieve livelihoods outcomes. The resultant consequence implies organized social relations, and strong informal safety nets hence propagate joint livelihood activities including resource mobilization to meet social problems such funeral arrangements, common enclosure for livestock, youth herding together for protection against bandits. Whereas, in the highlands, which is largely private covering Baringo North and Eldama Ravine, the productivity of social livelihood assets for individual households increases social

resources which local communities draw in pursuit of their livelihood, social networks and connectedness, membership in groups, the relationship of trust, reciprocity and exchanges. This means the social livelihood assets productivity facilitates cooperation, reduces transaction costs and provides the basis for informal safety nets and strategies chosen to achieve livelihoods outcomes. Therefore, the resultant consequence implies sustainable livelihoods

In general, livelihood assets productivity varied from region to region and yields different dynamics. In the drier and marginal parts of the county covering Tiaty and Baringo South which are largely communal, Livelihood assets productivity decreased. Whereas, the highlands covering Baringo North and Eldama Ravine, livelihood asset productivity for individual households increase. This could be associated with security of land tenure system.

5.2. Conclusion

The study concludes that the dynamics of land use changes decrease human, physical, and financial livelihood assets productivity. The effects occasion land use conflicts characterized by fatal inter-ethnic fights that led to forced eviction making it difficult for the local communities to engage n livelihood activities, hence deterioration of agricultural land productivity. This makes the ongoing land reform at County and National level under the constitution 2010 almost redundant.

5.3. Recommendation and Policy Implications

This section presents both theoretical and policy recommendations and implications of the study.

5.3.1. Theoretical Recommendations

The study results have contributed more knowledge on the concerns on communal land and other variables that influence the implementation of land reforms in the Kenya. The results support the application of production theory aligned to the sustainable livelihood framework (SLF) theory which was adopted for the study. This approach shed light on the understanding and application of the theories in explaining land use changes. The study also recommends use of other theories; the tragedy of commons, the Dualistic Development Thesis, Government intervention in supporting the understanding of the land use changes and its dynamics. This perspective contributes to the body of knowledge, and ought to be emulated by other researchers. The approach needs to be out scaled to cover all the arid and semi-arid lands in (ASALs) in Kenya, which constitutes 68% of the total land mass, specifically the dry and marginal lands in northern part of Kenya, facing similar land use conflicts problems. There is need for government to sensitize local communities residing on unregistered Community Land to register their land within the provisions of Community Land Act, 2016. Registration of land will increase livelihood assets productivity, enhance security of tenure and eliminates land use conflicts and improve the livelihood of the communities. The study noted a high level of land uses conflicts among the

residents, particularly in dry (pastoral) and marginal (agro-pastoral) unregistered community lands, which has caused unstable and uncertain livelihood to the local communities.

5.3.2. Policy Recommendations

The study recommends a complete overhaul of the current policy formulation and implementation framework, including institutions and processes. The policymakers and experts ought to change their mindset to relevantly respond to the local community's livelihoods. Land use policies should focus on basic livelihood activities such as Livestock and crop production as conceptualized by the local communities. There is a need to change the dual policy orientation in Kenya, and put in place a uniform land tenure system that recognize, protect and secure land use in the entire country as enshrined in the constitution of Kenya 2010.

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