EFFECTS OF SUGARCANE FARMING ON FOOD PRODUCTION IN DEDE DIVISION, MIGORI COUNTY, KENYA

BY

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DECLARATION

Declaration by the candidate

I declare that this thesis is my original work and has not been presented for a degree or any other award in any University.

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DEDICATION

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ABSTRACT

Food production issues have dominated Kenyan Government development planning agenda for decades. Low food production have been experienced especially in areas where cash crops such as sugarcane are grown as it competes for rich agricultural land with food crops. Despite income from sugarcane, some households in Dede Division are still experiencing food shortages. This study assessed the effects of sugarcane farming on food production in Dede Division, Migori County. The specific objectives were; to determine the extent of expansion of land use for sugarcane production, to assess the effects of land use change on food production and to establish the effects of relocation occasioned by sugarcane farming on food production. The study adopted a descriptive research design with a sample size of 370 households drawn from a population of 9,503 households within the Division. Quantitative data was collected using household questionnaires administered to household heads. Qualitative data was obtained using key informant interviews (KII). More primary data was collected from direct observation and use of photography. Secondary data was obtained from published works, books and journals. Quantitative data was cross tabulated and the analysis presented in tables. Qualitative data was coded, compiled and integrated into the text. The study revealed that three quarters of the household heads (70.3%) who had given their land to an heir admitted that sugarcane was preferred by the beneficiaries followed by coffee (17.0%) and tobacco (12.7%). Before expansion of acreage under sugarcane, 27.1% of the land was set aside for maize and only 0.6% of the land was used for production of sugarcane. However, when commercialization of sugarcane started, the acreage under it increased from 0.6% to 61.2% per household. Its output increased from 1.8% to 97.8% tons. On food production,81.1% of the households sampled produced food lasting 5-6 months and none (0%) produced food that lasted below 1 month before expansion of area under sugarcane, after its expansion, 16.8% of the households now produce food that cannot last 1 month and 57.8% of the households now produce food that can only last 1-2 months. The study further revealed that the main cause of relocation in the study area was expansion of Sony nuclear farms as 81.3% of the households were relocated by the factory. Food production per household before the relocation stood at 23.3% of total produce for Maize, Beans had 16% but after relocation, Maize production reduced to 10.6% and Beans to 8.5%. It therefore emerged that land use was correlated with food production ($r=-.560$, $p<.05$) and land relocation had a negative effect on food production ($r=-.657$, $p<.05$). The study therefore concluded that; the allure of possible comfort from income generated through sugarcane production has contributed to the expansion of the area dedicated to it as a cash crop, changes in land use by the households are responsible for the low food production in the study area and lastly relocation resulted in low food production in the Division. This study therefore recommends that, measures be put in place by the Government to ensure that expansion of commercial sugarcane cultivation is controlled so as to boost food production, there should be policies focused on encouragement of efforts of Non-Governmental Organisations already on the ground such as 'Njaa Marufuku' to improve food production, the Government should also put measures in place for the relocated population to be adequately empowered to improve their coping capacity.

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LIST OF ABBREVIATIONS

ASAL – Arid and Semi-Arid Lands

AWSC – African women's studies centre

CARP – Comprehensive Agrarian Reform Program

CSR – Corporate Social Responsibility

DAO – District Agricultural Officer

DWCP – Decent Work Country Program

FAO – Food and Agriculture Organization

FAOSTAT – Food and Agriculture Organization Statistics Division

GDP – Gross Domestic Product

IDP – Internally Displaced Person

IFAD – International Fund for Agricultural Development

ILO – International Labour Organization

KESREF – Kenya Sugar Research Foundation

KII – Key Informant Interviews

KSCL – Kilombero Sugar Company Limited

KNBS – Kenya National Bureau of Statistics

NAAIAP – National Accelerated Agricultural Inputs Access Program

SCAO – Sub-County Agriculture Officer

SONY – South Nyanza

OPERATIONAL DEFINITION OF TERMS

Land subdivision/ Land fragmentation: For purposes of this research, the two terms will be used interchangeably to refer to the act of dividing land into two or more lots, parcels or parts as inheritance to sons.

Food production: An activity of or producing, preparing, processing, making, preserving packing or repacking and or changing the form of food. In this research the term shall limit itself to the actual crop farming and harvesting of grains like Maize and Millets, cereals like Beans and tubers like Cassava and sweet potatoes (AWSC, 2014).

Food security: Is a 'situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life'(FAO 2001; 2010).

Food access: Is ensured when households and individuals within them have physical, economic, and social access to food and utilize adequate and appropriate foods for nutritious diet (AWSC, 2014).

Relocation: The spatial removal of people from one settlement area to another settlement area often on mutual agreement and mostly after compensation (Simelane, 1995).

Nuclear farms: Extensive sugarcane plantations owned and managed by the sugarcane factories (Evelyn, 2005).

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CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Sugarcane (*Saccharum officinarum*) is produced in more than 100 countries around the world and is widespread in the tropics and subtropics (Rehm & Espig, 1991). Sugarcane originated from tropical South and South East Asia. Crystallized sugar, extracted from the sucrose stored in the stems of sugarcane, was known 5000 years ago in India. In the 7th century, the knowledge and production of sugar was transferred to China. Around the 8th century sugarcane was introduced by the Arabs to Mesopotamia, Egypt, North Africa and Spain, from where it was introduced to central and South America by Christopher Columbus. Brazil has the largest area under sugarcane cultivation in the world, being responsible for approximately one third of the global harvested area and production. For the year 2007, 6.7 million hectares were harvested with a production of 514 million tons of sugarcane. From 2000 to 2007 an impressive pace of approximately 300 thousand hectares of land was converted into sugarcane every year. She produces 739.3 million metric tons per year (Fischeret al., 2008).

Most of the recent expansion in sugarcane area has occurred in Sao Paulo State. From the years 1995 to 2007, there was a 70% enlargement of the sugarcane area in Sao Paulo, from 2.26 million ha to 3.90 million ha, which represents 58% of the Brazilian area under sugarcane (FAOSTAT, 2008). There are some observable similarities in the pace of expansion of area under sugarcane in Sao Paulo and those existing in Florida United States of America (USA). Sugarcane production is concentrated in areas south and west of Lake Okeechobee in Palm Beach, Hendry and in the Everglades. The 2008-2009 sugarcane harvest season produced 1.40

million metric tons of raw sugar from approximately 12.15 million metric tons of sugarcane. Sugarcane was harvested on 157,138 hectares, which represented a 1.7% increase from the previous year (Roka et al., 2010). The foregoing conforms to the trends in both Brazil and Philippines, however, Roka et al. (2010) further notes that in the past 20 years, several important changes have taken place within Florida's sugar industry that has affected grower costs and returns from producing sugarcane, notably decline in the acreage of sugarcane grown by independent growers.

During the period 1975 to 1986, there was a sharp increase in Brazilian sugarcane area which was entirely due to the domestic feedstock demand of the ethanol program. The region of Central America and Caribbean had the highest share in terms of percentage of cultivated land used for sugarcane production between 1969 and 2007. An estimated 7% of cultivated land was used for growing sugarcane. At that time, Brazil devoted 4.4% of cultivated land to sugarcane (Fischeret al., 2008). It is imperative to note that while in Brazil, Fischer et al.(2008) observed that the expansion of sugarcane could increase deforestation rates either 'directly' by intruding in areas of native non-protected forest areas or 'indirectly' by forcing other land uses (e.g. displaced livestock production and agricultural crops such as soybeans) to open up new sugarcane land, on the other hand, other studies carried out in other parts of the world reveals that challenges with expansion of area dedicated to sugarcane production are almost similar. Fernandez &Nuthal (2012) observed that in June 10th 1988, sugarcane lands were placed under the Comprehensive Agrarian Reform Program (CARP). Agrarian reform in this context referred to the redistribution of land to the tillers of the soil (i.e., small farmers, tenants and farm workers). Under the program a land owner may retain an area of not more than 5 hectares and 3 hectares may be awarded to each child (15 years and above). The intention was to establish owner cultivation of economic

sized farms that would ultimately improve productivity and lodge equity among planters, tenants and farm workers in the sugar industry. However since its official introduction, it has created many problems key amongst them being interference with land allocation for food that countervails economic and social well being.

India ranks second in the world in sugarcane cultivation and with an average production of 273.93 metric tons in 2008-09; it had a share of 22 percent in world's sugarcane production. In Andhra Pradesh, the major sugarcane growing and jaggery producing districts in the Telangana, coastal Andhra and Rayalaseema regions are; Nizamabad, Visakhapatnam and Chitoor Districts respectively. There are many other areas where sugarcane growing is a major activity and has been expanding, however, the yields of sugarcane in the North coastal zone has been stagnant for the past two decades (hovering around 70-80 t/ha). The major reason given is 'shortage of farm employment' which resulted from relocation of population and not getting remunerative prices (Rao, 2012). Shortage of farm employment combined with low remunerative prices for sugarcane erodes the ability of the population to put food on the table. Fischer et al.(2008) makes the most concise allusion to the bigger problem associated with expansion of areas under sugarcane cultivation in many parts of the world when they state in their research that the recent boom of ethanol production in Brazil has drawn international attention to the environmental impacts of land conversion into sugarcane monocultures. Major areas of concern include deforestation and threats to biodiversity, environmental pollution and competition for land with food crops

Outgrowing is a type of contract farming with long and complex history in Africa, but has recently emerged at the centre of global debates about agricultural commercialization. Contract farming, it is argued, provides an opportunity for the rural poor to participate in production in

commercial value chains and access markets for their produce. Contract farming is widely used by agribusiness companies to produce exports of high value crops such as sugarcane, coffee and tea; it can only benefit the rural poor in developing countries if an adequate governance and legal framework is in place. Kilombero Sugar Company Limited (KSCL), the largest sugar company in Tanzania, contributing almost three quarters of sugar being produced in the country illustrates these changes clearly (Sulle, 2017).

As sugarcane production expands, the availability of land for both the company and out growers remains a major constraining factor. The company acknowledges that about sixty percent of the land within the 40km radius from KSCL is under sugarcane, with much of the remainder used for other crops. This, however, ignores the fact that some of the remaining land is used for communal settlement, including areas for social services and national parks. The lucrative prices of sugarcane from the company and the previously reliable market have encouraged out growers to put most of their farmland into sugar cane, leaving very little space or none for food crop production. It is also difficult to leave sugarcane farming and opt for the production of food crops, such as rice and maize, because birds nesting in sugarcane eat these crops. This means that families either look for alternative food producing land in distant areas or depend on buying foodstuffs from the market (Sulle, 2017). Presently, the demand for sugar outstrips its production in Ethiopia. The government of Ethiopia is currently enhancing the production capacity of old and new sugar estates to meet local demand and for export. The country aims to boost annual sugar production from the current level of 0.3 to 2.25 million tons together with generation of 181 million litres of ethanol. The sugar factories are also expected to contribute about 448 megawatts of electric power through co-generation (Esayas et al., 2016). The two studies show expansion in areas under sugarcane. However, in both studies, the researchers used participatory

rural appraisal (PRA) approach. There is need to use a different approach to study the extent of expansion of land under sugarcane in the study area.

During a study done by Wawireet al.(2011) on the sugar sub sector he acknowledges that there is displacement of population which has led to loss of settlement land to sugarcane plantations. To some extent the SCAO-Awendo/ Rongo gives a glimpse of the problem at hand when he mentions that Sony Sugar Company indeed relocated some people but the sugarcane sector in the Sub County continue to perform poorly due to Sony's low capacity to handle the increased acreage under sugarcane leaving farmers with low purchasing power (Ndirangu, 2010).The above literature reviews provide vital evidence that expansion of sugar plantations through nuclear farms by milling factories at their inception led to relocation of people. However, they majorly focus on relocation and its economic impacts ignoring the implication on food production. Besides, most of the research has been concentrated in the western sugar zone of Mumias and Nzoia. Limited data exists on the effect of relocation of people as a result of sugarcane farming on food production especially in Sony sugar belt. This study therefore conducted an in depth assessment of the effects of relocation occasioned by sugarcane farming on food production in Dede Division, Migori County.

In Kenya, the total area under cane as at the end of the first quarter of 2004 was 107,622 hectares compared to 106,313 hectares in the same period in 2003, representing an increase of 1.2%. The increase was attributed to South Nyanza sugar belt as all the other zones experienced diminishing cane area (Evelyn, 2005). In South Nyanza sugar belt where the study area is, the desire to be economically independent has led to expansion of area under sugarcane farming as farmers donate land to their sons as inheritance hence leading to land fragmentation (Nyangweso, 2011).

In 2003, a cane variety named Co 945 occupied the largest cane surface with 30,220 hectares, representing 25% of the total area. Variety N14 came second to occupy 28,262 hectares (23%). A sizeable bulk of the area amounting to34,968 hectares (29%) had mixed varieties of unknown percentage (Evelyn, 2005). Locally, Sugarcane is primarily grown by small scale farmers which exert pressure on available agricultural land (Kenya, Republic of, 2002). The total land area of Dede Division is 108.2 km^2(10820 hectares). The total land area under small holder sugarcane farms is 59.3 km^2(5930 hectares) out of which 4.1 km^2(410 hectares) is large scale nuclearfarm within Dede Division (Ndirangu, 2010). Traditionally sugarcane has been grown in Kenyan lake region for beer brewing and also for chewing. Commercialization of sugarcane in the region came with the establishment of sugar schemes by the government in the 1960's, eventually farmers in the area became interested in expanding cane production in order to maximize profits leading to a decline in attention and cultivation of subsistence crops (Aluoka, 1999). Some of these studies were conducted more than one decade ago. Economic and Socio-cultural changes necessitate another study. Secondly, none of these studies was carried out in Dede Division. Despite the realization of the expansion of area under sugarcane in the area, the studies failed to assess the effects of changes of land use on food production in these areas. This study therefore sought to involve the farmers' direct participation in the study.

Research highlighting the extent of expansion of land use for sugarcane production and how this affects food production in the study area is not well documented. Dede Division produces a total of 332,500 tons of sugarcane worth kshs 83.10 million to Sony sugar factory per year mainly from small holder farms. It is assumed that this is the amount spread among all the farmers supplying cane to the factory. The wide perception of sugarcane farmers is that they are food secure since they ought to be able to afford food at market prices from the farmers who grow or

sell the food commodities (Ndirangu, 2010). This, however, is not the case as the average amount received is either too little or comes too late in between the farming seasons. The other misleading assumption is that farmers produce enough staple food to supply their household needs (Aluoka, 1999). Aluoka based his arguments on assumptions and perceptions; this study sought scientific evidence by seeking views from stakeholders in the study area. The truth is that the continuous enlargement of sugarcane farms at the expense of subsistence crops has created a situation where demand is there but supply is less hence prices of food have increased making it difficult for farmers to be able to afford the staple food in the open village markets (Aringo, 2008).

In Awendo area commercial sugarcane farming has been practiced for nearly thirty seven years with inception of Sony Sugar Limited Company in 1979. Expansion of land under sugarcane production increases the risk of low food production, particularly when such expansion is accompanied by a sizeable decrease in size of land under subsistence crops; this is so especially in areas where farmers have small parcels of land. Also, until the new cash crops start generating a profit, sugarcane growing creates uncertainties in food production and security (Netondo et al., 2010). These studies have shed light on contribution of sugarcane farming to low food production especially when farmers have limited land. Further, these studies touch on decrease in production of subsistence crops. Some of the studies also link competition for arable land between cash crops and food crops. However, there is limited evidence of studies carried out to assess the effects of changes of land use on food production. This study sought to fill this gap.

Some households relocated by sugar millers' nuclear farms have moved to nearby towns and others have moved far in search of new settlements (Wawireet al., 2011). Sugar factories require large tracts of land to set up nuclear farms which forms the first line of sugarcane supply to the

milling factories. Milling factories which were recently established like Sukari industry in Homa Bay County (established in 2011) have no nuclear farms owing to the dense population in its immediate surrounding at the time of its establishment, however, factories established earlier on like Sony sugar company established in 1979 led to relocation of the locals in order to set up its nuclear farms.

This study in general, therefore, sought to assess the effects of sugarcane farming on food production in Dede Division, Migori County.

1.2. Statement of the Problem

Sugarcane in Dede Division has been practiced under contract farming, an arrangement where the farmer provides the land while Sony does the ploughing, supply of seed cane and transportation of harvested cane; the expenses are deducted from the farmers' total earnings after harvesting. Over the years, this arrangement has been very attractive and it has meant that Sony Sugar Company receives a steady supply of cane from contracted and un-contracted smallholder farmers. The desire to put more land under sugarcane may be the cause of the unbalanced land allocation in favour of sugarcane as both categories of farmers compete in expansion of sugarcane production and neglecting food crops leading to low food production. Being a recent phenomenon, this study sought to carry out an empirical study to determine the extent of expansion of land use for sugarcane production in the Division. Though the net income from sugarcane is marginally higher than the traditional cash crops, there is need to take into account the number of months sugarcane takes from the time it is planted to its full maturity which is between 18 to 22 months. Considering other financial demands like health and education, it is difficult to spread the cash received especially where those on salaried employment are few as in

Dede Division. It is a common feature to notice that some households are faced with periods of inadequate food especially before sugarcane matures for harvesting. This study therefore sought to assess the effects of land use change on food production. At the beginning, Sony Sugar Company had to acquire large nuclear farms to support its initial crushing capacity. Relocation of people became necessary in order to create room for the nuclear farms. Out of those relocated, some bought land parcels and settled nearby within the Division. In most cases the resettled land is small and inadequate for both cash and food crop production since the compensation was inadequate. Despite studies done on sugarcane farming in other parts of Kenya, very little research has been carried out in Dede Division to establish the effects of relocation occasioned by sugarcane farming on food production. This study sought to fill this gap.

1.3. Objectives of the Study:

The overall objective of the study was to assess the effects of sugarcane farming on food production in Dede Division, Migori County.

Specific objectives were:

1. To determine the extent of expansion of land use for sugarcane production in Dede Division, Migori County.
2. To assess the effects of land use change on food production in Dede Division, Migori County.
3. To establish the effects of relocation occasioned by sugarcane farming on food production in Dede Division, Migori County.

1.4. Research Questions:

1. What is the extent of expansion of land use for sugarcane production in Dede Division, Migori County?
2. What are the effects of changes of land use on food production in Dede Division, Migori County?
3. What are the effects of relocation of population which is occasioned by sugarcane farming on food production in Dede Division?

1.5.Significance of the Study

The findings of this study may not only generate vital information to determine the extent of expansion of land use for sugarcane production, the effects of land use change onfood production, and also effects of relocation occasioned by sugarcane farming on food production, but also inform policy makers and other stakeholders in Kenya on such issues within Dede Division and similar areas. The findings may also be useful to sugarcane manufacturing factories as it offers reliable data available for them to make decisions regarding their Corporate Social Responsibility (CSR) in support of food production in their areas of jurisdiction.

The findings of this research are important as they may assist in shaping the farmers attitude on importance of reducing acreages set aside for sugarcane and increase the ones for food crops. Dede Division was therefore selected for this study due to its strategic location close to two major sugarcane crushing mills Sony and Sukari factory. The research findings may also be useful in economic planning to address the issues of manufacturing industries food and its production. Further, these findings will add to existing knowledge on sugarcane and its influence on food production.

1.6.Scope and Limitations

This study was carried out amongst households in Dede Division of Migori County to assess the effects of sugarcane farming on food production within Dede Division only. The study limited itself to extent of expansion of land use for sugarcane production, effects of land use change on food production and relocation of population occasioned by sugarcane farming. The study focused mainly on food crops on the basis that the food crops mentioned (Grains) are staple food in western parts of Kenya (Nekesa & Meso, 1997).The main tool of data collection was household questionnaires. In most of the cases, the researcher found the household heads present in the homes, however, in some instances the household heads were not found nearby. This meant that the researcher had to revisit the affected homesteads on a different date.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This chapter reviews literature relevant to the study in line with the main objective and the specific objectives; the review is basically based on concepts and records related to the study from books, journals and relevant articles. It also presents conceptual framework for the study.

2.2. Extent of expansion of Land use for Sugarcane production

World crop statistics collected and published by the Food and Agriculture Organization (FAO) have been available for years since 1950. According to these data, world production of sugarcane at the mid last century was about 260 million tons produced on around 6.3 million hectares, which is an average yield of just over 40 tons per hectare. Only 30 years later, in 1980, the global harvest of sugarcane had reached a level of some 770 million tons cultivated on about 13.6 million hectares of land with an average yield of 57 tons per hectare. Another nearly 30 years later, the estimates of sugarcane production for 2007 indicate more than doubling of outputs to 1525 million tons from some 21.9 million hectares of harvested sugarcane. In summary, the global harvest of sugarcane had a nearly six fold increase from 1950 to 2007 while harvested area increased 3.5 times. During the same period average global sugarcane yield increased from 41.4 tons per hectare in 1950 to 69.6 tons per hectare in 2007, i.e. a sustained average yield increase per annum of nearly 1% (Fischer et al., 2008).

Increase in acreage of land put under sugarcane cultivation has been sustained globally as from 1950's through the year 2000 up to date. Fischer et al.(2008) during a research in land use dynamics and sugarcane production in Brazil it was noted that Brazil accounted for 75% of sugarcane area increases in the period from 2000 to 2007 and two thirds of global production increases in that period. From 2000 to 2007, an impressive pace of approximately 300 thousand hectares of land was converted into sugarcane every year (FAOSTAT, 2008). Similarities can be drawn in the Brazilian scenario and other research findings elsewhere for example in the Philippines currently, there are approximately 58,996 sugarcane farmers cultivating around 398,720 hectares of sugarcane land. Around 5 million people are employed in the industry and other sugarcane related activities. From a net importer of sugar in 1995, the country achieved self-sufficiency in 2003. The growth rate of sugarcane production was achieved mainly through the expansion of cultivated areas. Sugarcane was planted in 382,956 hectares for crop year 2007, up from 372,339 hectares in crop year 1995-96 (Fernandez &Nuthal, 2009).

Mixed farming is practiced by most farmers since its perception to help soil retain its nutrients over a period of time. Converting biodiversity-rich habitats into monoculture crops, such as sugarcane, reduces species richness and abundance to a level where species can no longer play their original ecological roles. Indirect land-use change (ILUC) occurs when industrial crops displace and/or shift previously productive lands (for example agriculture or pasture) to other areas, which in turn can cause further biodiversity loss Lapolaet al.(2010). For example, sugarcane production for ethanol caused 0.23–0.38 ha of ILUC per 1000 litres in Brazil which led to bio-diversity loss (Nassar et al.,2013). However, Bergeret al. (2010) reported that careful planning can reduce biodiversity loss due to bio-fuel production. A reduction in rodent population was noted. The low abundance of rodents in the sugarcane zone was perhaps due to a

high mortality rate associated with pre-harvest fire and the deleterious side effects of agrochemicals (Gheler-Costa et al., 2013). Berger et al., (2010) reported that rodents were more abundant in a sugarcane field where pre-harvest fires were halted for ten years than in a field with regular fires in São Paulo State, Brazil.

In Southern Nations, Nationalities and People's Region (SNNPR) 52.4% of the farm sizes range from 0.04 to 3.42 hectares (Tena et al., 2016). These findings agree with a previous study done by Senbeta et al (2001) during a study of regeneration of indigenous woody species in central Ethiopia that found out that most sugarcane farms occupy extensive acres of land in areas where sugarcane is planted for commercial purpose. During sugarcane expansion, the original tree species were bulldozed to facilitate mechanization. The removal of mature trees, which serve as seed sources, may explain the extinction of the original species. Previous work has also shown that clearing of mature trees (seed sources) affects regeneration (Senbetaet al., 2001). The clearing of original vegetation for labor camp construction and firewood harvesting during the expansion of the sugarcane plantation may have accelerated the vegetation composition change. A study in Ethiopia, in Awash valley attributed the over-extraction of trees to commercial farms Lavers, (2012), and this process may have been quickened by a change from public to private ownership.

In Nzoia sugar-belt in Kenya, the acreage under sugarcane increased due to the introduction and promotion of mono-cultural sugarcane farming concomitant with the construction of Nzoia and Mumias sugar factories in the 1970s. The increase in sugarcane acreage consequently led to reduced land holdings or ownerships because most of the farmers were lured into selling their vast lands out for monetary gain, with another lot leasing out their lands to investors in sugarcane at prices below prevailing market rates. As a result they themselves were left with very little

acreage of land to share out amongst the household members; such units do not benefit from economies of scale and could not sustain the food production requirements of such households (Obuoyo, 2005).

A research study on sugarcane farmers in the Lake Victoria basin concluded that overall, most farmers engage in sugarcane farming to raise income for the education of their children, acquisition of additional property, notably, land and construction of permanent houses now that grass that was used for thatching houses has been eliminated through conversion of land to farming. Site specific differences in the benefits are also a reflection of differences in the felt needs, general community cultural orientations and education levels (Waswa et al., 2012).

The studies above concentrate on sugarcane farming in various locations, Nassaret al. (2013) in Brazil, Aynekulu et al. (2016) in Ethiopia and Obuoyo (2005) in Kenya. Studies by Lapolaet al. (2010) and Aynekulu et al. (2016) and Senbeta *et* al. (2001) correlates to the reduction in biodiversity of different species of animals and crops in severely disturbed regions and clearing of mature trees (seed sources) which affects regeneration of trees and encourage monoculture and rise of large sugarcane plantations. Studies in Ethiopia by Lavers (2012) also correlates with the studies by Obuoyo (2005) that most farmers are lured into leasing their land for sugarcane farming to obtain money, leading to large acreage of holdings being under sugarcane. Unfortunately all studies did not reveal expansion of land use for sugarcane production. Therefore the extent of expansion of land use is not known.

Expansion of acreage under sugarcane has been occurring regardless of the size of agricultural land available in these areas. In Brazil Fischer et al. (2008) states that the current sugarcane area represents only 2.5% of the 264 million ha of agricultural land use in Brazil, of which nearly 200 million hectares are pastoral lands while in the Philippines, farms with less than 10 hectares are considered small; less than 50 hectares are considered medium; and above 50 hectares are large for sugarcane production (Fernandez & Nuthal, 2009). It is evident from the foregoing literature that these studies were carried out in countries which have expansive tracts of land available for any agricultural use, in contrast, Kenya has only approximately 582,646 square kilometers of land out of which only 20% is of agricultural potential (Kenya, Republic of, 2010), there is therefore need to carry out a similar research in an area where there are limitations on the size of land available for Sugarcane expansion. Dede Division was chosen for this purpose since it is within the South Nyanza sugar belt and has lands that are generally not expansive as it covers 108.2 square kilometers (10820 hectares) with a population density of 415.7 persons per sq. km. according to data obtained from Kenya National Bureau of Statistics(2009).

The reasons behind expansion of acreage under sugarcane globally are varied. In Brazil, the main drivers for the recent expansion of sugarcane, particularly in Sao Paulo, were market opportunities created by the international demand for sugar and ethanol (Fischer et al. 2008), in Florida, United States of America, the conversion of pastureland into sugarcane was done explicitly to increase per acre returns from what a cow-calf enterprise could be expected to earn. Vegetable crops like sweet corn, green beans, tomatoes and watermelons earn substantially higher per acre returns, their collective earnings however, is not sufficient to displace the current 30,360 hectares being harvested as sand land sugarcane (Roka et al., 2010). On the other hand, China is the world's third largest sugar producer after Brazil and India. During the milling years

2004/2005 and 2013/2014, the average yearly sugar production was 11.64Metric Tons, 49.86% more than in the previous decade. Guangxi province registered the largest increase in both acreage under sugarcane and production in metric tons (MT), it produced 7.21 Metric Tons of sugar per annum on average compared to the production in recent decade, it increased by 104.25% compared to the production of 3.53Metric Tons sugar per annum on average during the 1994/1995 and 2003/2004 and the major reason for the expansion of area under sugarcane in China is to ensure that at least 70% of sugar consumption in the country is from domestic production (Li &Yang, 2015).

In the Philippines, on June 10th 1988, sugarcane lands were placed under the Comprehensive Agrarian Reform Program (CARP). Agrarian reform in this context referred to the redistribution of land to the tillers of the soil (i.e., small scale farmers, tenants and farm workers). Under the program a land owner may retain an area of not more than 5 hectares and 3 hectares may be awarded to each child (15 years and above). The intention was to establish owner cultivation of economic sized farms that would ultimately improve productivity within the small holder farms(Fernandez & Nuthal, 2012).Still on the small holder farms, since the mid 1950s the Swaziland sugar industry has expanded rapidly. Although it is the smallest southern African state, by the early 1980's Swaziland had the second largest sugar industry in the region after South Africa, and, by 2014/2015, the GDP was dominated by sugar processing which accounted for over 42%, whilst the industry remains predominantly based upon large scale estate production. There has been long term involvement by Swazi small holders, who have been incorporated into the industry from a subsistence or semi subsistence agriculture. Since 2000, this has accelerated as large scale irrigation projects dependent upon two dams which have enabled thousands of farmers, who formerly relied on rain fed practices to consolidate their

individual farms into commercial irrigated sugarcane co-operatives. During this period, the area under sugarcane has grown by 28%, most of which is due to small holder expansion. It is possible to draw comparisons between small holder farms in the Philippines, Swaziland and in South Nyanza sugar belt where about 85% of the total cane supply is from small scale growers (Evelyn, 2005), however, in the Philippines and Swaziland cases the expansions are directly attributable to Government intervention through policies like CARP and Co-operatives respectively(Fernandez & Nuthal, 2012), there is need to study an area where small holder expansion of sugarcane is dominant and not directly influenced by Government policies. Dede Division was ideal for this type of study due to the dominance of small holder farms.

It is important to note that the expansion in area under sugarcane has also been experienced in southern parts of Nyanza, particularly in the study area, in a study on Kenya's Sugar industry; Evelyn (2005) observed that the total area under cane as at the end of the first quarter of 2004 was 107,622 hectares compared to 106,313 hectares in the same period in 2003, representing an increase of 1.2%, she attributed the increase to expansions of sugarcane acreage in South Nyanza sugar belt. South Nyanza sugar belt is an area that encompasses Dede Division which is the focus of this study. Though these studies reveal an increase in area put under sugarcane production, some of them were done many decades ago, due to time lapse, a lot of changes have occurred necessitating another study.

Literature reviewed shows that each country had a reason to focus their policy on increasing the acreage under sugarcane, however, most of them were carried out in areas that have large expansive tracts of land at their disposal for sugarcane expansion a case in point is in the Philippines where, farms with less than 10 hectares are considered small; less than 50 hectares, medium; and above 50 hectares, large for sugarcane production(Fernandez & Nuthal,2009) while

in Brazil Fischer et al. (2008) states that the current sugarcane area represents only 2.5% of the 264 million ha of agricultural land use in Brazil, of which nearly 200million ha are pastoral lands. There exists a big contrast in terms availability of farmland in these areas and in Kenya which has approximately 582,646 square kilometers (58264600 hectares) comprising 97.8% land and 2.2% water surface. Only 20% of the land area can be classified as medium to high potential agricultural land and the rest of the land is arid and semi arid land (Kenya, Republic of, 2010). Considering the noted increase in acreage under sugarcane in other parts of the world and also in Kenya, it has been noted in South Nyanza sugar belt, and bearing in mind the limited nature of prime agricultural lands in Kenya generally, there is need for an empirical investigation to determine the expansion of land use for sugarcane production. Apart from its close proximity to Sony sugar factory, Dede Division in Migori County was picked for this study due to its position as one of the leading Divisions in cane supply to Sony Sugar factory (Ndirangu, 2010).

2.3. Effects of Land use change on food production

Land is a basic resource for sustainable development of a country. All development takes place on land as the ultimate natural resource; it is a factor of production, a family and community property, source of identity and a source of wealth. Proper management of land and natural resources is essential and cannot be over-emphasized. Land is one of the most important productive assets for rural households. Access to more productive lands means higher production, more food from own farms means more available food for consumption, higher income, higher ability to buy food from the markets improves ability of access to food (FAO, 2004). Changes in land use is a common practice in tropical Africa due to fragmentation of farms which are composed of a number of parcels at different locations or at times a title of land may

comprise land owned by a farmer as well as land leased from others or joint ownership of parcels in different locations for varied farming intentions (FAO, 2008).

Diversification of food production is practiced by various countries to cushion food shortage in the world. Rice is the staple food for 3 billion people worldwide. Of the world's 1.1 billion poor people with an income of less than one dollar per day, almost 700 million reside in the rice-growing countries of Asia, including China. Studies by Nguyen *et al.*, (1996), used data from a survey conducted among 1200 households in Jilin, Shandong, Jiangxi, Sichuan and Guangdong Provinces in 1993–1994 to examine the impact of land fragmentation on the productivity of three major grain crops. The results indicate that there is a statistically significant and positive relationship between plot size and output of maize, wheat and rice. A research undertaken by Fleisher et al.(1992) used data from a survey among 1200 households in Jilin, Jiangsu, Henan, Hebei and Jiangxi Provinces in 1987–1988 to examine the effect of land fragmentation, as measured by number of plots, on productivity. Their main finding was that the number of plots had negative impact on agricultural production.

A recent study released jointly by the University of Melbourne and Deakin University reported that in the absence of a change in policy planning, food self-sufficiency for Melbourne from the surrounding food sources could fall dramatically as the urban population doubles from 4 to 8 million by 2050 (Carey et al.,2016). The authors reported that the food bowl currently provides 41% of the total food supply for the city but this could drop to 18% due to climate change, population growth, and diminishing supplies of arable land and water. To curb food shortage, production in urban cities, Despommieret al. (2010) proposed that one approach to addressing the future trend of diminishing agricultural resources, changing climate, and other factors

involves the concept of vertical farming. The vertical farming model was proposed with the aim of increasing the amount of agricultural land by 'building upwards.' In other words, the effective arable area for crops can be increased by constructing a high-rise building with many levels on the same footprint of land (Despommier et al.,2010). The Mirai Company in Japan has developed and marketed indoor multi-level farms with impressive production statistics (Shimamura, 2016). One Japanese farm comprises 25,000 square meters producing 10,000 heads of lettuce per day (100 times more per square foot than traditional methods) with 40% less energy, 80% less food waste, and 99% less water usage than outdoor fields (Kohlstedt et al., (2015).

A study for Central and West Africa reveals that when applying better agricultural technology (high yield crop varieties, fertilizer, machinery, water) yields in any case can be improved – for example – 1.9 times for rice, 2.7 times for maize, 4.7 times for potatoes, 4.5 for bananas (IFAD, 2011). Another study estimates that the value of African agricultural production can grow from 280 billion dollars in 2010 to 880 billion dollars in 2030, generated by 225 billion dollars by cultivating new lands, 235 billion dollars by higher yields and for 140 billion dollars by a shift towards high value crops (McKinsey, 2010). In Edo State, Nigeria a study examined the economies of scale and technical efficiency of small-scale farmers. The data collected from 200 rice farmers selected using multistage sampling technique and analyzed using descriptive statistics, and stochastic frontier model. Production functions among hybrid rice and inbred (local) rice producers were estimated independently using the Battese & Coelli (1995) model to specify a stochastic frontier Cobb-Doglas production function with behaviour inefficiency component to estimate all parameters together and the level of significance in one-step maximum likelihood estimation.

In Kenya Rice is the third most important staple food in Kenya after maize and wheat. It forms part of the larger diet for urban population. About 95% of the rice in Kenya is grown under irrigation in paddy schemes managed by the National Irrigation Board (NIB). The remaining 5% of the rice is rain fed. The average unit production under irrigation is 5.5t ha^{-1} for the aromatic variety, and 7t ha^{-1} for the non-aromatic varieties. Unit yield for rain fed is slightly below 2t ha^{-1}.The increase in rice output is attributed to land expansion, increase in both population and incomes and due to changing of consumer preferences in favor of rice in urban centers (Kajima et al.,2006). These irrigation schemes include Mwea, Bura, Hola, Perkera, West Kano, Bunyala and Ahero. According to Omosa (1998), farmers in neighbouring Kisii abandoned food crop farming for coffee farming so that they could use the additional income to satisfy their food needs on the market. Resultant coffee prices have however, been low, with endemic poverty as has been witnessed in the neighbouring Western sugar belt.

The studies above correlate with findings in China by Nguyen et al. (1996), Nigeria, Battese& Coelli (1995) and in Kenya by Kajima et al. (2006) that Rice production was third most important food farming practiced followed by maize and wheat being some of the staple food. Hydro-genic concept of vertical farming was adopted to increase the amount of agricultural land by building upwards, to curb food shortage production in urban cities, these findings correlates with Despommier (2010) and Shimamura (2016) findings on marketed indoor multi-level farms with impressive production statistics in Japan. Unfortunately all these studies did not reveal effects of land use change on food production in these areas.

Obtaining a universally accepted definition of the term land use has been one of the problems encountered in related studies (Mbowa, 1996). A review of literature, however, suggests that numerous definitions of land use have been adopted, ranging from actual tillage, value of farm products sold to the level of family harvest. Many authors combine two or more of these definitions (Bizimana et al., 2004). Analysis of data at the household level in Khabra Kalan Village in the Thar Desert of India revealed that effects in land use on food production are far reaching and has had negative results in overall farm output of the livelihoods of inhabitants. The mixed use of the land holdings results into shortfall of food on small farms 12% in cereals and 42% in pulses due to preference on livestock (Ram et al., 1999). Despite India being the second largest producer of sugarcane in the world after Brazil, this particular study was not conducted in a sugarcane zone. Though it does show that the changes in land use has negative implications on food availability in the affected area due to more attention given to livestock. It could be complimented by drawing the Brazilian experience where currently, the savannah region ('Cerrados'), considered a world bio-diversity hotspot (Myers et al., 2000), is the ecosystem most threatened by sugarcane expansion in Brazil as it is situated on the frontier of agricultural expansion and has excellent cultivation potentials. However, the recent boom of ethanol production has drawn international attention to the environmental impacts of land conversion into sugarcane monocultures. Major areas of concern include deforestation, threats to biodiversity and competition with food crops. Given that the literature reviewed for India does not give a clear case for a cash crop dominated area and the Brazilian case has not clearly stated what the land was hitherto being used for before the sugarcane monoculture, since the study in India focused on preference to animals, it becomes necessary to carry out research that would

relate the land use to food production in a mono-cultural cash crop. This study therefore sought to address this by studying the effects of land use change on food production.

For the time being, Africa remains predominantly rural. Poverty is concentrated amongst rural people and the rural poor continue to depend substantially on agriculture and related natural resources for their livelihoods. In practice, small holders make an immense contribution to agricultural output, generally holding land under customary tenure systems. Smallholders, although central to the agricultural economies of most African nations and very responsive to new markets and opportunities, are unable to guarantee food production at sufficient scale due to constant changes in their land use which has a bias towards cash crops (Musambayi, 2013). In a study of land use, land fragmentation and economic efficiency in southern Rwanda, Bizimana et al. (2004) observed that various issues directly influence agricultural land fragmentation and use. Among the main factors that have directly or indirectly contributed to the variations in land use is the traditional system of inheritance of land, as the population increases, not only does the size of the holdings fall, but also allocating various activities in the farm becomes a challenge. The unbalanced allocation in favour of certain crops is the source of inefficiencies in agricultural production. Though in the foregoing study, population increase and bad cultural practices affect land use, it is important to review other literature to find out other possible factors contributing to reducing food production, this motivated research in a sugarcane growing area. In countries where sugarcane is grown, it is difficult to isolate sugarcane from reduction in food output due to large tracts of land it occupies after change in land use in its favour (Netondo et al., 2010).Though these studies give views on some effects of changes in land use, they lack a common basis; furthermore, none of them sought the input of small holder farmers. Based on

these shortcomings, this study sought the views of small scale farmers in assessing the effects of land use change on food production.

In Kilombero, Tanzania, as sugarcane production expands the availability of land for both the company and out growers remains a major constraining factor. The company acknowledges that about 60% of land within the 40km radius from Kilombero Sugar Company Limited is under cane, with much of the remainder used for other crops. This, however, ignores the fact that the land here is put on a variety of uses, some of the remaining land is used for communal settlement, including areas set aside for social services and national parks. The lucrative prices for sugarcane from the company and the previously reliable market have encouraged out growers to convert most of their farmland into sugarcane leaving little space or none for food crop production (Sulle, 2017).The study mentions reduction in food output after conversion of farmland into sugarcane; however it is inadequate in addressing the issues at hand in that, firstly, Kilombero Tanzania consists mainly of large scale plantations, the few out growers (small holder farmers) involved in the research were all contracted by the company (KSCL) therefore are tied to the contractual obligations hence challenges here may not mirror one involving small holders. There is therefore need to carry out research among small holder farmers both contracted and non-contracted in order to bring out clear assessment of effects of land use change on food production.

Kenya's land policy recognizes that land is not just a commodity of trade but also a principal source of livelihoods. But as the populations continue to rise, the land is put into a myriad of uses, mostly due to cultural practices of inheritance fuelled by pressures of siblings to be economically independent and with majority of Kenya's farmers practicing subsistence farming,

smaller units of land with several small parcels under crops means these farmers cannot even feed themselves (Mbuthia, 2014). In another study, Mbuthia (2017) again made another important observation, that in Kisii and Nyamira, changes in gender roles in relation to agricultural land tilling in these counties is now a major threat to food production and security. Men now concentrate on cash crops as women are left with the task of producing food crops to feed the family. These studies were carried out in non sugarcane growing areas; there is need for an empirical analysis to be carried out in a sugarcane growing area to ascertain the effects of such changes.

In Nzoia sugar-belt, the acreage under sugarcane increased due to the introduction and promotion of mono-cultural sugarcane farming concomitant with the construction of Nzoia and Mumias sugar factories in the 1970s. This tremendous increase in sugarcane acreage consequently led to reduced land holdings or ownerships because most of the farmers were lured into selling their vast lands out for monetary gain, with another lot hiring out their lands to investors in sugarcane at a throw-away prices. As a result they themselves were left with very little acreage of land to share out amongst the household members; such units do not benefit from economies of scale and could not sustain the food production requirements of such households (Obuoyo, 2005).

The effects of land use on food production observed in the study above in Nzoia are comparable but not similar to other cases observed in other parts of Kenya, a study conducted in the sugarcane growing area of Belgut Division in Kericho County revealed that there are two types of farming systems namely food crop and cash crop farming falling under the control of women and men respectively. Analysis on the allocation of land holdings between different crops shows that with the introduction of sugarcane acreage under food crops has declined while that under cash crops has increased with sugarcane taking a higher percentage of the holdings. The study

found that there was a significant difference in acreage under food crops before and after the introduction of sugarcane. The analysis also showed that while food demands are high due to family sizes, food purchases are low because of low and unpredictable incomes accruing to sugarcane farmers (Kilel, 1993). Though a recent report by World Bank in Kenya tends to bring out the historical angle when it argues that historically women tended to focus on food crops and men on cash crops, as a result of increasing male migration out of rural areas, women are now shouldering more responsibility for a wide variety of farm tasks (Crop and Livestock)while continuing to maintain responsibility for their traditional roles (World Bank, 2010).Though the above literature review have touched on the changes in roles of the women in food production, they failed to address the crucial factor of reduction in production of own food from the farms in sugarcane growing areas, a gap which this study sought to fill.

Likewise in Uriri Division of Migori County which is an immediate neighboring Division to Dede and which is also a sugarcane growing area, a similar study was conducted and it revealed that Sugarcane farming is the most predominant agricultural practice. Farmers also practice some subsistence farming alongside to supplement the farmer's household food requirements. The gradual change to sugarcane production at the expense of subsistence farming has created more demand and less supply of food crops hence prices of food have increased making it difficult for farmers to be able to afford the staple food in the open village markets. Farmers believe that they can live comfortably with their families on the cash returns from the crop. However, the farmers do not take into account the duration that that sugarcane takes from planting to maturity which is 18-22 months. Considering other financial commitments of the households, it is difficult to spread the income between the possible payments received especially within the households having no other avenues for source of income. Many families are therefore faced with challenges

of access to food, especially before the sugarcane matures for harvesting and marketing (Aringo, 2008).

Traditions and customs as well as formal succession laws promote and regulate the transfer of property from one generation to another (FAO, 2004). Apart from economic satisfaction, other positive effects of sustainable land use include settlement and the social values granted by land ownership. Social status conferred by land ownership has encouraged the purchase of land regardless of small size of the parcel. Individuals purchase or inherit land for the simple reason of being a land owner and some usage is arbitrary, not informed by current trends. Urban encroachment into rural areas also introduces a new phenomenon in land use; it reduces the land available for agriculture putting pressure on available land leading to low food production (Wawire et al., 2011).This situation therefore called for a scientific study to carry out an assessment of the effects of land use change on food production by the households in Dede Division of Migori County.

2.4. Effects of relocation occasioned by Sugarcane farming on food production

Over the last 30 years, human settlement has taken a complex pattern manifested by encroachment on water catchment areas and forests, relocation and rising occupation of the Arid and Semi-Arid Lands (ASALs). The displacements and other forms of movements such as relocation has led to unplanned informal settlements (slums) in the major urban centers and compounded waste management problems. The drift to the marginal areas has led to degradation of the fragile ASAL ecosystems, increased human-wildlife conflicts as well as land use conflicts between agriculturalists and pastoralists, with the latter two partly attributable to the prolonged absence of a national land use policy which would usher in the land reforms envisioned by Vision 2030 and the Constitution of Kenya 2010 (Kenya, Republic of, 2010).

Rural movements raise both hopes and concerns depending on causes. Income of those relocated sent home in the form of remittances can increase food production, help diversify livelihoods and incomes, and reduce vulnerability associated with poverty. However, human relocation also reallocates household labour associated with productive and reproductive activities in the areas of origin, reduces labour for food production and increases the work burden of men and women, depending on who is left behind. By enlarging the labour force and the pool of consumers, those relocated can boost economic growth in receiving areas, even if urban locations may experience considerable strain on food reserves from the influx of population. Ensuring that displacements or relocation do not harm domestic development is a constant challenge for the areas of origin (Jokisch, 2002). The studies above have demonstrated that relocation can reduce labour force hence increase work burden on those left behind leading to low food production. However, some studies have contrary opinion and argue that income of those relocated can increase food production and help diversify livelihoods and vulnerability. This study however, provide mixed results therefore this study sought to reveal other angles to these phenomena which had not been brought out clearly by the other studies done elsewhere for instance, the effect of such movements to the food reserves and the general food production.

An important component of FAO's work involved determining the potential of displacement and relocation to spur rural development in receiving areas. For that, FAO promotes policies and programmes to enhance living conditions in rural settings, reduce the magnitude of distress of those relocated, and improve the conditions under which internal movements takes place. In doing so, FAO takes into account how such movements relates to rural-urban linkages, changes in rural livelihood strategies and the determinants of these changes, as well as how such movements affects access to productive assets including land. Social assets are also considered,

which, in such context, include not only social relations between producers and traders but also other networks. Special attention is also devoted to promote gender equality and access of rural migrant workers to decent rural employment (FAO, 2008).

In Kenya, one other recent study on the effects of sugarcane farming on smallholders in North Bunyala, Kakamega, Egesa (1994) noted that there has been a general decline in food production in the area. The fear of deteriorating food situation in the sugar belt can be linked to the whole issue of the sugar crisis in the country which has, in many instances, led to serious income losses to the sugarcane farmers. In the case of Babukusu of Western Kenya, Nasimiyu (1985) has argued that changes in land tenure system and agricultural innovation led not only to economic ranking of traditional crops and greater work load for the women but also to women's marginalization in controlling the factors of production. Most people in Koru, Kopere and Koguta village were among those who founded and settled as the displaced persons during the establishment of the Muhoroni sugar factory. The settlers were allocated very small farms ranging between 1.5 and 2.5 acres. However, most of them had not been issued with land title deeds, and they were referred as squatters. Most of them cannot practice very intensive farming due to small settlement schemes.

The studies above correlate on how relocation can reduce labour force (Jokisch, 2002), Egesa (2004) posits, how there is decline in food production in the area due to sugarcane farming, Nasimiyu (1985) has argued that changes in land tenure system and agricultural innovation led not only to economic ranking of traditional crops and greater work load for the women and displacement leading to the squatters. Unfortunately all these studies did not reveal how relocation occasioned by sugarcane farming affects food production.

ILO has been dealing with labour and relocation since 1919, and it has pioneered the development of international instruments for the governance of both and protection of migrant workers and relocated people since the 1930s. ILO is now incorporating displacements, relocation and migration concerns into the Decent Work Country Programs (DWCPs) and national development programmes. ILO helps countries to build capacity to benefit from such movements and protect the rights of displaced workers based on its recently developed multilateral framework on distress movements (ILO, 2006).

One of the key areas of recent literature on the impacts of displacement and relocation on rural livelihoods has focused on the differences between relocated households and inhabitant households in agricultural production in rural origin areas. A popular view on the impacts of relocation on agriculture is that rural movements lead to a decline in agricultural cultivation and food production. Rural households with relocated population were found to have lower agricultural productivity than those without people relocated (Rozelleet al., 1999; Schmook & Radel, 2008). Nevertheless, an opposite view contends that remittances generated from those displaced but have settled elsewhere increase rural household incomes and enable rural households to make agricultural improvements and eventually cope up. Abundant empirical evidence from different regions has shown that the potential negative influences of lost household labour on agricultural production cannot be compensated by increased access to capital and enhanced agricultural investment (Tayloret al., 2003; de Haas, 2006; McCarthyet al., 2006). In addition, a "middle-path" finding from South-Central Ecuador showed that small holder agriculture was constantly threatened by internal relocations, nor were remittances invested in agricultural production and other improvements suffice to compensate. This argument is supported by a recent survey-based study in the southern Ecuadorian Andes, which

suggests that relocated households differ from non-displaced households in terms of food production and sending remittances as per the area cultivated in subsistence crop produce. Taken together, these findings illustrate that internal displacements and relocation are complicated and has diverse effects on agricultural production practices (Jokisch, 2002).

A number of studies have examined the influence of internal movements on rural household agricultural technology use and they give opposing perspectives. The pessimistic view argues that labour scarcity resulting from internal movements such as relocation leads to the decay and abandonment of traditional labour-intensive agricultural technologies by the relocated households and prevents adoption of innovative agricultural technologies which may boost food production (Mazambani,1990, Black,1993), By contrast,(Oberai &Bilsborrow, 1984) argue that relocation leads to technological improvement in rural areas through investment of remittances in more modern technologies and the stimulating effects of the new ideas and knowledge brought back by those relocated upon their return. Other studies also found that some relocated households were more likely than non-relocated households to use new farming technologies to improve agricultural productivity (Simelane, 1995; Mendola, 2008).What may actually hold true is that seasonal low production of food by farm households engaged in cash crop farming like sugarcane could be due to migration of male labour (Nyangweso, 2011).

A study carried out in Kilombero sugarcane growing area perhaps sums up the fear of the farming households on the impact of their loss of land which is their only source of food production as a result of relocation. The expansion of sugarcane farming by Kilombero Sugarcane Company Limited (KSCL), including that which involves out growers schemes, is not a simple task. Any plan that involves the eviction or relocation of the local community is subject

to all sorts of contestation over land ownership at the local and national levels. For instance, after securing KSCL in 1998, Illovo Sugar Company wanted to get full control of all estate land as indicated on the documents it received from the Sugar Board of Tanzania (SBT). However, since the previous management of the company did not cultivate all land, the nearby communities occupied uncultivated land, and it became difficult to remove all of them because the central government was reluctant to compensate them. As a result the company asked for extra land for the estate and the factory, and the SBT offered its previously surveyed land in Ruipa which is several kilometers away from the current KSCL location. District officials supported this proposal, but the communities who occupied the land since it was earmarked for sugarcane development back in the 1970s refused to leave uncompensated fully citing loss of their food farmlands. A long lasting dispute ensued which has not been resolved to date (Sulle, 2016).

There is a general consensus that when those relocated remit something back, it reduces rural poverty and contributes to the improvement of household living standards but it does not improve food production (Taylor &Mora, 2006; Airola, 2007; Schmook& Radel, 2008; Wouterse & Taylor, 2008). In terms of consumption patterns, several household survey-based studies showed that relocated households with remittances tended to spend more than non-relocated households on food and productive activities (Zarate-Hoyos, 2004; Adams, 2006; Taylor &Mora, 2006; Airola, 2007). This perhaps confirms that such households are unable to produce food of their own. A subset of the research on the impacts of relocation on household income and consumption has also assessed the differences between relocated and non-relocated households in asset accumulation (Adams, 1998; Entwisle &Tong, 2005; Fordet al., 2007; Garip, 2007). Overall, these studies suggest the effects of internal movement on household assets differ across origin regions (Hua, 2010)the above studies have provided vital information of effects of

relocation on household living standards. These studies have also taken into consideration that those relocated have left some of their relatives behind to whom remittances are made hence they concentrate on comparison of income, food production and consumption level of those relocated and the non-relocated. These studies, however, failed to address issues which are core to the very survival of all human races, food production. This study, therefore, sought to conduct an in-depth assessment of effects of relocation of population specifically assessment of their capacity to produce food from their farms.

There is always need to empirically understand how wealth is redistributed among farming communities when there is a disturbance to the social equilibrium by way of land acquisition for large scale farming or location of factories (Nmaduet al., 2008). It is also worth noting that most farmers in the affected areas have been relocated without adequate compensation, land has been leased well below value, those relocated end up encroaching on parklands and the new ventures have created fewer jobs (MacFarquhar, 2010). The foregoing literature reviews strongly suggest that the individual households' welfare is least taken into consideration when relocation orders are issued. Chu et al. (2015) during a study of large scale land acquisitions in Zambia also noted that in the name of development, affected communities are often resettled, with little attention given to the impacts on their livelihoods and future well being. It is with these in mind that this researcher sought to establish how the relocation of farmers in Dede Division influenced their food production activities.

When Sony Sugar Company was being established in the late1970's the area that was earmarked for factory nuclear farm stretched far into areas that currently comprise Dede Division. Indeed not a large portion of the Division was alienated for the factory nuclear farm; however since it

affected 100 households within the Division, many livelihoods were disrupted due to the close knit nature of the inhabitants. All those whose land was covered by the nuclear farms were compensated in order to vacate. Judging from the small parcels that the relocated peoples own, the level of compensation wasnot enough, (Aringo, 2008). In a study conducted in Shonga District of Edu Local Government area of Kwara state, Nigeria, Nmadu et al.(2008) also noted that the amount of compensation paid to the farmers when Nigeria Sugar Company (now known as Josedam) and associated companies was being created was far less than what the farmers expected and this has contributed to rising inequality among them. The main cause of relocation of people in Dede Division was to pave way for the expansion of the nuclear farms, recently, cases have emerged where people lease out their land parcels to private investors to develop commercial sugarcane farms and due to weak legislation, they find themselves turned into Internally Displaced Persons (IDPs) as their land parcels are turned into sugarcane farms. Since the parcels are small they're forced to move to nearby local market centers and towns. Documentation on the effects of relocation of populationdue to sugarcane expansion and more importantly how such movements affects food production in the areais scanty.This study sought to establish the effects of movements resulting fromrelocation of population to pave way for the nuclear farms, whether they are able or not to produce similar quantities of food as was the case before relocation.

Most of the literature reviewed involves countries having extensive tracts of land; hence mostly the farms are large multinationals some which involve mechanization. In Kenya, most studies done are on economic impact of sugarcane. Data on the impact of the increased involvement of the small holder sugarcane farmers in the country specifically Southern Nyanza sugarcane zone, where the study area is, has been lacking. This study sought to involve the views of the small

holder farmers in assessing the effects of relocation occasioned by sugarcane farming on food production.

2.7. Conceptual Framework

Conceptual framework is a set of broad ideas and principles taken from relevant field of enquiry and used to structure subsequent presentations. Conceptual framework involves forming ideas about relationships between variables in the study and showing these relationships graphically or diagrammatically (Mugenda & Mugenda, 2003).

The conceptual framework demonstrates a possibility that a reduction in land size, may improve farming and production in general if the intervening variables like government policies are positive e.g. provision of subsidies and improvement of education levels of farmers. On the other hand reduction in the size of land can lead to reduction in food production especially when such a reduction in size of land is not accompanied by improvement in technology and improvement in farmers' level of education to enable them to practice modern farming like green houses and proper application of fertilizer. On the other hand there is need to consider access to food. Crops grown (sugarcane)may be sold and the income got can be used to acquire food from the markets. Government policy comes in as it can discourage cheap sugar imports by imposing higher taxes hence raise the income for local farmers. However the reverse is true when imported sugar floods the local market and also if the sugarcane crop yields are low and income got from it cannot sustain household food requirements until the next harvest. Alienation or reduction of land as is the case with relocation of population to create room for nuclear farms in Sony may also limit the means of a person to access food.

Independent Variables **Dependent Variable**

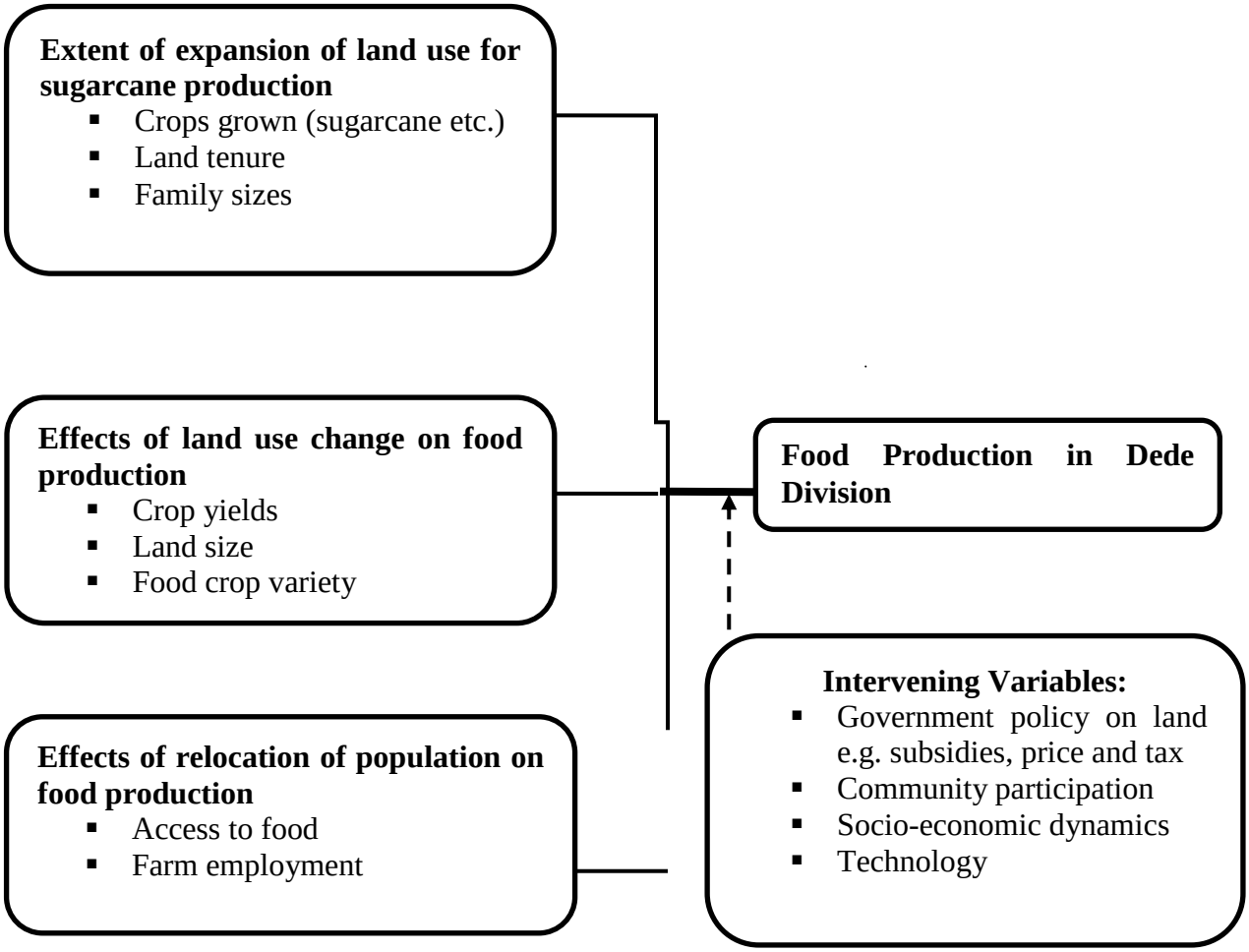

Figure 1 Conceptual framework

Source: Researcher, 2018

CHAPTER THREE

METHODOLOGY

3.1. Introduction

This chapter gives the research design, the study population, sample size and sampling procedure. It also gives data collection instruments, their piloting, validity and reliability, as well as administration of the instruments, data analysis techniques and data presentation methods.

3.2. Study Area

Dede Division is located in Awendo Sub-County which is one of the Sub-Counties in Migori County. Awendo is a fairly new Sub-County carved out of the larger Rongo hence information from the larger Rongo is sometimes used. The study area is 108.2 Km^2 comprising two locations namely North Sakwa and West Sakwa having four and three sub locations respectively. It borders Rongo Sub-County to the North and North West, Kisii South and Gucha South Sub-Counties to the east, Trans Mara Sub-County to the South East, Uriri Sub-County to the South and Ndhiwa Sub-County to the West. It rises between 1260 – 1800 metres above sea level. It is found 0.52^0 South of the Equator and 34.21^0 East of the Greenwich Meridian (Abigail, 2010).

Social and cultural systems contribute significantly to the process of development. They are dynamic human functional components and they tend to portray the underlying problems and opportunities for development (Ambwere, 2003), likewise, the population of Dede Division is predominantly rural with almost the entire population being Luo, there is a smallpopulation of Maragoli (a Luhyia sub tribe)who have bought land and settled to the south near Uriri Sub-County border. The existing socio-economic system in the study area shows a homogenous

society with almost similar cultural values. This might explain why, in 1979, when sugarcane was introduced almost the entire population embraced it fully. In terms of population, North Sakwa has 22,874 people with males and females being 10,932 and 11,942respectively, the density stands at 424 persons per sq. km. and West Sakwa 22,278 people with males and females at 10,503 and 11,775 respectively and a density of 410 persons per sq. km. which gives a total population of 45,152 people (Kenya National Bureau of Statistics, 2009).

Dede Division has a bimodal rainfall pattern with long rains falling between February and May and the range is 600 – 1000mm p.a. with a reliability of over 60%, short rains falls between September and December and the range is 300 – 700mm p.a. with a reliability of over 60%. The area has annual mean temperatures of between 19.3^0 – 20.8^0c. Soils in Dede Division are predominantly moderate to well drained, shallow to deep, reddish brown, friable sandy loam to sandy clay loam, humic ACRISOLS as well as humic and ferralic CAMBISOLS. In other areas to the west bordering Ndhiwa Sub County the soils are majorly Nitosols, Andosols and Clay while the rest of the Division especially areas bordering Rongo Sub County to the North has Alluvial and Black Cotton soils (Ndirangu, 2010).

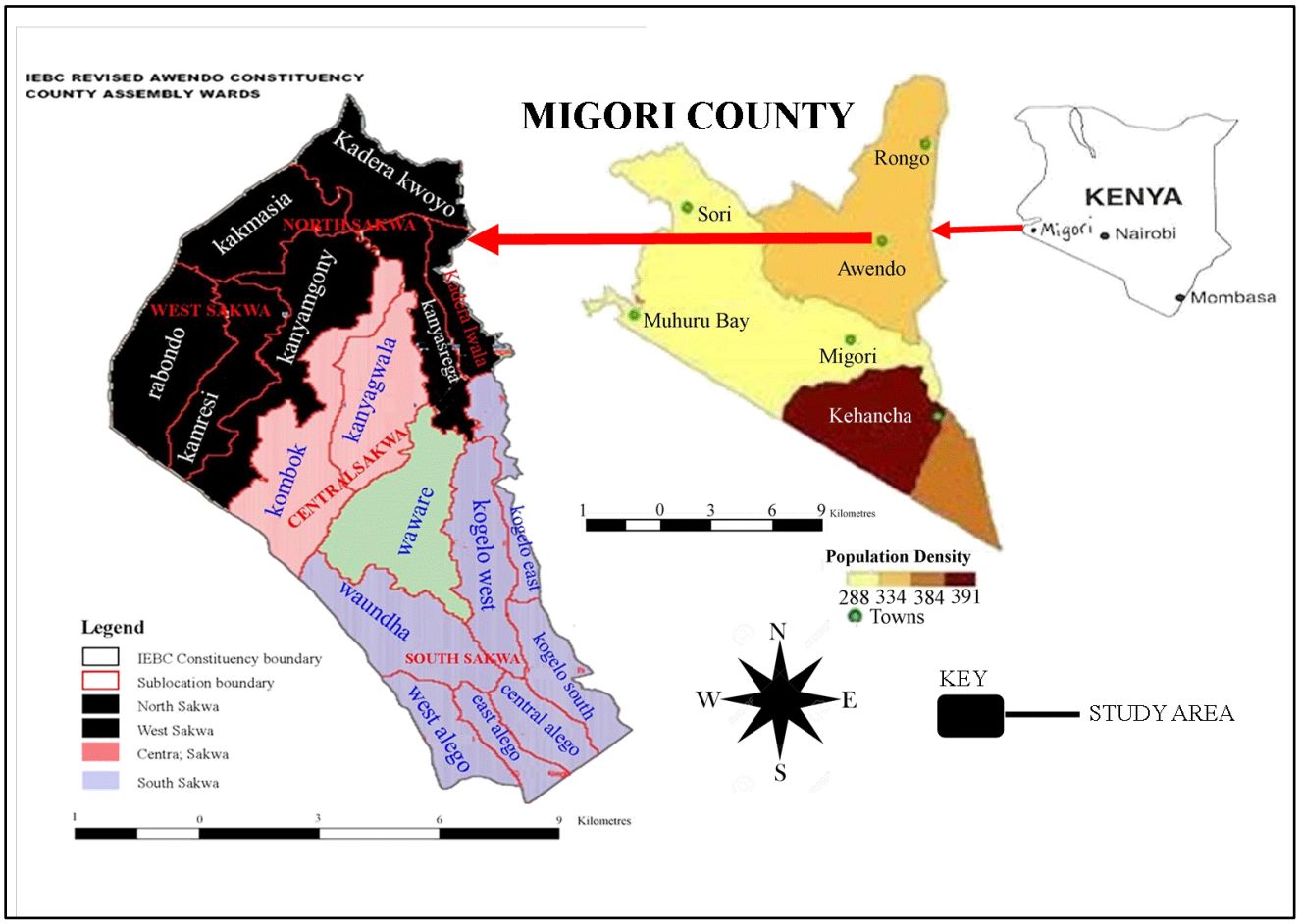

Figure 2 Consolidated map of the Study Area

Source: Independent Electoral and Boundaries Commission

3.3. Research Design

The study adopted descriptive research design. Descriptive research design seeks to obtain information that describes existing phenomena by asking individuals about their opinions, perceptions, attitudes, behavior or values (Mugenda & Mugenda, 2003).

The study was carried out in Dede Division of Awendo Sub County in Migori County (Figure 2). Random sampling technique was used to select the respondents who included small scale farmers. The key informants included chiefs, assistant chiefs, and Sub County Agricultural Officers, KESREF officials at Opapo sugar research station and Sony sugar company head of agriculture. Primary data was collected using household questionnaires to 370 respondents from Dede Division. Statistics on the size of the land under sugarcane was obtained from the Agriculture Department of Sony Sugar Company. Secondary data was collected from KESREF offices at Opapo, Sub County Agricultural Officers at Rongo and Awendo and Sony Sugar Company at Awendo. Data was analyzed using descriptive statistics focusing on frequency distributions and percentages. Cross tabulation were used to explore the relationship between key variables in the research questions of this study and the significance of the relationship suggested by the cross tabulation tables were confirmed by use of the chi-square statistics.

3.4. Target Population

The target population of the study constituted all the households in Dede Division Migori County, local administration officials, Sony sugar agriculture officials and KESREF officers. According to the Kenya national bureau of statistics (2009), Dede Division had a total population of 45,152 having9,503 households. This population is distributed amongst the two locations in the Division as follows North Sakwa location 22,874 (4,786 households) and West Sakwa location 22,278 (4, 7170 households).

3.5.0. Sampling

3.5.1. Sample Size

For purposes of this study households were sampled. The households in Dede Division exhibit homogenous characteristics with reference to their social, economic, and political, activities as

well as their environmental and geographical space. This homogeneity made it appropriate to use Krejcie &Morgan's (1970) table to determine the sample size from a population of 9,503 households (see appendix I). The sample size for households in the study was **370** drawn from a population of 9,503 households. This is determined from the formula for determining sample size where,

S = required sample size,

X^2 = the table value of chi – square for 1 degree of freedom at the desired confidence level (3.841),

N = the household size of the two divisions, 9,503(Kenya National Bureau of Statistics, 2009).

P = the population proportion (assumed to be .50 since this provides the maximum sample size),
d = the degree of accuracy expressed as a proportion (.05).

$$s = \frac{X^2NP(1-P)}{d^2(N-1)+X^2P(1-P)}$$

$$= \frac{3.841\times 9{,}503\times 0.5\,(1-0.5)}{0.05^2\times(9{,}503-1)+3.841^2\times 0.5\,(1-0.5)}$$

$$= \frac{9125.25575}{27.44332025}$$

= 332.51281794

= 333

For ease of analysis this figure was adjusted by 37 to achieve the threshold sample size for 9,503 households, which is 370 (Krejcie &Morgan, 1970). To arrive at the correct number of sample, the researcher summed up all households from each village then calculated the percentages from the sub-location totals. It is from the percentages that samples for each sub-location are derived. This is shown in the sample frame below (Table 1)

Table 1: Population Sample frame

Location	Sub – location	Village	Population	Household	Sample	%
North Sakwa	Kadera Kwoyo	1.Marongo	1,380	241	9	
		2.Ngulu	1,200	237	9	
		3.Ringa	1,080	220	8	
		4.Weke	1,270	228	9	
		5.Rabondo	900	225	9	
		6.Nyambija	762	200	8	
	Sub loc Total		**6,592**	**1,351**	**52**	**14%**
	Kadera Lwala	1.Wawaga	1,617	307	12	
		2.Waendhe	1,436	300	12	
		3.Kagak	1,316	273	11	
		4.Ranen	1,503	285	11	
		5.Ponge	1,139	260	10	
		6.Ang'ogo	998	290	11	
	Sub loc Total		**8,009**	**1,715**	**67**	**18%**
	Kakmasia	1.Nyakuru	1,230	260	10	
		2.Oboke	1,184	258	10	
		3.Nyan'gaya	1,018	247	10	
		4.Kitota	1,300	267	10	
	Sub loc Total		**4,732**	**1,032**	**40**	**10.8%**
	Kanyasrega	1.Raruowa	1,011	200	8	
		2.Nyan'ginja	908	182	7	
		3.Kindu	737	134	5	
		4.Dago	885	172	7	
	Sub loc Total		**3,541**	**688**	**27**	**7.2%**
	Location Total		**22,874**	**4,786**	**186**	**50.36%**
West Sakwa	Rabondo	1.Kamadhi	800	190	7	
		2.Agongo	867	200	8	
		3.Siruti	721	170	7	
		4.Gada	679	159	6	
		5.Gamba	569	123	5	
		6.Kwe	850	170	7	
	Sub loc Total		**4,486**	**1,012**	**40**	**10.7%**
	Kanyamgony	1.Nyarombo	1,680	344	13	
		2.Dede	1,240	300	12	
		3.Saria	2,284	421	16	
		4.Ombasa	1,348	346	13	
		5.Karabuor	1,592	320	13	
		6.Opoya	1,702	330	13	
		7.Kamyawa	1,641	352	14	
	Sub loc Total		**11,487**	**2,413**	**94**	**25.4%**
	Kamresi	1.Kodeny	1,200	219	8	
		2.Wahaya	1,050	215	8	
		3.Nyatadni	980	222	9	
		4.Wambi	1,190	200	8	
		5.Kanyango	1,003	206	8	
		6.Wagalo	882	230	9	
	Sub loc Total		**6,305**	**1,292**	**50**	**13.6%**
	Location Total		**22,278**	**4,717**	**184**	**49.64%**
Divisional Total			**45,152**	**9,503**	**370**	**100**

Source: Kenya national bureau of statistics, national census (2009)

To enable the researcher obtain data only relevant to the study, the researcher employed purposive sampling in selection of the key informants. Each sub location was considered as a cluster, and with the help of the local administration; all villages in it were identified (Table 1). Stratified random sampling technique was then used to select the villages to be sampled. All households in each selected village was then identified and given a number which the researcher then randomly picked for sampling. Convenience sampling also called 'accidental' sampling technique was used to select the first household within the clusters starting from the household closest to the road, the researcher then successively visited every household picked for sampling within the geographical space of each selected village. According to Moore& McCabe (2005) sampling technique is used when natural but relatively homogenous groupings are evident in a statistical population.

3.5.2. Data Collection Procedure

Both qualitative and quantitative data was collected. They consisted of both primary and secondary data sources.

3.5.3. Primary Data

To successfully conduct the survey, the researcher used household questionnaires as primary instruments to collect the necessary data required for this study. The method was chosen as it suited even illiterate respondents who could not read and /or write down their answers as the questionnaires were read and interpreted for them in a language they understand.

Household Interview

The researcher administered a semi-structured questionnaire as the main tool for collecting quantitative data from the household heads (Appendix II). The semi structured format allowed inclusion of both open ended and closed question items which were essential in limiting response irrelevancies while facilitating timely analysis (Nyanamba, 2011).

Key Informant Interview (KII)

Key informant interview guide was used to collect data from the key informants including the two chiefs from North and West Sakwa, five assistant chiefs from the seven sub locations namely Kadera Kwoyo, Kanyasrega, Kakmasia, Kanyamgony, and Kamresi, Sub-County agricultural officers from Awendo and Rongo, KESREF Research assistant and Sony sugar company Head of Agriculture which was used to obtain qualitative data which was also used to triangulate quantitative data in the research study.

Observation

Observation checklist can yield information which people are normally unwilling or unable to provide. The checklist covered types of crops grown, types of dwellings and the dietary conditions. The researcher employed the use of photographs to record some of the data from the field especially those related to types of crops grown and sugarcane activities in the study area.

3.5.4. Secondary Data

This is data which have already been collected and analyzed by someone else. Such types of data was collected from KESREF offices at Opapo, Sub County Agriculture offices at Awendo and Sony Sugar Company – Agriculture Department; others were obtained from Books, Journals, the internet, published and unpublished works.

3.5.5. Pilot testing of Research Instruments

To pilot test the research instruments, the researcher administered 10 interview schedules to a group of 10 non-sampled respondents within Dede Division in order to test whether the questions generated the responses appropriate and relevant to the study. This enabled the researcher to reformulate the instruments accordingly depending on the outcome of the pilot test.

3.5.6. Validity of Data Collection Instruments

In order to validate the instruments, the researcher ensured that the instruments were pre-tested, by administering 5 instruments to non-sampled people to check their understanding of the questions, and subsequently the questions were rephrased to replace any ambiguous or misleading questions before the final instruments were administered to collect data, besides, the researcher ensured that the instruments were sufficiently formatted and the content was capable of measuring what they purported to measure with regard to the set objectives of the study; the researcher also sought the advice from the supervisors to ensure the instruments used were suitable and valid.

3.5.7. Reliability of Data Instruments

Reliability is the level of internal consistency or stability of measuring device overtime. A measuring instrument is reliable if it provides consistent results over time (Borg& Gall, 1989). To ascertain the reliability of data instruments, the researcher used the split-half technique in which interview schedules were administered to a group of 10 non-sampled respondents at the same period of time in order to estimate how well the questions checking the same concepts yielded the same results. The interview schedules were then separated into evenly numbered and odd numbered questions and results noted, scored and correlated to ascertain the reliability

coefficient. Reliability values were found to be 0.814 averagely for all the instruments hence were reliable.

3.5.8. Data analysis and Presentation

Quantitative data was entered and coded using statistical package for social scientists (SPSS). Basic demographic data for the respondents was analyzed by use of frequency counts and percentages and presented using tables. To achieve objective one, which is expansion of land use for sugarcane production, descriptive analysis was carried out using frequency counts and percentages. Chi square test of association was also carried out. Qualitative data for this objective was presented in verbatim reports and discussed. For objective 2 of the study, data was analyzed using descriptive statistics that entailed frequency counts, percentages, and also inferential statistics where correlation and regression analysis to establish the size of land at the household's disposal and that placed under crop farming was done. Regression model was used to determine the effect of land use on food production. Objective three also adopted descriptive, correlation and regression analyses methods to determine the frequency counts, associations and the effect of land relocation on food production. The results were summarized and presented in tables, charts and graphs which enabled the researcher to sum up the conclusions. Qualitative data compiled from key informant interviews (KII) was categorized into broad themes, coded and classified into sub - themes, the themes and responses were then integrated into the text of the report which has supplemented the quantitative data.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1. Introduction

This study investigated the extent of expansion of land use for sugarcane production, effects of land use change on food production and the effects of relocation of population occasioned by sugarcane farming on food production in Dede Division, Migori County. This was in the light of the unbalanced land allocation in favour of sugarcane which has led to low food production by households in Dede Division. The data was collected and analyzed by use of descriptive and inferential statistics. This chapter presents the results of the analysis.

4.2. Socio Demographic Characteristics of the Respondents

Three hundred and seventy five (375) questionnaires were administered, of which three hundred and seventy two (372) were filled and returned whilst the remaining 3 respondents could not be reached. The five extra questionnaires were to cover for such an eventuality.

Table 2: Age distribution of Respondents

Age category	Frequency	Percent
18-20 yrs.	12	2.8
21-30 yrs.	86	23.6
31-40 yrs.	125	34.6
41-50 yrs.	92	23.6
>50 yrs.	55	15.4
Total	**370**	**100**

Source: Field data, 2014

The most frequent age range of the participants in the study was 31-40 years followed by those in ages 41-50 years. At 2.8% and 15.4% those in ages 18-20 and more than 50 years were the

least active in participation as shown in table 2 above. The study was conducted based on the premise that an adult should ideally be aged 18 years and above which is the age at which identification documents can be issued to an individual in Kenya and further clarified by Kenya National Bureau of Statistics (2010) that the household head is the most responsible or respected member of the household who makes key decisions in the house on day to day basis, and whose authority is honoured by all members of the household.

Table 3: Distribution of Respondents by Household Category

Relation	Frequency	Percent
Head	289	78.1
Spouse	67	18.1
Sons above 18yrs	14	3.8
Total	**370**	**100**

Source: Field data, 2014

The study showed that 78.1% of the respondents were household heads while 18.1% were spouses of the household heads. The remaining 3.8% of the respondents were sons above 18 years (Table 3). Most responses (78.1%) captured were from the household heads' point of view, this helped in getting the correct information on who had the last word with regard to expansion of land use for sugarcane, effects of land use on food production and relocation occasioned by sugarcane in Dede Division. Kenya National Bureau of Statistics (2010) affirms that the household head is the most responsible or respected member of the household who makes key decisions in the house on day to day basis, and whose authority is honoured by all members of the household. This is indeed true as confirmed by Haralambos &Heald(2007) that the man in most cases assumes the household head title. There were instances during the research that females were interviewed as household heads, this complication is explained by Mooney et al.

(2013) when they point out that females and children at times below 18 years are increasingly becoming household heads in Africa due to the HIV/AIDS scourge.

Table 4: Level of education and main occupation of Household Heads

	OCCUPATION																	
Highest level of Educ	**Farm**		**Trade**		**Artisan**		**Casual Emp**		**Salary Emp**		**Student**		**Does Nothin**		**Total**
	Fr	**%**	**Fr**	**%**	**Fr**	**%**	**Fr**	**%**	**Fr**	**%**	**Fr**	**%**	**Fr**	**%**	
Never gone to School	23	6.2	00	00	01	.3	01	.3	02	.5	00	00	05	1.4	**32**
Lower Pri	22	5.9	02	.5	00	00	00	00	00	00	00	00	02	.5	**26**
Upper Pri	106	28.6	30	8.1	09	2.4	12	3.2	08	2.2	03.	8	00	00	**168**
Sec	43	11.6	07	1.9	03	.8	08	2.2	20	5.4	03	.8	02	.5	**86**
Post Sec	18	4.9	01	.3	00	00	04	1.1	30	8.1	03	.8	02	.5	**58**
Total	**212**	**57.2**	**40**	**10.8**	**13**	**3.5**	**25**	**6.8**	**60**	**16.2**	**09**	**2.4**	**11**	**3.1**	**370**

Source: Field data, 2014

The study revealed that those who had never gone to school, those who reached lower primary and those who reached upper primary had (151) 70.4% of them being engaged in farming while only (61) 29.6% of those who reached secondary level and beyond were interested in farming. Majority (32) 80% of the households sampled for this study who had reached upper primary were engaged in trading, (10) 76.9% were artisans and (13) 52% were on wage employment and only (10)16.7% were on salaried employment. The trend changes on salaried employment as those with secondary education have (20) 33.3% and those with post-secondary education have (30) 50% of them being on salaried employment. Only small percentages (18) 8.7% of those with post-secondary education are into farming. At (5) 45.5% those not gainfully employed and do nothing were majorly those who had never gone to school as illustrated in Table 4above.

Nyambogaet al. (2014) during a study on poverty reduction efforts in Kenya observed that a large population in the country goes without food and that the majority are rural poor who are small scale farmers. Main household head occupation was relevant in the study because it was useful in assessing the factors contributing to increase in land subdivision under sugarcane farming. It is important to note that 212 (56.6%) of the households sampled were engaged in farming which requires only land regardless of the level of education while only 158 (43.4%) were into the other occupations. This might explain why there is pressure to subdivide land as most of them prefer farming. Modern agriculture actually requires some level of education to grasp and implement new ideas like fertilizer application in right measures, green house concepts and even irrigation, however, it is evident from the sampled population that only 18 (8.7%) of those with post secondary education embrace farming as most of them 30 (50%) who were sampled in this study are engaged in salaried employment and are perhaps doing farming as a part time activity. This might probably explain why the food production is low due to poor implementation of modern farming techniques. Empirical studies carried out among sugarcane growing households in Kaduna state in Nigeria revealed that about 50% of the farmers had no formal education while the remaining had at least primary level education (Sulaimanet al., 2015). It implies that half of the farmers could be in danger of missing or not understanding most of the written information and up to date knowledge about sugarcane farming (Sulaimanet al., 2015). This compares well with statistics of Ngugiet al. (2013) in a study of Migori County, who found out that 20% of the residents have no formal education and a total of 65% of the residents have primary level education only, though Kuria east sub-county has the largest share (26%). Awendo Sub-County closely follows at 19%. Dede Division is within Awendo. Key informant interviews also affirmed that the low levels of education in the division forms a major reason behind many

residents within the division turning to farming as the main occupation as most of them shun trading and artisanship.

4.3. Extent of expansion of Land use for Sugarcane Production

The first objective of this study was to determine the extent of expansion of land use for sugarcane production in Dede Division, Migori County. To achieve this objective, various variables were examined. To determine the influence of sugarcane production on land allocation, the respondents were asked to state whether they had ever given land to an heir and to state the type of cash crops grown by the heirs on the pieces of land inherited. Data collected was cross tabulated and the results analyzed are presented in Table 5.

Table 5: Influence of Sugarcane production on Land allocation

Type of cash crop	**Ever given land to heir**			
	YES		NO	
Sugarcane	260	70.3%	125	33.8%
Coffee	63	17.0%	134	36.1%
Tobacco	47	12.7%	111	30.1%
Total	**370**	**100%**	**370**	**100%**

Source: Field data, 2014

About three quarters of the household heads (70.3%) who had ever given their land to their heirs had sugarcane being grown by the beneficiaries as a cash crop from the land which had been allocated to them. Coffee was cultivated by 17.0% while, at 12.7% Tobacco was the least in preference as a cash crop by those who had received their portion of land. Within the percentage of the households who reported not to have ever given their land to heirs only 36.1% and 30.1% grew Coffee and Tobacco respectively. On the other hand, households which reported not to have given land to their heirs but were growing sugarcane were only 33.8%. There is some

indication that the allure of possible comfort to be derived from income generated through sugarcane production has contributed to the expansion of the area dedicated to it as a cash crop. (See table 5 above). This is indeed confirmed from an excerpt obtained from key Informant Interviews conducted during the study that;

> *Most of the households in North Sakwa Location have dedicated most of their land to the growing of sugarcane, even those with smaller pieces of land to satisfy the demands of the sons who want to grow Sugar cane to be economically independent. For families with many sons this has meant that most of their land is under one crop (sugarcane) there has been little efforts aimed at diversification.*

Table 6: Influence of sugarcane production on Land allocation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.396[a]	2	.006
Likelihood Ratio	10.513	2	.005
N of Valid Cases	370		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 27.65.

The data on influence of sugarcane production on land allocation was run in a Pearson chi-square test for level of significance where the p value of the Pearson chi-square test was 0.006 that is ($p < 0.05$). This implies that there is a high probability that the expansion in land size was influenced by the type of cash crop grown for the observations under the study. With 70.3% (Table 5) of the respondents growing sugarcane on the inherited land, it is indeed the main driving factor behind

the expansion in area dedicated to it and decrease in land size dedicated to other crops in the study area. Ndirangu (2010) in his annual report tends to support this position when he reports that during a training organized by National Accelerated Agricultural Inputs Access Program (NAAIAP) in Awendo town two thousand five hundred (2,500) farmers were invited out of which only ten (10) out of the three hundred (300) who reported for the training admitted growing either tobacco or coffee as a cash crop, all the rest were sugarcane farmers. It is true that farmers here still believe that they can live comfortably with their families on the cash returns from the crop (Sugarcane), (Ndirangu, 2010). However, the farmers do not take into account the duration that sugarcane takes from planting to maturity which is 18-22 months. It is actually difficult to spread the income between the possible payments received. This leads to inability to access adequate food until the crop is harvested and marketed (Aringo, 2008). It is this continuous growing of sugarcane that has put pressure on available arable land, and in the longer term, with the current rates of population growth and migration into the area, land may become more constrained leading to low food production (Kennedy & Cogill, 1997).

Kenya government accords high priority to the development of the sugar industry. The government policy is centered on attainment of self-sufficiency in the meeting of the country's demand for sugar, while in the long run; the government expects to earn foreign exchange through exports. As such, Aluoka (1999) notes, that the government has allocated substantial amounts of resources for the expansion of the industry and a long term sugar development program has been evolved consisting of detailed investment proposals for rehabilitation and also expansion of existing sugar factories. Sugarcane production therefore is believed to influence land allocation other crops and the one given to sons as inheritance, (Ambwere, 2003).

To find out why most households did not have adequate land for which to grow both cash crops and food crops, they were asked to state why the total acreage at their disposal was small. The data collected under the question was analyzed and presented in Table 7.

Table 7: Reasons for diminishing Land holdings for crops in the study area

Why is your land parcel under crops small?	Frequency	Percentage
Given the limited land as inheritance to my sons	349	94.3
Sold some parcel to a buyer	15	4.1
Inherited small piece from my father	4	1.1
Other	2	0.5
Total	**370**	**100**

Source: Field data, 2014

Findings from this research showed that those household heads who gave their land as inheritance to their sons stood at 94.3% of the entire sampled households, 4.1% sold their parcels to a buyer, only 1.1% indicated that they received the small pieces from their fathers, 0.5% of the households have small land pieces due to reasons other than the ones listed above for example some have leased their land. This sudden surge in interest on sugarcane and its inevitable expansion has a most probable link to reduction in land acreage for other crops especially food crops since majority of the households interviewed agreed to having given part of their land to siblings as inheritance. A closer look at the type of cash crops grown by the beneficiaries on their land may suggest the extent of expansion of area under such crops.

Globally, land tenure comes in different methods such as inheritance, renting, purchasing and land being offered as a gift. So far such practices have encouraged expansion of land under cash crops (Obonyo et al., 2016). While Obonyo et al. (2016) based their research on land fragmentation and implications on food security, the current study concentrated on land use for

sugarcane. An observation by Sulle (2017) during a research in Kilombero Sugar Company in Tanzania showed that the lucrative prices of sugarcane from the company and the previously reliable market have encouraged out growers to put most of their farmland into sugarcane hence low food production. Though he did not link this directly to expansion of area under sugarcane, the results in Table 7 reinforced by key informant interviews (KII) from the study area provide a strong interrelationship between expansion of land under sugarcane growing and reduction in sizes of land under other crops hence vindicate Sulle's observation that sugarcane expansion has led to low food production.

To determine if the size of land at the disposal of a household was considered while deciding to grow sugarcane, the researcher sampled households with less than one acre, those having one acre up to those with more than three acres and asked them to state whether they grew any cash crop. The results obtained were cross tabulated and the analysis is presented in Table 8.

Table 8: Size of Land and decision to grow cash crops

	Grown any cash crop?		
Size of land	**Yes**	**No**	**Total**
<1acre	73.5%	26.5%	100%
1 acre	63.0%	37.0%	100%
2 acres	73.4%	26.6%	100%
3 acres	74.0%	26.0%	100%
>3acres	84.6%	15.4%	100%

Source: Field data, 2014

Most households sampled for this study in all the categories of land acreage responded positively to growing cash crops in varying percentages. The smallest percentage of those households who responded positively to growing a cash crop was in the category of one acre at 63%, the highest

was 84.6% for those with more than three acres of land. A similar trend is noted for those respondents who reported not growing any cash crop with the biggest percentage being those households with one acre at 37% and those with more than three acres being at 15.4%. This is shown in table 8.

Table 9: Size of Land on decision to grow cash crops

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.835[a]	4	.065
Likelihood Ratio	9.029	4	.060
N of Valid Cases	357		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.61.

The p value of the Pearson chi-square test was 0.065 that is ($p < 0.05$). This implies that there is a very small probability that the size of land owned is considered when growing a cash crop since all households were growing a cash crop regardless of the size of the land acreage. It comes out in this study that majority of the households grow cash crops regardless of the size of the land at their disposal. This is confirmed by Egesa (2004) that households in sugarcane growing areas rarely consider growing food crops on their farms as a priority. Obuoyo (2005) during a study in Nzoia sugar-belt had similar findings where the acreage under sugarcane expanded due to the introduction and promotion of mono-cultural sugarcane production concomitant with the construction of Nzoia and Mumias sugar factories in the 1970's. This tremendous expansion in sugarcane acreage consequently led to reduced land holdings or ownerships because most of the farmers were lured into selling their vast lands out for monetary gain, with another lot leasing out their lands to investors in sugarcane at prices below prevailing market rates. As a result they are

left with very little acreage of land to share out amongst the household members; such small units also shared out were uneconomical and could not sustain the food production requirements of such households. During one of the key informant interviews an agricultural officer sought to clarify that;

> *In a bid to bring under control the rapid expansion of land under growing of sugarcane, the County Government of Migori has enacted a by-law that caps the growing of sugarcane for farmers who own more than one acre parcels of land only. This in essence means that those with smaller parcels either have to lease land elsewhere or stop growing sugarcane. The enforcement of this by-law has begun albeit with some resistance. There are also plans to promote growing of food crops through provision of seed subsidy. All these are geared towards improving food crop production.*

This is a good control measure; however, its implementation might prove to be a big challenge to the County government as the farmers are lured by the drive to get cash to send their children to school and meet other household obligations. All these literature reviewed points at sugarcane expansion on the available land.

Plate 1 below shows a none contracted small holder cane with ratoon and freshly planted sugarcane.

Plate 1 Planted cane at the foreground and ratoon cane at the middle background

To find out the effects of sugarcane farming on food production in Dede Division, the researcher further sought to determine the acreage that was dedicated to different types of crops before and after the commercialization of sugarcane. The respondents were asked to state the acreage dedicated to the selected crops and their yields in tons before and after introduction of commercial sugarcane in the study area. The results were analyzed and presented in table 10.

Table 10: Acreage under individual crops before and after the introduction of commercial Sugarcane in the study area and its output in Tons

Crop	Acreage before cane introduction	% acreage	Output in tons	% output	Acreage after cane introduction	% acreage	Output in tons	% output
Tobacco	2.0	13	1.1	9.4	1.4	9	0.69	0.2
Groundnuts	0.8	5.2	0.70	6	0.3	1.9	0.41	0.1
Cassava	2.1	13.5	1.17	10	0.6	3.9	0.45	0.2
Millets	2.3	14.8	1.08	9.2	0.8	5.2	0.81	0.3
Beans	1.2	7.7	1.35	11.5	0.3	1.9	0.45	0.2
Potatoes	1.2	7.7	0.72	6.1	0.2	1.3	0.36	0.1
Fruits	0.8	5.2	1.0	8.5	0.1	0.7	0.98	0.4
Rice	Nil	Nil	Nil	Nil	0.1	0.7	0.52	0.2
Coffee	0.8	5.2	0.80	6.8	0.3	1.9	0.36	0.1
Maize	4.2	27.1	3.6	30.7	1.9	12.3	1.17	0.4
Sugarcane	0.1	0.6	0.20	1.8	9.5	61.2	270	97.8
Totals	**15.5**	**100**	**11.72**	**100**	**15.5**	**100**	**276.2**	**100**

Source: Field data, 2014

Data collected from the field shows that before commercialization of sugarcane, the main cash crops which were cultivated in the study area were Tobacco and Coffee which were given about 13% of the acres of land per household and 5.2% of the acres respectively, the rest was left for food crops and a small percentage of 0.6% acres of the land was left for sugarcane mostly used for brewing of traditional beer and also chewing, the total production was about 0.20 tons which is about 1.8% of the total tonnage of crops produced by the households. Maize had the largest acreage at 27.1%, Groundnuts 5.2%, Cassava 13.5%, Beans 7.7%, Millets 14.8% and Fruits 5.2% of the land. This trend changed after commercialization of sugarcane where acreage for Maize was reduced to 12.3%, beans 1.9%, groundnuts 1.9%, cassava 3.9%, millets 5.2%, and fruits 0.7%, the other cash crops were also now less favored with Tobacco having only a paltry 9% of the land, coffee had 1.9%, meanwhile Sugarcane had expanded and was now taking a whopping 61.2% of the land. It was now commercialized and its tonnage had increased to 270

which is 97.8% of all the household farm tonnage. In a bid to increase food supply, the government, through a non-governmental organization called Njaa Marufuku introduced and started to promote the growing of dry-land rice in the area, this effort has been too little too late as the total tonnage realize from the dry land rice is only 0.52 tons.

From the data above, it is evident that acreage under sugarcane has expanded and those under other cash crops have drastically reduced. Sugarcane takes a higher proportion of acreage than Maize, Tobacco and even coffee combined. In actual sense sugarcane takes more than half the total acreage in the study area. A report on the sugar industry made by Evelyn (2005) noted that the total area under cane as at the end of the first quarter of 2004 was 107,622 hectares compared to 106,313 hectares in the same period in 2003, representing an increase of 1.2%, she attributed the increase to expansions of sugarcane acreage in South Nyanza sugar belt. South Nyanza sugar belt is an area that encompasses Dede Division which is the focus of this study. She further makes a very important observation, that overall, the sugar industry recorded an improvement in cane yields of 9.6% with 72.25 tons per hectare in the first quarter of 2004 up from 65.93 tons per hectare in the same period in 2003. Further, she notes that Mumias, Nzoia and Sony sugar zones realized improved cane yields. Other studies done in sugarcane growing areas confirm that sugarcane farmers have significantly smaller percentages of their land under food crops compared with non sugarcane growing farmers (Kennedy & Cogill, 1997). From the foregoing it is indeed true that as more land acreage is put under sugarcane, production increases, however, land under other crops notably food crops is reduced leading to actual decrease in total amounts harvested. Aringo (2008) in his research carried out in Uriri Division, also tends to support this when he stated that an estimated 130,000 families in the Lake Victoria basin were engaged in the sugar industry with a further 50,000 people employed directly by the factories. As a result of

sugarcane influence, farmers in these areas have tended to move into sugarcane cultivation leading to its expansion.

During a Key Informant Interview (KII), the following sentiments were expressed by an informant;

> *Most pressure to subdivide land comes from children especially sons. Some of the sons are not even of mature age but they feel that their parents own big parcels of land and deny them economic independence hence they demand that they are given their portions so as to grow their own sugarcane hence leading to further expansion of area put under sugarcane crop. Some lease or sell their inherited land and move to nearby market centers and towns.*

The net effect of the pressure is that most of these parcels regardless of size are put under sugarcane growing, hence leading to its expansion and inevitably a reduction in area under other crops especially food crops. Similar observations were made in other studies carried out in other parts of the world for instance Ogbu (1993) in a study carried out in Nigeria found out that traditional agricultural systems on ancestral land in many parts of tropical Africa were for the most part adequate to satisfy consumption needs. However, this notion changes when modern commercial farming is introduced in an area demand for land rises, this therefore means that the traditional pressure to own land is secondary since the real catalyst is the desire to be economically independent by growing a cash crop. The demand most probably leads to expansion of the land under the sugarcane as argued by Omolo & Odongo (2004) that commercial production of sugarcane is still undergoing a crisis and the main beneficiaries are milling factories, the main losers being farmers who are impoverished as they neglect other crops and concentrate on expanding the area under sugarcane crop. Sony Sugar Company was

established in 1979 and from then onwards promotion of sugarcane as a commercial crop in the area has been sustained resulting in large acres of land being put under the crop

To find out the extent of the reduction in land sizes among the households before and after commercialization of sugarcane, the researcher analyzed the data collected from the field. Those households who owned 5 acres and below, those with 5 to 10 acres and those who had above 10 acres were all analyzed. The results of the analysis are shown on Table 11.

Table 11: Land ownership before and after commercialization of Sugarcane

Size of land	**Frequency before**	**%**	**Frequency after**	**%**
5 acres and below	83	22	311	84
6-10 acres	50	14	30	8
Above 10 acres	229	62	18	5
Don't know	5	1	8	2
Non responsive	3	1	3	1
Total	**370**	**100**	**370**	**100**

Source: Field data, 2014

Most households interviewed during this research acknowledged that currently, they do not own large pieces of land as the ones their parents or grandparents owned before commercialization of sugarcane started. About 22.4% of the households sampled had five acres and below, 13.5% owned between 6-10 acres and 61.9% had ten acres and above, 2.2% of the households could not remember the acreages owned before commercialization of sugarcane. Among the Luo in Kenya access to land has been the major source of livelihoods for small and medium farmers. But access to land is governed by the tenure arrangements such as land inheritance, leasing or renting, purchasing which in turn results into land fragmentation (Obonyo et al., 2016). The

assertion above suggests that livelihood is an allure of access to land, livelihoods among sugarcane growing communities are closely tied to sugarcane growing itself as Kilel (1993) shows in her analysis in Belgut Division, that, there are two types of farming systems in the Division, namely food crop and cash crop farming falling under the control of women and men respectively. Analysis on the allocation of land holdings between different crops shows that with the introduction of sugarcane as a commercial crop, acreage under it has increased as the men tilt land allocation to crops in their favour to produce sugarcane. The situation in Belgut compares well with the one prevailing in Dede Division as statistics collected from the field indicates a pattern of land use that point at sugarcane production expanding and possibly contributing to diminishing land size dedicated to other crops.

4.4. Effects of Land use change on food production

The second objective of this study was to assess the effects of land use change on food production in Dede Division, Migori County. To achieve this objective, the respondents were asked to state the size of their current land in acres, patterns of land use, acreage set aside for food crops and the yields that were realized in tons before and after commercialization of sugarcane and also the length of time that harvested food lasted in months. Data collected from the field was analyzed and presented.

In order to determine the changes in land use and relate it to food production, current sizes of land owned by the households in the study area had to be ascertained. Data on land sizes from the field was cross tabulated and analyzed results presented in Table 12.

Table 12: Current sizes of Land owned by Households in Dede Division

Land size	Frequency	Percentage
5 acres and below	311	84.1
6-10 acres	30	8.1
10 acres and above	18	4.9
Don't know	08	2.2
Non responsive respondents	03	0.7
Total	**370**	**100**

Source: Field data, 2014

In the study area majority of the households owned 5 acres and below, that is 311 households representing 84.1% of the sampled households. Between 6-10 acres was 8.1%, 10 acres and above was 4.9% and 2.2% did not know their farm sizes, 0.7% did not answer the question. The data confirms that land currently at the disposal of most of the households has considerably reduced. The reduction has meant that the amount of acreage dedicated to food crops has reduced. It is not only households but also the Kenya Government has had to grapple with major challenges in matters dealing with land. It was faced with the problem of ensuring that all land is put into productive use on a sustainable basis by facilitating the implementation of key land policy principles on land sector, productivity targets and guidelines as well as conservation of land quality in pursuit of food production (Musambayi, 2013). Kenya has not had a clearly defined National Land Policy since independence consequently the land question has manifested itself in many ways such as fragmentation (which results into small land parcels), breakdown in land administration and disparities in land ownership. These at times lead to social, economic, underutilization and abandonment of agricultural resources. In essence the effects of the role of women and men in land use and abandonment of traditional crops have led to low food production (Hlimi, 2013).

To gauge the changes in land use and its influence on food production, it was necessary to find out the patterns of land use and land ownership by the households in the study area. Respondents were asked to give the size in acres of the land they apportioned to different activities and the respective members of the households responsible for those activities. Data collected was analyzed and presented in Table 13.

Table 13: Patterns of Land use and ownership in selected Households in Dede Division

Activity	Ownership	Acreage	Percentage
Food crops	Female spouse	3.6 Acres	24.32
Cash crops	Male spouse	8.2 Acres	55.41
Livestock	Both Male & Female	2.0 Acres	13.51
Housing	Male spouse	1.0 Acres	6.76
Totals		**14.8** Acres	**100**

Source:Field data, 2014

It was revealed that land is generally put into four main activities. Averagely, households have set aside 24.3% of their arable land to food crops and have gradually left women in control while 55.4% has been left for cash crops and it is the men who are in charge, 13.51% is set aside for livestock grazing and 6.76% of the acres are for setting up homes. With the coming of the cash crop economy, the role of women in providing food for the family in Dede Division has changed as shown in the table above. In this respect most women have now taken charge of food production especially the main cereals; in addition they are the ones in charge of cows and the calves as they do the milking. It was observed that women are involved in the milking and tending for the cows and calves while the men were more interested in the bulls as they are the

ones used for ploughing and so they always ensure that they are well fed and ready for the purpose. Meanwhile as the women are apportioned small sections of the land to grow maize, the men, since they are the ones who traditionally own the land, and are the main decision makers deciding on what farming activity to be undertaken, apportion the largest chunks of the land to sugarcane, such changes in roles of providing food to the family have a negative effect on crop production (Kilel, 1993).

Given that some of the land parcels within the study area are small (measuring 5 acres and below), giving priorities on what type of food crop to produce becomes a challenge to the households. The effects of land use change on food production could be established through analyzing the actual size of land left for staple foods like essential grains for example maize, millet and beans and also others like cassava and sweet potatoes and comparing the data with what was there some decades back before commercialization of sugarcane. The data obtained was analyzed and presented in Table 14.

Table 14: Acreage set aside for selected food crops by households before and after commercialization of Sugarcane and their yields in Tons

Crop	Acreage		Yield		Acreage		Yield	
	Before	%		%	after	%		%
Maize	4.2	38.1	3.6	45	1.6	57.1	1.17	36
Beans	1.2	10.9	1.35	17	0.3	10.7	.45	14
Cassava	2.1	19.2	1.17	15	.3	10.7	.45	14
Millets/Sorghum	2.3	20.9	1.08	14	.4	14.3	.81	25
Sweet Potatoes	1.2	10.9	.72	9	.2	7.2	.36	11
Totals	**11.0**	**100**	**7.92**	**100**	**2.8**	**100**	**3.24**	**100**

Source: Field data, 2014

Maize had an average of 16 acres being dedicated to it before commercialization of sugarcane which produced an average of 3.6 tons of maize per harvest season which is 45% of the overall tonnage of produce for that season, millets or sorghum 2.3 acres giving 1.08 tons (14%), beans had 1.2 acres giving 1.35 tons (17%), cassava was at 2.1 acres producing 1.17 tons (15%) and sweet potatoes at 1.2 acres produced 0.72 tons (09%). More data collected from the field during this research shows that as opposed to the era before sugarcane was commercialized when the portion of land dedicated to maize by households was 4.2 acres yielding 3.6 tons of maize on average, the current sizes of land dedicated to production of this staple food crop has considerably reduced with maize currently having only an average of 1.6 acres per household dedicated to it which gives a paltry 1.17 tons which is 36% of the total harvest tonnage on average per harvesting season. Millet/ sorghum now has 0.4 acres giving .81 tons (25%), beans has 0.3 acres also producing .45 tons (14%) even cassava at 0.3 only produces .45 tons (14%) and lastly sweet potatoes at 0.2 produces .36 tons (11%).

The study further sought to determine whether a correlation existed between size of land owned and size of land under crop production. The findings are presented as shown in Table 15 that follows.

Table 15: Correlation between size of Land owned and size of Land under crop production

		Size of land owned	size of Land under Crop Production
Size of land owned	Pearson Correlation	1	.800**
	Sig. (2-tailed)		.000
	N	370	370
Size of Land under Crop Production	Pearson Correlation	.800**	1
	Sig. (2-tailed)	.000	
	N	370	370

**. Correlation is significant at the 0.01 level (2-tailed).

The findings in Table 15 on the correlation between Size of land owned and size of land under crop production clearly indicates that there is a strong positive correlation between the two variables (r=.800, p=.000). This implies that land under crop production was associated with size of land owned and therefore the size of land not used for sugar cane farming was very significant in crop production. Furthermore, the study sought to establish whether there is some association between land under sugar cane farming and size of land under crop farming. The findings are presented as shown in Table 16 that follows.

Table 16: Correlation between Land under Sugarcane farming and Land under food crop Farming

		Size of land under sugar cane farming	Size of Land under Crop farming
Size of land under sugarcane farming	Pearson Correlation	1	-.560**
	Sig. (2-tailed)		.000
	N	370	370
Size of Land under Crop farming	Pearson Correlation	-.560**	1
	Sig. (2-tailed)	.000	
	N	370	370

**. Correlation is significant at the 0.01 level (2-tailed).

The findings in Table 16 on the correlation between size of Land under Sugarcane farming and Land under food crop farming indicates that there is a moderate negative correlation (r=-.560 p=.000). This implies that land under food crop production was negatively associated with size of land under sugarcane farming and therefore the size of land used for sugar cane farming has led to a reduction in food crop farming.

Experts and policy makers have raised the alarm over planting one type of crop year in, year out. Bad practices in land use, they warn is threatening food production. Added to these, they say, is the shrinking sizes of agricultural land which is making farming expensive and that the cost of production in small farms is much higher, yet yields are low. Small scale farmers try to evade this cost by investing less in farm inputs such as fertilizer and quality seed, a move which is self defeating (Mbuthia, 2014). Mbuthia, however, carried out his study in Nyamira which is not a sugarcane dominated County and he was not explicit on the various competing land uses. Sometimes studies done in non sugarcane growing areas may not give a clear picture of the situation prevailing in a sugarcane growing area like Dede Division. Though they do give a

glimpse of the challenges that accompany changes in land use such as diminishing sizes of land parcels used for food production. Obonyo et al. (2016), during a research on land fragmentation and food security conducted in Ugunja Sub-County tries to bring it out when he found that land use is commonly cited as an impediment to agricultural food production and development because of the inefficiencies involved in identifying the nutritional requirements for each successive food crop in rural farms. Preference for cash crops by households owning small land parcels as is the case in most parts of Nyanza makes it difficult to produce enough food. The small farms means applying organic fertilizer and mechanization in agriculture through use of machines such as tractors is almost impossible hence productivity levels of food are threatened (Mbuthia, 2014).

However, the land size dedicated to the food crops changed gradually with the commercialization of sugarcane farming which escalated reduction in land sizes dedicated to food crops as has been observed during a research done in Migori County by African Women's Studies Centre (AWSC) in 2014 that one of the major challenges to food security in Migori County is small land parcels set aside for food crop production which is attributable to competition from sugarcane growing as men abandon their role of producing food for the family and concentrates on sugarcane production leaving women to carry out food crop farming. In majority of such households income from the cash crops(Sugarcane) hardly benefits the women and children.

The findings above compares well with those of Laure et al.(2007) who also found that size and type of land set aside for the crop influences its yields and that as the men set aside less fertile and small sections of their land for staple food production, it means low food yields from the farms. Though Laure et al. (2007) points at low crop yields as resulting from small land parcels

set aside for crop production, the study does not suggest reasons behind the small land parcels, this is revealed in a study done by Kilel (1993) in Belgut, he noted that before cane introduction, the main cash crops in the area did not require large tracts of land and there was therefore little competition between cash crops and food crops. Since sugarcane requires large tracts of land for it to be commercially undertaken, this has caused stiff competition between the man and the woman of the household effectively meaning it is competition between cash crops and food crops. It is important to note that a crop such as beans has a slightly higher production since it can be intercropped with most of the food crops planted in the area. This study therefore corroborates the studies done by Kilel (1993) by affirming the biasness in land allocation.

To find out the adequacy of the food harvested from the farms to the households, the researcher sought to find out the length of time food harvested lasts before and after expansion of area under sugarcane farming. The respondents were asked how long the food lasted in months. The results were analyzed and presented in Table 17.

Table 17: Length of time harvested food lasts before and after expansion of area under Sugarcane

No of months	Before expansion	%	After expansion	%
Less than 1	00	0	62	16.8
1-2	11	3	214	57.8
3-4	45	12.2	80	21.6
5-6	300	81.1	10	2.7
More than 6	10	2.7	00	0
Non respondents	04	1.0	04	1.1
Total	**370**	**100**	**370**	**100**

Source: field data, 2014

It emerged during this research that the food crops harvested by the majority (81.1%) of the households lasted between 5 to 6 months before expansion of land under commercial sugarcane, 3% of the households harvested food lasting 1 to 2 months, 2.7% of the households harvested food lasting over 6 months and most importantly none (0%) harvested food lasting less than one month. However, after the introduction of commercial sugarcane, things changed and 16.8% of the households now harvested food that could not last even a month, 57.8% of the households harvested food that lasted between 1 to 2 months, 21.6% of the households harvested food lasting 3-4 months, 2.7% of the households harvested food lasting 5-6 months and none of the households (0%) now harvested food that lasted over 6 months.

Since most crops especially Maize takes more than three months to be harvested, it means that most of the time the households have to look for the staple food elsewhere. Access to food as a problem is compounded by the continuous farming of commercial sugarcane at the expense of subsistence farming which has created more demand and less supply of food crop hence prices of food have increased making it difficult for farmers to be able to afford the staple food (Maize) in the open market (Aringo, 2008).

Plate 2 below shows a farmer's attempt to maximize the use of his half acre piece of land by planting kales side by side the sugarcane.

Plate 2 Mature sugarcane with vegetables (Sukuma wiki/Kales) grown side by side at Kadera Kwoyo sub location in Dede Division.

These findings are supported by a study conducted by Musambayi (2013)in three regions in Kenya on the impact of changes on land use and food production. Simple regression model was used to investigate the significance of the relationship between reduction in land size and food production. The results of the survey research showed that there is a significant relationship between land reduction and food production and that reduction in size has an impact on all the dependent variables. They depend on how the land factor is handled. In essence the smaller the land parcels the lower the food production.

The second objective mainly focused on the effect of land use change on food production. Having established extent of change in land use, the second step entailed establishing its effect on food production. Simple linear regression model was therefore carried out to establish whether a correlation existed between land use change and food production, its consequent effect

and the proportion of change in food production accounted for by land use change. Scores of food production views from the respondents were regressed against scores of land use change. The findings on simple linear regression model unique contribution of the land use change are presented as shown in Table 18 using standardized coefficients.

Table 18: Coefficients of Land use change

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.481	.063		7.639	.000
	Land use change	-.808	.026	-.868	-31.473	.000

a. Dependent Variable: food production

The findings as indicated in Table 18 shows that without engaging any variable in the model, there is a constant of 0.481 which is significant at 0.05, (B=.481, p=.000). This means that there would still be food production without the introduction of land use changes due to other variables. However, our variable of interest was land use change and the magnitude and strength of its effect on food production. The findings clearly indicates that land use change uniquely and negatively contributed towards food production (β=-.868, t(370)=-31.47, p=.000). There is a strong contribution of land use change if there are no other variables. It was also necessary to examine the proportion of variation in food production that was caused by land use change. The findings on this were therefore presented as shown in Table 19 that follows.

Table 19: Summary model results on land use change

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.868[a]	.754	.753	.40499	.754	990.579	1	362	.000

a. Predictors: (Constant), land use

The findings in Table 19 shows that land use change was correlated with food production (R=.868), a correlation that is considered strong. When this value is squared and multiplied by a 100%, we obtain the percentage change in food production accounted for by land use change, which was 75.4%. This is a large percentage and very significant, (F(1, 362)=990.579, p=.000) implying that the significance was not by chance but the choice of the variable was clear. Thus it can be deduced that land use change accounts for a significant proportion in food production such that the more the land is utilized on sugar cane farming the less the food is produced within the area.

The findings above are confirmed by data collected from key informants during this study which indicated that changes in land use in favour of sugarcane has led to low food production, this is further reinforced by findings from a study done by Netondo et al. (2010) where he noted that one of the principal causes of low food production is the social values tied to land ownership and that the key determinant underlying this is the traditional role of the man in matters of land. However, the common factor is that food production is reduced when the man directs his energies away from food production. Data collected from non crop farming communities also indicated that sudden changes in land use leads to reduced productivity. In a series of runs with the savanna model without the households' model, Thornton et al. (2003) found that about the same numbers of livestock could be supported on 196 km^2 parcels as on intact group ranches run

by maasai morans. Model experiments with another area under a maasai women group showed that livestock numbers can decline substantially due to the change. The effects of land use change are diverse and have the potential of reduction in the production levels in food especially with the commercialization of sugarcane farming which has complicated land availability to households for food production.

4.5. Effects of relocation of people occasioned by Sugarcane farming on food production

The third objective of this study was to establish the effects of relocation occasioned by sugarcane farming on food production in Dede Division, Migori County. To achieve this objective, the respondents were asked to state the causes of movement in the study area, food production levels before and after relocation and how the relocation has impacted on food availability. The data collected from the field was cross tabulated and the analyzed results presented. To find out the main cause of movement in the study area, the researcher sought to find out the causes of movement in the study area. The results were analyzed and presented in Table 20.

Table 20: Causes of movement in the study area

Cause of movement	Frequency	Percentage
Has leased all his land	03	2.4
Has sold his land	05	4.1
Relocated by Sony Sugar company	100	81.3
Other reasons	15	12.2
Totals	**123**	**100**

Source: Field data, 2014

Those households who relocated because they had leased all their land were 2.4%, those who had sold their land were 4.1% and the majority 81.3% moved as a result of relocation by Sony sugar company, 12.2% households also moved due to reasons other than those covered by this research. The internal movements that has occurred within the study area is attributable to a variety of factors such as leasing and selling of land, the major cause is relocation by Sony Sugar at the inception of the project. Though the total number of households who were relocated by Sony looks small, it is not negligible since those who moved were part of a larger family since Luos in most parts of Nyanza live in large families known as clans. When a household within the clan moves away, the whole clan is affected in one way or the other due to close family affiliations (Obonyo et al., 2016).

Large scale acquisition of land for commercial agriculture and mining are leading to loss of land and are undermining the livelihoods of affected rural communities. These land based investments have been characterized by a lack of consultation with and participation by affected communities. Cases of unjust displacement, where households are forced off their land without their consent and without compensation, have been widely reported. There are however instances where communities have resisted relocation (Chu et al., 2015). In Awendo Sub County, some communities were relocated, and most of the households interviewed affirmed that it is due to the expansion of the nuclear sugar farm in the area that they were relocated.

Most of those who were relocated settled within the Division, few moved elsewhere, most of those who moved elsewhere were those who moved due to reasons other than relocation by Sony Sugar. Their capacity to produce food has reduced. Interviews with individual African sugarcane growers in 2013-14 among small scale farmers in Nkomazi, South Africa suggests that over the past 50 years the industry has transformed livelihoods, first by peoples' displacement and

resettlement and reducing them to small scale agriculture. The evictions and resettlement of people into trust lands from 1954 created conditions typical of Bantustans in South Africa: overcrowded villages with limited grazing and unproductive land. For many households the remnants of subsistence agriculture were destroyed or reduced to little more than the maintenance of a kitchen garden (James & Woodhouse, 2016). The scenario depicted above is almost similar to a case in Zambia where during the construction of the Kariba Dam in the 1950s relocation of nearly 57,000 people, mainly Tonga speaking people occurred. Sixty years later, these communities continue to struggle for food production and livelihoods. Yet in recent years investments in the mining, tourism and agricultural sectors and also increasingly industrial developments have led to relocation of communities. These developments, accompanied by increasing population and urbanization have resulted in mounting pressure on and competition in demand for land. Poor people in rural, urban and peri-urban areas are most susceptible to displacement due to having unrecognized land rights(Cliggett, 2005).

In order to get a clear picture of the effects of relocation on the food produced in the study area, the researcher compared food production levels before and after the relocation of people by Sony Sugar Company in the Dede Division. The respondents were asked to state the food crops which were grown before and after relocation and the yields. The analyzed results are presented in Table 21.

Table 21: Food production levels before and after relocation in tons per acre

Crop	No of tons before relocation%		No of tons after relocation%	
Maize	1.98	23.3	.90	10.6
Beans	1.35	16	.72	8.5
Cassava	.99	11.7	.54	6.4
Millet	.81	9.6	.36	4.3
Potatoes	.54	6.4	.27	3.2
Totals	**5.67**	**67**	**2.79**	**33**

Source: Field data, 2014

Before relocation, the households sampled produced 1.98 tons of maize per acre on their farms which was 23.3% of the total tonnage of food crops produced in the farm in one season, 1.35 tons of beans (16%), .99 tons of cassava (11.7%), .81 tons of millets (9.6%) and .54 tons (6.4%) of sweet potatoes was also produced. However, after being relocated, their produce nosedived to .90 tons of maize which now represents (10.6%) of the total tonnage produced, .72 tons of beans (8.5%), .54 tons of cassava (6.4%), .36 tons of millets (4.3%) and sweet potatoes reduced to .27 tons (3.2%) per acre per harvest season.

The study revealed that there is a connection between the quantity of crop produced before and after the relocation. As confirmed by Alcamo et al. (2003) the result indicated the level of decrease in quantity of crop production, which is a result of the number of hours farmers now spend on their farms and also the inadequate labour supply that is less than what was there before the relocation. All these suggests that majority of the farmers in the area no longer harvest what they did as before the relocation. The average yield is low when compared to the world average of 4.3 tons per acre (FAO, 2009). Studies carried out in non sugarcane growing areas revealed similar results. Though reasons for relocation were totally different, the end results are similar, especially reduced food production.

In a food survey carried out in Barkin Ladi Local Government area of Plateau State in Nigeria where people had relocated due to deadly gun attacks by militant Boko Haram gunmen, the findings revealed that there is a change in the quantity of food produced as the number of farmers that harvested over 10 bags before the relocation was 98% but this dropped to 30.5% after relocation occasioned by gun attacks**(**Ayuba, 2016). Though Ayuba (2016) cites a completely different cause of the movement, the end result is quite clear, reduction in food crop production and it is here that similarities are identified, however, circumstances under which the relocation in Barkin Ladi occurred and the prevailing circumstances in Dede Division are quite different since the case in Dede Division is occasioned by sugar cane farming. Similar observations were also made by an assessment sponsored by the World Bank which estimated that every year since 1990; roughly 10 million people worldwide have been relocated involuntarily by infrastructural development projects (Alcamoet al., 2003). In India alone during the last 50 years, an estimated 25 million have been relocated due to development projects. In this same period in China, development projects caused more than 40 million people including 13.6 million to be relocated in the 1990's (Otunnu, 2010).

During the key informant interviews, Sony sugar officials stated that all those individuals whose land was incorporated into the nuclear farms were compensated in order to vacate. 100 people were affected. That the households were compensated is not in doubt, it is the adequacy of the compensation that is debatable as the amount of money given could not buy an equal amount of land as the one they had vacated. There are several similarities even in other countries for example when the effects of acquisition of farmlands on the socio-economic structure and income distribution among farmers in Edu Local Government area of Kwara State, Nigeria was studied, the results indicated that the farmers' average age was 43 years. It was also noted that

the amount of compensation paid to the farmers was far less than what the farmers expected and this contributed to rising income inequality among them (Nmaduet al., 2008). There is also the other bit of lack of guidance on investment opportunities for the evictees. Coupled with the current scenario where people lease out their land parcels to private investors to develop sugarcane farms and since the land parcels are small they are forced to relocate to nearby towns and cut off their links with their relatives (Immink &Alarcon, 1991).

To find out how relocation of population resulting from sugarcane farming has impacted on farm food availability, the respondents were asked whether it has reduced farm labour employment or decreased the farm yields from the household farms. The results were analyzed and presented in Figure 3

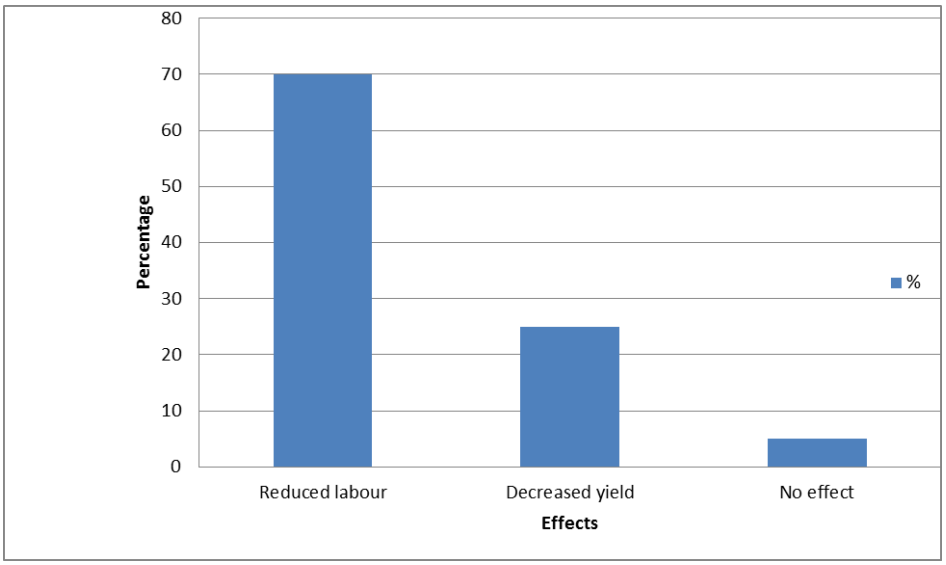

Figure 3: The effects of relocation on farm food production

Of all the households who were relocated, 70% of them experienced reduced labour in their farms while 25% of them reported reduced yields in their farms and only 5% indicated that there was no effect at all. In addition to these findings, further analysis on the relationship between

relocation of people and food production was presented as shown in Table 22. Scores on relocation were correlated with those on food production based on the views from the resident respondents.

Table 22: Correlation between relocation and food production

		Relocation	Food Production
Relocation	Pearson Correlation	1	-.657**
	Sig. (2-tailed)		.000
	N	370	370
Food Production	Pearson Correlation	-.657**	1
	Sig. (2-tailed)	.000	
	N	370	370

**. Correlation is significant at the 0.01 level (2-tailed).

Table 22 presents the findings on the relationship between relocation of population and food production. From the findings, Pearson Product moment correlation indicated a moderate negative significant correlation between relocation of population and food production (r=-.657, p=.000). This implies that food production is associated with relocation of people such that the more the people are relocated due to sugar cane farming, the less the food is produced.

Simple linear regression model was thus carried out in order to establish the effect of relocation on food production. This was carried out since the two variables were negatively correlated and therefore to the core of the objective, a conclusion could be reached after regressing food production on relocation of population to finding how relocation contributed to food production using standardized coefficients. The summary findings on the percentage change in food production due to relocation are presented in table 23 as shown.

Table 23: Summary model on effect of relocation on food production

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.657[a]	.432	.430	.79556	.432	275.279	1	362	.000

a. Predictors: (Constant), relocation

Table 23 presents the findings on the overall variance in food production accounted for by relocation of population. First, the findings shows that there is a correlation between relocation and food production (R=.657), a value which when squared, yielded an R square value of 0.432. This means that land relocation accounted for 43.2% change in food production (R square=.432, p=.000). These findings further implies that out of the 100% expected change in food production due to various variables relevant, if these variables are not included in the model, relocation accounted for 43.2%. The remaining percentage could be accounted for by other variables not specified in the model. Furthermore, the model indicates that the results are significant, (F(1,362)=275.279, p=.000). The F value is large implying that it was not by chance but rather as a result of fitting the model. This also implies that the relationship between relocation and food production was not equal to zero, but the choice of the variable qualified significant results. It can thus be deduced that relocation accounted for a significant percentage change in food production.

Results on the effect or contribution of relocation on food production are also presented as shown in table 24 that follows.

Table 24: Model coefficient effect of relocation on food production

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.971	.134		7.225	.000
	mean consumer attitude	-.624	.038	-.657	-16.592	.000
a. Dependent Variable: relocation						

The model in table 24 shows that population relocation uniquely contributed to food production (β=.657, p=.000) using standardized coefficients. This implies that relocation is negatively associated with food production and contributes to low food production. The findings are also significant as indicated by t(379)=16.592 at a p value less than 0.05, which is p=.000. This further implies that the results are not by chance but purely as a result of fitting the model. Examining the unstandardized coefficients, the findings brought out clearly shows that in the event that relocation of people was not included in the model, there was a constant of 0.971 that shows that there would still be some change or reduction in food production.

The above analysis is echoed by observations made during in-depth interviews where an assistant chief from North Sakwa location opined that;

> *Though not many households have been affected by relocation, a number of the ones that have been affected have moved into nearby towns and taken up trading and artisanship, those opting for the countryside purchase smaller unproductive parcels and experience reduced employment in the farms which has led to low food production. Those left to work in cash crop farms are few and unable to manage meaningful food production. In most cases the age group that is prone to relocation is the younger generation. The old generation rarely sells out their land.*

The relocation of people particularly the youth moving away from their ancestral land to settle elsewhere, may affect the households negatively especially their economic coping capacities as observed by Omwoyo & Kisovi (2009) that during their adult life a man should be able to contribute positively to the environment and food production of their area by seeking ways of diversifying their incomes within their areas of settlement. This view is stressed by Ngugiet al. (2013) when he states that the area in which a person is born or lives can determine the level of access to opportunities like education and employment because income and education can influence settlement patterns, food production and also livelihood diversification which can be an effective coping strategy for relocated people. The study area has had a number of its inhabitants settling in nearby towns and markets hence face challenges common in such areas. It has also been postulated that the household's vulnerability to low food production and dietary inadequacy may be increased, particularly when household food outsourcing does not change much even in response to swelling of population in towns regardless of whether there is higher household income (Nyamboga et al., 2014).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1. Summary

This study sought to analyse three objectives namely; to determine the extent of expansion of land use for sugarcane production, to assess the effects of land use change on food production and lastly to establish effects of relocation occasioned by sugarcane farming on food production in Dede Division, Migori County. In summary the following were the findings; to gauge the extent of expansion of land use for sugarcane production, households who had given land to their heirs were asked to identify which cash crop they produced between Sugarcane, Coffee and Tobacco. It came out that 70.3% cultivated commercial sugarcane compared to coffee and tobacco which were at 17.0% and 12.7% respectively. The results were also run on a Pearson chi-square test and the results showed that there was a high probability that the expansion in land size under a particular crop was affected by the type of crop grown. These results were corroborated by information obtained from key informants. This study therefore concluded that the allure of possible comfort to be derived from income generated through sugarcane production has contributed to the increased expansion of the area dedicated to it as a cash crop.

Before the acceleration in expansion of area under sugarcane, maize, which is a major staple food in the study area had 27.1% of the land area on average per household set aside for its cultivation, however, when sugarcane was commercialized, the size of acreage set aside for maize reduced by more than half to 12.3%. The rest of the food crops also had the amount of acreage set aside for their cultivation drastically reduced. It should also be noted that area under sugarcane expanded from 0.1acres (0.6%) to 9.5 acres (61.2%) this resulted in increase of output

of sugarcane from 0.20 tons (1.8%) to 270 tons (97.8%). This study therefore revealed that sugarcane farming has taken more than half of the total land area in the study area at the expense of food crops.

On effects of land use change on food production, the study revealed that the role of women in food production has gained prominence. Food crops under the ownership of the female spouses are apportioned 3.6 acres of the household land while cash crops under the ownership of the male spouse are given 8.2 acres. Such changes in roles have led to low food production. In general, this study has revealed that acreage of land under food crop production has gone down. The main factor influencing these changes is sugarcane, Maize had an average of 4.2 acres being dedicated to it before commercialization of sugarcane and produced an average of 3.6 tons, currently, maize has an average of 1.6 acres of land dedicated to its production which has reduced to 1.17 tons per acre. This study also revealed that the food crops harvested by the majority (81.1%) of the households lasted between 5 to 6 months before expansion of land under commercial sugarcane, 3% of the households harvested food lasting 1 to 2 months, 2.7% of the households harvested food lasting over 6 months and most importantly none (0%) harvested food lasting less than one month. However, after expansion of land under commercial sugarcane, things changed and 16.8% of the households now harvested food that could not last even a month, 57.8% of the households harvested food that lasted between 1 to 2 months, 21.6% of the households harvested food lasting 3-4 months, 2.7% of the households harvested food lasting 5-6 months and none of the households (0%) now harvested food that lasted over 6 months. Though some non-governmental organizations like ‘Njaa Marufuku’ initiative, in an effort to prop up food production have intervened. Their impact, lacking goodwill from both the national and county governments, are minimal. The study therefore concluded that changes in land use is

responsible for the reduction in acreages under food crops which have in turn led to low food production within the study area.

To establish the effects of relocation occasioned by sugarcane farming on food production in Dede Division, Migori County, data collected during the research showed that out of the 123 people who had moved away from their original lands, 81.3% were relocated by Sony Sugar Company. Before they were relocated, the respondents used to produce 1.98 tons ofmaize which accounts for 23.3% of the total produce, 1.35 tons of beans (16%), cassava.99 tons (11.7%), millet.81 tons (9.6%) and .54 tons of sweet potatoes (6.4%)on their farms. However, after relocation, their farming fortunes have dwindled and currently they can only manage to produce .90 tons of maize which now represents 10.6% of the total food produce, .72 tons of beans (8.5%),cassava .54 tons representing 6.4%, millets.36 tons (4.3%) and .27 tons of sweet potatoes (3.2%) on their farms. Most households perceived relocation in a negative way. They argued that relocation reduced farm employment in the household establishment. They also viewed relocation negatively since it led to low food production in the area (Figure 3). This showed that as more household members are relocated, the ability and desire to grow food crops reduce considerably. Therefore population relocation resulting from sugarcane farming was found mainly to be detrimental to the household food production within the area under study.

5.2. Conclusion

In view of the findings of this research, the following conclusions can be arrived at; in terms of the extent of expansion of land use for sugarcane production, the phenomenal increase in acreage of land area under commercial sugarcane has led to increase in sugarcane output, this increase in output has not necessarily translated into adequate food to the household. Consequently this study has demonstrated that the expansion of sugarcane growing has led to constriction of land

available for food crop production as the cash crop is given more land and attention at the expense of other activities. Some respondents, especially those who reached upper primary have moved to nearby towns and have turned to trade, artisanship and casual employment as a coping strategy to sustain their families.

The land available for food crop farming has become progressively smaller; this is a major effect of land use change. This comes out when changes inland use and ownership is put in perspective, the dominance of males in land allocation compromises food production in households as he apportions the best land to cash crops. This study therefore concluded thatthe competition between cash crops and food crops for land, with sugarcane(a cash crop) receiving higher priority in terms of acreage allocated to it, has led to low food production by the affected households. The nature of land use has changed to majorly growing ‘sukuma wiki’ in the resultant small farms for those near rivers (Plate 2). Those away from the rivers have turned to growing of sweet potatoes and dry-land rice which do not require large tracts of land through the interventions of some nongovernmental organizations such as ‘Njaa Marufuku’.

Relocation in the area was occasioned by the arrival of Sony Sugar factory and the inevitable expansion of the nuclear sugarcane farms, in most instances, the relocations led to reduction of farm employment and reduced farm yields, especially when part of ahousehold in a large clan were relocated leaving behind fewer members. Apart from settling in clusters, due to the smaller alternative parcels, some have settled in the small markets resulting into their expansion. The study therefore further concluded that apart from development of towns, the relocation of household members has led to a reduction in their capacity to produce their own food from their farms.

5.3. Recommendations

1. The National Government should institute measures to ensure that households with one acre of land and below should only use a quarter of it for sugarcane growing. This can be done through proper legislation of laws governing land inheritance, lease and disposal.
2. Efforts of Non-Governmental Organisations already on the ground such as 'Njaa Marufuku' should be strengthened through tax concessions and government subsidies as they hold the key to improvement of food production. The strengthening of such initiatives should form a major focus since the benefits of dry land rice can be threefold; it is basically a food crop but can at times be a cash crop, it requires a smaller piece of land.
3. Both the National Government and the County Governments to institute measures to ensure that small and medium enterprises are encouraged by setting aside land in small towns and markets to enable establishment of Jua Kali sheds for village artisans. The Markets may promote small traders like hawkers to enable those relocated and without adequate land for farming make a living.

5.4. Suggestions for further research

1. The Government of Kenya owns majority of shares in Sony Sugar Company in Migori County while Sukari Sugar Industry in the neighbouring Homabay County is wholly private. From the small holder point of view, there is need to do a comparative study on the standards of living of small scale farmers contracted under the two firms. This can inform on the ongoing debate on privatisation of the sugar factories in the Country.
2. Some Non Governmental organisations (NGO's) have been instrumental in alleviating food insecurity in different parts of Kenya. In the study area, Njaa marufuku is operational. This opens a field for research on the impact of NGO's in improvement of food production in sugarcane growing areas.
3. Development induced relocations by Sony sugar factory led to more settlement of people in nearby towns. There is need for a socio-economic study on urbanization resulting from displacement by sugar farms.

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APPENDICES

Appendix I. Krejcie & Morgan's Table for Determining Sample Size for a Given Population

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note:-
'N' is population size.

'S' is sample size.

Source: Krejcie and Morgan, 1970

Appendix II. Questionnaire

Effects of sugar cane farming on food production in Dede Division

Hello:

I am a Master of Arts student at Maseno University, conducting a research on **Effects of sugar cane farming on food production in Dede Division** as a partial fulfillment of the requirements for the award of the degree of Master of Arts in Project Planning and Management. You are kindly requested to respond to this questionnaire in the best way possible. Information from this research will help to develop a comprehensive understanding of the subject matter, advice stakeholders and form basis for further research.

Your responses will remain confidential and will only be used for analysis and evaluation.

Thank you for your assistance.

Respondent's name _____

Division _____

Location _____

Sub-location _____

Village _____

Consent from the Respondent: Sign _____

Questionnaire No._____ Dat _____

1. Can you please tell me the first names of all the members of your household who usually live here, sleep here and eat from the same source, including yourself? Please include all members except temporary visitors. Names are only used in the interview and will not be related to data in the report.

(After the name, continue with other questions about each individual. The questions should be directed to the person who is most knowledgeable about the household members.)

2.		3.	4.	5.	6.	7.	8.
Member Number	**What is the first name of each member?**	**What is the gender of (name)?** 1.Male 2.Female	**How is (name) related to household head** 1.Head 2.Spouse 3.Child ≥5years 4.Child <5 years 5.Grandchild 6.Relative 7.Other (specify)	**What is the age of (name)?** Yrs/ mon	**Is (name) currently enrolled in school?** 1.Yes 2.No	**What is the highest level of education completed by (name)?** 1. Never gone to school 2. Lower primary 3. Upper primary 4.Secondary 5.Post-secondary training	**What is the occupation of (name)?** 1. Farming 2. Trading 3. Artisan 4. Wage employment 5. Salaried employment 6. Student 7. Does nothing 8. Other(specify)
1				/			
2				/			
3				/			
4				/			
5				/			
6				/			
7				/			
8				/			
9				/			
10				/			
11				/			
12				/			

9. What is the household's main source of livelihood?

Crop farming	1
Livestock farming	2
Trading	3
Artisan	4
Wage employment	5
Salaried employment	6

10. State other sources of financial support to the family (*multiple responses permitted*). ***(If None, go to Q 12)***

Source of Financial Support	1. Yes	2. No
None		
Children		
Relatives		
Friends		
Community Based Organization (CBO)		
Non- governmental Organizations (NGO)		
County Government of Migori		
Government of Kenya		
Others (Specify)		

11. Approximate the total amount of external financial support per month (Ksh.) ***(if any)***

<1000	1000-2000	2000-3000	3000-4000	4000-5000	>5000
1	2	3	4	5	6

12. Expenditure per month (Ksh.)

S.No.	Expense	Estimated amount (Ksh.)
1	Food	
2	Education	
3	Health	
4	Clothing	
5	Rent	
6	Fuel	
7	Electricity	
8	Water	
9	Transport	
10	Others(specify)	

13. What was the approximate size of land owned by your family before commercialization of sugarcane farming?

Less than 5 acres	1
Between 5 to 10 acres	2
More than 10 acres	3
Don't know	4

14. Do you own the crops grown in this parcel of land?

1. Male spouse. 2. Female spouse. 3. Both

15. How did you acquire the land?

Through inheritance	1
Through buying	2
Other (specify)	3

16. Have you ever subdivided your land?

1. Yes 2. No ***(if no go to Q 18)***

17. If you have ever given land to an heir, what is the preferred cash crop?

Sugarcane	1
Coffee	2
Tobacco	3

18. What size of your land in acres do you dedicate to the following?

Cash crops		1
Food crops		2
Housing		3
Livestock		4

19. Why is your total land parcel small?

Subsequent subdivision of limited land to siblings	1
Sold out some parcel	2
Inherited a small piece from my parent	3
Other (specify)	4

20. Do you grow sugarcane?

1. Yes 2. No

21. What size of your farm did you dedicate to the following crops before and after commercialization of sugarcane?

What is the type of crop grown?	What is the size of land for crop now?	What was the size before commercialization sugarcane?	What was the yield before commercialization of sugarcane?	What is the yield now?
Sugarcane				
Tobacco				
Coffee				
Maize				
Beans				
Cassava				
Millet/Sorghum				
Sweet Potatoes				
Others				

22. Do you use fertilizer or manure in your farm?

    i. Yes 2. No

23. How do you spend the cash from the proceeds of your farm per year?

S.No.	Expense	Estimated amount (Ksh.)
1	Food	
2	Education	
3	Health	
4	Clothing	
5	Rent	
6	Fuel	
7	Electricity	
8	Water	
9	Transport	
10	Development	
11	Others(specify)	

24. If to buy food in **Q 24**, how long does that food normally last in months?

<1 month	1-2 months	3-4 months	5-6 months	>6 months	Until the next season of the cash crop	Never harvested in the last season
1	2	3	4	5	6	7

25. Do you grow any food crop?

i. Yes 2. No

26. What yield did you realize from your farm for the following food crops?

	What is the type of crop grown on your land?	What is the size of land for (crop)? *(Acres)*	What yield was realized in last season? (*specify units*)	What was the average income per annum before introduction of sugarcane	What is the average income per annum after introduction of sugarcane
1	Bananas				
2	Maize				
3	Millet				
4	Cassava				
5	Sweet Potatoes				
6	Groundnuts				
7	Beans				
8	Sugarcane				
9	Tobacco				

22. Have you leased out part of your land?

1. Yes 2. No ***(if no go to Q 35)***

23. Why did you lease out part of your land?

To get money	1
Lack of necessary farm inputs to work on it	2
Low fertility	3
It was far from home and difficult to reach	4
Of non-desirable quality (muddy, stony e.t.c.)	5
Other (specify)	6

24. How long did the harvest from your farm last this family in months before and after expansion of the area under sugarcane?

(a) Before

<1 month	1-2 months	3-4 months	5-6 months	>6 months	Until the next season of the cash crop	Never harvested in the last season
1	2	3	4	5	6	7

(b) After

<1 month	1-2 months	3-4 months	5-6 months	>6 months	Until the next season of the cash crop	Never harvested in the last season
1	2	3	4	5	6	7

27. Indicate the quantity your household used to harvest before and after relocation

Crop		Harvest before relocation	Harvest after relocation
Maize	1		
Beans	2		
Millet/sorghum	3		
Cassava	4		
Sweet potatoes	5		

28. Do they remit some money back home?

1. Yes 2. No

29. What is the main cause of relocation in your area?

Has leased out all his/her land	1
Has sold his/her land	2
Was relocated by Sony Sugar Company	3
Other reasons(specify)	4

30. How has relocation impacted on food availability?

Reduced farm labour employment	1
Decreased farm yield	2
No effect	3

Appendix III. Key Informants Interview (KII) Guide

Chiefs/Assistant chiefs

1. Roughly estimate the following;
    - The number of individual households who have leased their land to other sugarcane farmers.
    - The number of individual households who have sold their land.
    - The number of individual households who have sold their land and migrated elsewhere.
    - The number of individual households growing sugarcane in your area of jurisdiction.
    - The number of households who have settled into your area of jurisdiction in recent years.
2. Comment on the following in your area:
    - Typical family diet
    - Level of education
    - Level of infrastructure
    - Cases of children not going to school.
    - Ways in which farmers in your area spend the money earned from sugarcane sales.
    - The pros and cons of sugarcane farming in this area.
    - Food production situation in your area.
    - The standards of living in your area.

- The parameters that you would give as indicators that the standards of living in this area are high.

3. Suggest what you would give to the County Government so as to further uplift the standards of living in this area.
4. Suggest what points you would include in a memoranda to be taken to the chief executive officer of Sony Sugar Company with regards to benefits of the factory to the farmers in your area.
5. Make a wish list to your area Member of Parliament on what you think might help sugarcane farmers in Dede Division.

Sub-County Agricultural officers

1. Comment on the food production situation in this District.
2. Comment on length of time the harvested food lasts.
3. Give an overview of the food production situation in Dede Division.
4. Mention some areas in which the County Government or the Central Government is trying to come in to help the local farmers.
5. Give the farmers some advice on the best land use tactics they can employ to utilize their land for both cash crop and food crop farming.

KESREF officials at Opapo Sugar Research station

1. Suggest the sugarcane variety that gives the highest tonnage and the highest sucrose content at the same time.
2. Variety of sugarcane most suited for Dede Division with regard to its soil type.
3. Some of the best sugarcane farm practices that leads to good harvest of the crop.

Sony Sugar/Sukari/Transmara Company Agriculture Department Officials

Comment on the following;

1. The major variety of sugarcane grown by the farmers in Dede Division.
2. The average tonnage of sugarcane produced by the farmers in the area served by the factory.
3. How Sony assist the average farmer financially to realize good harvests.
4. Technical advice the department gives to the farmers.
5. Effect of advice on the overall produce of the farmers.
6. Compensation of the land owners for their lands.

Appendix IV. Observation Checklist

a) Type of sugarcane grown
- 1 CO N14
- 2 CO 945
- 3 CBO
- 4 Others (specify)

b) Types of animals kept
- 1 Dairy Cows
- 2 Bulls
- 3 Others (specify)

c) What is the type walling for the household dwelling?
- 1 Dressed in stones/ bricks/blocks
- 2 Iron sheets
- 3 Mud/dung
- 4 Cement/Semi permanent
- 5 Others (specify)

d) Sugarcane farming and associated activities.
- 1 Cane harvesting
- 2 cane weeding
- 3 intercropping

e) The various categories of farms.
- 1 Freshly planted cane
- 2 Ratoon
- 3 Maize

f) Cash crops grown.
- 1 Coffee
- 2 Tobacco

g) Assess the source of water.
- 1 Underground water
- 2 Harvested rainwater
- 3 Piped water
- 4 River/Stream
- 4 A combination of the above (specify)

h) Availability of sanitation in the household.
- 1 Ordinary pit latrine

2 Ventilated improved pit latrine