Population and Food Security in Kenya: An Application of Spectrum Model

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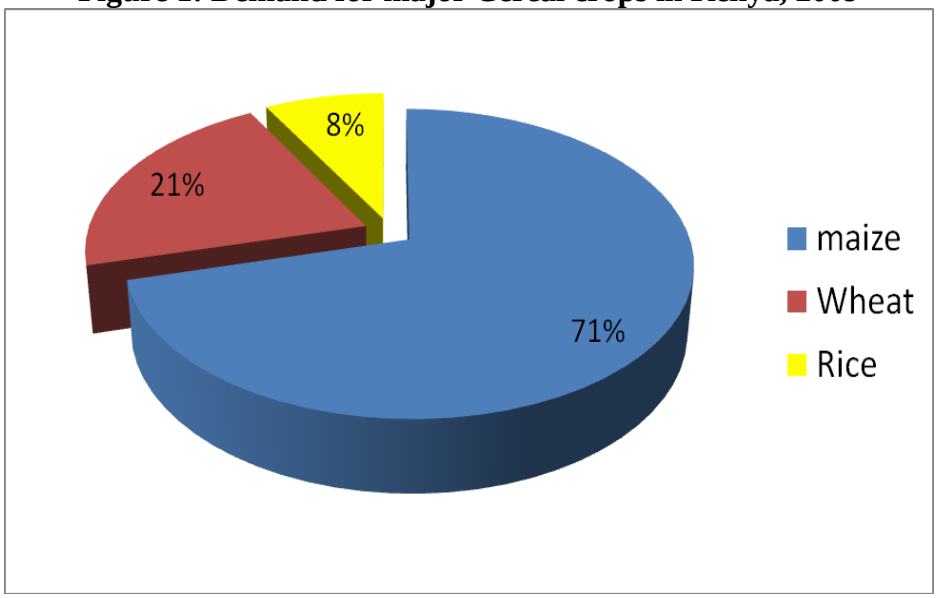
Abstract

The current size and pace of growth of the human population of about 2.9 percent growth per annum remain unprecedented. This paper considers what we know about the relationship between population and food security and what population projections suggest would be the case over the next half century in Kenya if the status quo in production of cereals as represented by maize which is the main staple food remained unchanged. This project demonstrates the relationship among population growth and food security in Kenya using the Spectrum Model. Despite difficulties in predicting the exact constraints or possibilities that may determine future population trends, the study using Spectrum Model, demonstrates how population projections could help the dialogue about the present and future challenges of food security as measured by the demand of major cereal crops. The paper make policy and programmatic recommendations that would help avert future food insecurity

Introduction

The current size and pace of growth of the human population of about 2.9 percent growth per annum remain unprecedented. This paper considered what we know about the relationship between population and food security and what population projections suggested would be the case over the next half century in Kenya if the status quo in production of cereals as represented by maize which is the main source of livelihood remained unchanged (see figure 1 on the demand of cereals in the Kenya).. While we may not predict the constraints or possibilities that will determine future population trends; however population projections allow us to talk about the present and to appreciate the challenges of the future. The number of people to be fed in a population is determined by three possible flows which include people entering or leaving a population through birth, death and migration.

Figure 1: Demand for major Cereal crops in Kenya, 2009



Source: Department of Land and Crops Development and Management, 2010;NCPB, 2009;Statistical Abstract

Demographers make projections under strong and conservative assumptions of a constant situation. Population projections are estimated on the basis of the basic components of population growth remaining constant. While the assumptions are necessary for projections, the population forecasts are based on anticipated changes in the basic components of population growth. In the situation of no change, the population growth in Sub-Saharan African nations will

continue to contribute to environmental degradation especially in situations where land holdings have become smaller and smaller. In the situation of positive changes such as declines in fertility, improved access to safe and nutritious food, increasing education, and land reform, population growth may not be a significant problem for food security.

The relationship between population, food security, the environment, and natural resources is well documented (Lutz et al. 2002; Zuberi and Kevin, 2011). Three crucial processes produce food insecurity: (1) food stocks--determined by the domestic production of food, and the capacity to import food for the population; (2) access to food—determined by the level of poverty and transportation and distribution systems within a given area; and (3) nutritional adequacy (Zuberi and Kevin, 2011). A food-insecure situation exists when necessary food stocks are not available to the population; and when there is insufficient access to food for the population to maintain consumption at adequate nutritional levels to maintain an active life style. Procuring adequate stocks of food and making them accessible to the population in need results in food security.

In this paper, population projections helped us understand how current food insecurity may impact future populations. A key dimension of food insecurity is population undernourishment and remains a persistent problem in regions like sub-Saharan Africa (FAO 2009). According to the United Nations sub-Saharan African nations though with a lot of variations have the highest percentage of people suffering from undernourishment (UN 2009). Estimates suggested that the population in sub-Saharan Africa suffering from hunger increased between 1990 and 2008 (FAO 2009) and approximately 30% of its population in the region is undernourished. In fact, the current state of undernourishment in sub-Saharan Africa is worse compared to other regions of the world in the recent past (UN 2009). This situation in sub-Saharan Africa is further compounded by the projected growth of the African population relative to the rest of the world (Population Division ESA/UN 2011). In short, subjected also with the youthfulness of its population like in countries like Kenya, Africa will continuously have a larger percentage of the world's population to feed. What this means is that Africa will be in an increasingly greater need of the total food production in the world in order to sustain its food security.

Rationale

Over the years, the Kenya Government has strived to achieve national, household and individual food security. This is evidenced by several development strategies and policies that have been prepared and launched to steer the development of the agricultural sector in the country. Being the mainstay of Kenya's economy agriculture accounts for approximately 27 percent of Kenya's Gross Domestic Product (GDP) and is the main source of livelihoods for about 80 percent of the population in rural areas (MoA, 2009). Kenya's Vision 2030 aims to achieve a 10 per cent per annum economic growth, with agriculture and allied sectors expected to be the main drivers of this growth through promotion of an innovative, commercially oriented and modern agriculture (GoK, 2007). Therefore, it is important to assess the feasibility of achieving this growth rate because agriculture is constrained by a number of factors of which, supply and demand constraints are crucial ones. The imbalance between production and demand impacts food security, which calls for policy interventions and planning to tackle the situation in future.

Maize and Food Security in Kenya

Since independence, the government has concentrated on policies aimed at enhancing maize production to boost the country's food security. For many years food security was equated to self-sufficiency in maize production. Maize is the main staple food in Kenya for a large proportion of the population in both urban and rural areas. Maize consumption is estimated at 98 kilograms per person per year, which translates to roughly 30 to 34 million bags (2.7 to 3.1 million metric tons) per year. Maize is also important in Kenya's crop production patterns, accounting for roughly 28 percent of gross farm output from the small-scale farming sector (Jayne et al., 2001). However, there has been a fluctuating trend in maize production over the last decade, which threatens household food security and income sources.

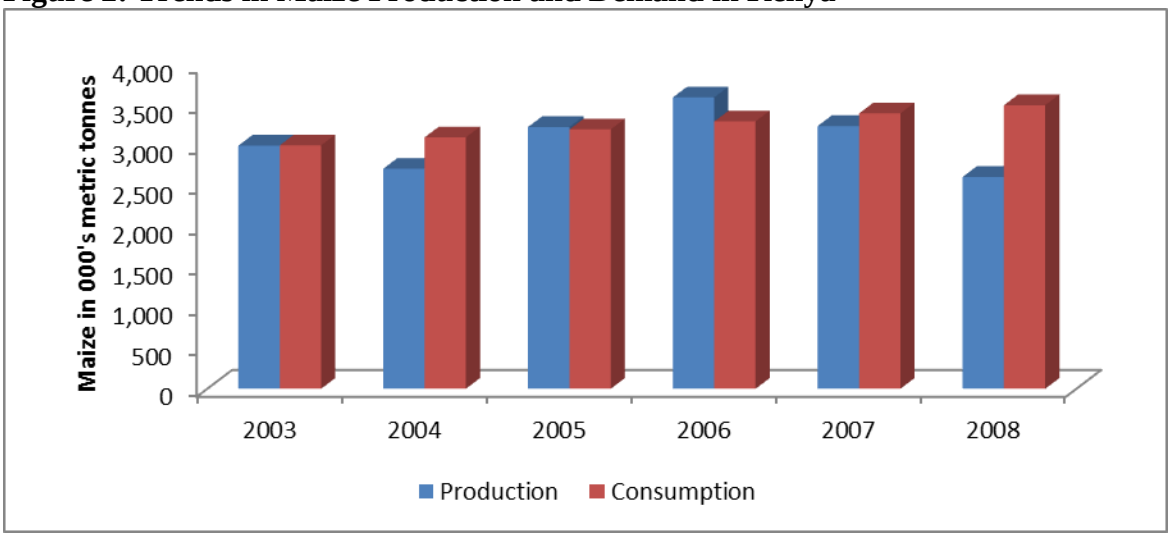
Moreover, statistics show that growth in maize production has been marginal averaging about 2 percent. This is lower than the population growth rate which stands at about 1-2 percent. If the country is to achieve self-sufficiency, domestic maize production has to grow at a rate of 4 percent Low self-sufficiency has been attributed to lack of productivity enhancing technologies, high incidence of pests and diseases, erratic climatic conditions and difficulty in credit (Nyoro et al., 2007). As a result, on-farm yields are low averaging 1.5–2.6 tonnes per hectare compared to

on-station yields of about 5–8 tonnes per hectare. In the last one decade, the country has experienced years of heightened food insecurity and dependence on imports and emergency humanitarian assistance. In 2009, Kenya imported 16.8 million bags of maize (GoK, 2010).

Trends in Maize Production and Consumption

Maize demand in the country has been on the increase outstripping supply. For instance, in 2008 maize production stood at 2.4 million metric tonnes (26 million bags) against a national requirement of 3.1 million tonnes (34 million bags) (Figure 2). Based on the prevailing growth rate, it is projected that Kenya will have a maize deficit of 1.2 million metric tonnes by 2020 (Nyoro et al., 2007). Increased reliance on imports implies that the foreign exchange reserves and resources earmarked for development is diverted to procurement of food. The graph below compares production and consumption trends over the years.

Figure 2: Trends in Maize Production and Demand in Kenya



METHODOLOGY

Spectrum Model Rapid

Rapid is a socio-economic model within spectrum for projecting social and economic indicators for countries or regions (Health Policy Initiative, Task Order I, page 5). The model combines economic indicators such as labor force participation rates, the primary enrollment rate, etc. with population projections initially created from Dem Project model to project the future requirements of the indicators. The projection into the future can be done as far as 50 years. The projections can then be used as the basis of policy presentations to stimulate policy dialogue about the importance of population factors to social and economic development. Such presentations are usually intended to increase policy makers' awareness of population factors in order to improve the policy environment for effective population program. In this study, climate change is assumed in the modeling due to limitation of data to incorporate in the model

Agricultural Projections

Agriculture is the key economic sector in many developing countries since it provides a significant proportion of the economy's employment, food, and export earnings (World Bank, 2008). In countries with abundant land and few urban centers, rapid population simply leads to more land under cultivation. However, when land is scarce and a significant proportion of the population lives in cities, then rapid population growth raises the dual problem of less land per capita for food production and more people to feed. Improvements in technology and management can raise yields and lead to increases in the amount of food produced even if the amount of arable land is shrinking and it takes time to develop and implement new technologies.

Rapid population growth may make it difficult to adopt new technology that will keep up with rising demand for food. In addition, as the intensity of cultivation increases, environmental problems may arise from the clearing of new lands for cultivation, from heavy fertilizer use, and from intensive irrigation. The RAPID model addresses these issues by projecting the amount of arable land per capita in the future and the demand and supply of certain key crops. These indicators are intended to illustrate the pressures created by rapid population growth in the agriculture sector.

Equations

The following formulas are based on the RAPID-Computer Programs for Examining the Socioeconomic Impacts of Population Growth developed by Health Policy project, Task Order 1

1. Arable Land per Capita: Description and Methodology: The amount of arable land available per capita is projected by dividing the total arable land area by the total population. This indicator is useful in demonstrating how the amount of land supporting each person (or family) will be reduced in the future (i.e., as the population grows and the amount of arable land remains relatively constant, the parcels of land available to support each person or family will become smaller).

Equation:

$\text{Arable Land per Capita}_t = \text{Arable Land}_t / \text{TotaI Pop}_t$,

Where:

Arable Land per Capita (t) = amount of arable land available per capita in time (t)

Arable Land = total amount of arable land in time (t)

Total Population (t) = total population in time (t).

Input and Sources:

Total Arable Land

The future amount of total arable land usually remains constant. It can, however, be changed to reflect a country's development plans or to reflect changes brought about by nature (e.g., increases in arable land through irrigation. schemes, or reductions in arable land due to desertification). Setting future assumptions to reflect national goals is useful in demonstrating the difficulty in maintaining current arable land per capita ratios with continued high rates of population growth.

Total population projection

The Dem Project module supplies this variable.

2. Consumption of Major Crop

The total annual consumption of a country's major crop is projected by multiplying the average annual per capita consumption of that crop by the total population for each year of the projection. This indicator is useful in demonstrating how food production and/or food imports will have to increase in direct proportion to increases in the population. Basic staple crops, such as rice or maize, are usually considered in this analysis.

Equation:

Major Crop Consumption 1 = Consumption Per Capita (t). Total Population t,

Where:

Major Crop Consumption (t) = total annual consumption of major crop in time (t)

Consumption per Capita = per capita consumption of major crop in time t

Total Population (t) = total population in time t.

Inputs and Sources:

Per capita consumption of major crop

This figure can be taken directly from the National development plan, Statistical year book, FAO year book, or can be estimated by dividing the total consumption (or production +1- imports) of the crop in a year by the total population in that year. The future per capita consumption of the crop can remain constant, or can be changed to reflect increases or decreases in individual income.

Total population projection (The Dem Proj module supplies this variable).

3. Production of Major Crop

The total annual production of the country's major crop is projected by multiplying the total production in the previous year by an exogenously specified growth rate. This indicator is especially useful when combined with the annual consumption of the crop to demonstrate the difficulty of food production maintaining pace with population growth. (Note: The production of the major crop in the base year is entered directly into the model.)

Equation:

Major Crop Prod (t) = Major Crop Prod (t-1) (1 +Prod Growth),

Where:

Major Crop Prod (t) = total annual production of major crop in time t, for I> 1

Prod Growth = annual increase in crop production in time t.

First-year major crop production (t = 1) is simply the production itself without the multiplier for growth.

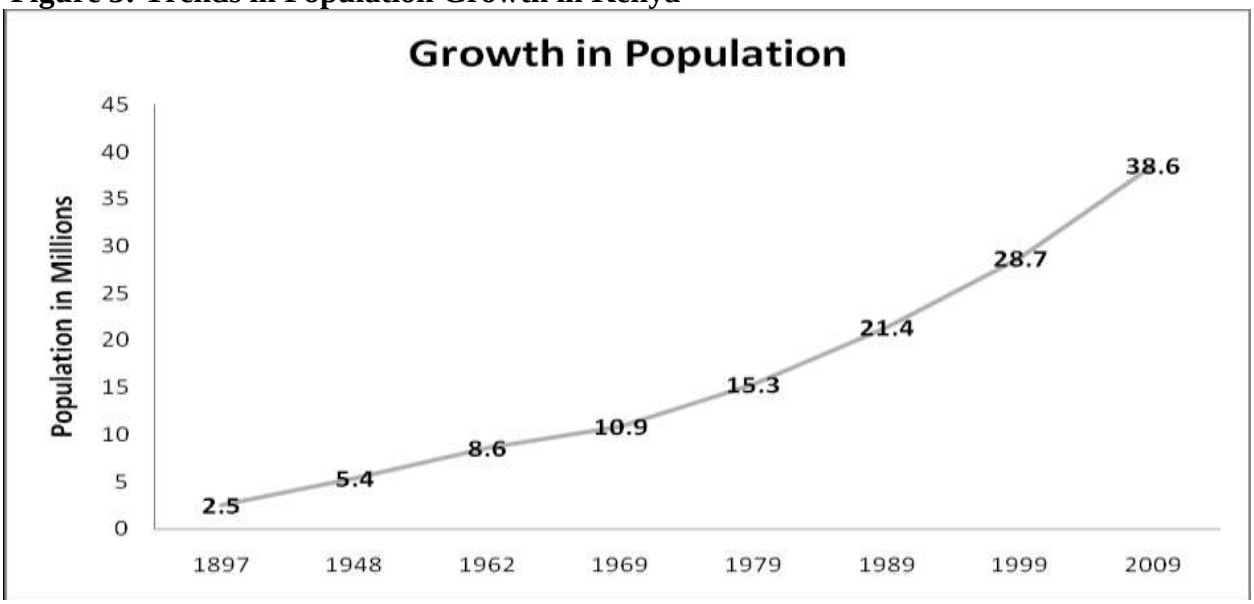
Note: Production of major crop in the base year was obtained from FAO statistical year book

FINDINGS

Population Size and Structure

The population of Kenya has continued to increase exponentially over time. The 2009 Kenya Population and housing Census enumerated a total of 38,610,097million people, representing an increase of about 35 percent from the 1999 census. Kenya Population increased from only 8.6 million persons in 1962 to 10.9 million, 15.3 million, 21.4 million, 28.7 million and 38.6 million persons in 1969, 1979, 1989, 1999 and 2009 respectively (Figure3).

Figure 3: Trends in Population Growth in Kenya



Source: ***GOK 2009 Kenya Population and Housing Census Volume 1C pp.2***

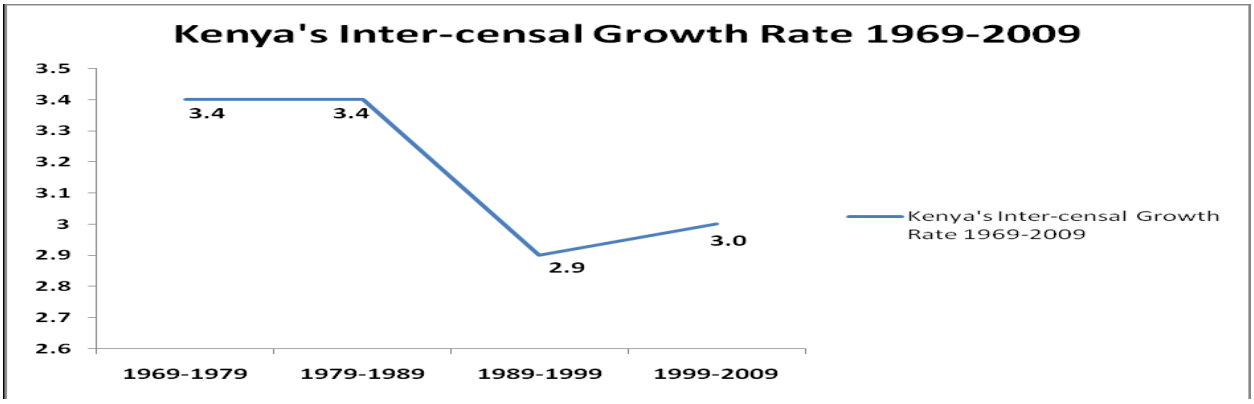
The population is growing at about one Million two hundred thousand persons per year and is currently estimated at about 44.4 million people. Kenya's population has therefore doubled over the last 25 years. The high fertility levels have had greater impact than mortality rates on population size and growth, and have been the driving force behind the rapid population growth and a youthful population structure. Kenya's economy is based on agriculture (employment, food, foreign exchange) hence the growth in population means the shrinking availability of land for people to work. Growing population, scarcer land, low and declining non-farm employment options increases pressure for land. Population growth and finite land suggest a demographic urgency for changes in the way that land is viewed at the national level.

The past and current high fertility rates coupled with improvement in child survival have resulted into a youthful population. The 2009 Kenya population and housing census revealed that about 43 percent of the total population is below age 15. Many females will soon enter their reproductive years and have children within the next decade. The 2009 Census results also revealed that female in the reproductive age (15-49) constituted about 48.3 percent of the total population. This young age structure creates a powerful momentum for future population growth.

Population Growth Rates

The 2009 Census revealed an increase in the Inter-censal population growth rate from 2.9 in 1989-1999 to 3.0 percent in the period 1999-2009. This was the second time an increase in population growth rate is being observed. The 1962 Census results had also confirmed an increase in population growth rate which continued until it reached the peak in 1979 before it started easing off.

Figure 4: Figure 4: Inter-Censal Population Growth Rates 1969-2009



Source: GOK 2009 Kenya Population and Housing Census Volume 1A pp.22

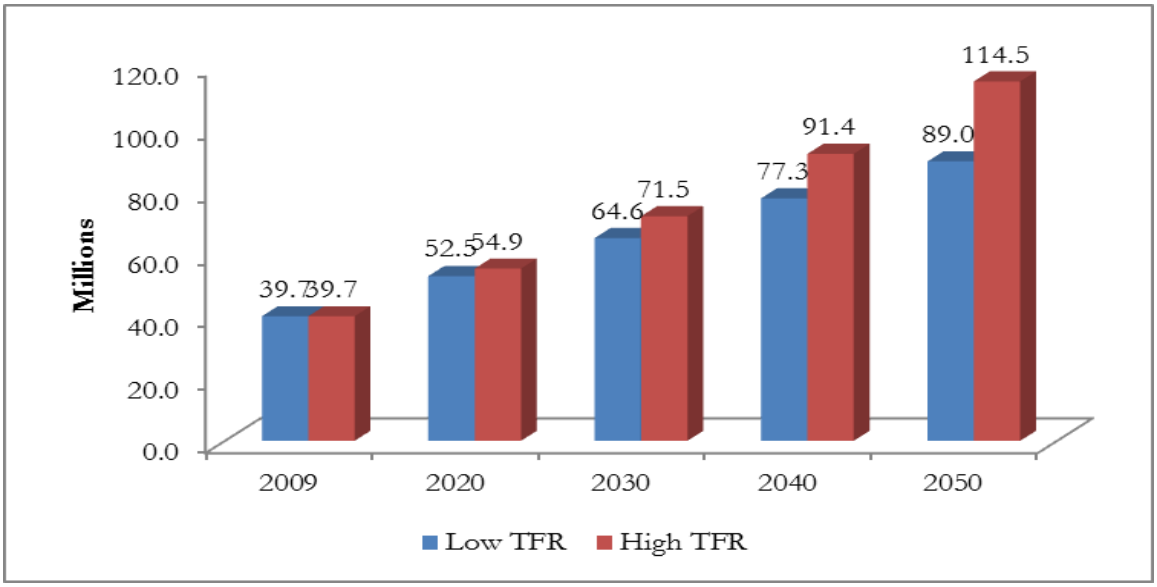
A time series analysis of the census results indicates that the natural rate of population increase accelerated from only 2.5 percent per annum in 1948 to 3.3 and 3.8 per cent in 1962 and 1979 respectively. The growth rate then declined from 3.8 percent per annum in 1979 to 3.3 and 2.8 percent in 1989 and 1999 respectively, before again registering a marginal increase to 2.9 percent in 2009.

The above acceleration in population growth rate between 1948 and 1979 is attributed to increase in fertility levels and decline in maternal mortality, and also to improvement in health especially child nutrition and socio-economic status. The decline in the growth rate in the period 1979 to1999 was mainly due to Kenya entering the demographic transition as fertility declined. The decline in fertility was due to the use of contraceptives. The Kenya experienced a stall in fertility in the 2000s which resulted to the observed marginal increase in population growth rate as reflected by the 2009 census results. This population growth is high considering the prevailing economic growth rates. The rapid population growth and size will therefore be the most important long-term social and economic challenge for Kenya and the realization of Vision 2030 and attainment of early population stabilization

Projected Population

The future population size of Kenya will depend on the nature of future fertility levels. Under high fertility assumptions scenarios, Kenya's population is projected to increase from 38.7 million in 2009 to 71.5 million in 2030 and 114.5 million in 2050 as shown in figure 3. Likewise, under low fertility scenarios, Kenya's population is projected to increase from 38.7 million in 2009 to 64.6 million in 2030 and 89.0 million in 2050 as shown in figure 5.

Figure 5: Projected Population Size in Kenya



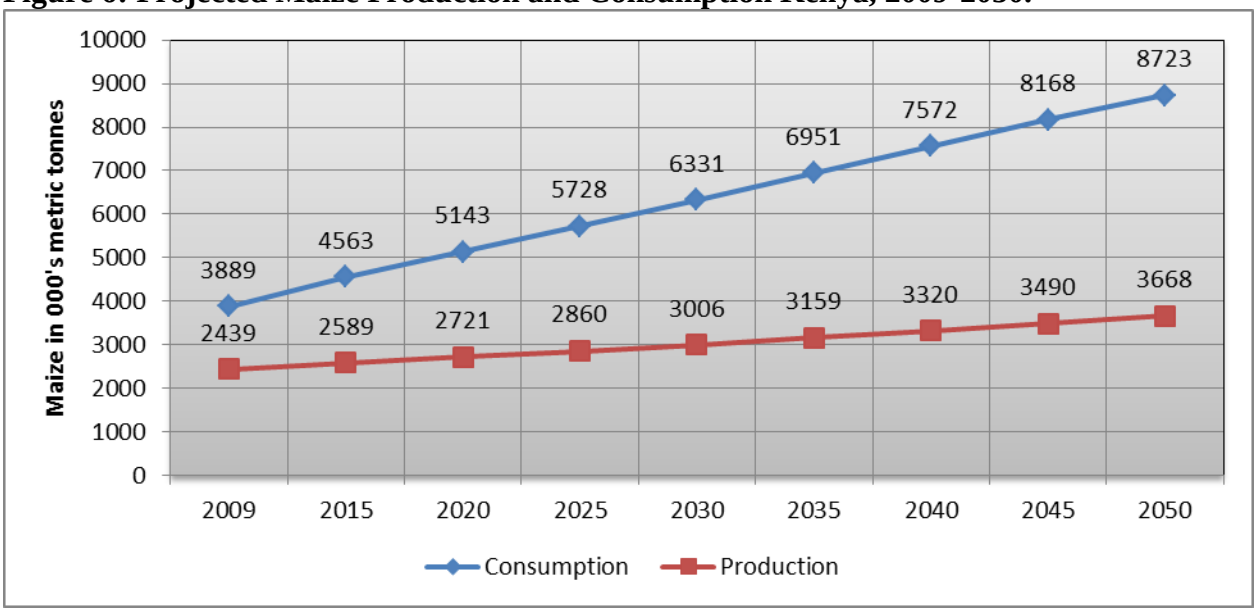
Source: Spectrum using the 2009 Kenya Census

Projected Maize Production and Consumption

Production and Consumption of major cereals (maize) in general are estimated on the basis of assumptions about annual production, growth rate and the average annual per capita consumption of that particular crop and the projected population. Population projections used for consumption projections are given in figure 4 above estimated using Spectrum model population projection (*Dem-project'* module).

Figure 6 have been presented to summarize our projection for maize crop production and consumption in Kenya. It can be observed that maize output has been projected to rise from 2439 thousands metric tons in 2009 to 3668 thousand metric tons. Consumption on the other hand is expected to increase from 3889 thousands MT in 2009 to 8723 thousands MT. The gap between maize production and consumption is expected to widen in the future and this present a great challenge to ensuring future food security.

Figure 6: Projected Maize Production and Consumption Kenya, 2009-2050.



Source: Computed using spectrum

Climate Change, Population Change and Food Security

Climate change studies predict considerable warming of sub-Saharan Africa by 2050. And when temperatures rise by even one single degree Celsius, yields reduce by 65 percent. Global temperatures are expected to rise by two degrees centigrade by 2050. This will have adverse effects on agricultural production; food prices, health and wellbeing with yields of rice, wheat and maize for example, are expected to decline by about 15 per cent, 35 per cent and nine per cent respectively. With crop yields succumbing to water and heat stress, food prices take on an extra significance.

Drought cycles seem to have shortened to every 2-3 years instead of 5-7 years in the past. The effect of climate change and global warming is posing great danger to agricultural productivity. This has been aggravated by population pressure in high potential areas pushing human settlement to water catchment areas and also cultivation of the fragile ASALs (Nyariki D.M., 2007).

Chronology of droughts 1997–2009
January 1997: the Kenyan Government declared a state of national disaster after a severe drought threatened the livelihoods of 2 million people.
December 2000: 4 million people were in need of food aid after Kenya was hit by its worst drought in 37 years.
March-June 2004: the long rains failed and the subsequent crop failure left more than 2.3 million people in need of assistance.
December 2005: President Kibaki declared a 'national catastrophe' in reference to the famine that affected 2.5 million people in northern Kenya.
January 2009: President Kibaki declared drought and famine in the country a national disaster and announced that 10 million people are food insecure and in need of emergency support.

Source: Kandj et al., 2006

Adapting to climate change is a costly affair. The predicted cost in Sub-Saharan Africa as a percentage of the Gross Domestic Product (GDP) is extremely large in comparison to any other global region, mainly because GDP levels are comparatively low. Agriculture sector adaptation costs in the region account for 40 per cent of the total, principally linked to construction of more rural roads (Standard On 15th September). If agricultural productivity could be increased, the region would be less vulnerable and better equipped to meet future climate change challenges.

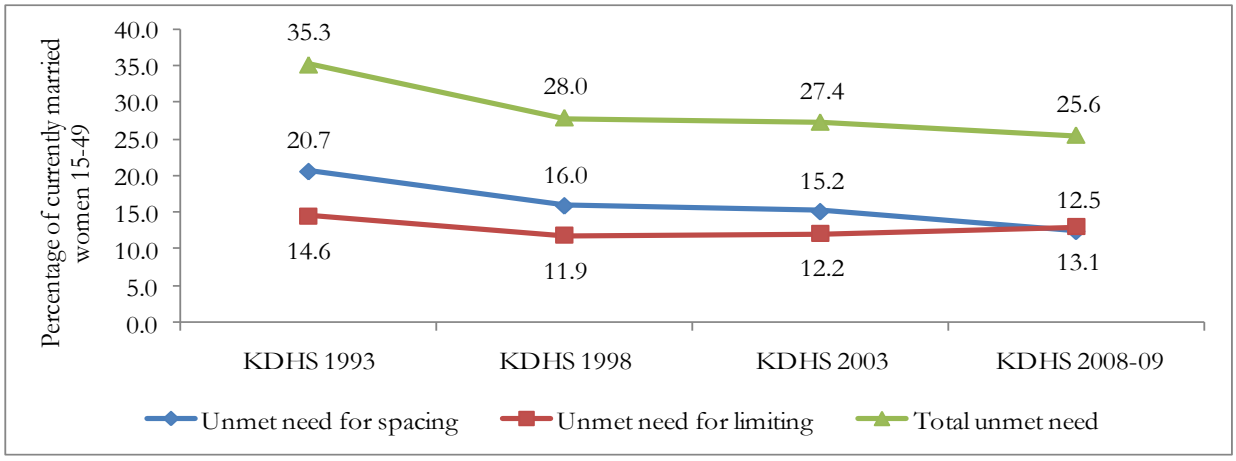
POLICY RESPONSE

Fertility reduction and a lower rate of population growth can be critical to Kenya's ability to achieve its national vision 2030. In this regard, family planning which helps couples voluntarily plan and space births is an important intervention to reduce fertility. According to 2008-09 KDHS, CPR was estimate at 46 percent. However, progress to reduce unmet need for family planning[1] has been slow in Kenya *(Figure 7).* To satisfy unmet need, Kenyan couples who want to space or limit their births need access to a choice of contraceptives consistently available at affordable prices. Public policies and programmes can be adopted to help satisfy unmet need. Political and other leaders, planners, and programme implementers can all contribute. By moving

[1] A woman has unmet need for family planning or contraception if she is fecund, sexually active, and does not want a child for at least two years (spacing) or would want to stop childbearing altogether (limiting) but not using any effective contraceptive methods (Westoff 1988).

to satisfy current unmet need, Kenya will be on track to achieve lower fertility. In the end, good demographic outcomes depend on good policies that empower individuals and couples to make free choices.

Figure 7: Percentage of Currently Married Women aged 15-49 with Unmet Need for Family Planning, Kenya 1993-2008_09



There is an urgent need for investment in agricultural production especially in the production of maize (main staple food among other cereals grown) to avoid food security crisis. The paper recommends public and private sector investments in the agricultural sector and diversification of cereal crops. Also since data shows that demand of other cereal crops like wheat and rice are much lower, targeted campaigns of behavioral change towards foods which are culturally not the norm should be intensified as Kenya works toward near future food security sustenance. Because of the need to slow the acceleration of population growth and given the known benefits of women's education in delaying childbearing and other health outcomes, it will be important to increase investments in women and girls as well as voluntary family planning as essential complements to agriculture and food policy solutions. Finally, since most land mass of Kenya is arid or semi-arid; expansion of irrigation has the potential to make substantial contribution in agricultural advancement for food security.

CONCLUSION

According to best practices a country like Malawi has yielded compelling success stories with the adoption of new technologies that has increased small holder maize production in the last two decades. The diffusion of new technologies in Africa has been more widespread for maize than for other food crops (case of Malawi as an example). This implies that this success could provide lessons for further increasing food production in neighboring countries in sub-Saharan Africa.

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