SOME IMPLICATIONS OF POPULATION GROWTH AND MAIZE PRODUCTION IN KENYA (1980-2000)

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DECLARATION

This is my original work and has not been presented for a degree in any other University.

Dmukasa.

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This thesis has been submitted for examination with my approval as the University Supervisor.

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ABSTRACT

The aim of this study is to investigate the relationship between the demand for maize and its production in the period 1980 to 2000. For this reason, population projections were calculated for a period 1980-2000 to estimate demand for maize for the period under consideration. Some assumptions are made regarding fertility and mortality trends as well as area and yield of land under maize cultivation.

Recommendations will be suggested to ensure enough maize for the population in the future.

Figure 1.1 KENYA ADMINISTRATIVE BOUNDARIES.

Source : National Atlas of Kenya, Survey of Kenya 1970

1.1 Introduction

There has always been a need to balance population and food throughout human history. New developments in agriculture have helped to meet demands of growing population especially in big urban areas of the more developed countries.

In the developing countries, especially in Africa, the situation has been more serious in recent years. The population has been growing rapidly and the countries have been faced with unfavourable conditions of food production such as scarcity of fertilizers and high concentration of population in the more agriculturally productive areas. This has led to the destruction of natural vegetation, soil erosion, low usage of advanced technology such as fertilizers, mechanisation and irrigation.

The low levels of food production have been combined with high rates of population growth thus creating an imbalance in food supply and demand in many African countries.

Kenya is one of the African countries with one of the highest population growth rates. At the same time it has experienced food shortage, maize in particular. Maize has become Kenya's staple food. This study is going to analyze the future trends of population growth and maize production and see if there is potential for an imbalance. The next section is going to focus on the backgorund of Kenya in light of agricultural production and demographic factors.

1.2 Background of the Study Country (KENYA)

Kenya is one of the African countries that have the highest population growth rates.[1] The analysis of the 1969 Population Census data by the Central Bureau of Statistics gave an estimated rate of natural increase of 3.3 per cent.[2] Further, the analysis of the 1979 Population Census data gave an estimated rate of natural increase of 3.9 per cent.[3]

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[1] World Bank: Kenya Economic Memorandum, Annex 1, Agricultural issues, 1981, p.2.

[2] Ominde, S.H.: Population Change and Social Economic Development in East Africa, Population Studies and Research Institute, Nairobi, p.47.

[3] Central Bureau of Statistics: 1979 Population Census (unpublished).

The successful performance of the agricultural sector between 1964 and 1974 has been succeeded by a period of erratic and sometimes negative growth rates.[4] (see Table 1.1).

Table 1.1 Agricultural Production Growth Rates, 1974-1979.

Year	Percent growth from previous year
1974	-
1975	2.9
1976	1.0
1977	9.2
1978	1.4
1979	-0.5

Source: The World Bank: Kenya, Country Economic Memorandum Annex 1, Agricultural issues, 1981, p.2.

Between 1974 and 1979, however, the annual growth rate fluctuated between -0.5 and 9.2 percent. The average rate between 1974 and 1979 was 2.4 percent. This is far below the natural rate of population growth which has risen as mentioned above to about 3.9 percent by 1979.

The good performance in agriculture in the 1960's was attributed to the rapid diffusion of high yielding maize; yield increases for several important crops (coffee, tea, maize and wheat) and the expansion of crop

4 World Bank: Kenya Economic Memorandum, Annex 1, Agricultural issues, 1981, p.2-

production in previously under-utilized high potential areas. However, by the early 1970s, the impetus to growth from these factors decreased. There has been an increase of land constraint in the high and medium potential zones, while growth of output lagged due to drought and a stagnation of subsistence production.

Table 1.2 shows the situation by province. It may be that the agricultural core area is the most heavily populated thus causing a constraint of land availability in these areas.

The average population density in the medium and high potential agricultural areas of Central, Coast, Eastern, Nyanza, Rift Valley and Western Province was 116 in 1969 and 172 in 1979. The population densities in medium and high potential agricultural areas in the Coast, Eastern and Rift Valley are much higher than that of the total area due to the fact that a big part of their areas are low potential. For example, the Coast Province has about 86 percent low potential areas and the Eastern Province has 83 percent low potential area. Population densities in agricultural core areas in the Coast, Eastern and Rift Valley Provinces are 7.2,5.6 and 5.4 times respectively, higher than that of total area (Table 1.2) in 1979.

There has also been an increase of population densities in the medium and high potential agricultural

areas in almost all provinces except North Eastern during the period 1969-1979. For Central, Coast, Eastern, Nyanza, Rift Valley and Western Provinces, the increases are 40.3 percent, 41.9 percent, 40.8 percent, 81.0 percent, 46.0 percent, 38.5 percent from 1969 to 1979 respectively. This is likely to have been the result of an increase of rural to rural migration, from low to high potential areas.

Central, Nyanza and Western Provinces have shown less per capita maize production (per square kilometre) than expected considering their maize production per square kilometre due to the high population density. This implies that there is more pressure on land in these three provinces. Another observation from table 1.2 is that per capita maize production in all provinces declined from 1969 to 1979.

Table 1.2 Population Crude Densities in Kenya by Province, by Total Land and Total Medium and High Potential Agricultural Land; and Maize Production and Per Capita Maize Production by Province in 1969 and 1979.

Province	Population density[1] - medium and high potential agricultural areas (per sq.km)		Population density[2] - total area (per sq.km.)		Maize production[3] (tonnes) per sq. km.		Per capita maize production per sq.km. in tonnes	
	1969[1]	1979[1]	1969[2]	1979[3]	1969[4]	1979[5]	1969	1979
Central	181	254	127	178	9.40	8.36	.07	.05
Coast	81	115	11	16	0.31	0.25	.03	.02
Eastern	71	100	12	18	0.91	0.71	.08	.02
N. Eastern	-	-	2	3	-	-	-	-
Nyanza	116	210	169	211	18.80	16.72	.11	.08
Rift Valley	70	102	13	19	7.20	5.14	.55	.27
Western	179	248	161	223	30.01	28.51	.19	.13
Nairobi	-	-	749	1205	-	-	-	-

Source: 1 Ominde, S. H.: Population Change and Agricultural Development in Kenya, Workshop on Agricultural Settlement, Agricultural Development and Population Change, 1981, p.31-32.

2 Central Bureau of Statistics, Ministry of Finance and Planning: 1969 Population Census, Vol.4, p.23.

3 Central Bureau of Statistics: 1979 Population Census (provisional results), unpublished.

4,5 Ministry of Agriculture: Crop Production; unpublished, 1980, p.13, p.18.

1.3 Statement of the Problem:

Population and food are closely interrelated and the population problem has sometimes been identified as a food problem. The need to balance population and food has existed throughout human history. In recent times, new developments in agriculture have helped to meet the demands of a rapidly growing global population especially in more developed countries.

However, a considerable proportion of the world's population is living in regions of precarious food supply where hundreds of millions of inhabitants are undernourished and millions are faced with possible starvation.[5]

In recent years, weather conditions in several important food growing areas have been unfavourable and food production is further threatened by the scarcity of fertilizers in many parts of the world, particularly Africa. The high rates of population growth have also serious implications for both the production and the demand for food in many developing countries.[6]

Kenya in particular, is one of the countries with highest growth rates. Its food problem is often associated with maize shortage, maize being the country's staple food. Recently in the period 1979-1981, there has been a shortage of maize and the

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[5] Johnson, D: Population and Agriculture in Developing Countries, New York, 1976, pp. 66.

[6] Johnson, D: op. cit. pp. 72.

Table 1.3 Maize Production in Kenya for the years 1969-71, 1978, 1979 and 1980

Area harvested '000 ha.				Yield kg/ha.				Production-metric tonne			
1969-71	1978	1979	1980	1969-71	1978	1979	1980	1969-71	1978	1979	1980
1383	1490	1400	1500	1489	1456	1286	1269	3060	2168	1800	1900

Source: FAO: FAO Production Yearbook, Vol.34, 1980, Rome, p.65

government has been forced to import more to meet the demand. There has been a decrease in maize production which has been caused mainly by a reduction in yield per hectare and bad weather conditions.

With the availability of unused agricultural land in the productive Kenyan highlands approaching its limits and with short-term prospects of significant food production increases in the semi-arid and arid parts of Kenya being remote, Kenya is likely to continue facing food shortage problems especially if the population growth rate continues to be very high. So research is needed to be done both on food production and demographic factors to evaluate potential trends in food demand and food supply are in balance vis-a-vis population growth.

1.4 Objectives of the Study:

The objectives of this study are as follows:-

1) To project the population of Kenya up to the year 2000 in 5 year intervals. Two sets of projections will be constructed assuming different fertility and mortality trends.

2) To project maize production up to the year 2000. Three sets of projections will be constructed based on different assumptions regarding (i) area under maize cultivation and (ii) yield per unit land.

3) To project maize demand up to the year 2000. Two sets of projections will be constructed based on different levels of consumption of maize.

4) The shortfall between maize supply and maize demand will be analysed.

5) To recommend what can be done to ensure enough maize for the population in the period 1980 to 2000.

1.5 Justification of the Study:

When analysing the maize problem in connection to population growth, the supply of maize will be compared to the demand of maize. The projected maize production will be the maize supply. The projected population will serve as a basis when calculating the projected maize demand after assuming levels of consumption of maize per person per year.

As there has been no prior research carried out in Kenya about the implications of the population growth in connection to food demand, it is hoped that the recommendations which will be outlined after the findings will be helpful to the central planning unit of the Ministry of Agriculture and the Ministry of Economic Planning and Development.

1.5 Literature Review

It seems possible that the rapid population growth of England and Wales during the eighteenth century induced the intellectuals of the latter part of that century to review their ideas about the impact of increasing numbers on welfare.

Malthus in his first 'Essay' (1803) reasoned that the systems of equality which try to alleviate economic distress are self-defeating.[7] He said that these systems stimulate demographic growth and because the supply of agricultural land is limited, the entire population ends up by living on the margin of subsistance. In his theory, he assumed arable land to be fixed and did not consider the possibility of improved techniques leading to significantly higher yield per unit of land.

Marx has analysed the relationship between population growth and food production. He saw the problem in terms of income distribution and land distribution. If income and land are distributed fairly among the population, he believed there would not be any shortage of food.[8]

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7. J. Overbreek: History of Population Theories, Rotterdam University Press, 1974, P. 42.

8. J. Overbreek: Op Cit. P. 74.

Ester Boserup expressed herself along similar lines. She argued that economic development can come about as a result of an adjustment process to population presssure. In essentially rural environment, population growth forces cultivators to give up the existing extensive and often leisurely methods of cultivation. More intensive land use becomes necessary, better tools and fertilizers are often adopted, harder and more work become inevitable, the spread of irrigation is promoted and the old way of life is broken up. Total output increases.[9] She goes on to argue that greater population density is conducive to a better division of labour.

In recent Food and Population FAO Studies,[10] B.R. Sen when addressing the U.N. Population Commission in 1976 said,.....

> "The warning has been sounded from many platforms and there seems to be less complacency today about the social and political consequences of birth rates progressively exceeding death rates and the widening gap between food supplies and population growth, particularly in those areas of the world where hunger and malnutrition prevail on a wide scale".

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9 E. Boserup: The Conditions of Agricultural Growth, Allen and Unwin, London, 1965, P. 52.

10 FAO: FAO Studies in Food and Population, FAO, Economic and Social Development Series, No. 1, Rome, 1976, P. 77.

1.4.1 Kenya

Although the problem of population growth and food production has been noted by the Government of Kenya and has been discussed in Parliament and in recent development plans, little research has been carried out in this area. The Kenya National Food Policy States;

> "The rapid expansion of the population and a shortage of unexploited land in the main high potential areas are beginning to pose a dangerous potential imbalance in the relationship between the national supply of and demand for food."[11]

On the other hand Lars Bondestan in his article,. "The Foreign Control of Kenya Population"[12] says that control over land is extremely biased and there is a continual process of land concentration in a few hands. He says that big land owners are not always interested in increasing production, and that small land owners do not produce a surplus, sufficient to invest in improvements and only a fraction of them are reached by agricultural credit institutions.

Bondestan stresses the point that population pressure on land in Kenya has less to do with a high birth rate but more with uneven ownership of land and lack of peasant control over their produce.

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11 Kenya, Republic of: Sessional Paper No. 4 of 1981 in National Food Policy, 1981, P.2.

12 Lars Bondestand and Stuffen Begrstorm, editors, 1981: Poverty and Population Control, Academic Press, New York; Toronto, 1981, P. 132.

Further in his study, "Demographic Aspects of Agricultural Development and Food Supply"[13] Conrad Tauber states,

> "Reductions in birth rates are necessary if rates of population growth are to be reduced to a level at which growth in food production can again keep pace with them".

He believes however, that population growth has led to a search for new agricultural techniques. The world population conference in 1974[14] recognized that the solution to the problem of population growth depends largely on a balance between the size of the world's population and the world's production of food. Furthermore it urges all countries to give higher priority to production of food and fertilizers to increase their distribution in addition to the production in the remainder of 1974 and throughout the rest of the decade. It recommends that the competent United Nations specialized agencies intensify world food programmes in order to foresee and remedy world food shortages; and that they encourage and support the introduction of technical knowledge and an acceleration of agricultural products and fertilizers into the developing countries.

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13 FAO: Op. Cit. P. 62.

14. United Nations: Report of the United Nations World Population Conference, 1974, New York, 1975, P. 36.

The World Bank paper, "Kenya, Country Economic Memorandum",[15] states that the high rate of Kenya's population has three implications for agricultural development. First, agricultural development, and especially food production, must achieve a growth rate exceeding that of population growth. Secondly, because of the limited absorptive capacity of other sectors in the economy, agriculture will have to provide employment opportunities for most of the new labour force entrants. Thirdly, Kenya's already limited supplies of good quality arable land will come under increasing pressure, and a definitive land policy will be essential for continued agricultural growth.

S.H. Ominde states that, although there are still policy options that will enable agriculture to contribute to the basic needs and development needs of the country as a whole, the problem of rapid population growth in the rural areas must be faced. He states that Kenya must give urgent attention to the moderation of the rate of population growth and eventual stabilization of the population as a permanent solution to the threat of declining living standards.[16]

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15 World Bank: Kenya Country Economic Memorandum, Annex 1, Agricultural Issues, 1981, P. 27.

16 S.H. Ominde: Population Change and Agricultural Development in Kenya, A Kenya Case Study Workshop on Agricultural Settlement, Agricultural Development and Population Change, 1981, P. 40.

L.P. Mureithi and J.O. Otieno in their article, "Food, Population and Rural Development in Kenya: Progress, Policies, Problems and Prospects,"[17] state that there is a likely imbalance in the next decade between agricultural production and population growth. They suggested that the problem can be solved either from the demand side by reducing increases in consumers (population growth) or from the supply side by augmenting agricultural production. With regard to population policy, they further recommended that research into the determinants of population growth in an African situation is urgently required and more research ought to go into family planning. Concerning increasing agricultural production, they recommended that there is need to assess land carrying capacity, paying special attention to dry land research and dry farming methods, optimal land use plans and strategies. Research and development should be accelerated in the area of small farm implements for various terrains and soil texture. They also recommended that a comparative study of large and small farms is called for so as to assess the relative contribution of each and how 'efficiently' each can be used as an instrument to achieve various social and economic objectives.

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17 T. Dams, K. Hunt and G. Tyler, editors: Food and Population Priorities in decision making, Saxon, 1976, pp. 65-101.

1.7 Theoretical Framework:

This study is based on Esther Boserup's theoretical work about the relationship between population and food.[18] She tried to find out if there could be a situation of food shortage being brought about by higher population growth rate than the rate of growth of food production. She came up with the conclusion that population growth forces cultivators to give up traditional ways of subsistence farming and more intensive land use becomes necessary with increased use in technology and fertilizers. Therefore, total output increases; in which case high population growth rate should automatically mean high food production rate and there should not be a situation of food shortage.

Esther Boserup's proposition is going to be tested in Kenya situation by relating maize production to population growth in the period 1980 to 2000.

This study looks at Kenya as having limited high and medium potential arable land. At the same time it is experiencing rapid population growth. The method going to be used is projecting maize production and maize demand and comparing the two. From this data if it is found that there is a shortage of food, then Eshter Boserup's theory will be proved wrong. It will mean that the rate of food production does not increase at the same rate as that of population growth. For example it will not be automatic that population will increase the use of technology and fertilizers even if its rate of growth is increasing. Past trends will also help us to prove this.

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18 E. Boserup: The Conditions of Agricultural Growth, Allen and Unwin, London, 1965, p. 52.

1.8 Operational Hypothesis:

In this research it is hypothesized that:-

1) Kenya will experience changes in some of the demographic variables in the period 1980 to 2000. In order to be able to test this hypothesis, it is necessary to identify the actual demographic variables which have been experiencing change and in what direction, hence some minor hypotheses under the major ones are stated below:-

   (a) Kenya's fertility levels will remain constant or decline slightly.

   (b) The mortality will decline slightly.

   (c) As a result of the above demographic changes, annual population growth rates in Kenya will continue to rise.

2) The amount of total maize production in Kenya will increase in the period 1980 to 2000. In order to test this hypothesis it is necessary to identify the actual variables which will affect maize production and in which direction these variables will change; hence some minor hypotheses under the major ones are stated below:-

   (a) Yield of maize per hectare will increase.

   (b) Area of maize production will increase.

   (c) As a result of the changes in the above variables, the annual National maize production growth rates will be rising.

3) The demand for maize in Kenya will outweigh the supply.

1.9 Data Sources and Analysis

The research methodology was designed to serve the main objectives and test the hypothesis outlined. Four main steps were followed in the research namely, planning and problem formulation, data collection, analysis and outlining recommendations from the results. The need for the importance of studying the interaction between population and food was realized. The problem was then identified and an intensive examination of related literature was carried out. Specific study objectives leading to the formulation of the hypothesis were set. Data were mainly procured from secondary sources which included the 1969 and 1979 Kenya Population Census data, Demographic Surveys of 1977 and 1978, Kenya Fertility Survey of 1977/1978, Kenya Statistical Abstracts and Ministry of Agriculture and FAO publications.

In the data analysis demographic and agricultural projection techniques have been employed.

1.10 Summary of the Chapters

This study is made up of seven chapters. After the introduction (Chapter 1), the second chapter, deals with

the agricultural profile, in particular maize production, which will be traced for the purpose of arriving at our assumptions for maize production projections.

The third chapter deals with the demographic profile of the country where fertility and mortality trends will be traced for the purpose of arriving at our assumptions for projecting the population.

In the fourth chapter, the population will be projected using two sets of assumptions namely constant fertility and slightly declining mortality and declining fertility and declining mortality during the period 1980-2000. These projections will help us to project the demand for maize up to the year 2000.

In the fifth chapter, maize production will be projected using three sets of assumptions about area and yield per unit area during the period 1980-2000. These will help us to forecast the maize supply up to the year 2000.

In chapter six, projected maize demand and projected maize production will be compared and this will show the extent of the imbalance between the two.

In chapter seven, recommendations will be given to ensure enough food supply for the population in the future.

2.0 Definition of important concepts

Age Specific Fertility Rate is the average number of births occuring to women of a given age group. It is computed as:-

$\frac{bi}{Pi} k$ where bi is the total annual registered births in the age interval i, Pi is the mid-year population of women in the same age group. k is constant, normally 1,000.

Total Fertility Rate is the mean number of births occuring to a woman who lives to the end of her reproductive life (15-49 years).

Infant Mortality Rate - Infants in demography are defined as the children below one year. Infant mortality rate is the ratio of registered infant deaths to registered live births in a specified year.

Sex Ratio is the ratio of males to females in the same universe. It is calculated as:-

$\frac{mi}{fi} k$ where m is the number of males recorded in some statistical universe of persons.

f_1 is the number of females in the same universe.

k is an arbitrary factor of 100.

1.12 Summary

In this chapter, light has been thrown on the background of Kenya. Statement of the problem has been outlined. Objectives of the study and the justification of the study have been looked at. The literature about the study has been reviewed. The theoretical framework and the operational hypothesis has been outlined. Data sources have been given. The chapters to follow have been summarized and important variables have been defined.

The next chapter deals with agricultural profile, in particular maize production both the past and future trends.

CHAPTER TWO

FOOD PRODUCTION FACTORS

MAIZE IN PARTICULAR

2.1 Principal Geographic Features

Kenya lies at the edge of the old, stable land mass of Southern Africa. There, the vast expanses of gently undulating plateau lands - so characteristic of the African landscape - are abruptly interrupted. The spectacular fracture of the Rift Valley runs the entire length of the country, housing a string of lakes from Rudolf in the North to Magadi in the South. Extinct volcanoes - the 518,160m peak of Mount Kenya, astride the equator yet permanently capped by snow - tower over the countryside before the land falls away to the Indian Ocean and the deserts of the Horn of Africa. South a location has endowed Kenya with a wide range of physical characteristics, affording a remarkable variety of natural vegetation, food production, and generally changing limitations of land use within a comparatively small area.

2.1.1 Natural Vegetation

More than half of the country is an arid lowland, gradually passing from the poor scrub land of the Coastal hinterland to the barren desert of the remoter areas of the Northern Province. As the land rises inland, the vegetation moderates to the sub-tropical and temperate type and the prospects for cultivation improve.

In the middle altitude, the rising grasslands provide a home for game and herds of domestic cattle. The plateau and upland areas lying between 152,000cm and 274,320cm, which cover roughly the South-Western quarter of Kenya, comprise some of the best land for settlement and agriculture in Africa. Eventually the land drops to the basin of Lake Victoria, housing the rich lands of Nyanza on the lake's North-Eastern shore.

2.1.2 Climate

Lying in equatorial latitudes, Kenya experiences differences in climatic conditions caused mainly by variations in altitude. Seasonal changes in temperature are only slight, but while the mean temperature at the Coast is over 27°C, at 274,320cm it is about 13°C. Altitude has an even more dramatic effect on rainfall, which varies from over 2540mm a year around Mt. Kenya to less than 245mm in the North towards the Northern frontiers. Over the greater part of the country, the rain falls in distinct seasons.

Moisture-laden winds bring rain to the central upland areas during March to May, while a second rain season extends from October to December. Annual rainfall is usually in the range of 1143mm to 1905mm. West of the Rift Valley the climate is characterized by a marked wet season from March to September, the volume of rainfall diminishing toward the North to less than 508mm in Turkana. In the region bordering Lake

Victoria, rainfall is spread more evenly through the year. Kisumu on the shore of the lake receives a mean total of roughly 1016 mm.

The area capable of intensive cropping or grazing without irrigation is limited to a narrow strip of land along the Coast and to the higher elevations, which have a good probability of receiving 889 mm. or more of rain. The greater part of the land area of Kenya, therefore, can support only extensive grazing. The potentiality for increasing the cultivated area by irrigation is also limited by the poor availability of water. There are few perennial rivers in Kenya. Only two reach the Ocean throughout the year - the Tana and the Galana; others succeed in reaching it, or Lake Rudolf, for a few months but then dry up, submerge or turn into swamps. The rivers of Nyanza form part of a different drainage system flowing into Lake Victoria and eventually to the Nile.

2.2 Role of Agriculture

After reviewing the resources of Kenya, one has to conclude that the country's rate of growth and the improvements in the standards of living will continue to depend, for many years to come, primarily on developments in the agricultural sector. It generates over 60 percent of foreign exchange earnings and comprises over 30 percent

Figure 2:1 KENYA : AGRICULTURAL AREAS.

Source: Population Change and Agricultural Development in Kenya by S.H.Ominde. Population Institute, University of Nairobi, 1981

Gross National Product (GNP).[1] Of the total African population, it is estimated that more than 80 percent is engaged directly in the primary economy. The increase in gross revenue of African farmers has been of the order of 80 percent since 1956, over and above subsistance production which has also been increasing.

2.3 Land Use

Although Kenya straddles the equator, its range of production conditions is wide. There is a comparatively narrow coastal belt with rainfall adequate for tropical agriculture, with a rapid transition to dry semidesert and desert conditions in land until the sharply modifying influences of the mountains are experienced. The highlands of Kenya are characterized by higher rainfall, lower temperatures, diverse soil types and vegetation.

Of the total area of the country, however, only about 13 percent of 58,265,000 hectares receives a rainfall consistently above 762 mm. annually, and is otherwise suitable for intensive livestock and crop production or mixed farming and plantation industries. Crop production is restricted to some 26 million acres in the highlands, the lands to the West extending to Lake Victoria and the narrow coastal strip. The remainder of the productive land is limited under present conditions to pastoral activities. The large, arid and sparsely

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1 World Bank: Kenya Economic Memorandum, Annex 1, Agricultural Issue, 1981, P.1.

populated Northern Province, which occupies 56 percent of the total land area, together with much of the coastal and southern provinces, make very minor contributions to the economy. Kenya's economy rests basically on the lands of the southwest of the country. Table 2.1 shows how the land of Kenya is divided.

Table 2.1 Categories of Agricultural Land by Province

'000 hectares

Province	High Potential	Medium Potential	Low Potential	Total	All other land	Total land area
Central	909	15	41	965	353	1,318
Coastal	373	796	5,663	6,832	1,472	8,304
Eastern	503	2,189	11,453	14,145	1,431	15,576
Nairobi	16	-	38	54	14	68
North-Eastern	-	-	12.690	12,690	-	12,690
Nyanza	1,218	34	-	1,252	-	1,252
Rift Valley	3,025	123	12.220	15,368	1,515	16,883
Western	741	-	-	741	82	823
Total	6,785	3,157	42,105	52,047	4,867	56,914

Source: Central Bureau of Statistics, Kenya Statistical Abstract, 1980, P. 98.

From Table 2.1, Central Province, Nyanza and Western Provinces have 70 percent, 97 percent and 90 percent high potential areas of their total land each, respectively.

These three provinces have the highest percentage of high potential area, and this reflects how crop production is concentrated in these provinces. Rift Valley

has the largest high potential area of about 3,025,000 hectares although this is only 18 percent of its total area. Coast, Eastern and Northern have 68 percent, 74 percent and 100 percent low potential areas of their total land areas each, respectively. This reflects how crop production is low in these provinces.

For the whole of Kenya, the total high potential and medium potential area is 19 percent of the total land area. The total low potential area is 81 percent of the total land area. This crop productive land is little compared to total land area.

The wide variations in climate and altitude, coupled with a variety of soils, largely determine the pattern of Kenya's agriculture. On the other hand, density, marketing facilities, traditions and tribal customs have had a significant influence on the development of a varied pattern of land use. The cropping pattern varies from high altitude wheat, pyrethrum, tea and Arabic coffee through the sisal and cotton of the medium altitudes to the coconuts and cashewnuts of the tropical coastal belt. This wide variation complicates the problem of farm planning and farm development and, in particular, gives rise to a wide range of research problems with a consequent major need for qualified personnel to deal with problems of plant and animal breeding, selection of suitable varieties, maintenance of soil fertility

and pest control and the like. Table 2.2 shows the area for each crop. This was abstracted from the 1974/75 Integrated Rural Survey which is so far the most recent intensive survey done.

Table 2.2 Total area under crops, Oct. 1974-Oct.1975

	Total area in '000 hectares	
Crops	Pure	Mixed
Cereals		
Local maize	244.6	970.0
Hybrid maize	258.2	242.6
Finger millet	30.5	47.4
Sorghum	16.8	189.6
Other cereals	18.5	93.4
Pulses and Nuts		
Beans	49.9	713.6
Cow peas	11.7	259.5
Pigeon peas	0.1	115.2
Field peas	4.1	12.3
Groundnuts	3.5	14.3
Other	1.1	36.3
Root crops		
English potatoes	48.9	212.3
Sweet potatoes	10.9	21.7
Cassava	41.2	28.7
Other	17.7	24.4
Fruits, vegetables & oils		
Bananas	19.6	110.8
Other fruits	1.2	12.3
Vegetables	4.0	52.0
Oil seeds	13.0	11.5
Temporary industry crops		
Sugar cane	55.0	8.7
Pyrethrum	22.4	4.7
Cotton	25.0	45.1
Others	2.6	3.4

Table 2.2 cont'd.

Crops	Pure	Mixed
Permanent cash crops		
Coffee	92.0	19.3
Tea	59.0	5.8
Coconut	2.0	49.3
Cashewnuts	5.5	48.0
Others	23.1	10.5
Total	1065.5	3362.7

Source: Central Bureau of Statistics, Kenya Statistical Abstract, 1980, p.123.

Table 2.2 shows that the area for food crops is about three times that for cash crops when each crop is planted alone (pure). The area for maize when not mixed is about 583,000 hectares compared to the area for cash crops which is about 287,000 hectares. It is evident that in terms of area, Kenya has concentrated more on food crops than cash crops. For instance, the area devoted to maize is about 45 percent of the total cultivated area when the crops are not mixed. This also reveals the importance of maize as a staple food in the country.

Although pulses and nuts have high protein content, the area devoted to them is very small, being only 7 percent of the total area. This shows that the food intake of the population is biased towards the carbohydrates relative to proteins.

The area showing mixed cropping does not tell us much since it might involve a variety of crops.

In the next section, the main crop in this study, will be looked at in detail. Emphasis will be put on the area under maize production as well as yield in the past two decades.

2.4 Maize Production

Maize is, by far, the main agricultural crop in Kenya, both in terms of cultivated area (Table 2.2) and volume of production. Maize cultivation with around 1.5 million hectares, as an average in recent years, accounts for approximately 45 percent of the national crop hectarage and for about one third of the physical output of cropped land.[2] As the leading food grain, it represents about 75 percent of the aggregate of cereals and pulses in the country.[3] About 90 percent of the rural population is engaged in the production of this grain,[4] and also for most of the population, maize meal and the grain itself are an essential component of the average diet.

2.4.1 Production situation and perspectives

Maize production has the characteristics of a two season crop in Kenya with the long and short rain months of the year as the most important cultivation periods in most

2 FAO and UNDP: Maize Marketing and Pricing in Kenya, Government Printers, 1978, p.1.
3 FAO and UNDP: Op.cit. p.1
4 FAO and UNDP: Op.cit. p.1

areas; normally the former season accounts for 70 to 80 percent of annual production.

In Table 2.3., the last decade's figures of area, production and average yields are presented. Figures from this table show that between the first (1968-72) and second (1973-77) five-year period averages, annual hectarage of maize shown increased around 17.6 percent, rising from 1,665,200 hectares to 1,908,000 hectares. Production increaments between these two period averages was about 48.8 percent with average yields increasing by 32.0 percent. The annual accumulated rates of increase for area between the two periods were about 2.8 percent, for production about 8.3 percent and for yields 5.7 percent, which indicates that higher productivity per hectare had been a major influence in attaining the rapid growth of production achieved in that period.

The average hectarage of maize sown in the 1973-1977 period was 1,908,000 hectares and in the period 1978-80, it was 1,463,000 hectares - a decrease of about 23 percent. Production fell by 22 percent.

Table 2.3 Kenya: Maize Production series

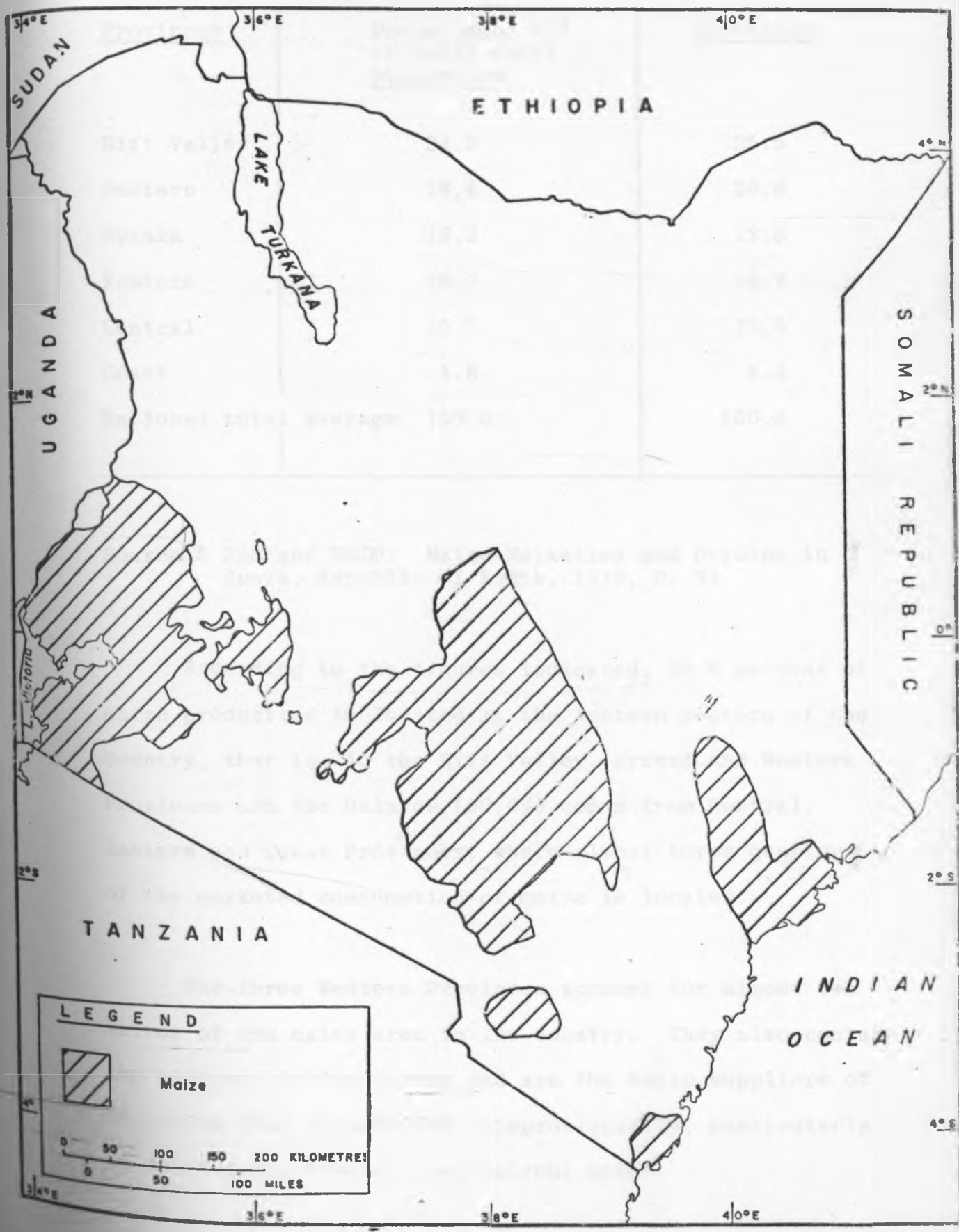
Year	Area ('000 ha.)	Production ('000 metric-tonne)	Approximate yield (metric tonne/ha)
1968	1504	1455	0.97
1969	1472	1430	0.97
1970	1562	1277	0.82
1971	1749	1823	1.04
1972	2037	2462	1.21
1973	2000	2334	1.17
1974	1751	2315	1.32
1975	2053	2906	1.42
1976	1953	2467	1.26
1977	1783	2553	1.46
1978[x]	1940	2169	1.46
1979[x]	1400	1800	1.29
1980[x]	1500	1900	1.27

Source: FAO and UNDP: Maize Marketing and Pricing in Kenya Republic of Kenya, 1978, p.33.

[x]FAO: FAO Production Yearbook, 1980, Vol.34, Rome, p.102.

Taking the normal year average, Table 2.4 shows the distribution of maize production and area.

Figure 2:2 KENYA : MAIZE GROWING AREAS.



Source: National Atlas of Kenya, Crop Combination. Survey of Kenya 1970

Table 2.4 Distribution of Maize Production and Area.

Provinces	Percentages of national total production	Hectarage
Rift Valley	34.2	25.5
Eastern	18.4	26.6
Nyanza	18.2	13.5
Western	16.?	16.7
Central	10.7	13.5
Coast	1.8	4.2
National total average	100.0	100.0

Source: FAO and UNDP: Maize Marketing and Pricing in Kenya, Republic of Kenya, 1979, P. 34.

According to the figures indicated, 69.4 percent of maize production is located in the Western section of the country, that is, in the Rift Valley, Nyanza and Western Provinces and the balance (30.6%) comes from Central, Eastern and Coast Provinces, where almost three quarters of the marketed consumption of maize is located.

The three Western Provinces account for almost two thirds of the maize area in the country. They also contain the highest yielding areas and are the basic suppliers of the grain that is marketed inteprovincially, particularly to the Central Province and Nairobi area.

2.4.2 Maize Production Structure by Type of Holding

Maize supplies are generated primarily by small-holder production (see Table 2.5).

Table 2.5 Maize Production Structure by Type of Holding 1976/1977 (Percentages).

	Small farmers			Large farms
	Total	Individual small-holders	Marketing Co-ops-members	
Area	94.0	88.0	6.0	6.0
Production	91.2	85.5	5.7	8.8
No. of holdings.	92.1	88.9	3.1	0.3
Proportion of rural population	77.3	74.0	3.3	12.4[1]
Approximate marketed production.	39.6	39.0	40.2	⁄8.50[2]
Proportion of total marketed production	82.2	76.5	6.3	17.2

Source: FAO and UNDP: Maize Marketing and Pricing in Kenya, Republic of Kenya, 1978, P.35.

[1]Includes workers families.

[2]Estimates.

Table 2.5 shows that 94 percent of the area under maize and 91 percent of production normally belong to the smallholders sector and the balance (6 percent and 8.8 percent respectively), corresponds to large farms (over 20 hectares). The latter group accounts for only approximately 0.3 percent of the total number of holdings while smallholder maize growers account for 92.1 percent. Population-wise smallholder maize producers account for about 77 percent of rural communities, and large farms have around 12 percent of the same. The aggregate (89.0 percent) indicates the very high proportion of the rural population engaged in maize production, which corresponds to almost 79 percent of the total population in the country. This implies that most of the maize is cultivated at subsistence level. This works as an obstacle to introducing modern techniques of production, for example, mechanization, use of fertilizers, irrigation, etc., as these changes are usually easily implemented on large scale product systems. It also means that most of the product is consumed locally in which case commercialization of the product becomes a problem. While only 40 percent of all smallholder production is marketed, this figure runs to at least 85 percent for large farms.

Another problem of subsistance farming is collection of statistics and undertaking research on production of maize. This is more easily done on large farms than on small ones. The implimentation of suggested changes is also a problem on many small scale farms.

In the next section, alternative maize production projections are going to be calculated based on assumptions about yield and area under maize cultivation.

2.5 Alternative maize production projections (1980-2000)

The following conclusions about the trends for yield and area for maize can be deducted; yield per unit land for maize has been increasing in the 1960s and early 1970s. There has been a sharp decline in the late 1970s. The area under maize cultivation has been increasing in the 1960s and 1970s.

In general, total maize production has been increasing in the 1960s and early 1970s. There has been a sharp decline in the late 1970s. This decline is likely to have been caused by the decline in yield per unit area which occured in the late 1970s. (Section 2.4).

2.5.1 Assumptions behind the three sets of projections of yield per unit land and area under maize cultivation

Specific assumptions have been made about the yield per unit land and area on which the three maize production assumptions are based. The three sets of projections are developed for 1985, 1990, 1995 and 2000.

If small farmers increase planting hybrid maize and the use of fertilizers as between the years 1970-1975, the yield per unit land will increase by 1.5 percent per annum. For Set 1, it is assumed that the yield will increase at a rate of 1.5 percent per annum between 1980 to 2000. If the farmers increase the use of technology and fertilizers and if the irrigation schemes continue in the arid and semi-arid areas, for Set 11, the yield is expected to increase at a rate of 1.5 percent per annum from 1980 to 1985, 2 percent per annum from 1985 to 1990, 2.5 percent per annum from 1990 to 1995 and 3.0 percent per annum from 1995 to 2000. From 1978 to 1980, the yield per unit land has been declining at a rate of about 1 percent per annum. If there is no increase in the use of fertilizers, technology or hybrid maize, the yield of maize is likely to continue declining taking into account the fact that there is a constraint of land, which will continue to cause destruction of natural vegetation, causing soil erosion. For Set 111, the yield is expected to continue declining at the rate of 1 percent per annum from 1980 to 2000.

From 1965 to 1980, the area has been increasing at a rate of about 2.5 percent per annum between 1980-2000. For sets 1 and 11, the area is expected to increase at the same rate of 2.5 percent per annum between 1980 to 2000. For Set 111, a rate of increase of 2.0

percent per annum is expected. The increase in the area of production is likely to continue as a result of more improvements in the incentives for maize production; for example the increase of prices for maize. People are also expected to anticipate adverse weather conditions and this will help them to grow more maize by expanding the area of cultivation when the weather is favourable.

Projected yield and area are shown in Appendix 1, Tables 1 and 11 respectively.

2.5.2 Projected Production

Table 2.6 shows the projected total production for the years 1985, 1990, 1995 and 2000 considering 1980 as base year.

The projected production Q_{t+n} has been calculated from the formula:

$Q_{t+n}=A_{t+n}\ Y_{t+n}$ 1/ where A_{t+n} is corresponding projected area and Y_{t+n} is corresponding projected yield. (Figures of the projected area and yield in Appendix 1 are used).

1/ S.T. Oats: The value of Agricultural Planning, New York, 1974, p.71.

Table 2.6 National maize production projections (Q_{t+n}) for Sets 1, 11 and 111, 1980 as base year

Year	'000 tonnes		
	1	11	111
1980	1900	1900	1900
1985	2271	2288	1983
1990	2714	2819	2062
1995	3244	3554	2135
2000	3877	4577	2198

Table 2.7 Expected production percentage increase for sets 1, 11 and 111 from 1980 to the years 1985, 1990, 1995 and 2000. (From table 2.6)

Sets	Percent increase from the year 1980 to:			
	1985	1990	1995	2000
1	20.0	31.6	68.3	104.0
11	20.0	47.4	87.0	140.0
111	4.2	8.4	12.1	15.7

2.5.3 Expected maize production increase rates

In order for Kenya to achieve maize production of 4,577,000 tonnes as in Set 11, it must make an effort to increase the yield by over 1.5 percent per annum from 1980 to 2000. The area of production must be expanded by 2.5 percent per annum from 1980 to 2000. The national maize production will have increased by 140

percent from 1980 to 2000 (Table 2.7).

For Set 111, the increase in production is expected to be lowest. The national maize production will be 2,198,000 tonnes. This is expected to be contributed by the decline in the yield of 1 percent per annum from 1980 to 2000. The maize production will have increased by only 15.7 percent from 1980 to 2000 (Table 2.7).

Past trends has shown that production of maize varies from one province to another as already seen early in this chapter. In the next section projected maize production by province will be calculated based on maize production data by province in 1980. This will help us to see the expected maize supply by province by the year 2000 and it will serve as a factor when analysing the imbalance of maize supply and maize demand among the provinces.

2.5.4 Projected maize production by Province:

The distribution of maize production by province in 1980 is shown in table 2.8.

Table 2.8 : Estimated production of maize in 1980

Province	Production (tonnes) '000	Percentage of national total production
Rift Valley	875	56.3
Western	234	15.0
Nyanza	208	13.4
Central	110	7.1
Eastern	109	7.1
Coast	18	12.0
N. Eastern	0	0
TOTAL	1554	100.0

Source: Ministry of Agriculture, Kenya: Provincial Director's Annual Reports, Ministry of Agriculture, 1980, p.12.

The figures show that Rift Valley Province had the highest production and Coast Province the least. Most of the maize produced in Rift Valley is purchased by National Cereals and Produce Board (NCPB) and then distributed to the low productive provinces. Rift Valley, Western and Nyanza provinces have the highest yielding areas. The marketed consumption of maize is located in the Central, Eastern and Coast provinces.

Table 2.9 Projected distribution of maize production by province by the year 2000

Province	Percentages of national total production
Rift Valley	50
Western	10
Nyanza	10
Central	10
Eastern	10
Coast	5
North Eastern	5
National total average	100.0

Table 2.9 shows that the percentages of maize produced in Rift Valley, Western and Nyanza are likely to go down by 6 percent, 5 percent and three percent respectively from 1980 to 2000 due to the fact there is continuing pressure on their land. Through the arid and semi-arid irrigation schemes, the percentages of maize produced by the Eastern, Coast and North Eastern provinces are likely to increase from 1980 to 2000.

Using the projected percentages (Table 2.9), the projections by province in the year 2000 are found out from the national production projections of the year 2000. The maize production projections by province are shown in Appendix 1, table 111. Analysis of the supply

and demand of maize in the provinces is going to be discussed in Chapter 5.

2.6 Summary

This chapter noted that the yield per unit land for maize and the area under maize cultivation has been increasing in the 1960s and early 1970s. Total maize production has been increasing in 1960s and early 1970s until late 1970s when there was a sharp decline.

Assumptions behind the three sets of maize production about the yield per unit land and area under maize cultivation have been outlined. Past trends have shown that production of maize varies from one province to another. The maize production has therefore been projected on provincial basis for the year 2000 but based on different proportions of total production from those of the year 2000. These maize production projections by province will serve as a basis when analysing maize demand among the provinces.

The next chapter analyses the demographic profile of Kenya, and thus portrays the actual picture for food demand, and also provides a basis for projecting what is to be required in the future.

CHAPTER THREE

DEMOGRAPHIC PROFILE

3.1. Introduction

Among the developing countries of Africa, Kenya's documented population data reveals a striking acceleration in the rate of population growth from the middle of the present century. Table 3.1 below shows both the inter-censal annual rate of growth and the rate of natural increase between 1948 to 1979.

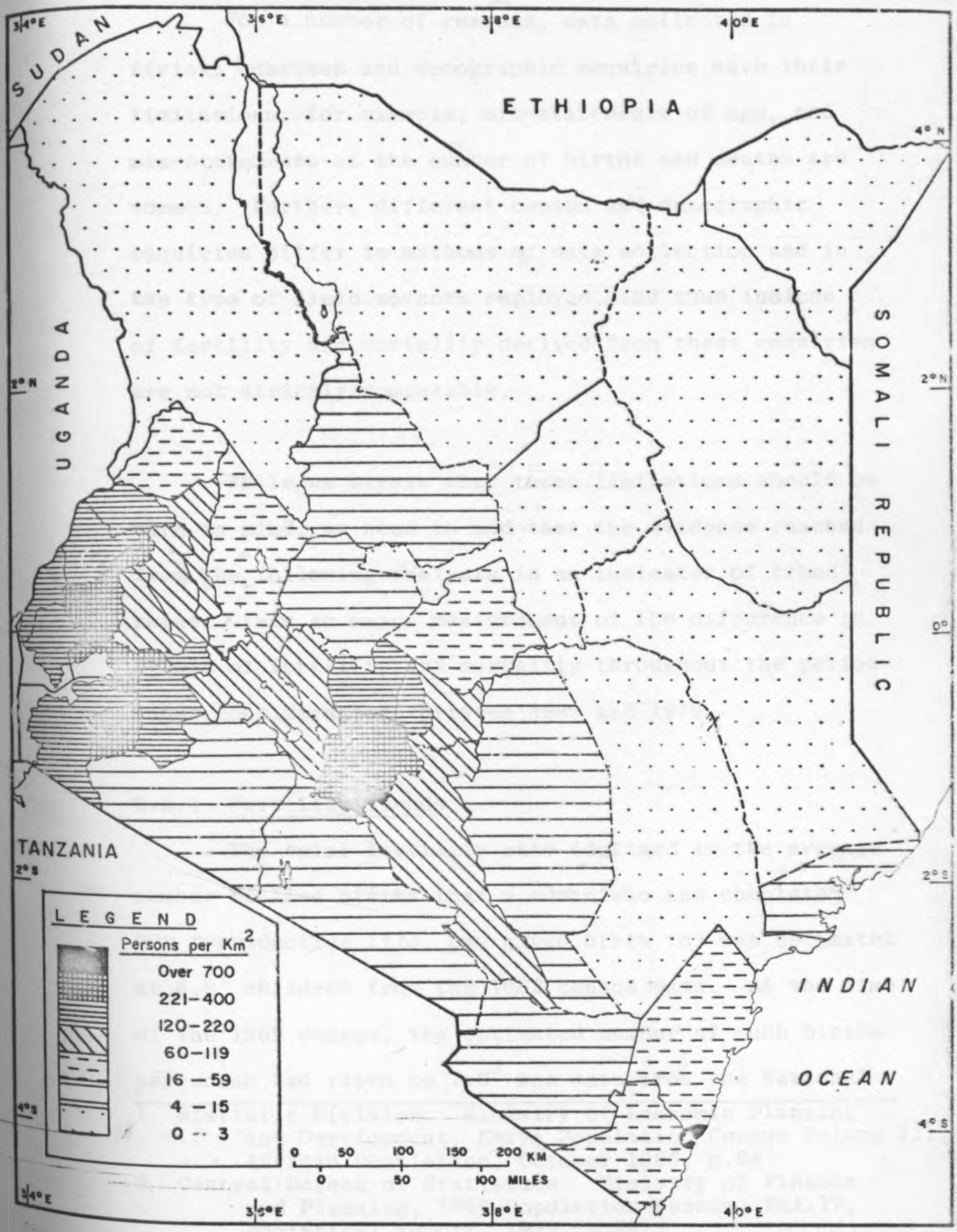
Table 3.1 Population size and population growth rates 1948-1979

Year	Population	Intercensal annual growth rate (percent)	Rate of natural increase
1948	5,405,966	3.4 (1948-1962)	2.3
1962	8,636,263	3.4 (1962-1969)	3.0
1969	10,942,705	3.4 (1969-1979)y/	3.9

Source: Simeon H. Ominde: Population Change and Agricultural Development in Kenya, Workshop on Agricultural Settlement, Agricultural Development and Population Change, 1981, p.3.

The implications of the accelerating population growth rates are treated in more detail later in this chapter. However, of more importance to the future situation are factors explaining the accelerated growth rate of the population which is the result of past trends in levels of fertility and mortality. In our next section, we are going to look at these trends.

Figure 3:1 KENYA POPULATION DENSITY 1979.



Source: Based on 1979 Population Census data.

3.2 Fertility and Mortality trends

For a number of reasons, data collected in African censuses and demographic enquiries have their limitations; for example, mis-statements of age, and mis-statements of the number of births and deaths are common. Further, different census and demographic enquiries differ in methods of data collection and in the type of field workers employed, and thus indices of fertility and mortality derived from these enquiries are not strictly comparable.

While we stress that these limitations should be born in mind, we need to add that the evidence reached from the following analysis is an indicator of trend rather than an exact measurement of the difference in levels of fertility and mortality throughout the period under consideration, between 1962 and 1979.

3.2.1 Fertility trends

The total fertility rate (defined as the average number of live births that a woman who has completed her reproductive life, has given birth to) was estimated at 6.8[1] children from the 1962 census data. At the time of the 1969 census, the estimated number of such births per woman had risen to 7.6[2] and data from the National

1 Statistic Division: Ministry of Economic Planning and Development, Kenya Population Census Volume 111, African Population, October 1966, p.68.

2 Central Bureau of Statistics: Ministry of Finance and Planning, 1969 Population Census. Vol.1V, Analytical Report, 1977, p.29.

Demographic Survey conducted in 1977 gave an estimated total fertility of about 8.1[3]. This suggests an approximate rise or increase in total fertility of about 18 percent from 1962 to 1977.

The 1979 census gave an estimate of about 7.9[4] as the total fertility rate. From these data, we can conclude that in the 1960s and early 1970s, fertility has been rising. We can also conclude that by the end of the 1970s, fertility had stabilized at a level of approximately 8 live births per woman. Presumably, one of the reasons for the higher number of live births between 1962 and 1979 is the decline in the incidence of childlessness and foetal loss. These conditions are themselves the result of improvements in the health conditions of the population. Table 3.2 shows a decline in the proportion of childless women between 1962 and 1979.

Table 3.2 Proportion of childlessness amongst all Kenyan African Women by age group

Census Year	Age Group						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
1962	79.1	36.6	22.3	17.8	15.3	14.4	13.7
1969	75.5	24.7	11.1	8.1	7.6	7.8	7.9
1977	72.8	23.5	7.0	4.4	3.8	3.8	4.5
1979	69.5	21.4	7.6	4.8	3.3	3.3	4.5

Source: R. A. Henin: Alternative Population Projections for Kenya and its Provinces, Population Studies and Research Institute, University of Nairobi, 1979, p.7.

3 Central Bureau of Statistics: Kenya National Demographic Report, 1977, p.29.

4 Central Bureau of Statistics: 1979 Population Census (provisional), unpublished.

From the year 1969 to 1979, the proportion of childless women for age groups 15-19, 20-24, 25-29, 30-34, 35-39, declined by 8%, 13%, 32%, 41% and 54% respectively. Another evidence regarding the rising trend in fertility, is that indicated by the shape of the age distribution. Persistent high levels of fertility give a broad-based age distribution that tapers rapidly with age, while persistent low levels of fertility give a narrow-based distribution. Conversely, mortality changes have only a slight effect on the age distribution. The increasing proportion of the total population under 15 years of age in the 1960s and early 1970s reflect the increase in fertility during that period. (Table 3.3).

Table 3.3 Proportion of the Population under 15 years (both sexes for 1962, 1969, and 1979

Age Group	1962[1] Census	1969[1] Census	1979[2] Census
0-4	17.7	19.4	18.9
5-9	15.7	16.3	16.3
10-14	12.7	12.5	13.6
0-14	46.1	48.2	48.4

Source: [1] R. A. Henin: Alternative Population Projections for Kenya and its Provinces, Population Studies and Research Institute, University of Nairobi, 1979, p.8.

[2] Central Bureau of Statistics: 1979 Population Census data (Provisional results)

The rising trend in fertility in Kenya had shaped the age distribution, in that population was becoming increasingly younger, that is, becoming more and more broad-based with increasing proportions in the younger ages up to the early 1970s.

3.2.2 Regional Fertility Differentials

Although fertility for Kenya as a whole has been demonstrated, the data available shows that there are important differences shown in table 3.4.

Table 3.4 Total fertility rates, 1969 and 1979 by Provinces

Province	1969 (TFR)[1]	1979 (TFR)[2]
Nairobi	5.17	5.48
Central	8.25	8.61
Coast	4.67	7.08
Eastern	7.48	8.37
North Eastern	5.32	7.37
Nyanza	6.15	8.67
Rift Valley	5.77	8.42
Western	7.86	9.00
TFR for Kenya	7.6	7.90

Source: [1]Central Bureau of Statistics: Ministry of Finance and Planning: 1969 Population Census, Vol.4 Analytical Report, 1970 p.52.

[2]Central Bureau of Statistics: Compendium to Volume 1 1979 Population Census, Ministry of Economic Planning and Development 1981, p.17.

While there is little doubt that the above rates are affected by misreporting, the order of magnitude of the

differences between provinces is such that it also represents genuine fertility differentials. By and large fertility is high in Western, Central, Eastern, Nyanza and Rift Valley provinces; low in Coast, North Eastern and Nairobi provinces.

It is observed that in the more favourable agricultural heartland, fertility is much higher than in low potential agricultural areas and this will increase the constraints of land availability since it is these very regions of the country that will continue to experience sustained high fertility and hence accelerated population increase.

3.2.3 Mortality trends

One very important and convincing explanation of the cause of accelerated population growth is mortality trends. There is evidence of substantial mortality decline between 1962 and 1979. The crude death rate was established at between 18 and 23 per 1000 in the 1962 Census, at 17 in the 1969 Census, 14 in the 1977 National Demographic Survey and around 12 in the 1979 Census. Life expectation at birth is shown in Table 3.5 from 1962 to 1979.

Table 3.5 Life expectation at birth 1962-1979)

Year	Expectation of Life at Birth	
	Male	Female
1962	40.0	45.0
1969	46.9	51.2
1977	51.2	55.8
1979[1]	54.1	56.9

Source: Frank L. Mott: Infant mortality in Kenya: Evidence from the Kenya Fertility Survey, Population Studies and Research Institute, University of Nairobi, 1979, p.10-11.

[1] Central Bureau of Statistics: 1979 Population Census data (provisional results).

Paralleling the decline in general mortality, estimated infant mortality rates also appear to have declined sharply. The 1962 Census estimated that 174 out of every 1000 babies born died in the first two years of life.[5] By 1969, deaths in the first two years of life were estimated at 157 per 1000.[6] Another source of information on mortality is given by the proportion of children dying to children ever born according to maternal age group. These proportions can be converted into standard indices of infant and child mortality.[7] (see Table 3.6)

5 Frank L. Mott: Infant Mortality in Kenya: Evidence from the Kenya Fertility Survey, Population Studies and Research Institute, University of Nairobi, 1979, p.11

6 Frank L. Mott: Op.cit. p.11.

7 W. Brass et al: The Demography of Tropical Africa, Princeton, New Jersey, Princeton University Press, 1968, p 140-142.

Table 3.6 Proportion of children dying by age group of mother, 1962, 1969 and 1979

Age Group	1962[1]	1969[1]	1977/78[2]	1979[3]
15-19	.146	.128	.101	.119
20-24	.170	.147	.130	.128
25-29	.205	.174	.144	.141
30-34	.238	.202	.157	.167
35-39	.269	.231	.174	.189
40-44	.308	.263	.189	.216
45-49	.338	.304	.236	.252

Source: [1]R. A. Henin: Alternative Population Projections for Kenya and its Provinces, Population Studies and Research Institute, University of Nairobi, 1979, p.12.

[2] Central Bureau of Statistics: Kenya Fertility Survey 1977-1978, Ministry of Economic Planning and Development, 1980, p.104.

[3] Central Bureau of Statistics: 1979 Population Census (provisional results).

The Table (3.6) indicates that child mortality declined between 1962 and 1979.

3.2.4 Regional mortality differentials

In common with fertility, there are significant regional variations in child and infant mortality. Some estimates of child mortality by province show marked differentials within regions. (Table 3.7).

Table 3.7 Child mortality estimates by provinces, 1979

Province	Mortality at age 1 (Q 1)	Mortality at age 2 (Q 2)	Mortality at age 3 (Q 3)	Mortality at age 5 (Q 5)
Nairobi	95	93	92	100
Central	63	67	78	97
Coast	161	177	187	217
Eastern	93	103	115	147
North Eastern	125	135	141	172
Nyanza	149	174	202	264
Rift Valley	92	108	124	144
Western	135	152	173	200
KENYA	118	125	141	165

Source: Kibet, M.K.J.: Differential Mortality in Kenya by District. M.Sc. Thesis, University of Nairobi, 1981.

Judging from Table 3.7 it seems that child mortality is lowest in Central, Rift Valley, Nairobi and Eastern Provinces; highest in Western and Nyanza Provinces and intermediate in the Coast Province. With more improvements in nutrition and effective control of the main killer diseases of children (such as malaria) the potentials for further population increase throughout the country are very real.

3.3. Migration

3.3.1 International Migration

The development of Kenya as a modern state has attracted an important stream of international migrants

from outside Africa and from the countries of Eastern Africa; namely Uganda, Tanzania, Rwanda, Burundi, Somalia and Ethiopia. The total population of migrants in 1969 were about 159,000[8]. This was about 2 percent of the total population of the country. In 1979, the total migrants were about 180,000[9]. This was about 1.2 percent of the total population. Such migrants have tended to concentrate in urban areas. By 1979, total international migrants in Nairobi were about 63,000. This was about 7.6 percent of its total population (830,000).[10] These migrants have increased the demand for food in the urban areas which at the same time are not productive.

3.3.2 Internal migration

Considerable internal migration movement is one of the most important determinants of population characteristics. It is also one of the most important dynamic factors in the evolution of Kenya's economic regions.

This economically and socially motivated movement is, first, a shift of rural population from the less to the more prosperous agricultural areas. This movement

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8 S. H. Ominde: Population Change and Socio-economic Development in East Africa, Population Studies and Research Institute, University of Nairobi, 1980, p.77

9 Central Bureau of Statistics: 1979 Population Census (provisional results)

10 Central Bureau of Statistics: Op.cit.

has increased to put more pressure on land in the agricultural core areas. National vegetations have been destroyed and this has caused soil erosion,one of the causes of low yields. At the same time, demand for food has increased in these areas which have to feed the poor agricultural areas at the same time.

A second type of movement involves the influx from rural areas to developing urban areas which have been gathering momentum since the end of the second world war. This has increased the demand for food in urban areas which at the same time are not agriculturally productive.

There is a shift of rural population from the densely settled high potential areas to the less densely populated areas due to increasing population pressure.[11]

Table 3.8 shows some current rates of migration which were obtained from the 1979 Population Census data.

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11 S. H. Ominde: Population Change and Socio-economic Development in East Africa, Population Studies and Research Institute, University of Nairobi, 1980, p.79.

Table 3.8: Annual migration by Province from data on place of residence in August, 1978

Province	Enumerated[x] in Province	Resident in Province last year	In migrants	Out migrants
Nairobi	799,397	714,989	180,265	95,857
Central	2,258,636	2,263,709	83,301	88,374
Coast	1,295,499	1,273,599	62,325	40,425
Eastern	2,620,937	2,644,352	56,254	79,6-9
N. Eastern	365,319	369,435	8,251	12,369
Nyanza	2,549,178	2,595,000	65,557	111,379
Rift Valley	3,115,630	3,055,473	138,203	78,046
Western	1,759,315	1,792,271	58,359	91,315
TOTAL	14,763,911	14,763,911	-	-

[x] Excluding children under 1 year

Source: Central Bureau of Statistics: Compendium to Vol.1, 1979 Population Census, Ministry of Economic Planning and Development, 1981, p.7.

From table 3.8 we can conclude that Nairobi Province had the highest number of in migrants. This is not surprising, it, being the capital and the centre for trade, administration and industry. It also explains the higher demand for food in the Nairobi Province. Rift Valley had the highest number of in migrants among the agricultural provinces. These migrants might have come from its neighbouring areas,namely Western and Nyanza provinces due to their high population pressures. Some migrants might have come from the dry areas of

Eastern and North Eastern provinces to settle in medium and high potential areas of Rift Valley. If this situation continues, Rift Valley will start experiencing much more pressure on its land. Central, Western, Eastern and the Coast received migrants which averaged 65,000 and this number was 7 times higher than that of North Eastern Province. North Eastern Province received few migrants mainly because it has low potential land which is not suitable for agricultural production. Looking at out migrants, Nyanza had the highest number. It may be an indication of the shift from the more densely settled high potential areas to the less densely populated areas. The numbers are also quite high for Western, Central and Eastern provinces.

3.4 Differential population growth rates and their implications to food production

Table 3.9 shows population growth between 1969 and 1979 by provinces. It is important to analyse the implications of differential rates of growth to appreciate the significance to resource availability. Some very rapid population growth rates have been indicated in the Coast, Eastern and North Eastern Provinces. This may partly be due to better coverage at the time of 1979 census enumeration.[12] Nairobi has shown the highest annual population growth rate of 5.1 percent. Being an urban

12 S. H. Ominde: Population Change and Agricultural Development in Kenya, Workshop on Agricultural Settlement, Agricultural Development and Population Change, 1981, p.10.

area, this rapid increase of population has an impact on the demand side of food (maize in particular).

Table 3.9 Population growth rates 1969-1979 by Province

Province	Population 1969	Population 1979	Av. Annual percent increase (inter-censal between 1969-1979
Nairobi	509,000	835,000	5.1
Central	1,676,000	2,348,000	3.4
Coast	944,000	1,339,000	3.6
Eastern	1,907,000	2,717,000	3.6
N. Eastern	246,000	373,000	4.3
Nyanza	2,122,000	2.634,000	2.2
Rift Valley	2,210,000	3,240,000	3.9
Western	1,328,000	1,836,000	3.3
Kenya	10,943,000	15,324,000	3.4

Source: S. H. Ominde: Population Change and Agricultural Development in Kenya, Workshop on Agricultural Settlement, Agricultural Development and Population Change, 1971, p.9.

The four most agriculturally productive provinces namely Central, Nyanza, Rift Valley and Western have annual population growth rates (intercensal rates) of 3.4 percent, 3.9 percent and 3.4 percent respectively. Given the current population densities and the general demand for agricultural land in these areas, these rates are high and if they are not controlled, these provinces will find it difficult to produce enough

maize to feed their population and the population in the poor agricultural areas of the country. Due to shortage of agricultural land, destruction of valuable natural vegetation is already gaining pace, with a resultant phenomenon of soil erosion which in turn is being followed by reduced food yields. The problem of land fragmentation with its negative effects on agricultural production is another consequence of high population growth rates in these areas.

No doubt increasing population growth rates mean increasing demand for food, and to avoid a situation of excess demand, food supply should grow preferably at rates above population growth or at least, at similar rates with population.

3.5 Summary

The acceleration in the rate of population growth in Kenya is a result of recent trends in levels of fertility and mortality. Fertility has been rising from 1960s to early 1970s. By the end of 1970s, fertility had been constant at a level of approximately 8 live births per women. Data available show that there are important regional differences. The highest rural fertility is in the Western, Central and Nyanza provinces with Rift Valley showing above average fertility (Table 3.4). The lowest fertility is to be found in the Eastern

and Coast provinces. It can be concluded that in the more favourable agricultural heartland fertility is very much higher than in the low potential areas.

Another explanation of the cause of accelerated population growth is in the decline in mortality in the 1960s and 1970s. Child mortality has also declined for all age groups (Table 3.6). Regional variation of mortality rates is substantial. Among the agricultural provinces, the Coast, Nyanza and Western provinces have the highest child mortality rates. In the Central, Eastern and Rift Valley, the child mortality rates are lower (Table 3.7). It can be concluded that in the provinces where there is high population densities (Nyanza and Western), the mortality is higher. This may partly be due to a smaller increase in agricultural output and a low quality per capita agricultural land because of pressure on this land.

The effect of external migration on total population growth has been negligible but the role of internal migration has been significant. Major migrations are clearly affected by the agricultural potential of land; internally people move to areas of better quality land or areas of less agricultural density. Nyanza and Western provinces have high agricultural density and these provinces have sizeable

losses from lifetime migration. Similarly, the Eastern and North Eastern provinces have low quality agricultural land; they have also experienced net losses from life-time migration.

In the next chapter, two sets of population projections are calculated based on assumptions of future trends on fertility and mortality. These population projections will help us to project maize demand.

CHAPTER FOUR

ALTERNATIVE POPULATION PROJECTIONS FOR KENYA 1980-2000 AND MAIZE DEMAND PROJECTIONS

4.1 Population projections and their uses

In theory population projection are a relatively simple calculating operation based on assumption about trends in fertility, mortality and migration. They may be prepared for the total population of a nation, its principal geographical subdivisions or specific localities within it. Further, they depend on the availability of accurate population data for a base period distributed by age and sex.

The principal uses of population projections relate to economic and social planning. The users include national and local governments, business firms, labour unions, university research centres and social service organizations. The less developed countries have recognized the necessity of making comprehensive plans for achieving specific goals. Taken together, these plans constitute public policy related to accelerating social and economic development. A first step in planning is to study relevant aspects of the population and the economy, both at the present time and in the recent past.

4.2 Relevance of population projections to Food Demand

The growth of food demand is determined largely by population growth factor-changes. An increase in population would automatically increase the demand for food. However, the rate of increase of demand for food also depends on factors like changes in consumption patterns.

The age composition of the population affects food demand since different age groups require different calories and proteins. If the proportion of young children in the total population is increasing, this would affect the caloric and protein requirements of the population.[1]

4.3 Demographic trends and the assumptions behind the two sets of projections

Fertility and mortality trends in Kenya have been discussed in detail in chapter 3. The general conclusion is that fertility has been rising in the 1960s. In the 1970s it seems to have levelled off. On the other hand, mortality has been declining throughout the period under consideration. International migration to and from Kenya has been negligible.

Specific assumptions about fertility and mortality trends on which the two population growth projections for Kenya are based have been made. The two projections are produced for 1985, 1990, 1995 and 2000.

1 FAO: Introduction to Agricultural Planning, Rome, 1970 p.36.

For Set 1, it is assumed that fertility is constant from 1980 to 2000 at a total fertility rate of 7.9 children per woman. For Set 11, it is assumed that fertility will be declining at a rate of 0.5 percent per annum in the period 1981-1985, 1 percent per annum in the period 1986-1990, 1.5 percent per annum in the period 1991-1995 and 2.0 percent per annum in the period 1996-2000. By the year 2000, total fertility would be 6.5 children per woman which is 17.7 percent lower than what it was in 1980.

Earlier analysis has shown that there is evidence of constant or slight decline in fertility in the late 1970s. So it is reasonable to assume that fertility will be constant throughout the remaining part of this century or that fertility will be declining in this period. Considering that most of the population is still reluctant to accept small size family, it is reasonable to assume that by the year 2000, the total fertility rate will not go down below 6 children per woman. Table 1 in Appendix 11 shows the projections' assumptions.

Mortality in the two projections is assumed to be declining but at different rates. In Set 1, life expectation at birth will be improving at the following rates: 0.3 percent per annum, 0.4 percent per annum, 0.5 percent per annum and 0.6 percent per annum for the

periods 1981-1985, 1986-1990, 1991-1995 and 1996-2000, respectively. The life expectation at birth for females is expected to be 60.7 years and 57.9 years for males by the year 2000 which is about 4 years higher than for 1980. In Set 11, the mortality rate is assumed to decline faster than in Set 1 and life expectation at birth is expected to be improving at the following rates: 0.4 percent per annum, 0.5 percent per annum, 0.6 percent per annum and 0.7 percent per annum for the periods 1981-1985, 1986-1990, 1991-1995 and 1996-2000, respectively. The life expectation at birth for females is expected to be 62.1 years and 59.3 years for males by the year 2000, which is about 5 years higher than for 1980, (Table 11 in Appendix11). With the population growth rate likely to remain above 3.0 percent per annum during much of the remainder of the century, the government's ability to devote enough resources to a dramatic reduction in child mortality will be limited. Under these circumstances, it seems unrealistic to assume an increase of more than 6 years in the expectation of life at birth from 1980 to 2000.

4.4. Method of population projections and the results of the two Sets of Projections

Fertility trends are reflected in the two sets of projections, (Table 1 in Appendix 11) showing total fertility rates. The age specific fertility rates are arrived at from total fertility rates using different proportions to get those for the years 1980, 1981-1985, 1986-1990, 1991-2000 for both sets (Table 111 in Appendix 11).

Mortality trends are shown in table 11 in Appendix 11 showing life expectations at birth of both males and females.

The population is to be projected in 5-year intervals, taking the base years 1980, 1985, 1990 and 1995. Table 1V in Appendix 11 shows the population of 1980 by age and sex.

4.4.1 How to get the survival ratios (^{p}x)

The "Regional model lifetables and stable populations"[2] were used. The North model life table was used since the child mortality for Kenya is relatively high, (chapter 3). Survival ratios for each sex are obtained according to the projected life expectation at birth, ^{e}o, for males and females separately from the life tables. Interporation between two expectations of life was resorted to where necessary.

4.4.2 How to project population at ages 0-4

The age specific fertility rates (ASFR) for each sex is first calculated for age groups 15-19 to 45-49 in the base years from the ASFR of both sexes. In our study, the base years are 1980, 1985, 1990 and 1995 and the ASFR for both sexes are shown in table 111 in the Appendix 11.

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2 A. J. Coale: Regional Model Life Tables and Stable Population, Princeton, University Press, 1966.

The following formulas were used:

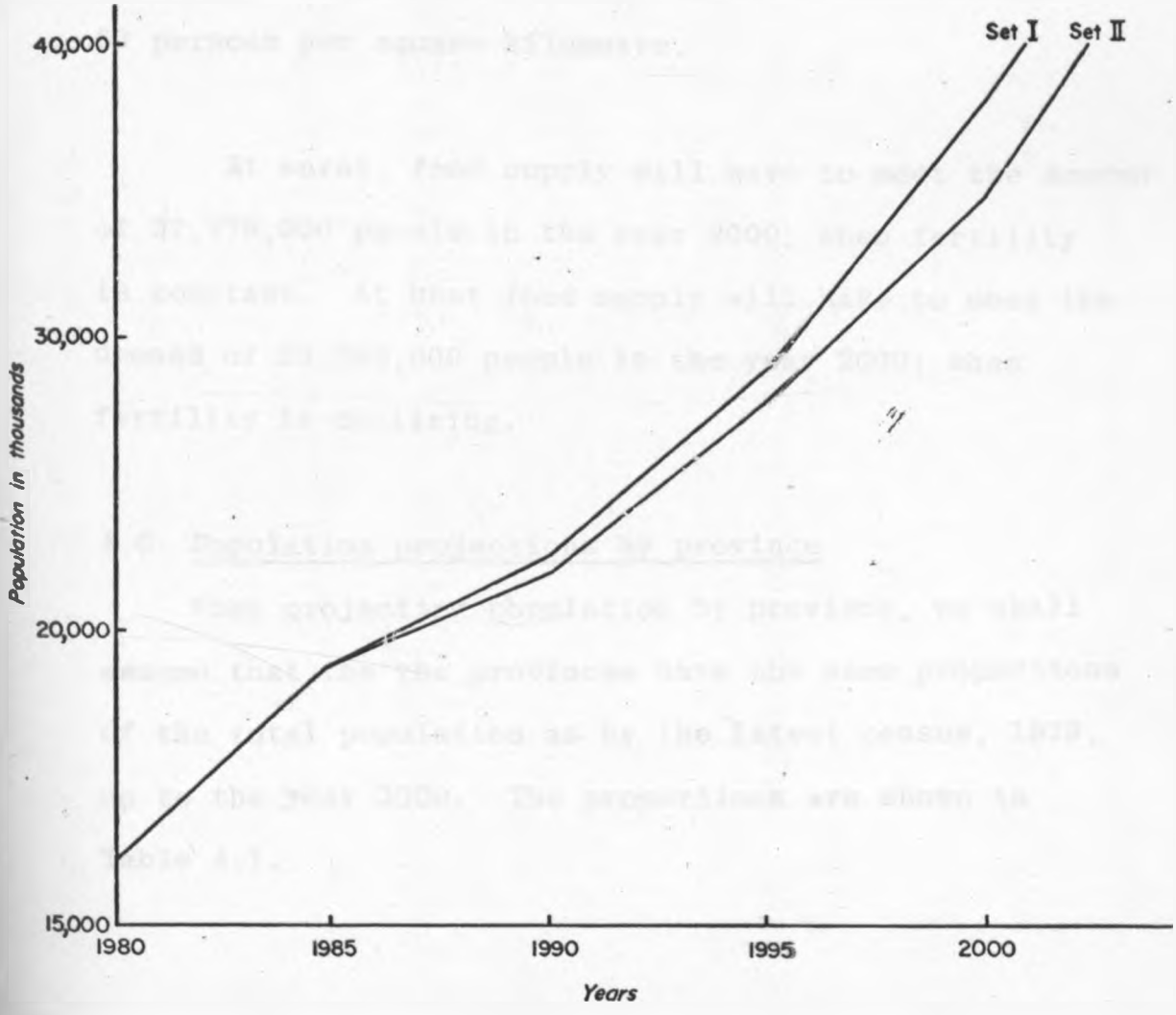
$$\text{ASFR (males)} = \frac{\text{ASFR(both sexes)}}{1.97}$$

$$\text{ASFR (females)} = \frac{\text{ASFR (both sexes)}}{2.03}$$

The sex ratio for Kenya is assumed to be 103. For example if the population of 0-4 age group for females in 1985 is going to be calculated, this is the procedure. The population of females for ages 15-19 for 1980 and the projected population of females for ages 15-19 for 1985 are added up and divided by 2. The ASFR for females for the years 15-19 is multiplied by the result. This is carried out for the remaining age groups in the reproductive ages. This is how to arrive at the total number of births (after multiplying by 5). To get the female population of age group 0-4, survival ratio at birth is multiplied by the result. This procedure is followed when calculating male population for age group 0-4, but ASFR for males is used to get the number of births.

Results of the two sets of projections are shown in Table V, Vl, Vll and Table Vlll in Appendix ll. Figure 1 shows the results of two sets of projections.

Fig. 4:1 GRAPH FOR TWO SETS OF POPULATION PROJECTIONS



Source: Base Population: 1979 Population Census data (Provisional Results)

4.5 Possible growth of the total population

The constant fertility assumed in Set 1 will generate a population which is 2.4 times more than the 1980 population. The declining fertility assumed in Set 11 will generate a population which is 2.1 times more than the 1980 population.

Under Set 1, the population density in the year 2000 would be 66 persons per square kilometre. Under Set 11, the population density in 2000 would be about 59 persons per square kilometre.

At worst, food supply will have to meet the demand of 37,779,000 people in the year 2000; when fertility is constant. At best food supply will have to meet the demand of 33,595,000 people in the year 2000; when fertility is declining.

4.6 Population projections by province

When projecting population by province, we shall assume that the the provinces have the same proportions of the total population as by the latest census, 1979, up to the year 2000. The proportions are shown in Table 4.1.

Table 4.1 Proportions of population by province to total population by 1979 Census.

Province	Proportion
Nairobi	.054
Central	.053
Coast	.088
Eastern	.177
North Eastern	.024
Nyanza	.173
Rift Valley	.211
Western	.120
Total	1.000

Proportions of population by province to total population by 1979 Census (Table 4.1) have been assumed to be the same up to the year 2000. The growth rates in Table 3.9 have not been used in the provincial projections because of period fluctuations of inter-regional migration.

Table X1 shows the population densities by province by the year 2000 for the two sets of projections. Crude densities are exceptionally low in the arid and semi-arid areas of the North Eastern Province, the highest densities have occured in Central, Nyanza and Western provinces where they will be over 400 persons per square kilometre in both sets of projections by the year 2000. For example in Central Province the density will increase by 125 percent from 1979 to 2000 by Set 11.

The continuing increase in the rural density of population in the country where there is good agricultural land has serious implications for food production. This is likely to get more acute as the years go by. Agricultural production will be severely limited by the scarcity of good land, unless intensive land usage and changes in technology intervene to overcome this constraint.

In the next section, maize demand is going to be projected based on two sets of population projections.

4.7 Maize demand projections

4.7.1 Assumptions behind maize demand projections

In our study, two alternative maize demand projections are going to be calculated. The first projections are going to be based on the consumption level of maize of 1980 which is about 120 kgs[3] per person per year. This consumption level is assumed to be constant up to the year 2000. It is assumed that all other factors which affect food demand will not change like prices, shifts in urban population, changes in per capita income etc. It is also assumed that all the maize produced is for human consumption.

The second projections are going to be based on recommended diet in Eastern Africa where the staple food is grain. Supposing that Kenya follows the

3 Ministry of Agriculture: Food Consumption in 1979 and 1980, unpublished, 1981, p.23.

recommended amount of grains per day for different age groups as in Table 4.2, it would be useful to estimate how much maize would be required for consumption by the year 2000.

Table 4.2 Recommended diet in Eastern Africa where the staple food is grain (cereals)

Age group	Pulses (peas or beans) or (grams)	Oil seeds (groundnuts in shell or simsim (grams)	Grain (cereal e.g. millet, maize, etc.) (grams)
0-5 months	0	0	0
6-12 months	0	0	227
1-5 years	14-114	20-142	369
6-15 years	159	207	268
15-45 years	28	37	824
Over 45 years	37	45	511

Source: Ministry of Health: Nutrition in Eastern Africa, a Manual for Teachers and Others, Nairobi, 1976, p.63.

Consumption maize projections based on 1980 Consumption level (maize expected to be demanded)

Based on Sets 1 and 11 of population projections, Table 4.3 shows the quantity of maize that is expected to be consumed by the total population for the year 1985, 1990, 1995 and 2000. The consumption level of 1980 of 120 kgs. per person per year is used to calculate these projections.

Table 4.3 Consumption maize projections, Sets 1 and II

Year	Set I '000 tonnes	Set II '000 tonnes
1980	1920	1920
1985	2348	2348
1990	2853	2825
1995	3521	3452
2000	4533	4031

According to Set I from table 4.3, the quantity of maize expected to be consumed will increase by about 136 per cent from the year 1980 to the year 2000. According to Set II, the quantity of maize expected to be consumed will increase by about 110 per cent from the year 1980 to the year 2000.

4.7.2 Consumption maize projections based on receommended diet in Eastern Africa where the staple food is grain

In order to find how much will be consumed in the years 1985, 1990, 1995 and 2000 (for two sets of population projections) if this diet is followed, the amount consumed by each group per day in these years is first calculated and then multiplied by 365 days.

To split ages 0, 1, 5, 15 and 45 from the total of age groups 0-4, 5-9, etc. -------, Sprague's interpolation formula as described in "Methods and Materials of Demography"[4] has been used.

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[4] A.J. Shryock and S. Siegel: Methods and Materials of Demography, Academic Press, New York, San Francisco, 1976, p. 543.

For example, taking projected population for the year 1985 for Set 1 (see Appendix 11), table V1). Consumption maize projection is calculated as in table 4.4.

Table 4.4 Maize consumption according to population Set 1 in the year 1985

Age group	Total population '000	Grams per day per person	Kgs. per day for different age groups
0-5 months	285	0	0
6-12 months	612	227	138,924
1-5 years	4093	369	1,510,317
6-15 years	6009	568	3,413,112
16-45 years	6943	824	5,721,032
Over 45 years	1625	511	830,375
TOTAL	19571		11,613,760

Source: Data based on recommended diet in East Africa (see Table 4.2).

The total amount of maize which will be taken per day in the year 1985 will be 11,613,760 kgs. (11,614 tonnes). Considering the whole year 1985, the total amount of maize to be consumed will be (11,614 x 365) tonnes which is 4,239,110 tonnes and an average of about 215 kgs. per person per year. This method is used when projecting maize consumption for the other years. Table 4.5 shows the consumption maize projections for Sets 1 and 11.

Table 4.5 Consumption maize projections, Set 1 and Set 11

Year	Set 1	Set 11
	'000 tonnes	'000 tonnes
1980	1920	1920
1985	4239	4239
1990	5112	5061
1995	6309	6185
2000	8122	7223

Assuming a higher level of maize consumption (215 kgs. per person per year) in the period under consideration, it can be deduced from table 4.5 that the quantity of maize expected to be consumed will be 323 percent more in the year 2000 than in the year 1980 according to Set 1. According to Set 11, the quantity of maize expected to be consumed will be 276 percent more in the year 2000 than in the year 1980.

4.7.3 Projected maize consumption by province based on 1980 consumption level

The maize consumption projections by province for the year 2000 can be calculated using the projected population by province (see Appendix 11, Table 1X and X) and the 1980 consumption level of 120 kgs. per person per year. It has been assumed that all the provinces will consume maize at the same level.

Table 4.6 Projected maize consumption by province for the year 2000 for Set 1 and 11

Province	Set 1 '000 tonnes	Set 11 '000 tonnes
Nairobi	244	218
Central	718	616
Coast	399	355
Eastern	802	714
N. Eastern	109	97
Nyanza	784	697
Rift Valley	957	851
Western	544	484
TOTAL	4557	4032

Amount of maize expected to be consumed by the year 2000 will vary from province to province as shown in table 4.6. The provinces which will have the highest demand of maize are Rift Valley, Eastern, Central and Nyanza. Out of the total consumption of 4,557,000 tonnes (Set 1), Rift Valley, Eastern, Nyanza and Central are expected to consume about 21 percent, 18 percent, 17 percent and 16 percent respectively.

4.8 Summary

Past trends of demographic factors have been stated and the assumptions about fertility and mortality behind two sets of projections have been outlined. The method used when projecting population has been shown. When fertility is constant, food supply will meet demand of 37,779,000 people in the year 2000 and when fertility is declining food supply will meet demand of 33,595,000 people in the year 2000. Population projections by province up to the year 2000 were based on the provincial proportions of the total population as by 1979.

Two sets of maize demand projections were calculated based on two different levels of consumption of maize. The first projections were based on consumption level of maize of 1980 which is about 120kgs per person per year and the second projections were based on the recommended diet in Eastern Africa where the staple food is grain. Projected maize consumption by province has been calculated assuming that all provinces will consume maize at the same level. The highest demand of maize is expected to be in Rift Valley and Eastern provinces.

In the next chapter, we are going to analyze if there will be an imbalance between maize supply (projected maize production) and maize demand (projected maize consumption) by the year 2000 and some implications will be outlined.

CHAPTER FIVE

ANALYSIS OF MAIZE DEMAND AND MAIZE SUPPLY BY THE YEAR 2000

5.1 Projected maize demand and supply

In the previous chapter, maize demand projections have been calculated. These will help us to see if maize expected to be produced (chapter two) will be enough for the growing population by the year 2000.

Tables 5.1 and 5.2 show the imbalance of maize supply and maize demand if the present level of consumption of 120 kgs. per person per year is considered.

Table 5.1 National maize production Set 11 (HIGH) and National maize demand projections Set 1 and 11 compared

'000 tonnes

	Maize Production	Maize demand		Imbalance according to demand	
Year	Set 11	Set 1	Set 11	Set 1	Set 11
1980	1900	1920	1920	-20	-20
1985	2288	2348	2348	-60	-60
1990	2819	2853	2825	-34	-6
1995	3554	3521	3452	+33	+102
2000	4577	4533	4031	+44	+546

Table 5.1 shows that maize produced will not be able to meet the maize demand for the years 1985 and 1990 according to the two sets of population projections.

For the years 1995 and 2000, maize produced will be able to meet the maize demand according to the two sets of population projections. In order for Kenya to achieve the production of maize of about 3,554,000 tonnes and 4,577,000 tonnes by the years 1995 and 2000 respectively, (maize production Set 11) it will have to expand the area for production of maize by about 2.5 percent per annum from the year 1980 to 2000 and the yield per hectare will have to be increased by 2.0 percent per annum from the year 1980 to 2000.

Table 5.2 National maize production Set 111 (LOW) and National maize demand projections Set 1 and 11 compared

'000 tonnes

Year	Maize production	Maize demand		Imbalance according to demand	
	Set 11	Set 1	Set 11	Set 1	Set 11
1980	1900	1920	1920	-20	-20
1985	1983	2348	2348	-365	-365
1990	2062	2853	2825	-791	-763
1995	2135	3521	3452	-1386	-1317
2000	2198	4533	4031	-2335	-1833

Table 5.2 shows the imbalance between maize supply and maize demand when considering the projected national maize production for Set 111 (LOW). If the

yield continues declining at a rate of about 1 percent per annum and the area expands by only about 2 percent per annum, Kenya will face acute maize shortages for both sets of population projections. Table 5.2 shows that the shortages will continue increasing from the year 1980 to 2000. By the year 2000, Kenya will have to import over 1,800,000 tonnes of maize to meet the demand.

Table 5.3 shows the imbalance of maize supply and maize demand if a higher level of maize consumption of 215 kgs. per person per year (chapter four) is considered.

Table 5.3 National maize production Set 11 (HIGH) and National maize demand projections Set 1 and 11 compared

'000

	Maize production	Maize demand		Imbalance according to demand	
Year	Set 11	Set 1	Set 11	Set 1	Set 11
1980	1900	1920	1920	-20	-20
1985	2288	4239	4239	-1951	-1951
1990	2819	5112	5061	-2293	-2242
1995	3554	6309	6185	-2755	-2631
2000	4577	8122	7223	-3545	-2646

According to projected maize production Set 11 (HIGH), maize expected to be supplied will not meet

the demand from 1980 to 2000 if a higher level of maize consumption of 215 kgs. per person per year is considered. The shortages will continue increasing throughout the period under consideration. Kenya is expected to import over 2,600,000 tonnes of maize to meet the demand in the year 2000. If projected maize production Set 111 (LOW) is achieved, the situation will even be worse. By the year 2000, Kenya will be expected to import over 5,000,000 tonnes of maize to meet the demand. See table 5.4.

Table 5.4 National maize production Set 111 (LOW) and National maize demand projections Set 1 and 11 compared

'000 tonnes

	Maize production	Maize demand		Imbalance according to demand	
Year	Set 11	Set 1	Set 11	Set 1	Set 11
1980	1900	1920	1920	-20	-20
1985	1983	4239	4239	-2256	-2256
1990	2063	5112	5061	-3049	-2998
1995	2135	6309	6185	-4174	-4050
2000	2198	8122	7223	-5924	-5025

In brief, maize production Set 11 (HIGH) will meet the demand for maize at current consumption levels by the years 1995 and 2000. However, there will be a short fall if higher consumption levels (215 kgs. per person per year) is assumed.

Maize production Set 111 (LOW) will not meet the demand for maize both at current consumption levels and at higher consumption levels from the year 1980 to 2000. Kenya will be forced to import more maize to meet the demand.

5.2 Projected maize demand and maize supply by province

From chapter two and four, it has been seen that there are variations of supply and demand for maize by province. Tables 5.5 and 5.6 shows the imbalance of maize supply and maize demand by province in the year 2000 assuming that the 1980 consumption levels will be constant until the year 2000.

Table 5.5 Projected maize production Set 11 (HIGH) compared with projected maize consumption Set 1 and 11 by province in the year 2000

'000 tonnes

Province	Maize production	Maize demand		Imbalance according to demand	
		Set 1	Set 11	Set 1	Set 11
Nairobi	-	244	218	-244	-244
Central	457	718	616	-261	-159
Coast	228	399	355	-171	-127
Eastern	457	802	714	-345	-257
North Eastern	228	109	97	+119	+131
Nyanza	457	784	697	-327	-240
Rift Valley	2288	957	851	+1331	+1437
Western	457	544	484	-87	-27

Table 5.5 shows that Rift Valley and North Eastern provinces will have a surplus of maize supply. The surplus of maize supply in Rift Valley is more outstanding. The other provinces are expected to get extra maize from Rift Valley. Nairobi, Eastern and Nyanza provinces are expected to have more deficit of maize supply than other provinces.

Table 5.6 Projected maize production Set 111 (LOW) compared with projected maize consumption Set 1 and 11 by province in the year 2000

'000 tonnes

Province	Maize production	Maize demand		Imbalance according to demand	
		Set 1	Set 11	Set 1	Set 11
Nairobi	-	244	218	-244	-244
Central	220	718	616	-498	-396
Coast	110	399	355	-289	-245
Eastern	220	802	714	-582	-494
N. Eastern	110	109	97	+1	+13
Nyanza	220	784	697	-564	-477
Rift Valley	1099	957	851	+142	+248
Western	220	544	484	-324	-264

Table 5.6 also shows that Rift Valley and North Eastern provinces will have a surplus of maize supply if the provinces achieve maize production projections

of Set 111 (LOW) but the surplus will be lower than what they will have if they achieve maize production projections of Set 11 (Table 5.5). Other provinces will have more maize supply deficits if they achieve maize production projections of Set 111 than if they achieve projections of Set 11.

This situation will be worse and Rift Valley will not be able to satisfy even any two provinces which are expected to have a deficit of maize supply.

In the next section, we are going to look at some of the implications of the imbalance between maize supply and maize demand for Kenya.

5.3 Some implications

It is assumed that the population of Kenya will not improve its diet but will continue taking an average of 120 kgs. of maize each person per year as in 1980, it will be able to feed the total population from the quantity of maize produced according to Sets 11 and 111 by the year 1995 and 2000. To be able to achieve this production of maize, the area of production will expand at a rate of 2.5 percent per annum from the year 1980 to 2000. However, most of the arable land is already under cultivation, especially in high and medium potential areas. This implies that if Kenya has to expand the area of production exceeding

this rate of increase, it will have to adopt "slash-and-burn" techniques which may cause serious environment deterioration including heavy erosion and to adopt irrigation techniques which are very expensive in semi-arid and arid lands.

At the same time, Kenya will have to increase its yield per hectare at a rate of above 2 percent per annum. In order to do this, Kenya's population especially the smallholders, will have to increase the use of pesticides, fertilizers and improve seeds, all blended by a high level of managerial skill to distribute those commmodities. They should also be encouraged by remunarative prices and adequate marketing facilities.

From the article called "Gross margin of main crops - 1981" (unpublished) from the Ministry of Agriculture, Kenya, they have estimated that in order to be able to produce maize at about 2000 kgs. per hectare, a farmer uses approximately 160 kg/ha. of single super phosphate and about 200 kg/ha. of ammonium sulphate. Looking back at the yield projections in the Appendix, taking 1980 as base year, Sets 1 and 11 will be 1642 kg/ha and 1939 kg/ha, respectively by year 2000. The smallholders who produce about 80 percent of maize will have to raise the use of fertilizers from nearly 0 kg./ha to 150 kg/ha for single super phosphate and to about 2000 kg/ha for ammonium sulphate nitrate by the year 2000.

If Kenya improves its caloric intake according to Table 4.3, it will have even a harder task to be able to feed the growing population at such high rates. It needs to produce about 8,000,000 tonnes of maize which is far below the three sets of projected maize production. Assuming that area will be increasing at a rate of 2.5 percent per annum by the year 2000, the area will be about 2,000,000 hectares.

In order to be able to produce 8,000,000 tonnes, the yield will have to be about 4000 kg/ha. This means an increase of about 5.7 percent per annum from the year 1980 to 2000. In order to be able to achieve the yield of 4000 kg/ha., a farmer uses approximately 290 kg/ha. of single super phosphate and 375 kg/ha. of ammonium sulphate nitrate.[1] So in order for Kenya to achieve such a yield, the percentage of small-holders will have to increase the use of fertilizers from nearly 0 to the above postulated levels of ammonium super phosphate and ammonium sulphate nitrate.

If it is assumed that Kenya will pay fertilizers at the same rate as in 1979, that is K.£0.07 per kg. for ammonia sulphate nitrate and K.£0.08 per kg. for

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1 Kenya, Ministry of Agriculture: Gross Margin of Main Crops - 1981 (unpublished), 1981, p.3.

super phosphate[2] it will spend about K.£46 million on ammonium sulphate nitrate if the average yield will be about 4000kg/ha. and the area for planting maize will be about 2,000,000 hectares. Assuming the inflation will continue from the year 1980 to 2000 at a rate of 10 per cent per annum, the total cost to import fertilizers will be about K.£300 million.

Considering the economic problems facing Kenya, and scarcity of foreign exchange, it might be difficult for Kenya to spend all that money on importation of fertilizers. On top of that, Kenya will have to provide economic incentives for smallholders to be able to buy and use that amount of fertilizers.

5.4 Summary

Projected maize demand and supply has been compared to see if there is an imbalance according to different sets of maize production and maize demand. Assuming a low level of consumption and National maize production set II (High) maize produced will not be able to meet the maize demand for the years 1985 and 1990. Assuming a low level of consumption and National maize production set III (Low), the shortages will continue increasing from the year 1980 to 2000. Assuming a high level of consumption and both (High) and (Low) national maize production sets, the shortages will continue increasing from the year 1980 to 2000.

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[2] Central Bureau of Statistics: Kenya Statistical Abstract, Ministry of Planning and Economic Development, 1980, p. 62.

Provincial comparisons of projected maize demand and maize supply were made for the year 2000 assuming projected maize production set II (High) and a low level of maize consumption as well as a high level of maize consumption. Again maize production set III (Low) was compared with a low level and a high level of maize consumption. In both cases, Rift Valley and North Eastern provinces are expected to have a surplus of maize in the year 2000. The implications of these findings have been outlined.

In the next chapter, some recommendations will be outlined and the study will be concluded.

CHAPTER SIX

SUMMARY, RECOMMENDATIONS AND CONCLUSION

6.1 Objectives and basic findings

The main objective of this study was to find out if there would be an imbalance between population and maize production by the year 2000. This objective was carried out by projecting both population and maize production from the year 1980 to the year 2000. The population was projected behind assumptions about fertility and mortality trends (Chapter Four). Maize production projections were behind assumptions about area and yield per unit trends. (Chapter Two).

According to the present level of consumption (about 120 kg per person per year), the high medium and low maize production projections will be sufficient for the population projected in the years 1995 and 2000.

On the other hand, if an increased level of consumption is assumed, (about 215 kg per person per year), this production will not be sufficient for the population projected in the two sets. Indeed it will represent only about half of the maize requirement.

6.2 Other findings and policy related considerations

In the present analysis, it was shown that (i)

Kenya has had both positive and negative food production growth rates in the past. Between 1964 and 1974, the annual growth rate of agricultural production averaged 4.7 percent. In recent years (1974-1981), adverse weather conditions and a growing constraint on land supply, especially in the Central, Nyanza and Western Provinces, have reduced the growth rates to 2.4 percent. (ii) Due to the poor performance of food crops in particular and a rapidly growing population, per capita food production has declined. (iii) Though food-population imbalance has been evident since the mid 1970s, policy makers did not give priority to food production until the 1980s when they drafted the first National Food Policy in Kenya. (iv) There is now a tendency for Kenya decision makers to view the food situation both in terms of increased output of agricultural products and the influence of demographic patterns. (v) In the past, the government has been putting major emphasis on large scale farms but at the same time it had neglected to improve economic incentives for the smallscale farmers who produced about 80 percent of all the maize. (iv) The high rate of increase demand for maize projected in this study between 1980 to 2000 depends mostly on the high rate of population growth. (vii) The demand for food crops is directly proportional to the rate of growth of population. (viii) In order to achieve a balance between maize demand and maize supply, after improving

the caloric intake, Kenya has to expand the area of production by about 2.5 percent per annum and the yield per hectare by about 5.7 percent per annum.

In the past, Kenya had believed that it could solve the food problem by concentrating only on measures that increase output in utter disregard for the role of the population variable. It is only recently that Kenya has noticed that it should not neglect demographic levels if it is to solve the food problem. The National Food Policy has shown the danger of the high rate of population growth, in the light of sufficient food supply. It states, "The rapid expansion of the population and a shortage of unexploited arable land in the main high potential areas are beginning to expose a potentially dangerous imbalance in the relationship between the national supply of land demand for food". Politicians and newspapers have been stressing the problem of food especially in relation to the rapid population growth rate. So in this sense, one cannot say that the Kenya government is not aware of the problem of food in the context of high population growth.

While Kenya is anxious to boost food production and reduce population growth, it must take appropriate steps to achieve these goals.

6.2.1 Food production increase: policy recommendations

Limited availability of arable land limits the expansion of food production at a high rate. From chapter five, it was seen that the area of maize production will have to expand at a rate of 2.5 percent per annum, which Kenya cannot afford, unless it adopts a "slash-burn" technique which may cause serious environmental deterioration including heavy soil erosion. The best alternative which Kenya can embark on is to increase the yield per hectare. In order for Kenya to achieve maize production of about 8,000,000 tonnes in the year 2000, as required for the consuption of 215 kg per person per year, Kenya has to increase yield up to 4000 kg/ha by the year 2000 and this is when the area of production is expanding at a rate of 2.5 percent per annum. If the area is expanding at rates between 1-1.5 percent per annum between 1980 to 2000, however, the yield would have to reach about 5000 kg/ha by the year 2000. From chapter five, it was seen that if Kenya had to produce maize at the level of 4000 kg/ha, it would have to spend about K£ 100 million to import fertilizers at the 1979 rate of importation. Considering the possibility of a 10 percent rate of inflation from 1980 to 2000, it would have to spend about K£ 300 million to import fertilizers.

Kenya is facing financial problems, and constraint

of foreign exchange.[1] This situation is likely to continue for some years due to increasing crude petroleum prices, relatively low prices for coffee and tea on world markets and the increase of the level of inflation, both internally and externally. Consequently, it will be extremely difficult for Kenya to raise about K.Shs 300 million for the importation of the necessary fertilizers unless there is some foreign aid from international bodies like the World Bank, International Development Finance, USAID and UNDP. Moreover, even if it got the whole amount of money to import all the amount of fertilizers needed, the problem would still remain of giving the small-scale farmers economic incentives to use the fertilizers at a rate of about 300 kg/ha from nearly 0 kg/ha.

Kenya must also try to improve the transportation of fertilizers to small-scale farmers through co-operatives and this can only be done if there is better managerial skill both in the Ministry of Agriculture and the Ministry of Cooperatives and Marketing. To this end, the government should reintroduce a Guaranteed Minimum Return Schedule, the only source of seasonal credit for many farmers. This will enable them to buy fertilizers.

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1 The World Bank: Kenya Economic Memorandum, Annex 1, Agricultural Issues, 1981. p.1.

Improved seeds, for example hybrid maize, should also be encouraged and distributed by cooperatives. In addition, the government should see that it leaves sufficient margins between fixed producer and consumer prices so as not to let the producer have a loss. All these factors would encourage a small-scale farmer to adopt the use of fertilizers. Yet given the problems facing the Ministry of Agriculture, e.g. poor management, and uncoordinated and inappropriate policy decisions, it is unthinkable that a small scale farmer would be able to use fertilizers at a level of about 300 kg/ha by the year 2000.

6.2.2 Population: Policy recommendations

From chapter four, it was seen that the rate of growth of population is the principal factor affecting the demand for food crops. When an improvement in caloric intake is added to population growth, a total of 8,000,000 tonnes of maize will be required by the year 2000. Obviously, it will be very difficult for Kenya to achieve this level of maize production. Given this difficulty, Kenya should try to reduce the high population growth rate which is about 4.0 percent per annum.

Kenya was the first sub-saharan country to officially adopt a policy of fertility reduction through family planning.

The commitment of the political leadership to the programme in recent years has been strong, but its objectives are not vigorously persued. No specific demographic target is seriously aimed at, family planning services are provided in a package with maternal and child health care, with emphasis on the latter.

The Kenyan people almost universally favour large families. Administrators and planners show a better understanding of the situation, but express skeptism about the chances of reducing population growth through family planning alone. Past studies have shown that no significant fertility reduction in Kenya is possible unless there are changes in fertility and related attitudes and a stronger role for women in the family decision-making process.

Prospects for a significant reduction in the population growth rate in the near future are dim. Mortality appears to be declining, but there is no indication that fertility has declined significantly in any major section of the population.

6.2.2.1 Policy for fertility reduction

Kenya should strengthen substantially the regular family planning programmes. This can be done within the framework of the current programme, e.g. by increasing

its efficiency through new methods or encouraging new cadres of outreach workers. The family planning centres should also be increased especially in rural areas.

In order that wide spread use of family planning methods can be accepted by the public, it is essential, first, to educate and convince politicians and policy makers its importance through seminars and workshops.

In the meantime, the government policy on social economic development if implemented should lead to higher levels of education, health and female employment. Such developments should indirectly reduce the level of fertility.

6.3 Recommendations for Future Research

In this study it has been shown that both the high and medium potential arable land in Kenya is limited in supply. It has also been shown that given the current demographic characteristics in the country, the population will continue to grow at a high rate. Thus, to be able to provide enough supply of food to meet the potential population growth, further research needs to be carried out in certain areas as follows:

(a) The effect of land redistribution in respect to grazing vis-a-vis food production.

(b) The effect of population migration from low to high potential agricultural land and vice versa in relation to land availability.

(c) The effect of high and increasing income per capita on the demand for various food types e.g. proteins, carbohydrates etc.

(d) Methods of increasing small scale production through the provision of incentives to the farmers.

(e) Research into crop yield in respect to various seed types of maize.

(f) Research into the application of various types of fertilizers to maize production.

(g) Research into possible increase of maize production by employing cheap but improved means of production e.g. use of animals.

The above list is far from being exhaustive. It is likely that other fields requiring research may arise from this study.

6.4 Conclusion

In concluding this study, it is clear that in the case of Kenya a high rate of population growth does not mean a high enough rate of food production to feed the growing population. There has been a food shortage, maize in particular (its staple food), in the past and the shortage has also been focused in the future. So Esther Boserup's proposition is not true in the case of Kenya. She did not consider other parameters like limited availability of land, shortage of foreign currency to import fertilizers and lack of economic incentives for small-holders to start using technology and fertilizers and limited resources to develop irrigation schemes in semi arid and arid lands.

In order to solve the food shortage problem, Kenya should put more weight on both food production and reduction of population growth. To succeed, it will have to follow the stated food policy recommended earlier in this chapter in the short run.

In the long run, Kenya should work on fertility reduction to avoid future food problems. The policy of fertility reduction is outlined above. Unfortunately, it may take more than 20 years before the majority of Kenya's population prefers "small family size".

If Kenya succeeds in reducing its population growth rate, it will still continue following policies of increasing food production and this can help it to have excess food which it can export to help in earning more foreign exchange.

In concluding this study, it is clear that if Kenya does not give priority to both increasing food supply and reducing food demand through reducing high population growth rate, it will continue to face food shortages both in the short run and the long run.

At the provincial level, Rift Valley is expected to continue having a surplus of maize supply. This surplus will be distributed among other provinces which are expected to have deficits, but this will not be enough to satisfy them. Nyanza, Western and Central Provinces have a high proportion of high and medium agricaltural core areas but they have high pressure on their land. So there is little hope that in the near future there will be any increase in maize production in these provinces. With the arid and semi-arid

irrigation schemes, there is some hope that maize production will increase in the Eastern Coast and North Eastern Provinces. Nairobi, being an urban province, will of course continue depending on the agricultural provinces.

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APPENDIX 1

Table 1: Projected yields showing Set 1, 11 and 111 taking 1980 as base year

kg/hectare

Year	1	11	111
1980*	1267	1267	1267
1985	1352	1362	1192
1990	1442	1498	1117
1995	1539	1686	1042
2000	1642	1939	967

Table 11: Projected area showing Set 1, 11 and 111 taking 1980 as base year

'000 ha

Year	1	11	111
1980*	1500	1500	1500
1985	1680	1680	1664
1990	1882	1882	1846
1995	2108	2108	2049
2000	2361	2361	2273

* Data based on the 1980 figures from FAO Production Yearbook, 1980, Vol.34, Rome, p.102.

Table 111 Maize production projections by province in the year 2000 for Set 1, 11 and 111

'000 tonnes

Provinces	Set 1	Set 11	Set 111
Rift Valley	1938	2288	1099
Western	387	457	220
Nyanza	387	457	220
Central	387	457	220
Eastern	387	457	220
Coast	193	228	110
North Eastern	193	228	110

Source: Data based on the 1980 figures from FAO Production Yearbook, 1980, Vol.34, Rome, p.102.

APPENDIX 11

Table 1: Projected total Fertility rates for sets 1 and 11

Year	Set 1	Set 11
1980[1]	7.9	7.9
1981-1985	7.9	7.7
1986-1990	7.9	7.4
1991-1995	7.9	7.0
1996-2000	7.9	6.5

Source: [1] Data based on the 1979 Census, Kenya Government, National Population Census, 1979.

Table 11: Projected life expectation at birth for Sets 1 and 11 for males and females

Years	Females		Males	
	Set 1	Set 11	Set 1	Set 11
1979-80 [1]	56.9	56.9	54.1	54.1
1984-85	57.7	57.7	57.9	55.1
1989-90	58.6	59.1	55.8	56.3
1994-95	59.6	60.5	56.8	57.7
1999-2000	60.7	62.1	57.9	59.3

Table 111 Age specific fertility rates for Set 1, and Set 11 for all years

Age	1979*	1981-85	1986-90	1991-95	1996-2000
10-14	.0031	.0031	.0029	.0027	.0025
15-19	.1795	.1756	.1664	.1550	.1414
20-24	.3677	.3588	.3402	.3169	.2889
25-29	.3720	.3634	.3446	.3211	.2926
30-34	.3106	.3034	.2876	.2679	.2443
35-39	.2257	.2202	.2088	.1945	.1773
40-44	.1049	.1032	.0978	.0911	.0831
45-49	.0139	.0139	.0131	.0122	.0117

* Age specific fertility rates for 1979 are used in Set 1 for all years (constant fertility).

For age specific fertility rates of Set 11, the rates of total fertility rates decline were used to calculate them for each age group.

[1] Data based on the 1979 Population Census, Kenya Government, National Population Census, 1979.

Table 1V Age proportion according to adjusted population and the 1980 age-sex population

Age	Age proportions		Population of 1980	
	Male	Female	Male	Female
0-4	.187	.184	1,476,389	1,474,642
5-9	.164	.161	1,294,800	1,290,312
10-14	.139	.135	1,097,422	1,081,939
15-19	.112	.113	884,253	905,623
20-24	.086	.090	678,980	721,292
25-29	.067	.070	528,973	561,005
30-34	.52	.054	410,546	432,775
35-39	.040	.042	315,305	336,603
40-44	.033	.035	260,539	280,503
45-49	.029	.029	228,958	232,416
50-54	.024	.024	189,483	192,345
55-59	.019	.018	150,007	144,258
60-64	.015	.014	118,427	112,201
65-69	.013	.011	102,637	88,158
70-74	.009	.008	71,056	64,115
75+	.012	.011	94,741	88,158
			7,895,119	8,014,360

Source: Data based on the 1979 Population Census, Kenya Government, National Population Census, 1979.

Table . V Projections for Set 1 for the years 1985, 1990, 1995 and 2000 for males

	Males ('000)			
Age	1985	1990	1995	2000
0-4	2332	2852	3391	4417
4-9	1603	2031	2451	3121
10-14	1337	1640	2096	2709
15-19	1053	1048	1303	2070
20-24	754	907	1226	1339
25-29	610	743	1032	1200
30-34	413	643	722	983
35-39	302	499	626	802
40-44	304	384	479	698
45-49	248	291	369	462
50-54	215	235	266	351
55-59	175	200	219	259
60-64	132	157	181	199
65-69	97	115	120	156
70-74	71	79	91	108
75+	48	55	58	64
TOTAL	9694	11879	14630	18900

Source: Data based on the 1979 Population Census, Kenya Government, Nationan Population Census, 1979

Table V1 Projections for Set 1 for the years 1985, 1990, 1995 and 2000 for females

	Females ('000)			
Age	1985	1990	1995	2000
0-4	2202	2796	3363	4310
5-9	1601	1901	2365	3075
10-14	1301	1600	2057	2660
15-19	1065	1051	1365	2031
20-24	852	948	1229	1346
25-29	611	772	1029	1209
30-34	447	689	754	1006
35-39	421	533	674	834
40-44	326	408	518	656
45-49	270	314	394	502
50-54	222	258	301	379
55-59	185	209	244	285
60-64	142	166	192	226
65-69	107	115	146	170
70-74	75	79	94	120
75+	50	59	57	69
TOTAL	9877	11898	14714	18879
GRAND TOTAL	19571	23777	29344	37779

Source: Data based on the 1979 Population Census, Kenya Government, National Population Census, 1979.

Table V11 Projections for Set 11 for the years 1985, 1990, 1995 and 2000 for males

''000

Age	1985	1990	1995	2000
0-4	2332	2478	3072	3470
5-9	1603	1924	2328	2344
10-14	1337	1636	2029	2297
15-19	1053	1101	1353	2070
20-24	754	1057	1226	1339
25-29	610	833	1032	1200
30-34	514	633	822	1008
35-39	398	489	626	801
40-44	304	374	479	607
45-49	249	291	369	462
50-54	216	235	276	351
55-59	175	200	219	259
60-64	134	157	181	199
65-69	100	115	135	157
70-74	80	78	91	106
75+	45	59	61	64
TOTAL	9694	11750	14366	16735

Source: Data based on the 1979 Population Census, Kenya Government, National Population Census, 1979.

Table VIII Projections for Set 11 for the years 1985, 1990, 1995 and 2000 for females

Age	Females ('000) 1985	1990	1995	2000
0-4	2204	2425	3011	3411
5-9	1601	1904	2231	2304
10-14	1301	1511	2057	2292
15-19	1065	1148	1365	2035
20-24	852	1048	1229	1347
25-29	611	872	1029	1210
30-34	447	690	854	1011
35-39	421	533	674	837
40-44	326	408	518	657
45-49	270	317	394	503
50-54	222	258	301	380
55-59	185	229	244	286
60-64	142	176	192	226
65-69	107	125	146	171
70-74	75	89	94	121
75+	48	61	62	66
TOTAL	9877	11791	14401	16860
GRAND TOTAL	19571	23541	28767	33595

Source: Data based on the 1979 Population Census, Kenya Government, National Population Census, 197

Table 1X Population projections for Set 1 by province for the year 1985,1990, 1995 and 2000 *

Province	1985	1990	1995	2000
Nairobi	1056	1284	1585	2040
Central	2990	3638	4490	5980
Coast	1720	2092	2582	3325
Eastern	3459	4209	5194	6687
N. Eastern	469	571	704	907
Nyanza	3381	4113	5077	6536
Rift Valley	4123	5017	6192	7971
Western	2345	2853	3521	4533
TOTAL	19571	23777	29344	37779

Table X Population projections for Set 11 by province for the years 1985, 1990, 1995 and 2000.*

Province	1985	1990	1995	2000
Nairobi	1055	1271	1553	1814
Central	2990	3602	4401	5140
Coast	1720	2072	2531	2956
Eastern	3459	4167	5092	5946
N. Eastern	469	571	704	907
Nyanza	3381	4113	5077	6536
Rift Valley	4123	5017	6192	7971
Western	2345	2853	3521	4533
TOTAL	19542	23541	28767	33595

* Data based on the 1979 Population Census, Kenya Government, National Population Census, 1979.

Table 1X Population projections for Set 1 by province for the year 1985,1990, 1995 and 2000 *

Province	1985	1990	1995	2000
Nairobi	1056	1284	1585	2040
Central	2990	3638	4490	5980
Coast	1720	2092	2582	3325
Eastern	3459	4209	5194	6687
N. Eastern	469	571	704	907
Nyanza	3381	4113	5077	6536
Rift Valley	4123	5017	6192	7971
Western	2345	2853	3521	4533
TOTAL	19571	23777	29344	37779

Table X Population projections for Set 11 by province for the years 1985, 1990, 1995 and 2000*

Province	1985	1990	1995	2000
Nairobi	1055	1271	1553	1814
Central	2990	3602	4401	5140
Coast	1720	2072	2531	2956
Eastern	3459	4167	5092	5946
N. Eastern	469	571	704	907
Nyanza	3381	4113	5077	6536
Rift Valley	4123	5017	6192	7971
Western	2345	2853	3521	4533
TOTAL	19542	23541	28767	33595

* Data based on the 1979 Population Census, Kenya Government, National Population Census, 1979.

Table X1 Expected population densities by province in the year 2000

Province	Set 1 Projected population	Set 11 Projected population	Area in square kilometres	Set 1 Population density per square kilometre	Set 11 Population density per square kilometre
Nairobi	2,049,000	1,814,000	693	2944	2618
Central	5,780,000	5,140,000	13,173	439	390
Coast	3,325,000	2,956,000	83,041	40	35
Eastern	6,687,000	5,946,000	154,540	43	38
N. Eastern	907,000	806,000	126,902	7	6
Nyanza	6,536,000	5,812,000	12,525	522	464
Rift Valley	7,971,000	7,089,000	170,162	47	42
Western	4,533,000	4,031,000	8,223	551	490

Source: Data based on the 1979 Population Census, Kenya Government, National Population Census, 1979.