FARMER RESPONSE TO POPULATION PRESSURE ON LAND: A CASE STUDY OF KIKUYU DIVISION, KIAMBU, KENYA.

BY

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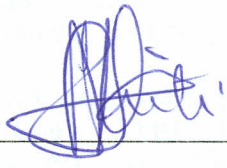
DECLARATION

This thesis is my own original work. It has not been presented for a degree in any other university.

CANDIDATE: 

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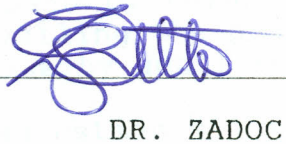
This thesis has been submitted with my approval as the university supervisor.

SUPERVISOR: 

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ABSTRACT

This study had a four-fold purpose: (a) To undertake a historical search for the causes and evolution of population pressure in Kikuyu Division, (b) To examine the relationship between out-migration, fertility control, generation of off-farm sources of income and population pressure and (c) To test Boserup's thesis that increasing population pressure leads to more intensive land use.

Both primary and secondary data were collected to achieve the objectives listed above. Primary data were collected using a questionnaire and oral interviews. Questionnaires elicited data on farmer characteristics and responses to land pressure. Secondary data helped to trace the evolution of land pressure in the study area. Data were analysed by use of averages, percentages, frequencies, correlation, the chi-square test and linear regression.

The study established that the current population pressure is due to land rights dispossession, land consolidation and registration of title of the period 1952-1955 and net increase in population. The respondents are aware of the presence of population pressure on land. Birth control was significantly related to land pressure. Outmigration as an adjustment strategy was insignificant. Farmers adjusted to land pressure by changing livestock combinations, adopting intensive livestock feeding systems, vertical space use, and increasing cropping density. Land pressure and soil husbandry practices are not necessarily related.

From the findings, it is concluded that land pressure can be eased by reversing some contributory factors such as availing the productively inefficient estates for purchase by small scale farmers.

Innovative adjustments to population pressure observed herein should be publicised and disseminated to reach the wider audience. It needs to be further impressed upon the public that the land resource is non-elastic and the need to control population growth rates is great and urgent. Areas for further research by scholars are also given.

DEDICATION

This thesis is dedicated to my sisters Grace Wanjiku, Purity Muringo and Susan Wanjiru for their concern and love to me.

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Above all the greatest expression of gratitude goes to Almighty God who enables and is source of all knowledge.

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INTRODUCTION

1.1 Statement of the Problem

About 87.1% of Kenya's population is rural (Odingo, 1988). 70% of this population lives on the arable one-fifth of the country's land (Ominde, 1981) resulting in skewed population distribution. Areas formerly isolated as Native reserves remain densely populated. Variation in climate and agricultural potential enhance the skewness. Declining land per capita is a great concern as population continues to expand at a rate of 4% per year (Kenya 1989). Fear of present and future land resource damage resulting from population pressure has been expressed (Kenya, 1980, 1983, 1984, 1989).

Previous studies (e.g Owako 1971; Bernard and Anzagi 1979; Campbell 1979; Ominde 1981; Sindiga 1984; Kisovi 1989) have made it clear that population pressure is experienced in low as well as high agricultural potential areas of Kenya. However, they have not investigated the responses of the affected farmers. These studies have inclined to the view that increasing population density leads to declining output, disregarding the possibility that it may stimulate production and more intensive use of land

(Boserup 1965, 1981). Other studies (e.g Mbikeseki 1979; Shibadu 1980; Omare 1981; Matende 1985; Ojoo 1985) which focus on land-use changes that occur with population pressure, have not investigated external linkages and demographic responses to population pressure.

This study traces evolution of population-land stress and investigates strategies employed by farmers to cope with declining land sizes. Farmer characteristics influencing choice of coping strategy are examined. It also tests the validity of Boserup's thesis that increasing population density stimulates more intensive use of land.

Kikuyu Division is currently experiencing population pressure (Bernard and Anzagi 1979). By 1979 it had 639 persons/sq.km., and the population density was projected to be 947 persons per sq.km. by 1988 (Kenya, 1981; 1983). The population has increased rapidly, from 109,996 (1979) to 161,016 (1988) and expected to be 190,996 by 1993 (Kenya 1988; 1989). This increase has taken place against a constant land area of 170 sq.km., (Kenya 1989).

Land holding sizes continue to decrease, and average about 1.48 acres per family of six (Kenya, 1984). Holding sizes range from an average of 0.25

acres in Kinoo Location to over 2.39 acres in Karai Location (Forestry and Woodfuel Development consultants, 1987). Kenya (1973) projected that land-family ratio in Kabete location alone would decline from the observed 2.7 acres in 1962 to 0.7 acres by the year 2000.

Despite the foregoing scenarios, no study has been carried out to investigate farmer response to population pressure. This makes Kikuyu division a suitable area for this study.

1.2 Research Questions

The study addressed the following questions:

1) What are the historical events and circumstances that have led to population-land problems in Kikuyu Division?
2) What are the economic and demographic coping mechanisms which have evolved in response to population pressure?
3) To what extent is Boserup's thesis that increasing population density leads to more intensive land use applicable in Kikuyu Division?
4) How do farmer socio-economic characteristics influence his/her response to population pressure?

1.3 Objectives

1. To establish the historical causes and evolution of population-land problems in Kikuyu Division.

2. To investigate the relationship between out-migration, fertility control, generation of off-farm sources of income and population pressure.

3. To test applicability of Boserup's thesis that, increasing population density leads to intensive land use.

4. To assess the influence of selected farmer socio-economic characteristics such as education, farm size, age, family size and income on adjustment strategy adopted.

1.4 Premise/Hypotheses

Premise

1. The current population pressure problems are a culmination of discernible historical events and circumstances.

Hypotheses

1. Land pressure is significantly related to outmigration, fertility control and off-farm sources of income among farmers.
2. There is a significant relationship between land pressure and,
   i) Crop choice and husbandry practices.

ii) Livestock combination and rearing practices.

iii) Soil fertility restoring practices.

3. Farmer socio-economic characteristics such as education, farm size, age, family size and income are significantly related to adjustment strategies.

1.5 Justification for the study

Population policy guidelines (Kenya 1984) underscore the need for studies that examine people's behaviour in a land scarcity situation. Consequently, this study examines various strategies employed by farmers to cope with population pressure. The findings will hopefully assist planners to align government policy with farmers' initiatives so as to attract maximum support. This is in line with the current bottom-up approach to development, where community-based efforts in self-help projects are supported by relevant policy. This approach, as opposed to the traditional top-bottom approach, has proved a success in underdeveloped countries since it builds on grassroots initiatives (Douglas 1980; Owako 1971; World Bank 1984). In Kenya for example, Government efforts to control livestock population (in the 1950s) in Machakos District were fruitless because the local population perceived the destocking policy as undermining their wealth and prestige (Owako 1971).

The findings will hopefully enlighten planners on lines of action where finite land resources are overcrowded in other areas of Kenya such as Kisii and Vihiga Districts. This study may be useful to scholars as a basis for future comparative studies on population pressure adjustments in other areas in Kenya. A conceptual model for studying farmer response to population pressure has been proposed.

The findings of this study will also possibly bring to light, causes of population pressure in Kiambu District. This enhances the background knowledge necessary for any enduring solution for the problem. Lastly, the study explores the relationship between fertility control and land-pressure hence the findings shed some light on the important area of determinants of human fertility.

1.6 Scope and limitations

The study focused on Kikuyu Division of Kiambu District. Evolution of population pressure in the study area was examined. Effects of past events and circumstances such as the colonial policies on tenure changes and population redistribution in post-independence Kenya were assessed. This topic is wide and could not be studied entirely. Therefore, emphasis was on; farmers background information, and

changing social, economic and agronomic aspects in response to land pressure. The relationships between population pressure and intensification of land use and the role of socio-economic variables in farmer response to land pressure were also considered.

A sample of 130 farm household heads operating small scale farms was interviewed. Large holdings were deliberately excluded because population pressure problems are more glaring among the small scale farmers.

A study in population pressure can hardly avoid measurement related problems. Different techniques for measuring population pressure have been used in empirical research. These include, crude density, physiological density, agricultural density, carrying capacity and consequences of population pressures.

These measures have been criticised for various short-falls in accuracy. Nevertheless, carrying capacity and consequences of population pressure have come out as acceptable indices for measuring population pressure. Hance (1970) observes that research can successfully be undertaken in the field on symptoms of population pressure. Recently, Bernard and Anzagi (1979) and Kisovi (1989) have factor-analysed these symptoms and a few significant ones

identified. These indicators are used for measurement of population pressure in this study. Only strong indicators of population pressure in high and medium agricultural potential areas have been adopted, they include land per capita, heritable land, land holding size, arable land per capita and use of marginal areas.

1.7 Operational Definition of Terms and Concepts

Population Pressure: Population pressure is sustained stress exerted upon resources in a given area by its people and their activities. Rural population pressure is intensified by population increase and resource removal to the outside. It is ameliorated by additional supplies from the outside, demographic and production adjustments. In this study the term is used interchangeably with land pressure and land scarcity.

Response/Adjustment strategy: This is the way in which a farmer may act so as to cope with land pressure.

Socio-economic Factors: These are also referred to as farmer characteristics. They are those sociological and economic aspects attributed to man

and his environment such as farmer's age, education, farm size, income level and family size.

A household: A household comprises a person or groups of persons bound by ties of kinship who normally reside together under a single roof or under several roofs within the same compound such persons who share a community of life in that they are answerable to the same head and have a common source of food (Kenya 1981a). Under this definition, polygamous wives living within a single compound are included in the same household regardless of the cooking arrangements. Those in separate homesteads are considered as two households.

Holding: A holding consists of a well defined area of land, usually with title deed and is easily identified as part of an agricultural operation.

Head of a household: The senior member of the household resident in the household compound or if residing elsewhere returns at frequent intervals. The terms head of household and householder are used interchangeably to refer to the same person.

Holder: This is a person or persons who have the control and ability to take decisions relevant to the agricultural activities on the holding.

Plot: Any piece of cultivated land within a holding that contains a single crop or a homogenous mixture or association of crops. A plot may have no distinct boundaries. It is merely bound by the extent of the planting of the single crop or homogenous mixture of crops.

Land use: Activities on land, livestock rearing, cultivation of crops, fallow and non-agricultural form of land use.

Large scale farm: Any land holding over 12 hectares (Kenya, 1981).

Small scale farm: Any land holding between 0.2 and 12 hectares (Kenya, 1981).

Cybernetic system: A system where imbalance in one aspect is transmitted to other parts of the same. For example shortage of vegetal material in an ecosystem has impact on carnivorous predators which are not directly dependent on vegetation.

CHAPTER TWO

LITERATURE REVIEW AND THE THEORETICAL FRAMEWORK

2.0 Literature Review

Human societies' response to 'stressful' phenomena is an area that has attracted many studies. In the list are: Drought (Campbell 1979; Odegi 1983), Floods, (Kroda 1987) and Hailstorm, (Samson and Gichuiya 1971). Population pressure is a form of 'stress' that has been debated in Kenya for the last fifty years (Bernard and Anzagi, 1979). Despite its long history little research has been done on it.

In recent years, scientific research on population pressure includes the works of Owako (1971), Mbikeseki (1979), Sindiga (1988) and Kisovi (1989). The findings from these works support that population pressure builds over time. Zelinsky, Kosinski and Prothers (1970) observed that population pressure has ecological and historical dimensions, among others. This means that if population pressure and subsequent adjustment strategies are to be understood, they should not be divorced from their historical context.

In recognition of the preceding fact, this study undertook a historical search for the causes and

evolution of population pressure in Kikuyu Division. The forementioned studies are concerned with exposing the population pressure problems in various Kenyan districts, (Owako 1971; Sindiga 1979) and improving the indices of measurement (Hance 1970; Bernard and Anzagi 1979: Kisovi 1989), and have not investigated farmers' coping strategies in the affected areas. Previous works (e.g. Kuczynski 1949; Great Britain 1955; Kenya 1974; 1984; 1989) have voiced concern over population-land imbalance in or around the study area. Yet, little is known about farmer response to population pressure. This study attempted to fill this gap.

Population pressure

The concept of population pressure has defied universal definition for a long time. About two decades ago, a symposium on population pressure on resources in developing countries failed to come up with a precise definition of the concept. Instead, a working definition that population pressure suggests some imbalance between human numbers, their needs and the natural and human resources of a given area was adopted. It was proposed that population pressure should be defined operationally in every new investigation. Hence, this study define population pressure as sustained stress exerted on resources in

a given area by its people and their activities. Rural population pressure is intensified by population increase and resource removal to the outside and, ameliorated by additional supplies from the outside. In this study the terms 'population pressure' and 'land pressure' are used interchangeably, principally because land is the main resource under consideration.

Like definition of the concept, indices of measuring population pressure are still rudimentary. Therefore different indices have been used in empirical research. These include crude population density which is the ratio of people to a unit of land area. This is the most frequently used measure of population pressure, and is most useful when applied to small statistical areas. When used at regional or national scales, the statistic is misleading because it conceals the areal variation of population and resources (Sindiga 1984). Hance (1972) adds that persistent use of this measure is responsible for the erroneous view that large parts of Africa do not experience population pressure. Ominde (1981) used physiological density to study land-population relationship. Trewartha (cited in Kisovi 1989) rightly observed that physiological density is a more accurate measure. This is the ratio of total population in a given area to the amount of arable land in the area. This index excludes barren areas

and steep slopes not suitable for agriculture. The index assumes that non-arable land is not under productive use, leading to its disregard in theory, while at a practical level such land is useful. This shortfall is avoided in this study.

Carrying capacity is a model for measurement that has become increasingly popular in population pressure studies. It was first used by Allan in 1949 to recommend resettlement of people from overcrowded areas in Northern Rhodesia (present day Zimbabwe). In Kenya, this model has been used by Bernard et al (1979) and Kisovi (1989)among others, and it is useful as a diagnostic tool at regional scale, but less rigorous for household level analysis and hence not suitable for this study.

A number of studies (Hance, 1970; Grigg, 1970 and 1980) have focused on describing and analysing consequences of population pressure. An agricultural locality undergoing population pressure may exhibit a number of physical symptoms. Hance (1970) developed a list of 15 population pressure symptoms and concluded that research could successfully be undertaken in the field on symptoms. Examples of the symptoms include landlessness, use of marginal land and soil erosion. Hance pointed out that all the symptoms need not exist in an area at the same time.

Nevertheless, occurrence of multiple symptoms in an area confirms presence of population pressure. Bernard et al (1979) and Kisovi (1989) identified significant population pressure symptoms. These are landsize, arable land per capita, use of marginal areas, subdivision of land and heritable land. It is notable that the variables are mainly ratios of people to land. These are used in this study as surrogates for population pressure. Hence population pressure crystallises into definite measurable variables.

Responses to land pressure

Boserup (1965, 1981) states that population pressure prompts certain changes in landuse. Such adjustment is towards improving and sustaining yields to cope with increased demands of the population thereon. Specifically changes include frequency of cropping available land, shorter farrow period, extension of land under cultivation, use of manure and increase in cropping density. Implicitly the preceding alternatives for adjustment (by Boserup), suggest that there must be some form of response to population pressure. This assumption is upheld in this study. The idea is adopted so as to examine if population variation between households as related to the land has led to observable responses in practice of agriculture.

Hart (1970) stated that under a given set of technical, economic, political, social, cultural and psychological conditions, a given piece of land can support a limited number of people and their activities without undue stress on the land. Adjustments are inevitable when this number is exceeded, and may take the form of emigration to sparsely settled areas, seeking employment in other areas or it might take the form of devastation and eventual migration. Hence adjustment strategies are varied. Grigg (1970, 1980) classifies them into two categories, namely demographic and production responses. This classification is adopted in this study for better management of the responses to population pressure.

Population growth is a factor contributing to population pressure in agriculturally productive areas such as Kiambu. Reduced infant mortality rate and sustained demand for children have led to a total fertility rate (TFR) of 7.7 births per woman which is quite high. Population doubled between 1969 and 1988 in Kiambu District and Kikuyu Division in particular (Kenya 1983). Similarly, population densities have increased from 184 persons per sq. km in 1969 to approximately 431 persons per sq. km in 1988 (Kenya 1981, 1988). Given such a phenomenal increase in population, there is need to establish whether or not

farmers have adjusted through farming practices.

Eyre (1970), Maro (1975), Ogutu (1993) and Omare (1981) observe that population dynamics lead to certain predictable changes in land use. Such include, cultivating previously neglected land, diversifying and intensifying agriculture, development of external linkages to provide other sources of income, better care and management of land, migrating and control of human fertility. About 65% of respondents in the study area are aware of present or future land shortage (Bernard et al 1979). This study sort to establish which among the forementioned diverse responses have taken place, given the awareness of land shortage.

As seen above, coping mechanisms and farmers' socio-economic characteristics are diverse. According to Mbwesa (1988), roadside farming (as a consequence of land scarcity) in Kikuyu Division varied with farmer socio-economic characteristics. Similarly, Mabogunje (1970) and Simkin (1970) observe that farmer expectations and characteristics determine the type of response to land pressure. In this study, the choice of population pressure coping strategy is examined in relation to farmer characteristics.

Hoy (cited in Bernard et al, 1979:65) states that

population pressure can be ameliorated by developing external linkages to areas with resources. Failure to meet all subsistence requirements from agricultural endeavours and lack of additional land to compensate for land shortfall may cause households to rely on off-farm income (Douglas 1980). In Kano, Nigeria, Mortimore (1970) observed that population pressure on land resulted in increasing frequency of alienation by sale of land. It also resulted in exploitation of secondary sources of income such as wage labour, trade and pension. Boserup (1965, 1981) proposed that external resources may serve to ameliorate population pressure. This study pursues a similar objective in establishing the relationship between population pressure and external sources of income for farmers.

In the Philipines, Simkins (1970) observed that migration resulted from population pressure. He established that there was movement down the pressure gradient from areas of high density to sparsely populated frontier lands. He cautioned that migration was not an automatic response as there are a number of other alternatives. Others who have observed migration as a response to land pressure are Kosinski and Prothero (1970), Maro (1975), De Wilde (1967), and Munroe and Munroe (1975). The foregoing studies observe that migration may result from land scarcity but are silent on the possibility of fertility control

in response to the same. Grigg (1976, 1980) identifies both outmigration and fertility reduction as demographic adjustments to land pressure. In the study area, the relationship between population pressure and demographic responses has not been well examined. The present study provides a deeper investigation into this relationship.

A second set of adjustments to land pressure has been classified as production responses (Grigg 1970, 1980). Boserup (1965, 1981) holds the view that population growth is the major driving force in agricultural change. She proposes that change from food gathering to crop production was a result of independent inventions rather than transfer of techniques. Cultivators find it profitable to shift to more intensive systems of land use after a certain density has been reached. She concludes that agricultural change can plausibly be explained in terms of population change. Her theory is silent on prospects of control of human numbers to maintain existing level of subsistence without agricultural change. Maro (1975) notes that though the theory is supposed to apply in pre-industrial societies engaged mainly in production for subsistence, its operative principle that population pressure leads to intensification in agriculture can be used to explain agricultural change for any society undergoing such

change.

The above line of thought has not been researched. Existing studies have predominantly followed the persuasion that population pressure leads to declining output and overlooked the open possibility that it may lead to increased production and more intensive use of land, at least in the short term. In recognition of this hiatus, this study makes the relationship between population pressure and agricultural intensification, one of the major aspects for investigation.

De Wilde (1967), Mabogunje (1970), Ogutu (1993), Maro (1975) and Ojoo (1985) have observed that farmers in high density areas adjust to land pressure variously. They identified, seeking off-farm sources of income, intensification by soil fertility maintenance, livestock types, numbers and feeding practices, and choice of crops as common responses. This study aimed at establishing whether or not a relationship exists between land pressure and methods of agricultural intensification in the study area.

Other studies, (e.g. Omare 1981; Ojoo 1985; Mbikeseki 1979) have investigated changes in usage of land with population density. These studies have taken a regional approach and relied heavily on

secondary data. Land pressure is first and foremost felt at household level and, is secondarily a regional phenomena. Hence the regional approach is unsuitable, instead a household survey as in this study is required to investigate responses. Secondary data also inhibits identification of possible responses, such as manuring and cropping practices. Subsequently, the above shortfalls are avoided in this study.

In the foregoing literature, it has been shown that population pressure builds over time, thus it cannot be divorced from its evolution. Population pressure and its measurement have been discussed. The importance of investigating the influence of socio-economic characteristics in the adjustment process was underscored and various responses to population pressure discussed.

2.1 Theoretical Framework

A system approach proposed by Bernard and Anzagi (1979) (see figure 2.1) helps us to understand the structure, function, equilibrium and change process of population pressure on resources. This model assumes a cybernetic system which at least theoretically proposes a state of equilibrium between man and land. In such a state of equilibrium over the long term, the system would be homeostatic, i.e. the society

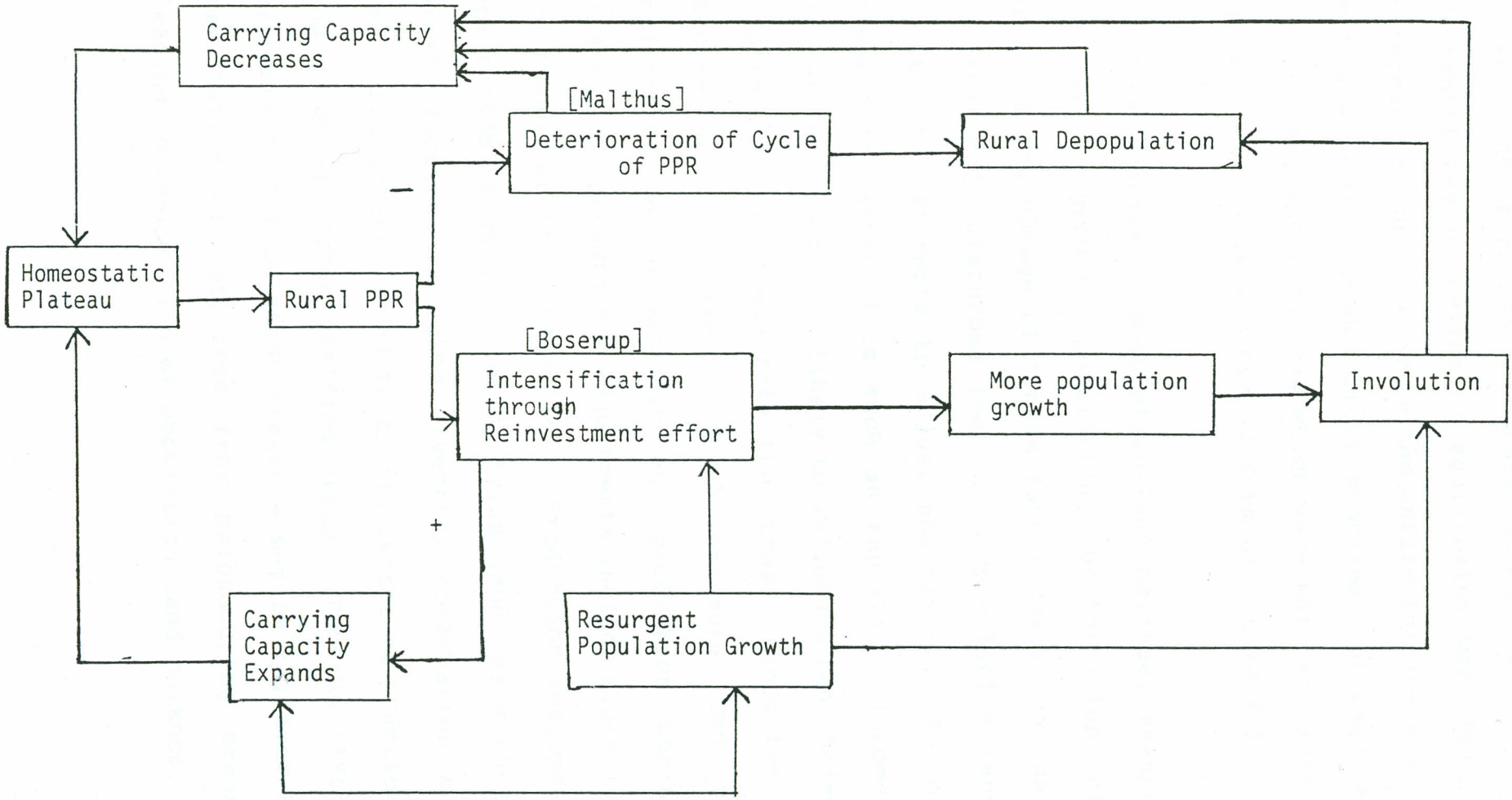
negotiates a complex set of practices to exploit the environment. Practices which avoid prolonged deterioration of either the resource base or the Human subsystem are adopted. In the long run, without compensating change in the Human system, the balance can be upset.

When population grows and density increases, positive feedback in the form of population pressure causes deviation and homeostasis is disturbed. The system can attempt to adjust through negative or corrective feedback in two rather opposite ways. On the one hand, crowding may force people to intensify their use of land, to husband and conserve resources with greater care. The system is thereby brought to equilibrium incrementally. On the other hand, output per unit of labour and land may ultimately decline. In other words, marginal productivity per capital falls towards zero. Thus, instead of undergoing evolution towards a more intensive form the system possesses inertia (Brookfield 1972) and retrogressively experiences involution (Geertz 1970). Consequences such as outmigration may foster rural de-population while starvation may ultimately decrease the population and restore balance to the system.

If on the other hand, density increases rapidly in already crowded areas, an opposite set f processes

may occur. Cropping patterns, fallow cycles and conservation may be altered for the worse which in turn may deplete the land base leading to food shortages and environmental deterioration. At worst, this can cause people to emigrate or induce higher rates of mortality to restore balance by natural checks (the Malthusian idea). This stand is often adopted in many land pressure circumstances leading to alarming conclusions.

FIGURE 2·1 A MODEL OF POPULATION PRESSURE AND AGRICULTURAL CHANGE



PPR - Rural Population Pressure

SOURCE: Bernard and Anzagi (1979: 52)

For the purposes of this study, only the incremental way of restoring equilibrium was chosen for investigation. To examine the entire lattice would pose formidable methodological problems and require enormous data and resources which were not available. Figure 2.2 below is a modified form of Figure 2.1.

From a state of population-land balance, events such as a growing population, delimitation of territory and change of tenure favour deviation, and homeostasis is disturbed leading to population land stress. Man attempts to adjust positively. Socio-economic characteristics such as education, income, age and family size and likely to influence the choice of strategies to ameliorate the stress, hence being intervening variables. Land pressure can be ameliorated by demographic and production coping strategies. Demographic adjustments include migration and human fertility reduction. Production responses are basically ways of intensifying land use such as mixed cropping, changing livestock combination and rearing practices, soil fertility restoring practices and adopting higher yielding seeds. Boserup (1965) proposes that population pressure may be relieved by importation of resources from neighbouring areas, leading to restoration of population-land balance.

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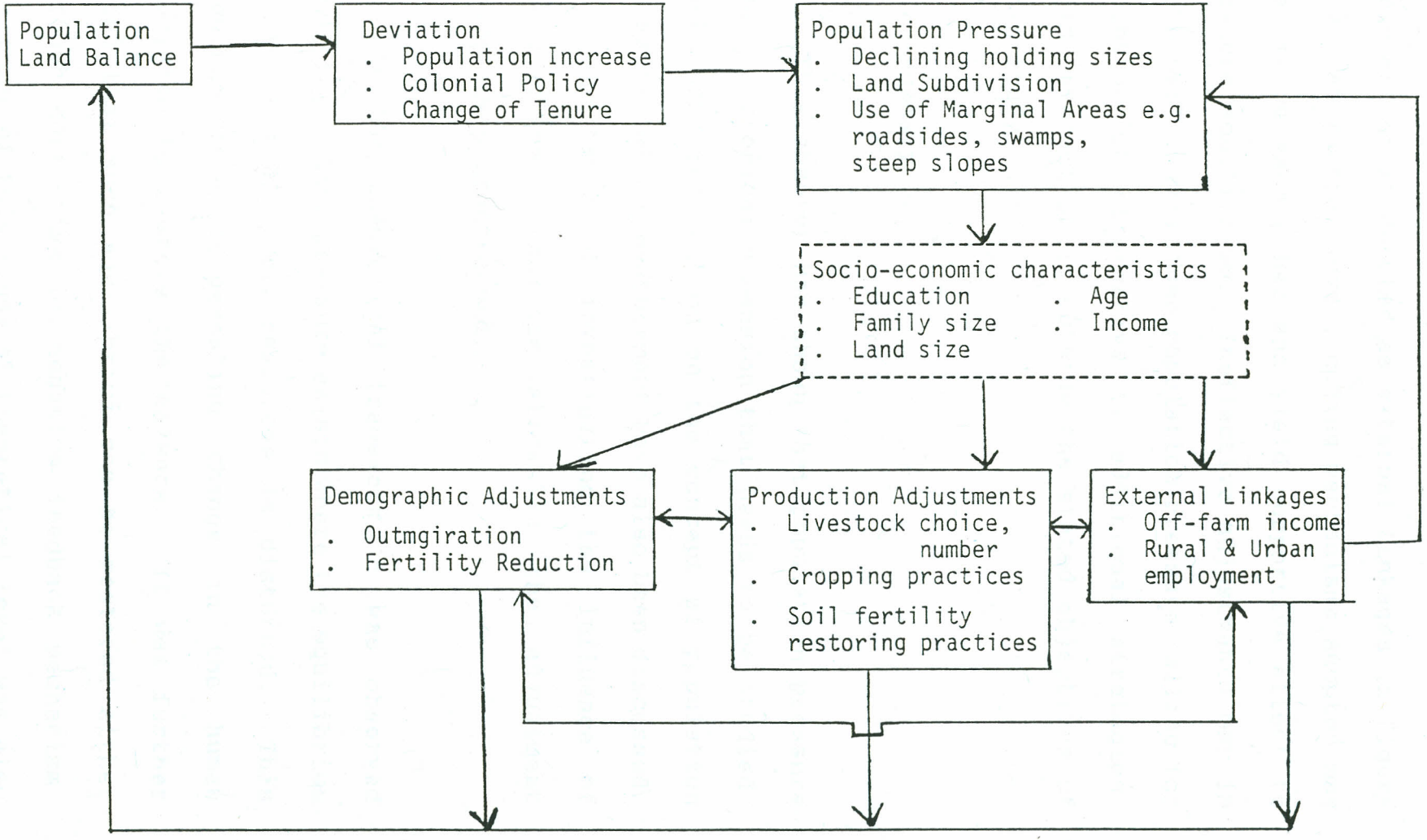
FIGURE 2.2 A CONCEPTUAL MODEL OF FARMERS ADJUSTMENT TO POPULATION PRESSURE



This option is denoted as external linkages in figure 2.2. At another level, coping mechanisms adopted may reinforce each other and yield supportive effect to restore equilibrium. Ineffective adjustments may in turn lead to sustained population pressure calling for adoption of alternative or additional strategies. This interaction is outside the stated objectives of this study.

2.2 Summary

This chapter has shown that population pressure has a historical dimension that needs to be studied. Background information on the concept of population pressure and its measurement have also been discussed. The importance of investigating the influence of socio-economic characteristics in the adjustment process was underscored.

In the theoretical framework it was observed that, population pressure exists where the equilibrium of man and his land resources is disturbed. This requires some compensating change in the human subsystem to restore the balance. It was further noted that such equilibrium can be restored either through corrective or negative feedback mechanism. The scope of this study at theoretical level was also highlighted.

CHAPTER THREE

STUDY AREA AND RESEARCH METHODOLOGY

3.0 Introduction

This chapter presents the research design utilised herein and background information on the study area. The latter includes; location and size, resource potential and the demographic profile of the study area. The former focuses on types and sources of data collected, methods of data collection, sampling procedures and data processing and analysis.

3.1 Study Area

This section focuses on three main themes; Firstly is background information on the study area in terms of location and size. This is then followed by a review of ecological resource potential and lastly the demographic profile of the study area.

3.1.1 Location and size of Kikuyu Division

Figure 3.0 shows the location of Kikuyu Division. It lies south of the equator between latitudes 0^0 25'S and 1^0 20'S and between longitudes 36^0 30' and 37^0 15'E. It borders Kajiado District to the south and south-west, Limuru Division to the north, Kiambaa Division to the east and Nairobi Province to the

south-east.

The total land area for Kikuyu Division is 170 sq.km., 8.9 percent of the district's 1935 st. km. (Kenya 1983). At the District level, the division has the highest population density and the lowest arable land per capita of 0.11 ha (Jaetzold and Schmidt 1983). This made it particularly suitable for investigating farmers' responses to population pressure. The wide range of land holding sizes also made it suitable for varying pressure levels. Further, the area was suitable for investigation because it is mainly a dominion of small scale farmers who are susceptible to land scarcity (Naulikha 1991).

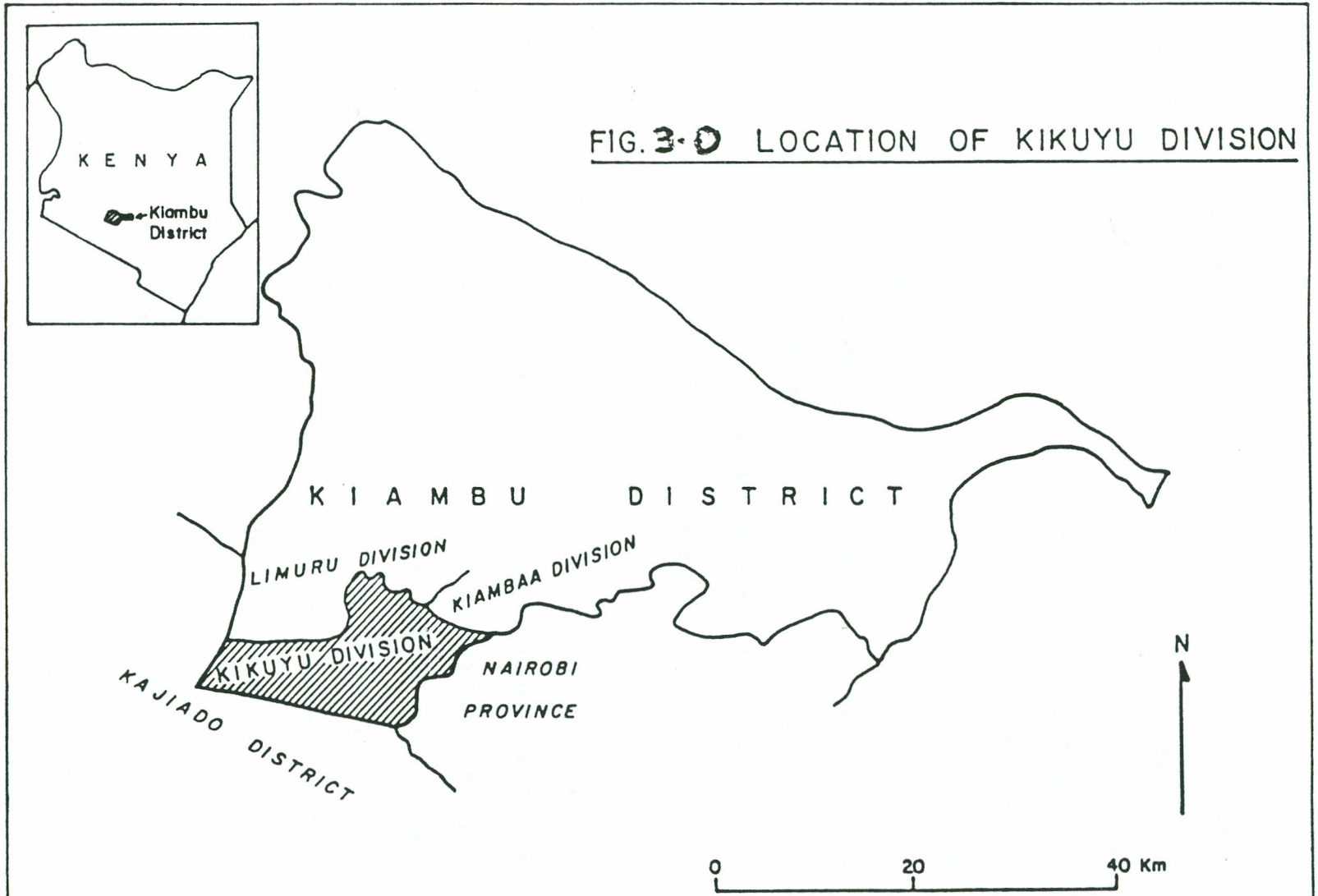


FIG. 3·0 LOCATION OF KIKUYU DIVISION

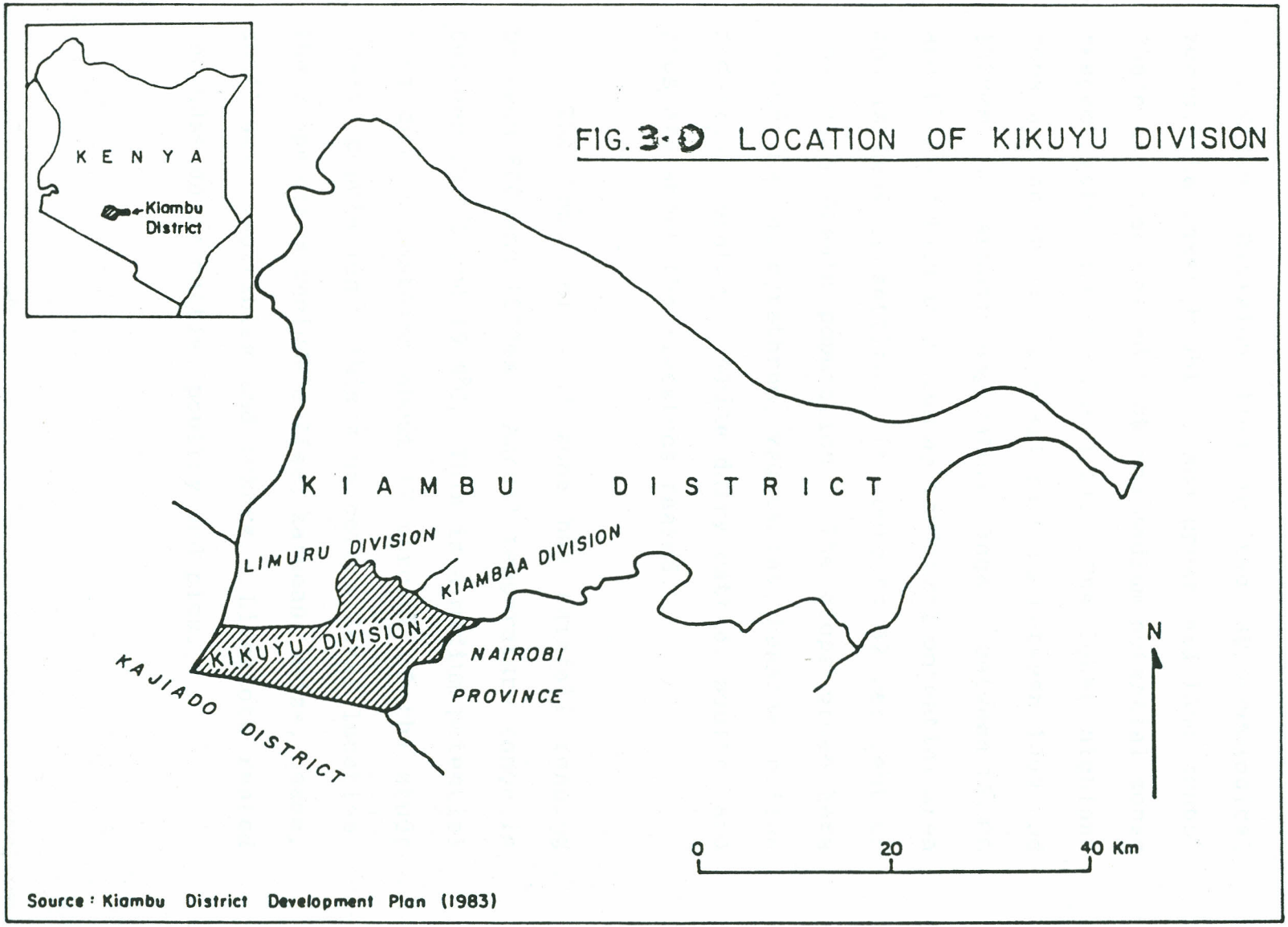


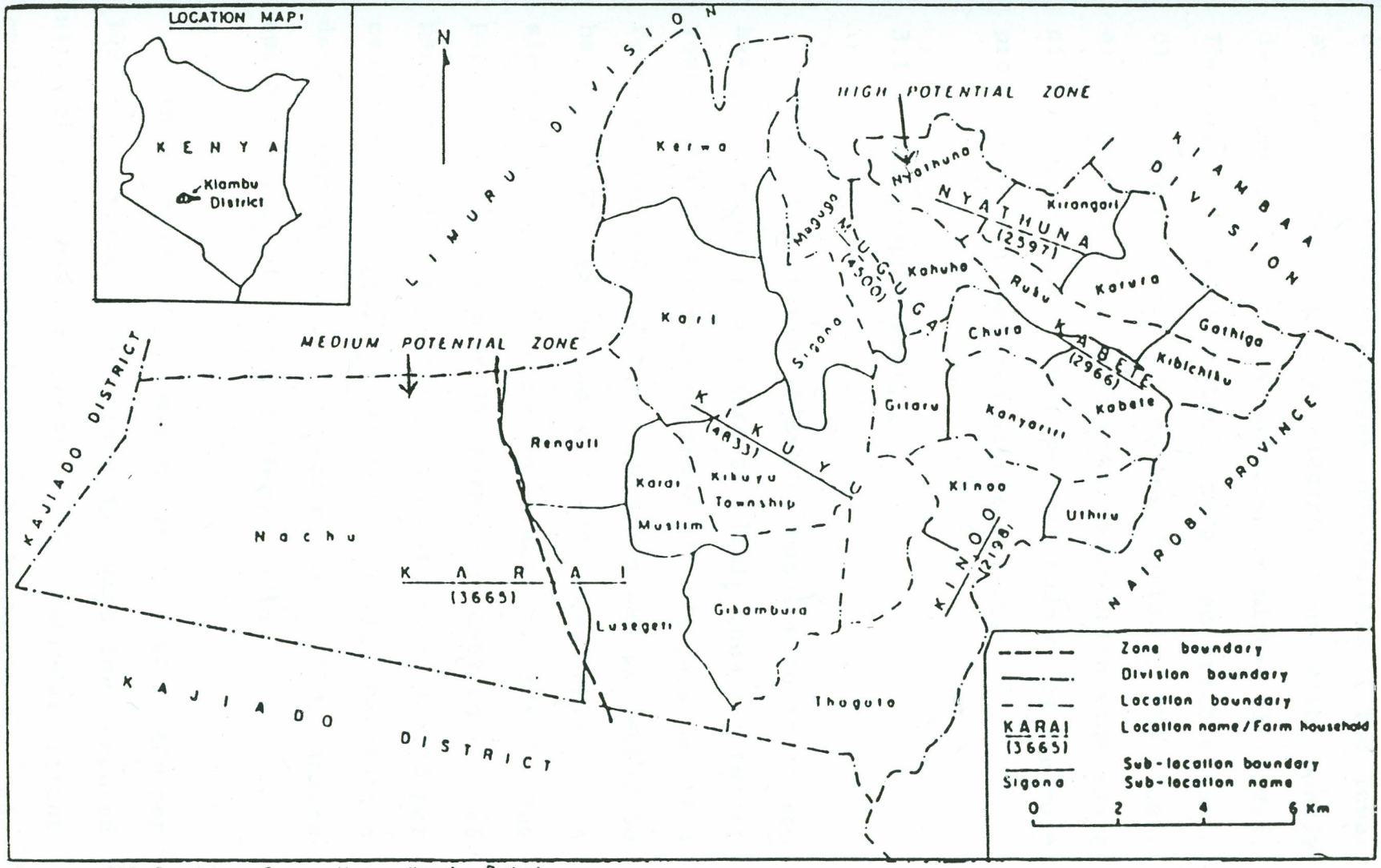
FIG. 3·0 LOCATION OF KIKUYU DIVISION

Source : Kiambu District Development Plan (1983)

3.1.2 Ecological and resource potential

Kikuyu Division lies in two agro-ecological zones, the lower highland and upper mid-land zones. These are also called high and medium potential zones respectively (see figure 3.1). The lower highland zone has an annual rainfall ranging between 1000 and 1300mm. The annual temperature range is between 16.4^{0}C and 17.7^{0}C. This is a high agricultural potential area and is heavily settled. It contains 82 per cent of the study area's population. The crops grown here include maize, pyrethrum, vegetables, bananas, coffee and irish potatoes. While dairy cattle, poultry and pigs are among the livestock reared.

The upper mid-land zone has rainfall ranging between 800 and 1000mm. Annual temperature range is between 19.5^{0}C and 19.9^{0}C. This is a medium potential area and it contains about 17 percent of the study areas' population. This zone covers Karai location. The crops grown include coffee, katumani maize, beans, sunflower, vegetables and tubers. Livestock reared includes dairy cattle, poultry and pigs.



Source. 1989 Population Census Map - Kiambu District

FIG 3.1: KIKUYU DIVISION AGRO-ECOLOGICAL ZONES AND ADMINISTRATIVE BOUNDARIES

The lower highland zone is hilly and has a series of deeply dissected ridges and valleys. The lower altitudes have gently sloping land with poorly developed soils compared to those in higher altitudes. The soils are well drained, deep, red friable humic clays commonly called coffee soils. The lower altitude area is covered with brown calcareous loams of volcanic origin. The upper altitude soils are more productive when compared with the latter.

3.1.3 Demographic Profile

Like other parts of Kenya, population in Kiambu has grown rapidly, and more so within the last twenty years. The 1969 census recorded 475,576 persons, 1979 recorded 686,290 and the population was projected to be 1,054,173 persons as at 1988 (Kenya 1984). A similar trend is visible for Kikuyu division. The population rose from 79,393 persons in 1969 to 109,146 persons in 1979, registering a growth rate of 3.75 per cent per year (Kenya 1969; 1981; 1984). Population density was 639 persons per square km in 1979, ranking among the highest in Kenya (Kenya 1981a).

Infant mortality is estimated to be 42 deaths per 1000 live births. This rate is quite low compared with other areas in Kenya. The national infant mortality rate is estimated to be 92 deaths per 1000

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live births (Kenya 1988). This low mortality of infants contributes to net population increase. The youngest age groups increase rapidly adding to dependence. About 62 per cent of the population is made up of young people (below 20 years) and those aged over 60 years, implying high dependence. It is notable that the total fertility rate is high in Kiambu District. It was estimated at 7.7 births per woman in 1989. Population is therefore increasing rapidly.

3.2 Types and Sources of Data

Basically two types of data were collected, documentary and field survey information. Various sources were used to gather documentary data while questionnaires were used to collect field data. Following is an account of the sources and data collected.

3.2.1 Documentary Data

This study began with a wide review of documents focusing on population and land resource imbalance in Kenya. The initial review facilitated realization of questions that could not be answered by existing literature leading to crystallization of objectives that the study set out to achieve. This search

concentrated on existing studies on population-land balance, it defined the status of population pressure in Kiambu district and Kikuyu division in particular.

Evolution of population pressure was traced by review of historical and archival material such as field survey materials, journals and reports on the subject. Kenya's population and farm census data on the study area were utilized to give background information on population-land balance. These were mainly in form of Government census reports and publications.

3.2.2 Field survey data

Field work comprised of careful administration of a well constructed questionnaire (Appendix A.1) in selected locations o the study area. Section 1 of the questionnaire focused on farmers' background. This included sex, age, occupation, education, marital status and family size. Section two of the questionnaire elicited information on demographic responses to population pressure covering aspects such as the number of migrants, characteristics of migrants and farming practice, breed of crops, crop variety per plot, soil fertility restoration and livestock rearing practices to establish production responses to land pressure was sought. Section three of the

questionnaire gathered information on indicators of population pressure i.e., land size, subdivision of land, arable land per capita, heritable land and marginal land use.

Since Kikuyu Division is a large area (170 km. sq.) questionnaires were administered with the assistance of two research assistants. These were university students on vacation well conversant with the study area. Ability to communicate effectively in English and the local language (Kikuyu) was an important criteria for recruitment.

A two-day training session was held for the research assistants. Each questionnaire item was discussed in detail so that they understood the intended meaning and use of questions. Training also focused on how to approach sensitive questions like the number of children in a household, land and income of farmers. A pilot survey was conducted by the assistants and the necessary advice and instructions given.

Oral interviews were conducted with selected farmers (Appendix A.4). This was done to corroborate historical information acquired from secondary sources. Special attention was given to early settlement history of the study area, colonial land

appropriation, displacements and resettlement. Views on the current land problems were also sought. Criteria for selection of respondents to oral interviews was mainly rapport between the respondent and the researcher. The generation born early this century were targeted for the oral interviews because they were witnesses to changes in land ownership that have taken place. Colonial period civil servants mainly teachers and sub-chiefs gave oral interviews on changes in land ownership in the division. Guiding questions were asked to ensure that informants did not digress from the topic. Appendix A.4 is a list of respondents who assisted in collection of oral data.

3.3 Data Collection

A variety of methods were used for data collection. Data on the evolution of land pressure were collected at two levels. First, through content analysis from archival document, books and reports. Secondly, through oral interviews with guiding questions (Appendix A.4).

Data on farmer characteristics, demographic responses, production responses and indicators of population pressure were collected by a questionnaire survey. Interviews were conducted from March to April 1993. This was preceded by a pilot survey carried out

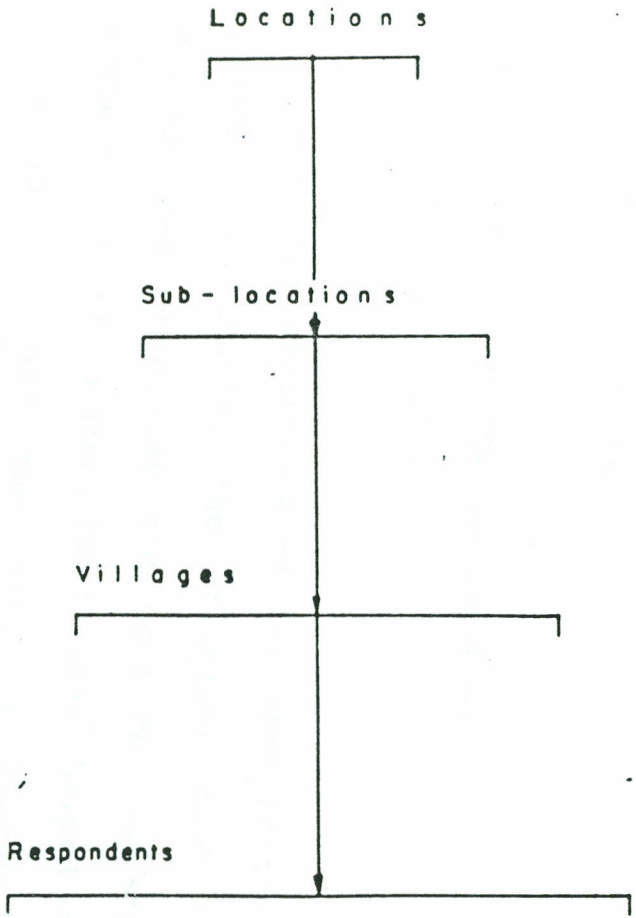
in March 1993. This was to test the questionnaire with respect to wording and details of information required. Ten households were chosen for the pilot survey. Improvements done included ordering related questions, focusing vague questions, eliminating duplication of questions, and coding the questionnaire.

3.4 Sampling procedure

There was relative uniformity in farmer characteristics and minimal ecological variation. Therefore the administrative frame was suitable for sampling purposes. The household was the basic survey unit. This strategy was predicated on the premise that land pressure is experienced by individual farmers leading to individual responses.

A sample of 130 farmers was taken from a study population of 20,759 farm households (Kenya 1989). This sample comprised 0.63 per cent of the study area population. Such a sample was convenient in terms of yield of data and of finance and time available. Two previous studies on population pressure (Bernard 1979 and Kisovi 1989) utilised similar sample sizes successfully i.e. 0.5 per cent and 0.42 per cent respectively.

The village (an enumeration area as per the 1989 census maps) was the smallest unit used in sampling. This was utilized to ensure that there was representative population samples selected from each location. Random sampling using the ballot method was used to select six sublocations one from each location. A list of villages in each sublocation was subjected to further random sampling to yield a sample of villages. To determine the number of respondents from the selected villages, the number of households in the location was expressed as a ratio of households in the division. Figures 3.0, 3.1 and Table 3.1 show details of the sampling structure.



6 Locations of Kikuyu Division

6 Sub-locations obtained by random sampling

20 villages obtained from a list of villages in each of the sub-location

Number of Respondents in each village determined by expressing number of households in the locations as a ratio of the number of households in the division

Source : Fieldwork, 1993

Table 3.1 Estimates of population, number of farm families by location and households interviewed and sampling proportion by location.

Location	Population	Estimated No. of farm families	Number of house-holds	Sampling propor-tion
Kikuyu	17,290	4,833	30	.2308
Nyathuna	*	2,597	16	.1231
Karai	18,794	3,665	23	.1769
Kabete	30,868	2,966	19	.1462
Muguga	21,102	4,500	28	.2154
Kinoo	21,092	2,198	14	.1076
Total	109,146	20,759	130	1.00

* By 1979 Nyathuna (now a location) was part of Kabete and Kinoo Locations.

Source: Kenya 1981 (Census reports)
Fieldwork 1993.

With the assistance of the area residents and research assistants, the principal road in each village was identified and used as the transect. Systematic sampling along the transect helped identify households. Only the head of household was interviewed. Fig. 3.1 shows distribution of sample villages in the study area.

3.5 Data Processing and Analysis

Documentary data on evolution of population pressure in the study area were analysed, corroborated and presented qualitatively. Thus, premise one was tested qualitatively. Events related to population pressure were identified and their effect assessed. The findings were counter-checked with other written sources. These were then supplemented with oral interviews. Data was collected regarding the early settlement in the study area, colonial land appropriation, related displacements and the current population pressure. With some interviewees it was done twice for clarification or counter-checking of facts.

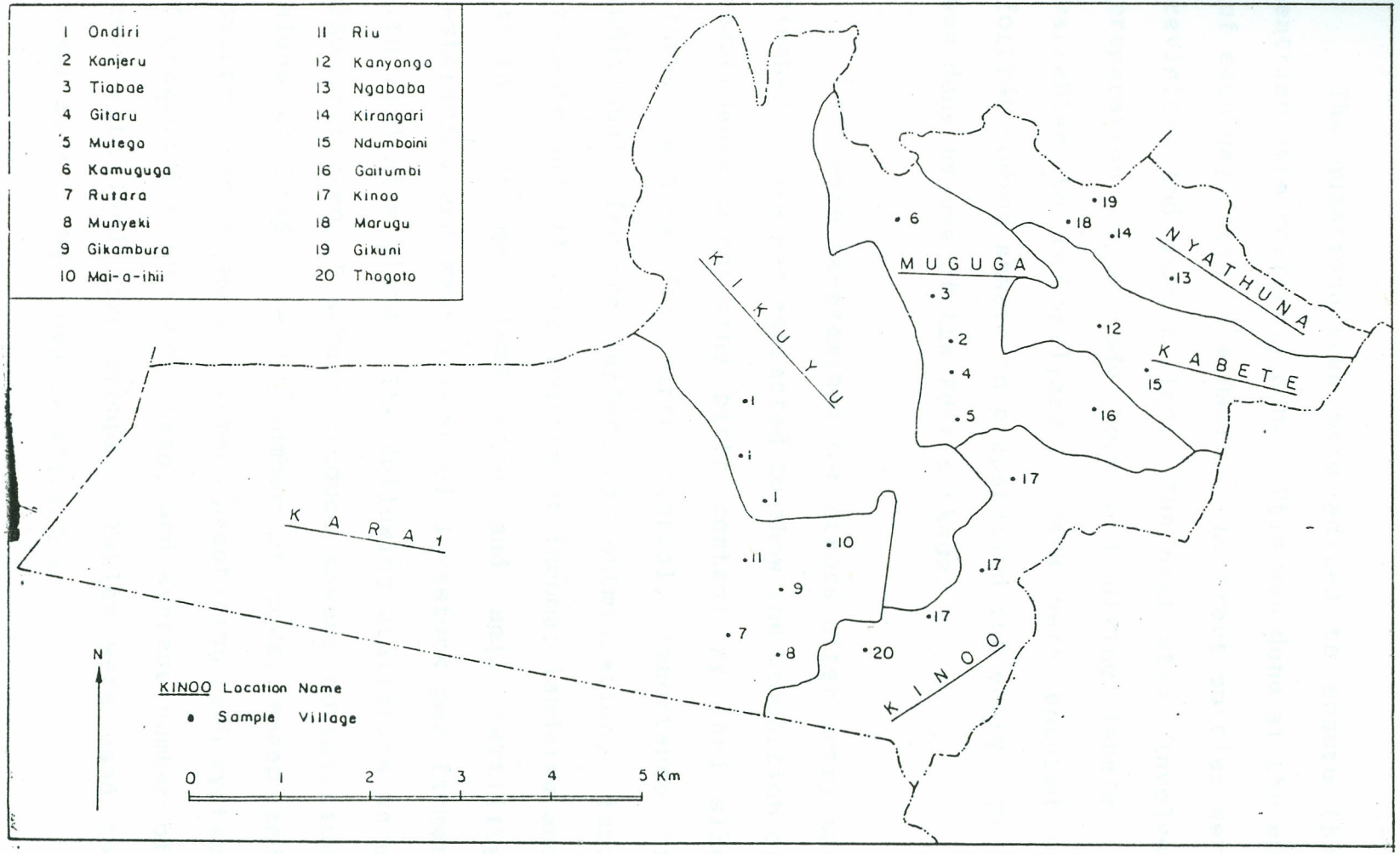


Fig 3-3: Distributions of sample villages in the study area (Kikuyu Division).

3.5.1 Coding and tabulation

The questionnaires were edited to ensure that entries were correctly done. This was done at the end of each day during fieldwork. Incorrect entries were revisited and gaps filled. The next stage involved preparation of a code book and giving labels to variables to be analysed. Data were entered on fortran coding sheets in preparation for entry. This was done by use of the Edix package.

Data were re-examined for errors after entry and cleaned. Data was extracted to show the proportion of respondents practising birth control by land size class, reasons for birth control, importance of individual factors affecting outmigration, land pressure and off-farm sources of income, landsize and off-farm income, land size and soil fertility restoration and mean number of livestock per farmer with land size class. The following statistics were also extracted; Pearsons product moment correlation values of land size by number of cows, sheep and poultry. Percentage of farmers practising each system of grazing for cows and sheep, and average number of crops with land size groups. Tables were used to summarize all the above relationships.

Tabulation was also done for chi-square values to determine the relationship between socio-economic characteristics and adjustment strategies adopted. Pictorial evidence was also prepared to illustrate some aspects observed in the field (see plate 5.1 and 5.2).

3.5.2 Statistical Analysis

The Statistical package for social sciences (SPSS) was used to obtain the following statistics: percentages, frequencies, cross-tabulation, multiple linear regression, chi-square significance test and the pearsons product moment correlation. These statistics are discussed in detail below.

3.5.3 Frequencies and Cross-tabulation

Frequencies were the output of the initial raw data transformation. The initial transformation yielded essential descriptive statistics such as percentages, mean, mode, median, standard deviation and variance. These statistics are useful in understanding individual variables before further computation. These statistics are utilised widely in chapters five and six. Cross-tabulation was a useful way of comparing change in any one of two selected variables. This was used in tracing changing

responses in land use with varying land pressure indices. For example farmers' age with poultry number, number of sheep, system of grazing and number of outmigrants among others. Cross-tabulation was used to discern relationships between farmers' socio-economic characteristics and adjustment strategies adopted (section 6.0).

3.5.4 Pearsons product moment correlation

The Pearsons product moment correlation was used to discern relationships between land size and livestock numbers. The aim was to find out if any statistical relationships exist between the selected variables and if so the direction and magnitude of such relationships. Correlation is essentially a possible connection, relationship or interdependence between two sets of phenomena (Hammond and McCullagh 1974; Ferguson 1976). The formula below was used to compute correlation coefficients between variables.

$$r_{xy} = \frac{Nxy - x\ y}{[Nx^2 - (x^2)\ ]\ [N^2Y - (Y^2)\ ]} \qquad 1.0$$

Wher N = Number of Variables

x,y = Variables

(adopted from Hammond and McCullagh 1974).

Coefficient of correlation varies between 0 and ± 1.

Thus, the closer the value of r to plus or minus 1, the closer the relationship between the variables and the closer the value is to zero, the less close is the relationship. When the coefficient of correlation is positive it means that an increase in the values of one variable is associated with an increase in values of the other variable. A negative correlation value means that an increase in one variable is associated with a decrease in values of the other variable.

3.5.5 Multiple regression analysis

Regression analysis was used to determine the linear dependence of a variable on a set of independent variables. In other words, the extent to which one variable varies in response to variation in other related variables. In this case, regression was used to determine the degree of linear dependence of outmigration on the independent variables, i.e. land per capita, land size and heritable land per capita.

Regression is a statistical tool which enables one to estimate or predict the unknown values of another variable. The multiple regression model incorporates more than one independent variable to explain the variation in the dependent variable. The regression model utilized in the study was:

$$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 \ldots b_j x_j \pm e \qquad 1.1$$

Where: a = the y-intercept

b_j to b_j = regression coefficients

x_j to x_j = the explanatory variables

e = the random error (residual)

y = the estimated value of y (the dependent variable)

(adopted from Hammond and McCullagh 1974)

This model gives the strength of the relationship between the dependent variable y (response) and independent variables x_j ..... x_j (population pressure).

3.5.6 Chi-square significance test (x^2)

The chi-square test was used to assess statistical independence among variables. The test was chosen because the data were at a nominal level and in form of frequencies. The test was applied to assess the significance of relationships between (a) land pressure, and human fertility control, (b) land pressure and soil husbandry practice, (c) cropping practices and land pressure. It was further utilised to assess relationship between farmers' socio-economic characteristics and selected coping strategy. It examined relationships between farmer characteristics (ie. education, income, age of farmer, family size) and selected coping strategies (e.g. outmigration,

birth control, number of poultry, cattle and sheep, soil fertility restoration methods and rented land).

Each set of variables tested for association entailed both a null (Ho) and an alternative (H1) hypothesis. The rejection level for the null hypothesis was decided at 0.05 level of confidence. In each case, the degrees of freedom were part of the output of the programme SPSS. These were necessary in order to arrive at a critical value for the chi-square. Critical values were obtained from a statistical table (Appendix A.3). For each set of variables the null hypothesis was rejected and the alternative accepted when the critical value for the chi-square was greater than the computed value. These are indicators of degree of association.

The chi-square evaluates whether observed frequencies differ significantly from those which could be expected under a certain theoretical assumption. The test can be used to match data as observed against data as expected. To apply the chi-square, the following conditions must be fulfilled. The data must be in the form of frequencies counted within each category. The total number of observations must exceed 20. The expected frequency in any one category must not be less than 5. The observations must be independent of each other

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(Hammond and McCullagh 1974; Ferguson 1976). The chi-square test is computed using the formula:

$$x^2 = \frac{(o-e)^2}{e}$$

Where x^2 = chi square value

o = observed frequencies

e = expected frequencies

From this formula it is evident that the chi-square is a measure of the aggregate difference between the observed frequencies and those expected, so that the greater its value the less likely that the null hypothesis is correct.

3.6 Summary

This chapter focused on the study area and the research design. Background information on the study area included; location and size, ecological and resource potential and its demographic profile. It was shown that Kikuyu Division is densely populated and it has low arable land per capita. This made it a suitable location to examine adjustments.

Both documentary and field survey data were collected. The former were used to examine the evolution of land pressure and the latter for discerning demographic and production adjustments to land pressure. Land pressure is felt at the household

level hence, the household was used as the basic unit of survey.

Documentary data were analysed qualitatively. Quantitative data were coded and tabulated and then subjected to statistical analysis. The produced statistics included the pearson product moment correlation, the chi-square test and linear regression analysis.

CHAPTER FOUR

EMERGENCE AND EVOLUTION OF POPULATION PRESSURE IN KIAMBU DISTRICT

4.0 Introduction

This chapter examines the evolution of population pressure in Kiambu District. The wider context of Kiambu District is used because most available secondary data are on a district scale. Furthermore policies with implications on population-land balance are made at district or provincial levels. Nevertheless specific examples are drawn from the study area. The situation prior to colonisation is highlighted to provide essential background knowledge for understanding the emergence of population pressure in the study area. This chapter answers objective one and seeks to verify premise one of this study. The chapter further examines circumstances that have contributed to or sustained population pressure in Kiambu.

4.1 Early Settlement and Population Pressure in Kiambu

Approximately 99 per cent of the population of Kiambu District is Agikuyu (Kenya 1981). The Agikuyu migrated from the Kenya Coast along the Tana Valley

and Mbeere country. This movement was gradual, and by mid 19th century the pioneers had arrived in Kiambu (Muriuki 1974; Kiriga 1991). Prior to Kikuyu settlement, Kiambu was sparsely occupied by the Dorobo people. This hunter-gatherer community dwelt in forested areas and their mode of subsistence did not encourage large concentrations of people. This ensured that an area sustained the group in relation to their food requirements (Kenyatta 1971; Kiriga 1991).

The Dorobo lost most of their land resource access and rights of use due to Kikuyu migration into the area and because of the sedentary lifestyle of the newcomers. Others were assimilated and adapted to an agricultural lifestyle. Kiambu became the southern and last frontier of Kikuyu expansion. This expansionism was halted by the establishment of colonial rule in 1893. From then on, colonial boundaries and restriction worsened land availability in Kikuyuland.

Land scarcity began after the settler influx into Kenya and subsequent occupation of high potential land between 1900 and 1912. This occupation disregarded land rights o previous holders. Such were either confined in specifically bounded areas or were displaced. The sole objective then was to create

farmland for the incoming aliens.

Early stages of land alienation involved creation of legal tools of expropriation. The first of these are the 1901 East African Order in Council and the Crownland Ordinance of 1902. These were drafted to enable the colonial administration to acquire land from the Natives. This was done on assumption that the Africans had no legal title to waste, unoccupied or uncultivated land and that the Crown could assume title to such land (Sorrenson, 1970). These legislations enabled the commissioner of land to lease land surrounding Native Reserve areas, fallow land and virtually any spare land not under active occupation. The bulk of land taken up by Europeans in Kiambu was alienated under the provision of these ordinances. Between 1902 and 1906, about 60 000 acres of land Kiambu were alienated (Sorrenson 1967).

This process of alienated gained momentum after three other legislations, the Crown Land Ordinance of 1915 and Kenya Order in Council of 1920 and 1921. In effect, they extinguished all Native Land rights. They facilitated evacuation of Africans from land desired for European settlement. Some residents of Tigoni, Kiambu and limuru areas were resettled in Lari after eviction under the Native Trust Ordinance (Kiriga 1991).

As the colonial years passed, the Kikuyu people found their land situation more and more congested. As early as 1914, Kikuyu leaders protested to the Colonial Government over illegal alienation of their land and the serious consequences which were emerging as a result of enclosure (Herz 1974). Throughout the 1920s and 1930s district officials at Kiambu issued warning about the consequences of population pressure (Kuczynski 1949). Similarly, the Kenya Land Commission acknowledged that Kiambu District was overcrowded and badly eroded (Great Britain 1943). In response, the colonial office appointed another commission to plan reconditioning of farming areas (Zwanenberg and King 1975).

Between 1934 to 1944, a soil conservation programme involving terracing, grass planting, composting and manuring was promoted. This programme continued after World War II and by 1958, impressive recovery had been made. The advent of Land Consolidation and Registration of Titles between 1955 and 1958, was a further effort to combat the persistent population and land problems. Guided by the Swynnerton Plan of 1954, consolidation and registration of title was implemented as apart of a comprehensive plan to foster widespread agricultural change. After independence, efforts to alleviate population pressure mainly involved redistribution of

population. Former settler farms were sold to the Government which in turn resettled citizens. This was true of the 1,000,000 acre settlement programme in the Kenya highlands (Sorrenson 1967). This programme included numerous settlement schemes such as Ol-Kalou Salient in Nyandarua, where thousands were settled. These efforts have brought some relief to the densely populated areas, nevertheless, population pressure still persists (Anzagi and Bernard 1979; Kenya 1989).

4.2 Large Holdings and Land Pressure

At independence, many Europeans left Kenya. Many being Administrators and Businessmen whose capital was fluid, or whose assets could easily be disposed of. Some Europeans, however, remained on their land doing what they had done for years. This took place at the expense of the farmers who were dispossessed of land and remained congested on small holdings with their families.

At independence, it was a popular idea among Europeans and African Elites that large farm production was the mainstay of the country's economy and these had to remain intact inorder to safeguard the economy. Leys (1975) for instance maintained that production could not be sustained at the same levels if these holdings were subdivided. This opinion

prevailed despite evidence that small scale farmers were producing high quality tea and coffee (Githumo 1981). In agreement with this notion, large settler-owned holdings were transferred to wealthy Africans in Kiambu on a willing buyer willing seller basis. Thus, the alienated land lost hope of ever reverting to the initial owners. Consequently, nationally about 3.5 million acres of farm and ranch land were still owned and managed by Europeans as at 1973 (Hoagland cited in Osoro-Nasubo 1973). At the same time, the average holding per European farmer was 1,685.6 acres. This compares poorly with the 4 acres per African farmer at the same time in the Highlands (Osoro-Nasubo 1973).

In Kiambu, about 78,063 hectares of land are under such large holdings, majority of it being under tea and coffee (Kenya 1984a). Hunt (1984) observed that 50 per cent of all Africanised land in Kiambu District was owned by only 183 individuals, a district of over 686,000 people. This scenario indicates that despite the Africanisation of land ownership, the colonial alienation set up has persisted and contributes to population pressure today (Leys 1984; Hunt 1984).

4.3 Institutions and Land Pressure

In Kiambu, public institutions have been major competitors for land from the earliest times of colonial settlement, and have contributed to population-land imbalance. Land right holders have from early this century been displaced by institutions. This assertion does not contest the socio-cultural or economic worth of these institutions but underscores the fact that they have displaced the rightful initial holders, without adequately compensating them. This has therefore rendered them landless altogether.

This form of alienation is prevalent in Kikuyu Division. As early as 1901, the Church of Scotland Mission of Thogoto acquired 2,599 acres of land belonging to several mbari (a kinship group composed several families among the Kikuyu (Kiongo and Kariuki, 1988). There is no evidence that this land has ever reverted to the initial owners. Institutions such as Alliance high school, Thogoto mission hospital, Kikuyu campus of the University of Nairobi, among others, are built on this land.

Similarly, the International Laboratory for Research on Animal Diseases (ILRAD) occupies 173 acres of land at Kabete. This land is carved out of a

productive and densely populated area. Other institutions occupying land initially owned by individuals or families include: Kabete Veterinary Laboratories (1200 acres), Kabete Campus of the University of Nairobi (493 acres) while the Kenya Agricultural Research Institute at Muguga occupies over 2,500 acres of land (Kenya 1982; 1984a).

The foregoing scenario shows that institutions have been a major competitor for land and have consequently displaced right holders. Some of those displaced in this way were compensated with smaller pieces or poorer land than they initially held. For example, those displaced at Thogoto were resettled in Karai Location. They are found in Mai-a-Ihii and Gikambura Villages of Karai location. They were allocated land at flat rates of 5 acres for displaced land owners, three acres each for the '<u>ahoi</u>' (tenants) and two acres for the squatters. Those who were evicted from Kabete and Muthangari in the 1930s in order to create room for the Jean School, Kabete, were resettled in Gikambura.

4.4 The effects of Land Consolidation and Registration on Land Pressure

Land consolidation and registration of titles began in Kiambu in 1955 and was completed by 1958 (Sorrenson 1967). This exercise was designed to

facilitate land conveyancing, to consolidate land and provide farmers with a secure title to their own holdings, to facilitate long-term development of land, to ensure good soil husbandry and conservation as well as to facilitate use of land as collateral for loan among African farmers (Kenya 1966). The exercise contributed to an increase in agricultural crop production but also had serious consequences on the long term population land-relationship. The exercise created a class of rural land holders as well as a landless class. Among the Mbeere, Brokensha and Njeru (1977) observed that land adjudication left some people with poor quality, small pieces or no land. It also resulted in inequality in the distribution of land, more so because this was during the state of emergency when many land owners were in detention camps. The rich, leaders and other influential people manipulated the exercise to their advantage. Some detainees walked home to face dispossession or smaller pieces of land than what they initially held.

Land registration crystallised the position of those without solid claims to land, the Ahoi. These were landless men in the Kikuyu society who got cultivation or building rights from a land owner. Land owners were under societal obligation to avail such rights on family land. Registration of land eliminated this cushioning institution for the

landless. The Ahoi became dependent upon wage employment (Kiriga 1991; Harbeson 1973). The predicament of these people is today vividly expressed in heavy reliance on roadside farming in most of Kikuyu Division and Kiambu in general (Mbwesa 1988). Land registration resulted in widespread purchase of land within the study area (Chapter 6). It can safely be asserted that such purchases are by dispossessed tenants, the dispossessed and rich individuals from the same areas.

Registration of absolute land rights has affected other non-right holders dependent on land such as daughters, sons and close relatives. Such people suffer in case of land sale which is at times done without their knowledge. Registration of land titles has facilitated parcelization of land into uneconomic units mainly through subdivision and sale. Thirst for land persists and has led to the wealthy buying off the poorer land owners. Table 4.1 below shows that 39 per cent of the respondents had acquired their land through purchase. Purchase of land by city elites desiring a rural life has also contributed to declining land holding sizes.

4.5 Inheritance System and Population Pressure

Property inheritance system has implications on the population-land situation. Among the Kikuyu the eldest son takes the father's place and becomes a trustee holder of the family land. Despite this, he has no more rights than his brothers over that land (Githumo 1981; Kanogo 1987). In some Bantu communities inheritance practice has been observed to worsen population pressure. Bager (1980) observed the same among the Gusii. Among the Abaluhya, Douglas (1980) observed that inheritance of family land from father to son contribute to land pressure in general and land fragmentation in particular.

After land registration, the system of inheritance has remained in place leading to registration of increasingly smaller pieces of land. The inheritance system has seen holding sizes decline at least three-fold in every generation (Kenya 1966). Field data (Table 4.1 below) indicated that 61 per cent of the respondents have acquired their land through inheritance while 39 per cent acquired it through purchase.

Table 4.1 Means of Land Acquisition by percentage

Land Acquisition	No. of respondents	Percentage
Purchase	51	39
Inheritance	79	61
Tenancy	-	-
Total	130	100

Source: Fieldwork 1993

The craving for one's birth right such as land and the attraction associated with ancestral land has seen individuals go back to Kiambu, thus contributing to population pressure.

4.6 Population Growth and Population Pressure

Population growth has been isolated (Anzagi and Bernard 1979; Kisovi 1989) as an important factor contributing to population pressure currently being experienced in Kenya's high potential area. In Machakos District, Owako (1971) noted that man-land ratio has been reduced through natural increase in population. Bager (1980) wrote that Kisii district faced land pressure that was made worse by a population growth rate of 3 per cent per year.

Since the 1940's western influence on the african lifestyle has increased. The impact of 'modernisation' is substantial in Kiambu District, being among the most economically well-off regions in Kenya. There has been weakening of traditional customs that regulated births such as lengthy breast feeding and taboos. Modern medicine and hygiene have reduced mortality and raised life expectancy (Herz 1974). Infant mortality in Kiambu is 42 deaths per 1000 live births, far below the national rate of 92 deaths per 1000 live births (Kenya 1989), indicating that more infants are surviving to childhood. Despite higher survival rates, the demand for children has changed little from the traditional high. Traditionally, more children were born to ensure that some survived the many scourges that claimed them before adulthood. Children were seen, and are still seen, as important contributors to family security socially and economically. These and other factors have led to a sustained Total Fertility Rate (TFR) or 7.7 births per woman in Kiambu (Kenya 1981). This results in a high dependence ratio. Currently, about 60.98 per cent of the population is below 19 years of age (Kenya, 1989).

Population increased at a rate of 3.5 per cent per annum in the period 1970-1980 and 3.64 per cent per annum in the period 1980-1990 (Kenya 1983; 1989).

Absolute numbers are more informative as seen in Table 4.2 below.

Table 4.2: Population Figures for Kikuyu Division and Kiambu District, 1962 - 1988

	Year			
Area	1962	1969	1979	1988
Kikuyu	-	79,397	109,146	161,016
Kiambu	402,886	475,576	686,290	1,054,173

Compiled from: Kenya Population Census Reports (1962; 1969; 1979) and Population Projection for Kenya 1980-2000 (1983).

It can be observed that population doubled between 1969 and 1988 in Kikuyu Division. It also more than doubled for Kiambu District during the same period. Similarly, the number of persons per square kilometre has increased, for the district. Density has risen from 184 in 1969 through 280 in 1979 to an estimated 431 persons per square kilometre in 1988 (Kenya 1970; 1981; 1983). In Kikuyu Division, population density increased from 334 in 1969 to 639 persons per sq. km. in 1979. Given that this increase has occurred on a constant land resource base, then the need to explore whether or not there have been changes in utilisation becomes clear.

4.7 Conclusion

The foregoing sections have revealed the factors responsible for the emergence of population pressure in Kikuyu division. The early attempts to combat the problem, and the events and circumstances that have contributed to or sustained land pressure in one way or another have also been highlighted.

The initial settlers of Kiambu District were the Gumba and then came the Dorobo. By the 1880s these indigenous people were replaced by the Kikuyu people who had started migrating into the area from the 1850s. Early 20th century saw an influx of Europeans into Kiambu and Kenya in general. This influx marked the beginning of land alienation, worsening people-land balance.

Creation of large holdings in Kiambu has played a role in alienating indigenous land right holders. Their establishment quashed all the hope of such land reverting to the initial land-right holders after they were transferred to the African elite at independence. The bulk of agricultural land in Kiambu remains in the hands of a few individuals while peasants are crowded on very small holdings.

Several public institutions have contributed to land pressure in Kikuyu Division by occupying vast areas. Families dispossessed of land by such institutions were not adequately compensated or were given lower potential land in some cases. Land consolidation and registration of title despite its advantages, created a landed and landless class. It abolished the cushioning institution of the ahoi or tenancy. It also facilitated conveyancing in land, causing suffering for dependants such as children and relatives in event of land sale. By improving conveyancing it has led to wealthy farmers buying off the poorer land owners.

The inheritance system of the Kikuyu has caused sub-division of holdings each generation resulting in fragmentation and uneconomic parcelization. Lastly, population increase has contributed to decline in population-land ratio. The rapid growth rate and increasing absolute numbers on a constant resource base has exacerbated the imbalance.

CHAPTER FIVE

FARMER DEMOGRAPHIC AND PRODUCTION ADJUSTMENT STRATEGIES TO LAND PRESSURE

5.0 Introduction

A population faced with limited land resources must devise ways and means of making use of these resources. Demographic and production adjustments are possible responses in any area under population pressure (Hart 1970). Specifically outmigration and control of human population may result from land pressure (Boserup 1965; 1981; De Wilde 1967; Mortimore 1972; Grigg 1980). This chapter presents and discusses the results of the analysis of data on demographic and production adjustments to population pressure. The chapter focuses on the second and third objectives and tests hypotheses one and two of this study.

5.1 Demographic Adjustments and Population Pressure

This section addresses objective two and hypothesis one, viz; "land pressure is significantly related to outmigration, human fertility control and off-farm sources of income among farmers". This is achieved under three subheadings (a) fertility control and land pressure (b) outmigration and land pressure

(c) off-farm income and land pressure.

5.1.1 Fertility Control and Land Pressure

The chi-square statistic was used to test the null hypothesis that, Land pressure and fertility control are not significantly related. Frequency distributions were used to shed more light into the relationship. Table 5.1 below shows the proportion of "ever-practised" birth control with land size class. It is observable that birth control is prevalent. Percentage reporting "ever-practised" declines as land size increases. It is likely that as land (a means of production) gets scarce due to demand, the need to share it with fewer people develops. This awareness leads to increased practice of birth control.

Table 5.1: Percentage of Ever-practised Birth Control by Landsize Class

Landsize (Acres)	Ever Practised Birth control (%)	Never Practised (%)	N/A (%)
0.0-2.9	57	43	-
3.0-5.9	51	42	7
6.0-9.9	25	66	9
10.0-14.9	-	100	-
15+	16.6	50	33.4

Source: Fieldwork 1993.

Field data shows that land scarcity is a factor behind birth control. As seen in Table 5.2 below, in terms of percentage, land scarcity ranked third after cost of living and education in determining birth control. 77.7 percent of the respondents gave land scarcity as the reason for young people to control birth. Emphasis was put on the young because some respondents were past child bearing age or had already achieved their intended complete family sizes. The cost of living and education possibly came first as factors influencing birth control due to the adverse economic circumstances prevailing at the time of data collection.

Table 5.2: Reasons for Birth Control

Reason	Farmers Perceiving it as reason not to control Birth (%)	Farmers Perceiving it as reason for the young to control Birth (%)
Cost of living	15.4	84.6
Education Cost	23.1	76.9
Land Scarcity	22.3	77.7
Inflation	67.7	32.3
Food Shortages	63.8	36.2

Source: Fieldwork 1993.

The chi-square was used to establish whether any systematic relationship exists between the practice of birth control and land pressure. The computed value, 30.07, was greater than the critical value, 15.51, at 0.05 level of significance, leading to rejection of the null hypotheses and adoption of the alternative hypotheses. Thus, the practice of birth control is significantly related to population pressure on land. Farmers see the need to adjust to land scarcity by controlling human numbers. Land pressure contributes to acceptance of means of birth control. As shown in Table 5.1 the proportion of farmers reporting "ever-practice" of birth control declines as holding sizes increase. Conversely, the percentage reporting "never-practice" of birth control increases with holding size. Hence, land resource availability depresses the practice of birth control, while scarcity of the same promotes the practice.

5.1.2 Outmigration

This subsection attempts to explore the relationship between population pressure and outmigration. The sample population revealed a very unfavourable population-land ratio. 80 per cent of people have less than 0.66 acres per person. While 90.77 per cent have less than 1.32 acres of land.

Such paucity of land made it curious to know whether or not outmigration takes place within the study area.

Regression analysis was used to determine the degree of linear dependence of outmigration on the independent variables, land per capita, land size and heritable land per capita. These variables accounted for 7.2 per cent of the variation in outmigration leaving about 92.8 per cent unaccounted for. This was interpreted from the value R = 0.07209. R was preferred because it gives the proportion of variation explained by the variables included in the equation.

Partial regression coefficients (see Table 5.3) show that other things being equal one standard unit change in per capita land causes the greatest change in outmigration and one unit change in land size the least change. This was not unexpected given that per capita land area is a ratio of number of people in a holding to their piece of land. Meaning that the more people there are on a small holding the higher the likelihood that some will move out. For example, a small holding occupied by only one individual ranks higher in people-land ratio than a larger holding with even more people occupying it. Hence, land size may not obviously determine outmigration. Overall, the independent variables explain minimal variance in outmigration, meaning that variables other than those

in the equation influence outmigration, in the study area.

Table 5.3: Relative importance of individual factors affecting outmigration

Variable	Partial Correlation Coefficient (B)	Standardised Partial Regression Coefficient (B)
Per capita land	.58570	.08941
Heritable land per capita	.24176	.39229
Landsize	.03693	.04758

Source: Fieldwork 1993

Though there was outmigration in the study area, it was not a popular response to land pressure. It is possible that land pressure has not reached critical levels that prompt this response in substantial amounts. Possibly other responses (e.g. production adjustments and off-farm sources of income examined in section 5.2) have made the situation bearable hence obviating migration as an adjustment strategy. It is also likely that potential movers possess inertia associated with immovable property acquired by them. Another possibility is that career, trade and labour opportunities afforded by Nairobi city enable the people of Kikuyu to remain on the pressured area by giving extra income. 56.2 per cent of the respondents reported having some form of income besides farm income.

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Studies in other parts of the world (e.g. Simkins 1970; Hart 1970; Maro 1975) have associated outmigration with population pressure. Population pressure in terms of land potential and availability exerts significant influence on outmigration (Owako 1971; Mbithi and Barnes 1975). In fact, most of the population movements in Kenya have an element of population pressure as a push factor (Migot-Adholla 1981; Milas and Asrat 1985). Douglas (1980) noted a high rate of outmigration among males in response to land scarcity in Bunyore.

5.2 Production Adjustments

5.2.1 Off-farm Sources of Income

Failure to meet all subsistence requirements from agricultural endeavours and lack of additional land to compensate for land deficiencies, households may resort to dependence on income earned from off-farm sources (Douglas 1980). Mortimore (1970) observed exploitation of secondary sources of income due to deficits in food crops in Kano, Nigeria. Such sources included wage-labour, trade and pension. Boserup (1965; 1981) proposed that external sources of income and other resources may serve to ameliorate population pressure in the affected area. This section examines off-farm income as an adjustment to population pressure. Data on land pressure and off-farm sources

of income were collected at ratio and nominal scales, respectively. Therefore, descriptive statistics were used in the analysis.

Table 5.4 illustrates household dependence on off-farm sources of income. In all 57.6 per cent of the respondents reported having some form of income besides the farm. Detailed examination revealed that 47.9 per cent had a monthly income. 9.5 per cent reported irregular income. 43 per cent reported having no form of off-farm income.

Given the substantial percentage (57.6) with off-farm income, it is clear that this is a strategy that has enabled farmers to continue living in a land pressure locality. By extension, such income is also a pull factor for potential outmigrants, explaining the poor adoption of outmigration as a response to land pressure (see section 5.1.2). Before drawing any conclusion, it suffices to first examine whether land size relates to off-farm sources of income.

Table 5.4: Sources of off-farm income

Source	Frequency	Percentage
Urban wage employment	38	29.2
Rural wage employment	10	7.7
Pension	3	2.3
Trade/Business	18	13.8
Other	6	4.6
Total	75	57.6

Source: Fieldwork 1993

Table 5.5 reveals no discernible trend between land holding sizes (indicator of population pressure) and proportion of farmers with off-farm income in the land size class, suggesting that land holding size is not a strong factor motivating farmers to seek off-farm income.

Table 5.5: Land size and off-farm income

Landholding size (acres)	Off-farm income (%)
0 - 2.9	64
3.0 - 5.9	45
6.0 - 9.9	36
10.0 - 12.0	75
13.0 - 15.9	50
16.0 - 18.9	50
19.0 - 21.9	-
22.00	-

Source: Fieldwork 1993

5.2.2 Soil husbandry

Extraction of nutrients from the soil by plants or through loss by erosion necessitates replenishment if land productivity is to be maintained. This section attempts to explore the relationship between land pressure and soil husbandry. The null hypothesis that :- 'Land pressure and soil husbandry are not significantly related' is tested.

Overall, adoption of soil replenishment practices was widespread. 97.5 per cent of the respondents used between one and five methods to restore soil fertility. All respondents were using at least one method of soil fertility replenishment (see Table

5.6). The chi-square statistic was used to determine whether or not any systematic relationship exists between mean number of soil replenishment methods and land size. The computed value, 26.638, was lower than the critical value, 41.34, at 0.05 level of significance. Therefore, there was more than 5 per cent probability that the relationship between the two variables under consideration was due to chance. The null hypothesis that land pressure and soil husbandry practices are not significantly related was accepted.

Similarly Table 5.6 shows no clear trend in soil husbandry practices with varying land sizes. This observation can be explained differently. First, soil fertility replenishment is widely accepted in the study area. Hence, differences between farmers in the same locality are minimal and can hardly be discerned as was anticipated. Such differences can possibly be discerned when one compares regions of high and low population pressure. Secondly, it is likely that innovations in soil replenishment originate from sources other than the farmers; for example from extension officers who disseminate information about them uniformly thereby diminishing differences among farmers.

Table 5.6: Land Size and Soil Fertility Restoration Practices

Landholding size (acres)	Average Number of Soil Replenishment Methods
0.0 - 2.9	3.18
3.0 - 5.9	3.1
6.0 - 9.9	3.9
10.0 - 12.9	3.8
13.0 - 15.9	3.0
16.0 - 18.9	3.0
19.0 - 21.9	3.1
22+	2.6

Source: Fiedwork 1993.

Thirdly, as observed by Anzagi (1979) and Kisovi (1989), soil husbandry does not improve with increasing land pressure and may lead to declining yield and soil deterioration. This is the trend of restoring population-land balance predicted by Malthus. This view notwithstanding, it is unlikely that this may take place soon in Kikuyu as soil replenishment is widely adopted. Boserup (1965) states that land pressure generates better soil husbandry. De Wilde (1967) and Maro (1975) have also

observed that population concentration on limited land resources leads to intensive use of the same and, subsequently to better soil husbandry practise.

5.2.3 Livestock Rearing Practices

This section examines the relationship between livestock combination and rearing practices as they respond to land pressure. Livestock numbers and types are examined in relation to land size. Frequency distribution and the pearsons product moment correlation are used to examine this relationship.

It is observable from Table 5.7 that livestock numbers vary with land size class. A trend of increasing numbers of cattle and sheep with land size is observable.

Table 5.7: Mean Livestock Numbers per Farmer within Land size class

Landsize	Cows (No)	Sheep (No)	Poultry (No)
0.0 - 2.9	2.21	1.34	91.2
3.0 - 5.9	3.79	2.1	21.1
6.0 - 9.9	4.0	2.3	28.8
10.0 - 12.9	9.5	2.75	2.8
13.0 - 15.9	9.0	10.4	4.5
16.0 - 18.9	16.0	6.0	-
19.0 - 21.9	8.0	10.0	166.67
22.0	30.0	30.0	10.00

Source: Fieldwork 1993

As further shown in Table 5.8 below, Pearson's R indicates a strong positive correlation between land size and cattle and sheep numbers. There are explanations to this. On one hand, it is possible that natural grazing makes rearing of cattle and sheep less expensive enabling farmers to domesticate more animals. Zero-grazing on the other hand, is expensive, as it requires purchased fodder, dairy supplements and transportation of the same. Under this system, farmers only afford few animals.

Table 5.8: Pearson R Values of Landsize (V15) by Number of Cow (V24BCow), Number of Sheep (V24BSHP) (Sheep) and Number of Poultry (V24Bp)

Variable	V15 Landsize
V24BCow	.68670
V24BSHP	.58695
V24BP	.04909

Source: Fieldwork 1993.

Table 5.7 shows that mean number of poultry per farmer by landsize class is highest at the lowest class. The same mean declines between land sizes 3.0 - 5.9 and 16.0 - 18.9 acres. It rises sharply in class seven (19.0 - 21.9). Consequently, there is no consistent trend of change in mean poultry numbers per farmer with land size. This may be partially due to the heavy capital investment required to venture into poultry farming. Hence, influenced by farmer's socio-economic status. This is further discussed in the next chapter.

Though correlation between land size and poultry numbers is weak, something is learnt about the direction of this relationship. Poultry numbers increase as land size decreases. Going by this observation, it is concluded that poultry farming as a space intensive farming activity is adopted as land size decreases.

Livestock feeding systems were examined with a view to establish how they relate to land size (Table 5.9). It was found that land scarcity makes intensive forms of livestock feeding more popular than the extensive forms. As shown in Table 5.9 below zero grazing was the most favoured form of feeding; 64.6 per cent used it for feeding cows while 41.8 per cent used it for feeding sheep. Pasturing was least favoured, 10.8 per cent used it to feed cows, while 18.0 per cent used it to feed sheep.

Table 5.9: Percentage of farmers practising different systems of grazing for cows and sheep

System of grazing	No.	Cows	Frequency	Sheep
Zero-gracing	84	64.6	54	41.8
Partial confinement	17	13.1	28	21.8
Tethering	15	11.5	24	18.4
Pasturing	14	10.8	23	18.0
Total	130	100.0	129	100.0

Source: Fieldwork 1993.

As shown below (Table 5.10) the proportion of farmers practising zero grazing declines with increasing land size. This shows that land availability leads to more luxurious forms of landuse, such as pasturing.

The proportion of farmers using pasturing as the main method of livestock feeding rises as land sizes increase (Table 5.10). Less land pressure results in less intensive use of land. This finding concurs with the proposition that farmers respond to land scarcity by utilising the available resources more intensively.

Table 5.10: Percentage of farmers in each feeding system with land size class

Landsize Class (in acres)	Zero-grazing	Partial Confinement	Pasturing
0.0 - 2.9	75	10.0	5.7
3.0 - 5.9	65.7	11.0	11.4
6.0 - 9.9	58.0	33.0	-
10.0 - 14.9	14.0	28.0	57.0
15.00 >	-	-	100.0

Source: Fieldwork 1993.

Other observed forms of intensive resource utilisation identified include recycling of farm products. Scarcity of fodder in particular has led to feeding livestock with dried poultry droppings and waste feed. In many cases, commercial scale poultry farmers indicated that it was necessary to have dairy cattle to utilise poultry by-products. Farmers without cattle sold these by-products to neighbours owning livestock. Poultry manure is an important method of soil replenishment. Livestock manure is valued for use on farms. Thus, feeding habits vary with changes in land size.

5.2.4 Cropping Practices

Analysis of farmer response to land pressure also included examination of crop choice and cropping practices. Breeds of maize grown by farmers and reasons for their choice were analysed in relation to land pressure (Table 5.11). In this case, land per capita represented land pressure. There were no significant differences in maize breed adopted in low and high brackets of land per capita (Table 5.11). Farmers preferred hybrids (82.3 per cent chose hybrids) to traditional maize breeds. Yield consideration was cited as the most important reason for the breed of maize chosen at least 84.6 per cent of the farmers indicated this.

The chosen breed in each case was perceived as having advantages over the other. This absence of influence of land pressure on the breed adopted may be explained in two different ways. First, it is likely that the pressure levels in the study area have necessitated widespread adoption of hybrid maize. Although this assumption can not be justified using the data in this study, it is likely that differences would emerge if comparison is done between regions. Secondly, it is possible that there are other factors influencing the decision on variety of crops to be planted. For example, advice from agricultural extension officers may have led to heavy adoption of hybrids.

Table 5.11: Breed of Maize Chosen by Farmers with per Capita Land

Land per capita (in acres)	Farmers growing traditional breeds (%)	Farmers growing Hybrid maize (%)
0.02 - 0.66	16	83.9
0.67 - 1.31	9	90
1.32 - 1.96	33	66
1.97 - 2.61	-	100
2.62 - 3.26	-	100
3.27 - 3.91	-	100
3.92 - 4.56	-	100

Source: Fieldwork 1993.

An interesting picture emerges when cropping density figures are examined (see Table 5.12 below). The average number of crops per plot is highest (5.6) for the lowest land size groups and goes down to 2.5 per plot among the larger holdings. This phenomenon can be explained in two ways. First, land scarcity prompts intensive use. Despite declining land size, certain needs have to continue being met from the land. This leads to planting many varieties of food crops per plot. The larger the holdings, the fewer the types of crops per holding, mainly due to market-oriented production leading to the production of only a few crops.

The data were subjected to the chi-square statistic to examine whether any systematic relationship exists between number of crops per plot and land size.

Table 5.12: Average Number of Crop types per Plot with Land Size Groups

Landsize (acres)	Average Number of Crops per Plot
0 - 2.9	5.6
3.0 - 5.9	5.4
6.0 - 9.9	4.3
10.0 - 12.9	4.3
13.0 - 15.9	4.2
16.0 - 18.9	3.9
19.0 - 21.9	2.5
22.0+	2.5

Source: Fieldwork 1993.

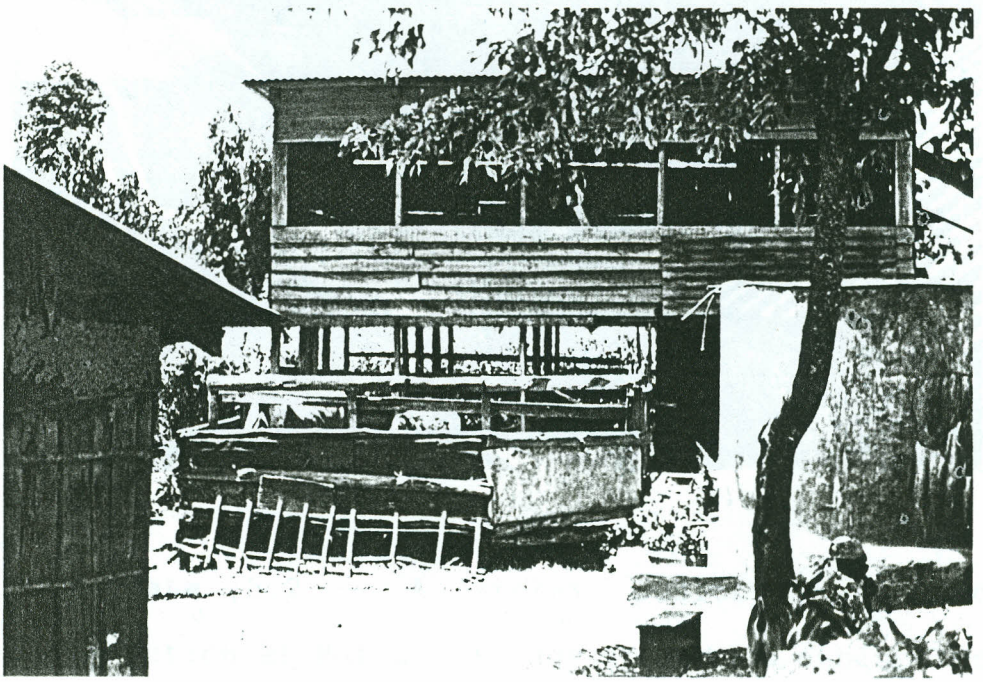
The computed value (50.5) exceeded the critical value (42.3) with 32 degrees of freedom at 0.05 level of significance. Hence the null hypothesis that; cropping density per plot is not significantly related to land pressure was rejected and the alternative hypothesis accepted. Other studies have observed that crop choice and cropping density respond to increasing land pressure (De Wilde 1976; Maro 1975; Ojoo 1985). Ojoo (1985) observed that low yielding crop varieties are abandoned with high yielding crop ones being adopted as land pressure increases. From the foregoing, it is reasonable to conclude that the soil is utilised more intensively due to land pressure and, is therefore more vulnerable to degradation if soil husbandry practices are not observed.

5.2.5 Other Innovations

Field observations further revealed that land scarcity has prompted deliberate changes in space and resource utilisation. Storey structures constructed for farm use such as poultry and cattle sheds were a good example of space utilization. Reasons given for such structures indicated that farmers were hesitant to expand buildings horizontally and preferred upward expansion. Plate 5.1 shows intensive space utilisation by a farmer from Gikambura sub-location. With a 0.7 acre plot, this farmer has adjusted to land

scarcity by erecting a storey structure that is multi-purpose. This structure houses poultry on the first floor and two dairy cattle on the ground floor. To the right of the cow shed, partially hidden by the water reservoir, is a living room for one of the sons. Also note the closely spaced buildings.

PLATE 5.1: Intensive Space utilization by a Farmer in Gikambura Sub-location.



One farmer (Mr. Kariuki) from Mutego village in Muguga sub-location said the main reason for erecting a storey poultry shed (see plate 5.2) was lack of space. This farmer also zero-grazed four goats in one corner of his kitchen. Lack of free range grazing pasture was the main reason given for this practice. He preferred to plant fodder on available land and restrict the animals to their shed. Unavailability of

pasture has forced some farmers to abandon dairy cattle rearing, so as to concentrate on commercial poultry farming.

Plate 5.2: A Storey Poultry Shed at Mutego Village in Muguga Sub-location.

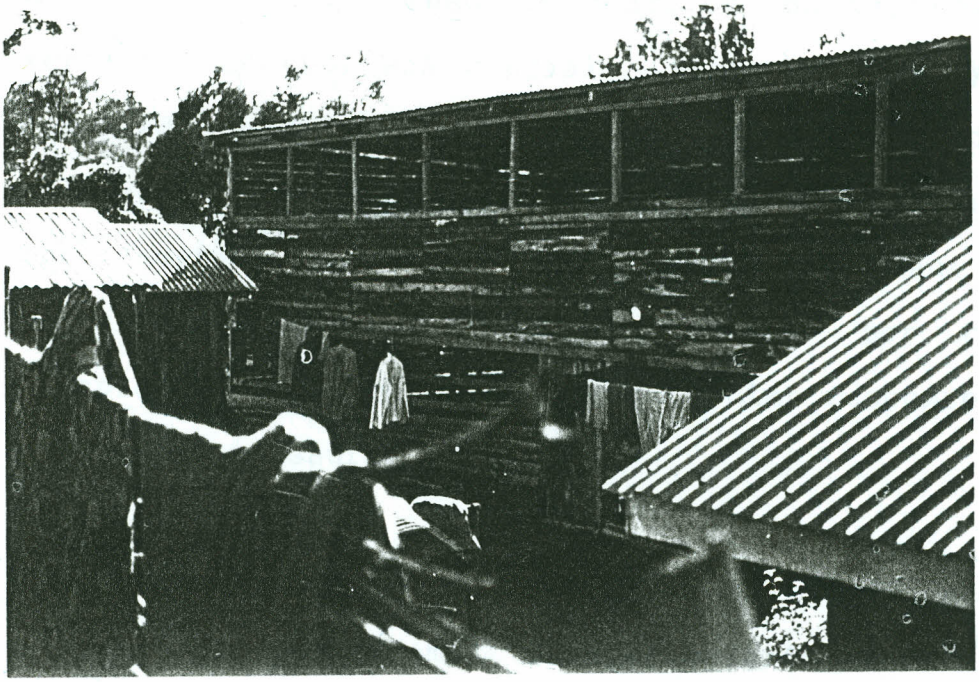


Plate 5.2 - A storey poultry shed under construction at Mutego village in Muguga sublocation. The farmer singled out paucity of space as the main reason for this upward expansion. Note that the houses are congested.

5.3 Summary

The analysis of demographic and production adjustments to land pressure has revealed that land pressure has influence on birth control among the youth. Farmers on smaller land holdings exhibited high awareness for resource scarcity and felt human fertility control was crucial. Regression analysis revealed that outmigration is not significantly related to land pressure. Independent variables in the equation accounted for only 7.2 percent of variance in outmigration, leaving 93 per cent unexplained. Migration is not a popular response to population pressure.

A significant proportion had some form of income besides the farm income. Cross tabulation indicated that this was not related to land pressure.

Soil husbandry practices are widely adopted in the study area, however, there was no significant relationship between land pressure and soil husbandry. Contingency tables showed that livestock numbers respond to holding size. Pearson's Product moment correlation established a strong positive correlation between land size and dairy cattle and sheep numbers. It revealed a weak negative relationship between poultry and holding size which means that poultry

numbers are likely to increase as land size decreases. This is presumably a response to unavailability of land.

Further data analysis showed that livestock feeding system varied significantly with holding size. Zero-grazing was the most favoured form of livestock feeding. Pasturing was least favoured. Livestock feeding habits become spatially restricted as land size decreases, ranging from pasturing to zero grazing. Field observations also revealed that farmers have adjusted to land pressure by intensively utilising space under farm structures. Upward expansion of farm structures has in some instances replaced horizontal expansion.

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CHAPTER SIX

FARMERS' SOCIO-ECONOMIC CHARACTERISTICS AND ADJUSTMENT STRATEGIES

6.0 Introduction

This chapter explores the relationships between farmer socio-economic characteristics and the choice of adjustment strategies to land scarcity. The null hypothesis that "Farmer education, age, family size and income are not significantly to adjustment strategy" is examined.

The chi-square test was used to determine whether or not a systematic relationship exists between socio-economic characteristic and, the adjustment strategy adopted. From Table 6.1 below education, income and age are significantly related to specific adjustment strategies, while family size is not. This chapter presents and explains these findings.

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Table 6.1: Results of Chi-square analysis between selected socio-economic characteristics and adjustment strategy adopted.

	Farmer Characteristics			
Variable	Age	Education	Income	Family Size
Outmigrants	-	0	0	0
Human fertility control	+	+	+	0
No. of poultry	-	+	+	0
No. of Dairy cattle	-	0	+	0
Soil Fertility Restoration	0	-	-	0
Rented land	0	0	0	-

Source: Fieldwork 1993

Key

- No relationship.

+ Significantly related.

0 Not considered

6.1 Farmers' Education (years) by Human fertility control, Number of poultry and Soil husbandry

The chi-square test results (Table 6.1) indicates that Farmers education and practice of birth control were significantly related. Cross-tabulation revealed increase in the frequency of practise of fertility control with increasing years of education. Hence education appears to have a depressing effect on human

fertility. Fewer years of education leads to less adoption of birth control. Others are for example Cochrane and Farid (1989;1990) and Kenya (1984; 1989) point out that education is a determinant of human fertility. Thus, more years of education contribute to awareness of different methods of birth control, leading to more adoption. Years of education are associated with income and are better quality life. More years of education often lead to more income and better quality life; hence diminishing the security utility of many children leading to fewer children (Cochrane and Farid 1989). Educated parents have higher regard for the quality than quantity of children. In this way,education has influenced birth control in the study area.

By use the chi-square test Farmers' years of education and number of poultry reared were observed to be significantly related. Cross-tabulation revealed that poultry numbers rise with farmer's years of education. Most poultry was reared for commercial purpose. It is therefore likely that commercial poultry farming, being a specialised activity, favours well-do-do farmers who happen to be among those well educated. Poultry rearing is a capital-intensive venture and bearing in the mind that more years of education predicates higher income, then more educated farmers are likely to engage in it.

It was anticipated that education would contribute to awareness of soil fertility restoration methods and practices. Yet when this relationship was subjected to the chi-square test it was not significant. This observation can be explained in two ways. First, farmer education by extension officers and the demand for sustained yield levels have contributed to wide adoption of soil replenishment, hence obviating the contribution of education. Secondly, the range of soil replenishment inputs and methods known is constant for every farmer; therefore, the expected contribution of education to awareness of soil conservation methods is pre-empted.

6.2 Age of farmer by number of migrants, birth control and number of cattle

The age of the farmer was tested for association with the number of the migrants, birth control and the number of cattle. The chi-square statistic (Table 6.1) indicated no significant relationship between these variables. Hence, the null hypothesis that "no significant relationship exists between the age of the farmer and the number of migrants from the respective household " is accepted. Increasing age was anticipated to relate positively with the number of migrants from household because older respondents are expected to have more grown up children living away. Absence of this relationship can be explained by

unpopularity of outmigration as a way of adjustment to land pressure (section 5.1.2).

Table 6.1 shows that farmers' age and the practice of birth control were significantly related. More younger respondents indicated "ever practice" of birth control than the older ones. This may be attributed to the aggressive family planning campaign that young parents have been subjected to (Kenya 1989). The older respondents did not experience much of the family planning campaign since this is a recent phenomena. Secondly, old age predicates larger land holdings and less subdivision. Land scarcity is thus more acute among the younger farmers prompting response by family size adjustment.

It was anticipated that age would relate significantly to the number of sheep and cattle given the sentimental attachment to livestock among old people. Older people also have larger holdings, and hence would be able to support more livestock. The chi-square statistical test indicated no relationship between age and number of sheep and cattle. Hence, age is not a significant variable in as far as adjustment of livestock numbers is concerned. As shown in section 5.2.2 the influence of land size on livestock numbers was more important in this case but, the influence of farmer's age is insignificant.

6.3 Farmers' income by number of dairy cattle and poultry and birth control

The association among the variables shown above was tested by use of the chi-square statistic. There was significant association between birth control, dairy cattle and poultry numbers with income (Table 6.1).

The influence of income on birth control was similar to that of education. Cross tabulation showed that higher income respondents had a higher frequency of "ever practice" of birth control. Low-income respondents reported lower frequency of birth control practice. This may be explained first, by the fact that higher incomes relate closely with more education (Kenya contraceptive prevalence survey 1984). Such individuals prefer quality rather than quantity of children. Second, higher income increases a feeling of security from old age poverty, famine etc. This diminishes the security utility of many children. Hence leading to fewer children and more birth control. On the other hand, low income individuals are likely to secure their future through children. For old-age security and future wealth, they are likely to beget more children and practise less birth control.

Income was significantly related to the number of cattle and poultry (Table 6.1). This is a two-way relationship and defies easy explanation. More livestock can contribute to higher income for the farmer as much as income can lead to greater investment in livestock and hence more income. Field observations point to the fact that higher incomes precede higher livestock numbers. Cross-tabulation revealed increasing number of dairy cattle with annual income group. Income may influence a farmer's choice of investment venture. This is true of investments in commercial scale poultry farming that require a high capital input. Income may also enable a farmer to invest in more cows under the zero grazing system.

6.4 Family size by rented/leased land

Renting or leasing land is a way of acquiring unutilized land resources in a locality. About 31.5 per cent of the respondents had adjusted to land scarcity in this way. It is likely that this practice would be more prevalent if such land was available. Acquisition of additional land resources by purchase was common, 38.5 per cent of the respondents had acquired their land by purchase.

From table 6.1, family size was not found to be significantly related to rented land. It was expected

that frequency of renting land would increase with increasing family size. This relationship was tested by use of the chi-square test. There was no systematic association, an observation that may be due to several reasons. First, family members were not all engaged in farming as a main activity, and therefore the demand for land need not rise with family size. Secondly, renting land was not a frequently sought option because the overall demand for land is high, leaving little land for rental or lease purposes. It is remarkable that 77.7 percent of the respondents considered their families to be experiencing land shortage. Thirdly, it is likely that large families had proportionally larger holdings than most of the small families. This evens the effect of family size on leasing or renting land, by obviating renting land besides the family holding since it is adequate. Hence there was no significant association between family size and renting or leasing of land.

Other studies Mbwesa (1990) and Naulikha (1991) have observed that farmer socio-economic characteristics such as education, age, family size and income influence farmer responses. Similarly, Mabogunje (1970), Simkin (1970) and Nasubo (1973) observed that farmer expectations and characteristics determine the type of response to land pressure.

Land renting and leasing are important options in rural land scarcity situations (Wisner 1978). Similar observations are reported by Hance (1970), Douglas (1980) and Grigg (1980). Wisner (1978) rightly observes that local redistribution of land (by renting and leasing) is important in supplementing the land base of households facing serious shortage but it does not fundamentally alter the prevailing condition of land scarcity in the locality as a whole.

6.6 Summary of the Findings

This chapter has examined relationships between farmers' socio-economic characteristics and their choice of adjustment strategies.

Education and income influence choice of adjustment strategy significantly. Age and family size did not have significant influence on farmers' choice of adjustment strategy to land scarcity.

Education was found to influence control of human fertility, higher education resulted in more adoption of birth control. Education and the number of poultry reared by a farmer were observed to be significantly related. Number of poultry reared increased with years of education of farmer.

There was no systematic relationship between farmers' years of education and soil fertility restoration. Services rendered by agricultural extension agents may have evened out the differences in education among farmers. Similarly, a limited range of soil replenishment methods pre-empted the contribution of education.

The age of the farmer was not significantly related to the number of migrants from a household as anticipated. This was because outmigration was generally unpopular as a response to land pressure. However, age was significantly related to practice of birth control. Fewer old people reported ever practising birth control while most young respondents did. Age had no association with the number of sheep and cattle reared, land size was an important factor here.

Income was observed to be significantly related to the practice of birth control among farmers. More income was closely associated with higher numbers of livestock. As observed, this is a two-way relationship. A closer look at the relationship established that income is likely to precede livestock number increase.

Lastly, family size and rented or leased land were not significantly related. Several reasons were given for this. Not all family members may be engaged in farming hence demand for land need not increase with family size. Renting land was not a very popular way of adjusting because the overall demand for land was high leaving little unutilised land. Lastly, the need to rent or lease land was in some cases evened out by larger families having proportionately larger holdings.

CHAPTER SEVEN

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

7.0 Summary

This chapter summarises the main findings and contributions of this study. For policy change, recommendations are made and lastly directions for further research are given. The main objectives of this study were:-

(a) To undertake a historical search of the causes and evolution of population-land problems in Kikuyu Division.

(b) To examine the relationship between outmigration, fertility control, off-farm sources of income and population pressure.

(c) To test Boserup's thesis that, increasing population density leads to more intensive land use.

(d) To assess the influence of selected farmer socio-economic characteristics (ie. education, family size, age and income) on adjustment strategy adopted.

Subsequently one premise and three hypotheses were formulated (see chapter 1).

Different sets of data have been utilised for this study. Primary data included farmer

characteristics, demographic and production adjustments and land pressure. This was elicited through questionnaire survey. Secondary data were gathered on emergence of population pressure, size of study area, its location, agricultural potential and the demographic profile.

Different methods of analysis have been used to assess the relationships between variables. Contingency table analysis was used to examine the relationships between livestock and landsize; variation of feeding system with holding size. Pearsons product moment correlation was used to summarise the relationship between land holding sizes and cattle and sheep numbers. The chi-square test was used to test the relationship between:- land pressure and birth control; land pressure and soil husbandry, and to examine the relationships between varied socio-economic characteristics vis a vis age, income, education, family size and strategy adopted in response to land pressure. Linear regression analysis was used to assess whether or not outmigration was dependent on land pressure.

Main Research Findings

1. The present population pressure is the result of specific events and circumstances in the history of Kenya. These include:

   (a) Land rights dispossession of individuals and families by missionaries, public institutions, international organizations and influential and wealthy persons from 1902 to independence. The effect of this has been to exclude many people from land initially held by them and causing congestion to others.

   (b) The land consolidation and registration exercise of 1952-1955 eclipsed the traditional cushion institution of tenancy and ushered in landlessness at a scale unknown before. It also improved conveyancing in land, leading to sale and excessive parcellation as well as skewed distribution of land among residents of Kiambu district.

   (c) Net increase in population is a significant factor leading to congestion of peasants in increasingly small holdings.

2. Awareness of presence of population pressure in Kikuyu is high and efforts are being made by farmers to control their fertility as a way of coping with the same. Outmigration as a response to land pressure was insignificant, farmers were reluctant to move despite the prevailing paucity of agricultural land.

3. Farmers respond to population pressure on land by adopting different forms of production. There were notable shifts in livestock combinations at varying levels of land scarcity. Feeding habits for livestock vary with land sizes. Luxuriant and wasteful livestock feeding systems such as range feeding were given up as landsize decline, favouring zero grazing and partial confinement. Commercial poultry became viable option in low landsize classes. Recycling of resources such as use of poultry waste to feed dairy cattle was also observed. Thus, population pressure has led to more intensive utilization of land and related resources.

4. Though soil replenishment was popular in the study area it was established that land pressure and soil husbandry are not necessarily related. Therefore land pressure may lead to serious deterioration of soils.

5. Land pressure has prompted change in space utilisation, vertical space use such as erecting storey farm structures was observed among some innovative farmers.
6. Land under crops was also used more intensively as land size declined. This was shown clearly by increasing cropping density as land scarcity bit.

7.2 Recommendations

1. There is need to publicise innovations such as vertical space utilization for farm structures and recycling waste poultry feed. Similarly, information concerning them should be disseminated for wider adoption.
2. Deliberate efforts should be exerted by the Kiambu District Development Committee to impress upon the public that the land resource base is constant and that the need to conserve it and step up control of human numbers exists now more than ever before.
3. Cases of land dispossession in Kikuyu division not addressed should be re-examined and settled so as to diffuse feelings of hostility still evident among the residents.
4. Some of the large estates in Kiambu district should be assessed to establish their production

efficiency, and the less efficient ones availed for purchase by small scale farmers. This will relieve pressure in areas such as Thogoto, Dagoretti and Kinoo.

7.3 Contributions of the Study

1. The findings of this study are significant to comparative studies of population pressure adjustments in other areas in Kenya. They are also handy for comparison with subsequent studies in the same study area, and in improving on knowledge of change in farmer responses due to socio-economic dynamics.
2. This study has proposed a conceptual model for studying adjustment to population pressure. This model (page 28) is easy to understand and useful as a take-off point for subsequent studies in adjustment. No originality is claimed over the model as a whole. The original idea is borrowed from Bernard and Anzagi (1979). Nevertheless, it has been improved, detailed and assembled to fit this study.
3. The study has also put into record hitherto unrecorded observations such as farmers' change in space utilisation, the trend towards vertical rather than horizontal expansion. And the re-use of poultry waste as cattle feed.

4. Lastly this study has provided insight into ways of responding to population pressure. The study has also identified some socio-economic characteristics (e.g. Age, Education and Income) that influence farmer adjustment to land scarcity. Therefore farmers' socio-economic characteristics are an important aspect of rural planning in circumstances of land scarcity.

7.4 Areas for Further Research

1. A follow up study needs to be done in Kikuyu division to examine factors that contribute to the observed absence of outmigration despite congestion and meagre agricultural land resources.
2. It was observed in chapters one and four that land fragmentation is acute in some parts of Kikuyu Division. One known effect of fragmentation is reduced productivity. A methodology needs to be developed and a study done to assess whether there are significant losses in productivity resulting from the excessive land fragmentation observed.
3. Studies parallel to this one should be done in other rural areas with an aim to compare findings.

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APPENDIX A.1

QUESTIONNAIRE

The aim of this Questionnaire is to collect data on farmers' response to population pressure on land in Kikuyu Division, Kiambu. The data being collected is purely for academic requirements and therefore any information provided will be strictly confidential. There are no right or wrong answers. Tick ( ) or fill information in space provided.

Location .....

Date .....

Sublocation .....

Interviewer .....

Village .....

Farm number .....

Background Information of Farmer

1.(a) Farmer's name ..... (b) Sex

1. Male ( )

2. Female ( )

2. Occupation (main source of income)

1. Farmer ( )

2. Wage earner ( )

3. Other, specify .....

3. What is your educational level? (Highest class attained)

1. Primary ( ) 4. High school ( )

2. Secondary ( ) 5. College ( )

3. University ( ) 6. No. formal schooling( )

4a. 1. Number of wives .....

2. Number of female children aged 0-20 years .....

3. Number of male children aged 0-20 years .....

4. Number adults other than wives aged 21-6 .....

Total Number .....

4b. How many persons live permanently on this farm?

.....

II Demographic responses.

5a. Excluding married daughters are members of this farm normally away? 1. No ( )

2. Yes ( )

5b. Enumerate them as follows excluding married daughters.

Number (ALd)***	Age	Sex M	Sex F	(RH)*	(T.Ab.)	(R.Ab)	**
1.	--	--	--	--	--	--	--
2.	--	--	--	--	--	--	--
3.	--	--	--	--	--	--	--
4.	--	--	--	--	--	--	--
5.	--	--	--	--	--	--	--
6.	--	--	--	--	--	--	--
7.	--	--	--	--	--	--	--
8.	--	--	--	--	--	--	--

* Relationship to Head. (RH) ** Reason for absence.

0. Head of Household.
1. Wife.
2. Brother/sister
3. Uncle/aunt.

1. Settled in a rural area.
2. Job seeking.
3. Wage employment.
4. Formal education.

4. Father/Mother. 5. Other training
5. Child.
6. Niece/Nephew
7. Grand child.

*** Access to Land.

1. Rights to ownership of this farm.

2. Right to a portion of another farm.

3. Claim of ownership of another farm.

4. No farm rights.

5. Other (specify) .....

KEY

RH: Relationship to Head of Household.

T. Ab: (T/P) Terms of absence (Permanent/Temporary)).

R. Ab: Reason of absence.

ALd: Access to land.

6. Do you consider your family to be experiencing land shortage?

1. Yes ( ) 2. No ( )

7. Have you practised or do you practise birth control?

1. Yes ( ) 2. No ( )

If yes, why? (give reasons)

1. .....

2. .....

3. .....

4. .....

5. .....

8. Do you share the view that younger generation needs to control their fertility? 1. Yes ( )

2. No ( )

(b) If yes, why? (give reasons).

i) .....

ii).....

iii).....

iv).....

III Production responses

9. Estimate proportion of farm devoted to;

Acres	0%	1-10%	11-20%	21-30%	31-40%	41-50%	51-60%	60%+
Pasture.....								
Fodder.....								
Food Crops.....								
Cash Crops.....								
Fallow or Unused.....								

10. How long does this land lie fallow? Months .....

Years .....

11. (a) Do you practise intercropping? 1. Yes ( )

2. No ( )

(b) Name crops you plant on the same plot.

1) .....

2) .....

3) .....

4) .....

5) .....

6) .....

7) .....

8) .....

12. Which breed of maize do you grow?

    1. Katumani ( )

    2. Hybrid ( )

    3. Traditional ( )

13. Why do you plant this/these? Give reasons.

    1. .....

    2. .....

    3. .....

    4. .....

14. Give total number of crops you grow.

    .....

15. Do you apply any of the following to your land?

    1. Animal manure ( )

    2. Fertilizer ( )

    3. Compost manure ( )

    4. None ( )

16. Which of the soil conservation measures below do you utilize?

    1. Terracing ..... ( )

    2. Reforestation ..... ( )

    3. Cover crops ..... ( )

    4. None ..... ( )

    5. Other (specify) .....

17. Do you keep any livestock on this holding?

    1. Yes ( ) 2. No ( )

(b) Show numbers of each

Type	Number
Cattle-Grade	_____
Cross Breed	_____
Traditional	_____
Sheep/Goats	_____
Pigs	_____
Poultry	_____

18. What system of grazing do you use for your Livestock?

	Cattle	Sheep	Goats	Donkey	Pigs	Other
Zero grazing	.....					
Partial Confinement	.....					
Tethering	.....					
Pasturing	.....					

19. Which is the most important source of feed for your livestock?

1. Grazing land within farm ( )
2. Grazing land outside farm ( )
3. Crop residues ( )
4. Cultivated fodder from own farm ( )
5. Grass cut from neighbour's farm, along the road or school compound ( )

20. What is your approximate annual income per annum in Kenya shillings (Kshs)

    1. Less than 2000 ( )
    2. 2001-5000 ( )
    3. 5001-7000 ( )
    4. 7001-9000 ( )
    5. 9001-11000 ( )
    6. 11000 and above ( )

21. Was any off-farm income earned last year by any member of your household? 1. Yes ( ) 2. No ( )

22. If off-farm income was earned last year, what was the source and how much was it?

    1. Urban wage employment Ksh. .....
    2. Rural wage employment Ksh. .....
    3. Own business Ksh. .....
    4. Other (specify) Ksh. .....

23. How often is off-farm income earned in your household?

    1. Irregularly ( )
    2. Monthly ( )
    3. Never ( )

24. Who earns off-farm income for the family?

    1. Male head of household ( )
    2. Wife/wives ( )
    3. Grown-up children ( )
    4. Others (specify) .....

Indicators of population pressure, land size, subdivision of land, heritable land by males age 0-20, arable land per person, marginal land use.

25. How did you acquire your farm?

    1. Inheritance ( )
    2. Purchase ( )
    3. Tenant ( )
    4. Other means (specify)

    .....

26. What is the size of this holding? ..... (acres).

27. What proportion is arable? .... (acres) .... (%).

28. Has this farm been formally subdivided?

    1. No ( ) 2. Yes ( )

29. If subdivided, how many subdivisions are there and what is their average size? Number .....

    Size (acres) .....

30. Please state whether you regularly cultivate or graze on each of the following:

    1. Along river channels .....
    2. In and around swamps .....
    3. Along roadside .....
    4. On steep slopes .....

31. Do you cultivate or graze on land rented or leased elsewhere?

    1. Yes ( ) 2. No ( )

    What is the size of the plot? ..... (acres)

32. Do you own any other piece of land besides this farm?

    1. Yes ( )

    2. No ( )

33. (If yes), how many pieces? .....

THANK YOU

APPENDIX A. 2

Non-schedule Standardized Interviews, Guided by the Following Questions.

1. Comment on the number of people in this Sub-location (/ Tick one).
   1. Too few ( )
   2. Alright ( )
   3. Many ( )
   4. Too many ( )
2. Give reasons for your view in (1) above.
   1. .....
   2. .....
   3. .....
   4. .....
   5. .....
   6. .....
3. What do you think are the reasons for the current population-land problems?
   1. .....
   2. .....
   3. .....
   4. .....
   5. .....
   6. .....

APPENDIX A.3

CRITICAL VALUES ON THE CHI-SQUARE DISTRIBUTION

	SIGNIFICANCE LEVEL				
	0.10	0.05	0.01	0.005	0.001
1	2.71	3.84	6.64	7.88	10.83
2	4.60	5.90	9.21	10.60	13.82
3	6.25	7.82	11.21	12.84	16.27
4	7.78	9.49	13.28	14.86	18.46
5	9.49	11.07	15.09	16.77	20.52
6	10.64	12.59	16.81	18.55	22.46
7	12.02	14.07	18.48	10.28	24.32
8	13.36	15.51	20.29	21.96	26.12
9	14.68	16.92	21.67	23.59	27.88
10	15.99	18.31	23.21	25.19	29.59
11	17.28	19.68	24.72	26.76	31.26
12	18.55	21.03	26.22	28.30	32.91
13	19.81	22.36	27.69	30.82	34.53
14	21.06	23.68	29.14	31.32	36.12
15	22.31	25.00	30.58	32.80	37.70
16	23.54	26.30	32.00	34.27	39.29
17	24.77	27.59	33.41	35.72	40.75
18	25.99	28.87	34.80	37.16	42.31
19	27.20	30.14	36.19	38.58	43.82
20	28.41	31.41	37.57	40.00	45.32
21	29.62	32.67	38.93	41.40	46.80
22	30.81	33.92	40.29	42.80	48.27
23	32.01	35.17	41.64	44.18	49.73
24	33.20	36.42	42.98	45.56	51.18
25	34.38	34.65	44.31	46.93	52.62
26	35.56	35.88	45.64	48.29	54.05
27	36.74	40.11	46.96	49.65	55.48
28	37.92	41.34	48.28	50.99	56.89
29	39.09	42.56	49.59	52.34	58.30
30	40.26	43.77	50.89	53.67	59.70
40	51.81	55.76	63.69	66.77	73.40
50	63.17	67.51	76.16	79.49	86.66
60	74.40	79.08	88.38	91.95	99.61
70	85.53	90.53	100.43	104.22	112.32
80	96.58	101.88	112.33	116.32	124.84
90	05.57	113.15	124.12	128.30	137.21
100	118.50	124.34	135.81	140.17	149.45

The critical values are determined by reference to the sample degree of freedom (v) and the selected significance level. If the test statistic equal or exceeds the critical value then the null hypothesis is rejected.

Source: Hammond, 1978.

APPENDIX A.4

LIST OF RESPONDENTS IN ORAL INTERVIEWS

NAME	DATE OF INTERVIEW
Alice Njeri Ngugi	12th March, 1993
Gathu Kuria	20th April, 1993
Kanini Kibuchi	28th March, 1993
Kariuki Kaboro	14th March, 1993
Mungai Kibatha	23rd April, 1993
Njoroge Kinyanjui	15th April, 1993
Thandi Thiong'o	18th April, 1993