# URBAN AGRICULTURE AND DEVELOPMENT CONTROL IN KENYA: THE CASE OF MACHAKOS MUNICIPALITY

## THESIS

**BY**

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**A thesis submitted in *part* fulfillment for the degree of Master of Arts (Planning) in the Department of Urban and Regional Planning, Faculty of Architecture, Design and Development, University of Nairobi.**

**August 2001**
**Nairobi**
**Kenya**

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***Dedication***

To the Entire family of the Late Gregory Makali Nzau

## DECLARATION

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

Signed.....Date.....4-09-2001

**Samuel Kioko Makali**
**(Candidate)**

This thesis has been submitted for examination with my approval as a University supervisor.

Signed.....Date.....14-09-2001.....

**Prof. Peter M. Ngau**
**(Supervisor)**

**August 2001**

## ACKNOWLEDGEMENT

This research has been completed successfully through the assistance and contribution of a number of individuals and institutions. Special gratitude go to the Government of Kenya through the Ministry of Lands and Settlement, Physical Planning Department for funding this research and my full course of study in the post graduate programme.

I sincerely thank my supervisor, Prof. Peter M. Ngau for his consistent guidance and valuable criticism and constructive comments that helped me to develop this study.

I am also indebted to the research assistants and the respondents who were interviewed and provided information that led to the development of this study.

The Machakos District Physical Planner Ms Jacinta Mbithi, Mr. Musembi, the Principal administrator of Machakos Municipal council, Mr. Mutua, the assistant administrator of the council and Mr. Ndunda, the Machakos District Agricultural officer also deserve special thanks for offering me the information required for the study.

To Lenny Ngugi and Simon Mbugua, thank you for sparing your time to type this work.

To family members, Capt Raymond Nzau, Aunt Mary Nduku, Penninah, Josephine and Patricia Mbula, I thank you for your prayers and patience.

To all the others who contributed in one-way or another towards the completion of this work, I sincerely say, Thank you.

The responsibility for any errors of omission or commission in this work is entirely mine.

# ACRONYMS

| | |
|---|---|
| CBD: | Central Business District |
| CBS: | Central Bureau of Statistics |
| FAO: | Food and Agriculture Organization |
| FYM: | Farm Yard Manure |
| H/H | Household |
| ILO: | International Labour Organization |
| KFMH: | Kenya Farm Management Handbook |
| LA: | Local Authority |
| LADP | Local Authority Development Programme |
| PPA: | Physical Planning Act |
| SPSS: | Statistical Package for Social Sciences |
| UA: | Urban Agriculture |
| UNCED: | United Nations Commission on Environment and Development |
| UNDP: | United Nations Development Programme |
| WCED: | World Commission on Environment and Development |

## ABSTRACT

Urban agriculture, described as any agricultural activity within the boundaries of an urban center encompassing all kinds of crop cultivation and animal husbandry is not a new phenomena rather it is as old as urbanization itself. Food production was an important phenomenon of both pre-industrial and industrial cities. During the last two decades, these activities have been on the increase in most developing countries and Africa in particular.

However, in most African counties, Kenya included, urban agriculture is considered illegal. Local authority By-laws usually dating from the colonial times simply forbid any agricultural activity within the boundaries of urban centers. A large number of urban dwellers continue to practice urban agriculture, contrary to the By-laws, while urban managers and planners quietly ignore the practice.

This study aimed at examining the relation between urban agriculture and development control with a case study of Machakos Municipality.

The research methodology employed included the use of primary and secondary data. In the collection of data from the primary sources, structured questionnaires and scheduled interviews for 100 households (70 Farming and 30 Non farming) and 30 market traders dealing with agricultural produce were used. Secondary data was collected from among others, Machakos District Physical Planning Office, Agriculture Office, Machakos Municipal Council Offices. Other tools applied included informal discussions, personal observation, and photography. The data collected was analysed using the Statistical Package for Social Sciences (SPSS) after which outputs generated were used as input in

Microsoft excel to generate graphs and charts. Analysed data was then presented using frequency tables, pie charts and bar graphs

The study found out that, the practice of urban agriculture in Machakos municipality is prohibited by the Public Health Act cap 242, the Local Government Act cap 265, and General nuisance by–laws, 1999 amendments. The Physical Planning Act of 1996 does not recognize the activity as one of the urban land uses and subjects every land including private land to planning. Furthermore, these legislations appear to conflict with other land related Acts such as the Registration of Titles Act Cap 281, which give conditional powers to the owner of land, and the Registered Land Act Cap 300.

Despite the existence of such legislations that should guide planning and growth of the town, 98 percent of the households interviewed were not aware of their existence.

It was established that, the practice is not confined to individual households as both government, religious and educational institutions are involved. Several factors were found to encourage the practice among them large family sizes, lengthy period of urban residence, and availability of open space.

The activity was found to play a significant role in the municipality's economy. It provides domestic food supply (74 percent of the households interviewed produced crops for subsistence purpose) Besides, it conserves soil, utilizes urban waste and has greening effect among others. In terms of development control with regard to agriculture, It was found out that the municipal council does not sensitize the residents on the existence of planning legislations and majority are not aware, there is lack of enforcement of the same, apparent conflicts in the existing legislations governing ownership and use of land. Lack of zoning By-laws and an approved Local Physical Development Plan to guide

development and provision of infrastrustructure. It was also found that UA has significant influence on the towns shape and rate of growth.

The study concludes that urban agriculture is practiced out of a 'felt need'. Although gazettment of the peri urban areas render it illegal, people continue to practice it. Local authorities rarely develop infrastructure in the peri-urban areas due to lack of a Local Physical Development Plan that could influence the residents to change the use of land.

The incorporation of the peri-urban areas into the urban areas does not revoke the special conditions for use of land formally in the rural areas. The Registration of Titles Act cap 281 allow agriculture in the formally rural areas while the PPA of 1996 and the General Nuisance By-laws prohibit the activity in the newly incorporated land.

It is on this basis that the study recommends that municipal boundaries should not be extended arbitrary by the Minister for Local government. The local authority should before hand prepare a local physical development plan and zoning schemes for the peri-urban area to determine the minimum acceptable land sizes and form the basis for provision of infrastructure. Integration of agriculture to the urban system arises from its potential in future to feed the municipality and includes sensitization of the local community on the dangers of using raw sewer and industrial effluent to produce crops, the need to conserve the environmentally fragile areas and employment of an agricultural officer by the local authority to manage farming. There is need for civic education to sensitize the residents on the existence and importance of planning law and by-laws.

The laws that govern the use and planning of land should be harmonized to facilitate the integration of agriculture to the urban system. UA if properly promoted has potential to contribute significantly to the Government's policy of proper urban development.

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# 1.0 CHAPTER ONE: INTRODUCTION

## 1.1 Introduction

The expression of urban agriculture (UA) or "intra and peri-urban agriculture", originally used only by scholars and the media has now been adopted by United Nations agencies such as the UNDP and FAO. This is a reflection of the magnitude of the practice globally and the attention it is receiving. Historically, agriculture is seen as the cause of urbanization (Mougeout,1995). According to Lewis Mumford (1961) cities started as villages that were composed of a cluster of families carrying out agricultural activities. As the Neolithic Agriculture became successful, sedentary life was cemented. Definitive urbanization was achieved in the "fertile crescents" of South West Asia by the Fourth millennium BC, in the Indus valley and Huangho basin from the third to the second millennium BC, in Meso America very late in the first millennium A.D, in the Central Andes, Northern Europe and possibly Sub- Saharan Africa during the first millennium A.D. As the urban way of life became more advanced some elements necessary for effective food production were 'diffused' (Lampard 1967). This may be the time when the prefixes "urban" or "rural" started to be fixed to the root word-agriculture.

Food production has been an important phenomenon of both pre-industrial and industrial cities. In Britain, for example, by 1950, agriculture was the main user of land. Four out of five acres of the land surface of England and Wales were still agricultural and this was one of the largest industries in Britain (McCulloch,1965). According to the World Commission on Environment and Development (WCED, 1987), historically, urban dwellers in industrialized countries faced severe food insecurity during periods of crisis such as war. The activities of growing food in

pots, on windowsills, balconies and in small back yard plots were seen as an important source of food and took a new dimension.

In the United States during World War II for example, "victory gardens" provided 45 percent of the fresh vegetables. At present, some families in western cities have garden allotments, mainly for vegetables but also poultry and small remnants such as rabbits and guinea pigs. This supplements the food budgets for some of the needy. The driving force for these people is a "green thumb" or the desire to be free from food contamination through chemicals.

In many developing countries, as far as many of the urban poor are concerned, their sources of livelihood, including the ability to command food are steadily being eroded. Besides this evidence, at first glance, UA may appear to be an oxy-moron. Agriculture is considered the quintessential rural activity while in urban areas it is often considered archaic, temporary and inappropriate. Some consider it marginal, at best perhaps a constructive recreational activity or an aesthetic function that helps to beautify the "ugly" city (UNDP, 1996). However, in an urbanizing world running short of resources, the possibility that cities can depend on the ingenuity of their residents to generate food security for they is significant. In countries like Kenya where hunger and malnutrition are major urban problems, an activity that can contribute to the nutritional self-reliance of a community, city or metropolis region deserves attention. Studies conducted in Kenya on UA suggest that despite the constraints faced, it is still thriving (Sanyal, 1995). Mazingira Institute, a Non-governmental organization did the first survey on UA in Kenya in 1985 in six towns. Their study set the pace for subsequent studies on UA in

Kenya. Studies conducted in the field reveal that most of the crops grown and animals kept are consumed by the producers (Freeman 1991).

Bakker (2000: 3), defines Urban Agriculture (UA) as an industry located within (intra-urban) or on the fringe (peri-urban) of a town, a city or a metropolis, which grows or raises, processes and distributes a diversity of food and non food products, (re-) using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area.

From this definition, Mougeout (cited in Bakker, 2000: 4 ) goes further to state that in any given city, at any given time, agriculture will be found that is rural, peri-urban and intra-urban in nature, the three interacting and complementing each other to varying extents, with the latter being more integrated into the urban system.

This study focuses on peri-urban type of UA in Machakos municipality where traditional land owners and recent buyers, despite having a knowledge of their land falling under the municipality and besides other competing urban land uses, continue practicing urban agriculture. The study attempts to understand the practice of UA in the context of Planning law and local authority By-laws. It examines the extent to which UA could be integrated to the urban system and whether it should be discouraged or accommodated. The development control issues arising from the practice and it's effect on the physical growth of the town is examined. In essence, the study examines the dilemma of urban agriculture in the context of development control in Kenya with a case study of Machakos Municipality.

**1.2 Statement of the Problem**

The presence of cities presupposes more or less attendant societal process of urbanization (Hauser, 1967). Broadly speaking, three conceptions of urbanization have currency in social sciences: the behavioral, the structural and the demographic. The first conceives of urbanization as an adjustment of personal behavior in the sense that it focuses on the conduct of individuals. The structural concept ignores the patterned behavior of individual person and fastens on the patterned activities of whole populations. The demographic approach, on the other hand, largely ignores individuals' behavior and structure of occupations and postulates that urbanization is a process of population concentration. Urban centers are viewed as points of population concentration.

In Kenya, the process of urbanization can be directly attributed to non African settlers (Obudho,1976). An accurate analysis of urban development was attempted after the 1948 population census. According to this census, an urban center was defined as any compact and gazetted settlement with a population of 2000 and above inhabitants. This definition has been carried up-to date. According to the Local Government Act, Cap 265, Section 12, the Minister for local government is empowered to establish a municipal council in respect of any municipality for what there is not in existence a municipal council established under the same Act.

According to the same Act, the minister may either on receiving proposal under section 6 or without such proposal by order exercise any area to be or to cease to be a municipality, define the boundaries of such a municipality, county or township or alter the boundaries of a

municipality, county or township. Once an area has been gazetted as a municipality, the same Act leaves to any given local authority the power to enact By-laws that permit or restrict certain activities including farming. Urban agriculture in Machakos Municipality is illegal as the General nuisance By-laws, 1999 amendments Section 9 and 11 (1) prohibit farming unless with written permission from the Town clerk.

In addition to this, according to the Physical Planning Act No 6 of 1996, Section 24 empowers the Director of Physical Planning to prepare with reference to any government land, trust land or private land within the area of authority of a city, municipal, town, or urban council or with reference to any trading or marketing center; a Local physical development plan. Under the same Act, section 29 gives power to each local authority to prohibit or control the use and development of land and buildings in the interest of proper and orderly development of its area. This contravenes the Registration of Titles Act cap 281 and the Registered land Act cap 300 that give absolute ownership to the landowners.

As a result of the gazettement, farmers who were initially farming on their lands are then considered to be carrying out an illegal activity since agriculture is not considered as an urban land use. The benefits of UA are thus lost behind myths that are the products of cultural. planning and policy biases.

According to Andrews (1979) and the Physical Planning Handbook of 1976, the activities considered as urban include, residential, industrial, landscaping and recreational, public purposes, commercial services, public utilities and transportation. Agriculture is thought to

interfere with productive uses of other land uses and so should be confined to rural areas (Mougeout 1993). Despite all this, agriculture still remains as the largest land use within municipal areas in Kenya and the local authorities have not fully grasped it's implications. This is too ironical considering the fact that agriculture is the backbone of the Kenya's economy as a whole and many local urban economies in particular. Kariuki (1986) asserts that agriculture is the mainstay activity of most Kenyans. The sector is held with so much esteem because of the role it plays, among them, employment creation, foreign exchange earning, food security provider and a stimulant of off-farm employment generation. Most of the Kenyan urban centers are distributed incidentally in the agricultural well-endowed areas. Agricultural activities hence continue to be prevalent along riparian reserves in and around urban centers.

Today, urbanization excludes agriculture. According to the Physical Planning Hand book of 1976, agriculture is simply referred to as subsistence *shamba* cultivation that is considered under the category of landscaping and recreation. The reason given for this scenario is that agriculture cannot compete favorably on economic grounds for land with housing and industry (Memon and Lee smith, 1993).

J.H Von Thunen (1826) developed the theory of location differential. According to him, the various agricultural land use around a market place bid for the use of land and it is assigned the highest bidder. Later on, Mather (1986) and Sullivan (1990) borrowed this concept and argued that land is allocated to the highest bidder. This order of allocation starts from the center with the highest bidder and it recedes outwardly into the otherwise rural areas. It is for this reason then that retail, industrial, residential and agricultural activities have been found to out bid each

other in a descending order. Due to this economic argument, agriculture appears displaced and separated from the growing urban areas.

According to McCulloh (1965), The pattern of land value will continue to reflect the tug of war between extensive uses like agriculture and more intensive uses like housing, roads and factories. Many farms, small intensive full time ones will be bought, sold or held at prices representing only a part of their value as commercial agricultural holdings. A strong investment element will be part of their market value. He further observed that, at the "belts and rings of urbanized" agricultural land, then will be the remainder of lowland which constitutes the rural areas where commercial agriculture will continue together with the local market activities arising from it. Land values will be affected by the continued urbanization.

Due to the steady rise in the use of land for private housing, it becomes worthwhile for agricultural owners to sell their land if it has been actively wanted for urban development (Convoy,1975). With the proceeds; it has been possible for the owners to seek out other farms, usually bigger.

Inspite of these views and observations there still exists a growing trend in the practice of agriculture in and around urban areas (Mougeout,1998). The question one is likely to ask is why is the practice so persistent? According to Cockram (1996), the primary reason why people grow food in urban centers is to feed their families. Case studies point to economic necessity as the driving force behind UA and to the important role garden play in household survival. According to Maxwell and Zziwa (1990), "urban farming tends to be an aspect of life for poor urban dwellers, who supplement their meager income by producing food in any

available land" This view is not wholly true because UA is also practiced by the middle and high income groups, public institutions and private companies (UNDP,1996).

The practice of urban agriculture is perceived by Rakodi (1988) as a furtherance of the people's way of life and partly an indication of economic hardships. It has also been found to create a personal satisfaction from the act of cultivation.

In Kenya, local authorities such as Machakos municipal council have for a long time tried to root out this practice out of their areas of jurisdiction through By-laws and various Acts. Despite these constraints, Urban Agriculture is still thriving and expanding in Kenya and elsewhere in Africa (Sanyal, 1995). What is evident is that UA is not a marginal activity in Kenya but rather a significant sub-sector within both the urban economy and the agriculture industry. Indeed, Lee Smith (1987) notes that half of all urban families in Kenya carry out urban farming.

A food gap exists in Kenya between the higher overall rate of population growth and the low rate of increase in the production of staple cereals. Relying on an increase in agricultural productivity on rural farm alone will not solve the food, nutrition and other needs of the ever-increasing urban populations (Ratta, 1995). Consequently, agricultural production must increase by tapping additional sources of production such as urban agriculture.

It is against this background that this study intends to examine the persistence of agriculture in the peri-urban area within Machakos municipality where despite the encroachment by other

land uses and existence of by-laws against the practice, the activity still dominates. Emphasis is on the peri-urban area because it constitutes traditional landowners and new buyers from which no study has been undertaken and where the activity thrives. The possible trend of UA in such areas has also been examined.

In order to carry out a detailed study, the main research question is, "How does Urban Agriculture relate to development control in Machakos municipality? More specifically, the study will try to answer the following questions:

1. What is the extent and role of UA in Machakos municipality?
2. What factors contribute to the practice of UA in the municipality?
3. What are the existing legislations related to land ownership and use?
4. How does Urban Agriculture relate to planning law and Local authority By-laws?
5. What is the level of enforcement of the existing planning law and By-laws related to urban agriculture?
6. How does UA relate to environmental management and gender in Machakos?
7. How can UA be integrated in the urban land use system?

### 1.2.1 Objectives of the Study

The broad objective of the study is to examine urban agriculture (UA) in the context of development control in Machakos municipality.

**Specific objectives**

1. To establish the extent of urban agriculture in the peri-urban area of Machakos municipality.
2. To find out the factors that encourage the practice of urban agriculture and its role in the municipality.
3. To establish the existing legislations on land ownership, use and the level of awareness of planning law and local authority By-laws related to UA.
4. To investigate the level of control of urban agriculture in Machakos municipality.
5. To suggest how urban agriculture can be integrated in land use planning in the municipality and other urban systems in Kenya.

### 1.2.2 Study Hypotheses

1. That urban agriculture in Machakos municipality is not a controlled activity and is primarily practiced for domestic food supply.
2. That those who practice UA within the municipality are largely unaware of the existing planning law and by-laws.
3. That distance from the central business district (CBD) influences the size of land put under farming by households.
4. That Machakos municipal council does not enforce the existing planning law and By-laws related to urban agriculture.

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### 1.3 Justification of Study

Only fairly recently has urban farming in Africa been the subject of serious research (Sanyal 1985, Lee smith et al 1987, Freeman 1991). However many of these studies have not been incorporated into the mainstream research on urban management in Africa. Recent research in sub-Saharan Africa has established that urban farming is a significant activity in many countries in the region and contributes to food security of African urban families especially the poorest ones ( Sanyal,1985).

Despite this evidence, Kenyan urban managers and planners continue to view agriculture as a rural and a poor mans undertaking unsuited to urban areas. It is mostly a story of informal development in the face of official disapproval (Smit,1994). The practice of UA is viewed with hostility by the authorities and as a result only few focussed studies have been conducted in Nairobi and elsewhere. Many studies have focused on nutrition and food security among the low-income areas of Kibera, Korogocho, Kanugu and Kitui (Mwangi, 1995). They have also focused on the stereotyped gender roles in urban cultivation (Freeman 1991; Dennery 1995; and Mazingira Institute 1987). The study by Cheruiyot (1999) examined UA as carried out in the middle and high-income areas focusing on the structure of agricultural activities in Karen area, Nairobi. His study found out that UA was practiced in order to obtain food, derive income and as a hobby. He also observed that the Nairobi city council did not appear to play any active role in controlling the practice. There is no study so far that has examined the specific relationship between urban agriculture and development control in Kenya. This study is aimed at filling this gap with a case of Machakos Municipality.

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Outside the large cities, few studies have been conducted on UA. A study conducted in Kisii and Keroka towns by University of Nairobi Master of Arts (Planning) class 1 of 1999/2000 revealed that 99 percent of the municipal land was under agriculture yet it is considered illegal. To what extent is this reflected in the other municipalities nationally? What is the perception of UA by the farmers and municipal authorities in these towns?

Machakos municipality- the oldest colonial administrative urban center in East Africa provides an important setting to undertake this study. Despite lack of attention on urban agriculture, the practice continues to expand in Kenya and Machakos municipality in particular. There is therefore the need to evaluate the ways and means of how it can be integrated in the urban system.

### 1.4 Scope of the Study

This study confined itself to the peri-urban area of Machakos municipality because it constitutes the area formally used for agriculture by the traditional landowners before the boundaries of the municipality were extended and were the activity still thrives besides encroaching urbanization. Both crop and animal husbandry activities were examined excluding practices such as forestry and flower gardening due to limited time and resources for the study.

Data collected mainly centered on the urban farmers, location and extent of UA, factors favouring the practice, land status and subdivision, the agronomic practices, marketing and the links created by the practice of agriculture in the peri-urban area. Only the observable and felt environmental effects such as deforestation or soil erosion and air pollution were of concern. The environmental effects, which require detailed chemical testing were excluded.

The emerging urban land uses within these areas and the percentage of land they are taking was also of concern. In terms of development control, Planning law and municipal By-laws related to farming were of interest. Of concern was awareness of the existence of planning law and By-laws, which hinder the practice and enforcement of the By-laws by Machakos municipal council. The development control issues arising from the practice of Urban Agriculture were also examined and analyzed.

### 1.5 Definition of Key Concepts

**Urban Agriculture (UA)**: The definition of UA is somehow amorphous (Atukunda 1995). For the purpose of this study UA is an industry located within (intra-urban) or on the fringe (peri-urban) of a town, city or a metropolis, which grows or raises, processes and distributes a diversity of food and non-food products, (re)using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area (Bakker,2000 :12)

**Peri-Urban Area**: This is the area where the advantages of combining farm and non-farm work can be maximized (Lynch,1999). This is the area that lies within the immediate surrounding of the towns' Central Business District (CBD). They tend to undergo over a given period of time, more dramatic agricultural changes than do locations in the more built up and central parts of the city.

**Urban Economy**: It refers to the ever-changing complexity of interrelated group of economic activities that take place within a relatively small area. The contribution of agriculture is taken to be minimal (Convoy,1975).

**Urban Centre**: This refers to any compact and gazetted town with a population of 2000 and above inhabitants engaged in non agricultural activities (Obudho,1976).

**Food Security**: This is access to the food required for a healthy and productive life. It means the ability to grow and to purchase food as needed. It also means that people do not have to rely on staples such as wheat, rice, potatoes and cassava. It focuses such attention on areas such as income, markets and natural resources (Mahendra, 2000:9)

**Market Gardening**: This is the growing of vegetables in small farms for sale.

**Environment**: This refers to the natural conditions including land, air and water in which people, animals and plants live.

**Urban Poor**: The urban poor are considered to be those people who spent less than an equivalent of one U.S dollar per day. However, the concept is difficult to define because poverty is multi-dimensional and its different aspects are not always tightly congruent with each other (Malombe, 1991).,

**Municipality**: In Kenya this is an area declared under section 3 of the Local Government Act Cap 265 to be a municipality. It is a town or city with its own local government; the governing body of such a town (Oxford Dictionary).

**Horticulture**: This is the division of agriculture which relates to the cultivation of fruits, vegetables, flowers and ornamental plants and nursery stock and seeds. Horticulture should be differentiated from crop production where the former is associated with the culture of plants in small-enclosed areas as opposed to the culture of plants in the field

**Planning law**: This is the existing legislation in the form of parliamentary Acts or Local Authorities By-laws that are used to guide the physical growth of towns and at the same time minimize nuisance. The Physical Planning Act No 6 of 1996 is referred to as planning law in this study

**Development control**: This is a legislative granting of permission to commence development and undertaking of actions to remedy undesirable and illegal development. It is also an administrative system seeking to plan the country's resources and regulate the use and development of land. For the purpose of this study, of concern will be enforcement of By-laws that hinder the practice of UA within Machakos municipality.

## 1.6 Research Methodology

### 1.6.1 Study Area

Machakos Municipality covers an area of approximately 519 $km^2$ within the central Division of Machakos District. Politically, the municipality is divided into 16 wards which include Machakos Central, College ward, Stadium ward, Hospital ward, Majengo, Madaraka, Machakos East, Machakos South West, Machakos North West, Mutituni, Ngelani, Misakwani, Muvuti, Kiima Kimwe, Kumutwa and Konza *(Fig 3.3)*. Machakos Central ward, Stadium, Majengo Hospital ward and part of Madaraka ward form the Central Businness District (CBD). They are located fairly on a flat terrain bordered by Mua hills to the North, Iveti hills to the North East and Kiima Kimwe hill to the South. These hills are found within Machakos North West ward, Machakos East and Kiima Kimwe ward, respectively. The hills act as catchment area for many springs and streams passing through and near the town. For the purpose of this study, the sample was drawn from Madaraka ward, College ward, Machakos East, Kiima Kimwe, Machakos South West ward as they form the peri-urban area of Machakos town and

left out the wards in the purely rural area. The wards were selected for the sample on the basis of their geographical location by forming the peri-urban area of Machakos Municipality and not randomness.

### 1.6.2 Target Population

The research focussed on households within Madaraka ward, College ward, Machakos East, Kiima Kimwe and Machakos South Westward. These wards form the immediate surrounding of Machakos Town CBD that constitute the peri-urban area. The focus was on both farming and non-farming households within these wards. The total population within the study wards is 74,046 consisting of 12,341 households (Kenya Population and Housing Census, 1999). The households consist of rental units and homesteads. Agriculture is practiced on the surrounding open land. UA is practiced on large farms at the rural fringe and the farm sizes decrease towards the CBD. It is more along Nairobi road, Kangundo road, and Konza road where there are favourable soils. It is less practiced along Kitui road due to poor soils and few streams.

### 1.6.3 Sources of Data

***Secondary data***

Secondary data was collected from the Machakos District Physical Planning Office, Machakos Municipal Council Offices, Machakos District Agricultural Office, Machakos District Lands Office, Machakos District Central Bureau of Statistics and Machakos District Survey Office. Data collected covered information on area of open land, land sizes, number of build up units, population of wards, agricultural production of both crop and animal farming, land tenure, source

of inputs, marketing outlets, attitude towards farming and awareness/ knowledge on planning law and enforcement of By-laws related to farming and the Public Health Act.

***Primary data***

Data was collected from households through questionnaires and oral interviews within the peri-urban area of Machakos municipality covering information on the household characteristics, land use characteristics, agronomic practices and awareness/ knowledge on planning law and By-laws. The information that was obtained form the Machakos district physical planner covered zoning regulation, attitude towards agriculture and how it is catered for in planning law and other legal policies on farming and the existing land uses within the municipality. From the market traders, information on their origin, trading commodities, income levels and the problems they faced in their business was obtained.

From the Municipal council town clerk and Public health officer, information on the extent of the municipality, the effect of agriculture on the town's growth, attitude towards the practice, zoning regulation, planning law and its enforcement was obtained. The District surveyor and Land Officer provided information on the rate of subdivision and land sizes within the municipality.

The District Agricultural Officer provided information on the practice of agriculture within the municipality, the crops grown, assistance given to farmers and the effect of the encroachment of other urban land use on agricultural production. The District Statistical Officer provided information on general population and demographic characteristics.

Personal observations and photography were other methods used to obtain primary data for the visible aspects of the study.

### 1.6.4 Sample Size and Sampling Procedure

A sample of 100 households was picked due to limited time and resources. In addition, this sample size constitutes about 1 percent of the study population of 12,341 households. This is in line with the general principle that a sample size should be 30 or above cases or of between 10 and 30 percent of the population with the sample percentage decreasing with increasing population. From the sample of 100, 70 were farming households while 30 households were non-farmers. The farming households were homogeneous and thus the sample drawn was representative. The sample was drawn from 5 wards that surround Machakos town CBD. A sample of 20 households was picked from each of the 5 wards, 6 of which were non-farming. The wards that constituted the sample size and study area have an area of 186 square kilometers which constitute 36 percent of the municipality's area. These were as follows:

**Table 1.1 Sample Size and Study Area**

| Ward | No of Households | | Total | Area ($Km^2$) |
|---|---|---|---|---|
| | Farming | Non-farming | | |
| Madaraka | | 6 | 20 | 7.4 |
| College | 14 | 6 | 20 | 9.2 |
| Machakos East | 14 | 6 | 20 | 21.6 |
| Kiima Kimwe | 14 | 6 | 20 | 16.1 |
| Machakos Southwest | 14 | 6 | 20 | 131.7 |
| TOTAL | 70 | 30 | 100 | 186 |

*Source, Author, 2000*

Sampling was done on the basis of the main tarmacked roads passing through the wards, which formed the sampling transect lines. Within Madaraka and Machakos East wards, Kangundo road formed the transect line, while within Kiima Kimwe ward; sampling was done along Konza road. Within Machakos southwest and College wards, Nairobi road formed the sampling transect line.

The farming households which were included in the sample were picked using the systematic random sampling where the first household was identified randomly and then the 10th household along both sides of every transect line was picked. For the non-farming households, identification was done first and then purposive sampling was applied to pick the six households in every ward along the same transect lines used for sampling the farming households.

Sampling for the market traders in the Municipal market was done on the basis of systematic sampling method. Data on the traders origin was provided by the market officer that was used to compile a list that formed the basis of sampling. The first trader was selected randomly from the list and then every 3rd was included in the sample of 30 respondents. Only those traders who came from the wards included in the study sample were interviewed.

### 1.6.5 Data Analysis

Both qualitative and quantitative methods of analysis of data were employed. This involved use of graphs, tables, bar charts and pie charts to present the descriptive data. For inferential statistics, the application of the computer statistical package for social sciences (SPSS) was done. This enabled the researcher to utilize both categorical and interval data in cross tabulation, means, frequencies, regression and correlation.

### 1.6.6 Study Limitations

A number of challenges presented themselves during the course of this study. One of them was lack of adequate time to carry out data collection. This was a result of the squeezed university calendar and the poor timing of the data collection period that coincided with Christmas festivities. As a result, many respondents were not on the mood of being interviewed as they

considered it a waste of time. To overcome this problem, the researcher engaged four research assistants from the local area who could communicate easily with the respondents and who were easily acceptable.

The other problem was suspicion among the respondents who thought that the study would culminate in their eviction from their land to pave way for urban expansion. This tended to delay the time allocated per interviewee due to the lengthy briefing on the purpose of the study. However this was overcome by employing research assistants from the local area.

Lack of farm records made it impossible to obtain amount of yields for different farm activities. This was coupled by poor estimation skills for distance and land size and was solved by engaging research assistants with at least an undergraduate degree and a three days training on how to estimate both distance and land size.

Lack of a clear cut boundary of the peri-urban area posed a challenge too and was overcome by establishing an arbitrary boundary by the researcher depending on the urban character of the area.

**1.7 Conceptual Model**

In early models of urban structure, agriculture is depicted as lying on the urban fringe or completely out of picture. J.H Von Thunen (1826) developed the theory of location differential. According to him the various agricultural land uses around a market place bid for the use of land and it is assigned the highest bidder. Later, Mather (1986) and Sullivan (1990) borrowed this concept and argued that land is allocated to the highest bidder. The order of allocation starts from the center (CBD) with the highest bidder and it recedes outwards into the otherwise

rural area. It is for this reason then that retail, industrial, residential and agricultural activities have been found to outbid each other in a descending order.

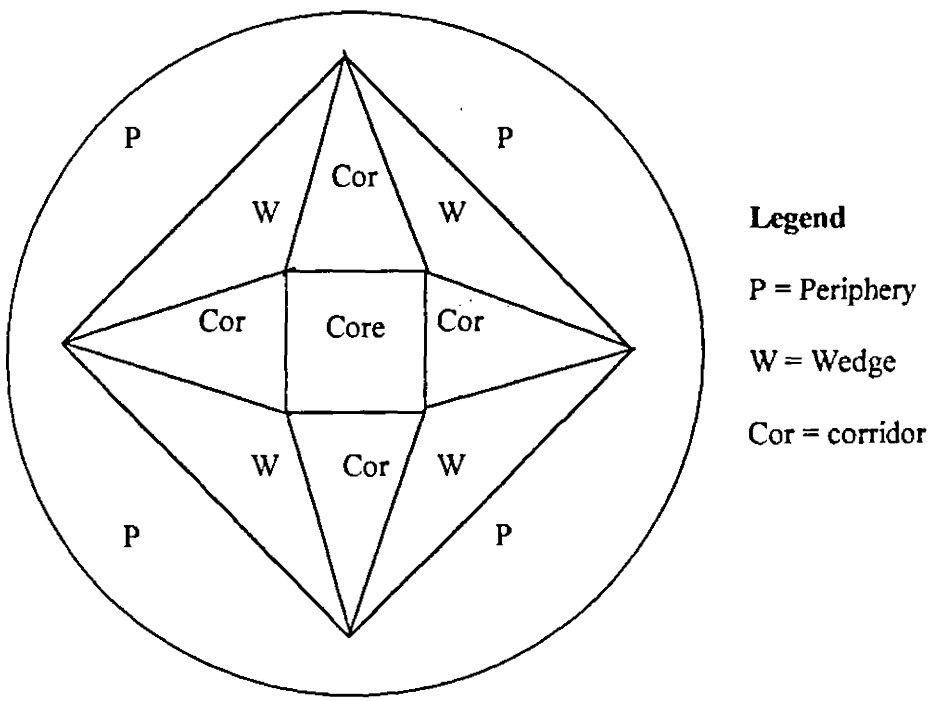
Other urban land use models include the concentric zone model of E.W. Burges (1923), the Sector model of Homer Hoyt (1939), and the multiple nuclei model advanced by C.D. Harris (1945). In all these models, agriculture has no place in the urban area and it is not by any means mentioned anywhere.

In recent studies, urban agriculture has began to appear in the literature of urban planning and development. However, agriculture continues to be considered as a temporary and residual factor. When agricultural activities in urban centers are examined in recent years, a one sided view is often taken. It has not been looked on a more holistic way (Drescher, 1996). This view is supported by Freeman (1991), who argues that urban agriculture has since the commencement of urban planning suffered irreparable damage whose magnitude is immeasurable.

In addition to this, even in residential development let a alone in urban proper, there has never been a provision for some level of farming. This is the case of Machakos municipality and elsewhere in Kenya. Indeed, the conceptual context of UA resides in the understanding of the informal sector (when considered as not included in the tax bracket). This is so despite the informal sector being defined as a non-farm activity.

The model on urban agriculture that was developed recently by UNDP (1996) is the "Four zone model of a city" which concerns itself with the location aspect. It identifies 4 zones where UA is practiced within cities as shown in Figure. 1.0 These include the core, corridors, wedges and the periphery.

**Fig.1.0 Four Zone Model**




*Source: UNDP, 1996: 97.*

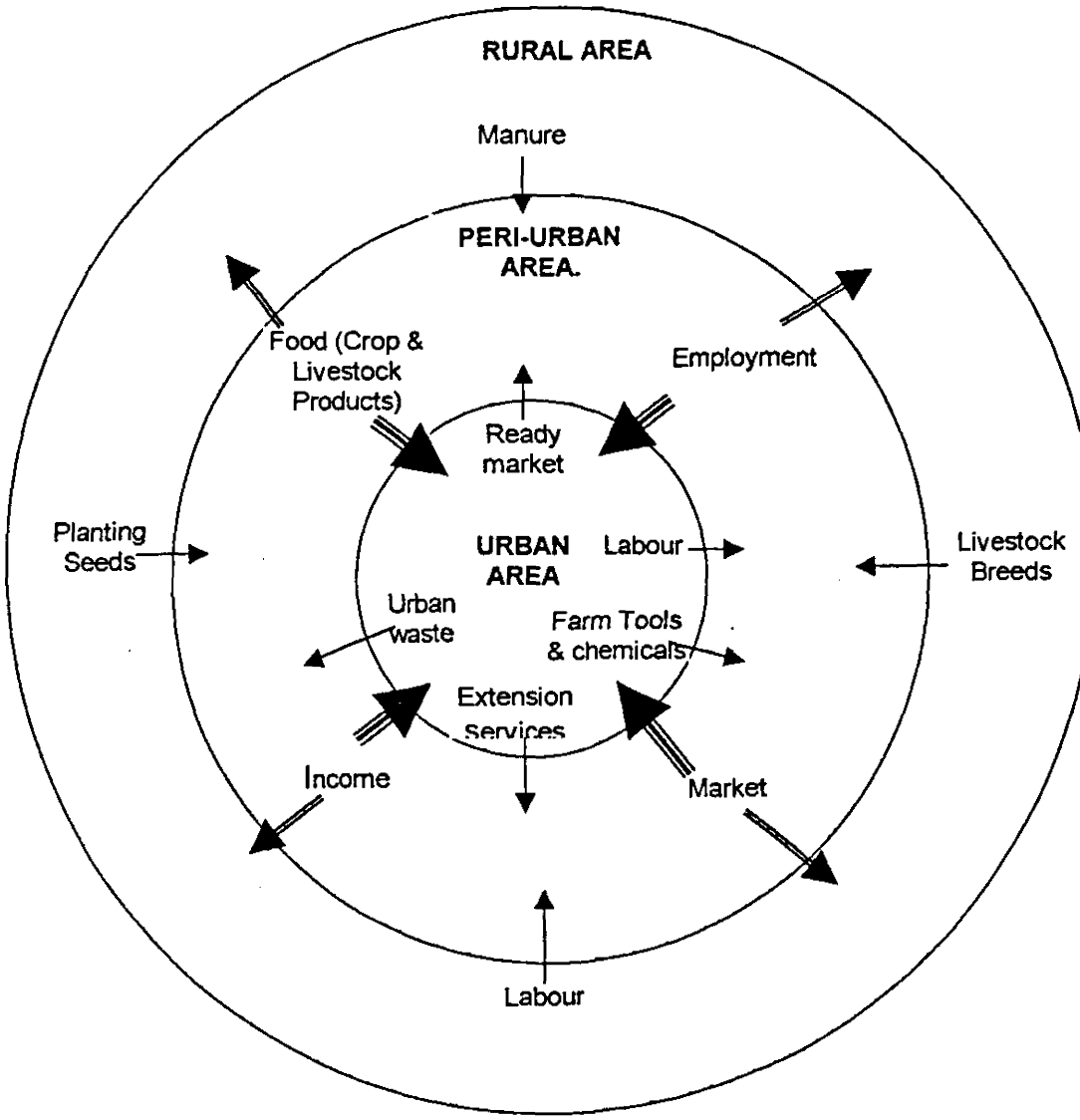
Agriculture in the four zones display a particular character derived from the nature of the zone itself. Farmers often farm in more than one zone. The core has the highest population and building densities with a predominance of commercial space. UA is mostly found on rooftops and balconies, on temporarily vacant lots, in converted buildings and in public parks.

The corridors are found along main roads and railway lines since this is where most construction takes place and large not yet built lots are common. The corridors have more developed transportation infrastructure and are well linked to the markets.

The wedges between the developed corridors together with the periphery provide the principal areas of land for UA in larger cities. Land is usually a mixture of residential and agriculture with housing gradually moving onto and replacing farmland. Wedges are where the greatest amount of urban land not suitable for development is found such as steep slopes and wetlands. These sometimes offer opportunities for the specific type of urban agriculture. The periphery is the rural fringe or peri-urban area surrounding the city. It is characterized by small and medium size farms oriented to the metropolitan market that are more diverse than those in the rural areas. A large proportion of families in this zone have some off farm income. Transportation efficiency or landscape features largely determine the size of this zone

The model developed for this study is a systems model that emphasizes the forward and backward linkages created by the practice of agriculture in the Urban, Peri-urban, and rural areas. This is intended to bring out the link of UA with the urban economy and the reason for the proposed integration. The forward and backward linkages of UA in peri-urban areas can be understood when one considers both the rural areas and the core of the town (CBD). The three areas are interdependent. The emerging model can be referred to as "the systems model of urban agriculture" in peri-urban areas.

**Fig. 1.1 The Systems Model of Urban Agriculture within Peri-Urban Areas**




**Legend**

Peri-urban forward linkage

Peri-urban backward linkage

Forward linkages of rural and urban areas

*Source: Author 2001*

## 1.8 Organization of the Study

The study is organized into seven chapters each dealing with particular aspects as follows:

**Chapter One**: This provides an introduction, statement of the problem, objectives, hypothesis and study methodology

**Chapter Two**: This includes a review of all relevant literature to the research subject.

**Chapter Three**: This provides background information on the study area.

**Chapter Four**: This chapter provides an analysis of the extent and practice of urban agriculture in Machakos Municipality. It discusses the socio-economic status of the farmers and non-farmers and the reasons behind the practice of urban agriculture.

**Chapter Five**: This chapter analyses the role of urban agriculture in the municipality.

**Chapter Six**: The chapter focuses on how urban agriculture relates to development control in Machakos municipality. It discusses the possible future trend of the practice from the view of the respondents and the researcher. A highlight of the integration of urban agriculture in the urban system and the available opportunities and constraints for the practice is also discussed.

**Chapter Seven**: This chapter presents a summary of findings, recommendations and conclusion of the study. Recommendations for further research based on findings are suggested.

# 2.0 CHAPTER TWO: LITERATURE REVIEW ON URBAN AGRICULTURE

## 2.1 Introduction

This chapter concerns itself with the review of the relevant literature on the new field of urban agriculture as presented by different scholars. This forms the basis of this study in terms of gap identification, problem conceptualization and the subsequent recommendations.

## 2.2 Urban Agriculture - Myths and Reality

The concept of urban Agriculture (UA) has been coming out of age over the last three decades in the wake of other formerly considered anomalies such as 'spontaneous housing' in the 1950's through the 1970's and 'Informal employment' in the 1960's through the 1980's. Originally expected to be crushed by the irresistible tides of western modernization, spontaneous housing and informal employment actually have endured, expanded and even have come to prevail in many places. The more conservative public would acknowledge them as diverse and very robust, if not functional, components of modernization process. Predictably, urban agriculture will take a similar course (Mougeout,1996).

The concept of urban agriculture is now evolving rapidly with far reaching implications for the future development of urban centers in both the North and South. Whereas initial submissions were concerned with establishing the identity of urban farming (ranges of production systems, locations, practitioners and legal status), recent interpretation have stressed its relationship with the economic, social and environmental sustainability of urban centers (food security, nutritional health, employment and income generation, entrepreneur development, open space management and waste resource re-use, gender employment, community development). Still

while the phenomenon is undesirable, most specialists would agree that an operational definition will need to be periodically revised out of practical experience (Maxwell 1994).

According to UNDP (1996), some misconceptions are still widespread in Africa and elsewhere. The benefits of urban farming are lost behind myths that are the products of cultural, planning and policy biases. It is therefore important to identify and address the myths since they misrepresent the significance of urban farming and hinder recognition of its potential.

a) Most agriculture labeled as locationaly urban is actually sited in rural settings: what is an urban area will vary from country to country. However, delimiting urban areas according to their field of activity rather than following jurisdictional boundaries, consistently has proven to be useful when planning and managing urban based activities. A wide range of criteria has been used to determine the location of agricultural activities in Africanist literature, from land use zoning (Mbiba,1994) to population density thresholds (May and Rogerson,1994). A need for clarity is fully justified, if not on planning grounds. The literature has been criticized for disregarding small centers, where rural-urban divide is quite questionable. Beyond the intra / peri-urban dichotomy, spatial zonations (core, corridors, wedges and peripherals) have been proposed more useful to explain the geographic niches of specific urban farming systems and to plan the spatial allocation and evolution of particular systems; during the physical expansion and land use development in an urban area (Smit et al,1996).

b) Urban agriculture is not technically different from rural agriculture, only done at the wrong place. Although closely related, UA is distinct from rural agriculture and interacts with it in many ways. Both originally share common technologies and biogenetic pools, complementary

commodities and a few production scales, systems and consumption markets. However UA is typically much smaller scaled and more spatially dispersed than rural agriculture, this affords more intensive, integrated, flexible and adaptive farming. UA tends to be technically more efficient, tapping on economies of agglomeration in urban centers-information from expertise, infrastructure, inputs, services and especially markets- which are unmatched in most rural areas. Urban dynamics press upon urban agriculture a measure of mobility and organization again unparalleled in rural areas, this is because in urban centers farming needs to compete or combine with a variety of other land uses, to avoid or overcome more severe ecological stress and respond swiftly to shifts in demand for perishable specialties (Smit, 1980). Urban dynamics constantly transforms urban agriculture impressing on it an opportunism and adaptability unparallel in rural agriculture (Rogerson, 1994).

c) Urban agriculture is nothing more than a euphemism for horticultural gardening in the urban center. Initial surveys by French geographers in West Africa and most Food nexus-programme surveys of African urban centers did emphasize this visually more impressing form of urban agriculture (Vennetier, 1961; Sanyal, 1986; Tricaud, 1987 and schilter, 1991) However, UNDPs survey commissioned to The Urban Agriculture Network (TUAN) in 1991-1992, identified over 40 different farming systems and their variants, each with its own technology, investment needs, yield rates and returns to labour and risk (Smit, 1996). More recent publications recognise the diversity of African urban gardens and address a range of non-horticultural systems (Centres, 1992; Sawio, 1993).

d) Within any given zone of a city, urban agriculture is mainly carried out in residential backyards. Most surveys show that residential backyards actually support only a small share of the full activity underway in any given urban center or within each household. Ground level land availability is particularly limited in low income; high-density districts where the numbers of off plot producers are larger. The UNDP survey identified seven large types of spaces; based on tenure and site characteristics; (home spaces) back side, and front yards, basements, sheds, rooftops, patios, balconies, walls, window sills, doorsteps, plastic tubes and sticks; community spaces, surplus or reserve public and private spaces, roadsides and other right of way, stream sides and floodplain, wetlands and water bodies and steep slopes.

All these venues have been intensively used in African urban centers (Freeman, 1991 and Maxwell, 1994). Since urban agriculture is much more than a residential land use, it is practiced in synergy with a wide range of other land uses; commercial, recreational; transportation; manufacturing, institutional, infrastructure or utility-related.

e) Urban agriculture is largely an informal, when not illegal, survival strategy of the urban poor. Although most urban agriculture produce for household subsistence, surveys, consistently show that all income groups and many public institutions and private companies practice some urban agriculture with varying shares of their food and non food being marketed locally, when not nationally or internationally (Muena, Lupanga and Mlozi, 1991; Sawio 1993 and Maxwell, 1994).

Better off groups are increasingly organizing the production of poorer practitioners when not employing them directly or indirectly through outsourcing (Drakakis-Smith, Bowyer-Bower and Tereva, 1995). With growing competition for urban agricultural inputs and services, surveys constitently show that the poor access to inputs support and benefits is disaproportiately curtailed (Mlozi,1993). Urban agriculture is not easily affordable by the poor recent arrivees to cities where it is well established.

There is anecdotal evidence of workers mobility from other sectors or occupation into and out of urban agriculture, though there seems to be a tendency for people to combine urban farming with other occupations; there is also anecdotal data on mobility within urban agriculture. But overall, systematic accounts over a range of socio-economic groups and farming systems during a period of years await further investigation. More studies refer to employment created by urban agriculture in activities which either provide inputs or use its outputs, in the rest of the urban economy (Schulter,1991).

f) Urban agriculture causes pollution and damages the environment. UA can cause pollution of soil, water and air and affect open urban areas adversely. Correctly practiced UA has many potential environmental gains than problems. Accordingly to Bakker (2000), UA reduces truck traffic and the resulting air pollution, can prevent soil erosion and rebuilds Urban forests. Expanding area can impact favorably on the urban Microclimate. UA is among the best, most sensible ways to dispose of much of a city's solid and liquid wastes (especially organic ones), by transforming them into a resource. Few activities contribute as efficiently to improving the

urban soil, water, air and living environment while closing the urban open loop ecological system of resources in, waste out.

g) Urban agriculture is unsightly and aesthetically inappropriate in the city. This is not true because it creates green spaces replacing vacant and unkempt lots and roadsides thus improving a city's appearance.

j) The "garden city" is archaic, utopian concept that cannot be created today. However, cities in developing countries are becoming garden cities in a very practical way. Meanwhile, concepts of "modernity" are actually holding back agriculture by defining industry as the activity for Urban areas and farming as the activity for rural areas (Garnett,1999).

**2.3 UA in the Urban Informal Sector**

The concept of 'informal sector' was borrowed from ILO report of 1972 and since then it was adopted as the official name. However, according to Obonyo (1988), where the phrase is applied to the economic fields, it requires a different connotation. In its simplest form, the term is used to refer to the economic activities conducted in open sites in which people work, exposed to all agents of weather. The term has however been varying from one country to another so as to fit the prevailing socio-economic conditions.

In Kenya, the Central Bureau of Statistics (CBS) in 1984 attempted to define the concept; "This consists of semi organized unregulated activities largely undertaken by self employed persons in the open markets, in the market stall, in undeveloped plots or on street pavements within urban centers. They may or may not have license from local authorities for carrying out such activities as tailoring, carpentry, blacksmithing, grocery, kiosks, meat and maize roasting, sale

of apparel and shoes, open air restaurants, repair of footwear, car repair, shoe shining and hair cutting". Following this definition, urban agriculture is not categorised as an informal activity. This may be attributed to the view that agriculture is not found within urban areas but as a rural activity.

Ryan (1986) later defined the activities of the sector as "those enterprises outside the tax net" but cautions that this is different from tax evasion. Only when considered from this viewpoint can UA be regarded as an informal activity. However, works done on the sector term it as groups of numerous types of non-agricultural activities which are carried out in both urban and rural areas. The recognition of the informal sector occurred after decades of harassment by urban administrators when they realized its value in job creation and productivity for the urban poor and therefore, active prosecution of the practitioners is being replaced by tolerance and even in some cases positive official acknowledgement and encouragement. May be UA will also be treated the same later on. Currently, the public blitz that the service components of the urban informal sector seems to enjoy has not been felt in the area of UA (Freeman, 1991).

Apart from a few researchers who have focused mostly on the backyard or roof top gardens, the farming and scavenging of garbage dumps (Wade 1983 and Sachs 1985), there has been little investigation on its (UA) nature, role and significance in African urban economics and urban agriculturists are usually either ignored or harassed by urban administrators (Bakker,1991).

One of the few focused analysis of the role of urban agriculture in African urban centers is contained in a more recent; detailed examination of policy aspects of urban gardens in Zambia.

Rakodi (1988) points out that UA is widespread in Africa. She takes to task the urban planners and administrators for failing to recognize the importance of this activity and the participation.

In Kenya, UA has been illegalised both by the colonial and post colonial administrators through the Local government Act Cap 265 and public health Act cap 242. Hake (1977) states that the notion of urban farming although widespread is an important pastime indulged in purely by city house wives, one which may be defined as a form of recreation or as disguised unemployment. He ignores the important role that agriculture plays in the urban economy.

In some of the recent literature it has been suggested that African urban cultivation may be a survival strategy particularly for less well educated women who are generally unable to afford to own property or compete with males for coveted urban wage jobs (Rakodi, 1988).

**2.4 UA in Global Context**

The practice of UA seems to have been recognized outside Africa long time ago. According to UNDP (1996), UA is a significant activity, central to the lives of tens of millions of people throughout the world. It is a rapidly growing industry that is increasingly essential to the economic and nutritional security of urban residents and that has far reaching economic, environmental and health implications. In an urbanizing world running short of resources, the possibility that cities can depend on the ingenuity of their residents to generate food security for themselves is significant.

The WCED (1987) states that, historically urban dwellers in industrialized countries faced severe food insecurity during periods of crisis such as war. The activity of growing food in pots, on windowsills, balconies and a small backyard plots were seen as an important source of food and form a new dimension. In the United states during the World War II, for example, 'victory gardens' provided 40 percent of the fresh vegetables. At the present some families in western cities have garden allotments mainly vegetables but also for poultry and small ruminants such as rabbits and guinea pigs. This supplements the food budgets for some of the needy. The driving force for these people is a 'green thumb' or the desire to be free from food contamination through chemicals. Loss of this resource would make little difference to financial security.

Darca Silk (1985) points out that, at least 85 percent of the vegetables consumed by urban residents in China are produced within the urban municipalities. The 'president permits' was used as the strategy to feed the urban population. These strategy however did very little to alleviate food security problems and as a result alternative approaches were devised. Food production in China therefore was incorporated into city planning way back in 1950's.

The megalopolies of Shanghai and Peking are 100 percent self sufficient in vegetable production using nationally established production goals. Fish, small animals and tree crops production are also intensive activities in Chinese cities and important sources of protein for urban residents. Both Hong Kong and Singapore have significant urban agriculture programs. Hong Kong produces almost half of its fresh vegetables consumption and almost three quarters of its poultry consumption.

In India, 'Ration cards' were used as a strategy to feed the urban residents (Chatterjee,1998). UA in India is so developed that the Asian farmers are known to have perfected the art of rising fish commercially in urban ponds.

In Jakarta, Indonesia, most of the agricultural products consumed are imported from Bogo, Bekasi, and Tangerang, the three satellite cities of Jakarta where urban farming is well established and recognized by the governing authorities. The governor of Jakarta gave the city's poor the permission to use idle land to grow food urging them to obtain permission first instead of just grabbing it (Bakker 2000). Most of the workers in UA are male farmers mainly from west and central Java.

In London, United kingdom, there are 13,566 ha of farmland on the Greater London fringe. About 500ha are under fruit and vegetables contributing $3 million to the economy and employing about 3,000 people (Bakker,2000). The urban agricultural activities include, commercial farmland, county farms, allotments, city farms and community gardens, private gardens, school gardens, orchards, parks, and temporary vacant land. However, land under agriculture is in decline on account of development pressures.

In the city of Sofia, Bulgaria, urban agriculture has been an essential element of Bulgarian life for centuries. Officially, only 2 percent of the economically active population is engaged full-time in agriculture. However, approximately half of Sofia households are engaged in cultivating fruit, vegetables and spices, and more than 90 percent make preserves and pickles

out of home grown or purchased agricultural produce. The percentage of households in Sofia achieving self sufficiency in different foods (either self produced or processed by different and relatives up country) is about 14 percent (UNDP,1998).

In Cagayan, Philliphines, agriculture is considered as a major urban land use and it is planned for. About 79 percent of the land is peri-urban and 21 percent is urban. In the peri-urban areas, some 13,000 small scale farmers and tenants ( of whom 3,000 are women) produce on 2,276 ha of land. They produce rice, banana, coffee, root crops, fruit and vegetables for both home consumption and market sales. The production is characterized by monocropping. However, farmers report many constraints in urban crop production such as pests, limited knowledge on appropriate inputs, poor infrastructure, high rates for additional labour, lack of capital, limited access to land and adverse climatic conditions such as excessive temperatures.

In California's most fertile valley, right in the middle of a completely urbanized residential area stands a four (4) hectare farm- the "Fair Garden farm". This four hectare farm had its soils excavated besides being under developed in 1974 when it was purchased by a couple. The purchasers dedicated it to the growing of food for commercial purposes under organic farming. Currently the farm is adequately producing 75 different varieties of fruits and vegetables. These produce benefit some 500 families besides serving as a center of education for schools within the vicinity. Vacant plots in New York have been reclaimed for community gardens (Alberman,1993).

Other more examples globally can be quoted in addition to the ones above. This shows urban agriculture is given prominence in almost all continents. What about Africa?

### 2.4.1 UA in Africa

Urban agriculture (UA) is probably as old as the first great urban centers built by our ancient civilizations. What is urban is culturally or historically defined; what ancient civilizations considered to be urban do not fit our contemporary reality, just as our definition may not fit the urban reality of future civilizations (Mougeot,1998). Despite the existence of agriculture in urban areas for so long, it is only fairly recently when UA in Africa has been the subject of serious research (Sanyal 1985; Lee smith et al 1987; and Rekodi,1988).

Surveys show that since the late 1970's, urban agriculture has been growing in many countries; in terms of practitioners, space used, contribution to household welfare and to the urban economy in general (Mougeot,1994). A plethora of factors explain this growth, rapid urbanization, crippled domestic food distribution systems, national policies harmful to domestic production, reduced public spending, subsidies and wages, retrenchment of formal employment, soaring inflation and plummeting purchasing power of middle class, lax urban regulatory enforcement. Civil strife, war and natural disasters also disrupt rural food production and supply lines to urban centers.

Recent studies have further linked the growth of UA to structural adjustment programme and major currency devaluations in the late 1980's and early 1990's (Drakakis-smith,1995, Fitzhegh,1995). Conditions sufficient to dampen the resurgence of urban agriculture appear increasingly unlikely in most of Africa.

According to WCED (1987), the major constraint to UA in Africa has been the availability of land. Some governments have been attempting to reclaim unoccupied land for this purpose. Others have been urging a new approach to urban expansion by setting aside some land specifically for urban agriculture or allotting bigger plots to meet housing and garden requirements.

Cockram (1996), states that government policies in Africa play an important role in legitimising or restricting urban cultivation. Land use regulations affect whether agriculture is temporary or permanent phenomenon through urban land use policy, zoning laws, tax structures and urban statutes all of which can be modified to promote or discourage UA. He notes that government policy towards UA is most constraining where cultivation of food plant is banned outright in many urban centers and discouraged as backward and rural in others.

However, an understanding of UA as an essential component of the African food supply system is not completely absent in Africa. There has been presidential decrees and declarations such as the one in Zambia in 1977 urging urban residents to grow their own food.

In Addis Ababa, Ethiopia, municipal land has been provided for the poor for gardening purposes (Bakker,2000). There are five co-operatives involved in UA alongside the rivers and the streams of the city. Some of the produce from these co-operatives is consumed by members but most of it is destined for sale.

In Cairo, Egypt, there is urban production of crops and livestock, including poultry. Some 16 percent of the households keep animals, predominantly chickens, geese, ducks, and pigeons. Of the production, 95 percent is for home consumption, suggesting that poultry is the main product in subsistence farming in Cairo. In spatial terms, this subsistence production is concentrated in peri-urban districts (Bakker, 2000).

In Accra, Ghana a study carried out in 1997 by Accra urban food and nutrition found out that 13.6 percent of the urban population were engaged in agriculture in the immediate urban or peri-urban areas. Both crop and livestock production takes place. Staple crops like maize and cassava are the most common crops. Vegetable production ranks lower with pepper, okra and tomatoes being the most widely grown. By far poultry is the commonly kept livestock. However, relatively few households were engaged in UA as farming ranked ninth as a primary livelihood category but ranked second as a tertiary activity. The main problem in UA facing the producers are, land in terms of access and tenure security, theft of crops grown far from the household and marketing which does not promote direct farmer-consumer selling (Bakker,2000).

In Dakar, Senegal, the contribution of UA to the food supply of Dakar is substantial in the case of vegetables and poultry. The proximity of Dakar, the major center for consumption; forms a determining factor in the development of the vegetable and poultry sector. Dakar poultry farming represents nearly 33 percent of total national production and meets 65-70 percent of the national demand for chickens. Private societies collect the chickens, store them near the production areas and distribute them to poultry farmers (Mbaye,1999).

Despite this, the public authorities do not openly promote it, neither is there a written policy for its eradication or prohibition (Valentin 1998). It is not taken as a priority in urban planning policies and programs.

In Harare, Zibambwe UA is defined as the production of crops and /or livestock within the administrative boundaries of the city. Some conditions, which favour the urban food production, include a relatively wet climate, large residential plot sizes and large open spaces within the city boundaries. During the rainy season, almost all available space is used for production of maize. Both on plot and off plot agriculture is practiced. Over 60 percent of the maize and leafy vegetables produced in the on-plot agriculture is consumed in the household, of the remaining 40 percent, 75 percent is sold from the home or at neighbourhood market stalls. The percentage of marketed produce in off-plot agriculture is slightly higher than that of on-plot agriculture. There is however very little difference between the non-agriculturist diets (Smith 1996).

In Dar-es Salaam, Tanzania, municipal level agriculture department such as the district agriculture office in the city favour urban farming. Both intra and peri-urban agriculture is practiced. Stevenson et al (1996) surveyed the peri-urban areas within a radius of 15-25 km of the city center to give an impression of Dar-es Salaam outreach. From his study he found out that 90 percent of 204 peri-urban farmers interviewed relied on agriculture as their primary economic activity. The peri-urban produce directly supplies the various markets in town and on account of the short distance, income opportunities are stable and likely to remain.

Other efforts recognize and promote of UA in Africa include the organized national campaigns such as "operation feed yourself" in Ghana, and the formal metropolitan support programs such as those for the "green belt" of Maputo. While some of them have represented top-down approaches, many originated from the urban food producers or their support organizations, reaching up and linking to the policy-makers (Mougeot, 1998).

From the foregoing, it can be said that UA is receiving growing recognition in Africa but it is yet to be legalised in the continent. What about in Kenya ?.

### 2.4.2 UA in Kenya-Origins and Development

Urban agriculture in Kenya may be traced back to the colonial era, mainly in the upcountry towns where the restrictions on subsistence farming were less strictly enforced. Indian migrants who participated in the construction of the Kenya-Uganda railway introduced urban agricultural activities. This was however limited to upcountry towns such as Machakos where they started growing some foodstuffs for their own consumption but sold any surplus produce to Europeans (Lamba, 1994). As the Indian immigrants settled in various Kenyan towns, they employed African workers to cultivate their (Indian) gardens. Realizing the economic and subsistence importance of urban farming, the African workers and their families likewise started to cultivate their own gardens (Mitullah, 1991). Later, urban farming evolved into a primary subsistence activity practiced by families of all income group. Although both cultivation and livestock keeping are widespread, subsistence crop is more common than livestock keeping (Lee Smith,1987)

Most of Kenyans major towns started as colonial administrative centers. Machakos was the first in East Africa interior. Many were gazetted as townships under the township ordinance of 1903. These centers of colonial authority and rule were treated as "islands of health" and security where high sanitary standards were maintained and rule strictly enforced (Memon, 1975 and Lee Smith, 1993). Boundaries of these towns were clearly marked by the colonial administration as a way of preventing any existence of substantial farming and settlement by Africans within the township boundaries. The distinctive zones (residential, industrial, administrative and business) drawn along socio-economic groupings that still exist in some of the major towns owe their origin to the colonial era. The high income suburbs of, for example, Nairobi were designed using the "garden city model" used in Europe at that time. Residential areas had quarter acre parcels of land with grid system tree lines along the streets. Buffer zones of open spaces for recreation by the public were left and served to separate the areas occupied by African settlements and their subsistence activities including farming under strict policy (Lee Smith and Memon,1992).

In the up country towns, farming was more acceptable than in the larger towns. It was not until early 1960's, that UA began to expand with the removal of segregation laws and the African population was allowed to reside permanently in the urban centers in Kenya. The post independence period is therefore marked by rapid urbanization but slow economic growth and employment opportunities. This has contributed to the large proportion of urban poor in Kenyan towns and consequently the expansion of urban informal activities including farming. Besides this, due to the gazettment of rural areas by the Minister for local authorities to be under municipalities, the farming activities, which were practiced previously, have become

"urbanized". The first ever survey on UA in Kenya was done by Mazingira Institute in 1985 in six towns. This formed the basis for subsequent studies on the subject. Many studies have focussed on Nairobi. According to Lee-smith et al (1987), Sanyal (1989), Mouget (1993), Rakodi (1991) and Dennery (1995), in the mid 1980's, 20 percent of Nairobi households were growing crops within the city limits. Moreover, 7 percent appeared to keep livestock in town. Although households in all socio-economic classes do urban farming, poorer households are over represented (Bakker 2000).

This was confirmed by a study in the slums area of Korogocho, Kitui, Kanugu and Kinyago carried out in 1997 by Alice Mwangi who concluded that 30 percent of the households could be classified as urban farmers. The people in the low-income areas obtain a 'shamba' (swahili word for plot) only on public land (roadsides, riversides) or privately owned land belonging to somebody else (along rail roads, in estates, industrial land). None of the low-income people own a piece of land.

According to Freeman (1991), four farming systems can be distinguished in Nairobi. The first one, small-scale subsistence crop cultivation, is by far the dominant type. The second type concerns small-scale livestock production often combined with the first type. The third type is the small scale market oriented crop production and finally in the South western part of the city (Karen, Langata), some large scale commercial farming remains from the colonial period characterized by irrigated vegetable fields, battery hen houses and grade dairy cattle.

What drives people to the practice of UA? According to Bakker (2000), farming is primarily done to improve the household's food situation. Not only in the absolute amount of food but also dietary composition. The importance of UA as a source of income should not be under estimated. Selling is, in fact, quite common also among the "subsistence" crop cultivators. However it usually concerns small quantities.

From the foregoing discussion, does UA have any significant share in the urban economy or is it a hindrance to development of towns or is it a cause of environmental degradation or a survival strategy? It is this dilemma that this study is set out to find.

**2.5 UA and the Environment**

The UNCED (1987), notes that the conservation of the environment is undermined by the greed of some of the rich and the desperation of the poor. Commodity production cannot be sustained while the ecological base is degraded. Agriculture is the key to address the issues of poverty reduction, food security, natural resource management and environmental sustainability (Dellere 1989). Agriculture in many ways embodies the idea of interaction among people, land, water and air (climate). This is the same immediately accessible conceptual framework for the environment. Environmentalism should guarantee people the right for pure water, clean air and fertile soil. Cleaver (1997) states that there is a relationship between natural resources and poverty alleviation. UA is perceived both to enhance and degrade the environment.

A study undertaken by Dennery (1995) in Kibera, Nairobi revealed that UA enhances soil conservation since the farmers dug drainage ditches against gully erosion. Sheet erosion was combated with crop residues and at the same time enhanced moisture retention.

UA is also seen as a method of solid and liquid waste management method since it recycles the waste. The use of organic manure by the urban cultivators increases soil fertility. By so doing there exists some kind of recycling of organic material.

According to UNDP (1996), the high population density of urban areas results in more intensive use of resources such as land and water than in rural areas, thus problems caused by chemical contamination have even more serious implications. Heavy use of chemical inputs by the farming sector can pollute the soil and the water table with nitrates and heavy metals. For example, a study done in New York City in 1976 measured the lead and cadmium content in vegetables from 17 gardens. The study concluded that the metal content in vegetables was not high enough to have a negative impact in healthy people, but other studies in the United States indicate that green leafy vegetables like spinach are the most vulnerable to heavy metal pollution and root crops and fruit trees are the most resistant. One expert suggested that green leafy vegetables should be planted at a maximum distance of 7.5 meters from roads where leaded gasoline is used.

Agricultural runoff washed down by the rivers has been found to kill plant and animal life in coastal bays near Rio de Janeiro and Washington D.C. Spraying insecticide also pollutes the air. However, a number of biologically based practices, including 'organic' regeneration and

bio-intensive agriculture are less damaging to the environment. Supplying composite and treated sewage to farmers is essential to reducing the amount of chemical fertilizer needed. Multi-cropping practice can substitute for insecticides.

Bakker (2000) states that, leaching of solid and liquid waste from intensive livestock farms into the soil is a major environment problem in urban as well as rural areas. In Holland, Thailand and United states, surface and ground water contamination from intensive large-scale poultry and sheep production were reported during the 1980's. Leaching can be prevented through the proper treatment and re-use of animal waste as fertilizer. However, intensive use of animal waste on soils can cause nitrate pollution in a period as five years.

Overgrazing and destruction of plantation areas by animals can lead to increased erosion. Loose animals also cause traffic problems and result in accidents in congested cities. For example in 1985, roving animals caused 12 of 2866 road accidents in Dar es Salaam. Zero grazing can be practiced to avoid over grazing, rotting dug and traffic congestion.

Agriculture in the city can have a negative impact on the green space and on biodiversity if it replaces forestland, wetlands or other biologically rich natural environments (UNDP, 1996). Farming along river and streamside can lead to increased erosion and silting in the river if farmers do not take care.

Intensive livestock farming can lead to odour and noise pollution. There may however be a double standard inherent in some of the opinions. Odour and noise caused by livestock often

are no worse than that caused by some other urban activities such as manufacturing and vehicular traffic.

Despite all these negative effects of UA, the UNDP (1996), concludes that UA is among the best, most sensible ways to dispose off much of a city's solid and liquid wastes (especially organic ones) by transforming them into a resource. Few urban activities contribute as efficiently to improving the urban soil, water, air and living environment while closing the urban open loop ecological system of resources in, wastes out.

**2.6 UA And Gender**

Studies conducted on UA and gender have revealed that female-headed households engage in urban farming more than their counterparts. A study by Mwangi (1995) in Nairobi among the low income groups of Kinyago, Kitui and Korogocho slums showed that female headed households were more common among the farming households than among the non farming households. The female heads among the non-farmers were also better educated than the rest since 14 percent of them had attained post primary school education compared to 5 percent among the urban farming households.

According to a study conducted by Dennery (1996) in Kibera slums, Nairobi, urban poverty contributes significantly to urban food production. Women from the Kamba and Kikuyu communities were the leading farmers in Kibera. These constitute of those who have stayed for long period in the slum and those who have large families. A case of one woman known as Martha aged 38 years arrived in the city of Nairobi in 1975 and has seven children ( 1 to 15 years of age). She ventured into food production in 1979 after her vegetable selling business failed. Martha cultivates three plots but she and her husband have trouble in making ends meet.

Her husband has difficulty in obtaining casual work and though Martha often makes eight to ten trips a day to the neighbouring residential areas to sell water, she can only manage to make enough cash to buy food for one day.

Most of the urban producers learn the basic skills they use in cultivation in rural areas. Often, one or both parents in Kibera are food producers. The events that occurred around the time the informants decided to start food production appear to have been the initial push or incentive that led to the decision. Serious financial difficulties preceded the entry of three out of four case informants into food production.

Both men and women in Kibera are close in how they perceive urban agricultural activities. Women see food production as part of their duty in feeding the family. Obtaining income from sales was considered secondary to savings on food expenditure. The women said that producing food increases their financial independence.

Gender differences in Kibera were not clearly apparent with regards to the proportion of food kept for home consumption versus what is sold. Since men are more likely to live in the city alone, it is probable that they spend less on food than female producers. As one woman known as Joyce pointed, the financial responsibilities of Kenyan men are inherently different than those of Kenyan women. Men are expected to provide income by working outside the home while women are expected to help within the home.

At the intra household level, conceptualization of the sexual division of labour translates into attitudes that shape the allocation of resources and producer practices. Women pointed out that because they prepare food, they know the needs of the household and therefore decide on how much to sell and what food to buy. The food production activities of women also shape their expectations as to how their spouses should allocate income from non-agricultural work. One woman said that she expects her husband to pay for school fees because her food production efforts largely eliminate household food expenditure.

Labour availability is a key factor determining the amount of produce obtained. Among food producing households, there is usually one adult who devotes most of his or her time for agriculture particularly in households with large number of dependent children. Gender issues were significant determinants of access to and control over agricultural and non-agricultural labour. Women in Kibera and in Kenya overall are responsible for chores such as fetching water and preparing meals regardless of how much time they have spent in the field. Male producers are more likely to have casual or regular work apart from food production than the female producers.

## 2.6 Legal and Policy Frame Work on the Practice of UA in Kenya

The practice of UA in Kenya is prohibited directly by two legal provisions, which include, The Local Government Act Cap 265 and the Public Health Act Cap 242.

### 2.6.1 Local Government Act Cap 265

According to the local Government Act Cap 265, section 154 (c), local authorities, (municipal, town or country council) have power to prohibit or permit cultivation. This applies to the cultivation on unenclosed and unoccupied land in private ownership and of any Government land reserved for any public road. The local authorities may enact By-laws, which are restrictive or permissive or take no actions in which case cultivation can be deemed legal. Section 144(5) of the same Act gives local authorities power for grant anyone license to occupy land which it owns for a term of up to 7 years. This provision may be done with or without the consent of the minister unless such consent is required by section 177 or by any other written law.

In contrast, section 155 (c) of the same Act empowers local authorities to grant the planting of any specified crops in areas suffering from famine or likely to suffer from shortage of foodstuffs.

The Municipal council of Machakos (General nuisance) By-laws of 1999 amendments section 9 states that, a person who keeps within the town a rabbit or an animal or poultry which causes nuisance to the residents in the neighbourhood shall be guilty of an offence. Section 9.1 of the By-laws states that, a person who except with the written permission of the clerk and subject to

the conditions he may deem fit keeps within the municipal council a game animal, a reptile other than a lizard, an ass, ox, bull, cow, goat, camel, sheep or pig shall be guilty of an offence.

Section 9.3 states that any person who except with the written permission of the clerk and subject to such conditions he may deem fit permits any animal to graze within the municipal council shall be guilty of an offence.

These sections prohibit livestock keeping within the municipality. The section under which crop cultivation is restricted in section 11(1) on roads and streets which states that, There, in the opinion of the council any hedge, tree or any other growth (including food crops) is so placed or in such condition as

a) to be a danger to any person or vehicle using a public street or

b) to interfere with

(i) the view along any public street to another

(ii) the use of the public street by pedestrian or vehicular traffic, the council may serve a notice to the owner or occupier of the land on such a hedge, tree or other growth is situated requiring him within such period of time not being less than fourteen days as shall be specified in such notice, to cause the hedge, tree or other growth to be looped, trimmed or removed.

From this analysis, it means if livestock is not a nuisance in any form to the public, then it is not illegal. The same applies to the crops in so far as they are not obstructing any public street. However section 155 (b) of the local Government Act Cap 265 empowers the local authorities

to engage in agriculture (crop and livestock production, extension services) and take measures for the prevention of the spread of diseases defined in the Animal Diseases Act.

### 2.6.2 Public Health Act Cap 242

Section 157 (1) spells out that the cultivation or irrigation of land within and around township boundaries or within 3 miles of such boundaries is prohibited. The minister for Health prohibits it once it is shown to his/her satisfaction that such activities are unhealthy or unsanitary. The minister above may do so after consulting with the minister for the time being responsible for agriculture. This therefore means that the cultivation of crops within Machakos Municipality can be undertaken with or without permission so long as it is not unhealthy or unsanitary.

Section 118 (f) and (g) specifies livestock and livestock buildings. On the basis of this, livestock buildings considered offensive or injurious to health are subject to removal under the Act.

The Machakos Municipal Council (General) nuisance By-laws allows a person to keep small livestock either through a written permission from the clerk or so long as they don't causes nuisance to the public. They also specify the kinds of livestock, which are allowed within the municipality, so long as they don't cause nuisance to the public.

### 2.6.3 The Physical Planning Act No 6, 1996

This Act can either hinder or promote the practice of agriculture within township boundaries. Section 24 (I) empowers the director of physical planning to prepare with reference to any government land, trust land or private land within the area of authority of a city, municipal, town or urban council or with reference to any trading or marketing center a local physical development plan. This means that the director will plan for different land uses at his discretion and if he doesn't give emphasis to agriculture which is not given priority in urban land uses, then whether it is on private land, it will be considered illegal.

This is supported by section 41 (a) of the same Act which spells out that no private land within the area of authority of a local authority may be subdivided except in accordance with the requirements of a local physical development plan approved in relation to that area.

Part V, section 29 empowers each local authority to

(a) prohibit or control the use and development of land and buildings in the interests of proper and orderly development of its area.

(b) control or prohibit the subdivision of land or existing plots into smaller areas

(c) ensure the proper execution and implementation of approved physical development plans.

(d) formulate by-laws to regulate zoning in respect of use and density of developments

(e) reserve and maintain all the land planned for open places, parks, urban forests and green belts in accordance with the approved physical development plan.

This means that, if the local authority encourages subdivision, the plots will become smaller hence discourage the practice of any meaningful agricultural activity. If it doesn't encourage

subdivision on the other hand and people have large tracts of land within the municipality, then. the practice of agriculture will be inevitable as people have an inclination towards it.

Section (1) of the Act spells out the function of a National physical planning liaison committee which is to determine development applications for change of user or subdivision of land which may have significant impact on contiguous land or be in breach of any condition registered against a title deed in respect of such land. This section enables the land owners willing to subdivide land or change use make an appeal if their applications are rejected by the local authorities. This has a bearing on the trend agriculture is likely to take in the peri-urban areas sine if small subdivisions and change of use of land is allowed, agricultural land will diminish.

**2.7 Land and Land Tenure in Kenya**

Prior to the advent of colonialism, land was the cornerstone of African humanity-it defined the African way of life. It was not only the focal point of social solidarity, but also determined the belongings, economic status, and spirituality of people. Land tenure was then characterized by the following salient features, which were all undermined by the colonial powers (Akoth, 1999)

- An abundance of land rights emphasizing sustenance of human and social life rather than ownership of land, whereby even aliens could be granted accessibility.

- A communal relation to land as against individual, giving rise to an attendant tenural arrangement

- A dynamic and adaptive tenure system consistent with the level of economic development and technologies utilized by the society.

For many Kenyan's land is an economic necessity and may ultimately be a matter of life and death. Kenya's economy has over the years been based primarily on the exploitation of land for agriculture.

A complex mixture of English land laws and traditional tenure or customary law governs Land in Kenya. There are three types of land tenure on Kenya.

(1) Individual or private tenure derived from the English land law, which confers on an individual or corporate entity the title to a specified piece of land. Ownership may be freehold or lease hold.

(2) Customary tenure, which still prevails in areas that have not been adjudicated, consolidated and registered. The land designated as Trust is communally owned by and are usually administered by local governments.

(3) Public tenure which refers to landholding and land use of un-alienated government land such land is supposed to be reserved for public purposes unless it is privatized through a presidential decree (Daily Nation, July, 14th 1998)

## 2.8 Development Control in Kenya

According to Cockram (1996), government policy plays an important role in legitimizing or restricting urban cultivation. Land use regulations affect whether agriculture is a temporary or permanent phenomena through urban land use policy, zoning laws, tax statutes all of which are modified to promote or discourage UA. In Kenya UA has been viewed with a lot of hostility by the authorities. Both urban managers and planners have ignored it.

The physical planning Act of (1996) defines development as the making of any material change in the use or density of any buildings or land or the subdivision of land that for the purpose of the Act is classified as class 'A' development.

Purdue (1977) defines development control as a legislative granting of permission to commence development and undertaking of actions to remedy undesirable and illegal development. The physical planning Handbook of 1972 defines it as "any administrative system seeking to plan the country's resources and regulate the use and development of land"

An efficient development control system should ensure control and development of urban land as a home for the inhabitants without seriously endangering the economic structure and policies of state. It has also to ensure good healthy environment of the residents and the town's aesthetics.

The objectives of development control as outlined in the physical planning Handbook include:

(i) to ensure the implementation of development projects conform with plan proposals and recommend enforcement actions in case of contravention's against plan proposals and certain standards;

(ii) To encourage the preparation of:

(a) land zoning plans for all urban canters in the country;

(b) advisory and sub-divisional plans; and

(c) long term plans as they are part of the development control tools that ensure safety, amenity, welfare, convenience, efficiency and public interest;

(iii) to give greater freedom to harmless development but at the same time guard against harmful development by carefully assessing and processing all development applications;

(iv) To ensure that planning standards regulations and procedure are updated from time to time in order to accommodate the changes that might otherwise bring conflict;

(v) To ensure that strong controls are exercised so that surrounding areas particularly to individual zones do not suffer or deteriorate as the various developers carry out their activities; and

(vi) To ensure the use of land and to ensure that planning powers are made to do things, which though proper and desirable are outside the scope of planning.

In Kenya, development control is the responsibility of local authorities. The Physical Planning Act of 1996 part v, section 29 empowers each local authority

(a) to prohibit or control the use and development of land and buildings in the interests of proper and orderly development of its area;

(b) to control or prohibit the sub-division of land or existing plots into smaller areas;

(c) to consider and approve all development applications and grant all development permissions;

(d) to ensure the proper execution and implementation of approved physical development plans;

(e) to formulate By-laws to regulate zoning in respect of use and density of development; and

(f) to reserve and maintain all the land planned for open spaces, parks, urban forests and green belts in accordance with the approved physical development plan.

In the same Act, section 32 (3), the local authority shall, when considering a development application submitted to it under subsection (1)

(a) be bound by any relevant regional or local physical development plan approved by the minister; and

(b) have regard to the health, amenities and conveniences of the community generally and to the proper planning and density of development and land use in the area.

Taken in this regard, it means that if the local authority perceives agriculture as a nuisance and inconveniences the community, then, the development control system is not effective.

# 3.0 CHAPTER THREE: BACKGROUND OF STUDY AREA

## 3.1 Introduction

This chapter presents a background analysis of Machakos municipality. Focus is mainly on the physical characteristics, population and demographic features, and an historical background of the town.

## 3.2 Location

Machakos town is located about 64 kilometers south west of Nairobi city. It is the administrative and commercial headquarters of Machakos District in Eastern Province. It is within the Central Division of the district (Figure 3.1 and 3.2). The town is located on a fairly flat terrain bordered by Mua and Iveti hills to the North and North East respectively and Kiima Kimwe hill to the South. The hills act as catchment areas for many springs and streams passing near the town that support farming activities.

## 3.3 Size

Machakos municipality was declared a township in 1906 by the colonial authorities covering 5 $km^2$ .It became an urban center in 1954 when the boundaries were expanded to cover 19 $km^2$. It was elevated further in 1980 and the boundaries were expanded to cover an area of 320 $km^2$ when it became a municipality. The boundaries were again reviewed in 1997 and currently Machakos covers an area of 519 $km^2$ out of 721$km^2$ of the central division. It is composed of 16 electoral wards (Figure 3.3 and 3.4).

**Fig. 3.1: Geographical Location of Machakos District.**

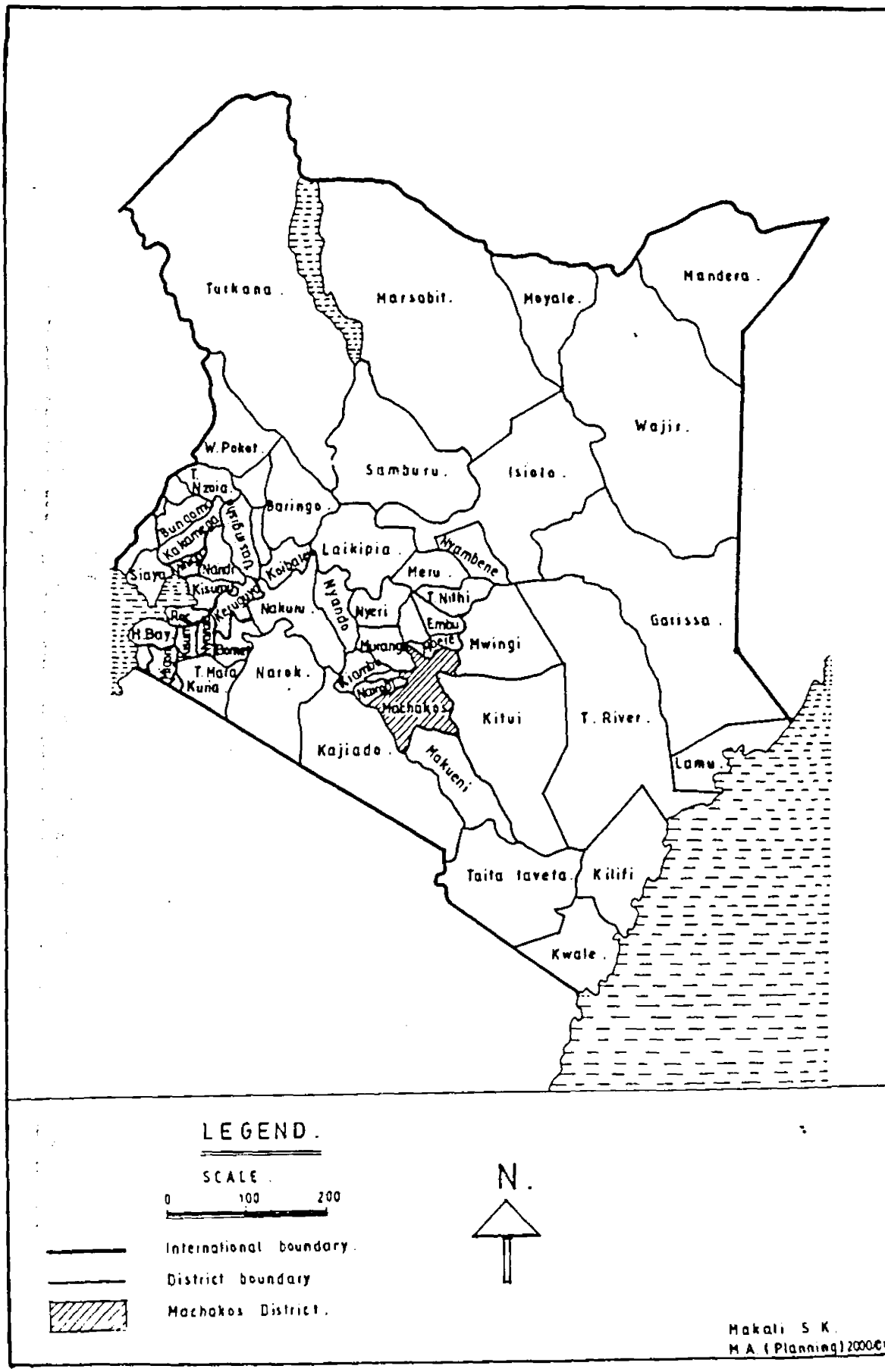


**Fig.3.2: Central Division In Machakos District.**

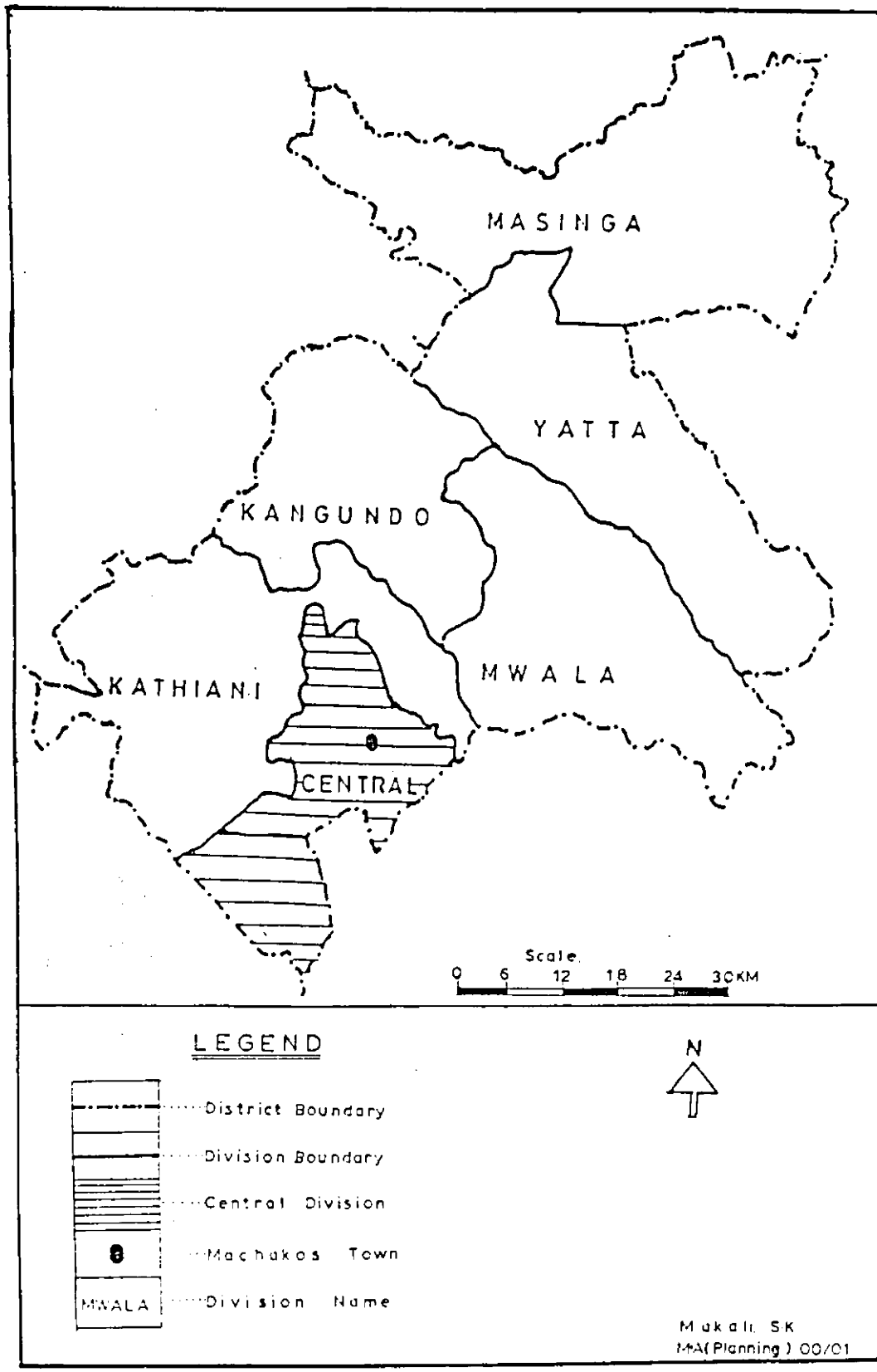


**Fig. 3.3: Machakos Municipality.**

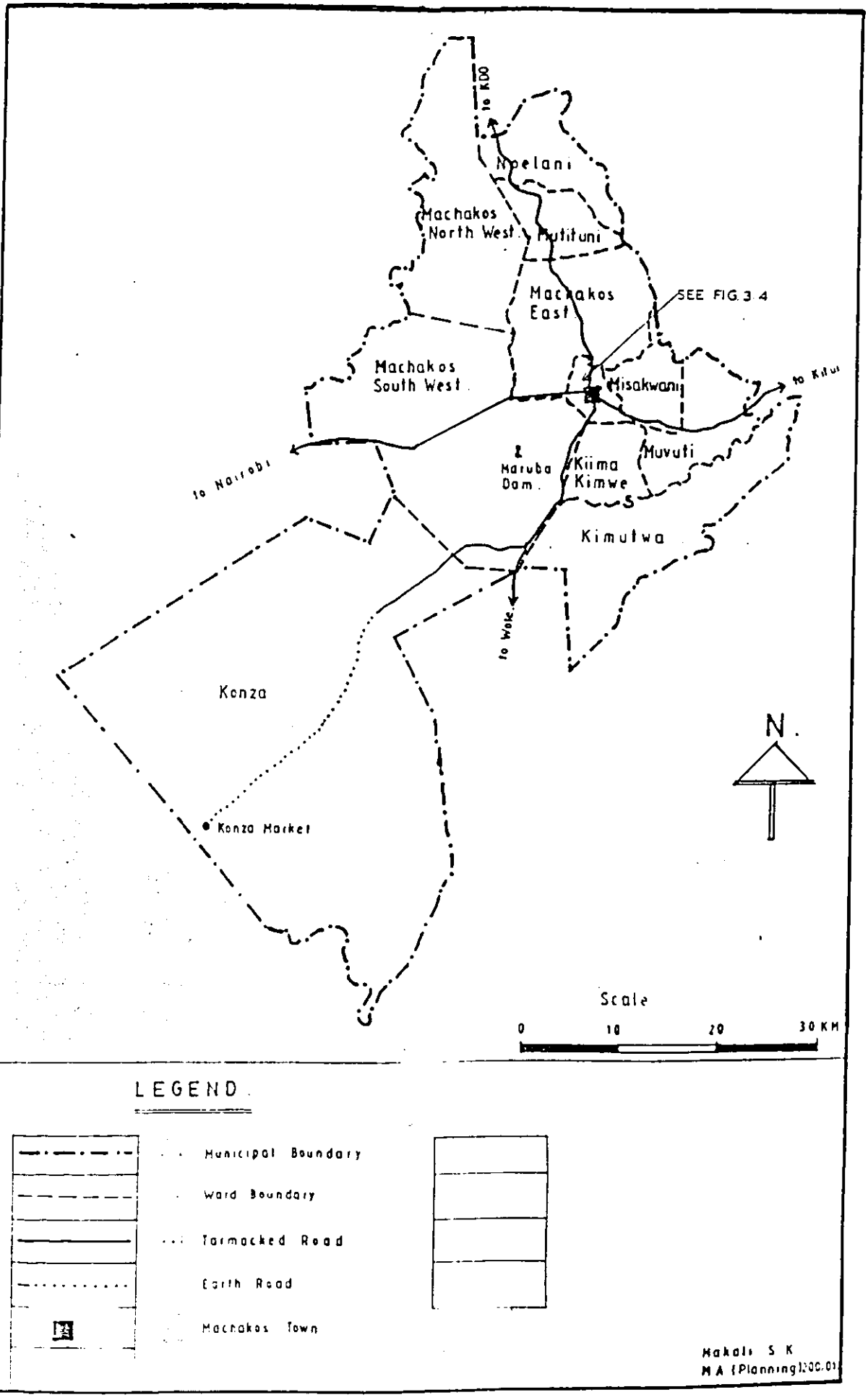
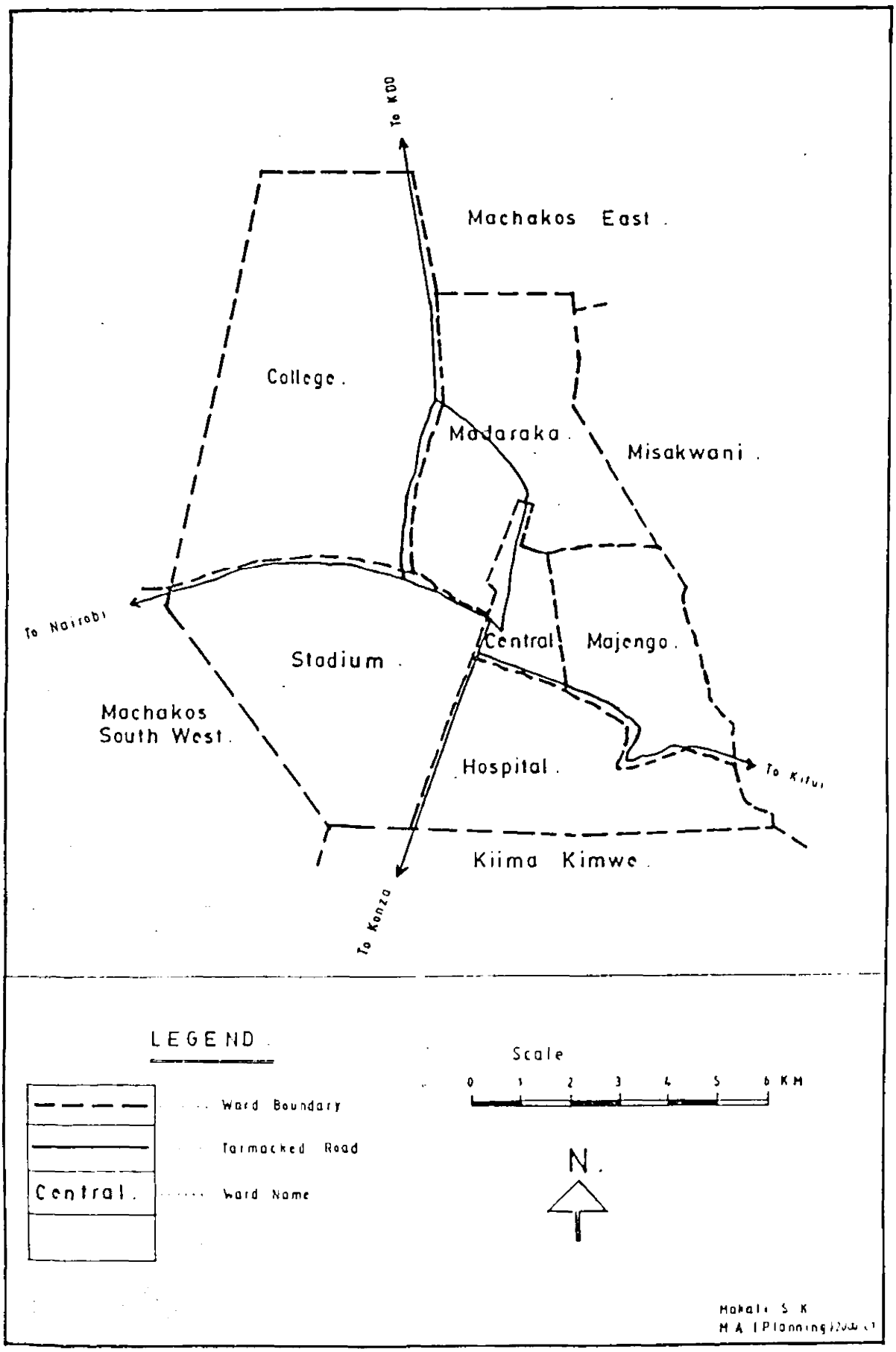


Fig. 3.4: Enlargement of Part of Machakos Municipality.



An important point to note is that the built up area is relatively small while the municipal boundary incorporates large areas that are predominantly rural and agricultural in character. It is the urban area that is treated administratively as a municipality.

### 3.4 Topography

Machakos municipality lies at an altitude of between 1320m to 2060m above sea level (Machakos Municipal Topo sheet 1:50,000). It is surrounded by hill massifs of Iveti, Mua and Kiima Kimwe that form the catchment areas for the rivers passing through and near the town (Figure 3.5)

### 3.5 Geology and Soils

The underlying geology of Machakos municipality is basement rock system which comprises of various types of Precambrian sediments which were transformed into gneiss, quartizites and marbles which outcrop in a number of hills such as Mua, Iveti and Kiima Kimwe hills (Kenya Farm Management Handbook, 1972) The soils of the hills have a friable fertility. They are developed on undifferentiated basement system rocks predominantly gneisses (Figure 3.6). They are somewhat excessively shallow reddish brown friable rocky or stony, sandy clay loams. They are mainly regosols with rock out crop and calcic comb sols, litho sols and ferralsols.

They support a variety of food crops, horticultural crops and cash crops such as coffee. The soils on the associated foot slopes are found with an increase in clay with depth and they have a moderately low fertility. They are found together with those of the uniform profile development and with humus topsoil.

Fig. 3.5: Cross Section Between Machakos South West Ward (Mua Hills) and Kinutwa Ward Near Kiatinani.

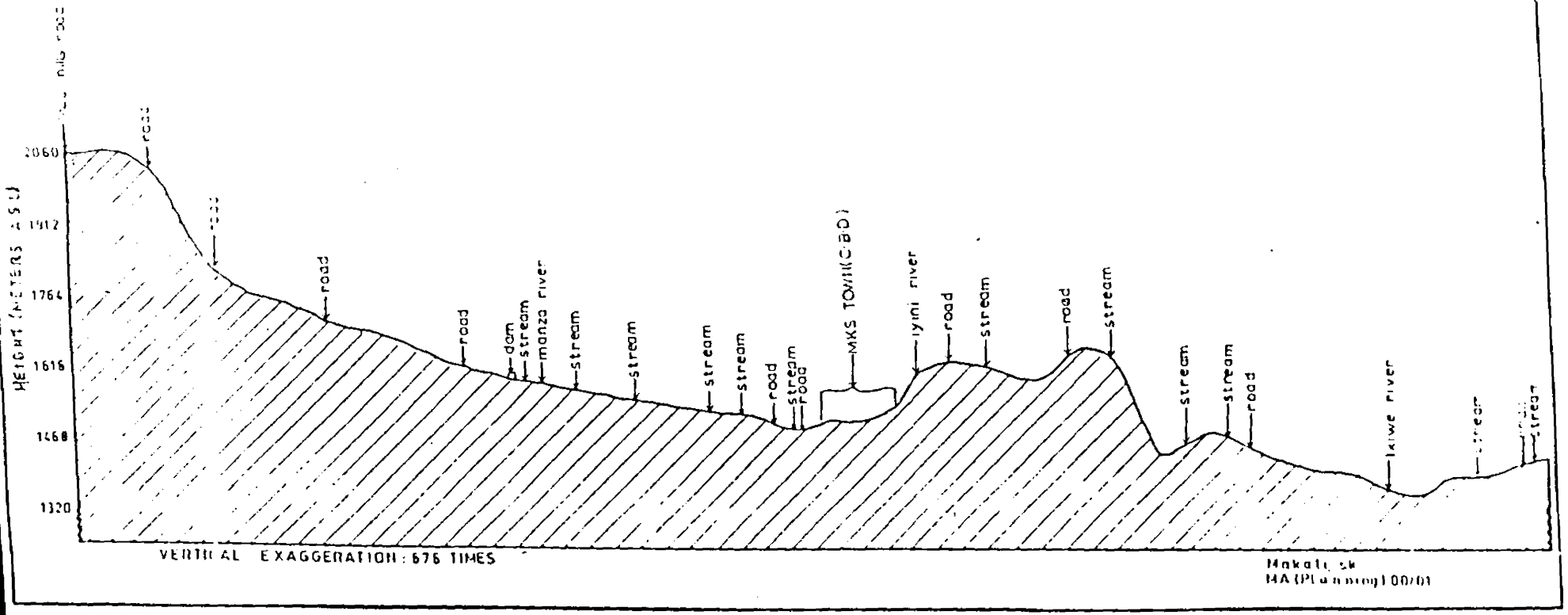
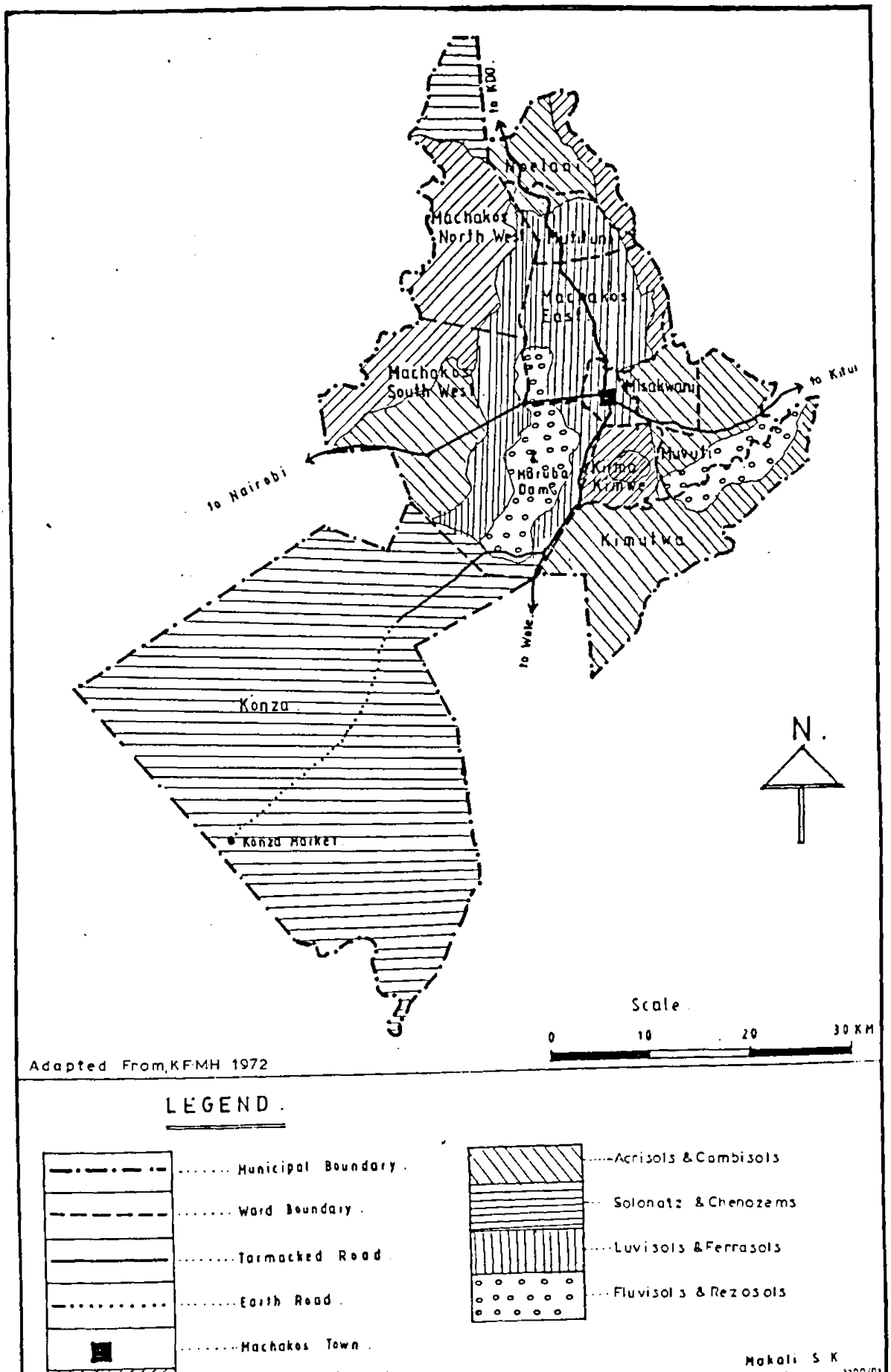


**Fig. 3.6: Machakos Municipality: Soils.**



The soils are developed on colluvium from undifferentiated basement system rocks. They are well-drained, very deep, yellowish red to dark reddish brown, friable clay, and coarse loamy sand to sandy clay loam. These include mainly luvisols, ferrasols, arenosols and acrisols (sandy loam to clay).

Soils that form the Konza ward, which is mainly a plain, are developed on undifferentiated basement system rocks, with volcanic ash mixture. They are imperfectly drained, moderately deep, dark brown, slightly saline, clay loams to sandy with strongly sealing sandy loam. These are solonatz, ferrosals and luvisols not so good for agriculture activities.

### 3.6 Climate

The climate of Machakos town is generally warm and dry.

#### *3.6.1 Rainfall*

Rainfall within the municipality varies with altitude. The high lying areas which include Mua, Iveti and Kiima Kimwe hills have high rainfall than the low lying areas especially those in the rain shadow of the hills.

The total annual rainfall is an average of 717mm per annum. This has a bimodal pattern with a significant difference in distribution over different years. The long rains occur between March and continue up to May while the short rains start at the end of October and last till December although it is not very reliable (Figure 3.7). Historical data indicate that in 4 out of 10 years, there is a major drought in the district. This has an effect on the agricultural activities practiced within the municipality. The distribution of both crop and livestock activities depend on the

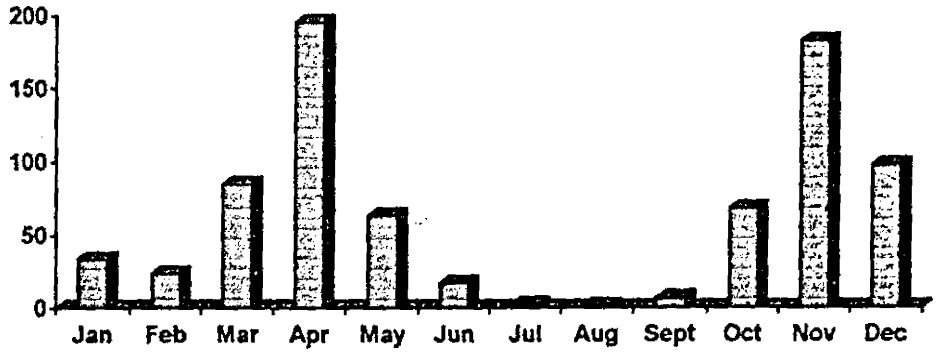
potential of a particular agro ecological zone. Most agricultural activities are concentrated within the central division of the district where the municipality lies.

The mean monthly rainfall is shown in Table 3.1

*Table 3.1 Mean Monthly Rainfall (mm)*

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33.3 | 23.9 | 84.9 | 196.0 | 63.8 | 17.5 | 2.8 | 1.5 | 6.7 | 68.3 | 183.2 | 98.4 | 65.0 |

**Fig 3.7 Rainfall Distribution**




*Source: Katumani Experimental Farm, Machakos, 2000*

### *3.6.2 Temperature*

The monthly temperature varies between 18°C and 25°C as shown in Table 3.2. The coldest month is July while October and March are the hottest. These conditions favour the growth of both food and cash crops such as maize, beans sorghum, horticultural crops, and coffee among others. The temperature also keeps evaporation levels low hence the ground retains water for long which enables crops to grow rapidly.

*Table 3.2 Mean Monthly Temperature*

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean Max | 26.0 | 26.8 | 26.2 | 25.1 | 24.4 | 23.1 | 22.0 | 22.8 | 25.5 | 26.4 | 24.3 | 24.4 |
| Mean temp | 20.0 | 20.5 | 21.0 | 20.3 | 19.6 | 17.8 | 17.0 | 17.3 | 18.9 | 20.2 | 20.0 | 19.4 |
| Mean Min | 14.0 | 14.2 | 15.8 | 15.6 | 14.8 | 12.5 | 12.0 | 11.8 | 12.4 | 14.0 | 15.8 | 14.4 |

*Source: Katumani Experimental Farm, Machakos,2000*

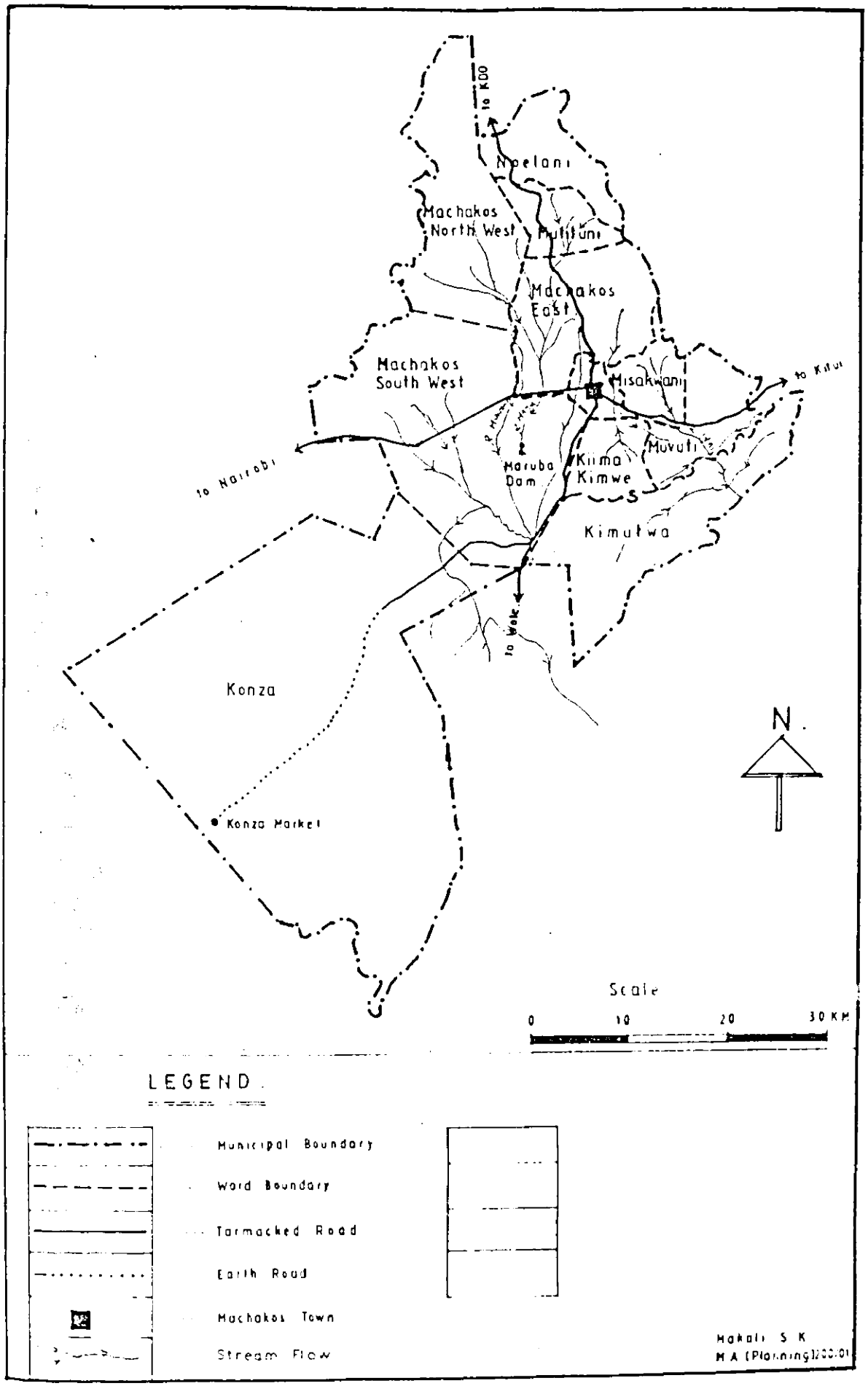
### 3.7 Drainage

The drainage pattern within the municipality can be described as dentritic and centripetal (Figure 3.8). There are three parennial rivers including River Mayai, Iyini and Manza, which are served by several tributaries from the Iveti, Mua and Kiima Kimwe hills. These provide the water which is utilized for agricultural activities within the municipality. Konza ward is disadvantaged, as no perennial river pass across it apart from small seasonal streams. It is however suitable for ranching.

### 3.8 Origins of Machakos Town

The year 1889 marked the birth of Machakos town as the earliest colonial town in Kenya. It owes its origins to the colonial settlement. It was created by the British government, which was determined to control the interior of East Africa from where the territory would be effectively managed. The imperial British East African company started the town in 1889 after it was chartered a colonizing agent by the British Government. This is supported by the pillar in the town whose writings are:

Fig.3.8: Machakos Municipality: Drainage.



*"The pillar marks the gateway of the old port of Machakos established by Mr. Fredrick Markison of Imperial British East Africa company in 1889, enlarged and strengthened by F.D Lugard, DSO the Norfork Regiment in 1890. It was the first post founded by the company in the interior of East Africa and from it Mr John Ainsworth established law and order in Ukambani".*

From the above writings, the origin of the town seems to be a matter of historical accident, strategic location to administer the interior of Kamba land and availability of natural resources in the town. Using Lee smith's (1992) words the boundaries of the town were clearly marked by the colonial administration as a way of preventing any existence of substantial farming and settlement by Africans within the township boundaries. This means agricultural activities within the town were banned.

However, it is the exploitation of the natural resources and the surrounding umland (Hill masses) which are productive agriculturally which continued influencing the growth of the town after the IBEA Company Headquarters were moved to Nairobi in 1901. If it was not for the agricultural activities, the town could have died away.

Since Machakos town was the first to be established in the interior of East Africa, it follows logically therefore that the pioneers exploited the natural environment for their survival. The origin of agricultural activities should have occurred after the IBEA Company offices were moved to Nairobi. This is because, during the period of colonial authority and rule the town was treated as an "island of health" and security where high sanitary standards were maintained and rules strictly enforced (Memon, 1975).

### 3.8.1 Growth and Development of the Town

The growth of Machakos town has been in four major phases, a period of precipitation of urban settlement between 1889-1899, followed by a period of decline and stagnation after the transfer of the British company from Machakos to Nairobi. This was followed by a period of slow growth between 1910-1960 after the town was made the headquarters of the District and finally an era of faster growth after independence, which prevails up to date.

It was with the establishment of a colonial settlement in the area that the colonialist intensified their administrative activity in the interior. Consequently people were attracted to the urban center that began to grow distinct land uses with agricultural activities dominating in the fringe of the town. The main land uses included (1) The administrative area (2) The residential area for the whites and the native servants as the Swahili and (3) The Commercial zone comprising of Indians retail shop and an open air market (Tumbo, 1992). As informed by one elder, the open-air market dealt mainly with exchange of agricultural produce.

The transfer of the British East African company in 1899 from Machakos town to Narobi led to increased farming in the area which deprived the town of the distinct land uses that were emerging .The place became dominated by agricultural activities. This boosted the trade in the town.

During the next phase a few Swahili people who had accompanied the British administrators from the coast who later remained settled in Machakos kept the town alive. After 1910's following the posting of the District Commissioner, the town began to experience a slow growth .The colonial administrators by this time had consolidated their power in the district. Three factors appear to have contributed to the gradual growth namely: 1) the colonial

administration was intensified under the emphasis of maintaining law and order. This created employment opportunities, which pulled the local community to take jobs in the "tribal police unit". Others were generally employed as house boys and office boys 2) expansion of retail trading business and a periodic open-air market boosted the money economy, which in turn drew more people into the town 3) a local native council was established after the passing of native authority (amendment) Ordinance of 1924. Many people were pulled to work in various activities that were introduced. This exodus did not guarantee jobs. Some were then to turn to informal jobs and activities (Tumbo, 1992).

At this time, the town expanded in population concentration, functions and activities. More and more construction was made. Gradually spatial structures of the town became elaborate with the commercial zone at the center of the town and the administrative area to the north.

The European residential area was at the far north beyond the administrative office where they practiced market gardening since it was close to a river. Indian residential area lay to the south, the Africans to the east and west of the town while the industrial zone was to the South West.

It is clear from the town setting at this time that no provision was made for African small-scale business since Indians mainly dominated the industrial area. Africans were forced to remain in the informal business and farming.

An important development, which took place at this time, was the opening of the hinterland. This facilitated greater commercial exchange between outlying district and the town. It was therefore possible to extend the influence of the town beyond it. Small trading centers also emerged in the rural areas, which established some commercial linkages with the town. This

promoted agricultural activities due to the opening up of marketing channel although it did not contribute greatly to the town's growth at that period.

It was only after independence when the town took a major expansion thus expanding the demand for food to feed the urbanized population. The town currently relies on agricultural activities among others to keep it alive and has become a district major center of administration, education, communication and other social welfare services. Employment opportunities were opened up. These attracted more people than they could accommodate thus leading to unemployment. Those who could not access jobs adopted farming as an activity to sustain them in the town. Others went back to the rural areas and engaged themselves in farming proper. These are the areas currently falling under the municipality where agriculture still thrives and supports the municipality's economy.

In terms of its elevation, the colonial authorities declared Machakos a township in 1906. In 1954, it became an urban center and attained its highest point in growth in 1980 when it became a municipality (Machakos L.A.D.P, 2001-2006). However, it is only a small part which is treated administratively as shown in Figure 3.9 on land use.

**Fig. 3.9: Machakos Municipality: Land Use.**

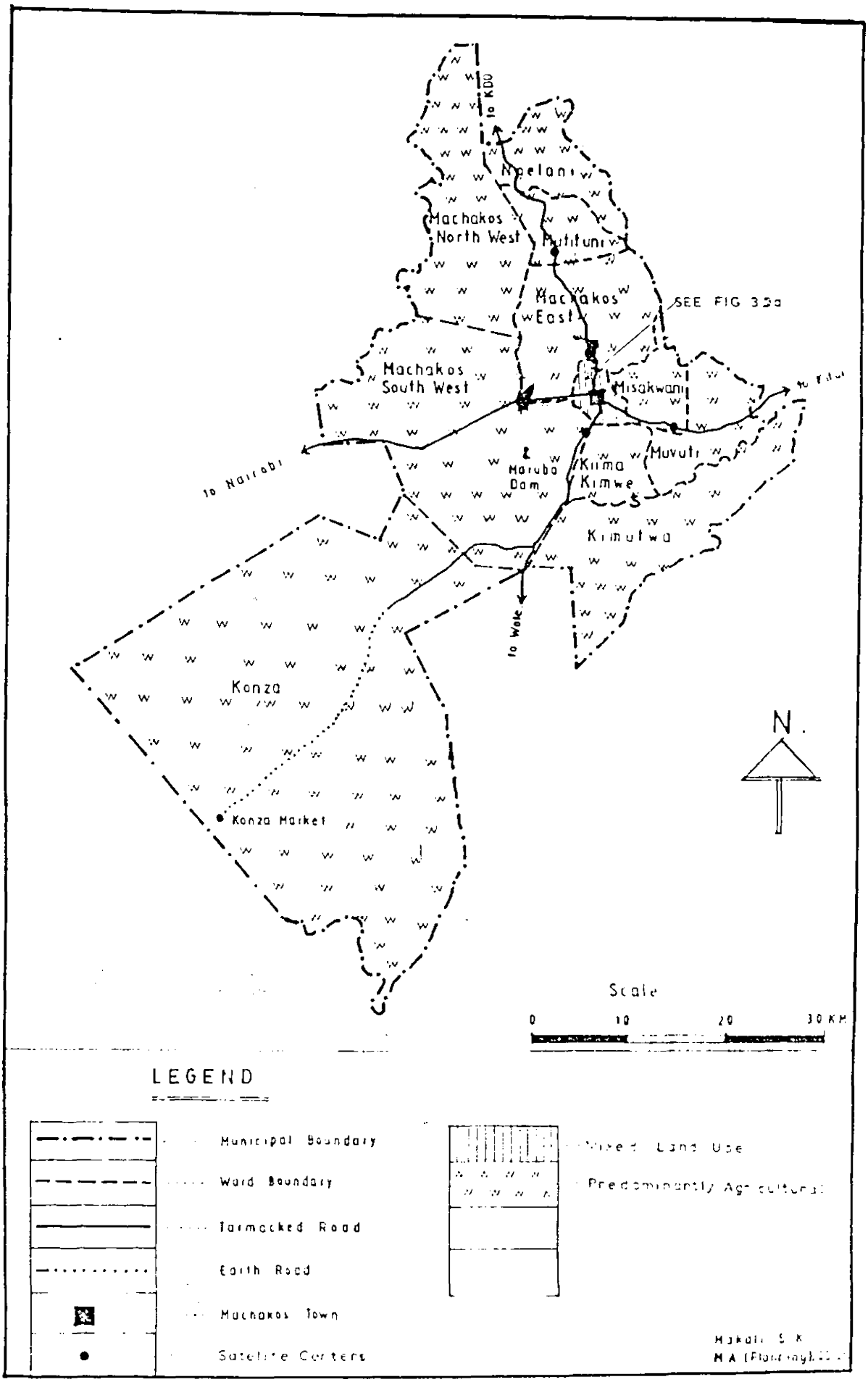
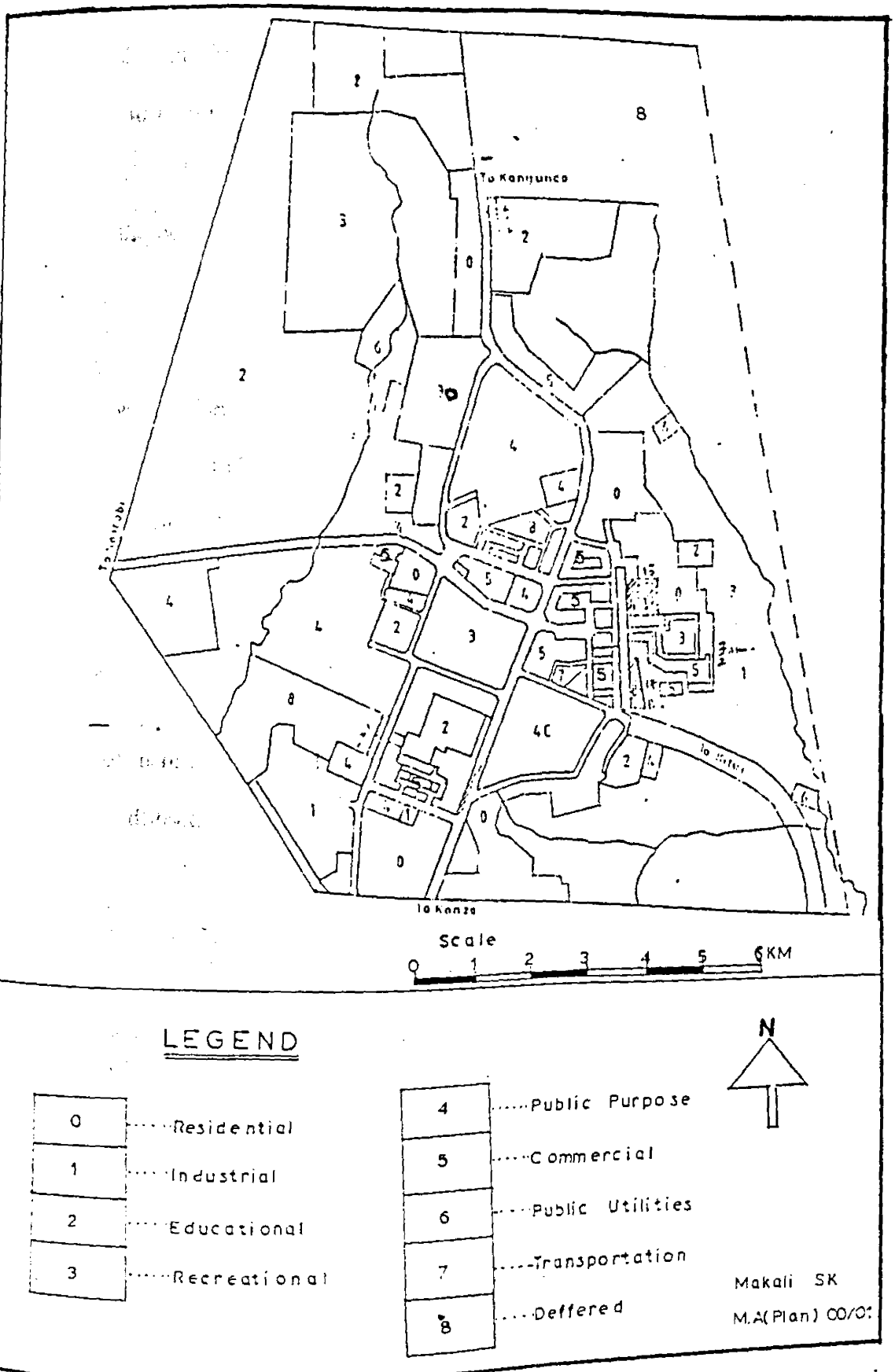


Fig. 3.9a: Land Use of the Enlarged Part of Machakos Municipality.



## 3.9 Population and Demographic Characteristics

### 3.9.1 Population Size, Density and Distribution

Machakos municipality by 1962 had a population of 2,907, which increased up to 6,907 by 1969, and 16,640 by 1979. The area of the township by that time was 19 $Km^2$. By 1980, the boundary was expanded to cover 320 $km^2$ and Machakos was elevated to a municipal status. Consequently, the population increased from 16,640 persons to 116,000 by 1989 and 134,000 by 1991.

The boundary was further expanded in 1997 to cover an area of 519 $km^2$ and subsequently the population increased to 143,274 persons with 70,999 males and 72,275 females and a sex ratio of 100:101. The population growth rate stands at 2.9 per annum. The number of households within the municipality is 31,131. The population density is 292 persons per $Km^2$ which is higher in comparison to 144 persons per $Km^2$ for Machakos District.

This shows that there are more people concentrated within the municipality compared to other areas within the district. This increases competition for the available resources. Table 3.3 shows the distribution of population by wards

**Table 3.3 Population Distribution by Ward**

| Ward | Male | Female | Total | Density |
|---|---|---|---|---|
| Madaraka | 4207 | 4201 | 8408 | 1136 |
| College | 4328 | 4359 | 8687 | 944 |
| Kiima Kimwe | 9334 | 9359 | 18693 | 1161 |
| Hospital | 1689 | 1855 | 3544 | 3544 |
| Stadium | 1700 | 1742 | 3442 | 3442 |
| Central | 2189 | 2111 | 4300 | 2854 |
| Majengo | 2436 | 2702 | 5138 | 3371 |
| Machakos S.W | 7456 | 6917 | 14373 | 109 |
| Machakos East | 7759 | 8110 | 15869 | 742 |
| Kimutwa | 4879 | 5075 | 9954 | 283 |
| Machakos N.W | 3522 | 3530 | 7052 | 140 |
| Ngelani | 4575 | 5280 | 9855 | 675 |
| Konza | 2152 | 2086 | 4238 | 27 |
| Mutituni | 5553 | 6202 | 11755 | 1050 |
| Misakwani | 3857 | 4117 | 7974 | 752 |
| Muvuti | 4967 | 5025 | 9992 | 478 |
| **Total** | **70999** | **72275** | **143274** | **292** |

*Source: Kenya Census Report, 1999*

### 3.9.2 Population Age –Sex Structure

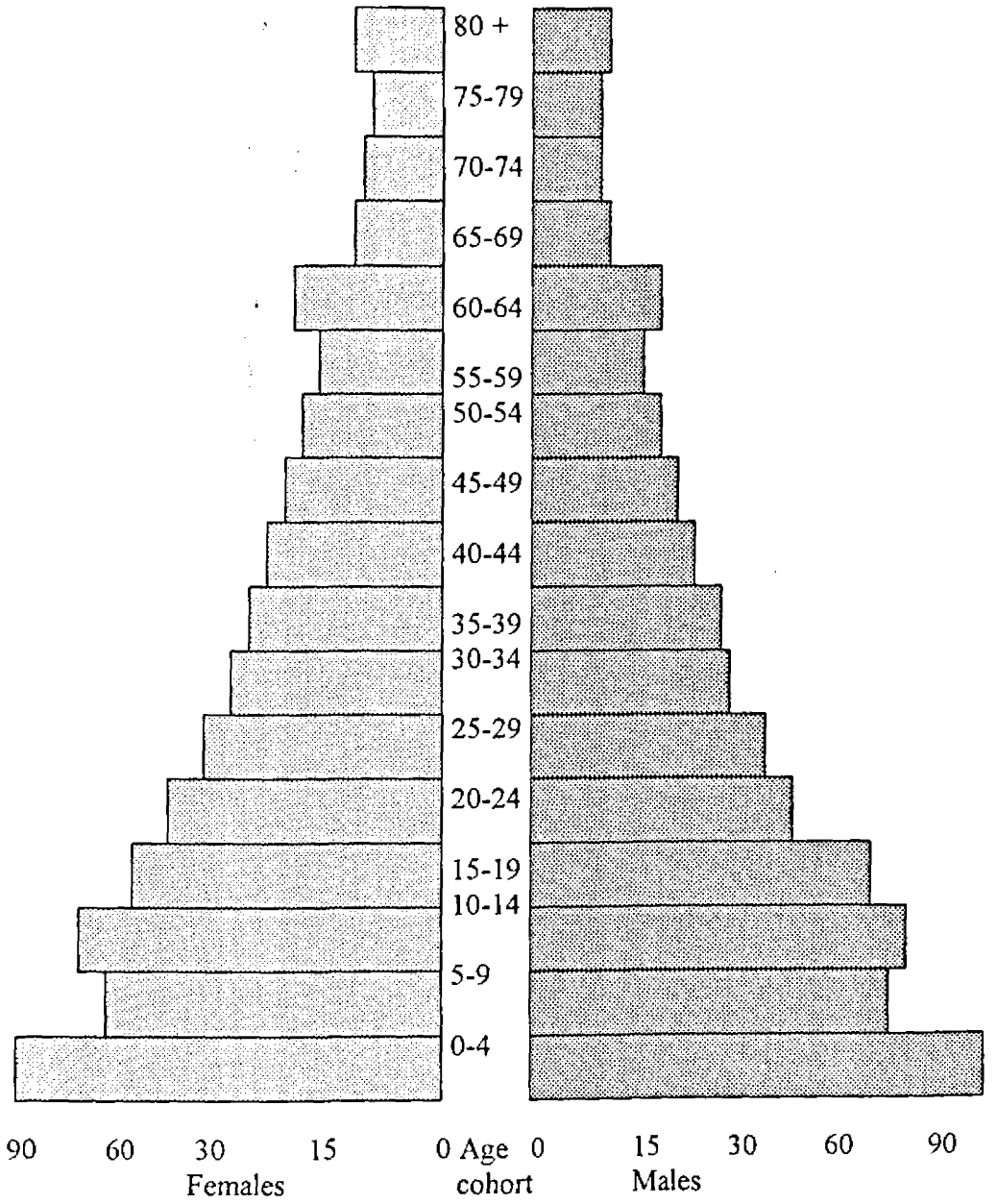
Table 3.4 and Figure 3.10 shows Age-Sex structure and the population pyramid for Machakos District. Data for the municipality was not available during the course of the study.

**Table 3.4 Age-Sex Structure: Machakos District**

| Age cohort | Females | Males |
|---|---|---|
| 0-4 | 92826 | 94097 |
| 5-9 | 61552 | 64015 |
| 10-14 | 66785 | 68805 |
| 15-19 | 54944 | 59933 |
| 20-24 | 42888 | 37546 |
| 25-29 | 33314 | 27441 |
| 30-34 | 25353 | 21357 |
| 35-39 | 23174 | 19215 |
| 40-44 | 18098 | 15638 |
| 45-49 | 15598 | 13009 |
| 50-54 | 12198 | 10696 |
| 55-59 | 9085 | 7021 |
| 60-64 | 12170 | 8551 |
| 65-69 | 6870 | 6088 |
| 70-74 | 5356 | 4681 |
| 75-79 | 4407 | 4571 |
| 80+ | 6826 | 5854 |

*Source: Kenya Census Report, 1999*

Fig. 3.10 Population Pyramid for Machakos District in 000's as Per 1999 Census



The pot shaped population pyramid is a reflection of that of the whole country with majority of the population are below 15 years. It tends to increase again after 60 years. This has a bearing on the dependancy ratio of the district which stands at 3 meaning that one economically active person supports three economically inactive people which is relatively a large number.

### 3.9.3 Population Employment

This has been calculated on the basis of the whole district.Again, data on the municipality was not available.Table 3.5 shows that majority of the population in Machakos District rely on agriculture as the main economic activity. Out of 764,460 persons between the ages 5 to 60 plus, 154,785 work on their own farms and 410,563 are economically inactive. It is only 119000 people who work for pay while the unemployed persons who have attained the stipulated employment age are 20,798. Child labour is common as shown by 534 children between ages 5 to 9 who worked for pay.

The number of those who worked for pay is likely to decline and that of those working on their farms to increase due to the declining growth conditions nationally.This is also explained by the limited off-farm employment opportunities within the district in general and the municipality in particular. The municipality's economy depend on agriculture and this is likely to continue in the foreseeable future.

**Table 3.5 Age Groups and Economic Activities in Machakos District**

| Age Group | Worked for pay | In family Business | In Family Farms | Unemployed | Economically Inactive | Not Stated | Total |
|---|---|---|---|---|---|---|---|
| 5-9 | 534 | 477 | 56662 | 1190 | 109465 | 8239 | **125,567** |
| 10-14 | 2378 | 430 | 3824 | 649 | 127236 | 1073 | **135,590** |
| 15-19 | 12265 | 2184 | 13045 | 3549 | 82909 | 925 | **114,877** |
| 20-24 | 20104 | 5845 | 21605 | 6279 | 25498 | 1103 | **80,434** |
| 25-29 | 19288 | 6851 | 18056 | 3328 | 12534 | 698 | **60,755** |
| 30-34 | 16298 | 5951 | 14157 | 1610 | 8047 | 645 | **46,710** |
| 35-39 | 14092 | 5609 | 13971 | 1134 | 7135 | 448 | **42389** |
| 40-44 | 10716 | 4329 | 12247 | 762 | 5292 | 390 | **33,736** |
| 45-49 | 8353 | 3417 | 11375 | 552 | 4586 | 324 | **28,607** |
| 50-54 | 5771 | 2617 | 9650 | 403 | 4166 | 279 | **22,894** |
| 55-59 | 2966 | 1726 | 7440 | 236 | 3576 | 161 | **16,105** |
| 60+ | 6304 | 4336 | 23664 | 1096 | 19944 | 1015 | **56,359** |
| Age NS | 91 | 34 | 79 | 10 | 175 | 48 | **437** |
| **Total** | **119,160** | **43,806** | **154,785** | **20,798** | **410,563** | **15,348** | **764,460** |

*Source: Kenya Census Report, 1999*

# 4.0 CHAPTER FOUR: THE EXTENT OF URBAN AGRICULTURE IN MACHAKOS MUNICIPALITY

## 4.1 Introduction

This chapter gives an analysis of the extent of Urban Agriculture (UA) in Machakos municipality and the factors that encourage it. It gives an account of the urban farmers, their socio-economic characteristics, location of UA within the municipality, the area used for UA, agronomic practices for both crop and livestock production, use of both crop and livestock products and highlights the factors that encourage the practice. Both individual households and institutions practice urban agriculture in Machakos municipality.

## 4.2 Households

In Machakos municipality individual households constitute the largest percentage of the urban farmers. The households are examined below in terms of size, gender, marital status, education occupation and income level.

### 4.2.1 Household sizes

From the 70 households (farming) sampled the average household size is six members while from the 30 (non-farming) households sampled the average household size is four members. It is observed that farming households tend to be bigger than non farming households hence the motivation to engage in urban farming since their demand for food is higher than the households with few members. A T-test for the household sizes showed a significant difference between the mean household sizes for the farming and non-farming household at 0.05 significance level (Annex 1).

Table 4.1 shows the distribution of households by size. Majority of the households (42.9 percent) have four to six members. This differs only slightly with those households who have more than six members (41.4 percent). The farming households, which have less than 3 members, constitute only 15.7 percent. About 63 percent of the non-farming households have between four to six members.

**Table 4.1 Household sizes**

| Household size | Farming H/Holds | | Non farming H/Holds | |
|---|---|---|---|---|
| | Number | Percentage | Number | Percentage |
| 1-3 | 11 | 15.7 | 10 | 33.3 |
| 4-6 | 30 | 42.9 | 19 | 63.4 |
| More than 6 | 29 | 41.4 | 1 | 3.3 |
| **Total** | **70** | **100** | **30** | **100** |

*Source: Field survey, 2000.*

From Table 4.1, cumulatively, 84.3 percent of the farming households have four and above members while 66.7 percent of the Non-farming households have four and above members. This further indicates that farming households tend to be bigger than non-farming

### 4.2.2 Household Head, Gender and Marital Status

The gender of the household head has an influence on the practice of UA (Mwangi, 1995). This study established that, for the farming households, 64.3 percent were male headed and 35.7 percent were female headed. Among the non-farming households 56.7 percent were male headed while the remaining 43.3 percent were female headed. The above pattern is more a reflection of the imbalance in land ownership in the municipality and the country at large where women own very little land. Studies have shown that only 10 percent of the women in Kenya own land on which they carry out agricultural activities compared to 90 percent of the male owners.

Although the percentages show that many households are male headed, it is the women and the children who carry out the farming activities as the men are constantly absent from home due to work commitments or because of the belief that farming is for women and the children. The men are expected to provide an income by working outside the home and at the women think it is their responsibility to feed the family so that any income from non agricultural work can be used in paying school fees or improving the general welfare of the family.

A T-test for sample proportions showed that there is no significant difference between the proportion of farming and non-farming female-headed households at 0.05 significance level (Annex 1).

The marital status of the farming households heads indicate that majority are married (82.9 percent), while the single headed families account for 7.1 percent, widowed, 8.6 percent and the divorced account for 1 percent.

Figure 4.1 shows the marital status of the farming household heads. For the non-farming household heads, majority, like the farming households are married (83.3 percent), while the

unmarried account for 13.3 percent and a 3.3 percent widowed (Fig 4.1.1). These percentages give a minor difference between the married household heads of both farming and non-farming households.

**Fig 4.1 Marital Status of Farming Households Heads**

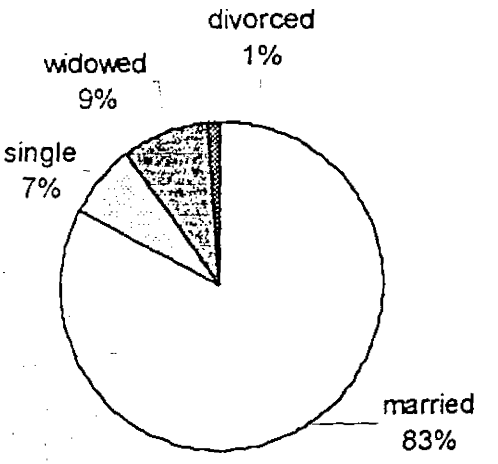
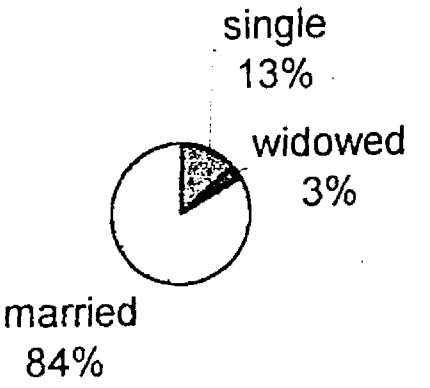



**Fig 4.11 Marital status of non farming household heads**



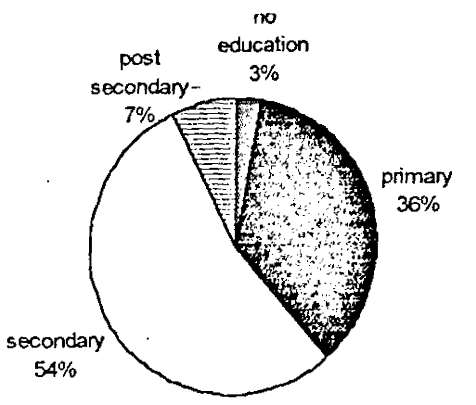

*Source: Field survey, 2000*

### 4.2.3 Education Levels

From the study, 54.3 percent of the farming household heads have attained secondary school level of education, 35.7 percent have attained primary school education, 7.1 percent attained post secondary education while a minority 2.9 percent lacked basic education (Figure 4.2). In comparison, 50 percent of the non-farming household heads have attained secondary school level of education, 16.7 percent have primary school level and a higher percentage of 33.3 percent have attained post secondary education. None of the non-farmers lacked basic education.

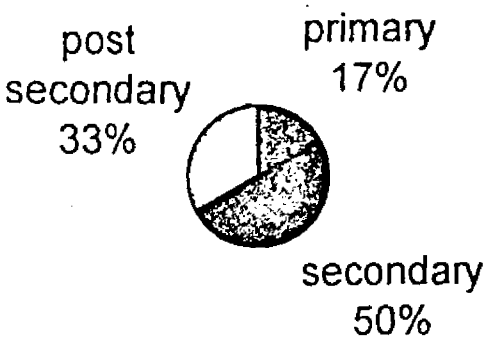
A T-test for sample proportions for non- farming and farming household heads showed a significant difference between those who had attained post secondary education at 0.05 level (Annex1).

**Fig. 4.2 Education Levels of Farming Household Heads**




*Source: Field survey, 2000*

**Fig. 4.22 Education levels for non farming household heads.**




*Source: Field survey, 2000*

### 4.2.4 Land Ownership

In terms of land ownership, Table 4.2 shows that majority (66.7) of the non-farming households had rented the land /space they had occupied compared to 8.6 percent for the farming households. Only 23.3 percent of the non-farming households owned land compared to 82.9 percent of the farming households. A T- test for sample proportions showed a significant difference in land ownership between farming and non-farming households at 0.05 level (Annex 1).

In terms of how the land was acquired, 8 percent of the households had bought, 61 percent inherited from their forefathers. 26 percent rented and only 5 percent had been allocated government land. This mode of acquiring land explains a significant factor in the practice of UA in Machakos municipality in that many household inherited land and continued to carry out the activities which their fore fathers carried on it and feel culturally attached to the land and therefore cannot understand why they should not farm on it as that is something they have been

doing since time immemorial. For the non farming households, only 23.3 percent had bought land. About 67 percent had rented the land and this may explain partially why they did not farm.

**Table 4.2 Land Ownership among Households**

| Ownership | Farming H/Holds | | Non farming H/Holds | |
|---|---|---|---|---|
| | Number | Percentage | Number | Percentage |
| Own | 58 | 82.9 | 7 | 23.3 |
| Rented | 6 | 8.6 | 20 | 66.7 |
| Council land | 2 | 2.8 | 2 | 6.7 |
| Government land | 4 | 5.7 | 1 | 3.3 |
| **TOTAL** | **70** | **100** | **30** | **100** |

*Source: Field survey, 2000*

### 4.2.5 Occupation

People engaged in different occupations occupy the peri-urban area of Machakos municipality. Out of the 100 sampled households heads, casual labourers accounted for 16 percent, those involved in business or other informal sector activities accounted for 33 percent, formal employment, 42 percent while those who were occupied in home keeping accounted for only 9 percent. Out of the 70 farming households heads sampled, 17.1 percentage were casual laborers, 37.1 percent were engaged in informal activities or business, 32.9 percent in formal employment while the remaining 12.9 percent were home keepers.

For the 30 non-farming household heads, 63.2 percent were in formal employment, which may explain why they did not practice farming. Table 4.3 shows occupation of both farming and

non-farming household heads. A T test for sample proportions for farming and non-farming household heads formally employed showed a significant difference at 0.05 level (Annex 1).

**Table 4.3 Occupations of Household Heads**

| Occupation | Farming H/Holds | | Non farming H/Holds | |
|---|---|---|---|---|
| | Number | Percentage | Number | Percentage |
| Casual | 12 | 17.1 | 4 | 13.3 |
| Informal / business | 26 | 37.1 | 7 | 23.3 |
| Formal employment | 23 | 32.9 | 19 | 63.4 |
| Home keeping | 9 | 12.9 | 0 | 0 |
| **TOTAL** | **70** | **100** | **30** | **100** |

*Source: Field survey, 2000*

### 4.2.6 Income

Income is perceived to be an important factor towards the practice of urban agriculture. From Table 4.4, household heads who earn a monthly income of less than 5000 account for 50 percent, those who earn between 5001 and 10,000 account for 22.9 percent while those who earn more than Ksh. 20,000 account for only 1.4 percent.

The Monthly income for the farming household heads ranged between Ksh 1,500 and 30,500 per month with an average of Ksh 7,400 while the monthly income for the non-farming household heads ranged between Ksh 1,500 and 25,000 per month with an average of Ksh 9,000.

A T-test for farming and non-farming household heads means income showed no significant difference at 0.05 level. Besides this finding, oral interviews with the farmers revealed that there is likelihood for those with low incomes to engage in the practice more than those with high incomes.

**Table 4.4 Income Levels of Household Heads (per month)**

| Income Bracket | Farming H/hold Heads | | None farming H/hold Heads | |
|---|---|---|---|---|
| | Number | Percentage | Number | Percentage |
| Less than 500 | 35 | 50 | 6 | 20 |
| 5001-10,000 | 16 | 22.9 | 14 | 46.6 |
| 10,001-15,000 | 14 | 20 | 6 | 20 |
| 15,001-20,000 | 4 | 5.7 | 2 | 6.7 |
| More than 20,000 | 1 | 1.4 | 2 | 6.7 |
| **TOTAL** | **70** | **100** | **30** | **100** |

*Source: Field survey, 2000.*

From the above analysis, the significant household characteristics between the farming and non-farming households include household size, education level of the household head, land ownership, and occupation of household head. The less significant include household gender, marital status and income.

### 4.3 Institutions

Both government and religious institutions practice urban agriculture in Machakos Municipality. Those sampled for this study included the following:

#### 4.3.1 Machakos Prison

The prison owns approximately 9 acres of land where they plant cereal crops such as maize and beans and horticultural crops such as *sukuma wiki*. The prisoners who work in the farms ensure that the crops yield properly. The produce consists of a substantial amount of the food consumed by the prison wardens and the prisoners. Any surplus is sold to other institutions such as schools. Information on the actual yields produced was not availed. The prison has a large unutilized land of 12 acres (Plate 1).

**Plate 1. Machakos prisons farm**

#### 4.3.2 The Redeemed Gospel Church

The church is concerned with poultry keeping. It has a large project with a project manager to ensure proper rearing of the poultry. The chicken are for sale within Machakos town hotels to earn the church some revenue to enable it achieve its evangelical mission.

### 4.3.3 Machakos Boys High School

This Institution is only concerned with Dairy farming. It keeps 10 grade cattle for milk production, which is consumed in the school. Expenditure on milk purchase was reduced to zero since the cows started producing. This has increased the dietary intake among the students. They are also used for training the agriculture classes.

## 4.4 Location of UA in Machakos

Agriculture in Machakos municipality is the dominant user of land covering about 450 square kilometers and can be described to be everywhere. This is so especially during the rainy seasons when almost every available space is used for production of maize (Plate 2). It is practiced less within the central business district and extensively within the peri-urban areas and the surrounding rural fringe of the municipality. This is due to the amount of open space available. From the study, an attempt to identify the location of farms within the peri-urban area showed that they are located in every available open space (Plate 3).

However, an attempt to categorize the location in relation to rivers, streams or roads revealed than 54.3 percent of the farms are far from rivers/ streams, 25.7 percent, along the roads and 20 percent of the farms are near rivers or streams (Table 4.5). About one percent of farms along the roads are on road reserves (Plate 4). The practice of UA in the area is determined by availability of open space and the availability of rainfall (Plate 5).

**Table 4.5 Locations of Farms**

| Location | No. of Farms | Percentage |
|---|---|---|
| Far from rivers/streams | 38 | 54.3 |
| Near rivers/steams | 14 | 20 |
| Along roads | 18 | 25.7 |
| **TOTAL** | **70** | **100** |

*Source: Field Survey, 2000*

**Plate 2. Maize Growing (The commonest crop)**

**Plate 3. A Farm along *Manza* Stream**

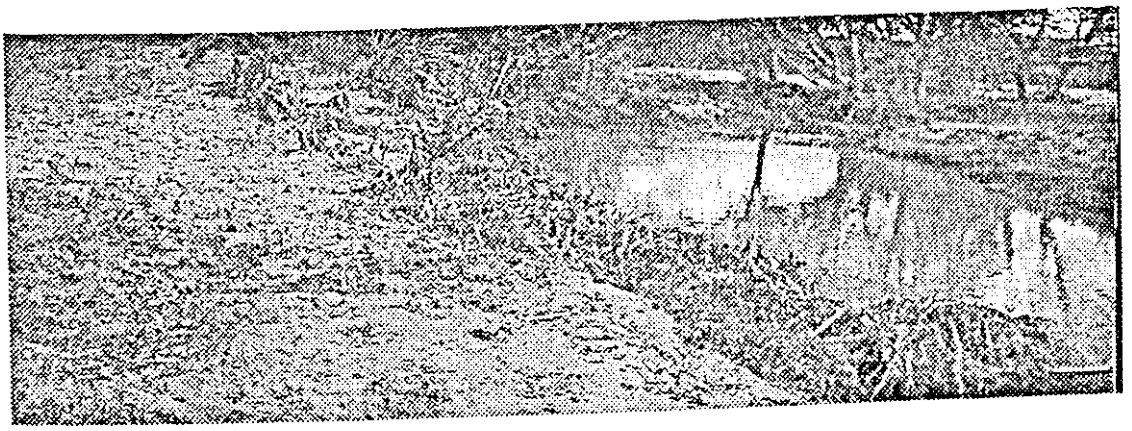


**Plate 4. Farming along Nairobi Road Reserve**

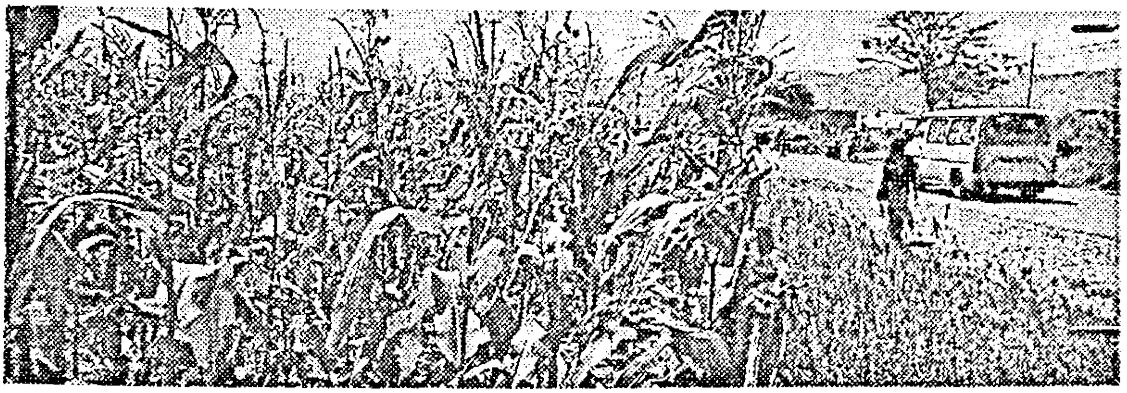
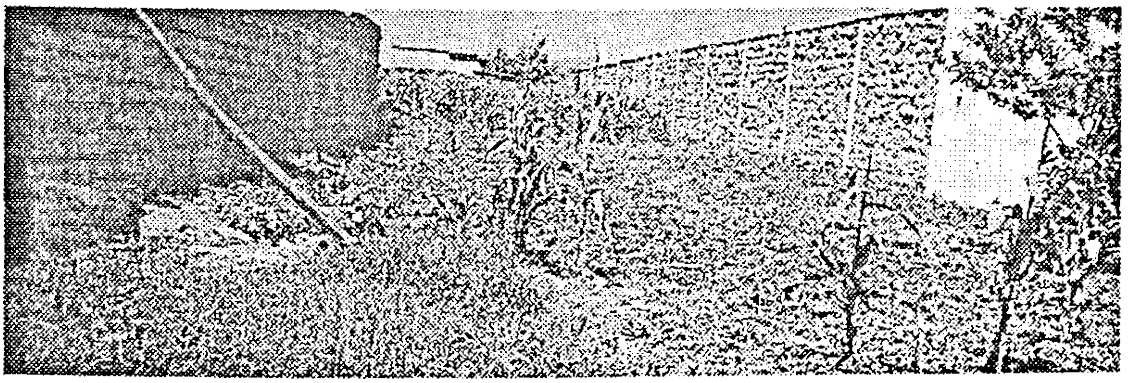


**Plate 5. Farming on an Undeveloped Plot**



### 4.5 Area Used for UA

In order to obtain data on the area used for urban agriculture, a question was included in the household questionnaire on the size of farmed land for both crop and livestock farming. Many of the farmers interviewed did not practice crop or animal husbandry separately. Form the study a total of 92.42 acres of land was under both crop and livestock farming for the 70 sampled households. This gives an average of 1.32 acres for each household. Approximately 200 square kilometers of the municipality is under farming which is equivalent of 20000 acres.

The farm sizes range between 0.00044 and 7.5 acres. One percent of the farmers farmed along road reserves, which consisted of those who did not have land and utilized every available open space. Table 4.6 shows the distribution of land sizes among the farming households.

**Table 4.6 Distributions of Land Sizes among Farming Households**

| Farm/Plot Size (Acres) | No. of Households | Percentage |
|---|---|---|
| Less than 2 acres | 58 | 82.9 |
| 2.1- 4 acres | 10 | 14.3 |
| 4.1- 6 acres | 1 | 1.4 |
| 6- 8 acres | 1 | 1.4 |
| **TOTAL** | **70** | **100** |

*Source, Field Survey, 2000*

From the study, majority of the household (82.9 percent) farm on less than 2 acres. For the non-farming households, 30 percent owned less than one acre while the remaining 70 percent did not own the land they were residing on.

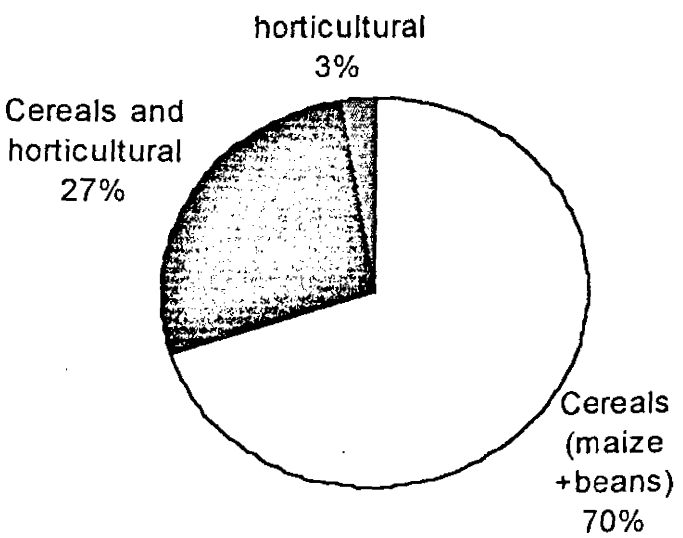
The average land size occupied by the non-farming households was 0.25 Acres. This gives an indication than there might be high subdivision rates due to population pressure or resulting form the encroaching urbanization process.

## 4.6 Type of Farming Activities

### 4.6.1 Crop Production

Although urban agriculture in Machakos municipality constitutes both crop and livestock farming, crop farming is the commonest. Crop farming was analysed in categories of cereals and horticultural crops. It was found that 70 percent of the urban farmers grew cereals only, 27.1 percent combined cereal and horticultural crops only and the remaining 2.9 percent grew horticultural crops (Figure 4.3). The amount produced differed significantly. About 72.9 percent of the households produced between 15 kilogrammes and 90 kilogrammes of maize per season, 21.4 percent produced between 190 Kgs and 720 Kgs and 5.7 percent did not produce cereal crops. It was not possible to obtain yields for horticultural crops as harvesting is done continuously and soled or consumed by the households.

**Fig.4.3 Types of crops grown**




*Source: Field survey, 2000*

### 4.6.1.1 Crop Husbandry

The study established that several inputs were applied by the farmers, which range from chemical fertilizers to urban waste. Table 4.7 shows the different percentages of urban farmers in terms of the inputs they use. Labour is analyzed separately due to the different dimension it takes.

**Table 4.7 Types of Inputs Applied**

| Input Type | No. of Urban Farmers | Percentage |
|---|---|---|
| Chemical fertilizer | 5 | 7.1 |
| Farm yard Manure | 20 | 28.7 |
| Manure and chemical fertilizer | 29 | 41.4 |
| Urban waste | 5 | 7.1 |
| Manure, chemical fertilizer and urban waste | 7 | 10 |
| None | 4 | 5.7 |
| **Total** | **70** | **100** |

*Source: Field survey, 2000*

From Table 4.7, majority (41.4 percent) of the farmers use a combination of Farm Yard Manure (F.Y. M) (Plate 6) and chemical fertilizes. Those farmers who did not use any input are the ones who had either rented their farms or whose farm/plot sizes where too small and comprised 5.7 percent of the farming households.

It was found out that the chemical fertilizer is sourced from Machakos town, while Farm Yard Manure was obtained either at household level (for those who had livestock) or from the neighbours.

**Plate 6. Cattle Kraal and Farm Yard Manure**

### 4.6.1.2 Labour

Labour as input was analyzed separately since it a major input in urban farming. The attempt was to find out the number, gender and source of labour for both crop and livestock husbandry. The sources were grouped into 5 categories to establish the source. The analysis showed that 60 percent of the labour was provided for by the farming families themselves (due to their large numbers) and 14 percent accounted for occasional casuals together with family labour. About 24.3 percent of the farmers obtained their labour from the rural areas and 12.9 percent from within the peri-urban area.

The remaining 1.4 percent obtained their labour from the town (Table 4.8). The families who hired labour were those, whose members had moved to other areas/towns in search of employment or education. The total number of hired labour was 35 among 50 farming households that give an average of one labourer per household

households that give an average of one labourer per household. Out of the 35 labourers, only one was a woman.

**Table 4.8 Sources of Labour**

| Source | No. of Households | Percentage |
|---|---|---|
| Family | 42 | 60 |
| Family plus occasional casuals | 1 | 1.4 |
| Rural areas | 17 | 21.3 |
| Town | 1 | 1.4 |
| Peri- urban areas | 9 | 12.9 |
| **TOTAL** | **70** | **100** |

*Source: Field survey, 2000*

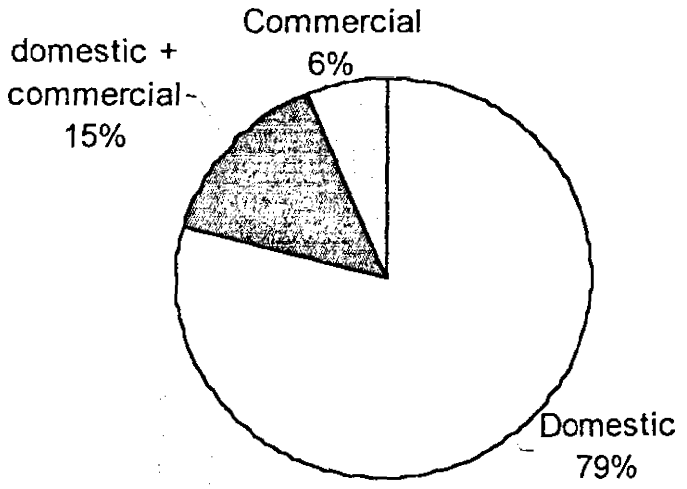
### 4.61.3 Uses of Crop Produce

Different farmers produce for diverse reasons. The reasons are many and this study grouped them into three broad categories that included subsistence, commercial and both subsistence and commercial purposes. From the study, 74.3 percent of the sampled farmers produce crops for household consumption, 5.7 percent for commercial and 14 percent for both household consumption and sale of the surplus (Figure 4.4). This shows that crop farming is not done mainly for economic gain but arises from food demand by the households.

For those who practice crop farming for both subsistence and commercial purpose, they sell part of the produce to get some cash for use in purchase of other household items.

However, all the households had a consensus that urban farming enables then to save some money from other sources which enables then undertake other activities such as construction of houses and payment of school fees. The role of UA is discussed in detail later in this study.

**Fig. 4.4 Uses of Crop Produce**

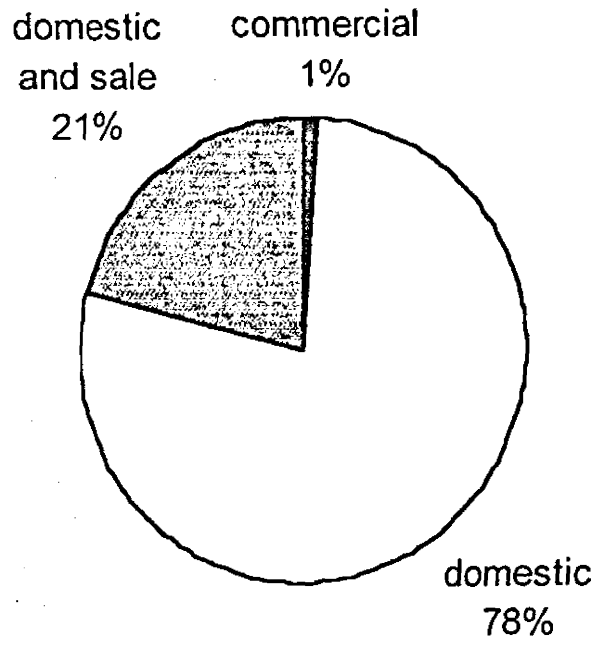



*Source: Field survey, 2000*

### 4.6.2 Livestock Production

Livestock production in this study is discussed separately for convenience since the practice is fully integrated to crop production. Out of the 70 farming households sampled, 31.4 percent did not keep any form of livestock due to small parcels of land/plot. Though the remaining 68.6 percent kept some form of livestock, only 1 percent kept it purely for commercial purpose (Plate 7). The rest of the households kept livestock as pets but at the same providing some form of dietary in take such as milk, eggs, and meat (Fig 4.5). Livestock is also kept for production of farmyard manure that is used as an input in crop farming (Plate 8).

**Fig 4.5- Uses of Livestock Products**




***Source: Field survey, 2000***

For the different types of livestock kept, Table 4.9 shows that 20 percent of the households kept cattle, 10 percent kept goats, 14.3 percent kept poultry only and 24.3 percent kept mainly both goats, cattle and poultry 14.3 kept poultry only.

**Table 4.9 Livestock Kept**

| Type | No. of Households | Percentage |
|---|---|---|
| Cattle | 14 | 20 |
| Goats | 7 | 10 |
| Poultry | 10 | 14.3 |
| Goats, cattle and poultry | 17 | 24.3 |
| None | 22 | 31.4 |
| **TOTAL** | **70** | **100** |

*Source: Field survey 2000*

Most households (24.3 percent) keep mixed livestock as a risk taker such that if one type of livestock is wiped by natural calamities such as disease the others remain.

**Plate 7. Exotic Cattle Breeds for Dairy Farming**

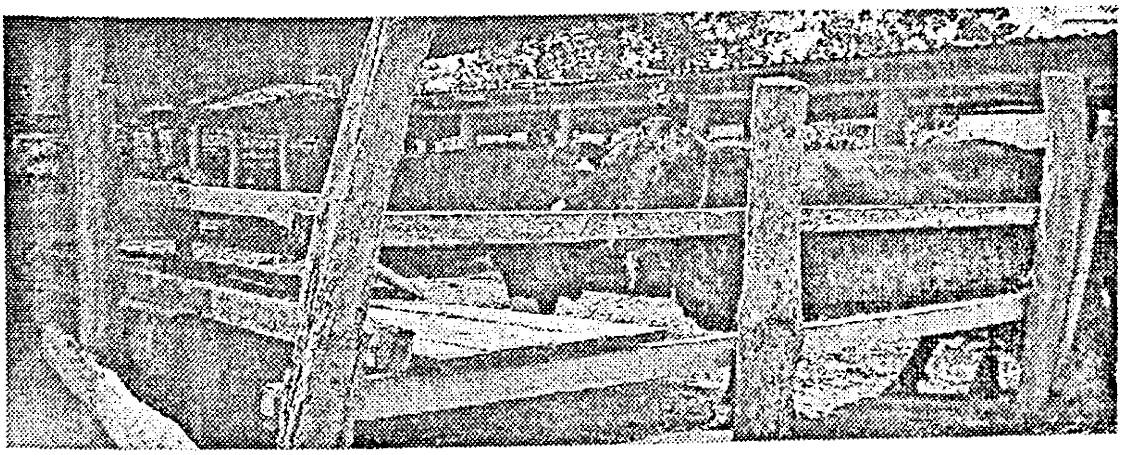
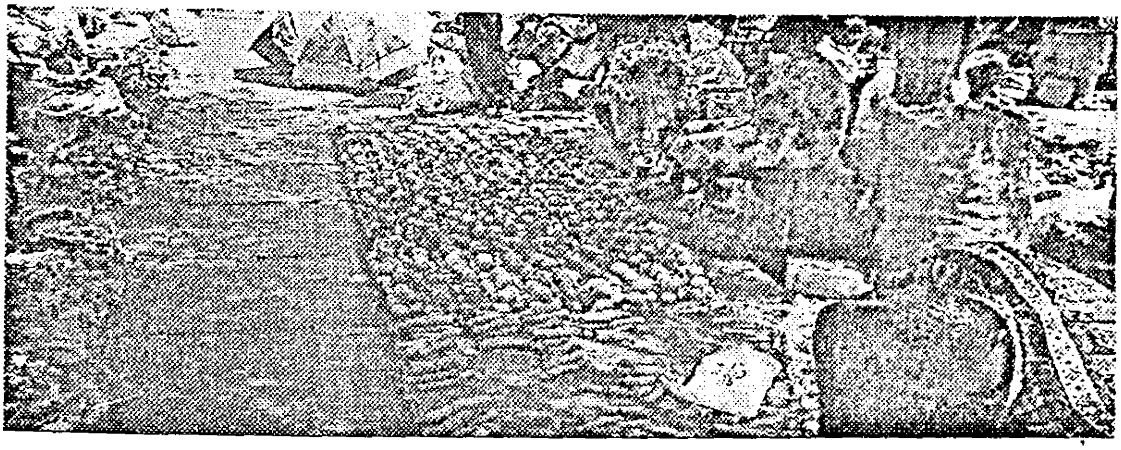


**Plate 8. Horticultural Crops Produced Through Application of F.Y.M**



### 4.6.2.1 Livestock Inputs

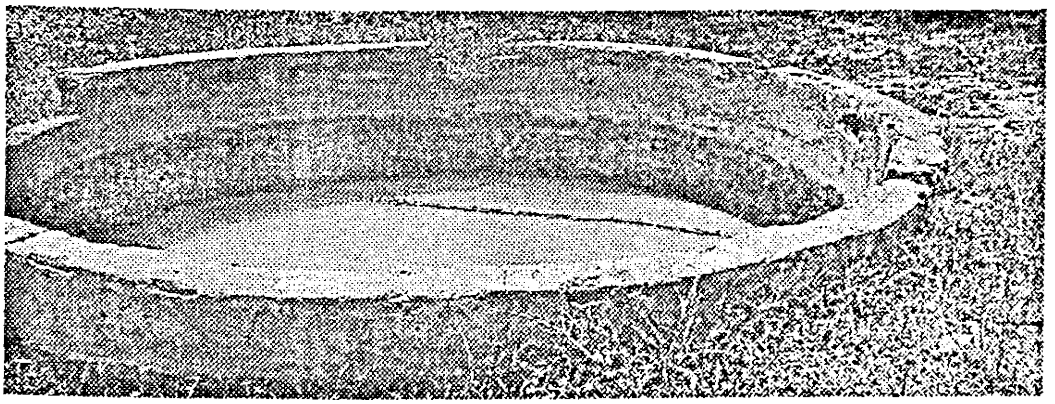
For livestock inputs, the dry maize stalks were mostly used. Napier grass is planted along terraces to act as both a soil conservation measure and a source of food for the livestock (Plate 9). Open grazing is also common along the road reserves and uncultivated open spaces. Drugs are bought from Machakos town and labour used is the same as that for the crop production. Zero grazing and tethering is widely practiced for both indigenous and improved cattle breeds due to diminishing land size and pressure from other encroaching land users.

**Plate 9. Napier grass used for livestock feeding**

### 4.7 Farming calendar

Agriculture is an activity that is determined largely by climatic conditions of an area. This has an effect on the seasonality of farming in that areas with reliable rains perform better agriculturally than others. This might also be affected by other factors such as the legal provisions that can influence when people undertake their farming activities. This study divided the farming calendar into two broad categories for crop farming, those who carry out crop farming continuously and those who carry it out seasonally. Some farmers who practice horticultural farming normally dig their own wells (Plate 10).

**Plate 10. A Well used for irrigation**



From the sample of farming households, 27.1 percent carry out crop farming activities throughout the year (continuously) while the remaining 72.9 percent do it seasonally when rains are available since their farms are not near streams or rivers where irrigation can be done. This means that agriculture within Machakos Municipality is mostly rain fed due to the limited access of water.

## 4.8 Factors that Encourage Urban Agriculture in Machakos Municipality.

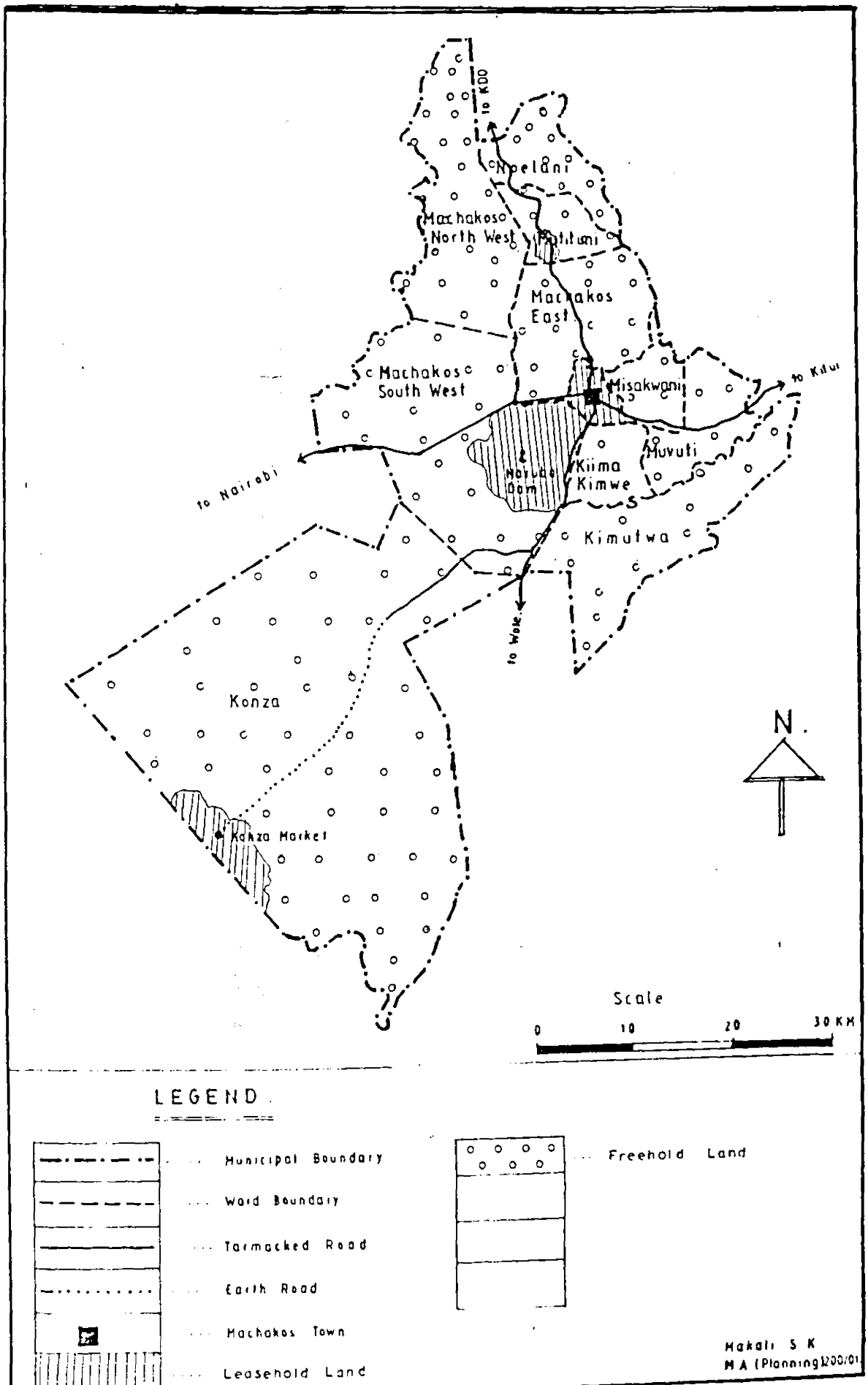
### 4.8.1 Land Tenure and Ownership

This is one of the most important factors that influence agriculture since it determines the level of investment in farming due to the rights one has over land. Effective control by the municipal council over any land within its area of jurisdiction will depend on tenure. From the study of a 100 households (farming and non farming) sampled, 90 percent occupied freehold land, 6 percent, government land and 4 percent trust / council land as shown in and Figure 4.5.0 and Table 4.10.

Although much of the land is under freehold, it does not mean it should not be subjected to planning regulations as stipulated in the Physical planning Act. However, the socio cultural and economic activities should be given due consideration.

The presence of agriculture within the municipality depicts the inability of the council to control the use of private land. Control of agriculture has not been possible because the Physical planning Act enacted in 1996 contradicts previous legislations such as the Registration of Titles Act Cap 281 section 23 (1) which states that once a proprietor has been issued with a certificate of Title by the registrar, that title shall be taken by the courts as conclusive evidence that the person named in as proprietor of land is the absolute and indefeasible owner. The owner has a right to use the land for the purpose it is registered which for the case of the owners in the peri urban is agricultural. In addition, the Registered Land Act Cap 300 section (4) states that except otherwise

Fig.4.5.0: Machakos Municipality: Land Tenure.



provided by the Act, no other written law and no procedure relating to land shall apply to land registered under the Act so far as it is inconsistent with the Act. The Physical Planning Act does not recognize these Acts and this has created conflict making it hard to implement it. It does not recognize the rights of the landowners despite the fact that other laws that give power to the landowners who practice agriculture within legal provisions preceded it.

**Table 4.10 Land Tenure Among Households**

| Tenure | Farming | | Non farming | |
|---|---|---|---|---|
| | Number | Percentage | Number | Percentage |
| Freehold /private | 63 | 90 | 27 | 90 |
| Government | 5 | 7.1 | 1 | 3.3 |
| Trust / council | 2 | 2.9 | 2 | 6.7 |
| **TOTAL** | **70** | **100** | **30** | **100** |

*Source:Field survey, 2000*

**Table 4.11 Land Ownership Among Households**

| Ownership | Farming H/Holds | | Non Farming H/Holds | |
|---|---|---|---|---|
| | Number | Percentage | Number | Percentage |
| Own | 58 | 82.9 | 7 | 23.3 |
| Rented | 6 | 8.6 | 20 | 66.7 |
| Council land | 2 | 2.8 | 2 | 6.7 |
| Government land | 4 | 5.7 | 1 | 3.3 |
| **TOTAL** | **70** | **100** | **30** | **100** |

*Source: Field survey, 2000*

In terms of land ownership, Table 4.11 shows that majority (66.7) of the non-farming households had rented the land /space they had occupied compared to 8.6 percent for the farming households. Only 23.3 percent of the non-farming households owned land compared to 82.9 percent of the farming households. A T- test for sample proportions showed a significant difference in land ownership between farming and non-farming households at 0.05 level. (Annex 1).

In terms of how the land was acquired, 8 percent of the households had bought, 61 percent inherited from their forefathers, 26 percent rented and only 5 percent had been allocated government land. This mode of acquiring land explains a significant factor in the practice of UA in Machakos municipality in that many household inherited land and continued to carry out the activities which their fore fathers carried on it and feel culturally attached to the land and therefore cannot understand why they should not farm on it as that is something they have been doing since time immemorial. For the non-farming households, only 23.3 percent had bought land. About 67 percent had rented the land and this may explain partially why they did not farm.

### 4.8.2 Land Size and Availability of Open Space

Land size has an influence on agriculture in that the larger the land, the more likely that people will farm on it as much of it will be open space (Plate 13). The study established that under the area of study, land size ranged between 0.00044 and 7.5 acres with 82.9 percent of the households lying within the range of 0.00044 and 2 acres, 15.7 percent between 2.001 - 4 acres and only 1.4 percent of the households owned land within the range of 6-8 Acres.

The land size within the study area is influenced by the mode of acquiring it. About 61 percent of the sampled households inherited land from their forefathers. Those who had access to larger parcels of land were able to diversify their agricultural activities by growing crops and keeping livestock. Land size within the study area varied by distance from Machakos town CBD. A regression of land size and distance from the CBD produced the equation Y= 1.168+0.024d, meaning that for any increase of one kilometer from the CBD there was an accompanying increase of 0.024 acres in land size. The regression produced a correlation coefficient (r) of 0.24 and an r square of 0.06.

Those with smaller sizes of land within the peri-urban area have intensified agriculture so as to get better yields or practice only kitchen gardening. Despite small land sizes at individual level, much of the peri-urban area is open and is green during rainy seasons covered by crops. This is as a result of only a small part that is less than 3 square kilometers covered by the Central Business District compared to 519 square kilometers covered by the whole municipality. The presence of the open space is indeed a catalyst for the residents to practice agriculture where the municipal authorities do not interfere with it.

A further decline of plot /land sizes within the municipality is reflected by the high sub-division rates of 1999 - 2000 shown in Table 4.11.

**Table 4.12 Land Subdivision Between 1999 –2000**

| Year / Ward | 1999 | 2000 | TOTAL |
|---|---|---|---|
| College | 25 | 14 | 39 |
| Machakos East | 45 | 17 | 63 |
| Madaraka | 14 | 7 | 21 |
| Kiima Kimwe | 16 | 11 | 27 |
| Machakos S. West | 43 | 19 | 62 |
| **TOTAL** | **144** | **68** | **212** |

*Source: Physical planning office, Machakos 2001.*

Though there seems to be a decline in the subdivisions done in the year 2000, this is only in official documentation.

A ground survey revealed that there are more informal subdivisions than these figures indicate. This is attributed to the inception of the physical Planning Act No. 6 of 1996 where, a certain fee has to be paid for any sub division in all the offices concerned with subdivision schemes such as the Physical planning office, Municipal council, the lands office, Survey office and the Land registrar's office. As a result a lot of illegal subdivisions have taken place.

### 4.8.3 Distance From Machakos Town Central Business District (CBD)

Farm sizes as expected vary with distance from the CBD in Machakos town in the sense that the further one moves outwards, the larger the farm sizes become. This means there is more space and therefore the residents utilize it for farming activities (Figure 4.6). Land size is seen to be a

function of distance from the CBD. A regression for land size and distance from CBD produced an a correlation coefficient (r) of 0.24 and an $r^2$ of 0.06. The analysis showed that there is a significant relationship between distance and land size at 0.05 significance level (Annex 1).

The regression produced a positive relationship as show by the equation Y = 1.168 + 0.024d. (Figure 4.7) where Y represents land size and d represents distance. This means that, for every one-kilometer increase in distance from the CBD, there is a corresponding increase of 0.024 acres in land size.

However, distance accounts for only 6 percent of the change in land size. The remaining 94 percent is explained for by other factors such as mode of inheritance and years of urban residence. This positive relationship does not however apply to all the five wards, which were included in the sample. It was only in College ward and Machakos S. West ward where a positive relationship between distance and land size. For Machakos East, Kiima Kimwe, and Madaraka Ward, the relationship was negative as shown by the following equations.

| | |
|---|---|
| College ward | Y= 0.525 + 0.417d |
| Machakos S. West | Y=1.13 + 0.122d |
| Machakos East | Y=2.395 - 0.356d |
| Kiima Kimwe | Y=0.83 - 0.376d |
| Madaraka | Y=1.32 - 0.079d |

This may be attributed to the fact that the study only covered a short radius of 3-5 Kms within the peri- urban area as it did not run a transect from the CBD to the purely rural area. The distance covered by the study could not give a good indication of the influence of distance on land size in some wards as expected.

Distance from the CBD therefore accounts for change in land size differently in the sampled wards as shown in Table 4.13.

**Table 4.13 Percentage Accounted by Distance From CBD**

| Ward | R | $R^2$ | % Accounted | Probability |
|---|---|---|---|---|
| Madaraka | 0.79 | 0.62 | 62 | 0.787 |
| College | 0.417 | 0.174 | 17.4 | 0.138 |
| Kiima kimwe | 0.376 | 0.141 | 14.1 | 0.186 |
| Machakos East | 0.356 | 0.126 | 12.6 | 0.212 |
| Machakos S.W. | 0.122 | 0.15 | 15 | 0.678 |

*Source: Field survey, 2000*

From Table 4.13 land size varies greatly with distance in Madaraka, College and Machakos South West wards accounting 62 percent, 17 percent and 15 percent respectively.

Provision of infrastructure facilities also declines with an increase in distance from the CBD. There are few infrastructure facilities in the outlaying areas, hence residents engage in more agricultural activities.

Fig.4.6: Relationship Between Distance (Kms) From CBD and Land Size (Acres).

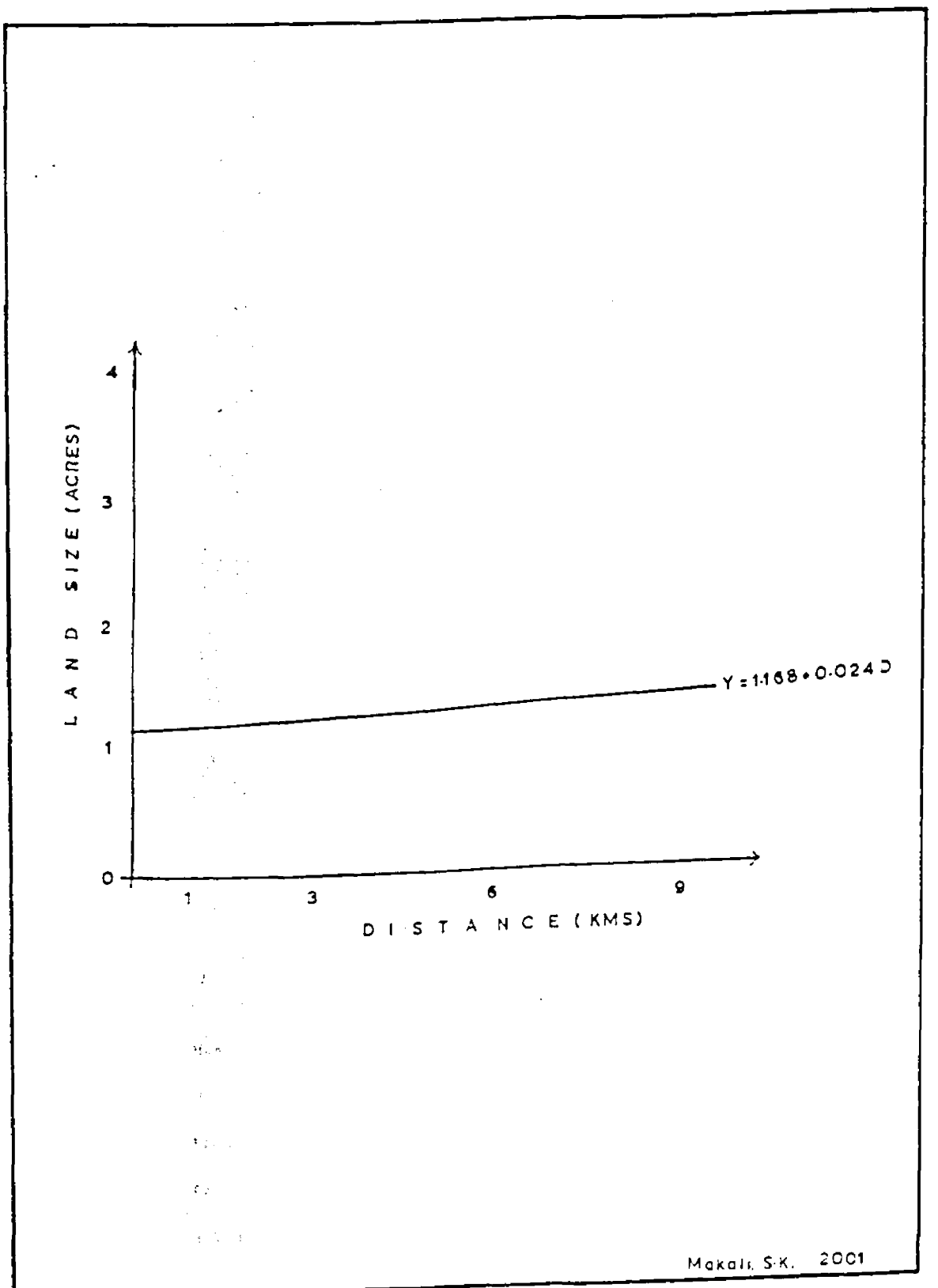


**Fig.4.7: Distribution of Farm Size in Machakos.**

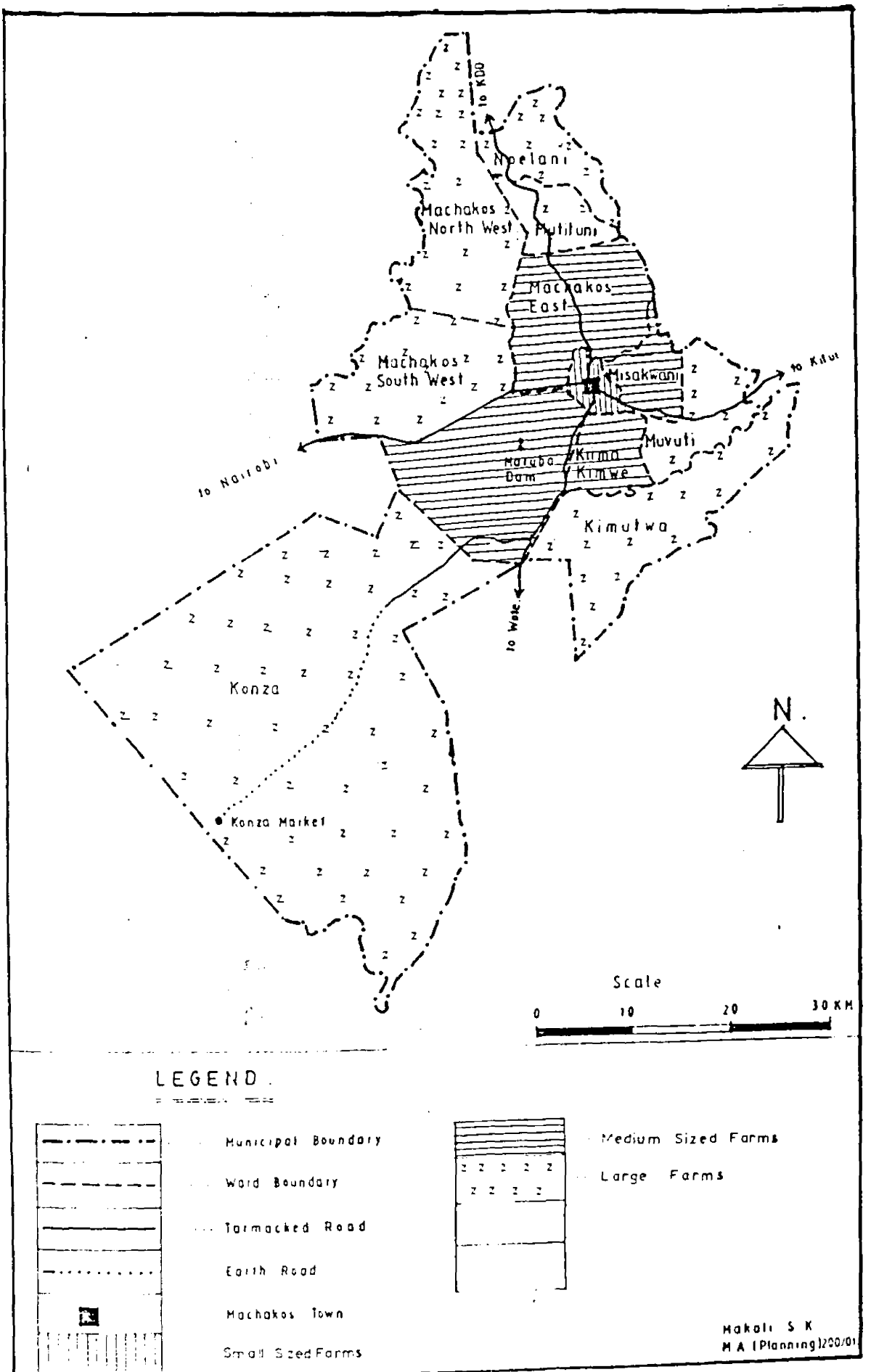
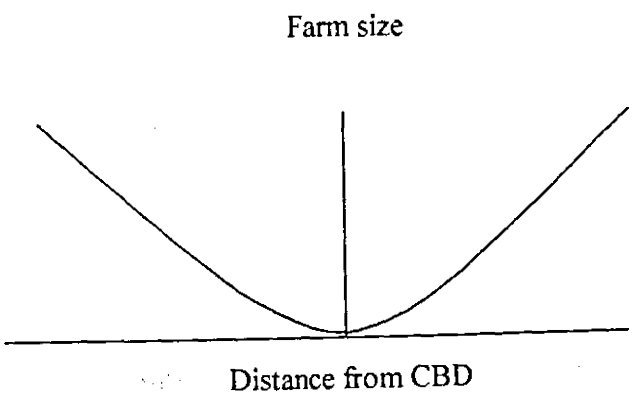


Figure 4.8 illustrates how farm size varies with distance from CBD

**Fig 4.8 Model of Increase in Farm Size with Distance**




### 4.8.4 Years of Urban Residence

The length of stay in an area can determine the type and level of activity one can engage in. The length of stay in Machakos town for the urban farmers ranged between less than one year and 64 years. The mean years of stay were 23 years. The farmers who had stayed for many years were those who inherited land from their forefathers and argued that they started farming since time immemorial.

To them, farming is part of them and they cannot understand how they can survive without it despite the fact that the build up town is almost catching up with them. One old man (mzee) in exclamation asked the researcher, *"Twieka Kuima tuthi va?"* (Where do we go if we stop farming?) The length of stay for the non-farmers within the municipality ranged for less than one year to 42 years. The mean years of stay was 8 years (Table 4.14).

A T-test for sample proportions of the farming and non-farming households who had lived for more than 30 years in the peri urban area produced a t-statistic of 4.78, which is greater than the

critical t- value of 1.96. Therefore, there is a significant difference between the farming and non-farming households who had lived for more than 30 years in the peri urban area at 0.05 significance level (Annex 1).

**Table 4.14 Years of Urban Residence of Household Head**

| Years | Farming | | Non-Farming | |
|---|---|---|---|---|
| | Number | Percentage | Number | Percentage |
| <1-30 | 40 | 57.1 | 28 | 93.3 |
| 31-60 | 29 | 41.4 | 2 | 6.7 |
| Over 60 | 1 | 1.5 | 0 | 0 |
| **TOTAL** | **70** | **100** | **30** | **100** |

*Sourcse: Field survey, 2000*

From table 4.14, the largest percentage (93.3) of the non-farming households had lived within the municipality for less than 30 years compared to 57.1 percent of the same for the farming household heads. A substantial number (41.4 percent) of the farming household heads had lived within the area for years ranging between 30 and 60. This may be attributed to the fact that they are the traditional landowners who fell under the municipality because of gazettment of the area to fall under the municipality.

### 4.8.5 Lack of Infrastructure Facilities

Since the elevation of Machakos town to a municipal status in 1980, very few infrastructure facilities have been put. Facilities such as improved roads, piped water, and sewerage system are only confined within the built up area which covers less than three kilometers square. As a result much of the municipality's area still lacks infrastructure facilities and remain rural in character.

This has resulted in dominance of agricultural activities as the residents have not experienced and noted any changes which reflect that their areas have fallen under a municipality and thus have become part of the town. There are no services rendered by the municipal council. This therefore means that there is nothing that can motivate the residents to change the user of land from agriculture to other urban uses.

### 4.8.6 Unawareness of Planning Law and By-Laws.

Crop farming and livestock rearing is illegal in Machakos municipality as per the General nuisance by-laws of the council, the Public Health Act cap 242 and the Physical Planning Act No. 6 of 1996. Out of all 100 households (farming and non-farming) interviewed, only 2 percent were aware of the existence of such laws. The remaining 98 percent were unaware of such planning law and by- laws. Indeed, the 2 percent consisted of a Magistrate and a former Mayor to the Machakos Municipal council. Both of them kept grade cattle within their residential areas for milk production for sale.This is discussed in detail in chapter six.

**Table 4.15 Number of Households Aware of Planning Law and By-laws**

| Awareness | Farming | | Non-Farming | |
|---|---|---|---|---|
| | Number | Percentage | Number | Percentage |
| Aware | 2 | 2.9 | 0 | 0 |
| Not aware | 68 | 97.1 | 30 | 100 |
| **TOTAL** | **70** | **100** | **30** | **100** |

*Source: Field survey, 2000.*

### 4.8.7 Lack of Enforcement of Planning Law and By-Laws

Machakos Municipality council does not react nor proact to farming activities within its area of jurisdiction. It is largely passive to farming activities. Out of the 70-farming households sampled, none had faced any restrictions or harassment on farming from the municipal authority. They all responded that the council took a very low profile and was silent on farming activities within the municipality. They expressed the feeling that the council was only effective in control of buildings and rowdy *matatus.(Public Service Vehicles)*

This therefore shows that the council in a way abets farming.This contravenes the municipality's General nuisance By-laws and physical planning Act which empowers the local authority to control the use of land be it private, government or trust land within it's area of jurisdiction. This is also discussed in detail in chapter six.

### 4.8.8 Lack of Zoning Regulations

Machakos municipality does not have an approved physical development plan which should guide its development. The local authority at the same time does not have zoning regulations, which could enable it, delineate certain areas for specific use and thus form a basis for development control. This is discussed in detail in chapter six.

### 4.8.9 House hold Size

Large families are likely to undertake farming to supplement food supply. When a comparison of the average household sizes among the farming and non-farming households for the study was done, it was found out that the farming households had a higher average size of 6 members

compared to 4 members among the non farming. A means T-test showed that there is a significant difference between the means household size of the farmers and non-farmers at 0.05 level (Annex 1).

### 4.8.9 Income of Household Head

From the study, there was a great disparity between the low and the highest income bracket among the sampled household heads. This ranged between Ksh. 1500 -30,500 per month. Research has shown that low-income households engage in urban farming more than the high income for domestic food supply. This study confirms the above findings. A T-test for difference in sample proportions showed that there is a significant difference between farming and non farming household heads earning less than Ksh. 5000 per month (Annex 1).

### 4.8.11 Education Level of Household Head

A comparison of the highest education level for the household heads revealed that while 33 percent of the non-farming household heads had attained post secondary education only 7 percent of the farming household heads had attained post secondary education. Majority of the farming household heads (54 and 36 percent) had attained only secondary and primary education level respectively. This therefore suggests that there is likelihood for those who have attained primary and secondary education to farm than those who attained post secondary education.

# 5.0 CHAPTER FIVE: THE ROLE OF URBAN AGRICULTURE IN MACHAKOS MUNICIPALITY

## 5.1 Introduction

This chapter examines the role played by urban agriculture in Machakos municipality. The practice of UA in the municipality has significant economic, social, physical and environmental effects as discussed below:

## 5.2 Source of Food

From the analysis, UA is done mainly to provide food to households in Machakos municipality. About 74 percent of the farming households interviewed responded that UA is mainly done for subsistence purpose. The food crops range from cereal crops such as maize and beans to horticultural crops such as tomatoes and sukumawiki (*kales*). In terms of yields for the cereal crops (maize) 73 percent of the farming household produced within the range of 15 Kgs to 90 kgs per season and 21 percent produced between 180 Kgs and 720 Kgs.

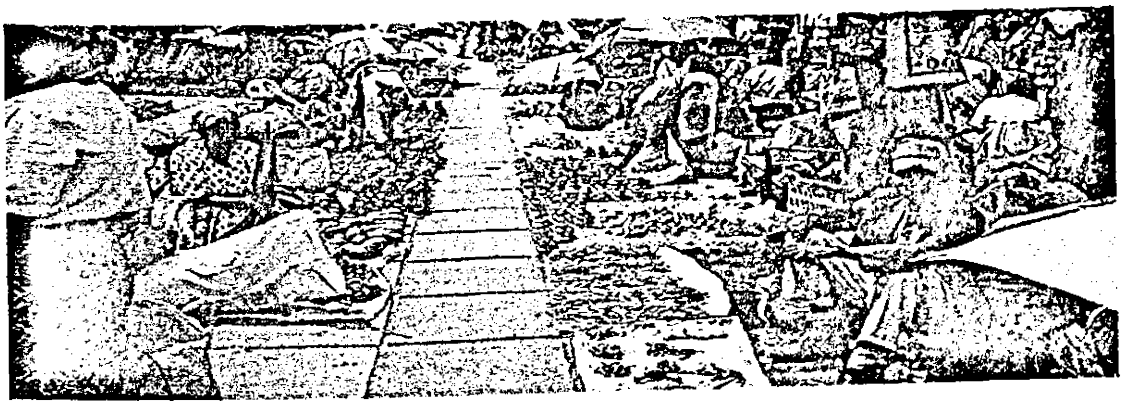
The remaining 6 percent of the households did not produce cereal crops. However it is important to note that those who produce higher yields are the households with higher acreage of land. The produce enables the households to save approximately 50 percent of their income spent food expenditure. The percentage of income saved is then invested in other household goods and welfare activities.

About 70 percent of the farming households said that that the produce from cereal crops was consumed for not less than six months. For those who had access to water source, vegetable

growing was done throughout the year. At the same time Machakos town relies heavily on the peri urban area for the supply of cereals, horticultural products and other food crops (Plate 11).

Out of 20 traders interviewed in the municipal market dealing with agricultural produce, 40 percent of those dealing with green maize said they obtained it within the peri urban area. About 80 percent of those dealing with green vegetables and other horticultural produce such as fruits and tomatoes obtained them from the peri urban area.

**Plate 11 Agricultural Produce Sold in the Municipal Market**



### 5.3 Source of Income

From the analysis, 20 percent of the farming households practice UA to diversify their incomes. This includes households whose head is engaged in other occupations. Sale is mainly for horticultural crops such as bananas, tomatoes and *sukuma wiki* (Kales) and cash crops such as coffee.

The women mainly do marketing of the horticultural produce during the afternoons either in Machakos Municipal market or locally from the farms. Those who were interviewed expressed

the view that the extra coins earned enable them to buy other household goods and clothes for their children. This also makes it possible for them to pay school fees and other levies without much difficulty.

Out of the 70 farming households sampled, about 6 percent practiced UA for commercial purposes. These were the households who mainly dealt with poultry keeping or dairy farming. They argued that the practice is profitable. For example, one farmer who only bred chicken for egg production supplies Garden hotel (a three star hotel in Machakos Town) with 5 crates per week that earns him 1000 shillings.

Another farmer who kept 5 dairy cattle for milk production said that he supplies Machakos Town hotels with milk that earns him Ksh 30,500 per month. This is an indication of how the practice might be profitable if well managed due to the availability of a ready market.

For those who practice agriculture for both subsistence and commercial purpose, quantification of the amount they earn from crop or animal product sales was impossible as they said that they sold on demand. Those who kept indigenous livestock breeds said that they supply milk to their neighbours who pay on monthly basis to the tune of Ksh. 20 per litre. Selling of animal by-products such as Farm Yard Manure (FYM) also earns them some income (Kshs.150 per one oxen drawn cart).

## 5.4 Employment Creation

This is one of the most important contributions of UA in Machakos Municipality in particular and Kenya in general. This is because the country has limited job opportunities and at the same time the economy is performing poorly to promise anything good in the near future.

UA offers employment opportunities. Out of the 70 farming households sampled, 25 households employed 35 people whose pay ranged from Kshs.1500 to 3000 per month. The number of employees per household ranged between 1 and 4. Those employed came from the rural, peri urban areas and from the built up urban area. About 24 percent of the employees came from the rural areas within the municipality and also from far places such as Makueni and Kitui Districts, 12.7 percent from the peri-urban areas and 1.4 percent came from the built up town. This therefore provides an important rural urban linkage in terms of remittance of the earnings these people receive to their respective origins.

Employment opportunities are also generated from the practice of UA in the sense that people start agro-vet stores in Machakos town in order to sell inputs to the farmers. They then employ people who were unemployed initially while at the same time earning the proprietors some profits. The need to transport the inputs and the agricultural produce also generates employment for drivers and other people. This shows that UA has considerable multiplier effect in terms of income and employment.

### 5.5 Strengthening Social Ties

From the study, it was found out that UA in Machakos municipality plays a role in enhancing social ties important for a society's growth in the sense that out of the 70 farming households sampled, only 44.3 percent kept cattle which can produce enough farmyard manure which is an important input for crops. As a result, the other farmers have established a mutual agreement with those who have cattle whereby the crop farmers exchange the dry maize stalks in return for farmyard manure during farm/plot preparation. The exchange of the solid organic waste (maize stalks and manure) helps in recycling the waste thus maintaining the environment in that if the waste is left to accumulate, it will pollute the land and water bodies when washed away by water. The accumulated cow dung would pollute the air due the bad odour. Pollution by the solid organic may not be understood wholly due to the availability of expansive land in small and medium municipalities and therefore the important role played by urban agriculture in absorbing the waste may not be appreciated.

This is not a monetary exchange but rather based on barter. In addition, during the weeding and harvesting season for crops, women form groups to assist one another. It is during such occasions when social ties are strengthened since the people will identify themselves with those particular groups.

### 5.6 Soil Conservation

The practice of UA within Machakos Municipality contributes significantly to conserving soil and maintaining the environment. Out of 70 farming households sampled, 58.6 percent undertook some form of soil conservation measures which ranged from manure application.

bench terracing, trench digging, planting napier grass, trash lines (Plate 12) and practicing agro forestry. This is in line with the environmental conservation measures undertaken all over the world as no meaningful development can take place without environmental conservation. About 41 percent of the households said that they did not undertake any form of soil conservation measures. These were mainly those who had rented the farms /plots and those who had very small parcels of land.

A close observation of the farm /plot parcels however revealed that they undertook soil conservation measures unconsciously through cover cropping and crop rotation. All these measures have enhanced the environment within the municipality.

**Plate 12. Soil Conservation Through Terracing and Planting of Napier Grass**

### 5.7 Utilization of Urban Waste

Urban agriculture in Machakos municipality has turned urban solid waste into a resource. This is mainly the organic waste from solids that are disposed at a certain points within the satellite centres of Machakos town, the sludge and wastewater from the sewage ponds (Plate 13).

From the analysis, about 18 percent of the sampled farming households utilized decomposed organic urban waste as an input for crops. They were mainly based near the satellite centres such as *Kenya israel, Valentine, and Kimutwa* where collection of solid waste by the municipal council is not undertaken (Plate 14).

**Plate 13. Sewerage Pond (The Seepage of Water Supports Growth of Maize and other Crops Within the Neighbourhood)**

**Plate 14. Urban Organic Waste Transported to a Farm**

This has assisted in cleaning the environment especially by utilizing the accumulated organic waste and reducing the effect of the waste on air pollution. If this waste is left to accumulate it would become an environmental hazard. The disposal of the wastewater is done at household level within the peri-urban area where it is disposed to kitchen gardens. This reduces the effect of accumulation and subsequent air pollution.

**5.8 Greening Effect**

Machakos town is a member of the "Green Towns" movement as evidenced by a sign at the entrance of the Municipal town hall. However, the greening of the town can largely attributed to the efforts of the local residents through the practice of agro forestry and planting fruit crops such as avocadoes and mangoes. These form green belts, which are a replica of Ebenezer Howards' Garden city. Greening is at its climax during the rainy seasons when every available open space within the peri-urban area including the road reserves are full of green maize that appeals to the eyes.

A comparison of the farmed and the unkempt lots, the idle lands appears ugly. UA also creates green belts around the satellite centres and Machakos Town Central Business District. This is necessary for moderating the microclimate of the area and cleaning the air since the green vegetation acts as carbon sink. During the dry spell, the fruit trees, the cash crops (coffee) and the agro forestry trees maintain the greening effect. It is only when perceived from this point of view that Machakos Town can be regarded as a green town.

### 5.9 Rural-Urban Linkages

Agriculture has important rural urban linkages. This is through the flow of both farming inputs and output (produce) from the practice that promotes the overall development of the region and balanced urban rural growth. Agriculture practiced in the peri urban areas serves as an appropriate example of explaining the rural urban linkage. From the study, agriculture had created economic, social and environmental linkages.

### 5.10.1 Economic linkages

In economic terms, the rural and urban areas are linked by the exchange of unprocessed and processed goods with both areas acting as markets for each other. Agriculture practiced in the peri urban area provides market for fertilizers, farm tools, pesticides, and herbicides from the urban areas.

Some labour and extension services are also obtained from the town. It also creates employment for labour from the rural area, it is a ready market for livestock breeds, manure and planting seeds. As a result those in the rural fringe get some income. In return, the urban area is supplied with food crops such as maize, beans, vegetables, and bananas among others as it is a ready market.

### 5.10.2 Social linkages

The social linkages are obtained through the informal exchange of both crop and livestock by products. For example, those farms in the rural fringe who have more livestock make arrangements with the farmers in the peri urban areas without livestock to supply them with the maize stalks for feeding the livestock, who in turn give them manure freely to grow food crops. In

addition, when the people living within the urban centers visit those who are within the peri urban area, there is likelihood that when going back they are given some food crops to carry as a sign of good will.

Agriculture also within the peri urban area promotes community cohesion in the sense that those within the peri urban organize themselves with those within the rural fringe area to weed their farms in the form of merry- go- round. It is during such occasions that social cohesion is enhanced. Those farmers within the peri urban area also establish good relationship with the people who supply them with farm inputs and those who buy their produce in the urban area and this with time also promotes social cohesion as friends of both parties will later join in to form a group of friends.

**5.10.3 Environmental linkages**

Many towns depend on their hinterland (rural areas) for most of their needs for natural resources such as water and energy and sewage disposal systems. The use of these resources within the urban areas may create stress in the surrounding areas. In addition, the polluting effects of urban-based activities also tend to have negative effects on the adjacent umland.

Agriculture practiced within the peri urban area tends to utilize the urban waste which would otherwise be a cause of pollution. For example, the organic solid waste and the sludge from the sewage treatment works is used as an input for crop production in the peri urban areas. The soil conservation measures carried out within the peri urban areas ensure that the water passing through the urban center is clean. Utilization of the water for irrigation by those within the peri urban areas is done on the understanding that it is utilized within the urban area.

The polluted water from the urban area first passes through the peri urban area and it is where it is utilized before reaching again the rural fringe. The polluted water is purified through the natural process due to soil conservation measures undertaken by farmers within the peri urban area such as planting trees and Napier grass along river/ stream banks.

The application of manure from the rural areas ensures that the soil structure and productivity is maintained to continue supplying food to the urban areas. The soil which could have otherwise become non-productive is reclaimed. By practicing agro forestry within the peri urban area, the general micro climate of both the rural area and the urban area is moderated in the sense that the trees will purify the air by acting as carbon sink which would other wise be polluted if agriculture was not practiced.

It is also due to alternative water sources such as wells used for irrigation within the peri urban area that the supply of water to the urban area and rural area is made possible during water shortage periods such as the dry spell. This is a significant linkage in that people cannot survive without water, which is sometimes scarce in rural areas and unavailable in the town.

The exchange of the dry maize stalks and farm yard manure enables recycling of the solid organic waste which would otherwise have accumulated thus casing environmental pollution as they decay or decompose. The recycling may be taken for granted due to the availability of land in small and medium sized municipalities such as Machakos.

# 6.0 CHAPTER SIX: URBAN AGRICULTURE AND DEVELOPMENT CONTROL IN MACHAKOS MUNICIPALITY

## 6.1 Introduction

This chapter discusses the extent of development control in Machakos municipality with regard to urban agriculture. It highlights the existing legislations related to ownership and use of land and the development control issues that emerged from the study.

## 6.2 Basis of Development Control

Development control in Machakos municipality with regard to urban agriculture has not been effective. UA in the municipality is regulated by the General nuisance By-laws, 1999 amendments Section 9 that state that, a person who keeps within the town a rabbit, or an animal or poultry which causes nuisance to the residents in the neighbourhood shall be guilty of an offence. Section 9.1 of the by-laws states that, a person who except with the written permission of the clerk and subject to the conditions he may deem fit keeps within the municipal council a game animal, cow, goat, camel, sheep or pig shall be guilty of an offence.

Section 9.3 states that, any person who except with the written permission of the clerk and subject to the conditions he may deem fit permits any animal to graze within the municipal council shall be guilty of an offence. This section prohibits livestock keeping within the municipality.

Crop cultivation within the municipality is restricted in section 11 (1) on roads and streets which state that, there in the opinion of the council any hedge, tree or any other growth (including food crops) is so placed or in such condition as, (a) to be a danger to any person or

vehicle using a public street or (b) to interfere with the view along any public street to another or the use of the public street by pedestrian or vehicular traffic.

The council may serve a notice to the owner or occupier of the land on such a hedge, tree or other growth is situated requiring him within such a period of time not being less than fourteen days as shall be specified by such a notice, to cause the hedge, tree or growth to be lopped, trimmed or removed.

The physical Planning Act No 6 of 1996 empowers the Director of Physical Planning to prepare with reference to any government land, trust land, or private land within the area of authority of a city, municipal, town, or urban council or with reference to any trading or marketing center a local physical development plan. The purpose of the plan is to guide and coordinate development of infrastructure facilities and services for the areas mentioned above and for the specific control of the use and development of land or for the provision of any land for public purpose.

Section 29 of the Act empowers local authorities to control or prohibit the use and development of land and buildings in the interest of proper and orderly development of its area, to control or prohibit the subdivision of land or existing plots into smaller sizes, to consider and approve all development applications and grant all development permissions, to formulate by-laws to regulate zoning in respect of the use and density of development and to consider and approve all development applications and grant development permissions.

However Machakos municipal council has failed to regulate development in the agriculture. Several issues emerged from the study which include:

a) Lack of awareness of the existence of the Physical Planning Act anc General nuisance By-laws.

b) Lack of enforcement of the same.

c) Apparent conflicts in existing legislations and unharmonious laws of and use.

d) Failure to prepare guide lines for land use, more specifically failure t laws to regulate zoning in respect to use or density of development and Local Physical Development Plan.

**6.2.1 Lack of Awareness of the Existence of the Planning Law and By-laws**

The study established that about 98 percent of the 100 households sampled are r existence of the Physical Planning Act or the municipal council General nu which regulate farming within the municipality. The remaining 2 percent are av a former mayor of the municipal council and a magistrate, both of whom k within their residential plots. The former mayor said that although such laws ( possible for somebody to survive without carrying out some form of agricultu constitutes an important source of food and additional income. He himself v 30,500 per month from milk supplies to several hotels in Machakos Town. For was illegalised through the arbitrary extension of the municipal boundary by local government and since people were used to farming, the activity cannot b the spur of boundary extension.

The magistrate explained that the Physical Planning Act came in too late to regulate agriculture, which is an activity which people had been used to and which forms the basis of their lifestyle. He further added that it did not respect other existing laws which govern the ownership and use of land such as the Registered land Act cap 300 and the Registration of Titles Act cap 281. He said that so long as these laws exist and are not harmonized, it will be difficult for the municipal council to enforce the planning laws and by-laws as there will be a legal clash and even if the council takes the people to court over breach of such laws, the judgment will be reached in favour of the earlier laws.

On his part, he said that he kept dairy cattle because he identified a potential market for milk in Machakos town. This enables him get extra money to supplement his income and at the same time provide his family with milk. He stated that although the General nuisance laws existed, the local authority was not enforcing them and a law is not a law until it is enforced. He expressed the opinion that if the municipal council enforced the planning law and by-laws, he would stop the practice. Due to lack of enforcement of the planning law and by-laws, the local residents have continued with farming and others have gone to an extent of grazing and farming along road reserves and along the streets along the CBD.

The large percentage of the households unaware of the Physical Planning Act and the General nuisance By-laws is a reflection of the failure on the part of the municipal council to sensitize or educate the public on the law requirements as far as farming is concerned just as other public health aspects are concerned. The municipal only published the By-laws and kept them on

shelves. This was evident when the researcher visited the council offices and requested for copies of the By-laws for perusal. The administrator did not know who kept the By-laws and had to call several officers to enquire. He was not aware also aware of the existence of By-laws dealing with farming within the municipality.

The By-laws were not accessible to the public and the researcher had to peruse them inside an office under lock. There is only a single copy of the municipal By-laws and the Physical Planning Act. Both documents are not accessible to the public. Many officers within the council are not aware of the contents of the Act although the Machakos District Physical planner has explained it and the the need for it's enforcement several times during the Town planning committee meetings.

As a result of failure to sensitize the local residents of such planning law and By-laws, they have continued with the practice of agriculture with no knowledge of its illegality. The residents said that there was no single day when the council prohibited them from farming and has remained silent over all the years. They only knew of buildings where one was supposed to seek for approval before putting up. This only applied to the area within a radius of three square Kilometers from the CBD.

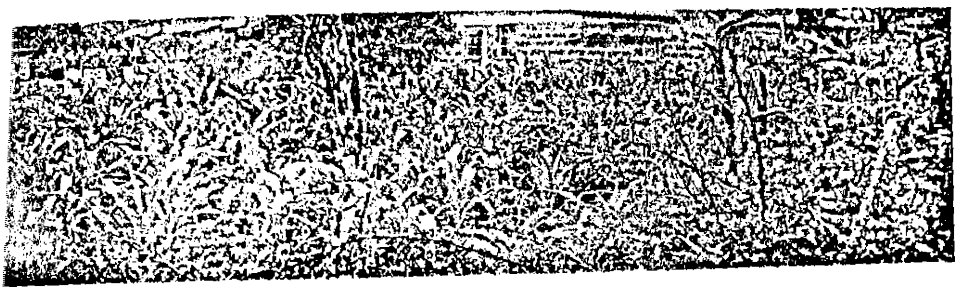
### 6.2.2 Lack of Enforcement of the Physical Planning Act and the General Nuisance By-laws

Machakos municipal council does not have an enforcement unit to deal with laws and By-laws related to urban agriculture. Concern has only been in the enforcement of the building code. A discussion with the principal administrator revealed that the municipality's economy relied on agriculture considering that out of the 519 Square kilometers covered by the municipality, only about 3 square kilometers constitute the CBD. He said that it was difficult to enforce such legislations because of the expansive nature of the municipality, the nature of land ownership and due to lack of enough personnel.

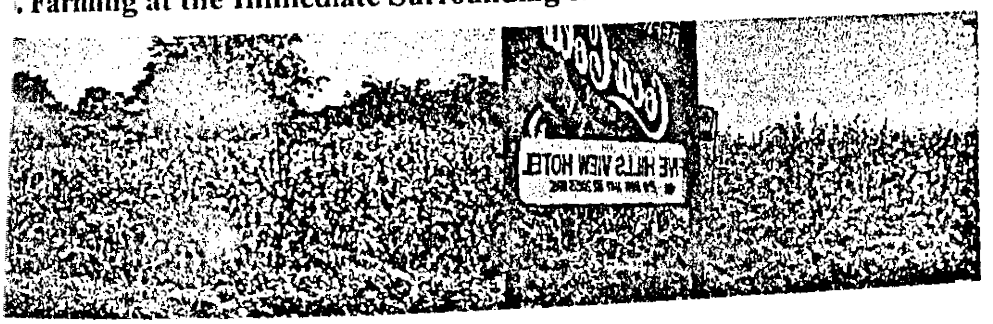
In addition, he stated that there was no firm ground to be strict on the activity considering the current economic situation and by the virtue of the fact that it has co-existed with the other land uses for long. He added that there was no proven bad effect of the practice within the municipality. He acknowledged that the By-laws were a colonial legacy.

As a result, the council has opted to be passive as far as farming is concerned and thus the activity has continued unabated and is likely to continue unless the council starts enforcing the existing legislations. This is a failure in the duty of the municipal council in terms of development control on the use of land. Indeed crops are grown within the council houses compounds in the immediate surrounding of the CBD along road reserves as shown in Plate 15 and 16. Grazing is done along streets within the CBD and along road reserves as shown in plate 17 and 18. This increases the risk of motor accidents.

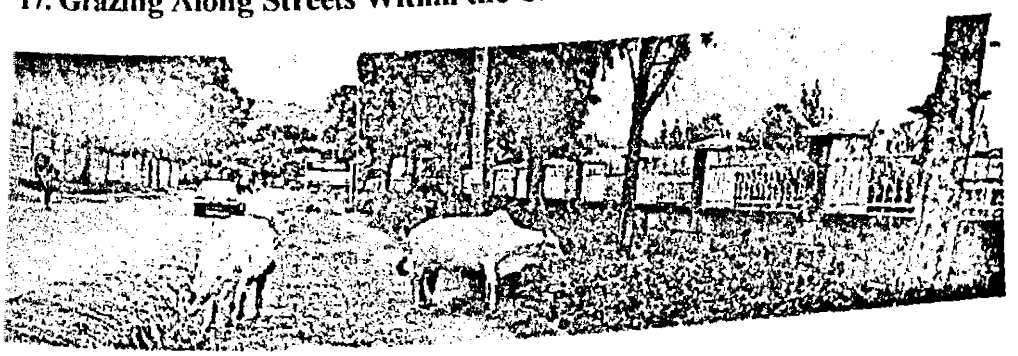
Farming within Machakos Council Houses



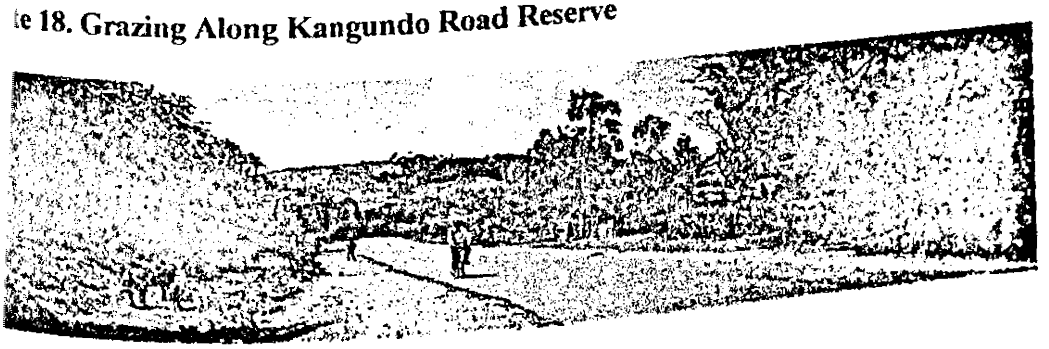
. Farming at the Immediate Surrounding of the CBD



17. Grazing Along Streets Within the CBD



te 18. Grazing Along Kangundo Road Reserve



### 6.2.3 Apparent Conflicts in Existing Legislations

The study established that, out of the 100 households sampled, 90 percent occupied freehold land. The land is registered and under the Registered Land Act Cap 300. Section (4) states that except otherwise provided the Act, no other written law and no procedure relating to law shall apply to land registered under the Act so far as it is inconsistent with the Act. In addition the landowners had title deeds that under Registration of Titles Act Cap 281 Section 23(1), once the proprietor has been issued with a certificate by the registrar, that title shall be taken by the court as conclusive evidence that the person named therein as the proprietor of the land is the absolute and indefensible owner.

This gives the owner the right to use the land as he deems fit and it is only the Attorney general who can revoke the registration of any registered land. These legislations protect the farmers when carrying out their activities but the Physical Planning Act enacted in 1996 and the General nuisance By laws amended in 1999 conflict with them.

The Physical Planning Act as stated earlier give powers to the director of physical planning to prepare with reference to any government land, trust land or private land within the area of authority of a city, municipal, town or urban council a local physical development plan. The Act does not recognize the previous legislations governing land ownership and use. This also applies the General nuisance By laws and this has brought problems of enforcement of the Act.

The municipal council has not been able to prohibit or control the use and development of land as far as urban agriculture is concerned in the interest of proper and orderly development of its

area. This poses a dilemma in which on one hand the owners practice agriculture under protection of certain Acts while at the same time it is regarded as an illegal activity by other laws. Recent laws that do not recognize what is catered for in the previous laws have brought about this conflict. As a result, the municipal council will not be able to control urban agriculture if the laws are not harmonized as far as land ownership and use is concerned. Before formulating or adopting the by laws the municipal council should have consulted the previous laws governing land. They should have formulated by laws, which are within their enforcement capacity and those, which would not hamper the municipality economy if enforced

### 6.2.4 Failure to Prepare Guidelines for Land Use-A Local Physical Development Plan

An approved Local Physical Development Plan is the tool for guiding and coordinating development of infrastructure facilities and services for a local authority area and for specific control of the use and development of land or for the provision of any land for public purpose. Machakos municipality does not have an approved Local Physical Development Plan. Although the responsibility of preparing development plan lies within the physical planning department, the initiative can be from the municipal council if the physical planning department is unable to do so.

During the study, the Machakos District Physical Planner said that the municipality lacked an approved plan because of lack of finances. She noted that the preparation of such a plan is expensive and the central government financing is inadequate and its mode of quarterly allocations is not the best.

The municipal council on the other hand is not ready to fund the preparation of the plan as it argues that it is the responsibility of the central government to fund such an exercise. There is no liaison between the physical planning department and the Municipal Council. As a result there is no basis for development control in as far as urban agriculture is concerned and the provision of infrastructure facilities necessary to transform the peri-urban area.

This explains why much of the peri-urban areas lack infrastructure and agriculture still dominates. The municipal council has failed in its duty because according to PPA section 29 (e), it should formulate by laws to regulate zoning in respect to use and density of development. There are no zoning By laws and therefore the preparation of the Physical Development Plan for the area is hampered as no zoning has been done to determine what areas should fall under what activity and what the minimum land sizes should be.

A discussion with the principal administrator of the municipality and the town engineer revealed that the council lacked qualified personnel for such an activity, as it does not have a planning unit. Due to lack of zoning the council has continued approving subdivisions in various wards without a proper basis of approval (Plate 19). As a result there is a likely trend of encroaching residential and commercial to come up with continued agriculture and lacking the necessary infrastructure facilities as shown in Plate 20 and 21.

**Plate 19. A Sold Plot (0.1 Acres) Awaiting Residential Development**

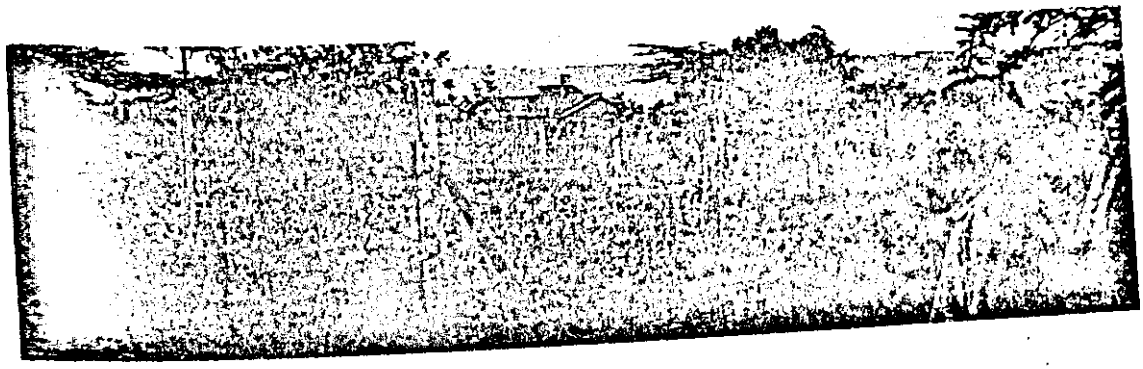
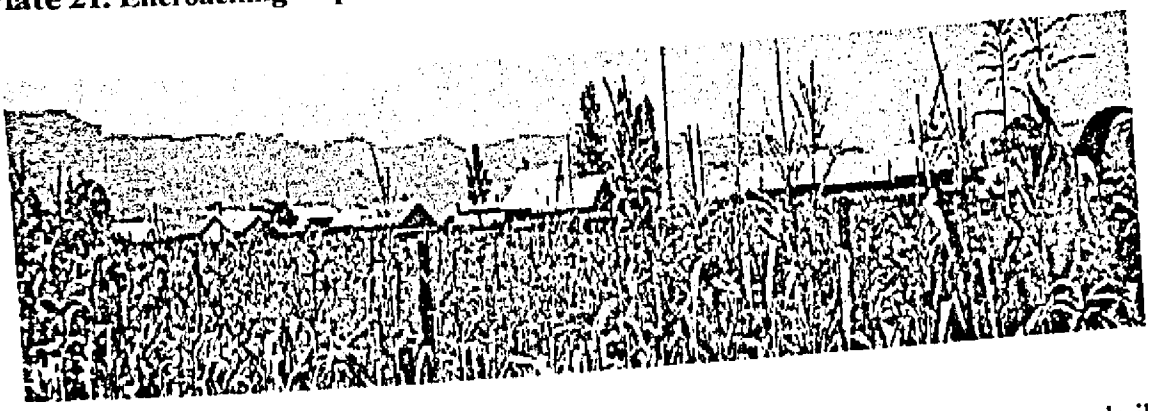


**Plate 20. Undeveloped Road Leading to one of Unplanned Upcoming Residential Developments**

**Plate 21. Encroaching Unplanned Residential Development**



The plot ratios and plot coverage are not determined and people are putting up buildings occupying more than 90 percent of the plot sizes. This has an impact on infrastructure, which

might be required in future including sewer lines, water reticulation system and roads. A problem is brooding since the existing road reserves in these areas are only six meters wide that used to serve the formerly agricultural land.

The density of upcoming residential and commercial building cannot be controlled while the previous landowners who sold part of their land continue practicing agriculture. Other landowners are not willing to sell their land within the peri-urban area and therefore still hold large pieces of land that they use for farming because the urban use of the land has not been determined. Until these areas are zoned and a Local Physical Development Plan prepared, urban agriculture will continue to dominate in the midst of encroaching urbanization and subdivisions will go on unabated.

### 6.3 The Future of UA in Machakos Municipality

The future of UA in Machakos municipality lies on its potential as a commercial activity as a source of food. The municipality has the potential of feeding itself in future. This will however depend on how integrated agriculture will be in the urban system through supportive policies and actions by the municipal council. At individual households, diverse reasons were given by different households on the intention to carry out farming activities in the future. Out of the 70 farming households interviewed, about 53 percent were firm on their intention to continue farming in the future while the remaining 47 percent did not intent to do so.

Of the 53 percent, about 10.8 percent argued that agriculture is profitable since it provides some income for the household. About 14 percent will practice agriculture in future because of lack of capital to establish commercial or residential developments that they deem profitable in

comparison to agriculture. About 16 percent perceived agriculture to be an important source of food that could not be compared to any other activity hence could not be abandoned at all cost. About 11 percent of the households considered farming as a supplement to the kitchen budget where it enabled them save some money due to non purchase of some food crops which they grew, while the remaining 48.6 percent (majority) of the households intended to farm in the future because they didn't have access to land else where thus could not abandon agriculture (Table 6.1).

These were the people who inherited land from their fore fathers and who felt culturally attached to it as it was where they buried their fore fathers and where they had been brought up. This therefore shows that farming in Machakos is unlikely to disappear in the near or distant future unless the local authorities develop infrastructure within the peri urban area, carry out zoning or enforce the existing land use planning policies.

**Table 6.1 Reasons for Intention to Continue Farming in Future**

| Reason | No. of H/Holds | Valid Percentage | Cum. Percentage |
|---|---|---|---|
| The only land | 18 | 48.6 | 48.6 |
| Important source of food | 6 | 16.3 | 64.9 |
| Lack of capital to change user | 5 | 13.5 | 78.4 |
| Profitable | 4 | 10.8 | 89.2 |
| Supplements income | 4 | 10.8 | 100 |
| TOTAL | **37** | **100** | |

*Source: Field survey, 2000*

Of the 47 percent of the households not intending to continue farming in future, about 46 percent perceived agriculture as not being profitable and had plans to invest in residential development which they perceived to be more profitable compared to agriculture. About 12 percent cited pressure from encroaching new land uses such as residential and commercial developments as a threat to farming in future. They said that those new land users would push them out of farming. About 27 percent cited lack of land / space for future farming due to population pressure. They argued that their pieces of land /plot were too small and there was a possibility that in future the remaining open portion would be occupied by their descendants hence would have no where to carry out their farming activities.

They however saw the possibility of renting farms from the rural fringe to enable them grow food crops. Only 6.1 percent of the household cited poor soils as a hindrance of future farming. They said that if by chance they got money to put up residential developments, they would not hesitate because the soils were water logged and in order for them (soils) to produce, alot inputs are needed.

The remaining 9.1 percent households said that due to the nature of occupation of the household head, they could not ascertain whether to continue with farming in future or not as that depended on where the household head will be posted.

These were mainly civil servants who had rented farms within the peri urban area or those who were carrying out on plot farming. These were mainly for those living in government houses or council houses, which stood on 1/2-acre land. These reasons are summarized in the table 5.3.

**Table 6.2 Reasons for Not Intending to Continue Farming in Future**

| Reason | No. of H/Holds | Valid Percentage | Cum. Percentage |
|---|---|---|---|
| Not profitable | 15 | 45.5 | 45.5 |
| Pressure from other landuses | 4 | 12.1 | 57.6 |
| Lack of land/ space | 9 | 27.2 | 84.8 |
| Poor soils | 2 | 6.1 | 90.9 |
| Nature of occupation | 3 | 9.1 | 100 |
| **TOTAL** | **33** | **100** | |

*Source: Field survey, 2000*

All these factors discussed will be influenced by the land use planning strategy that Machakos municipal council will take in future.

### 6.4 Integrating Agriculture in The Urban System

The need to integrate agriculture in Machakos municipality arises from its potential of feeding the municipality in the future while at the same time earning an income to the farmers by transforming it from subsistence to a commercial activity. The main objective of restricting urban agriculture in Kenya and Machakos municipality in particular is on public health grounds and uneconomic use of urban space. This criterion was put in place during the colonial period. Agriculture within their areas was considered as unhealthy. This legacy has been carried up-to-date through the public health Act cap 242 and the Local government Act cap 265.

The Local Government Act gives the Minister for Local government power to extent or change local authority boundaries arbitrarily. Subsequently, agriculture which falls within the extended

boundaries becomes an illegal and unhealthy activity in areas where previously had been thriving well. The areas are subjected to Planning laws with no regard to agriculture as an urban land use.

However, recent studies have shown that this activity is not likely to die out from the local authority boundaries and therefore is likely to conflict with the other urban land uses if not properly managed or accommodated. In addition, the activity has co-existed with the other land uses for a long period and has not been found to have unhealthy effects. Those practicing it don't regard it as unhealthy. In addition, the prevailing opportunities for urban agriculture in the municipality identified in this chapter can only be fully exploited through the integration of the practice in the urban system.This therefore, shows the need to integrate and accommodate agriculture in to the urban system.

The public health reasons are not sufficient enough to disregard the activity carried out of a felt need. The economic consideration of the activity as low value should not be given strong emphasis. Consideration of several factors should be the basis of allocating urban land for agriculture since it is both an economic as well as a social activity embedded on ecology. These should include the socio-cultural and economic factors, the extent of the local authority boundaries, the size of the CBD, the farming technology, population dynamics, the most necessary conventional urban land uses, Availability of infrastructure, and primarily the ecological factors of an area.

The interaction of these factors with the legal provisions are highlighted in Figure 6.1 Different actors including the Local authorities, the physical planning department and the community

should all be involved in planning and management of urban agriculture if it has to be harmonious with the other land uses.

Integration also involves sensitizing the local community on the appropriate areas for cultivation in order to avoid pollution of the agricultural produce by industrial or domestic effluent. Sensitization should also be on avoiding cultivation along the environmentally fragile areas such as along riparian reserves and sloppy areas. The local residents need to be educated on the most appropriate crop species and tree specie for agro forestry.

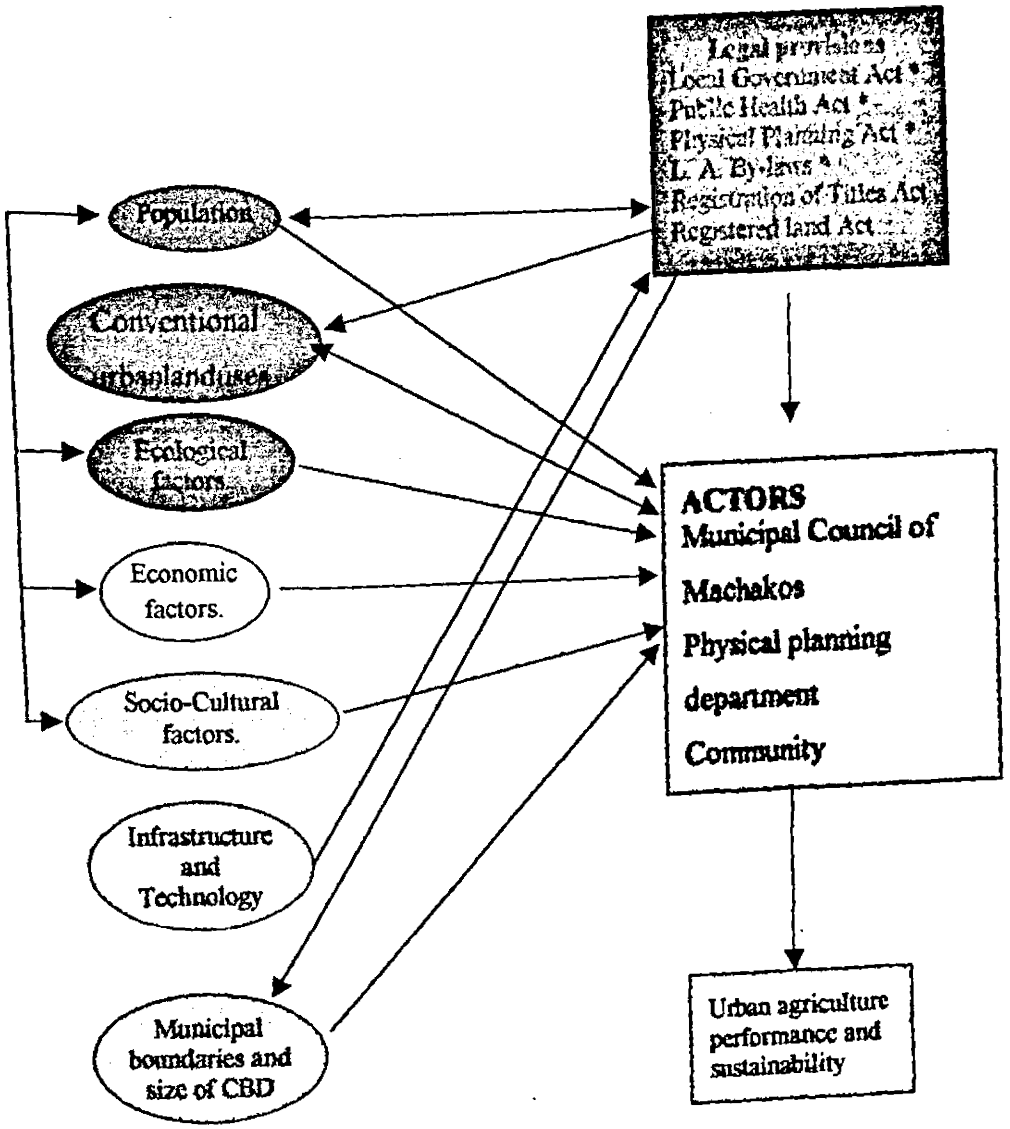
Inputs should be made affordable or be provided by the local authority to farmers on credit basis so as to enable them produce high yields of high quality able to fetch good price in the market. The inputs will solve the problem of poor soils. The local authority should provide extension services by employing its own agricultural officers who should be in permanent contact with the farmers. This will enable the farmers to produce enough for consumption and surplus for sale.

Infrastructure should be developed in the peri-urban and rural areas to facilitate transportation of agricultural produce. This will enable fast transportation of the perishable produce to the market when still maintaining their quality.Water reticulation system should be expanded to cover these areas also in order to reduce the problem of limited water sources. The local authority can harvest surface water through construction of earth dams to encourage irrigation. This will ensure production is done throughout the year.

The integration and accommodation of urban agriculture in the urban system will only be possible if the various laws that govern the ownership and use of land are amended and harmonized. Integration of agriculture to the urban system arises from its contribution to the

urban economy as one component of the whole urban system with its own forward and backward linkages as conceptualized in this study.

**Fig 6.1 Integration of Agriculture into the Urban System: Factors to Consider and their Link with Legal Provisions**




*Source: Author, 2001*

* - Some amendments and harmonization necessary.

## 6.5 Constraints Facing Urban Agriculture in Machakos municipal

UA in Machakos municipality is faced with a number of constra
unreliable rainfall that in turn has led to limited surface water sources
soil types especially within Machakos East ward, water logging, and l
6.3). The study established that inadequacy of water sources and hi
prominent problems. Diminishing land due to population pressu
services were other notable problems.

**Table 6.3 Crop Production Problems**

| Problem Faced | No. of H/Holds | Valid percentage | ( P |
|---|---|---|---|
| Inadequacy of water resources | 38 | 54.3 | 5 |
| Diseases and pests | 6 | 8.6 | 6 |
| Poor soils | 3 | 4.3 | 6 |
| High cost of inputs | 18 | 25.7 | 9 |
| Others | 5 | 7.1 | 1 |
| TOTAL | 70 | 100 | |

*Source: Field survey, 2000*

### 6.5.2 Constraints Facing Livestock Production

Most of the animals kept were of the indigenous type, which are more
and diseases. Due to their adaptability, they are not faced by many
productivity for both meat and milk. They are mainly kept for manure
crop production and also as a risk taker in future.

owever, the rearing of these animals is hindered by lack of expansive land for grazing. which so means limited pasture. This has forced the farmers to practice zero grazing or to grazing long road reserves thus causing inconveniences to motorists. Inadequate water, recurrent drought and lack of veterinary serves are other problems that were cited.

Farmers who kept exotic cattle said that the animals were more prone to diseases and pests and needed much care though they yielded well in terms of milk.

The major problems associated with the exotic animals included high incidence of pests and diseases, high cost of veterinary services, high cost of feeds, inadequate water and high labour charges.

### 6.5.3 Problems Faced in Marketing Farm / Plot Produce

Although the study established that majority of the households practice agriculture for domestic food supply, those which produce for sale and both domestic/ commercial purposes cited a number of problems. These included, low selling prices for the agricultural produce due to lack of diversity in agricultural produce, high trading fees at the municipal council's market, high transportation charges, and high perishability of the farm/ plot produce especially fruits, cabbages and tomatoes.

## 6.6 Opportunities for Urban Agriculture

Despite the above cited problems, there are opportunities for the continued practice of agriculture. These include:

### 6.6.1 Hilly Topography

Due to the large area occupied by Mua, Iveti, and Kiima Kimwe hills within the municipality, it is quite expensive to put up developments and as a result, these areas are likely to have agriculture as the main user of land in the foreseeable future so long as soil conservation measures are put in place.

### 6.6.2 Freehold Land Ownership

Since most of the land is under freehold within the municipality, and the local authority has failed to enforce the existing land use planning policies and the Physical Planning Act, farming is likely to continue as the dominant activity as the residents perceive it as important as it plays a great role in domestic food supply.

### 6.6.3 Ready market

The urban area where production of food crops is almost nil provides this. Due to the high number of the urban residents who do not practice agriculture due to lack of land and the high rate of rural urban migration, dependence will always be on the peri-urban and rural areas to supply food crops to the growing urban population.

### 6.6.4 Fertile soils

Although a few of the households interviewed expressed the opinion that poor soils are a constraint to farming, much of the area within Machakos municipality is covered by fertile regosol and lithosol soils for agriculture. What is required is application of inputs such as farmyard manure and fertilizer in order to obtain good yields.

The soils offer a good opportunity for continued practice of agriculture. The soils found within the hill massifs are the best suited for agriculture meaning the practice has a future as no developments can take place without incurring high costs in these areas.

### 6.6.5 Favourable climate

The bimodal rainfall pattern with an average of 717 mm per annum is an opportunity for growing food crops. Moderate temperatures that vary between 18 and 25 degrees centigrade support this. The climate favour cultivation of coffee, cereal crops and horticultural crops. The Konza ward that is considered as semi arid is favourable for ranching.

# 7.0 CHAPTER SEVEN: FINDINGS, RECOMMENDATIONS AND CONCLUSION

## 7.1 Introduction

This chapter presents a summary of findings that arose form data analysis and observations made during the fieldwork. This forms the basis upon which conclusions and recommendations are drawn from. The focus of the study was to examine the practice of urban agriculture within the context of planning law and the Machakos municipal By-laws related to the practice.

The study was carried out under the following hypotheses:

1) That urban agriculture in Machakos municipality is primarily practiced for domestic food supply
2) That those who practice urban agriculture within the municipality are largely unaware of the existing planning law and by-laws
3) That distance from the central business district influenced the size of land put under farming by households.
4) That Machakos municipal council does not enforce the existing planning law and By-laws related to urban agriculture.

## 7.2 Summary of Findings

This study set out to analyse four main objectives. The first objective was to establish the extent of urban agriculture within the peri-urban area of Machakos municipality. It was found out that urban agriculture was not only practiced by individual households but by institutions such as, churches, schools and other government institutions.

An analysis of the household characteristics of the individual households revealed significant characteristics between the farming and non farming households which include:

1) The farming households have large family sizes averaging six members compared to four for the non-farming.

2) Majority (33 percent) of the non-farming household heads have attained post secondary education compared to seven percent of the farming households.

3) Majority (63 percent) of the non-farming household heads are formally employed compared to 33 percent of the farming households.

4) Majority (83 percent) of the farming household heads own land compared to 23 percent of the non-farming households.

5) Female headed households engage in urban agriculture more than the male headed in Machakos municipality.

6) Majority (50 percent) of the farming household heads earn less than Ksh 5000 per month compared to 20 percent of the non-farming household heads.

The marital status is not a significant factor influencing urban farming in Machakos municipality.

On the same objective, crop production and livestock husbandry are carried out in an integrated form. A combination of cereal crops such as maize and beans and horticultural crops such as vegetables and fruits were grown. The commonest is maize. However, the production differs significantly from one household to the other. Mostly, the indigenous type of livestock for

cattle, goats, sheep and poultry were kept. The main inputs for crop production include farmyard manure and chemical fertilizers.

Urban waste such as wastewater and organic waste is also used. Families mainly provide farm labour. Paid labour is drawn from both rural, peri-urban and the urban area of the municipality. On the average, farming households employed one person per household as farm labour.

Crop produce is mostly for domestic food supply as about 74 percent of the interviewed farming households said that the produce was for domestic consumption. For those who grew vegetables, this is done throughout the year. It was only a small percentage of about 6 percent who produced for sale.

Livestock is mainly kept to provide farmyard manure, which is used as an input for crop production. Other benefits of livestock include provision of milk and beef to the families. Napier grass and dry maize stalks are the main inputs in livestock husbandry though open grazing was also done along road reserves and within the uncultivated open spaces. Crop farming is mainly rain fed with a minor percentage of the respondents carrying out irrigation.

The second objective of the study was to examine the factors that encourage the practice of urban agriculture and its role in Machakos municipality. A combination of legislative, social, cultural and economic factors do contribute to the practice. These include:

1) Large family sizes

2) Freehold land ownership

3) Lack of zoning and infrastructure development within the peri-urban area

4) Low incomes of the household heads

5) Relatively low education level

6) Availability of open space often dictated by the distance from Machakos town

7) Many years of urban residence

8) Unawareness of planning law and municipal By-laws

It was found out that the practice has significant economic, social and environmental effects. Among them:

a) The practice contributes greatly to domestic food supply with about 74 percent of the farming households practicing urban agriculture for subsistence purpose.

b) Farming within the peri-urban area supplies Machakos town with food crops.

c) Urban agriculture is a source of income for households.

d) The practice has created employment to 35 people from within and without the municipality.

e) Urban agriculture gives green scenery to Machakos town.

f) UA has enhanced the urban environment trough utilization of organic urban waste and wastewater. At the same time it contributes significantly to soil conservation.

The third objective was to establish the existing legislations on land ownership, use and awareness of the planning law and local authority By-laws related to urban agriculture. As discussed in the text, several legislations exist which prohibit urban agriculture. These include the Local Government Act cap 265 sections 154(c), which exposes local authorities to prohibit or permit cultivation.

The Public Health Act Cap 242, section 157(c) spells out that the cultivation or irrigation of land within and around township boundaries or within 3 miles of such boundaries is prohibited.

The boundaries are established through the Local Government Act Cap 265, section 12 that empowers the Minister for Local Government to establish a municipal council or exercise an area to be or to cease to be a municipal.

The Physical Planning Act section 24(1) empowers the Director of Physical Planning to prepare with reference to any government land, trust land or private land within the area of authority of a city, municipal, town or urban council a Local Physical Development Plan.

The Machakos Municipal Council General Insurance By-laws 1999, amendments Section 11 prohibit the keeping of livestock within the municipality except with written permission from the Town clerk. Section 11 (1) of the same prohibits growing of crops in so far as they interfere with the view along a public street.

The P.P.A and the local authority by-laws conflict with other land legislation's including the Registration of Tittles Act Cap 281. Section 23(1), states that once a proprietor has been issued with a certificates of title by the registrar, that title shall be taken by the courts as conclusive evidence that the person named there in as proprietor of the land is the absolute and indefeasible owner. This gives the owner right to use the land as he deems fit. It is only the Attorney General who can revoke the registration of any registered land.

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According to the Registered Land Act Cap 300, section (4), except otherwise provided by the Act, no other written law and no procedure relating to law shall apply to land registered under the Act so far as it is inconsistent with the Act.

In regard to awareness of planning law and By-laws relted to urban agriculture, it was found out that about 98 percent of the respondents are not aware of the existence of the Physical Planning Act and the Machakos municipal council General nuisance By-laws that are required to regulate urban agriculture.

The fourth objective was to investigate the level of control of urban agriculture im Machakos municipality. It was found out that,

1) There is total lack of enforcement of the Physical planning Act and the General nuisance By-laws by Machakos municipal council rendering the laws unnecessary as far as farming within the municipality is concerned. The council is passive towards the activity besides the existence if the bylaws.

2) There is failure to prepare guidelines for land use, more specifically failure to formulate By-laws to regulate zoning in respect to use or density of development and preparation of a Local Physical development Plan.

3) There is an apparent conflict in the existing legislations and unharmonious laws on land ownership and use.

**7.3 Recommendations**

Having highlighted the findings from the data analysis, it is important to recognize the fact that urban agriculture has valuable contributions in Machakos municipality, which range from economic, socio-cultural to environmental. Despite all these, it is still lowly regarded

economically. However, the continued persistence of the activity is a challenge within the planning circles and existing legislations, which prohibit the practice, and therefore more attention should be accorded to it.

In line with the findings of this study, two sets of recommendations deem fit. The first set looks into the existing legislations related to UA while the second set recommends some land use planning response.

### 7.3.1 Recommendations for Legislation

As a result of conflicting legislation's, their implementation has been problematic. The Physical Planning Act that was enacted in 1996, for example, does not recognize the Registration of Titles Act cap 281 and the Registered Land Act cap 300 which preceded it and therefore the land owners within Machakos Municipality and else where practice agriculture within existing laws and at the same time against other laws.

There is therefore a need to amend and harmonise the conflicting laws and the ones which are un responsive to the practice of urban agriculture should be amended to accommodate it. The Physical Planning Act should be amended to take care of the landowner's rights.

The Local Government Act Cap 265, the Public Health Act Cap 282, and the Machakos Municipal by -laws 1999 Amendments section (11) should be repealed to accommodate urban agriculture. Acts such as the Local government Act that give powers to the Minister to create municipalities at his own discretion illegalised agriculture within the Municipality. The

Minister for Local government should not have any powers to create a Municipality. The creation of Municipalities should be based on proper research and should be preceded by a prepared Physical development Plan after identifying the extent a particular town is likely to grow at a given duration of time. The ability to provide infrastructure and services and not population should be the criteria. The definition of an urban center should also be redefined to take care of agricultural activities and the unbuilt areas as the earlier definition does not apply in any of the urban centers in Kenya today.

Any area before gazettment should be served with the necessary infrastructure facilities that can support the urban growth. Before establishing by-laws prohibiting agriculture, Local Authorities should use defined criteria related to the Physical characteristics the area, economic base of its residents, Social cultural aspects, the extent of the municipal boundaries, the size of the build up area, the technology used and the type of farming activities practiced. Clear definition should be provided on the whether farming is prohibited within the Central Business District, the peri-urban area or the rural fringe of the Municipality.

If specific areas are delineated where agriculture should not be practiced, the enacted planning law and by-laws should be communicated to the local residents by conducting civic education so as to educate them on the existence of such laws and their implications giving due respect to their views. For example, there is need to educate local residents in Machakos municipality on the existence of the Physical Planning Act which the council should be implementing and the by-laws prohibiting farming as approximately 98 parent of the respondents are not aware. Maybe through this, a certain level of compromise can be reached between the local authority

and the residents when planning for such areas on how to integrate agriculture to other urban land uses. Integration of UA in the urban system is discussed in detail in chapter six.

### 7.3.2 Recommendations For Land Use Planning

Agriculture in Machakos municipality is practiced out of a 'felt need', which is the basis of all forms of planning. It is an activity that will continue in the future and therefore if left unmanaged is likely to conflict with other land uses as urban growth extents to the peri-urban area. Its persistent manifestation should be an eye opener to the planners and urban manages to integrate it into the urban system. As a result the following recommendation are deemed necessary for the integration of the practice.

The economic justification offered in the allocation of urban land resource should not be the basis of planning for agriculture but rather the social, cultural and environmental benefits and the length the practice has occurred should be given due consideration.

The local authority should include urban agriculture as a managed activity that should be within the department dealing with development control. This can be possible through employment of agricultural officers and support staff as relying on the district officers is not enough as they are not directly answerable to the local authority. This will ensure that the environmentally fragile areas are preserved and extension services are offered to farmers to ensure production of unpolluted produce and high yields. This will ensure that the farmers produce enough for domestic consumption and surplus for sale. The aim should be moving from the subsistence urban agriculture to commercial urban agriculture.

The Local Authority should establish zoning regulations, which form the basis for the preparation of a Local Physical Development Plan through liaison with the Physical Planner. When establishing zoning due consideration should be given to the physical aspects of different areas that would support agricultural activity.

The Local Authority should also establish the minimum acceptable land sizes within areas zoned for residential use, which should not be less than one acre so as to accommodate some form of agricultural activity.

If zoning and preparation of a physical development plan is done, the local authority should develop infrastructure such as road construction and improvement of the existing, provision of water and sewerage system. This will likely motivate the residents to change the user of land from agriculture or reduce the scale of agriculture.

Since agriculture has been found to be compatible with residential land use, educational, and other community facilities overtime, it should be planned for as part of them by allocating more land size to such activities.

There is need to improve the technology used in practicing agriculture so as to make it take less space within the peri-urban area but at the same time produce enough food for an average family. The technology used should be environmentally benign such as organic farming. The type of acceptable farming activities should be spelled out.

## 7.4 Recommendations for Future Research

Future studies on urban Agriculture should focus on:

1. The best way to harmonise and amend the conflicting legislation's so as to accommodate agriculture within urban areas.
2. The most appropriate size of medium and small local authorities and the extent of the boundaries
3. The ways of involving the community within the peri-urban areas in zoning, planning and management of urban agriculture.
4. Developing the most appropriate technology for urban agriculture to yield more on less space while maintaining high public health standards.
5. Ways of transforming urban agriculture to a commercial and competitive urban activity.
6. Appropriate ways of managing urban agriculture.

## 7.5 Conclusion

Urban agriculture in Machakos municipality was found to have co-existed with other land uses for a long period of time. Individual households, government institutions and religious institutions practice it. It occupies much of Machakos municipal land during the rainy season when most fields appear green covered by maize crop. Both crop and livestock production is carried out for different purposes with about 76 percent of the farming households doing it for subsistence purpose.

Development control in relation to urban agriculture in the municipality is not effective. The council has not sensitized its local residents on the existence of the physical planning Act and

the general nuisance bylaws. It has also failed to enforce the same laws making the practice to go on unabated. The formulation of zoning by-laws and the preparation of a Local physical development plan has not been done. As a result there is no tool for guiding urban activities or provision of infrastructure. The problem has been compounded by conflicting legislations regarding land ownership and use. This has made integration of the practice into the urban system difficult. Factors that have encouraged the practice include freehold land tenure, many years of urban residence, large and diminishing land size, availability of open land, large household sizes, low incomes among others.

The role played by urban agriculture in Machakos municipality include supplying food to both individual households and Machakos Town, generating income to households, strengthening social ties, maintaining the environment by conserving the soil and utilizing urban waste, providing a green scenery among others. There is need to integrate UA in the urban system due to its potential to feed the municipality and earn an income to the farmers in the future.

## REFERENCES

Alderman,H.(ed.) (1993).**Agriculture and Environment Challenges;** World Bank; Washington DC.

Andrews U.A. (1979). **A Guide to Urban Studies;** Prentice Hall, Scarborough.

Atukunda, G. (1995). **Farming in the City of Kampala; Issues for Urban Management;** University of Wisconsin, Maddison

Bakker, N. et al (eds.) (2000.) **Growing Cities, Growing Food: Urban Agriculture on the Policy Agenda;** Proff offsetdruck, Eurasburg.

Bouyer-Bower; (1995). **The Environmental Implications of (illegal) Urban Agriculture in Harare, Zimbabwe;** Working paper no.4 of OUA Research project R5946, University of Zimbabwe, Harare.

Chapin, F.S. (1965). **Urban Land Use Planning;** University of Illinois press; Urbania.

Chatterjee P. (1998). **The Tale of Two Cities Two Other Worlds most Crowded Cities Struggle to Feed Growing Waves of Rural Immigrants in URBAN AGE;** The Global city Magazine vol. 5 No.3

Cheruiyot, W.K. (1999). **An Investigation into the Practice of Agriculture in Sub-Urban Areas; A Case Study of Karen in Nairobi;** University of Nairobi, Unpublished M.A. Thesis

Cockram, M. (1996). **The Beautiful City: Gardens in Third World Cities;** Cornell University; New York.

Convoy, M' (1975). **The Challenges of Urban Economic Development;** Lexington Books, Toronto

Dellere, R. (1989). **Land and Food: The Challenge of Suitable Agriculture in the Tropics;** Westernham press, England

rescher, A.W. (1996). **Urban Micro Farming in Central Southern African; A Case Study of Lusaka, Zambia**; University of Freiburg Bolivia

Freeman, D.B. (1991). **A City of Farmers: Informal Urban Agriculture in Open Spaces of Nairobi, Kenya** McGill - Queens University press, Montreal

Gertel J. (2000). **Cairo: Urban Agriculture and Vision for a "Modern" City,** ***Growing Cities, Growing Food***; Proff offsetdruck, Eurasburg.

Gumbo, J. D. (1996). **Open Space Cultivation in Zimbabwe: A Case of Greater Harare**

Hale A. (1977). **African Metropolis: Nairobi Self-help City;** Sussex University press, London

Kenya, Republic of, (1997- 2001). **Machakos District Development Plan;** Government printers, Nairobi

Kenya, Republic of, (1985). **Registered Land Act Cap 300,** Government Printer, Nairobi.

Kenya, Republic of, (1978). **The Local Government Act cap 265,** (Revised edition) Government printer, Nairobi.

Kenya, Republic of, (1962). **Registration of Titles Act Cap 281,** Government Printer, Nairobi

Municipal Council Of Machakos , (1999). **By-laws** (amendments)

Kenya, Republic of, (1996). **Physical Planning Act No. 6,** Government printer, Nairobi.

Kenya, Republic of, (1972). **The Public Health Act Cap 242,** Government Printer, Nairobi

Lamba, D. (1993). **Urban Agriculture in Kenya.**

Lampard, E.(1967). ***Historical Aspects of Urbanization*** in Hauser P, (1967) **The Study of Urbanisation,** John Wiley and sons Inc; New York.

Lee smith D. et al (1991).**The Potential of Urban Farming in Africa: Eco-decision** Montreal, Canada.

Smith, D. et al Memon, P.A. (1994). **Agriculture in Cities Feeding People: An Examination of Urban Agriculture in East Africa** IDRC ,Ottawa

dombe, J.(1996). **Urban Poverty and Urban Management Issues in Kenya**; A paper Presented for the Workshop on Research on Urban Poverty in Eastern and Central Africa; UNCHS, (Habitat) 15-16th October, 1996.

Mather, A.S. (1998). **Land Use**, John Wiley and sons New York.

Maxwell, D. et al (1992). **Urban Farming in Africa; The Case of Kampala; Uganda.** ACTS press, Nairobi

Mbiba B, (2000). **Urban Agriculture in Harare: Between Suspicion and Repression**, in

McCulloch P. et al (eds.) (1965). **Land Use in an Urban Environment: A General View of Town and Country Planning**: Liverpool University press, Liverpool

Meryon P.A. and D Lee Smith (1993). **Urban Agriculture in Kenya**, Nairobi; Mazingira Institute (unpublished report)

Mougeot L. (1993). **Urban Food Self Reliance: Significance and Prospects,** IDRC reports vol. 21. No3.

Mougeot L.J (ed) (1996). **Urban Agriculture in Africa**, African Urban Quarterly; vol. 11 Nos. 2 and 3; African Urban Quarterly Ltd., Nairobi

Mougeot L.J. (1999). **Urban Agriculture: Definition, Presence, Potential and Risks** in Bakker 2000; **Growing Cities, Growing Food,** proff offsetdrunk, Eurasburg

Mougeot, L.J (1998). **Farming Inside and Around Cities in Urban Age**, The global city magazine (1998).

Mougeot, L.J. (1996). **An Improving Domestic and International Environmental For African Urban Agriculture** in Obudho, R.A. (ed.) 1996; ***African Urban Quarterly*** vol. 11 Nos. 2 and 3; University of Nairobi, Kenyan.

Mumford, L. (1961). **The City in History,** Harcourt Brace and World Inc, New York.

Mwangi, A.M. (1996). **Urban Agriculture, Food Security and Nutrition in Low Income Areas of the City of Nairobi,** Kenya; in Obudho R.A. (ed.) (1996) **African Urban Quarterly** vol. 11 Nos. 2 and 3 may-August, 1996, University of Nairobi, Nairobi, Kenya

Obudho R.A and Dick Foeken (1999). **Urban Agriculture in Africa; A Bibliographical Survey** ,Center for Urban Research, Nairobi

Obudho R.A. (ed.) (1996). **African Urban Quarterly** vol. 12 Nos. 2 and 3, May-August 1996, University of Nairobi, Nairobi, Kenya

Obudho, R.A. (1976). **The Nature of Kenya Urban Hierarchy, Implication for Regional Planning Strategy** (Unpublished Ph.D. Thesis)

Rakodi, C. (1988). **Urban Agriculture; Research Questions and Zambian Evidence: Journal of Modern African Studies.**

Rakodi, C. (1991). **Women's Work or Household Strategies? Environment and Urbanisation Paper,** ***pp. 39 - 45.***

Ratcliffe, J. (1976*).* **Land Policy: An Exploitation of the Nature of Land in Society;** Hutchinson; London

Sanyal B, (1986). **Urban Cultivation in East Africa peoples response to urban poverty:Paris,** The Food - Energy - Programme; United Nations University.

Sanyal, B. (1984). **A Strategy of Survival in Zambia** (Ph.D. Thesis) University of California, Los Angles

Sawio C.J. (1993). **Feeding the Urban Masses? Towards an Understanding of The Dynamics of Urban Agriculture and Land Use Change in Dar-es-salaam, Tanzania;** Worcester, Ph.D. dissertation, Clerk University

Sawio, C.J. (1998). **Urban Agriculture in Tanzania: Its Roles, Planning and Management Applications** , Paper Presented in Technician, Pretoria, 3rd - 5th March, 1998

Shah M. (2000). **Food in The 21st Century; From Science to Sustainable Agriculture;** World Bank, Washington DC.

Smit, J. et al (1996). **Urban Agriculture: Food, Jobs and Sustainable Cities**, New York: United Nations Development Programme.

Smith, J and Nasr, (1972). **Urban Agriculture for Sustainable Cities Using Wastes and Idle Land and Water Bodies as Resources: Environment and Urbanization.**

Tereva, D.S. (1996). **Urban Agriculture in Africa: A Comparative Analysis of Findings From Zimbabwe, Kenya, and Zambia.,** Department of Geography, University of Zimbabwe, Harare.

**The Physical Planning Hand Book,** (1976). Department of physical planning, Nairobi

Tumbo, S.N. (1992). **Analysis of Informal Sector Activities in Machakos Town: Towards a System Policies Design;** University of Nairobi, Unpublished M.A. Thesis

UNDP (United Nation Development programme ) (1996). **Urban Agriculture: Food, Jobs and Sustainable Cities;** UNDP, New York.

WCED (World Commission on Environment and Development) (1987). **Food 2000, Global Policies for Sustainable Agriculture,** WCED, New Jersey.

# ANNEXES

# ANNEX 1: RESULTS OF STATISTICAL ANALYSIS:

## T-TESTS FOR SAMPLE PROPORTIONS

Significance level $\alpha = 0.05$, 2-tailed

Degrees of freedom = (30 + 70) - 2 = 98

1. Households with more than six members
   $H_0$. There is no significant difference between farming and non-farming households with more than six members.
   Farming = 41%
   Non farming = 3%

$$t_c = \frac{/P_{s_1} - P_{s_2}}{\sqrt{\frac{P\%Q\%}{n_1} + \frac{P\%Q\%}{n_2}}}$$

$$= \frac{/41 - 3/}{\sqrt{\frac{41X59}{70} + \frac{3X97}{30}}}$$

$$= \frac{38}{\sqrt{34.6 + 9.7}}$$

$$= \frac{38}{6.66}$$

$$= 5.7$$

t computed 5.7 >t expected 1.96
$H_0$ is rejected.

2. Post secondary education of households heads.
$H_0$. There is no significant difference between the farming and non-farming household heads with post secondary education.
Non farming = 33%
Farming = 7%

$$tc = \frac{/33 - 7/}{\sqrt{\frac{33X67}{30} + \frac{7X93}{70}}}$$

$$= \frac{26}{\sqrt{73.7 + 9.3}}$$

$$= \frac{26}{9.1}$$

$$= 2.9$$

t computed 2.9 > t expected 1.96
$H_0$ is rejected

3. Household heads earning less than Ksh. 5,000 per month
$H_0$. There is no significant difference between farming and non-farming household heads earning less than Ksh. 5,000 p.m.
Non farming = 20%
Farming = 50%

$$t_c = \frac{|50-20|}{\sqrt{\frac{50X50}{70}+\frac{20X80}{30}}}$$
$$= \frac{30}{\sqrt{35.7+53.3}}$$
$$= \frac{30}{9.4}$$
$$= 3.19$$

t computed 3.19 > t expected 1.96
$H_0$ is rejected.

4. Land ownership
$H_0$. There is no significant difference between farming and non-farming households owning land.
Farming = 83%
Non farming = 23%

$$t_c = \frac{|83-23|}{\sqrt{\frac{83X17}{70}+\frac{23X77}{30}}}$$
$$= \frac{60}{\sqrt{14.1+59}}$$
$$= \frac{60}{8.5}$$
$$= 7.1$$

t computed 7.1 > t expected 1.96
$H_0$ is rejected.

5. Urban residence
$H_0$. There is no significant difference between farming and non-farming households years of urban residence.
Farming = 43%
Non farming = 7%

$$t_c = \frac{|43-7|}{\sqrt{\frac{43X57}{70}+\frac{7X93}{30}}}$$
$$= \frac{36}{\sqrt{35+21.7}}$$
$$= \frac{36}{7.53}$$
$$= 4.78$$

t computed 4.78 > t expected 1.96
$H_0$ is rejected.

6. Awareness of planning law.
$H_0$. There is no significant difference between farming and non-farming households aware of planning law.
Farming = 3%
Non farming = 0%

$$t_c = \frac{|3-0|}{\sqrt{\frac{3X97}{70} + \frac{0X100}{30}}}$$
$$= \frac{3}{\sqrt{4.2+0}}$$
$$= \frac{3}{2.05}$$
$$= 1.46$$

t computed 1.46 < t expected 1.96
Failed to reject $H_0$

7. Formal employment
$H_0$. There is no significant difference between the farming and non-farming household heads formally employed.
Farming = 34%
Non farming = 63%

$$t_c = \frac{|63-34|}{\sqrt{\frac{63X37}{30} + \frac{34X66}{70}}}$$
$$= \frac{29}{\sqrt{77.7+32.1}}$$
$$= \frac{29}{10.5}$$
$$= 2.76$$

t computed 2.76 > t expected 1.96
$H_0$ is rejected.

8. Households with 4-6 members
$H_0$. There is no significant difference between farming and non-farming households with a range of 4-6 members.
Farming = 43%
Non farming = 63%

$$t_c = \frac{|63-43|}{\sqrt{\frac{63X37}{30} + \frac{43X57}{70}}}$$
$$= \frac{20}{\sqrt{77.7+35}}$$
$$= \frac{20}{10.6}$$
$$= 1.87$$

t computed 1.87 < t expected 1.96
Failed to reject $H_0$.

# Regression 1

**Variables Entered/Removed[b]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | distance from CBD[a] | . | Enter |

a. All requested variables entered.

b. Dependent Variable: land size acres

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .024[a] | .001 | -.013 | 1.408385 |

**Model Summary**

| Model | Change Statistics | | | | |
|---|---|---|---|---|---|
| | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .001 | .044 | 1 | 76 | .834 |

a. Predictors: (Constant), distance from CBD

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 8.774E-02 | 1 | 8.774E-02 | .044 | .834[a] |
| | Residual | 150.750 | 76 | 1.984 | | |
| | Total | 150.837 | 77 | | | |

a. Predictors: (Constant), distance from CBD

b. Dependent Variable: land size acres

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 1.168 | .344 | | 3.394 | .001 |
| | distance from CBD | 3.392E-02 | .161 | .024 | .210 | .834 |

**Coefficients[a]**

| Model | | 95% Confidence Interval for B | | Correlations | | |
|---|---|---|---|---|---|---|
| | | Lower Bound | Upper Bound | Zero-order | Partial | Part |
| 1 | (Constant) | .483 | 1.854 | | | |
| | distance from CBD | -.287 | .355 | .024 | .024 | .024 |

a. Dependent Variable: land size acres

# Regression 2

**Variables Entered/Removed[b]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | machakos east distance[a] | . | Enter |

a. All requested variables entered.

b. Dependent Variable: machakos east landsize

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .356[a] | .126 | .054 | 1.3846 |

**Model Summary**

| Model | Change Statistics | | | | |
|---|---|---|---|---|---|
| | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .126 | 1.737 | 1 | 12 | .212 |

a. Predictors: (Constant), machakos east distance

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 3.330 | 1 | 3.330 | 1.737 | .212[a] |
| | Residual | 23.006 | 12 | 1.917 | | |
| | Total | 26.336 | 13 | | | |

a. Predictors: (Constant), machakos east distance

b. Dependent Variable: machakos east landsize

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 2.395 | .737 | | 3.250 | .007 |
| | machakos east distance | -.516 | .391 | -.356 | -1.318 | .212 |

# Regression 3

**Variables Entered/Removed[b]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | college distance[a] | . | Enter |

a. All requested variables entered.

b. Dependent Variable: college landsize

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .417[a] | .174 | .105 | 1.8585 |

**Model Summary**

| | Change Statistics | | | | |
|---|---|---|---|---|---|
| | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .174 | 2.528 | 1 | 12 | .138 |

a. Predictors: (Constant), college distance

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 8.732 | 1 | 8.732 | 2.528 | .138[a] |
| | Residual | 41.447 | 12 | 3.454 | | |
| | Total | 50.179 | 13 | | | |

a. Predictors: (Constant), college distance

b. Dependent Variable: college landsize

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95% Confidence Interval for B | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | .525 | 1.152 | | .456 | .657 | -1.985 | 3.036 |
| | college distance | .795 | .500 | .417 | 1.590 | .138 | -.295 | 1.885 |

# Regression 4

**Variables Entered/Removed[b]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | machakos west distance[a] | . | Enter |

a. All requested variables entered.

b. Dependent Variable: machakos west landsize

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .122[a] | .015 | -.067 | .9749 |

**Model Summary**

| Model | Change Statistics | | | | |
|---|---|---|---|---|---|
| | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .015 | .181 | 1 | 12 | .678 |

a. Predictors: (Constant), machakos west distance

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | .172 | 1 | .172 | .181 | .678[a] |
| | Residual | 11.404 | 12 | .950 | | |
| | Total | 11.576 | 13 | | | |

a. Predictors: (Constant), machakos west distance

b. Dependent Variable: machakos west landsize

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 1.137 | .542 | | 2.098 | .058 |
| | machakos west distance | .118 | .277 | .122 | .425 | .678 |

# Regression 5

**Variables Entered/Removed[b]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | kiimakimwe distance | . | Enter |

a. All requested variables entered.

b. Dependent Variable: kiimakimwe landsize

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .376[a] | .141 | .069 | .4451837 |

**Model Summary**

| Model | Change Statistics | | | | |
|---|---|---|---|---|---|
| | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .141 | 1.971 | 1 | 12 | .186 |

a. Predictors: (Constant), kiimakimwe distance

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | .391 | 1 | .391 | 1.971 | .186[a] |
| | Residual | 2.378 | 12 | .198 | | |
| | Total | 2.769 | 13 | | | |

a. Predictors: (Constant), kiimakimwe distance

b. Dependent Variable: kiimakimwe landsize

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | .830 | .266 | | 3.114 | .009 |
| | kiimakimwe distance | -.173 | .123 | -.376 | -1.404 | .186 |

# Regression 6

**Variables Entered/Removed[b]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | madaraka distance | . | Enter |

a. All requested variables entered.

b. Dependent Variable: madaraka landsize

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .079[a] | .006 | -.077 | 1.598937 |

**Model Summary**

| Model | Change Statistics | | | | |
|---|---|---|---|---|---|
| | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .006 | .076 | 1 | 12 | .787 |

a. Predictors: (Constant), madaraka distance

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | .194 | 1 | .194 | .076 | .787[a] |
| | Residual | 30.679 | 12 | 2.557 | | |
| | Total | 30.874 | 13 | | | |

a. Predictors: (Constant), madaraka distance

b. Dependent Variable: madaraka landsize

**Coefficients[a]**

| Model | | 95% Confidence Interval for B | | Correlations | | |
|---|---|---|---|---|---|---|
| | | Lower Bound | Upper Bound | Zero-order | Partial | Part |
| 1 | (Constant) | -.681 | 3.322 | | | |
| | madaraka distance | -1.063 | .824 | -.079 | -.079 | -.079 |

a. Dependent Variable: madaraka landsize

## Crosstabs

**Case Processing Summary**

| | Cases | | | | | |
|---|---|---|---|---|---|---|
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| awareness of planning law * farming status | 100 | 100.0% | 0 | .0% | 100 | 100.0% |

**awareness of planning law * farming status Crosstabulation**

Count

| | | farming status | | Total |
|---|---|---|---|---|
| | | farmer | non farmer | |
| awareness of planning law | aware | 2 | | 2 |
| | unaware | 68 | 30 | 98 |
| Total | | 70 | 30 | 100 |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | .875[b] | 1 | .350 | | |
| Continuity Correction[a] | .024 | 1 | .876 | | |
| Likelihood Ratio | 1.444 | 1 | .229 | | |
| Fisher's Exact Test | | | | 1.000 | .488 |
| Linear-by-Linear Association | .866 | 1 | .352 | | |
| N of Valid Cases | 100 | | | | |

a. Computed only for a 2x2 table

b. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .60.

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 34.588[a] | 39 | .671 |
| Likelihood Ratio | 44.867 | 39 | .239 |
| Linear-by-Linear Association | 15.746 | 1 | .000 |
| N of Valid Cases | 100 | | |

a. 77 cells (96.3%) have expected count less than 5. The minimum expected count is .30.

## Crosstabs

**Case Processing Summary**

| | Cases | | | | | |
|---|---|---|---|---|---|---|
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| urban residence * farming status | 100 | 100.0% | 0 | .0% | 100 | 100.0% |

T-Test

**Group Statistics**

| | farming status | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| household size | farmer | 70 | 5.80 | 2.56 | .31 |
| | non farmer | 30 | 4.00 | 1.36 | .25 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | |
|---|---|---|---|
| | | F | Sig. |
| household size | Equal variances assumed | 13.649 | .000 |
| | Equal variances not assumed | | |

**Independent Samples Test**

| | | t-test for Equality of Means | | | |
|---|---|---|---|---|---|
| | | t | df | Sig. (2-tailed) | Mean Difference |
| household size | Equal variances assumed | 3.633 | 98 | .000 | 1.80 |
| | Equal variances not assumed | 4.565 | 93.227 | .000 | 1.80 |

**Independent Samples Test**

| | | t-test for Equality of Means | | |
|---|---|---|---|---|
| | | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | Lower | Upper |
| household size | Equal variances assumed | .50 | .82 | 2.78 |
| | Equal variances not assumed | .39 | 1.02 | 2.58 |

T-Test

**Group Statistics**

| | farming status | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| urban residence | farmer | 70 | 23.80 | 19.14 | 2.29 |
| | non farmer | 30 | 7.93 | 9.60 | 1.75 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | |
|---|---|---|---|
| | | F | Sig. |
| urban residence , | Equal variances assumed | 49.949 | .000 |
| | Equal variances not assumed | | |

**Independent Samples Test**

| | | t-test for Equality of Means | | | |
|---|---|---|---|---|---|
| | | t | df | Sig. (2-tailed) | Mean Difference |
| urban residence | Equal variances assumed | 4.305 | 98 | .000 | 15.87 |
| | Equal variances not assumed | 5.505 | 95.487 | .000 | 15.87 |

**Independent Samples Test**

| | | t-test for Equality of Means | | |
|---|---|---|---|---|
| | | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | Lower | Upper |
| urban residence | Equal variances assumed | 3.69 | 8.55 | 23.18 |
| | Equal variances not assumed | 2.88 | 10.15 | 21.59 |

T-Test

**Group Statistics**

| | farming status | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| income of household head | farmer | 70 | 7405.71 | 5706.34 | 682.04 |
| | non farmer | 30 | 9143.33 | 4800.41 | 876.43 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | |
|---|---|---|---|
| | | F | Sig. |
| income of household head | Equal variances assumed | 1.882 | .173 |
| | Equal variances not assumed | | |

**Independent Samples Test**

| | | t-test for Equality of Means | | | |
|---|---|---|---|---|---|
| | | t | df | Sig. (2-tailed) | Mean Difference |
| income of household head | Equal variances assumed | -1.460 | 98 | .147 | -1737.62 |
| | Equal variances not assumed | -1.565 | 64.776 | .123 | -1737.62 |

**Independent Samples Test**

| | | t-test for Equality of Means | | |
|---|---|---|---|---|
| | | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | Lower | Upper |
| income of household head | Equal variances assumed | 1190.15 | -4099.43 | 624.20 |
| | Equal variances not assumed | 1110.54 | -3955.67 | 480.43 |

## ANNEX 2: QUESTIONNAIRES

## URBAN AGRICULTURE AND DEVELOPMENT CONTROL IN KENYA: THE CASE OF MACHAKOS MUNICIPALITY.

FARMING HOUSE HOLD QUESTIONNAIRE

*This research is carried out on behalf of the University of Nairobi as a partial requirement for the award of a Masters degree in planning. Any information obtained is purely for academic purposes.*

1. Questionnaire number_____

2. Date of interview_____

3. Ward _____

4. Approximate distance from town center _____ (kms)

*Household head characteristics*

5. Sex_____

6. Marital status_____

7. Education level_____

8. Years of residence in the area_____

9. Household size_____

10. Occupation (apart from faming)_____

Income per month

>5000 _____

5000 - 10,000_____

10,000 - 15,000 _____

< 15,000_____

11. Income per month from agricultural produce._____(Ksh)

12. How much can another activity such as residential fetch per month in this area?

13. Are you aware of the existence of any Planning Law or by-laws, which prohibit the practice of urban agriculture?

yes_____ No_____ If yes, Why do you practice it?_____

How did you come to learn about it ?_____

*Land characteristics.*

14. What is the status of the land you live on ?

Own___ Rented ____ Council Land _____ Government Land _____

15. What is the approximate size of you farm_____(acres)

16. Location in relation to river/streams

Near_____ Adjacent ___ Far ___

17. Do you have access to any other land else where? Yes ___ No ___ If yes, where? _____ How have you used it? _____

18 What other land uses compete with agriculture in this Area?

Residential _____ Commercial _____ Other _____

19. What is the cost of Land per Acre _____(Ksh)?

20. What is the reaction of the municipal council and the public health department to farming activities in this area?-

_____

21.What is your farming calendar? Once a year____ Continuous _____ seasonal _____

22.Do you carry our any soil conservation measures ? Yes _____ No___

23.If yes, which ones?_____

***Agronomic Practices***

24.State and Tick Where Appropriate

| Type of crop | Yield per harvest | Subsistence | Sale (where) & cost | Type of ivestock products | Amount/month | Subsistence | Sale (where and cost) |
|---|---|---|---|---|---|---|---|
| \ | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

25.What inputs do you apply/use?

| **Type** | **Tick (appropriately)** | **Source** | **Cost/kg/50kgs** |
|---|---|---|---|
| Chemical fertilizer | | | |
| Farm yard manure | | | |
| Certified seeds | | | |
| Pesticides | | | |
| Urban waste | | | |
| Breeding stock | | | |
| Veterinary drugs | | | |
| Water | | | |

26. What is the source of your farm labour?

Family___ Casual labour from rural areas ____ Casual labour from town centre_____ Casual labour from the peri-urban area____

27. Do you receive any extension services?

Yes _ No _ If Yes which are they_____

28. Do you intent to continue with farming in future? Yes ___ No___ why_____

# URBAN AGRICULTURE AND DEVELOPMENT CONTROL IN KENYA: THE CASE OF MACHAKOS MUNICIPALITY.

## NON-FARMING HOUSE HOLD QUESTIONNAIRE

*This research is carried out on behalf of the University of Nairobi as a partial requirement for the award of a Masters degree in planning. Any information obtained is purely for academic purposes.*

1. Questionnaire number_____
2. Date of interview_____
3. Ward_____
4. Approximate distance from town center_____kms

Household characteristics.

5. Sex_____
6. Marital status_____
7. Educational level_____
8. Years of residence in the area_____
9. Household size_____
10. Income per month

<5000_____

5000-10000_____

10000-15000_____

>15000_____

11. Why don't you practice urban agriculture? _____

12. Are you aware of the existing planning law which prohibit agricultural activities within the municipality?

Yes_____No_____

If yes, how did you come to learn of it? _____

13. Have you ever practiced urban agriculture at any given time? _____

What is your perception to the practice of urban agriculture? _____

Land characteristics

14. What is the status of land you live on?

Own_____Rented_____Council land_____Government_____

15. If own, what is the approximate size of your land? _____Acres

16. Location in relation to river/ stream

Near_____Adjacent_____Far_____

17. Do you have access to any other land elsewhere? Yes_____No_____

If Yes, Do you farm on it? _____

**URBAN AGRICULTURE AND DEVELOPMENT CONTROL IN KENYA: THE CASE OF MACHAKOS MUNICIPALITY.**

QUESTIONNAIRE FOR MARKET TRADERS (Dealing with agricultural produce)

*This research is carried out on behalf of the University of Nairobi as a partial requirement for the award of a Masters degree in planning. Any information obtained is purely for academic purposes.*

Date of interview_____

Sex_____

Education level_____

1. Where do you come from? ____
2. What is the source of your products? _____

Grow myself____ Buy from other farmers____ Other____

3.How often do you come to sell in this market?

Daily_____ Market days____When I have produce_____

4. What products do you deal with? _____

| PRODUCT | SALE PRICE |
|---|---|
| | |
| | |
| | |
| | |

5. Do you have any other occupation apart from business? YES ____ NO ____ If yes, how much do you earn form it per month _____(Ksh).

6. Do you pay any money to trade in this market?

YES _____ NO _____ If yes, how much? _____ (Per day/per week/per month)

7. Do you sale your products elsewhere?

YES _____ NO _____, If yes, where? _____

8. What problems do you face in carrying out your business? _____

**URBAN AGRICULTURE AND DEVELOPMENT CONTROL IN KENYA: THE CASE OF MACHAKOS MUNICIPALITY.**

***QUESTIONNAIRE FOR THE TOWN CLERK: (MACHAKOS MUNICIPAL COUNCIL)*** *This research is carried out on behalf of the University of Nairobi as a partial requirement for the award of a Masters degree in planning. Any information obtained is purely for academic purposes.*

Date of interview _____

What is the extent of your municipality? _____
What land uses prevail in the municipality? _____

What is their extend for each? _____

Do you have any By-laws pertaining Agricultural practice within the municipality?

YES _____ NO ____ If yes, what do they state? _____

What efforts has the Municipal council taken to alleviate poverty within its area of jurisdiction?

_____

_____

In Your own view, what is the extent of farming within the municipality?

_____

What is the status of land within the municipality? _____

_____

How do you deal with the problem of freehold land ownership in the municipality in case you want to carry out any developments in an area? _____

_____

What is the rate of growth of Machakos Town? _____

What do you think supports and sustains the economy of Machakos Town?

_____

What legal policies exist pertaining farming in and around the town?

_____

_____

**URBAN AGRICULTURE AND DEVELOPMENT CONTROL IN KENYA: THE CASE OF MACHAKOS MUNICIPALITY.**

*SCHEDULED QUESTIONNAIRE FOR MACHAKOS DISTRICT PHYSICAL PLANNER*

*This research is carried out on behalf of the University of Nairobi as a partial requirement for the award of a Masters degree in planning. Any information obtained is purely for academic purposes.*

Date of interview _____

What is the extent of your services as regards planning Machakos municipality?

_____

What criteria do you use when zoning a particular area for a given land use ?

_____

What is the extent of the town centre? What is its percentage in relation to the whole municipality?_____

What is the position of Agriculture as a land use within the municipality? How do you cater for it?

_____

How do you marry land use planning to the nature of land tenure of the peri-urban area?

_____

Have you already designated the peri-urban areas for given land uses? Yes____ No_____ If yes, which ones? _____

How do you involve the local community in planning?

_____

What is the rate of subdivision in the peri-urban area of Machakos municipality?_____

What land use(s) is encroaching more on the peri-urban areas?

_____

In your view, what supports the urban economy of Machakos Town?

_____

What legal policies exist as it pertains farming within a given municipality?

What is your view as far as farming within the municipality is concerned?

_____

What should be done to the practice?_____

What should be the minimum land size for agriculture? _____

**URBAN AGRICULTURE AND DEVELOPMENT CONTROL IN KENYA: THE CASE OF MACHAKOS MUNICIPALITY.**

***QUESTIONNAIRE FOR MACHAKOS DISTRICT AGRICULTURAL OFFICER***

*This research is carried out on behalf of the University of Nairobi as a partial requirement for the award of a Masters degree in planning. Any information obtained is purely for academic purposes.*

Date of interview _____

What is your role as regards agriculture in the district? _____

How are agricultural activities distributed within the district in general and Machakos municipality in particular? _____

What services do you offer to farmers? _____

What is your area of operation? _____

Is there a limitation to your area of operation? _____

How do you view farming in and around Machakos Town? _____

_____

What is the trend of agricultural land within Machakos municipality?.

Increasing ___ Decreasing __ Constant___ Why?_____

If Decreasing , what is the cause ? _____

What are the different types of crops grown and livestock kept within the municipality

_____

What are the production levels in different areas?

_____

Why do people produce? If for sale, where do they take their produce? _____

_____

What marketing forms and channels exist within the municipality?

_____

What is your view as regards urban expansion and particularly urban encroachment into the agricultural land? _____

_____

What are some of the environmental effects of farming in the peri-urban area of the municipality?

_____

What is your vision on farming generally within the municipality?----------