Dissertation By

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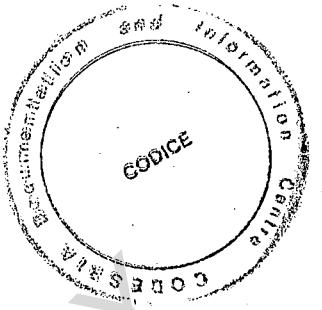
# Small scale farmers' perception of, and response to drought in makuyu division, muranga district, Kenya

1994

# SMALL SCALE FARMERS' PERCEPTION OF, AND RESPONSE TO DROUGHT IN MAKUYU DIVISION, MURANG'A DISTRICT, KENYA




BY

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF MASTER OF ARTS, DEPARTMENT OF GEOGRAPHY, KENYATTA UNIVERSITY

1994

## DECLARATION

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

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

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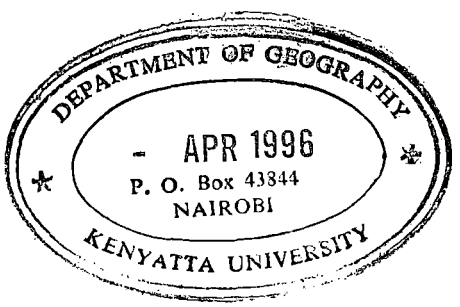

## Abstract

This study on small scale farmers' perception of, and response to drought in Makuyu Division of Murang'a District considered different aspects such as the history and impact of drought, farmers' perception of drought and possible influence on adjustment, as well as farmer responses to the 1984/85 and 1992 drought years and their suitability in averting drought. The study also examined statistically relationships between selected socio-economic variables and selected responses to drought.

Data were collected from both primary and secondary sources. Primary sources consisted of farm household interviews and repertory grids which aimed at gathering information on drought years and impacts, drought perception and responses. Secondary sources were mainly weather records archival documents, maps, government records and profiles which provided data on the history of drought and the geography of the study area. Data processing and analysis utilised techniques such as percentages, averages, frequencies, correlation, chi-square, cartographic and diagrammatic representations.

The study reveals that drought is a recurrent phenomenon in Makuyu Division with remarkable impacts. An attempt to construe farmers perception of drought revealed that farmers' are limited in their perceptions of various aspects of drought including, its causes, probability, symptoms and methods of this hazard control. These misperceptions affect farmers' mode of adjustment.

An examination of the responses made during droughts shows that farmers' responses are not effective in averting drought hazard.

Using the chi-square ($X^2$) test of significance no statistical relationship was found to exist between selected socio-economic variables (age, income, educational level and farm size) and choice of selected responses such as irrigation, mulching, type of cattle and growing drought resistant crops.

In retrospect a possible future drought recovery approach is suggested based on improving the existing structures. Recommendations are made that farmers' educational programmes need to be encouraged to instil proper drought perceptions; and a long term drought preplanning policy need be formulated so that effective strategies for coping with drought can be introduced. The study also points out the need to develop existing resources in Makuyu, at the same time integrating community participation as a check to future drought attacks. Areas for further research by scholars are also given.

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Above all, the greatest gratitude goes to the Almighty God, whose abundant grace took me through this challenging assignment. In retrospect, I wish to absolve all the acknowledged persons from any errors of omission and commission. If these do occur, they are entirely mine.

Finally I dedicate this thesis to my beloved parents, Mr. John Kibathi and Selina Muthoni who built a strong foundation for my life-long education since my childhood.

## ABBREVIATIONS

| | | |
|---|---|---|
| AEZII | – | Agro-ecological zone II which correspondents to Jaetzold's and Schmidt (1983) zonation coffee marginal zone (UM3). Temperatures here range between 20.7°C–19.7°C annually. Rainfall totals range between 900–1350 mm annually. |
| AEZIII | – | Agro-ecological zone III which is similar to Jaetzold and Schmidt's (1983) sunflower and maize zone (UM4). Temperatures here range between 20.7°C – 19.5°C. Annual rainfall totals range between 850 – 950 mm. |
| AEZIV | – | Agro-ecological zone IV which corresponds to Jaetzold and Schmidt's (1983):Cotton Zone (LM3) Temperatures lie between 21°C – 20.0°C annually Rainfall totals range between 790 – 980 mm annually. |
| KMD | – | Kenya Meteorological Department |
| KNA | – | Kenya National Archives |
| NGO | – | Non Governmental Organization |

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# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 Background to the Problem

Drought is a potential hazard for agriculture in nearly all of Africa, where evapotranspiration rates exceed available moisture (Wisner 1977). Kenya is no exception since nearly 80% of the country's land area is unlikely to receive more than 700mm of rainfall more than three or four out of ten years. Downing (1989) describes two areas of Kenya as traditionally drought-prone. These are, the eastern plateau, which roughly coincides with Eastern Province and is comprised of semi-arid, lowlying land that extends in an arch to the east and north of Mt. Kenya and, the generally arid pastoral areas of northern Kenya.

Existing literature (e.g. Downing et.al. 1989:Wisner 1977a, b) identifies three types of drought experienced in Kenya: national, regional, and local. The national drought mainly affects directly the production of more than 10% of Kenya's population and may last for two or more growing seasons, and generally involves serious food shortages. National drought comes once every ten years. The regional drought affects less than 10% of the total population and may last for one or two growing seasons. It may occur two to three times in ten years.

Local drought usually occurs once every year somewhere in Kenya (Wisner 1977a), especially in the marginal eastern foreland plateau. A local drought is simply a condition of rainfall variability associated with localised crop failure or serious food shortages during harvests (Mbithi and Wisner 1972).

This study focuses on Makuyu Division, one of Kenya's local drought-prone areas. Specifically, it assesses the local system(s) of drought adjustment among Makuyu farmers. The study takes a perceptual approach or framework on the contention that response to a phenomenon is related to the perception of the phenomenon itself and to awareness of opportunities to make adjustments (Burton, Kates and White 1978 and Van Apeeldoorn 1980).

Apparently drought and associated famine has been a reality to Makuyu small-scale farmers over the years, a plight aggravated by factors such as poor degraded soils and diseases outbreak. Ambler (1977a) cited Eastern Murang'a (today's Makuyu Division) as one of the areas in Kenya that experienced the great famine of 1897 to 1900, which amidst other factors, was associated with drought. Wisner (1977a) also recorded that Lower Forthall (present day Makuyu) was one of the areas that received relief food supplies during the 1961-62 drought.

Existing government and archival records reveal that Makuyu Division was badly hit by drought in 1971, 1972, 1980, 1981, 1984/85 and 1987. Cases of relief food delivered to the area have been recorded by Kenya National Archives, hereafter called KNA, (1972, 1981, 1984 and 1985). During the pilot survey and the main study farmers cited 1943, 1950-52, 1962, 1966, 1972, 1974, 1977, 1984, 1985, 1987, 1991 and 1992 as drought years. For each period, the farmers cited varied degrees of crop failure, livestock loss and subsequent famine. In 1992, newspaper reports voiced an outcry for relief food to be ferried to drought stricken Makuyu residents whose crops had failed due to the failure of 1991 short rains and the 1992 long rains (Daily Nation 28, July and 9, October 1992). Karega (1992) further exposed the plight of Makuyu residents due to the 1991/92 drought. He reported that more than 18,000 residents of Ithanga and Kakuzi locations of Makuyu Division were threatened with starvation while hundreds of children had stopped going to school due to hunger. The report also mentioned cases of malnutrition, kwashiorkor and marasmus as rampant in the entire division.



## 1.2 Statement of the Problem

Previous studies on drought management in Kenya focused mainly on national (e.g. Downing, Kang'ethe and Kamau 1989) and regional droughts (e.g. Wisner and Mbithi 1972; Campbell 1979; O'Leary 1980; Odegi-Awuondo 1983, 1990; Herlely 1984), paying little

attention to local droughts. Whyte (1977) argues that in as much as studies at an aggregate or macro scale are useful in revealing variations and regularities, they tend to limit local depth and social holism. Makuyu Division being one of the areas in Kenya experiencing recurrent local drought has attracted little research interest.

Besides, most of the existing studies on drought management in Kenya have tended to over-emphasize the role of government policy (Wisner and Mbithi 1972, Wisner 1977, Odegi-Awuondo 1983, Herlehy 1984 Matheka 1992), in explaining people's vulnerability and mode of adjustment to the drought hazard. Only a few of these researchers have considered farmer's perception of drought and how it influences adjustment behaviour.

Subsequently, this study seeks to fill gaps in knowledge of the history and the impact of drought in Makuyu Division of Murang'a District. The study examines farmers' perception of drought and its influence on choice of responses. The study also examines farmer responses during the 1984/85 and 1992 droughts, and assesses their effectiveness. The role of socio-economic characteristics in choice of coping mechanisms is also addressed.

## 1.3 Objectives

1. To trace the history and impact of drought on human well-being, crop and livestock productivity in Makuyu Division.
2. To examine farmers' perception of drought and possible influence on choice of coping mechanisms.
3. To examine farmers' drought coping mechanisms and their effectiveness in reducing farmer vulnerability to drought hazards.
4. To assess the relationship between farmers' socio-economic characteristics (For example age,family size,land ownership, educational level and income) and choice of drought coping mechanisms.

## 1.4 Premises/Hypotheses

**Premises**

1. Drought has no remarkable history in the study area.
2. The 1984/85, 1992 droughts did not have any significant impact on peoples' well-being and on crop and livestock productivity in the study area.
3. The coping mechanisms/responses practised by the small scale farmers are not effective in averting farmer vulnerability to drought hazards.

4. There is no significant relationship between farmers' perception of drought and choice of responses.

**Hypothesis**

There is no significant relationship between certain selected responses to drought and selected farmer socio-economic variables.

## 1.5 Rationale for the Study

One of the major objectives of Kenya's development policy outlined in Sessional Paper Number 8 of 1980 is that, the agricultural sector must continue to play the leading role in development and that nearly all the nation's food requirements must be met from domestic production (Kenya 1981). This objective cannot be realized if the impacts of environmental hazards such as drought, that threaten agricultural production, are not minimised. By examining how farmers cope with drought in Makuyu Division, this study unearths some of the strengths and weaknesses in local drought management systems and offers alternative approaches for policy intervention.

The study reveals that Makuyu Division continues to experience a series of famines due to drought attacks. An attempt has been made to investigate the roots of this persistent vulnerability to drought while possible ways of promoting preparedness to drought

attacks and enhancing self-sufficiency in food production in the division are suggested.

The perceptual approach used in this study goes along way in assessing the range and limitations of farmers' knowledge of drought per se and its ramifications to adjustment behaviour. These have clear policy implications in improving farmers' educational programmes, early warning systems of drought and promoting the need to utilize indigenous knowledge in the decision making process. Hankins (1974) cautions that government programs can go far astray if they ignore the perception of the people affected by drought hazard and ways they adjust to it. Further the study adds knowledge to issues in agricultural geography and opens frontiers for further investigations in food security.



### 1.6 Scope and Limitations

This study is confined to Makuyu Division in Murang'a district due to reasons discussed in section 1.7. The focus is on: perception of drought, perceptual rankings of causes of drought, its symptoms, frequency and methods of control as perceived by the farmer. Farmers' responses to drought and their suitability are analysed and discussed. Statistical relationships are worked out between socio-economic variables and selected drought coping strategies. The impact and history of drought is discussed.

A total of 120 small-scale farmers were interviewed. The large Co-operative and company owned farms were excluded, since the choice of adjustment mechanisms in these contexts represent group decisions or decisions made in circles not directly involved in the farming activities. Such would have made it difficult to construe farmers' drought perception.



## 1.7 Operational Definitions of Terms and Concepts

**Drought**: In this study drought refers to a protracted rainfall failure, a condition occurring when rainfall declines over a period of time to appreciably subnormal or well below average so as to affect the natural resource productive capacity of an area (see Darkoh 1989:15-16:UNSO 1992 :6-7).

**Perception**: This refers to the process by which people select, organise and interpret sensory situations connected with drought into a meaningful and coherent picture of the world.

**Response/coping Mechanism** :This refers to all the ways in which a farmer may act to reduce or increase the impact of drought.

**Vulnerability**: This is in the inability to:

1. Prepare for the likelihood of a drought.
2. Making adjustments in the event that drought occur.
3. To develop greater capacity to withstand the effects of future drought events

**Socio-Economic Factors**: This refers to those sociological and economic aspects attributed to man and his environment such as farmers' age, educational level, farm size, labour input, income level, and family size.

**Human well-being**: Smith (1977) defines human well-being as the quality of life of a population with respect to the following criteria: income, wealth, employment, health and education. This study adopts the same definition.

**Farm household**: A group of people who have one or more sources of income and cultivate a piece of land at least 1/4 acre. The land can be owned borrowed or rented.



## 1.8 Study Area

Makuyu Division, the study area (Fig 1.1) occupies an area of 643 $km^2$ of the Murang'a Districts' total area of 2,476 $km^2$. The division was chosen because of two reasons. Firstly, Makuyu is a dry zone -

prone to drought. It falls under agro-ecological zones IV (semi-arid), V (arid), VI (very-arid) and hence has low agricultural potential due to rainfall variability and unreliability. (Fig.2, see also Jaetzold and Schimdt 1977, Pratt and Gywnne 1989).

Subsequently any anomalies in rainfall triggers crop failures and, consequently famines. Secondly, the population of Makuyu Division has increased drastically since the early and late 1970s due to the spill-over of people from neighbouring high potential districts. This high influx has been attracted by land tenural changes associated with the subdivision of large estates and allocation of plots to individuals under land buying companies and cooperative societies. Thus, this area was appropriate for investigation into the extent to which immigrant farmers are capacitated to cope with drought given their different ecological knowledge associated with their background.

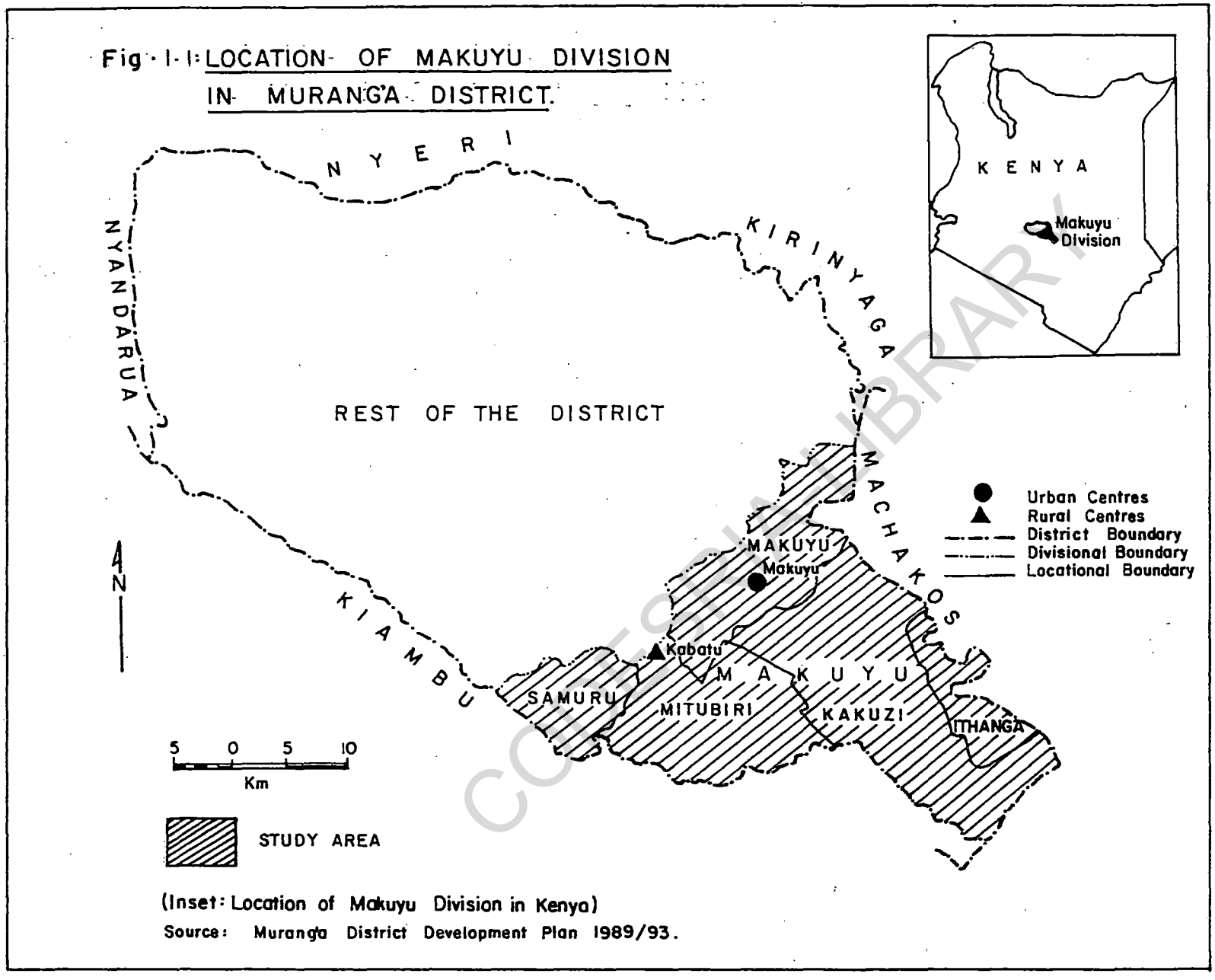
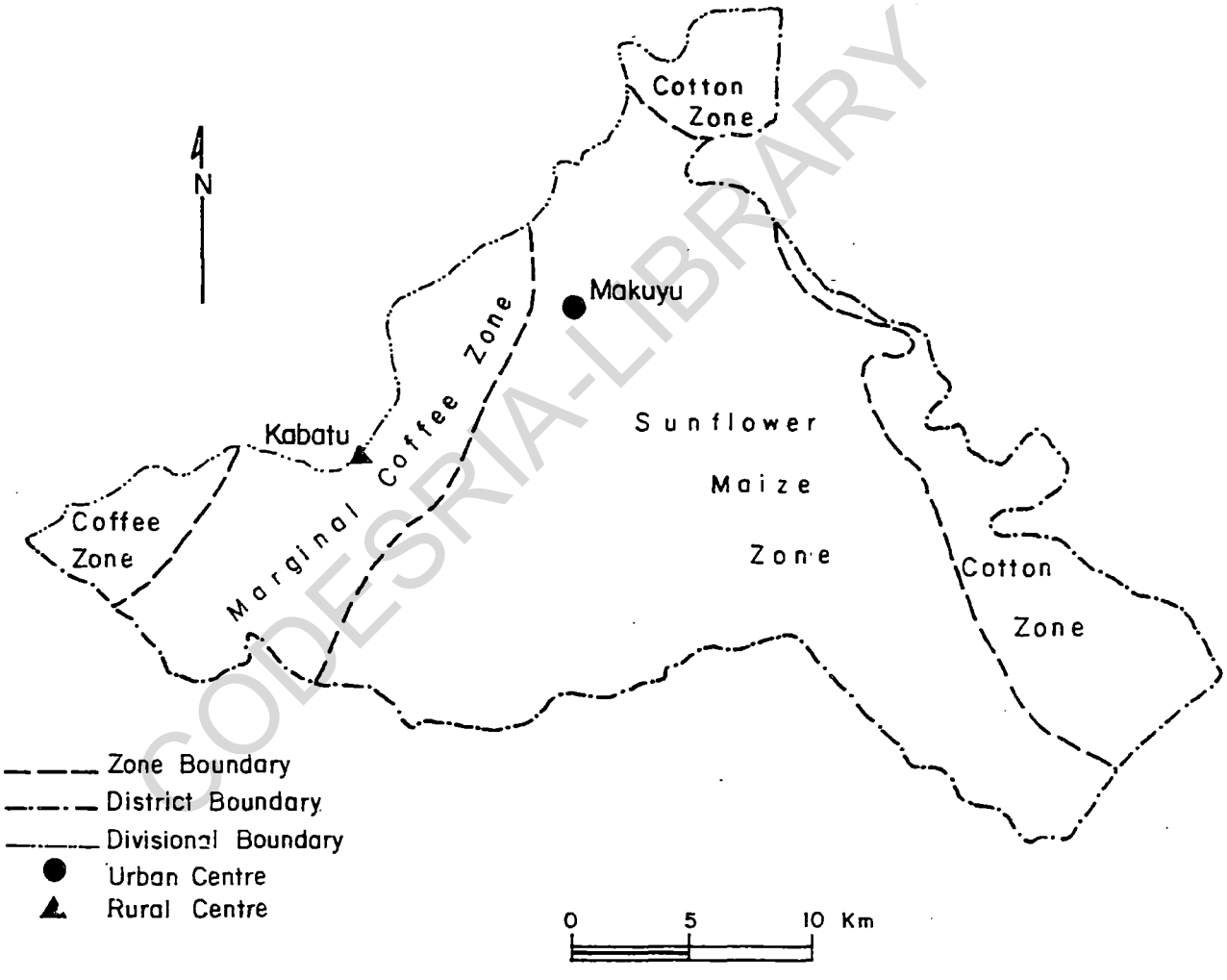



Figure 1.1

Fig·1·2: MAKUYU DIVISION

SIMPLIFIED AGRO – ECOLOGICAL ZONES.




Source: Farm Management Handbook of Kenya, 1982.



FIGURE 1.2

FIGURE 1.2

Rainfall in Makuyu Division is associated with the movement of the intertropical Convergence Zone (ITCZ) of the northeast and the southeast trade winds. This low pressure belt gives rise to two rainy seasons: the long rains (March to May) and short rains (October to November). Rainfall is unreliable and ranges between 500–900mm annually with some areas and sublocations such as Ithanga, receiving less than 500 mm annually.The mean maximum temperature ranges from 26°C to 30°C, while the minimum temperature range is between 14°C and 18°C.

The vegetation in the area is characterized by wooded grassland mainly of Acacia–Thermada associations. Areas under range use are extensive and under close management. Their stock carrying capacity is high, being less than two stock per unit.

Topographically, Makuyu Division consists of gently rolling land to the west at about 1034m above sea level, and level land around Kakuzi Hills which is roughly 914m above sea level. The eastern part of the division is generally low at around 914 m above sea level, otherwise it is broken by Kakuzi, Ithanga, Ngelelia and Zongololoni hills.

The soils in the division have developed from the basement complex and are subsequently poor and shallow. They have low

humus content and generally overly deeply weathered granitoid gneisses which have decomposed to kaolin quartz and vermiculite as opposed to the high humus volcanic soils in other parts of Murang'a District. Soil degradation is not a serious problem except in Ithanga and Kakuzi locations where a combination of poor agricultural practices and topography have aggravated the situation (Kenya 1989).

By 1979, Makuyu Division had a population of 60,402 persons with the lowest density of 93 persons per square kilometre in Murang'a District. Population projection for 1993 was 106,084 persons. Central Bureau of Statistics findings during the 1979 population census show that Makuyu Division had the highest rate of population growth between 1969 and 1979 of 5.04 percent in Murang'a District (see Table 1.2). This trend as mentioned earlier is as a result of high influx of immigrants following subdivision of large estates and subsequent allocation of plots to shareholders. Most of the shareholders are from Murang'a District. By 1980-81, the population was estimated at 68,800, distributed as shown in Table 1.1.

**Table 1.1: Population Distribution in Makuyu Division by 1980**

| LOCATION | POPULATION |
|---|---|
| Makuyu | 15,816 |
| Kakuzi | 15,714 |
| Mitumbiri | 10,078 |
| Samuru | 15,150 |
| Ithanga | 12,122 |
| Total | 68,800 |

Source:Were (1988: 29) Murang'a district socio-cultural Profile Draft Report.



Were (1988) revealed that Makuyu Division had the highest number of malnutrition cases, giving two explanations. First, most of the people in this area are casual employees in coffee plantations and therefore spend many hours in coffee farms and have little time to care for their children. Secondly, are the low wages that make it hard for them to afford to buy nutritional foods or medication.

Makuyu Division has a special feature in terms of land tenure and population settlement in Murang'a district. The brief history of the division is a pathetic case of the landless and the unemployed. The area was initially under sisal and coffee estates in the colonial period. After independence, Makuyu was sliced from Thika district to be incorporated into Murang'a district. From 1969, the whites

began to sell out their sisal estates to large cooperative societies, companies and individuals. High demand for land among the shareholders forced individualization of the purchased tracts of land.

**Table 1.2 Population distribution by Division in 1969 and 1979 in Murang'a District**

| Division | Area km2 | 1969 | 1979 | Density | Average Annual Increase |
|---|---|---|---|---|---|
| Kandara | 421 | 125805 | 181721 | 430 | 3.75 |
| Kigumo | 438 | 96773 | 135116 | 308 | 3.39 |
| Kangema | 341 | 89315 | 132912 | 388 | 4.08 |
| Kiharu | 407 | 96425 | 138182 | 339 | 3.66 |
| Makuyu | 643 | 36992 | 60402 | 93 | 5.04 |
| Total | 2476 | 445310 | 648333 | 261 | 3.83 |

Source: Murang'a District Development Plan 1989/93: 20.



Presently, the land tenure systems in the Division include: freehold under small holder schemes and large scale farms; government land and squatters. Large farms which cover a large bulk of the Division mainly in Kakuzi, Samuru and Mitumbiri locations

mark land which was bought by individuals and companies from former white settlers. These include Kenya Canners, a pineapple farm owned by the Delmonte Multinational Company, coffee and ranching estates owned by Kakuzi Company. The entire Samuru Location is under large-scale farms owned by private companies, namely; Socfinaf, Kakuzi and East African Acceptances, who major in coffee farming.

Kakuzi Limited and Kenya Canners together own more than two thirds of the land in the division. Kakuzi Limited, formerly owned by foreigners but now owned by Kenyans, used to be a sisal estate. Today the farm deals in coffee, livestock and forestry. The company has its own set of squatters who are former sisal workers but cannot be absorbed into the company's functions.

Kenya Canners (Delmonte) bought its land in 1965 to set up a pineapple plant that has the monopoly to can pineapples in Kenya. The company has its own squatters too, former sisal workers and their families.

The small holder farms comprise of small farms that have been acquired through various modes. Ithanga location is occupied by people who were previously landless or squatters who were given land by the government under the resettlement scheme programme

after independence. Small scale farmers in Makuyu and Kakuzi Locations were former employees of sisal and coffee estates who bought land from white settlers through co-operatives. Others such as those in Gathungururu obtained free land from their employer (Kakuzi Company) as part of their pension on retirement.

Kambiti location is occupied by people who were previously employees of a sisal factory which closed down declaring these people redundant. The other category of occupants comprises of immigrants from high potential areas who moved to Makuyu Division due to land pressure in their places of origin. They are to be found in all parts of the division but, mainly in Makuyu Location. The influx has particularly been highest since 1979 and is still in progress (Were 1988).

Yet another category exists and these are those squatting on other people's land or government reserved land. The affected people are found mainly in Ithanga, Kambiti and Kakuzi locations. Most of the squatters hail from Nyanza, Western and Central Provinces and some from the neighbouring Machakos district. They are mainly former employees of colonial settlers or sisal estates that no longer exist. These people have no land to grow food crops to feed the family (Were 1988).

Understanding the land tenure system of a community prone to an environmental hazard is vital as it highlights the socio-economy of such an area and also the degree of stability and ability to resist the attacks and the environmental hazard (Rolando 1982). Wisner (1977a) reliably observes that the majority of immigrants to marginal areas are normally poor and have little experience of dryland farming. Yet, others are burdened with labour constraints which limit them to below subsistence-sized acreages. These problems are aggravated by lack of capital and access to government services. This description fits well the background of the majority of peasants in Makuyu, and their very history partly explains their persistent vulnerability to drought attacks.

Were (1988) succinctly describes the whole division as underdeveloped. He observes that there is no single tarmac road except the highway to Nyeri and Nanyuki. The division suffers from serious food shortages and the people are on permanent Famine Relief programme from the government. As of July 1988, the Government had distributed 3,613 bags of maize and 300 bags of beans. Thus, Makuyu Division provides a setting in which to test hypotheses/premises on coping with drought.

## 1.9 Organisation of Thesis Chapters

This thesis has seven chapters. Chapter one has outlined the background to the study, problem statement, the objectives, hypothesis/ premises, rationale for the study, scope and limitations of the study, the study area and definitions of terms and concepts.

Chapter 2 is a review of related literature and the theoretical-conceptual framework on which the study is founded. Chapter 3 gives a detailed description of the research methodology used in the study.

Chapter 4 traces the history of drought in Makuyu and examines the related impacts on human well being, crops and livestock, while Chapter 5 presents a discussion on farmers' perception of drought and its ramifications to mode of adjustment.

Chapter 6 examines local responses to drought, and also assesses the suitability and adaptability of these responses in averting vulnerability to drought. It further examines the relationship between farmer socio-economic variables and choice of coping mechanisms.

Chapter 7 summarises the findings of the study, outlines policy implications of the findings, recommendations and suggests areas for further investigation.

# CHAPTER TWO

## 2.0 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

### 2.1 Introduction

This chapter reviews literature related to this study. It explores the themes, perception and response to drought hazard, exposing the gaps therein. The chapter also contains the theoretical framework which guides this study.



### 2.2 Drought Perception

Pioneering field studies in hazard perception date back to early this century. Cases in point include flood risk by Burton in 1902 (see Whyte 1977) and Saarinen (1966). Saarinen (1966), in a study on how farmers in the Great Plains of the United States perceived drought, found that, although experienced farmers were aware and could accurately assess drought risk, they tended to underestimate the frequency of drought and overestimate the number of good years, a factor that affected meaningful adjustment.

Burton, et. al. (1978) and Riebsame (1989) contend that human response to hazards is related to the perception of the phenomenon itself and to the awareness of opportunities to make adjustments.

Riebsame (1989) and Whyte (1977) stress that perception studies are salient in an attempt to understand why in many cases, people respond to climate in seemingly illogical or inappropriate ways, why people tend to see climate as stable and why they fail to consider potential impacts.

Oguntonyibo and Richards (1978) also underscore the importance of perception studies in hazard research. From a study in Nigeria, these two observed that farmers are careful observers of rainfall and the impact of drought on their farms and hence might supply planners and scientists with information that is not available through conventional monitoring channels. Similarly, Tennakoo (1986) observed that, though not as capable as scientists, the ordinary farmers display an ability to identify at least the factors accentuating drought effects. The present study sought to contribute to this perspective on the importance of underscoring indigenous knowledge in the decision making process pertaining to drought risk aversion. Darkoh (1989) considers failure to take into account the accumulated knowledge, experience, ingenuity and skills of the local people as one of the factors promoting dryland degradation and desertification.

Environmental perception studies thus expresses the desire to articulate the perceptions of ordinary people vis-a-vis those of

governments and outsiders, and thus to draw individuals and communities into collective decision making (Whyte 1977). Odegi-Awuondo (1990) also emphasises that a people's cultural values and individual personalities are crucial factors determining their adjustment to drought and famine.

According to the above scholars, environmental perception studies are expedient if any understanding of community or individual adjustment to hazards is to be achieved. Nevertheless, a gap is apparent in these studies in that emphasis has been on macro- or aggregate-scale analysis. In as much as a study at the aggregate level (regional or national) is useful in revealing variations and regularities, such an approach limits local depth and social holism (Whyte 1977). This study attempts to fill this gap by focusing on a micro-geographical setting.



### 2.1.2 Response to Drought

The drought problem in Africa and elsewhere in the world has been an object of scholarly attention since the work of Saarinen (1966). A vast amount of literature on the subject thus exists. In Kenya studies investigating how agricultural and pastoral communities respond to drought include Mbithi and Wisner (1974), Wisner (1977), Campbell (1979), O'Leary (1980), Odegi-Awuondo (1983,

1990), Akong'a (1989), Herlehy (1984), among others. However Makuyu Division of Murang'a district has received limited research attention despite the frequent occurrence of drought. This study sheds light on the situation in Makuyu, on the contention that responses to drought are not conventional but vary on the basis of socio-cultural factors (Oguntonyibo and Richards 1978).

Campbell (1979) studied response to drought among pastoralists and farmers in Kajiado district of Kenya. He attempted to identify the relationship between changing land use patterns, social systems and resource availability and the ability of people to cope with drought. By the use of a questionnaire survey he gathered different responses ranging from adjustments such as inter-family assistance and food relief to adaptations such as seasonal movement of herds. He concluded that perpetuation of contemporary land use patterns would increase vulnerability of both farmers and pastoralists to drought. Akong'a (1989) in a similar study in Kitui district found out that coping strategies to drought varied temporarily and spatially. Neither of these studies attempted to assess the role of farmer's perception of drought in choice of coping mechanisms. This study endeavoured to correct this lacuna.

Mbithi and Wisner (1974), and Wisner (1977a, 1977b) in very interesting studies of drought management in Eastern Kenya, attempt

to explain the perpetual vulnerability of the Kamba and Tharaka farmers to drought. They infer that drought proneness is a product, more of regional growth and income disparities in Kenya, than of physical environmental risk alone. They attribute this predicament to destruction of peasant modes of production by capitalistic modes introduced in the colonial era.

A study sharing the preceding perspective is that by Matheka (1992) on political economy of famine in Machakos district. The study dismisses the naturalistic fallacy that, vulnerability to drought is largely an environmental problem based on the vagaries of weather. Matheka (1992) insists that weakened traditional farming systems by the market economy is the heart of the matter. He elucidates that when the capitalist mode of production dominates the peasant mode by diverting labour either directly by wage migration, or indirectly by the introduction of a cash crop, the peasant mode suffers reduced control over its production process. Sharing the same view is Deacon and Darkoh (1987) who demonstrates that the effects of drought such as starvation, poverty and ecological imbalance cannot be wholly blamed on nature, but have their basis in colonial policies and post independence initiatives or lack of them. The validity of this argument not-withstanding, Mbithi, Wisner, Matheka, Deacon and Darkoh tends to concentrate only on the external instigators of the drought problem in Kenya. Little emphasis has been put in the need

to understand the problem from the victim's (farmer's) point of view. Investigating the latter dimension thus forms an important aspect of this study.

A closely related study is that by Herlehy (1984) among the Mijikenda. This study convincingly argues that the Mijikenda were resourceful in coping with drought and famine until colonial intervention increased their vulnerability through restricting squatting systems and a ban on wine trade. However, it does not specifically address the role of farmer's perception in resource management.

In other parts of Africa related studies include Hankins (1974), Van Apeldoorn (1981), Kigathi and Opschoor (1981), O'keefe and Wisner (1975), Roder and Dupree (1974) and UNSO (1992).

Van Apeldoorn (1981) in his study, 'perspectives on drought and famine in Nigeria', analyzed the drought and famine experience in the 1972-74 disaster. He attempted to unearth reasons why the majority of the rural population of northern Nigeria were so vulnerable to drought. In his conclusion, Van Apeldoorn emphasized that, for proper understanding of drought preparedness, there's need to understand the international context of famine, the defences of the traditional systems against disasters and the effects of these

defences on the partial transformation of the socio-economic system. Apeldoorn's findings albeit resourceful are based on a regional approach, making them short of local depth. Moreover he did not assess farmers' drought perception to understand vulnerability.

Kigathi and Opschoor (1981) in a study on drought management in Botswana, found out that people of low socio-economic status are more vulnerable to drought. They explained this as partly due to the fact that farmers do not provide employment for payment in kind during drought. In the same vein O'keefe and Wisner (1975), in their review on droughts in Africa, argue that much subsequent socio-economic change has actually constrained the peasants' range of alternative strategies from which to choose in times of environmental stress. They observe that the problem of drought is basically a problem of poverty, of continuing regional economic maldistribution and underdevelopment within countries, leading to increasing vulnerability of the poor in these regions. These two studies provide valuable resource materials in understanding the relationship between farmer socio-economic characteristics and choice of coping strategies.

A range of adjustments to drought adopted by resource users and resource managers is described vividly in papers presented in the Calgary meeting of 1972 (Hankins, 1974, Heathcote 1974, Mbithi

and Wisner 1974, Roder and Dupree 1974). For example, Roder and Dupree (1974) observed that even in a pre-industrial, pre-literate and very backward rural community, the resource users do everything in their power to adjust to drought. These adjustments vary from very primitive (traditional) to technologically advanced methods. Hankins (1974) found resource user's adopting actions in harmony with nature such as selection of drought resistant crops and choice of a combination of crops to suit soils of varying moisture content. These studies provide a basis of reference in classification of responses gathered in this study.

Perhaps a study having a close affinity to the proposed study is that by Oguntonyibo and Richards (1978). In a study on perception and response to drought by smallholders in Nigeria, these two concluded that peasant farmers were limited in their understanding of climatic origins of drought, and also in their ability to cope with the consequences. Instead, the majority of the farmers hold a teleological view in explaining causes of drought. This study sheds light on the experiences in a different socio-cultural background.

UNSO (1992) report has described in depth the various responses to drought and desertification in the Sudano-Sahelian

zone within the period 1985-1991. It however has analyzed the responses at international, regional, sub-regional and national levels giving minimal coverage for local or farm level responses.

In other parts of the world relevant studies include Kirkby (1974), Tenakoon (1986) and HeathCote (1974). Tenakoon in a study on drought perception and adjustment in Srilanka, observed that for individuals the choice of adjustments was a function of perception of drought hazard, perception of choices open to them, their command of technology and the relative economic efficiency of the alternatives. This study similarly hypothesized for this view, and sought validity from data gathered in Makuyu division.

In retrospect, the dearth of perception studies in drought hazard research has not been highlighted. This is particularly so in Kenya except that by Odegi-Awuondo (1983). However, this study was conducted in a pastoral community. The present study examines drought perception and management in a local farming community.

Limited scholarly attention has also been given to the role of socio-economic factors in the choice of adjustments to hazards. However, certain factors have been considered such as wealth/income (Eugene 1975; Burton et al. 1978; Whyte 1977) and age (Burton et al. 1978). Eugene contends that wealthy farmers have large investments

in machinery and land which enable them to take risks against any threat to crop production. Such farmers will also have access to capital and information to offset any loss incase of a hazard. Burton et al. (1978) also postulate that wealthier farmers are more likely to experiment with a variety of measures against flood or drought as they have the necessary support and security to carry over the following year.

As pertains to the role of age in adjustment, Burton et al. (1978) report that age has been found to influence response in that older people who later in life become committed to stressful situation may also be less flexible in canvassing stressful situations. This implies that older people are less likely to search for alternative mechanisms to avert drought hazard than young ones.



## 2.3 Theoretical Framework

In order to facilitate an understanding of farmer response to drought, this study adopted three closely related approaches namely human ecology theory, symbolic interactionist theory and micro sociological theory.

The human ecology theory principally advocates that man does not directly interact with his environment but is cushioned by

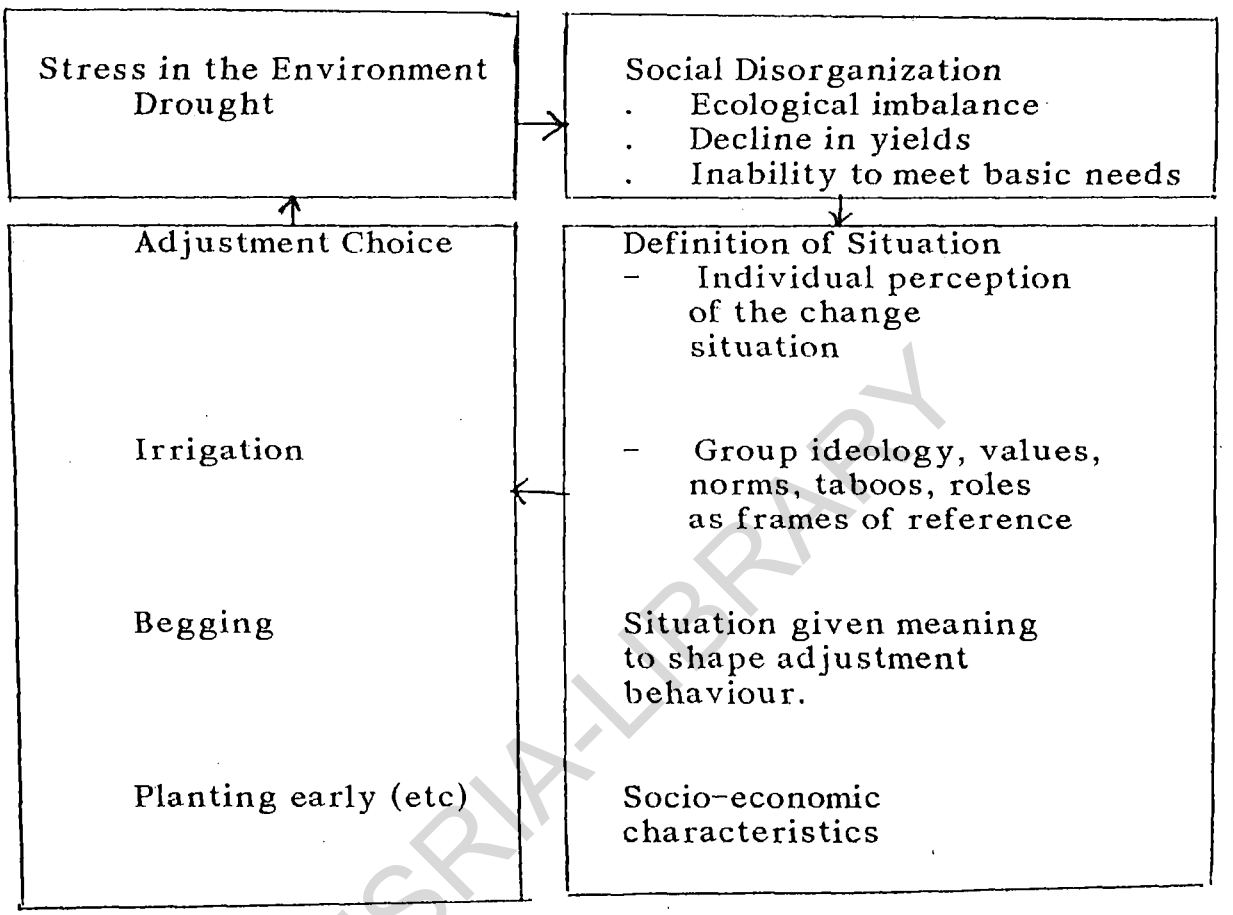
culture leading to selective perception and action (Wisner 1977; Richardson 1976; Riebsame 1989). This theory looks at human beings as creatures whose survival depends on mastering their social and economic environment by establishing balance with nature.

The human ecology theory is elaborated by the symbolic interactionist theory that asserts that human beings act towards things on the basis of the meanings those things have for them in the course of interaction. The core of the theory is that in a changing situation, behaviour is never random and purposeless but selective and purposeful (Odegi Awuondo 1990). In context of this study, drought (stress) may occur due to interaction between man and his environment. Subsequently, social disorganization occurs (see Figure 2.1), characterized by ecological imbalance decline in yields, low pasturage and inability to meet basic needs. Man's response to this hazard is preceded by a definition of the situation based on perceptual and cognitive filter composed of culture, personality, childhood experience, group ideology, recent experience and even immediate body stress (Wisner 1977; Whyte 1978). Perception therefore is posed as a filter between the hazard and the adoption of adjustments. Its principle role in the framework is to limit the range of adjustments adopted to something less than the total theoretical range of adjustments (Whyte 1977).

Measuring hazard perception thus helps explain the existing choice of adjustments, a major concern of this study.

A micro-sociological approach is also paramount in this study. Mbithi and Wisner (1972) accentuate that such approach focuses initially on the environmental experience of small groups of farmers, where the major emphasis is on spontaneous localized innovation or adjustment, rather than innovation originating from outside the group. Principally then for better conceptualisation of drought management, the emphasis need to be at a micro (local) scale analysis. This explains the choice of a division as the focus of this study.

Figure 2.1 **A Theoretical Framework on Adjustment to Drought**




Source: Adopted from Odegi-Awuondo (1990:14)

# CHAPTER THREE

## RESEARCH METHODOLOGY

### 3.0 Methods of Data Collection

Data utilized in this study were collected from both primary and secondary sources. The data covered four main areas: history and impact of drought, response strategies to drought, drought perception and farmer socio-economic characteristics.

### 3.1 Sampling Framework

According to Jaetzold and Schmidt (1983) Makuyu division had over 15,000 farm households by 1979. Such a large population could not all be covered within the limited time and financial constraints under which this study was done. Subsequently, stratified random sampling, random sampling and systematic sampling were employed.

Prior to fieldwork the study area was stratified into agroecological zones (See Jaetzold and Schmidt 1989). The different zones are main coffee zone (UM*2), marginal coffee zone (UM3) sunflower and maize zone (UM4) and cotton zone (LM4*) Figure 3.0 (See also abreviations).

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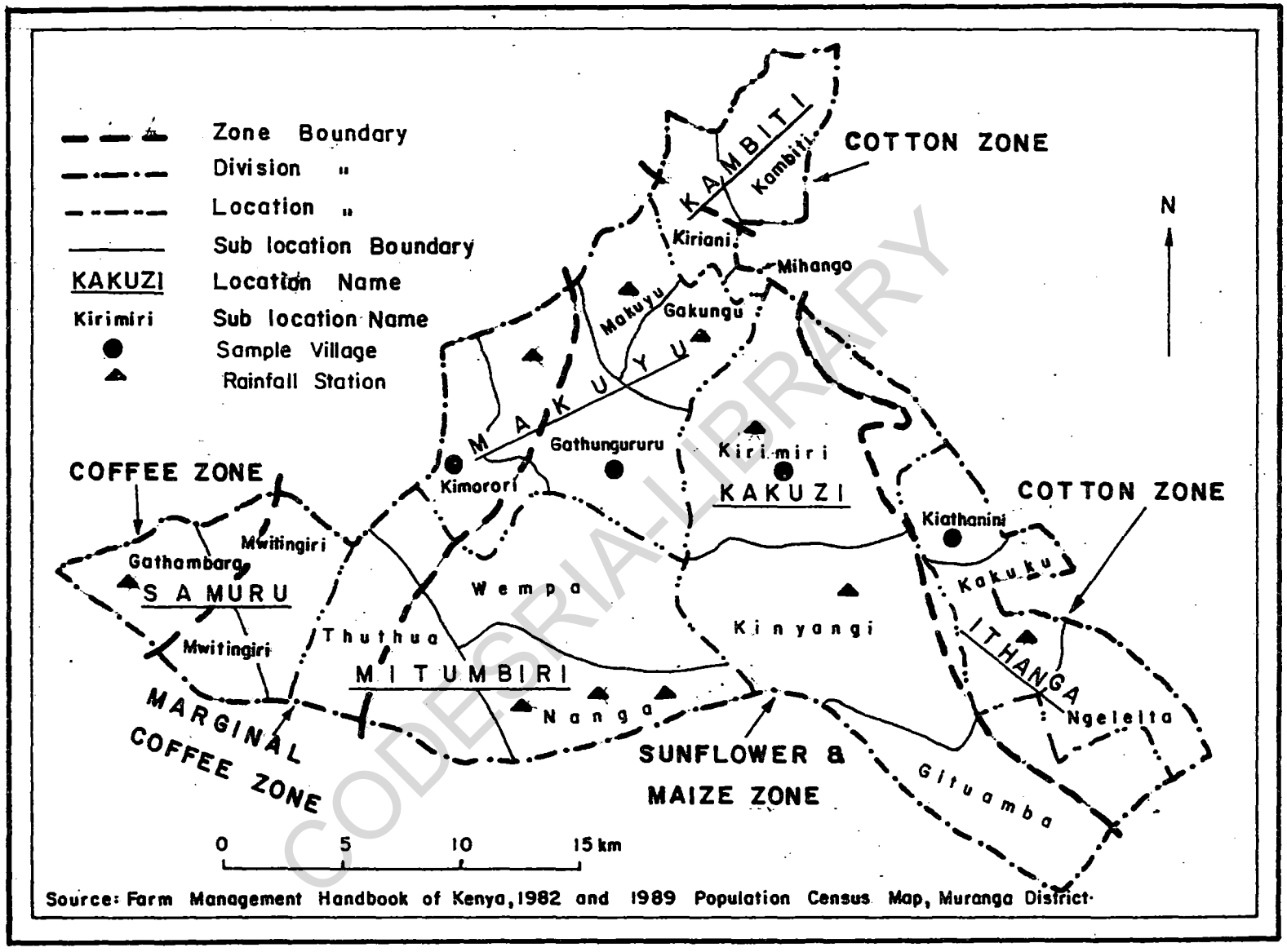
* UM stands for upper midland
* LM stands for lower midland.






Fig·3·1: MAKUYU DIVISION — SIMPLIFIED AGRO-ECOLOGICAL ZONES, SAMPLE VILLAGES ADMINISTRATIVE BOUNDARIES AND RAINFALL STATIONS

Fig 3.1

With the exception of the main coffee zone (UM2) a sub-location was randomly selected from each of the other three agroecological zones. Caution was taken not to pick sub-locations under large farms by first identifying them before selection. With the help of the 1989 population census base maps obtained from the Central Bureau of Statistics (CBS), villages in the selected sub-locations were identified. Further, random sampling was done where one or two villages were picked from each of the three agroecological zones. A village was picked from zones UM3 and UM4 each while two villages were picked from UM4 due to its large size (see Fig.3.1), so as to ensure representativeness. With the help of subchiefs the, total number of farm households in each of the selected villages was obtained as indicated in Table 3.0. The four villages had a total of 860 farm households which formed the study population. Since the total number of households differed across the sample villages or AEZ(s), the method of proportional allocation was used to compute the sample size to be selected from each stratum. In this method, the sizes of the samples from the different strata are kept proportional to the sizes of the strata using the formula:

$$n_1\, n_2 \ldots n_k = \frac{n.\ p_i}{N}$$

Where $n_1\, n_2 \ldots n_k$ = Sample size for each strata

N = Total sample size

$p_i$ = The proportion of the population

included in stratum i

N = Population size (Gregory 1968:117).

Subsequently in the study n= 120 to be drawn from a population of N = 860 which is distributed in three strata (agroecological zones) of size N (LM4) = 268, N (UM4) = 270 households. $N_2$ (UM4) = 152 households, $N_3$ (UM3) = 170 households.

Hence sample size for strata $N_1$ with 268 households is

$n_1 = np_1 = 120\ (268/860) = 37$

Similarly for strata

(i) $N_1$ with 270 households

$N_2 = n.p_2 = 120\ (270/860) = 38$

(ii) $N_2$ with 152 households

$N_2 = n.p_2 = 120\ (152/860) = 21$

and strata with $N_3 = 170$

$N_3 = n.p_3 = 120\ (170/860) = 24$

Thus, using proportional allocation, the sample sizes for different strata in the study were 37:21:24 respectively which is in proportion to the sizes of the strata viz: 268:270:152:170 (see Table 3.0).

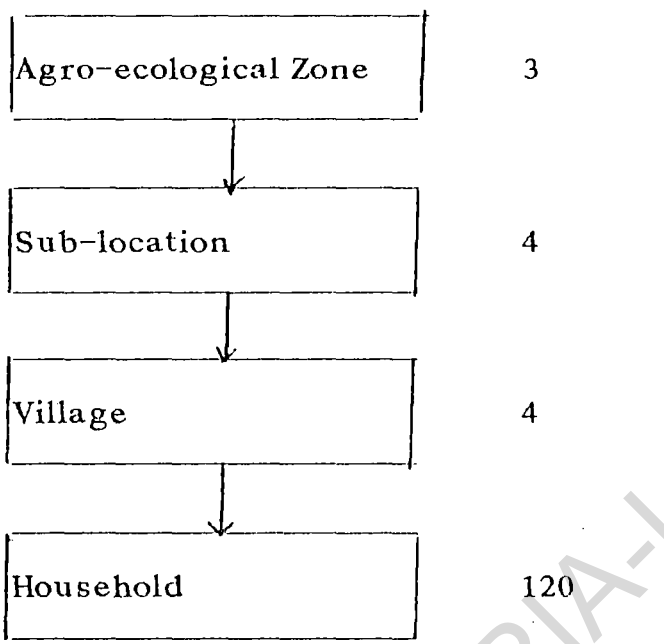
**Table 3.0:Names of Sample Villages**

| Agro-ecological Zone | Sub-location | | Village No.of house holds | TotalNo. of households selected |
|---|---|---|---|---|
| CoffeeMarginal (UM3) | Kimorori | Kagaa | 170 | 24 |
| Sunflower/maize Zone(UM4) | Kirimiri | Mithiini | 270 | 38 |
| | Gathungu-ruru | Gathungu-ruru | 152 | 21 |
| Cottonzone (LM4) | Ithanga | Kiathanini | 268 | 37 |

Selection of farm households was done through systematic sampling and the transect method. This involved drawing four transects in all directions from a central point which was the market centre of each selected village. A distance of four kilometres from the centre was marked on each transect. Transects followed footpaths or roads. Using systematic sampling, every third household along the transect was picked until the desired number was achieved in each sample village. In villages like Kagaa where households are sparsely distributed, transects had to be adjusted to longer distances ranging from 6 to 8 km so as to facilitate getting the target figure.

Figure 3.2 summarizes the sampling procedure used in this study.

**Figure 3.1:A Summary of the Procedure in the Selection of Sample Households.**






## 3.2 Data on the History and Impact of Drought

These data were collected from secondary and primary sources. Key documentary sources of secondary data included District Development Plans, Archival and Weather Records. Primary data were elicited from farmers through a questionnaire. A questionnaire was administered seeking information on aspects such as drought years recalled, worst drought year and impacts of the 1984 and 1992 droughts. Actual rainfall figures and trends in the study area were obtained from the Kenya Meteorological Department (KMD).

### 3.3 Data on response to drought and farmer socio-economic characteristics

These data were collected from farmers through a questionnaire (Appendix A3) which contained both structured and unstructured questions. The data covered household socio-economic characteristics such as farmer's age, educational and training levels, family size, occupation, land tenure, land size, income, year of settlement and place of origin, farm enterprises, labour and credit facilities.

Farmers' response to the 1984 and 1992 drought years was elicited. These two drought years were chosen because during reconnaissance it was confirmed that though many informants could recall other previous drought years, only a few remembered clearly the respective responses. The recency and magnitude of 1984 and 1992 drought years facilitated reasonable recall of response particularly the 1991/1992 drought that had ended a month before this study was done.



### 3.4 Data on perception of drought

The repertory grid technique was used to solicit data on drought perception. Certain aspects pertaining to knowledge of drought such as its causes, frequency, symptoms and methods of control were construed.

The repertory grid technique has its roots in clinical psychology and represents an attempt to understand people from their own perspective of

the surrounding world (Naulikha 1990). This method has quantitative advantages of survey work without the undesirable imposition of the investigator's opinions and perspectives on the respondent which is common in other types of interviews (Townsend 1977). In this method, the basic assumption is that any individual at any moment organizes his perceived world around a set of constructs. Each construct has two poles such as wet and dry, good or bad, important or unimportant, regular or irregular, frequent or rare and so on (Fransella and Bannister 1977). Most constructs, although common to most humanity, are personal in as much as they pertain to the individual in their relative significance, organization and particularly in their application. Townsend (1977) explains that constructs are graded with regard to particular elements based on the cultural environment, experience and possibly character.

The field of the grid is defined by the elements, while constructs define distinctions among the elements. Consequently, this technique measures the whole or part of an individual's cognitive system (Townsend 1977). This aspect makes it ideal for studying perception of any object or subject.

In the repertory grid matrix, (Appendix A2) the columns consist of elements, stimuli, objects or situation related to the respondent while the rows contain constructs ideas or responses that are used to classify the elements (Townsend 1977).

The procedure of using the repertory grid in data collection involves the use of the triadic method (Francella and bannister 1977). Elements are presented in groups of three (triad) to each respondent, and then one is asked to identify reasons why the two judged to be similar (construct of dissimilarity) are different (construct of dissimilarity) from the third. The distinctions become constructs on which respondents are asked to rate the elements (Townsend 1977). The respondents provide constructs and elements, hence ensuring minimum undesirable interviewer interference, and hence the relationships are of interest and relevance to the source.

Naulikha (1990) explains that a standard set of elements and constructs is necessary if the comparison of individually completed grids is to be achieved. This can be achieved by means of a pretest or a pilot survey.

For this technique to be used in this study a pilot survey was done in order to come up with a standardized set of grids.

During the pilot survey, 15 farmers were randomly selected from the villages covered in the final survey. The various factors (constructs) explaining drought perception (elements) were then put together in standardized grids without disregarding any, lest the farmers' image of drought was concealed. In the main survey the factors or constructs were presented to the farmer. Room was allowed for further factors not in the

grid. The farmer was asked to grade each factor (construct) on a scale of 0 to 4. Score 4 signified very important response and 0 very unimportant as perceived by the farmer. The other responses fell between these two extremes.

During the main, survey a total of twelve factors were identified on causes of drought, eight on frequency, nine on next probable drought, nine on symptoms and twenty on methods of control.

It is pertinent to note that the repertory grid technique is adoptable and has no fixed format. It is not concerned with relating the construct to any established normative data. Its main concern is the individual's construct patterning while leaving much of the rest to the inventiveness of the researcher with regard to the problem at hand.

The repertory grid technique was successful in reducing interviewer interference particularly in the pilot survey stage. Further, by giving the opportunity to the respondent to talk around constructs, the technique provided a useful insight into farmers' perception of drought. However, there were drawbacks. The carrying out of the grid is time consuming and may take anything upto one and a half hours to complete one grid. Furthermore, repertory grid analysis is not an easy technique to train field assistants to operate.

## 3.5 Data Analysis

Documentary evidence on drought experience in the study area was analyzed and presented qualitatively. After editing and coding of questionnaires, data on the history and impact of drought was extracted. Tables were drawn and frequencies and percentages computed to summarise recalled drought years, worst drought year and impacts. In order to ascertain the reliability of farmers' perception of drought years, the recalled drought years were correlated with actual rainfall figures and trends in the study area since 1962 using data obtained from the Kenya Meteorological Department (KMD). These analyses were used to verify premise 1 and 2.

Statistical analysis was done to test for any significant relationship between selected socio-economic characteristics and selected responses to drought, as in hypothesis 1. The Chi square test ($X^2$) of statistical significance was used. This test helps determine whether or not a statistical relationship exists between two variables (Nie 1975). This is done by Computing Cell frequencies which would be expected if no relationship is present between variables, given the existing row and column totals.

The expected frequencies are then compared to the actual (observed) values according to the formula (Gregory 1968).

$$X^2 = \frac{(f_o - f_e)}{f_e}$$

Where

$f_{o}^{i}$ = the observed frequency in each cell

$f_{e}^{i}$ = the expected frequency calculated as

$$f_{e}^{i} = \frac{(Ciri)}{N}$$

Where Ci = the frequency in a respective column marginal

ri = the frequency in a respective row marginal

N = the total number of valid cases.

Each socio-economic variable tested for relationship with response to drought has both a null ($H_0$) and an alternative hypothesis ($H_1$). To show that there is no relationship the rejection level for $H_1$ is decided at certain levels: 0.001, 0.05, 0.10 and 0.5 levels of confidence. In each case the appropriate degrees of freedom are calculated using the formula:

$$df = (r-1)(k-1)$$

Where df = degree of freedom

r = number of rows in tables

k = number of columns in the table.

On each of the socio-economic variables associated with the choice of farming strategies the null hypothesis ($H_0$) is rejected and the alternative accepted when the critical value for the chi-square is greater than the calculated value. The selected socio-economic variables tested for association with responses to drought included age, education level, farm

size, family size, income while responses included irrigation, mulching, storing food, fertilizer use, borrowing loan and migration.

The process of testing for perception of drought, was done in four stages. First, the total score on each response (factor) was computed on each individual grid. Secondly, the scores were standardized into percentages to ease comparison. Thirdly, the factors were ranked in order of importance depending on the percentages and total scores. Analysis was done for causes of drought, then symptoms, probable drought, frequency and methods of control in that order. Inferences were made on how perception influenced response depending on other scholar's findings in the same subject area.

In order to test for any relationship between perceived and actual drought years, the Pearson Product-moment Coefficient of Correlation (N) was used.

Correlation is a measure of the relationship or association between two or more variables, indicating the direction and degree of variation between variables. The formula below was used to compute bivariate correlation coefficients between variables (Harper 1965).

$$r = \frac{nx\Sigma xy - \Sigma xx\Sigma y}{\sqrt{nX\Sigma x^2 - (\Sigma x)^2 (nX\Sigma y^2 - (\Sigma y)^2}}$$

# CHAPTER FOUR

## 4.0 A HISTORICAL DIMENSION OF DROUGHT IN MAKUYU

### 4.1 Introduction

This chapter offers an examination of the history of drought in Makuyu division. Information on the history of drought as perceived by farmers is analysed. Specifically, the focus is on recalled years of drought, worst drought years and the impacts of the 1984/85 and 1992 droughts. This is followed by an analysis and discussion of actual drought years based on data that was obtained from Kenya Meteorological Department for the years 1962–1992. Finally, correlations are given between the perceived drought years and the actual drought years. Thus, the chapter addresses the first and second objectives of the study and, subsequently, the first and the second premises, namely:

(i) Drought has no remarkable history in the study area

(ii) The 1984/85 and 1992 drought did not have any significant impact on people's well-being and on crop and livestock productivity in the study area.

## 4.2 Reported Drought Years

Much useful oral historical data concerning the frequency and magnitude of drought can be called from farmers (Oguntonyibo and Richards 1978). In this study, all the 120 farmers interviewed agreed that drought is a serious problem in the study area. A varied range of drought years was mentioned across the agrocecological zones (see Table 4.0).

Table 4.0 shows that the highest reported cases of drought were in Mithini and Ithanga sample areas which are in the sunflower/maize and the cotton zones, respectively. This trend may be explained by historical factors. The majority of the farmers in these zones settled here back in the late sixties and early seventies, while some were squatters in the same area and have longer drought experience than farmers in other zones.

The lowest cases of drought were recorded in the Kimorori sample area which is in the coffee marginal zone, whereby only 4 of the 22 mentioned droughts were reported. This is expected given the climatical and historical aspects. Climatically, the coffee marginal zone is not as dry as the lower zones, hence drought occurrence may not be frequent.

**Table 4.0: Drought years as recalled by farmers**

| Simple Area / Drought Year | AEZ II Kimorori | AEZ III Gathunguru | AEZ III Mithiini | AEZ IV Ithanga | Times Mentioned Total |
|---|---|---|---|---|---|
| 1943 | – | 3 | 4 | 1 | 8 |
| 1953 | – | – | 1 | – | 1 |
| 1961 | – | – | 1 | – | 1 |
| 1964 | – | – | 1 | – | 1 |
| 1965 | – | – | – | 1 | 1 |
| 1968 | – | – | – | 1 | 1 |
| 1970 | – | – | 3 | – | 3 |
| 1971 | – | – | – | 10 | 10 |
| 1972 | – | 1 | 12 | 12 | 25 |
| 1974 | – | – | – | 1 | 1 |
| 1975 | – | – | – | 2 | 2 |
| 1976 | – | – | 1 | – | 1 |
| 1978 | – | 1 | – | – | 1 |
| 1980 | 2 | 2 | 6 | 17 | 27 |
| 1981 | – | – | 1 | 1 | 2 |
| 1982 | – | 2 | 1 | 1 | 4 |
| 1983 | 1 | – | 2 | – | 3 |
| 1984 | – | – | – | – | |
| 1987 | – | 2 | – | 2 | 4 |
| 1991 | 1 | – | – | – | 1 |
| 1992 | 24 | 21 | 37 | 36 | 118 |
| After every season | 14 | 26 | – | – | – |
| | – | – | 12 | – | – |

**Source:** Fieldwork 1993.

Historically, the farmers in Kimorori settled only recently, in the late 1980's and 1990's and thus, have little drought experience. This observation is compounded by the fact that the majority came from the wetter parts of Murang'a district. As discussed in Chapter One (see Section

1.8), Kimorori was formerly owned by white settlers.

Drought cases were remembered as far back as 1943 and 1952 with accuracy as to dates, (Cf climatic and other documentary evidence cited in Wisner 1977, Ambler 1977, Odingo 1986; Downing 1989; Parry et. al. 1988). The KNA (1933) mentions a drought induced famine that threatened families in Eastern Murang'a in 1933.

During the survey the 1961 drought was mentioned once. Wisner (1977), for instance, records that during the 1960-61 drought some 3,129 tons of relief maize were distributed to the lower area of Fort Hall (today's Murang'a district) which coincides with the study area. This drought was national and is said to have been severe even in other parts of the country (see Downing 1989, Parry et. al. 1988, Odingo 1990).

The 1970-72 drought was widely recalled. The 1970 drought was recalled by one respondent, 1971 by 10, and 1972 by 25 respondents. The 1972 drought period is widely documented as it did not only affect Kenya but was part of the Sahelian catastrophe that claimed thousands of lives (Frank and Chasin 1980). KNA (1971, 1972) records the severity of this drought in Makuyu division, where rain failure greatly affected crops, particularly in Ithanga, while other parts of Murang'a district were averagely wet. In response, the government ferried about 500 bags of maize and 210 bags of rice to famine victims in Makuyu. Archival documents

further explain that during the 1972 drought small farms were desperately hit by insufficient rainfall as the large farms survived through irrigation. The impact of this drought in the study area is said to have been aggravated by redundancy of former sisal estate workers after the collapse of Cooperatives (KNA 1972; (Kenya 1988).

The 1976 drought was recalled by one farmer. This is perhaps because it was only a minor drought (KNA 1976) , which affected mainly the bean crop while the early planted maize was harvested. It occurred after an indefinite end of the long rains, which had also come late. Tobacco and cotton were badly affected leading to the reduction of hectarage planted under each (see Table 4.1 below).



**Table 4.1: Reduced Hectarage under Cotton after 1976 Drought In Makuyu Division**

| Crop | Hectarage Planted 1975 | 1976 |
|---|---|---|
| Tobacco | 83 | 46 |
| Cotton | 340.2 | 325.6 |

**SOURCE:**Kenya National Archives (1976): Divisional Annual Reports XA/11/37 p.2.

Nevertheless, Akong'a (1989) describes the 1976 drought as having been severer in Kitui district, with the government spending KSh.2,177,560.25 on relief food alone.

The 1980-81 drought which also affected the eastern districts was cited in the study area. The 1980 drought was recalled by 21 informants, while the 1981 was recalled once. The 1981 drought is also recorded in government reports (see Kenya 1981). A mild drought is reported to have hit Ithanga sub-location leading to crop failure and subsequent food shortage, otherwise the rest of the division had enough harvests (KNA 1983).

The 1984/85 drought that hit the entire country was no exception in Makuyu division. It was reported by 99 respondents. Divisional monthly reports (Kenya 1984) indicate that Ithanga sub-location was worst hit. All food crops failed except cassava and arrowroots such that the division depended entirely on National Cereals Produce Board (NCPB) for food supplies and relief supplies by the government and NGOs.

Four respondents cited 1987 as a drought year. This agrees with documented evidence in Kenya (1988) which records a drought in 1987 which mainly affected Kambiti and Ithanga locations both of which are in the cotton zone. Below average rainfall resulted in poor harvests. Subsequently, the government had to offer 2,300 bags of maize and 1,000 bags of beans as relief food to the affected areas.

The 1992 drought was cited by 118 respondents. This study was carried out when this drought had barely ended such that its impact was

still fresh in the memories of the respondents.

As established by other studies (e.g Akong'a 1989; Oguntonyibo and Richards 1978; Wisner 1977; Ambler 1977; Muriuki 1974; Matheka 1992) local communities remember droughts by their names which describe either the impact or peoples' response. The 1943 drought was popularly known as '*Ng'aragu ya Mianga*' or cassava famine since at that time families depended on cassava flour, a diet that was then foreign to the Kikuyu (see also Muriuki 1974).

The 1984/85 drought had various names. Respondents at Gathungururu called it '*ukame*' drought which means 'dryness.' In Mithiini, it was popularly known as "*Rongoca famine*" that is, famine of moving here and there.' This describes the psychological stress and confusion that people underwent as they moved from place to place in search of food. Among the Kamba it was known as '*Nikwa Ngwete*', meaning 'I die with cash in my hands; thus, one was not guaranteed to get food even if money was available.

Interestingly, the 1992 drought had also been nicknamed. Some called it the '*Gatogerere*' or '*Gathirikari*' famine meaning 'yellow maize' famine. Most of the households largely depended on yellow maize during this drought since it was cheaper and easily available than other foodstuffs. Respondents from Ithanga called it '*Ng'aragu ya thaati*' meaning 'famine of

thirty shillings.' The explanation given to this was that during the 1992 drought, nearly all the basic foodstuffs such as maize meal, sugar, maize and beans cost KSh.30 per kilogramme, a cost that was too high for drought-hit households. This was in accordance with the free market behaviour where the little food that was available was exorbitantly priced.

With regard to drought predictability, 26 respondents noted that drought comes after every season (Table 4.0). 14 of the respondents who gave this answer were from the cotton zone while 12 were from the sunflower-maize zone. This emphasizes the recurrent nature of drought in the study area. This picture is also brought about by the drought years mentioned. All the years in the 1970s are mentioned and a greater part of the 1980s. Thus, the farmers perceived Makuyu to be generally dry.



### 4.2.1 Response to the Question on Worst Drought Year

The preceeding section has traced the drought years in Makuyu as recalled by the farmers. This section goes further to probe the assessment of farmers on the severity of past droughts. This was done by asking the respondents to name the worst drought year, giving reasons for their choice.

Table 4.2 shows that of the 22 drought years cited only 1984 and 1992 were cited as worst drought years, an observation made by 19 (15.8%) and

100 (83.3%) respondents, respectively. The reasons for the different opinions are amalgamated in Table 4.3.

Various explanations may be given for the high number of farmers who viewed 1992 as worst drought year. First the majority of respondents in Gathungururu and Kimorori sample areas had recently settled and therefore had not experienced other droughts except the 1992 one. Thus, as noted by Kates (1978), it was difficult for individuals to conceptualize droughts that to them had never occurred. Parra (1971 cited in Slovic et al. 1972) observed that droughts were perceived as greater in severity if they were recent and thus easier to remember. Accordingly, the 1992 drought may not have been severe in magnitude than previous droughts but was considered the worst since it was very recent and its effects were still being felt at the time of the study.

Table 4.2: Identification of the worst Drought Year by Farm households

| | | AEZII | | AEZ III | | | AEZ IV | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Total | Kimorori | | Gathungururu | | | Mithiini | | Ithanga | |
| | No. | % | No | % | No | % | No | % | No | % |
| 1984 | 19 | 15.8 | 2 | 8.3 | 3 | 14.2 | 6 | 15.7 | 7 | 11.8 |
| 1992 | 100 | 83.3 | 22 | 91.6 | 18 | 85.7 | 30 | 78.9 | 30 | 83.3 |

**Source:** Fieldwork 1993.

A critical analysis of the reasons given for viewing 1992 as worst drought year, to a certain extent agrees with the view that drought does not necessarily lead to famine (see Apeldoorn 1981, Rolando 1982). Food was available in the markets but 'food poverty' (Downing et al. 1989) increased vulnerability among farmers. Food poverty refers to the inability of households to purchase food primarily in local markets. Hiked food prices by unscrupulous traders meant that ordinary households could not afford food at the markets.

**Table 4.3: Reasons given for the worst Drought Years**

| Reasons | Number of respondents | % of respondents |
|---|---|---|
| 1992 as worst year. Food available but very expensive. | 100 | 83.3 |
| 1984 as worst drought year. Food not available. | 19 | 15.8 |
| Money available but no food | 10 | 8.3 |
| Livestock died | 12 | 10.0 |
| Crops dried | 13 | 10.8 |

**Source:** Fieldwork 1993.



### 4.2.2 The Impacts of the 1984 and 1992 Droughts on Farm Households

This subsection is a deeper analysis of the impacts of the 1984/85 and 1992 droughts which were considered as worst by farmers. As Riebsame (1989) insists, climatic impact assessment studies are vital as a basis for improving long-range planning of resource management programs and improvement of mitigation efforts in affected areas.

Table 4.4: Drought Impacts reported by Farmers as expressed by % of Households

| Impacts | AEZ II Kimorori | | AEZ III Gathungururu | | AEZ III Kirimiri | | AEZ IV Ithanga | |
|---|---|---|---|---|---|---|---|---|
| | 1992 | 1984 | 1992 | 1984 | 1992 | 1984 | 1992 | 1984 |
| Hunger | 100 | 100 | 95 | 95 | 100 | 100 | 100 | 100 |
| Food relief | 4.1 | - | 47.6 | 42.8 | 57.8 | 60.6 | 88.6 | 80.5 |
| Increased Sickness | 62.5 | 79 | 57 | 95 | 71 | 78.9 | 69.8 | 8.8 |
| Water Shortage | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Absence from School due to hunger | 4.8 | - | 33.3 | 28.5 | 50 | 50 | 66.6 | 30.5 |
| Loss of Employment | - | - | - | 4.7 | 10.5 | 10.5 | 5.5 | 5.5 |
| Scarcity of casual jobs | 20.8 | 19 | 33.3 | 23 | 5.2 | 5.2 | 5.5 | 5.5 |
| Poor harvests | 83 | 45.8 | 90 | 42.8 | 42.8 | 92 | 100 | 100 |

Source: Fieldwork 1993.



Table 4.4 summarizes the major costs and implications of the 1984 and 1992 droughts as perceived by the respondents. The loss of livestock (see Table 4.6) and to some extent human lives as a result of starvation is common in all drought prone areas. The table shows that there was no remarkable variation in the experienced impacts across the zones. Even in cases where mentioned impacts depict low percentages, it was more due to lack of drought experience than the absence of impact. For instance, the percentages, of households reporting some impacts in the Kimorori sample area for the 1984 drought are generally lower than the impacts in 1992,

since few of the farmers had settled here by 1984.

Hunger was the most important impact reported by all the households. When rain fails, it causes crop failure that directly affects the sole source of food in such a community that is self-provisioning. Such an effect inevitably calls for relief from external sources. In 1992, for instance, 69% of the households cited that they received relief food from either the Government or non-governmental organizations (NGO). Table 4.5 shows that of all the divisions in Murang'a District, Makuyu received the highest tonnage of relief food from the government during the 1984/85 drought.

The other impact recorded was water shortage. 79% of the households reported this scenario for the 1992 drought while 84% reported it for the 1984 drought. High temperatures and low rainfall that characterize drought dried up most of the few existing intermittent ground water sources, augmenting shortages.

Drought not only causes hunger or famine but also affects other social frameworks such as the education system. Households reported that school children were forced to leave school either to help earn a living from casual work so as to buy food or simply because there was no money to pay school fees.

In Makuyu, farming is the basic employer and absorbs casual labourers who get jobs either in large coffee estates or from well-to-do

neighbours. However, due to a drop in crop production during the droughts, jobs were scarce. This change affects farm household income and its ability to purchase food.

**Table 4.5: Famine Relief in Murang'a (in tonnes) during the 1984 Drought**

| Division | Maize | Beans | Milk | Families |
|---|---|---|---|---|
| Kangema | 33,950 | 1,800 | 440 | - |
| Kiharu | 67,750 | 2,700 | 660 | 680 |
| Kigumo | 62,100 | 2,700 | 660 | 4 |
| Makuyu | 193,950 | 6,840 | 1,760 | 1,734 |
| Kandara | 36,450 | 450 | 220 | - |
| Total | 394,200 | 14,490 | 3,740 | 2,414 |

**Source:** Downing (1989: 206)



Cases of sicknesses and health deterioration were cited by 65% and 69% of the households for the 1984 and 1992 droughts, respectively. Akong'a (1989) notes that while human deaths in Kenya arising directly from starvation have been eliminated, a famine-weakened population' is far more susceptible to other diseases including pneumonia, tuberculosis,

cholera, worms and malaria when rains do eventually come. Malnutrition is the most common disease yet oftenly ignored by impact assessors. Escudero (1985) describes malnutrition as the most common biological manifestation of climatical aggression. He further explains that drought-induced shortage of foodstuffs leads to malnutrition-related conditions. Lack of water for growth of food means inadequate diet which produces in human beings a vulnerability that makes them prey to infections and parasitic diseases of various sorts that affects children's body growth. A survey carried out in 1988, observed that the study area had the highest cases of malnutrition in Murang'a district (Were 1988).

#### 4.2.2.1 Drought Impacts on Livestock

Drought is associated with livestock depletion. Table 4.6 shows the percentage of households that reported livestock losses during the 1984 and 1992 drought years. The losses occurred either through sale, death or animal weight loss. 62.5% of the households sold their livestock during the 1992 drought. Only 1.6% of the households reported livestock death, while 45% experienced loss of livestock through weight loss, particularly cattle during the same drought year.

This information largely contrasts with the 1984 drought experience where over 60% of the households said that their animals died, 63% sold their livestock while 42.5% reported weight loss. This information may suggest that the 1984 drought was severe in terms of magnitude than the

1992 since few (1.6%) of households animal deaths were recorded for the latter year.

In periods of droughts and famine, livestock provide an essential food reserve if they can be kept alive (Garcia 1986). This is particularly so in agro-pastoral marginal economies, where livestock provide the basic source of income or direct food.

**Table 4.6: Percentage of Households reporting livestock losses by Agro-ecological zones (Sample Areas)**

| Cattle/Goats/Chicken | AEZ II Kimorori | | AEZ III Gathungururu | | AEZ III Kirimiri | | AEZ IV Ithanga | | Total % | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1992 | 1984 | 1992 | 1994 | 1992 | 1994 | 1992 | 1984 | 1992 | 1984 |
| Sold (% of households | 41.6 | 12.5 | 52.3 | 52.3 | 68.4 | 39.4 | 77.7 | 72.0 | 65.0 | 63.0 |
| Whosedied (% of hosueholds) | - | 8.3 | - | 61.9 | 2.6 | 81.5 | 2.7 | 80.5 | 1.6 | 60.0 |
| Lost weight (% of households) | 16.6 | 4.1 | 19.0 | 38.0 | 42.1 | 44.7 | 83.3 | 69.4 | 45 | 52.5 |

Source: Field work 1993.

Unfortunately, due to desperation many households were forced to discharge livestock at throw away prices. Respondents reported that during droughts they were forced to sell cattle at prices as low as KSh.50-200 per head that normally would go at not less than KSh.1500-2000. This

was mainly due to the famished state of animals and more important, the desperate need for money to buy food.

#### 4.2.2.2 Dietary Changes

Drought has far reaching implications even in terms of diet. Often it leads to a shift in normal foods to other substitute foods that may be undesirable or even less nutritious for the affected households.

Table 4.7 summarizes the major shifts in diet reported by the respondents. 98% depended on yellow maize during the two drought years since white maize was scarce.

Fasting (involuntary) was also a major dietary change reported by 95% of the households as practised in both drought years. Families had to do with one hard-earned meal a day, or had to spend hungry nights or survived on porridge (gruel) even for main meals.

Households cited dependence, solely on one type of substitute food during drought. At Gathungururu, families survived on kales (*sukuma wiki*) and arrowroots which were grown on marshy grounds. But other areas were less fortunate. At Ithanga and Kirimiri which are in the drier zones, 50% and 75% respondents, respectively cited a shift to wild fruits and vegetables that could be found in valleys and caves. Such include weeds

such as *Kikoe* and *Ngaatu*. Others fed on banana roots while 5% ate dying stock during the 1984 drought.

Respondents in Ithanga and Kirimiri also cited as having survived on cooked mangoes and pawpaws. These fruits are drought-tolerant and are normally eaten fresh and not cooked as food. Such a shift in food preparation is considered among the Kikuyu as degrading. Apeldoorn (1981) observed a similar practice in Nigeria during the 1972-73 drought, while Akong'a (1989) and Matheka (1992) report the same experience among the Akamba.

The feeding on substitute foods can be analysed as timely pieces of the magnitude of human suffering as in Makuyu. Garcia (1981) views this form of adjustment as dehumanizing and recommends that it should not be allowed to happen. But Odegi-Awuondo (1980) has a more philosophical interpretation of such a situation where individuals feed on other foods beside the normal diets during droughts. Basing his argument on the symbolic interactionist theory, he postulates that when an individual finds himself in a problematic situation such as drought where pure habit will not suffice; he must find some way to represent that situation to himself in symbolic terms if he is not to behave randomly.

The individual constantly redefines the situation he interacts with as pertaining to the physical, biological and social worlds. In context, if a

person is hungry enough during a drought, he redefines the situation such that what may previously have been defined as inedible is defined as good and found quite nourishing.

Table 4.7: Percentage of Farm households reporting Change in diet across Agro-ecological zones during the 1984 and 1992 drought years

| Area/% of Households | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Typeof Changes | AEZ III Kimorori | | AEZ III Githungururu | | AEZ III Kirimiri | | AEZ IV Ithanga | |
| | 1992 % | 1984 % | 1992 % | 1984 % | 1992 % | 1984 % | 1992 % | 1994 % |
| FoodRation | 100 | 62.5 | 100 | 100 | 38.0 | 38.0 | 94.4 | 99 |
| MajorChange denotedby: Eatingarrow-rootsonly | 4.16 | - | 50 | 47.6 | 5.2 | 4.0 | - | - |
| Feedingon wild vegetables | - | - | 4.76 | 4.76 | 50 | 44.7 | 72.2 | 41.6 |
| Eatingbananas only | 12.5 | - | 9.5 | - | 52.6 | 13.2 | 86.0 | 16.6 |
| Bananaroots | - | - | 4.7 | 4.7 | 13.1 | 10.5 | - | - |
| Cookedpawpaws | - | - | - | - | 52.6 | 36.8 | 94.0 | 52.7 |
| Dying Stock | - | - | - | - | 5.2 | 5.2 | | |
| Boiledmangoes | - | - | - | - | | 39.4 | 18.4 | |
| Eatingcassava | 33.3 | - | 9.5 | 9.5 | - | 36.8 | 5.2 | 16.6 |

Source: Field work 1993.



### 4.2.2.3: Drought Impact on Crop Yield (Maize and Beans)

Kates and Roberts et al. (1978) contend that the best indicator of climate sensitivity is crop yield variability. With this in mind, the farmers were asked to give estimates of maize and bean yields during a normal year

and that during the 1992 drought year. Normal yields were defined as an average yield over several years of sufficient rainfall.

It was salient to compare yields between a drought year and normal years so that the latter serves as a control given that poor crop yields may not necessarily be a consequence of poor rainfall alone but of a multitude of other factors such as soils, inputs and insect pests (see Riebsame 1989).

Maize and beans were selected since they are the major staple crops in the study area and often occupy the largest proportion of a farmer's land.

The proportional difference in production between the two periods is clearly evident from Figures 4.1 and 4.2. The two figures show that the majority of the farmers harvested minimally during the 1992 drought year. 108 (90%) respondents reported that they harvested between 0–4 *debes*[1], of maize, while 12 respondents recorded no harvest. These yields contrast sharply with production in normal years where majority harvest between 10–20 *debes* per harvest, which is equivalent to 2 to 4 bags of maize.

For beans, 95 respondents (79.2%) harvested at most 4 *debes*, while during a normal year the average harvest is 10 'debes' which is equivalent

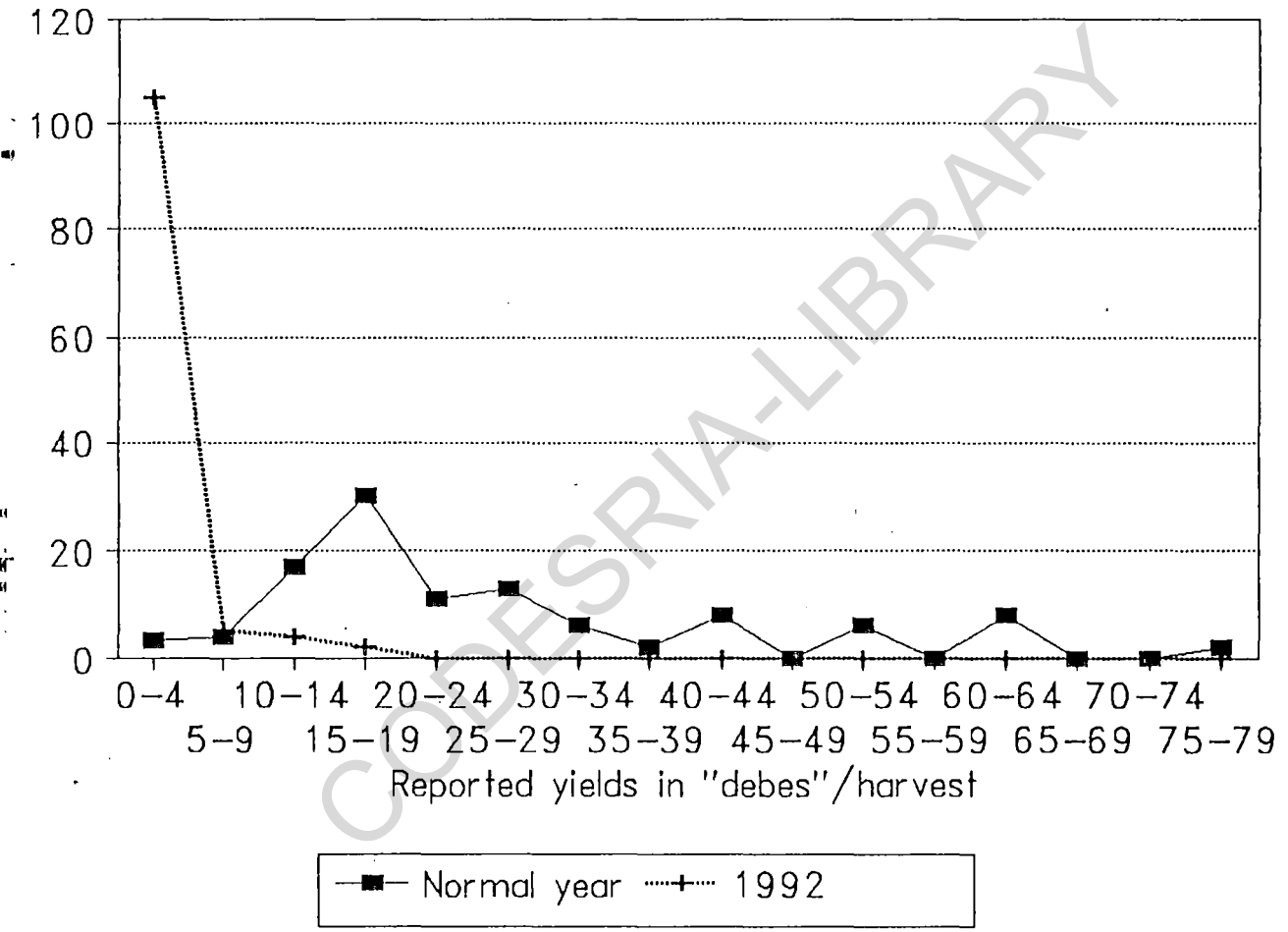
[1]A *debe* is used as the local unit of measure in the study area. Note that 5 *debes* = 1 bag (90kg) of grains.

to 2 bags of beans enough for the subsistence of a household, before the next harvest.

## 4.3 Drought Frequencies based on Rainfall records from Makuyu Rainfall Stations

The analysis done in the foregoing section on drought years and impacts is based on data given by the farmers. No indication is given whether or not these drought years were actual or merely perceived. Subsequently, in order to ascertain the reliability of the drought years given by the farmers, this section analyses rainfall records from ten selected rainfall stations in the study area (see Figure 3.1). Only data from stations with fairly complete rainfall records were used (see Table 4.8). Analysis of these records revealed drought years at both seasonal and annual levels between the years 1960–1992. Correlations are computed showing the degree of association between perceived and actual drought years.

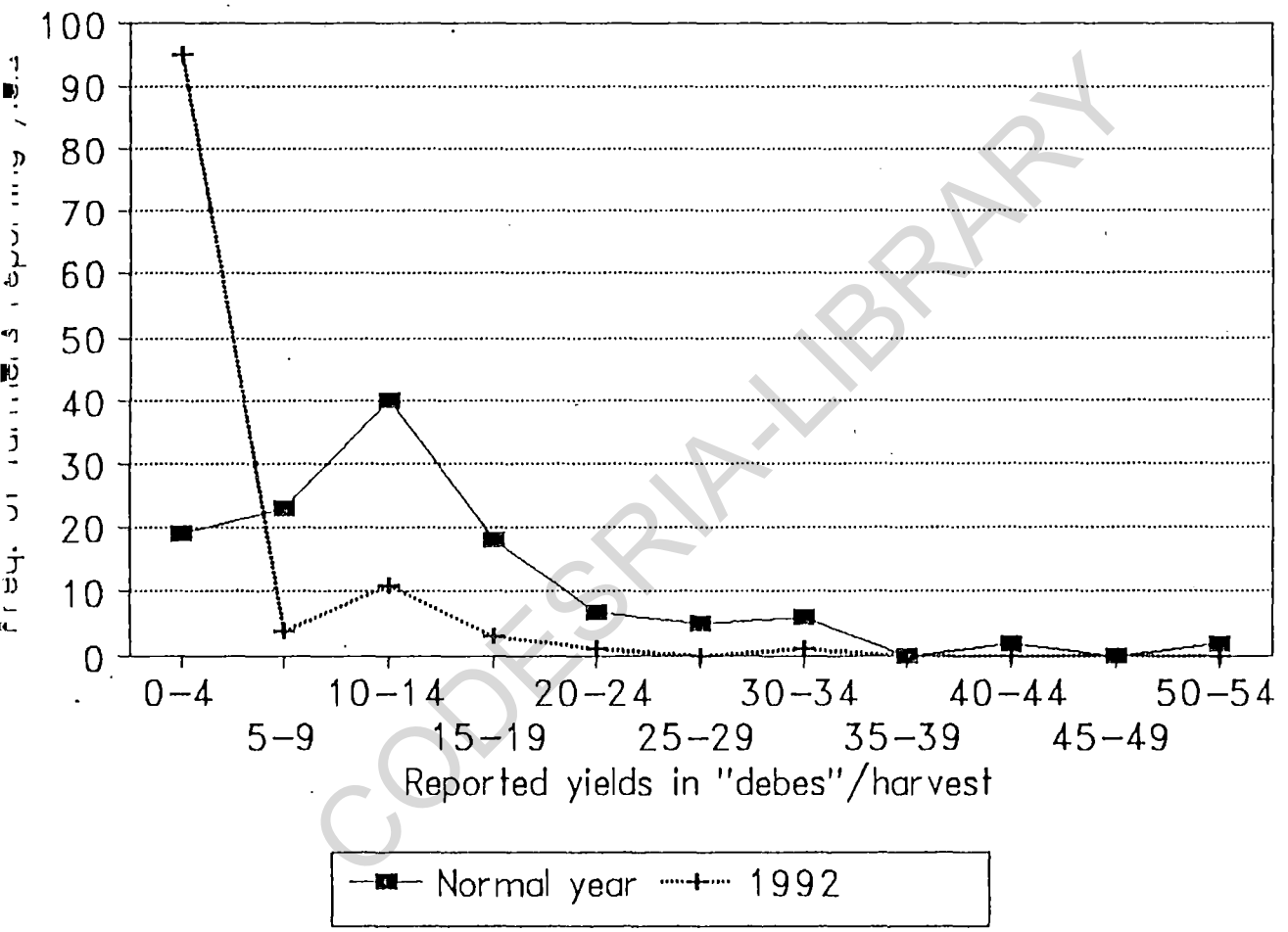
IG. 4.2: Maize yield reported by sample farmers during the 1992 drought and a normal year






Source: Fieldwork 1993.

FIG. 4.1: Bean yields reported by farmers during the 1992 drought and a normal year






Source: Fieldwork 1993.

The annual rainfall records for the ten reference stations (see Table 4.8) were subjected to the test for homogeneity using the Double-Mass Analysis Method. Double-Mass Analysis deals with accumulated values and provides a means of determining the consistency of rainfall data observations collected over a long period of time (Kohler 1949, Burrows 1982 and WMO 1986).

A linear plot was obtained for all the ten rainfall stations, which indicate that the rainfall data was homogeneous. Kohler (1949) explains that if the data is homogenous, the regression equation expressing the relation of two variables, X and Y takes the form $Y = mX$ for the accumulated values where m is a constant. This gives a straight line.

To ensure that meaningful rainfall indices were obtained, a period of observation of thirty years was considered though stations such as Ithanga had rainfall records dating back to 1972.

**Table 4.8: Number of years considered for each rainfall station**

| STATION | YEARS | NUMBER OF YEARS |
|---|---|---|
| Athara | 1962–1979 | 18 |
| Chi | 1962–1992 | 31 |
| Gethumbuini | 1962–1992 | 31 |
| Ithanga | 1962–1978 | 17 |
| Kitito | 1962–1978 | 30 |
| Makuyu Do | 1967–1987 | 21 |
| Mwitumberia | 1962–1992 | 31 |
| Nanga | 1962–1989 | 28 |
| Pundamilia | 1962–1977 | 16 |
| Sassa | 1963–1992 | 30 |

**Source: Kenya Meteorological Department**



Simple time series plots of monthly mean rainfall were plotted to determine and choose the rainy seasons in the area of study. This is essential when dealing with rainfall in areas where it has a strong seasonality. Annual rainfall in such areas would mask off certain pertinent characteristics that are otherwise displayed by seasonal rainfall. For each of the ten stations, a bimodal curve was obtained showing the two rainy seasons commonly referred to as the long (March–May) and short (October–December) rain in Kenya.

There exists no generally accepted quantitative definition of drought,

but most definitions are based on the ratio between actual rainfall and the amount that may normally be expected (Newolt 1978, Rowntree 1988). Subsequently in this study drought was defined as a period during which normalized values for either seasonal or annual rainfall were less than a calculated drought index of -0.2. The simple drought index is computed as the negative standardized score for seasonal or annual rainfall for the given reference station(s) (Downing et. al. 1985), in this case ten of them using the formula:

$$DI = \frac{xi - \bar{x}}{0}$$

where, $xi$ = Seasonal/annual rainfall totals

$\bar{x}$ = Seasonal/annual mean rainfall.

$0$ = Standard deviation

$DI$ = the drought Index

DI is normalized with a mean of 0 and a standard deviation of 1.

Drought frequencies were identified from Figures 4.4 - 4.12 which show seasonal and annual rainfall series in the study area between 1962 and 1992 using the following drought definitions:

Mild drought $-0.2<DI>-0.5$

Severe drought $DI \leq -0.5$

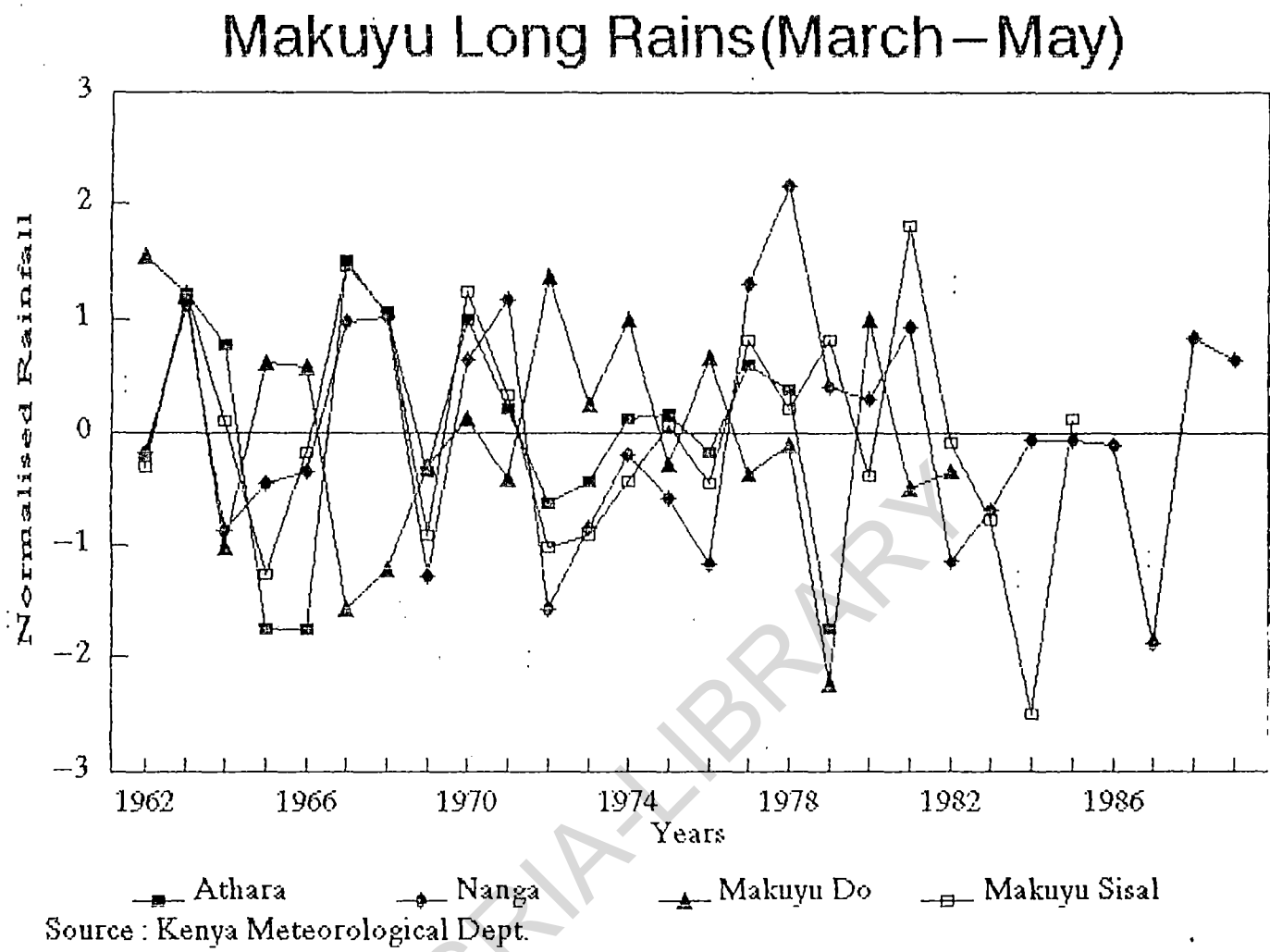
Appendix A1 summarizes the years of mild and severe droughts for either long, short or annual rainfall for the ten reference stations within the selected period.

### 4.3.1 Droughts during the Long Rains (march–may)

Computations in Appendix A1 show that between 1962 and 1992 mild droughts were experienced in the study area during the long rains in the years 1969, 1973, 1974 1975, 1976, 1980, 1984 and 1986. A calculated drought interval from these years suggests that a mild drought can be expected every three years during the long rains season in the study area.

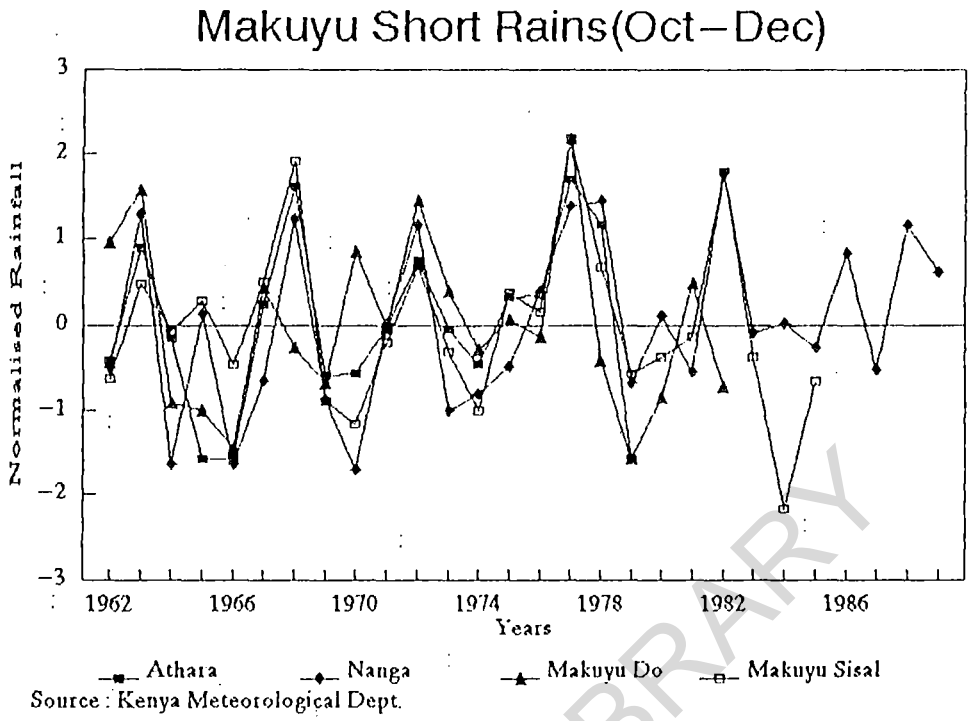
Appendix A1 also shows that severe droughts were experienced during long rains in the years 1962, 1965, 1966, 1969, 1972, 1973, 1976, 1979, 1982, 1983, 1984, 1985, 1987, 1990 and 1991. Severe droughts seem to be more frequent than mild droughts since the calculated averages from these years give a 1.9 years interval.

FIGURE 4.4: A plot showing long rains totals at Athara, Nanga, Makuyu Do, Makuyu Sisal Rainfall stations.



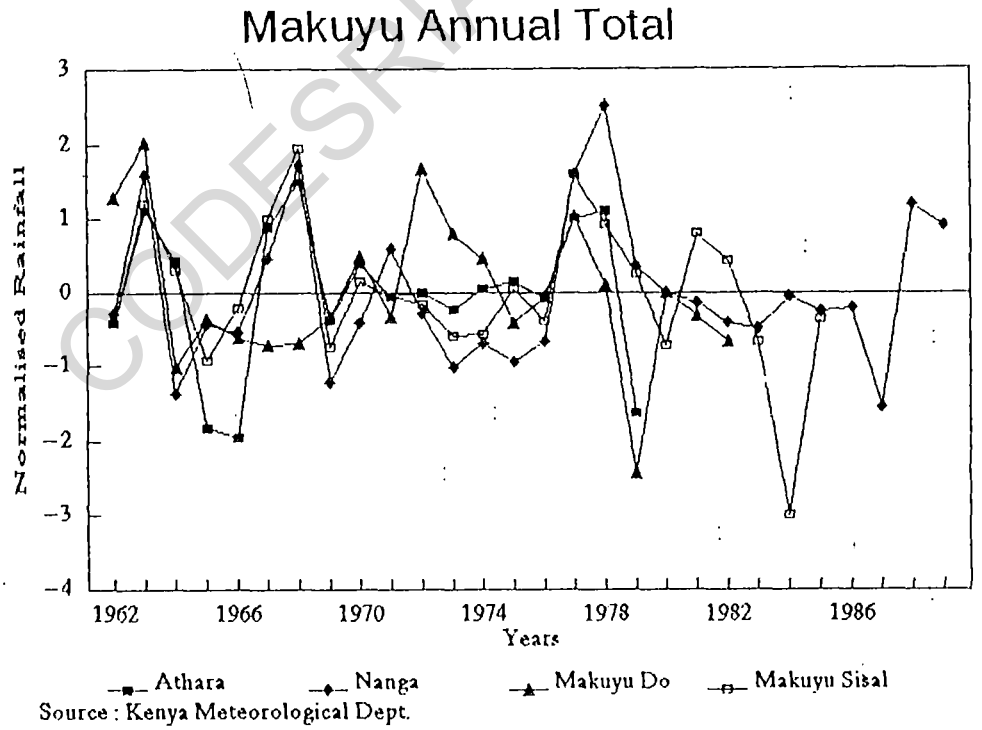

Source : Kenya Meteorological Dept.

FIGURE 4.5: A plot showing short rains totals at Athara, Nanga, Makuyu Do, Makuyu Sisal Rainfall stations.



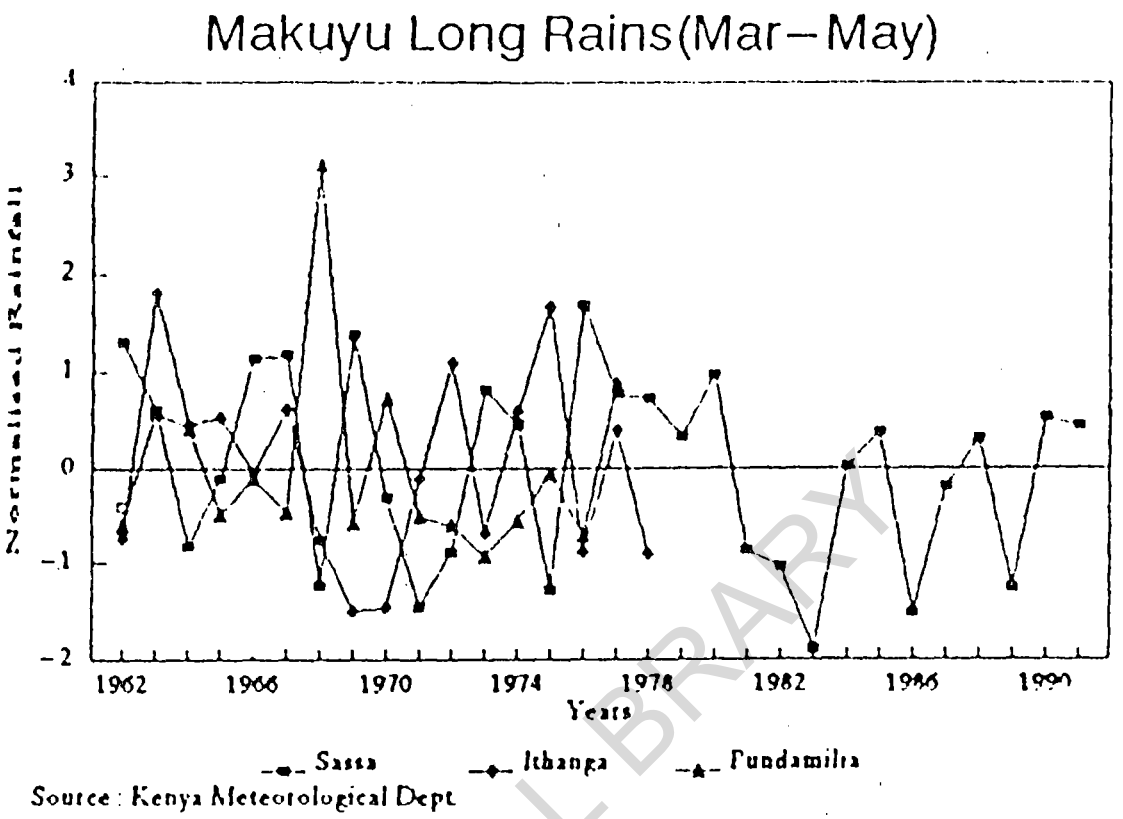

Source : Kenya Meteorological Dept.

FIGURE 4.6: A plot showing Annual Rainfall totals at Athara, Nanga, Makuyu Do, Makuyu Sisal Rainfall stations.



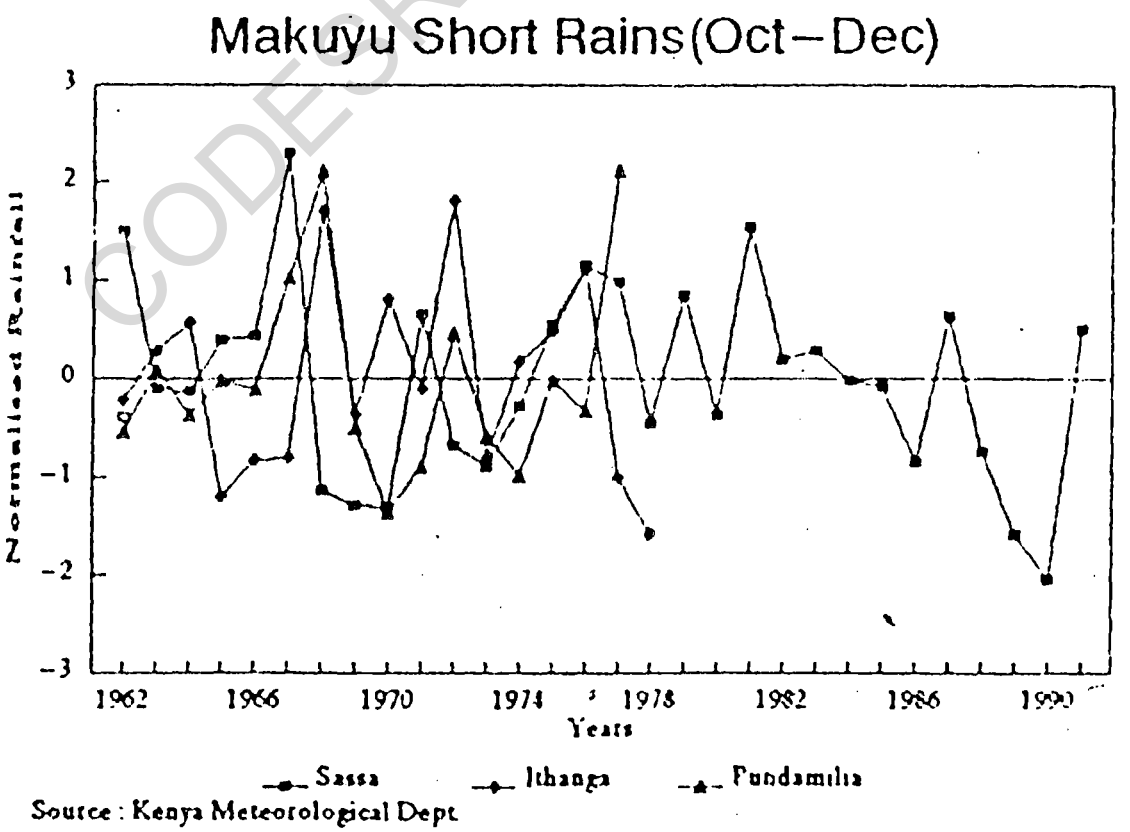

Source : Kenya Meteorological Dept.

FIGURE 4.7: A plot showing long rains totals at Sassa, Ithanga and Pundamilia Rainfall stations.



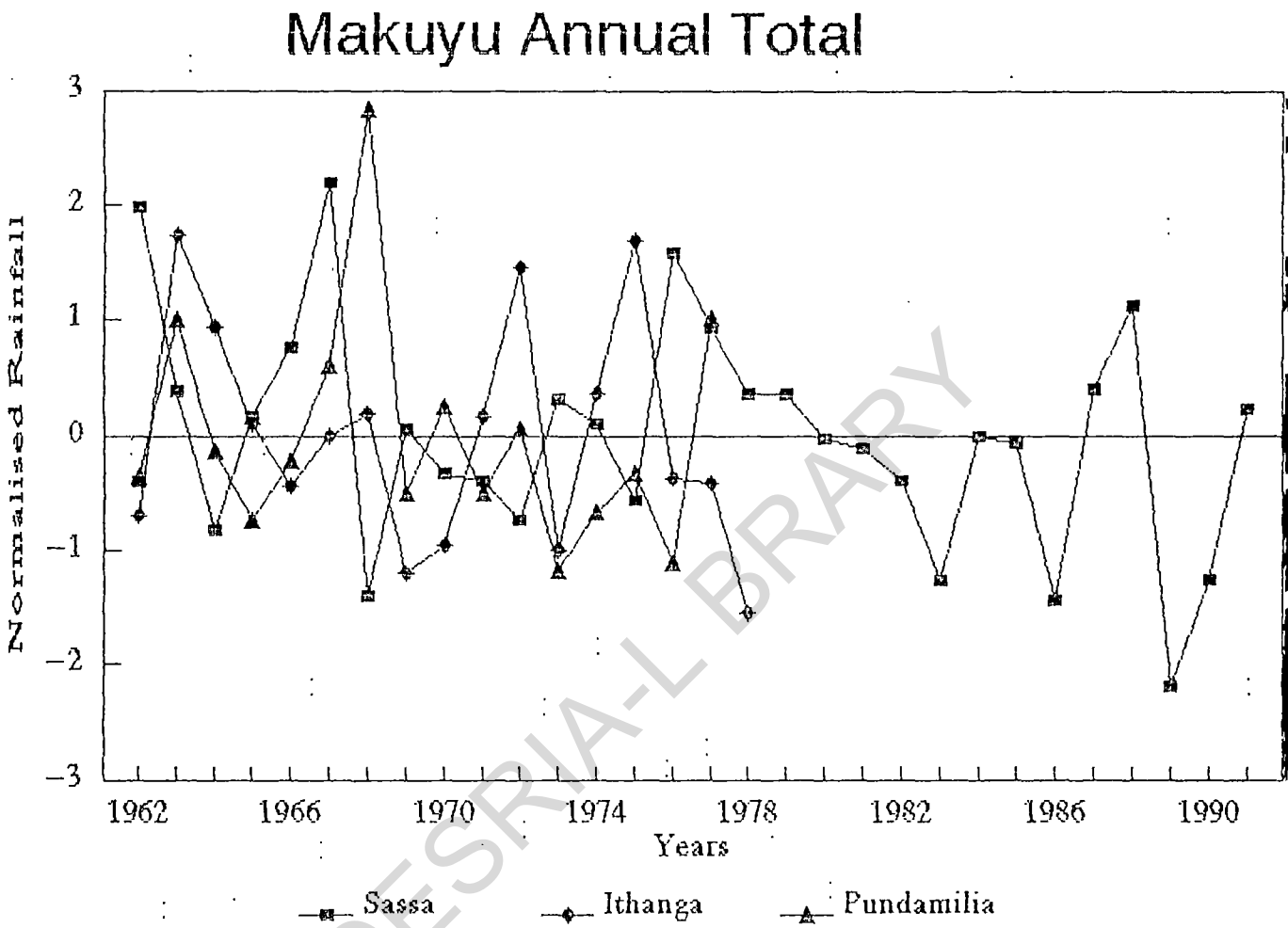

Source : Kenya Meteorological Dept

FIGURE 4.8: A plot showing short rains totals at Sassa, Ithanga and Pundamilia Rainfall stations.



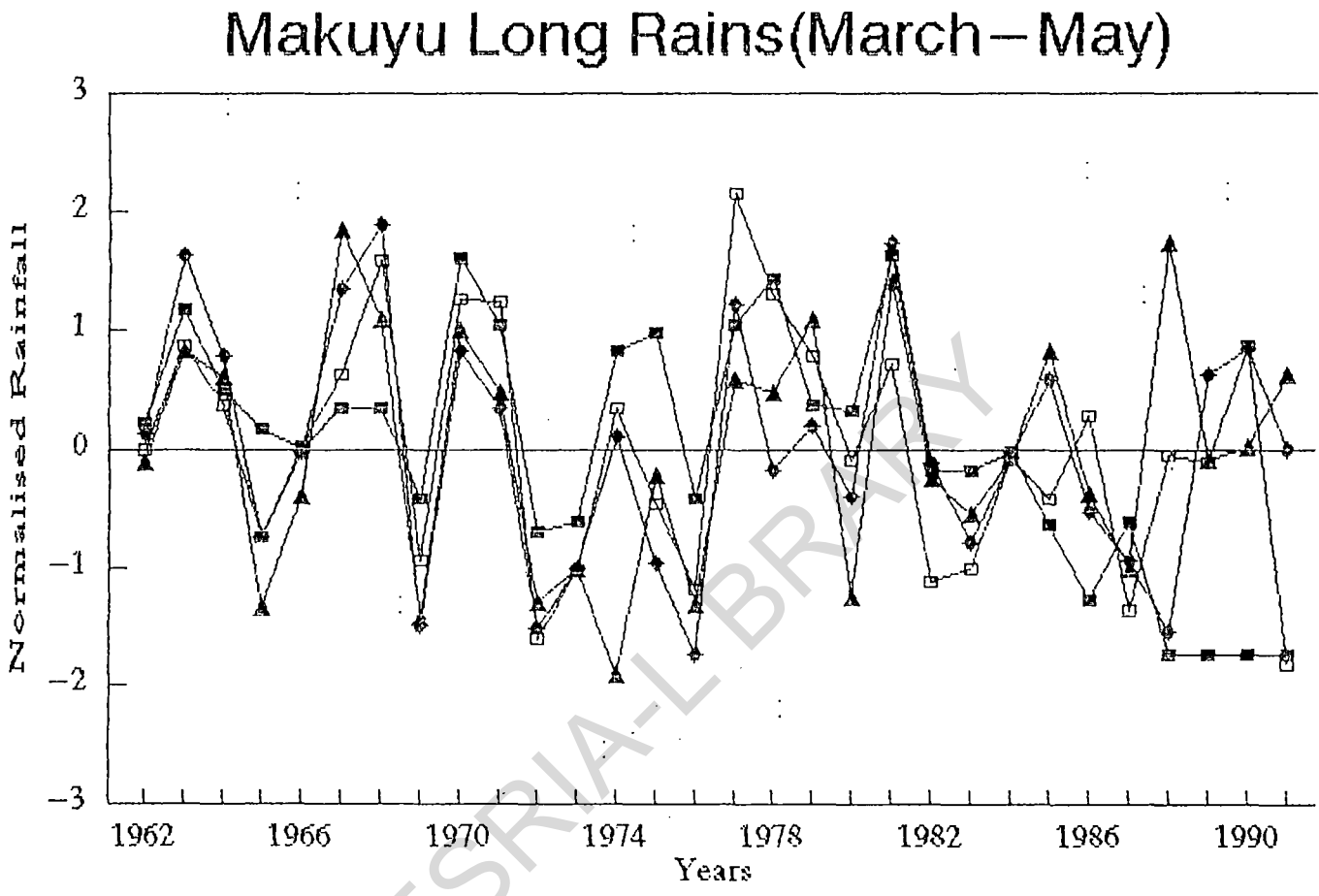

Source : Kenya Meteorological Dept

FIGURE 4.9: A plot showing annual rainfall totals at Sassa, Ithanga and Pundamilia Rainfall Stations.



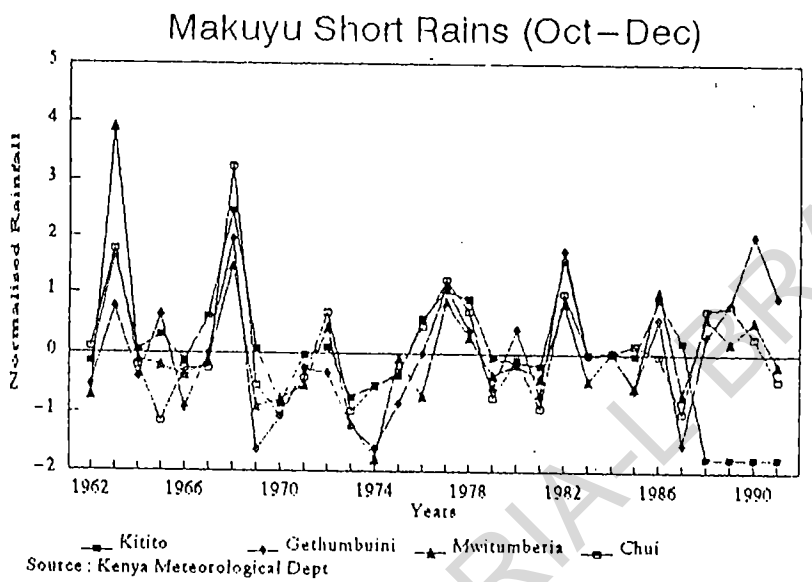

Source : Kenya Meteorological Dept.

FIGURE 4.10: A plot showing long rains totals at Kitito, Gethumbuini, Mwitumberia and Chui Rainfall Stations.



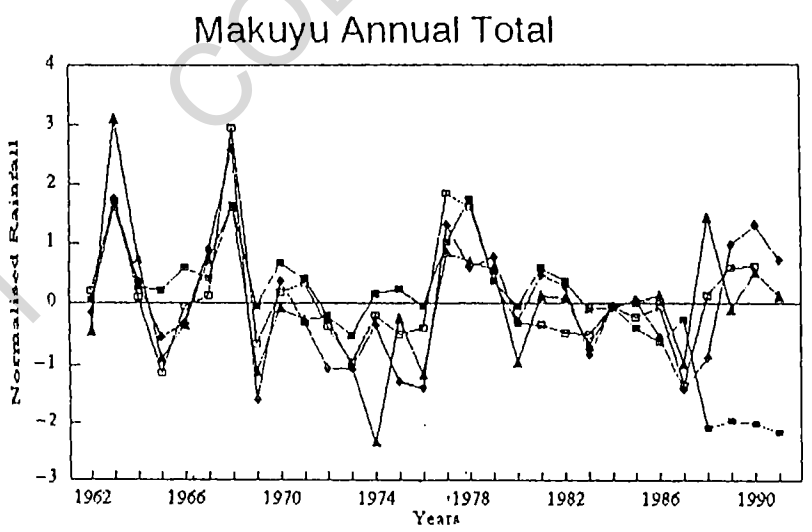

Source : Kenya Meteorological Dept.

FIGURE 4.11: A plot showing short rains totals at Kitito, Gethumbuini, Mwitumberia and Chui Rainfall Stations.




Source : Kenya Meteorological Dept

TABLE 4.12: A plot showing Annual Rains totals at Kitito, Gethumbuini, Mwitumberia and Chui Rainfall Stations.




Source . Kenya Meteorological Dept

### 4.3.2 Droughts during the Short Rains (october – december)

For the short rains season falling between October–December, both mild and severe droughts appeared more frequent. Mild droughts were experienced in 1962, 1970, 1971, 1972, 1974 and 1975. The mild droughts during this season average once every 1.7 years.

Severe droughts with drought indices less or equal to –0.5 during the short rains were recorded during the years 1965, 1966, 1968, 1969, 1970, 1973, 1974, 1979, 1980, 1984, 1985, 1987, 1991 and 1992. The calculated average interval for these years was 1.9 years suggesting that more severe droughts are more frequent during the short rains in the study area than mild droughts.

### 4.3.3 Correlations Between Perceived and Actual Drought Years

The data of perceived and actual drought years during the long and short rains (see sections 4.1.1 and 4.1.2) were subjected to Pearsons Product Moment Coefficient Correlation (r) to assess any possible inter-correlations between the three sets of drought years. A correlation coefficient of 0.853 was obtained between perceived and actual drought years during the short rainy seasons, while a correlation coefficient of 0.539 was obtained between perceived and drought years during the long rain seasons. These findings portray a high positive relationship between

the actual and perceived drought years. This is interpreted as showing that the change in the respective actual drought years closely matched with the change of the years recalled (perceived) by farmers. Subsequently it is deduced that farmers could reliably recall the drought years that had occurred in the study area during their time of stay. The obtained coefficients of 0.853 and 0.539 thus reinforce the reliability of the data given by farmers in drought years (see Table 4.0). They also suggest that there is a pertinent folk memory on drought years in the study area that can be used by policy makers in the designing of farmers educational programs and also by agro-meteorologists.

## 4.4 Summary of Findings

This Chapter focused on the history and impact of drought in the study area. The results based on folk memory and existing rainfall records have revealed that there is a distinct history of drought and related famines in Makuyu Division. The analysis also shows that a severe drought is likely to recur every three years during the long rains and after every two years during the short rains. The analysis also reveals that major droughts were easily recalled as most informants recalled the 1971/72, 1984/85 and the 1992 droughts as opposed to minor droughts. In the same vein, respondents with longer drought experience were able to recall more drought years than those who settled in the study area recently.

A cultural phenomenon explicit in the study area is the practice of naming droughts in accordance with either the impact or response.

This chapter also reveals that the 1984/85 and 1992 droughts had remarkable impacts on the well-being of households in terms of shifts in dietary habits, health, education, employment, crop and livestock production. Failure in crop production particularly the main staples, maize and beans, resulted into hunger and, due to limited monetary endowments, households had to shift to involuntary fasting and substitute foods such as wild fruits and vegetables that are less desirable and to some extent dehumanizing. It is clear that, while during a normal year households get enough harvests for subsistence and sometimes surplus for sale, during droughts, harvests are devastating.

Drought-induced famine also led to health problems particularly malnutrition and related ailments. This led to pupil absenteeism from school due to hunger and lack of school fees. Job scarcity and redundancy were prevalent and these impacts boiled down to making families rely on relief food supplies from the government and non-governmental organizations. Reliance on relief food is criticised as creating a state of dependency in households and thus exacerbating vulnerability to drought attacks.

The foregoing analysis clearly nullifies the guiding premise of this chapter which reads that 'drought has no distinct history and impact in the

study area.' It is now evidently shown that drought is a recurrent phenomenon in the study area with important impacts. Chapter Five proceeds to assess whether there is any relationship between farmer perception of drought and adjustment.

# CHAPTER FIVE

## 5.0 DROUGHT PERCEPTION AND ADJUSTMENT MECHANISMS AMONG MAKUYU SMALL-SCALE FARMERS

### 5.1 Introduction

As indicated in the literature review, a number of studies have shown that an individual's perception of a hazard influences the subsequent adjustment behaviour.

This chapter analyses farmers' perception of drought and it's influence on adjustment behaviour. Specifically, it examines the following aspects as perceived by the farmer: environmental quality of the area, causes of drought, next probable drought, drought symptoms and methods of drought hazard control. The premise that:

> "The farmer's perception of drought causes, probability, symptoms and methods of control do not influence choice of adjustment mechanisms" is tested.



#### 5.1.1 Perceived Environmental Quality of the Area

Table 5.1 shows farmers' perceived advantages and disadvantages of the study area. These responses summarize farmers response to the question: "What are your perceived advantages and disadvantages of this area?" as gathered in the pilot survey. Answers to this question provided a general overview of farmers' perception of their environment and gave

a sound basis for use of the repertory grid technique. In the repertory grid technique, the respondent provides both the elements and the constructs to ensure least interviewer interference (Whyte 1977, 1985: Townsend 1977). In this study, drought is the element and the constructs consist of the farmers' attitudes towards drought in respect to variables such as frequency, causes, symptoms and methods of drought control.

The enquiry on quality of the area made it possible to find out whether drought was perceived as a problem in the first place.

Of the perceived disadvantages, insufficient and erratic rainfall was the most significant, mentioned by 86.6% of the respondents. Problems related to inadequate rainfall such as inadequate water sources (46.6%), poor quality water (20%) and poor crop harvests due to low rainfall (33.3%) were also mentioned.

**TABLE 5.1: Perceived advantages and disadvantages of the area**

| Advantages | Number of Times Mentioned | % | Disadvantages | Number of Times Mentioned | % |
|---|---|---|---|---|---|
| Best place for farming during good rainfall | 12 | 80 | Physical<br>Inadequate water sources | 7 | 46.6 |
| | | | Poor quality water | 3 | 20 |
| Good soils compared to farmers place of origin | 4 | 26.6 | Inadequate rains, that leads to poor harvests | 13 | 86.6 |
| | | | Pests/disease outbreak | 6 | 40 |
| | | | Poor soils | 1 | 6.6 |
| | | | Economic | | |
| No pressure on land | 2 | 13.3 | Low prices for food and cash crops | 2 | 13.3 |
| A wide variety of crops grown | 4 | 26.6 | High food prices | | 2 |
| | | | Poor casual wages | 3 | 20 |
| No advantage | 2 | 13.3 | Poor business | 1 | 6.6 |
| | | | Agricultural | | |
| | | | Lack of inputs | 1 | 6.6 |
| | | | Lack of seeds | 6 | 4.0 |
| | | | Social | | |
| | | | Poor transport | – | – |
| | | | High School dropouts as children seek employment in estates | 1 | 6.6 |
| | | | Theft of crops and animals | | 2 |
| | | | No electricity | 1 | 6.6 |
| | | | Exploitative middlemen | 2 | 13.3 |

| | | |
|---|---|---|
| Too much dependence on shamba | 2 | 13.3 |

Source: Fieldwork 1993

The disadvantages perceived were more than advantages which is obviously common in most marginal environments. The limitations mentioned ranged from physical, economic, agricultural to social. During the reconnaissance, 40% of the farmers mentioned pest as a menace and this complaint frequently recurred in the main survey. Wild pigs, baboons and birds were cited as the most destructive to crops particularly cassava, millet, maize and sweet potatoes.

Despite the myriad problems cited, 80% of the respondents said that the study area is good for farming when rains are sufficient. Four (26.6%) said that the area had better soils than their places of origin; three (20%) perceived Makuyu Division as having the potential for supporting a large variety of crops; two (13.3%) said that the area had no land pressure, while two preferred the division to the higher areas because crops mature faster. These findings are consistent with Berry et al.'s (1972) study in Tanzania which observed that whenever you ask people about a locational choice (residence, farm, industrial site, commercial business), a sizeable majority demonstrate a positive attitude towards their present locations. Similarly, in North America, studies on a variety of locational preferences have registered favourable attitudes in at least two thirds of the respondents

(White 1972). Berry et al. (1972) concluded that the high preference universally exhibited even for contrasting ecological environments reinforces the general expectation of the farmer's high attachment to his land. From the above it can be deduced that, despite the marginality of their environment, Makuyu farmers perceive it favourably.

The numerous disadvantages mentioned depict that farmers in the study area perceive their environment as problematic and thus laden with risk and uncertainty. This necessarily raised the question why farmers have not been able to make meaningful adjustment in averting the risk and uncertainty surrounding drought.

The next section demonstrates possible links between farmers' perception of drought and adjustment. The analysis is based on the results of the repertory grids. In the grids, the elements consist of aspects of drought including causes, pattern, symptoms of drought, next probable drought and methods of drought hazard control. With 120 respondents and 4 as the maximum score on any construct, the maximum possible score on any construct given is 480 points.



### 5.1.2 Farmer's Perceived Causes of Drought

Unless the effects of a hazard can be traced back to their genesis no meaningful response or coping behaviour is likely to be evolved (Whyte

1986). Whyte emphasises that, it may be considered as dangerous to respond to drought as to illness before the cause has been properly identified because the wrong action can be harmful than no action. Understanding the cause of a certain hazard is thus deemed vital in understanding the choice of adjustment. Subsequently, this study considered it paramount to assess what farmers perceived as the cause(s) of drought.

Tables 5.2(a) and 5.2(b) show farmers' response to the question: "What in your opinion causes drought?" The perceived causes have been categorized into four groups. First are the teleological constructs that define causes attributed to supernatural powers. Second are the meteorological constructs that associate causes with physical or weather processes. Third, are the anthropogenic constructs that define man-made causes and fourth are the unascertained causes.

**Table 5.2(a): Respondent Perception of Cause(s) of Drought**

| Sample area | Gathungururu (N = 21) | | Kirimiri (N = 38) | | Kimorori (N = 24) | | Ithanga (N = 36) | |
|---|---|---|---|---|---|---|---|---|
| Perceived Cause | No. | % | No. | % | No. | % | No. | % |
| Teleological | | | | | | | | |
| God's will | 14 | 66 | 31 | 81.5 | 17 | 70.8 | 22 | 61 |
| People's sins | 8 | 38 | 15 | 39.4 | 13 | 4 | 13 | 36 |
| Traditional Spirits | 6 | 28.5 | 14 | 36.8 | 7 | 29 | 10 | 27.7 |
| Meteorological | | | | | | | | |
| The sun | 5 | 23.8 | 5 | 13.1 | 8 | 33.3 | 8 | 22.2 |
| Climate Change | – | – | 2 | 5.2 | 1 | 4.2 | 2 | 5.5 |
| Winds | – | – | – | – | – | – | 1 | 2.7 |
| Anthropogenic (Man-made) | | | | | | | | |
| Soil erosion | 3 | 14 | 1 | 2 | 1 | 4.2 | – | – |
| Cutting down trees | 4 | 19 | 9 | 23.6 | 7 | 29 | 9 | 2.5 |
| Pollution | – | – | – | – | – | – | 1 | 2.7 |
| I don't know | – | – | – | – | – | – | 2 | 5.5 |

**Source:** Fieldwork 1993

N = Total number of respondents.

**Table 5.2(b): Scores on respondents Perception of cause(s) of drought**

| Causes of drought | Scores | Scores as % of Maximum | Rank |
|---|---|---|---|
| God's will | 329 | 68.5 | 1 |
| People's Sins | 149 | 31.0 | 2 |
| Traditional Spirits | 84 | 17.5 | 4 |
| The Sun | 69 | 14.3 | 5 |
| Climate change | 24 | 5 | 6 |
| Dry winds | 4 | 0.96 | 9 |
| Soil erosion | 15 | 3.1 | 7 |
| Cutting down trees | 110 | 22.9 | 3 |
| Pollution | 4 | 0.96 | 9 |
| I don't know | 6 | 1.25 | 8 |

**Source:**Fieldwork 1993

Minimum score – 4 points

Maximum score – 480 points.



Table 5.2(b) shows the scores and rankings on perceived causes of drought whereby the highest possible score for each construct is 480 points (100%) while the minimum score is 4 points (1%). It is clear that teleological constructs emerged as the most important perceived causes of

drought. The highest ranking cause among the constructs was registered by the construct 'God' (rank 1) with a score of 68.5% followed by the construct 'peoples sins' (Rank 2) with a score of 31%. Traditional spirits (rank 4) with a score of 17.5% also seem relatively important. Such views seemed to have been largely influenced by the farmers' religious background and traditional persuasions. One respondent said that the 1992 drought had come because people had stopped to give sacrifices while an 85 year old farmer said that the rains had failed because her husband who previously used to sacrifice for rain to fall, had died the previous year. Another respondent claimed that a Kamba man who used to use charm to stop rain, had died a few months earlier; so they were now assured of rains in the future.

The natural hazard model postulates that all hazards result from the interaction of natural and man-made factors (see White 1972; Burton et al. 1978; Whyte 1977, 1986: Kates 1978). The Sahelian drought of the 1960s and the 1970s was explained more as an 'act of man' than an 'act of God' (Frank and Chasin 1980: Timberlake 1978). The view that drought is an 'act of man' did emerge in this study but very faintly. This is evident from the low scores among anthropogenic constructs. Cutting down trees (rank 3) scored only 22.9%, 'soil erosion due to poor farming methods' (rank 7) scored 3.1% while pollution (rank 8) scored lowest (0.62%) in this category.

Physical or meteorological construct also scored poorly. The sun

(rank 5) scored only 14.3%, 'climate change' (rank 3) scored 5% and 'dry winds' (rank 9) scoring 0.96% are explicit in their perceived insignificance.

The low score for the construct 'I don't know' (rank 6) at 1.25% shows that the majority of the respondents had a perceived cause for 'drought occurrence.'

The emerging picture from the above analysis is that Makuyu farmers have limited knowledge of the physical processes governing weather. The role of man in causing drought does not also seem to be clear. The farmers see drought more as an 'act of God' than anything else. Whyte (1985) contends that attribution of causality in hazard studies is significant in explaining adjustment behaviour. This is because when impacts are seen as not falling randomly, there is a tendency to blame some other forces or other sectors of the society. The choice of adjustment then becomes more dependent upon expectations of where the responsibility lies. Whyte (1986) elaborates this aspect further within the context of perception of locus of control. She defines locus of control as the measurement along a scale ranging from internal control (belief in one's ability to take decisions into one's own hands) to external control (believing that events in one's life are largely influenced by other people or fate–god, chance lack, etc.).

In keeping with Whyte's (1986) hypothesis, inferences can thus be made that attributing causes of drought to a less tangible force as God or

traditional spirits shifts the locus of control to the external part of the continuum. Subsequently, a farmer who believes that drought is caused by God or spirits may shift responsibility to the same forces, such that he leaves very little responsibility to himself in averting the hazard. In retrospect, attribution of causality to God or the spirits may influence the choice of adjustment to drought. The most likely responses are to pray, sacrifice or do nothing, letting fate take its cause. Such forms of adjustment though valid, are too passive and may exacerbate farmer vulnerability to drought.

Oguntonyibo and Richards (1978) warn against underestimating the significance of teleological explanations of drought. The two argue that such a view serves important social regulatory functions during drought attacks in controlling social behaviour, giving of alms and in increasing social responsibility and co-operation. Nevertheless, reciprocity as a survival strategy did not come out strongly in the study area. 70% of the respondents said they did not get any help from neighbours or relatives during the 1992 drought.

The role of religion in enhancing reciprocity during droughts seem to have been overplayed by other overriding factors such as lack of well established social links, general poverty during droughts and break up of traditional social networks due to modernization (see Chapter 6 for details).

Table 5.2(a) shows that there is no distinct variation in the perception of cause(s) of drought across the sample villages.

### 5.1.3 Farmer Perception on the Probability of Drought Occurrence

Efficient adjustment to natural hazards does not only demand an understanding of the cause but also the probabilistic character of natural events and an ability to think probabilitically, (Slovic and Kunreuther 1986). This section thus focuses on farmer perception of drought occurrence and probability in the study area.

Tables 5.3(a) and 5.3(b) show farmers responses to the question "Is there any pattern in which drought occurs in this area?" Using the method of classification employed by Berry et. al. (1972), the responses or constructs were categorized into five groups depending on farmers' perceived patterning of drought. The groups included rare cyclic, occasional cyclic, frequent cyclic, very frequent cyclic, no pattern and then not ascertained (I don't know response).

Table 5.3(b) shows that the construct 'no pattern' (rank 1) had the highest score of 63% showing that drought is perceived by most farmers as a random cyclic event.

Constructs depicting drought as a cyclic or regular event had very low scores. For instance, the construct "after six months" (rank 2) showing drought as a frequent cyclic event scored only 10.8% while "after every 1-2

years", suggesting drought as a frequent cyclic event, scored lowly at 6.6%. Constructs showing

**Table 5.3(a): Farmer Perceived nature of drought occurrence**

| Sample Area | Gathungururu (N = 21) | | Kirimiri (N = 38) | | Kimorori (N = 24) | | Ithanga (N = 36) | |
|---|---|---|---|---|---|---|---|---|
| Pattern/ Interval | No. | % | No. | % | No. | % | No. | % |
| Rare Cyclic Recurrence | | | | | | | | |
| 10–20 year | 4 | 19 | 4 | 19 | – | | 2 | 5.5 |
| After 8 years | – | – | – | | – | | 1 | 2.7 |
| Occasional Cyclic | | | | | | | | |
| 3–4 years | – | – | 1 | 2.6 | 1 | | 5 | |
| After 5 years | | | | | 1 | 4.1 | 3 | |
| Frequent Cyclic | | | | | | | | |
| 1–2 years | – | – | 4 | 10.5 | 2 | 8.3 | 3 | 8.3 |
| Very frequent cyclic After every six months | – | – | 6 | 15.7 | 2 | 8.3 | 5 | 13.8 |
| No pattern/No interval | 17 | 80.9 | 24 | 63 | 19 | 79.6 | 18 | 50 |
| Don't know | 2 | 9.5 | – | – | – | – | – | – |

**Source:** Fieldwork 1993

N = Total number of respondents.

drought perceived as a cyclic occasional event "after every 3–4 years"

(rank 5) and 'after 5 years' (rank 6) scored 5% and 3.3%, respectively, showing that they were not viewed as significant by farmers. Few respondents perceived drought as a rare regular event depicted by the constructs "after 8 years" (rank 8) scoring 0.8% and "after 10–20 years" (rank 3) which scored 6.6%.

**TABLE 5.3(b): Scores on Perceived Patterning of Drought**

| Scores as Pattern/Interval | Scores | Percentage of Maximum | Rank |
|---|---|---|---|
| No pattern | 304 | 63 | 1 |
| After every six months | 52 | 10.8 | 2 |
| After every 1–2 years | 32 | 6.6 | 3[1] |
| After every 3–4 years | 25 | 5 | 5 |
| After every five years | 16 | 3.3 | 6 |
| After 8 years | 4 | 0.8 | 8 |
| After 10–20 years | 32 | 0.6 | 3[2] |
| Don't know | 8 | 1.6 | 7 |

Maximum score 480 points (100%)

Minimum score 4 points (1%)

**Source:** Fieldwork 1993.

The range of years given on the perceived pattern also reflect some element of randomness. No distinct pattern emerged from the years given. Such constructs as "after every 1-2 years' (rank 3[1]), suggesting drought as frequent, and "after 10-20 years (rank 3[2]) depicting drought as rare obtained the same score of 6.6%. The average interval for drought years from the duration cited by the respondents is 10.5 years. Such an interval was found to be largely inconsistent with the actual statistical weather records for the study area. Computations in section 4.3.2 gave a three- year interval of drought during the long rains, and a two-year interval during short rains.

**TABLE 5.4(a): Perceived next Probable Drought**

| Sample area | Gathungururu (N = 21) | | Kirimiri (N = 38) | | Kimorori (N = 24) | | Ithanga (N = 36) | |
|---|---|---|---|---|---|---|---|---|
| Responses Next drought | No. | % | No. | % | No. | % | No. | % |
| Difficult to tell/anytime | 16 | 76 | 27 | 71.5 | 19 | 79 | 20 | 55.5 |
| After one year | 2 | 9.6 | 1 | 4 | 1 | 2.7 | | |
| Next 8-10 years | – | – | – | 1 | 2.6 | – | | 2 |
| After 2 years | 1 | 4.8 | – | – | – | – | 4 | 11 |
| After 5 years | – | – | – | – | – | – | 5 | 13.8 |
| After 3 years | – | 4.8 | – | – | – | – | 1 | 2.7 |
| After six years | – | – | 5 | 13 | – | – | 3 | 8.3 |
| God knows | – | – | 3 | 7.8 | 3 | 12 | – | – |

SOURCE: Fieldwork 1993.

NB: Percentages are of total respondents, not of replies as multiple answers were given

N = Total number of respondents

Farmers' perception of drought as a random event is further

supported by Table 5.4(b) which contains responses to the question: "when is the next probable drought." The construct "difficult to tell" (rank 1) scored the highest (67.5%) compared to the rest, whereby none scored more than 6%. Some respondents did give a definite time period during which drought would occur. This spanned from 0.5 to 10 years (see Table 5.4(b)).

**Table 5.4. (b): Scores on perceived next probable drought**

| Next Probable drought | Score | Score as % of maximum | Rank |
|---|---|---|---|
| Difficult to tell/ any time | 324 | 67.5 | 1 |
| After one year | 16 | 3.3 | $7^1$ |
| Next 8–10 years | 16 | 3.3 | $7^2$ |
| After 2 years | 28 | 5.8 | 3 |
| After 5 years | 12 | 2.5 | $5^1$ |
| After 3 years | 12 | 2.5 | $5^2$ |
| After six months | 32 | 6.6. | 2 |
| God knows | 24 | 5.0 | 4 |

**Source:** Fieldwork 1993.
Maximum score = 480 points
Minimum score = 4 points
Total respondents = 120

In more general terms, the above data could be interpreted to indicate that the farmers are limited in their perception of drought and its probabilities. Subsequently, as has been observed in other studies (e.g Slovic et. al. 1972; Saarinen 1969; Kates and Burton 1978; Kates 1986; O'riordan 1986), the farmers in the study area employed certain mechanisms for dispelling the uncertainty of drought. One such mechanism shown in Tables 5.4(a) and 5.4(b) is the belief that drought is undeterminable and unpredictable, and thus occurs randomly. The constructs "no interval", "difficult to tell" and "God knows" show that most of the farmers felt that they would rather not speculate on future droughts, as they perceived themselves and their environment to be at the mercy of God and thus it was needless to trouble themselves with the problem of uncertainty.

Another group of farmers denied the uncertainty of drought by perceiving it as a cyclic phenomenon which followed a regular pattern. Tables 5.3 (a) and 5.3(b) show six constructs which indicate that drought was considered regular. These include: "after 6 months", "after every 1-2 years; after every 3-4 years", "after 8 years and "after 10-20 years". Saarinen (1969) made similar observations in the Great Plains of the United States. Similarly, Kates (in White 1972) in a study on the flood plains of the United States, observed that farmers dispelled uncertainty of floods by viewing them as repetitive and even cyclic. Such a perception may influence adjustment (Slovic et al. 1985). These authors postulated that when resource users (e.g. farmers) viewed a hazard as cyclic, then their

world is viewed as either perfectly safe or as predictable.

The above constructs showing drought as regular are realistic in that they concur with computations from weather records discussed in Chapter 4. The problem comes in the perceived intervals. Actual records gave an interval of 1.9 years and 3 years for the short rains and the long rains, respectively. Apart from the construct "after every 1-2 years", the rest are inaccurate and almost exaggerated. When drought is perceived to recur "after every 8 years" or "after every 10-20 years", there is a danger of making a farmer complacent, such that if drought strikes before the perceived period, the individual may suffer heavy negative and devastating impacts due to unpreparedness.

Another systematic mechanism used by some farmers in denying the uncertainty of drought is use of 'the law of averages approach' (Slovic and Kunreuther 1972), also called the gambler's fallacy (Burton et al. 1978). From the constructs given regarding the next drought year, only one suggested that drought would occur after six months. The rest denoted years ranging from 2-10 years. To these Makuyu farmers, though drought would come in the future, they were certain that it would not recur in the following year since they experienced one in 1992 (year of study). Such a perception puts farmers at risk because it instils false confidence such that if drought struck in two years consecutively, farmers would be found

unaware and unprepared.

The availability bias which has also been observed in other studies (e.g Kates and Roberts 1978; Slovic and Kunreuther 1972; Slovic et al. 1986) was apparent in the spatial distribution of constructs given by the farmers regarding the patterning and the probability of drought. Tables 5.4(a) and 5.4.(b) show that more farmers in the Ithanga sample area were able to suggest the next probable drought year than those in Gathungururu and Kagaa sample areas. This is perhaps because most farmers in Ithanga settled in their present location in 1969, thus they have had considerable drought experience. Conversely, farmers in Gathungururu and Kimorori settled in 1986 and 1990, respectively, and therefore have little drought experience. This assumption is consistent with Slovic et al. (1985) contention that individuals are only able to evaluate and assess hazards they perceive. In the same vein, 'individuals who have limited or no experience of a hazard may not respond to it adequately. This can be observed in Table 4.7. Farmers in Kirimiri and Ithanga who have longer drought experience depict an upcoming tradition of substitute foods which they eat during droughts, unlike those in Kimorori and Gathungururu who depend mainly on the market. This implies that in the event of a future drought, they may not adjust to substitute foods as a survival strategy.

Note that according to availability, one judges the probability of an

event by the ease with which relevant instances are imagined or by the number of instances that are readily retrieved from memory. Subsequently (e.g. drought) instances of frequent events are easier to recall than instances of less frequent events (Burton et al. 1978; Tversky and Kahneman 1985).

### 5.1.4. Farmers Perceived Symptoms of Drought

Tables 5.5(a) and 5.5(b) show farmer perceived symptoms of drought. They show that farmers in the study area have limitations in forecasting capabilities. Most of them know it will not rain when it actually does not rain. This is evidenced by the constructs 'delayed rains (rank 1) with the highest score of 56% and "if it does not rain by March and October (rank 2) scoring 44.5%. Others include "delayed planting of crops" (rank 4); "If rain stops at mid season (rank 7) scoring 4.79% and weak seedlings (rank 5) which scored 8.75%. This picture is also explained by construct "cool cloudy conditions" (rank 3).



Kates (1978) postulates that one of the tools of hazard identification is diagnosis, where he defines diagnosis as an assessment of risk or hazard symptoms or consequence in relation to possible causes. Diagnosis is preliminary for forecasting, while the ultimate goal of forecasting is to provide guidance for taking action (Einhorn and Hogarth 1985), yet farmers

in the study area are not equipped with this knowhow.

The only traditional methods of forecasting mentioned were represented by the constructs "outbreak of pests and worms" (rank 7) but this scored poorly. This construct may specifically have been related to the 1984/85 drought whose outbreak was preceded by a serious army worm attack in some parts of Central Province (see Downing et al. 1989). The other construct is "if certain trees do not flower" (rank 9) scoring 4.5%. The main trees mentioned included the Jacaranda, the '*Muhuti*' and '*Mukara Mutimia.*'

**Table 5.5(a): Perceived symptoms of drought**

| Sample area | Gathungururu (N = 21) | | Mithiini (N = 38) | | Kagaa (N = 24) | | Ithanga (N = 36) | |
|---|---|---|---|---|---|---|---|---|
| Respondents | No. | % | No. | % | No. | % | No. | % |
| Symptom | | | | | | | | |
| Delayed rains | 15 | 11.4 | 21 | 55.2 | 19 | 79.0 | 16 | 44.4 |
| If it does not rain by 25th March and 15th October | 4 | 19.0 | 19 | 42.0 | 16 | 66.0 | 26 | 72.2 |
| Delayed planting of crops | 8 | 38.0 | 4 | 10.5 | 6 | 25.0 | 2 | 5.5 |
| Cool Cloudy conditions | 2 | 9.5 | 6 | 15.7 | 5 | 20.8 | 11 | 30.5 |
| If trees don't flower e.g. Jacaranda and Muhuti | – | – | 7 | 18.4 | – | – | 1 | 2.7 |
| Weak Seedlings | 4 | 19.0 | 7 | 18.4 | 3 | 12.5 | 8 | 22.2 |
| If rain stops at mid season | 1 | 4.8 | 7 | 18.4 | 3 | – | 11 | 30.5 |
| Outbreak of Pest and worms | 2 | 9.5 | 6 | 15.7 | – | – | – | – |

Source: FieldWork 1993.

**Table 5.5(b): Scores on Perceived Symptoms of drought**

| Symptoms | Scores | Scores as % of Maximum | Rank |
|---|---|---|---|
| Delayed rains | 272 | 56 | 1 |
| If it does not rain by 23rd March or 15th October | 214 | 44 | 2 |
| Delayed planting of crops | 62 | 12.9 | 4 |
| Cool cloudy conditions | 73 | 15.2 | 3 |
| If certain trees do not flower | 22 | 8.75 | 5 |
| Weak seedlings | 23 | 4.79 | 7 |
| Outbreak of pests and worms | 25 | 52 | 6 |

Maximum score = 480 points

Minimum score = 4 points

Total number of respondents = 120.

**Source: Fieldwork 1993.**



Diagnosis requires some knowledge of occurence of events or consequences, location or cause (Kates 1978). In such a case, therefore, since the majority of Makuyu residents are

immigrants it may be supposed that they have little knowledge of the area as pertains to drought and its symptoms. The ability to extrapolate with certainty symptoms of drought, requires many years of settlement in a place (Kates 1978). This is a criterion which most Makuyu residents don't meet since they have limited drought experience given that they had recently migrated to the study area. This implies that the inability to observe the symptoms of drought may also inhibit the trigger to take preparatory action.

### 5.1.5 Perceived Methods of Drought Hazard Control

Table 5.6 shows scores and rankings for responses to the question: "how can we reduce drought hazard?" A wide range of constructs were recorded. The constructs; "government to provide water and pumping machines for irrigation" (rank 1) scored highest (65.4%).

61% of the constructs given on how to control drought required the action of other people or forces other than the farmers themselves. Eight of the constructs suggest that farmers perceive the government as the prime body that can help them avert a drought situation. Most of the farmers, (78.5%) felt that irrigation of their farms would largely provide an outlet in averting drought risk and uncertainty.

**Table 5.6: Scores on perceived methods of drought hazard control**

| Method of Control | Scores | Scores as % of maximum | Rank |
|---|---|---|---|
| Government to provide water and pumping machines for Irrigation | 314 | 65.4 | 1 |
| Farmers be provided with a cash crop | 100 | 20.8 | 2 |
| Reduce food prices | 92 | 19.1 | 3 |
| Educate people to grow drought resistant crops | 78 | 16.2 | 4 |
| Avoid selling food/ store food | 72 | 15 | 5[1] |
| Sacrifice/pray God | 72 | 15 | 5[2] |
| Government to provide inputs, loans and credit facilities | 70 | 14.5 | 7 |
| Reduce dependence on farm produce | 57 | 11.8 | 8 |
| Better methods of farming | 46 | 9.5 | 9 |
| Improve transport | 39 | 8.1 | 10 |
| Plant trees | 38 | 7.9 | 11 |
| Reduce number of children | 26 | 5.4 | 12 |
| Conserve soil | 25 | 5.2 | 13 |
| Increase government relief | 12 | 2.5 | 15[1] |
| Get assistance in controlling pests | 13 | 2.7 | 14 |
| Increase pay for casual labourers | 12 | 2.5 | 15[2] |
| Rich to help the poor | 11 | 2.3 | 17 |
| Cultivate more land | 10 | 2.0 | 18 |

**Source:** Fieldwork 1993.

Other respondents felt that the government should assist in providing a cash crop that would provide farmers with a stable

source of income (see construct introduce cash crop rank 2, scoring 20.8%). Farmers also felt that the government could intervene through reduction of food prices. The respondents also noted that drought impacts are aggravated by high unaffordable food prices. For instance, 83% of the respondents cited 1992 as the worst drought year among all those they could recall and 79% gave high food prices as the reason for their view.

The construct "educate people to grow drought resistant crops" (rank 4) scoring 16.2% is the other factor showing farmers' perceived responsibility of the government. The construct "government to provide inputs loans and credit facilities' (rank 6) scoring 15.5% is yet another. Need for improved transport facilities (rank 9) scoring 8.1% also depicts need for help from the authorities. This construct was particularly recorded among farmers in Kiathanini sub-location who are oftenly cut off from the rest of the division when Miu river floods as there is no bridge.

The farmers also perceived increased daily wages by rich farmers and estate owners as a viable option to coping with drought. This study recorded wage dissatisfaction from respondents, who said they were paid only kshs. 25 per day, which is not enough even for a packet of maize flour.

The above analysis implies that farmers perceived

themselves to be in a desperate position when it comes to controlling the impacts of drought. Although they mentioned very salient solutions to drought problems, that required their own initiatives, they did not perceive these solutions as significant, as compared to those defining what the government should do. This can easily be observed from the low scores for constructs that require farmer's action. For instance, the construct "reduce the number of children" (rank 12) scoring 5.2%, is vital to a policy maker. Large families exacerbate drought impacts as they reduce the chance of storing surplus harvests during good years. The construct "better methods of farming" (rank 8) scored only 9.5%. This may be explained by the farmers' awareness that farming well requires inputs such as fertilizers, pesticides, better seeds which are beyond their reach due to financial constraints.

The construct "avoid selling food/store food" (rank 5[1] ) scored relatively high as compared to other constructs. The study observed that selling harvests is a serious problem for Makuyu residents. Due to lack of any other meaningful source of income, the farmers have to sell some of their harvests to get money for school fees and for fulfilling other social obligations in the home. Thus, little or no food is stored for a lean season. Food crops act as a form of 'cash crop' to them. Others suggested "controlling soil erosion" (rank 13). Soil erosion is not a serious problem in Makuyu except in Ithanga Location which is generally

slopy. "Plant trees" (rank 10) which can be very effective in controlling drought scored only 7.9%. This is because trees are mainly perceived as significant for firewood.

"Praying to God", scored relatively high showing that the farmers consider affecting the cause of drought as significant.

## 5.2 Summary and Conclusions

This chapter has revealed that Makuyu farmers have little knowledge of the physical processes governing weather. Subsequently they perceive drought more as 'an act of God' (a teleological phenomenon), than a consequence of climatic processes. It has been demonstrated that displaced knowledge on the cause of drought inhibits adjustment in that when respondents hold themselves less responsible in the cause, they also consider themselves less responsible in averting the impacts.

The inability of Makuyu farmers to predict drought and interpret it probabilistically was mainly attributed to their limited drought experience. Consequently the farmers used ways of coping with the uncertainty of drought such as perceiving drought; as a random undeterminable and event and as an event following the law of averages. They also applied the rule of availability.

Farmers' perceived methods of drought hazard control portray dependence tendencies. The farmers eskew responsibility of controlling drought hazard to God and the government other than to themselves. Whyte (1977) explains that an external locus of control attitude promotes a sense of complacency on the part of the victim who leaves little responsibility to themselves in seeking meaningful adjustment.

The overall conclusion of the chapter is that misperception of the nature of drought has affected adjustment among Makuyu farmers to a considerable degree. Though the chapter discusses how limited perception limits meaningful adjustment, it does not give details on specific adjustments and their shortcomings. This is covered in the following chapter which assesses responses to the 1984/85 and 1992 droughts. The general picture is that most of the adjustments are crisis-oriented and in the category of bearing loss, meaning that farmers mainly span into action when drought strikes.

The preceeding analysis thus nullifies the guiding premise of this Chapter that, the farmers' perception of drought causes, probability, symptoms and methods of control does not influence the choice of adjustment mechanisms!

# CHAPTER SIX

## 6.0 FARMERS' RESPONSE TO THE 1984/85 AND 1992 DROUGHTS

### 6.1 Introduction

This chapter presents and discusses farmers' responses or coping strategies during the 1984/85 and 1992 droughts. General agricultural adaptations are also considered. This chapter seeks to examine the validity of the premise that:

> "the co-response/coping mechanisms practised by farmers are not effective in averting vulnerability to drought hazard".

The chapter also gives an insight into the association between selected farmer socio-economic variables and selected responses to drought in an attempt to examine the hypothesis that, farmer socio-economic variables have no significant influence on responses to drought.

### 6.2 Responses to Drought

Structured and unstructured questions were used to identify the farmer adjustments during the 1984 and 1992 drought years. The farmers were further asked about the adjustments they make in their farms during droughts. As for the two drought years, various purposeful adjustments were mentioned. All the respondents mentioned buying food in the markets in both droughts years. Table 6.0 shows that 50% of the respondents sold

livestock in 1984 and 55% in 1992, 28% (1984) and 33.3% in (1992) ate bush foods or wild vegetables. Others relied on food reserves (4.2% in 1984 and 3.3% in 1992) while 59.2% in 1984 and 75% in 1992 systematically decreased food intake.

Prayer was also a major response cited by 60% of the respondents for 1984 and 55% for 1992. Yet others adjusted through searching for casual work (30.8% and 28.3% during the 1984 and 1992 droughts, respectively), share in rural business (0.8% in 1992) while a few (8.3% and 10% for 1984 and 1993, respectively) tried to raise some money by selling some of their few belongings such as watches, bicycles or by selling grass (for thatching and fodder) and charcoal (6.7% for 1984 and 5.8% for 1992).

The respondents also reported that they received help from outside during droughts. 53% said that they received relief food supplies from the government and NGOs such as the World Vision International and the church. 0.8% and 14.2% during the 1984 and 1992 droughts respectively, reported that they got help from the church. 7.8% in 1984 and 25.8% in 1992 obtained help from friends and relatives.

**Table 6.0: Response to the 1984/85 and 1992 Droughts Years**

| Response | 1984 Drought % of households | 1992 drought % of households |
|---|---|---|
| Borrow money | 6.7 | 11.0 |
| Casual labour | 30.8 | 28.3 |
| Relief | 60 | 60.0 |
| Pray | 51.7 | 55.0 |
| Food ration | 59.2 | 75.0 |
| Do nothing | 0.8 | - |
| Buy food | 70.8 | 100 |
| Migrate | 13.3 | 16.7 |
| Sell livestock | 50.0 | 55.8 |
| Will vegetables | 28.3 | 30.8 |
| Sell charcoal | 6.7 | 5.8 |
| Sand harvesting | 7.5 | 5.0 |
| Food reserve | 4.2 | 5.3 |
| Steal | 3.3 | 8.3 |
| Cook pawpaw | 25.8 | 30.8 |
| Help from relatives | 7.8 | 28.0 |
| Sell property | 8.3 | 11.7 |
| Food for work | 4.2 | 4.2 |
| Help from church | 0.8 | 10.0 |



**Source: Fieldwork 1993**

A few respondents, notably young men said that they earned money

through sand harvesting, a popular economic activity mainly at Ithanga. Stealing food, livestock and other property was also reported (by 3.3% of the respondents in 1984 and 8.3% in 1992) as an adjustment mechanism.

As regards adjustment to drought in farming practice, 8.3% mentioned farming strategies such as cultivation of bottom/wet lands, extending cultivated area (0.8%), irrigation (16.7%), intercropping (85.5%) and mulching (33.3%). Further, some farmers responded to droughts by scheduling for optimal soil moisture either through planting before the rains (25.8%) and staggered planting (0.8%). A major response in farming was the planting of drought resistant crops.

In this section an attempt is made to evaluate the different forms of adjustments with a view to assessing their viability in reducing vulnerability to drought in the study area. Each of the adjustments has been put under a certain category as outlined by Burton et al. (1978).

**TABLE 6.1: Adjustments in Farming Practice**

| Adjustment mechanism | % of Households Reporting |
|---|---|
| Irrigation | 16.7 |
| Intercropping | 85.8 |
| Drought Resistant crops | 95.50 |
| Farm Valley | 16.7 |
| Delay sowing | 65.8 |
| Plant early | 49.2 |
| Mulching | 33.3 |
| Do nothing | - |
| Staggered Planting | 0.8 |
| Plant Trees | 80% |
| Farm wetlands | 1.7 |

**Source; Field work 1993.**



These authors explain that once located and committed to a particular resource use, people use a variety of psychological, personal and social devices to reduce losses by either reducing the damage potential or by modifying the events and share them with other people. The classification has been used in a number of other studies (see Wisner 1977; Berry et al. 1972; Riebsame 1978).

### 6.2.1 Responses to Modify Event or Affect Rainfall Source

Prayer and traditional rites are among the most popular traditional ways of responding to extreme events in East Africa (Burton et al. 1978).

Nevertheless, with increasing modernization and influence of christianity, traditional practices such as rainmaking rituals have declined. In this study prayer was widely reported (see section 6.2). Only two Akamba farmers reported as having performed rainmaking rituals during the two drought years.

In chapter five (Section 5.1.2), it was noted that the majority of farmers in the study area view God or 'people's sins' as the cause of drought. Thus, they view prayer as the main way to appease God to stop drought. Oguntonyibo and Richards (1978) caution that teleological associations of drought should not be underestimated since they sometimes encourage passivity and complacency. Berry et al. (1972) support this view in contending that though prayer and rainmaking are important adjustments, their effectiveness and efficaciousness is questionable. They explain that teleological adjustments are widely practised in East Africa and may play an important role in helping people to cope with the great uncertainties of semi-arid agriculture. In practical terms, however, prayer as a way of altering the pattern of precipitation may not be as effective as perhaps would be cloud seeding and meteorological forecasts.



### 6.2.2 Responses to Bear/Accept Losses

This study observed that a farmer can suffer his losses either through figurative silence through doing nothing or by buying food in the

markets, selling livestock, collecting bush foods and wild vegetables, food rationing, fasting and eating food reserves. These types of adjustments registered the highest response from farm households as compared to other responses (see Table 5.0). It has been observed in other studies (e.g. Burton et al. 1978) that in the face of hunger, bearing loss is the most real and imminent option. A critical look at each of the adjustments in this category shows that they aggrevate the vulnerability of victims to drought impact than alleviate it as discussed below.

6.2.2.1 **Buying food in the Markets:** Virtually all households cited that they had bought food in the markets. Unfortunately, the cash necessary to purchase food was often scarce, thus families were forced to seek cash through means such as selling animals (such as cattle, goats and chicken). This often led to flooding of emaciated livestock in the markets subsequently lowering the prices. Respondents explained that they were forced to dispose off their livestock very cheaply (at between KSh.50–200 per head) whereas similar livestock could fetch over KSh.1000 per head in normal times. Thus, during drought, farmers incurred heavy losses which were compounded by the long term effect of reducing possessions which under normal conditions is not an approved approach.

Disposal of a farmer's capital assets in order to secure cash for food greatly constrained recovery from drought, making the household more vulnerable to future drought attacks. Some households mentioned that

they had not recovered from livestock losses during the 1984 drought.

6.2.2.2 **Food Reserves:** This was mentioned by very few respondents for the 1984 and 1992 drought years, (4.2% and 5.3%, respectively, implying that it was not a central survival strategy. Neuman (1989) made the same observations in Embu during the 1984 drought. This is because very few farm households (35%) store food after harvests due to what farmers called lack of surplus harvest (38%), large families (15%) or the need to convert excess production into cash for meeting household needs as school fees, clothing and supplementary foods (see section 6.2.4.8 for details).

6.2.2.3 **Wild Fruits and Vegetables**

Products from wild plants were consumed in greater quantities. This form of adjustment was reported mainly by respondents in Mithiini and Ithanga sample areas. Families could scout in the countryside, caves and river valleys for wild plants such as *Kikoe* or *Mukengeria* which served as vegetables but are normally considered weeds. Wild fruits such as *Ngaatu* were consumed. Raw pawpaws and mangoes were also cooked and eaten as vegetables, a practice that is not normal among families in the study area. Pawpaw and mangoes are normally eaten fresh as fruits.

As discussed earlier in Chapter 4 (Section 4.2.2.2) the consumption of such substitute foods among the Kikuyu and the Kamba is not taken very

kindly as it reflects abject poverty and misery, as well as laziness. Muriuki (1974) and Were (1988) report that gathering is a despised occupation among the Kikuyu, and that it is a taboo for a self-respecting Kikuyu to engage in such an activity. Similarly, Van Apeldoorn (1981) reports that scavenging for wild plants during drought- related famines is degrading and psychologically disturbing for the victims. Nevertheless Van Apeeldoorn (1980) argues that analysis of these plants have shown them to be as nutritious as domesticated ones.

On the whole issue of bearing loss as a form of adjustment during drought Wisner (1977) cautions that accepting loss should not be confused with the image of a fatalistic peasantly "merely accepting their lot." Rather he sees bearing a decline in welfare levels as an active process of allocation of resources within the family economy so that the family continues despite the crisis. The same may be said of Makuyu farmers, where socio-economic limitations also narrows the available opportunities for adjustment

### 6.2.3 Responses Involving Sharing Loss

The respondents shared their loss with others in various ways such as seeking help from relatives and friends (see Table 5.0). They also sought relief supplies from the government and non-governmental organizations (NGOs) such as the World Vision International and the Church. Burton et al. (1978) contend that in many societies, peasants look to relatives and

friends rather than to any government bureau or voluntary social agency for help in times of need. But observations in this study were contrary. Only 7.8% of the farmers reported having sought help from friends and relatives, while nearly 60% obtained relief food supplies from the government and the aforementioned NGOs. When asked whom they first turned to in recovering drought losses, 20% of the respondents mentioned relatives, 25% the government, 11% the church and 42% no one. Little reciprocity or symbiotic exchanges during times of drought in the study area may probably be attributed to lack of strong social networks since farmers are settlers from diverse origins (see details in section 6.2.3.2).

As mentioned in section 4.2.2.2, lack of sharing was also due to similarity in economic status across households during droughts. Families experienced similar problems thus one has little to offer to the other. Incidentaly, for those who got help, it was mainly from their relatives in high potential areas or children working in urban areas.



### 6.2.3.1 Government Relief

The farmers were asked whether or not they knew of individuals who had been assisted by the government in recovering drought losses. 90% of the respondents replied to the affirmative and they all said that the type of help mainly given was relief food which mainly comprised of maize and beans. The opinion of the farmers is based on their experience, since almost

every drought attack has been followed by relief food supplies from the government.

Relief supplies in times of drought are formidable in assisting drought-stricken victims. But critically it is only a short-term solution to the problem. This is particularly so since the assistance does not continue after drought ceases. The government seems to have been faithful in helping the farmers in the study area but only when crisis strikes.

A number of current studies have been very critical concerning the role of relief food as a drought survival strategy. White and Haas (1975) argue that public action (such as relief) reduces the awareness of a hazard, generates complacency and susceptibility to future attacks. Van Apeldoorn's (1981) study among Nigerian farmers established that relief food creates and perpetrates dependency. Interviews with officials in north and eastern Kenya (Mbithi and Wisner 1972) made it clear that relief food created a class of people who were perennially dependent upon the government.

Table 5.6 shows that 66% of perceived methods of drought hazard control reported by the farmers require the action of the government. Thus farmers exhibit an element of dependency and they seem to perceive minimal initiative on their part.

KNA (1980) and Were (1988) refer to Makuyu division as a relief zone. This study gathered that during the 1984 and 1992 drought years, food relief supplies seemed inadequate due to distribution of relief problems or scarcity in supplies. 5% of the respondents cited cases of irregularities in the distribution of food by government officials who either favoured those they knew or sold it for their own gain. Some families reported having received a 2 kg tin of maize and beans during each distribution that was either once or twice a month. This share may not have been enough even for a single meal. In areas like Mithiini and Ithanga where relief food was open for everyone, only those who could walk long journeys and make long queues at the distribution centres got the assistance; the old and weak who should have been the target groups (see also Mbithi and Wisner 1972) were left out.

Thus relief food that is not accompanied with or followed up by a long term drought recovery programme only excercebates the famine situation as it does not help rehabilitate the socio-economic structures of a community that are broken and weakened during drought attacks. This seems to be the case in the study area since continued relief with every drought seem not to have reduced the vulnerability of farmers.

**6.2.3.2 Reciprocity:** As discussed earlier, reciprocity did not serve as an important survival strategy among farmers in the study area. In Mithiini, it was reported that most people did not have sufficient food for their

families; thus, they could not assist others. Nevertheless, for those who practised it, it involved the mutual exchange of goods and services. In many African communities, food is borrowed or loaned on behalf of children (Mortimore 1987), who are viewed as innocent victims of circumstances. Reciprocity minimises the deleterious effects of famine and at the same time, engenders personal obligations, gratitude and mutual trust among givers and receivers (see Akong'a 1989). Mortimore (1987) observed declining reciprocity during drought years among farmers and he regrets that if a community cannot help in the bad years, cohesion is likely to degenerate increasing vulnerability to the hazard.

**6.2.3.3 Loans:** This is another strategy for distributing loss but was more of an exception than the rule. Only 5.8% of the respondents cited as having borrowed a loan at one time or another. Of these, 0.8% had borrowed the loan for buying a sewing machine, 1.7% for building a permanent house, and 3.3% for farm development. For the majority (94.2%) who had never borrowed a loan, various reasons were given: fear of default (28%), lack of security (55%), no idea of use (19.9%), and long processes of acquiring loans (19.2%), while 10% said they had not attempted to borrow loans as they were only accessible to farmers with cash crops. It is worthwhile to note that all the farmers who had access to loans were mainly teachers who had salaried employment. Most small scale farmers in the study area acquired title deeds in the late 1980s (Kenya 1989) after a Presidential decree. This is an aspect that to some extent has retarded agricultural development in the area since

farmers may have been reluctant to develop their plots due to lack of security.

### 6.2.4 Adjustments in Farming Practice

From a checklist of up to 12 agronomic adjustments farmers were asked to identify those they employed on their farms when they detected drought (Table 6.1).

**6.2.4.1 Early Planting:** This agronomic adjustment was reported by 49.2% of the respondents. Planting early ensures optimum use of available moisture by crops particularly during the early stages of crop growth. Farmers plant their crops early to ensure a high chance of harvesting. If the rains begin early and last long enough, early planting promises a good harvest. If the rains end early, the early planted crops still have a high chance of reaching maturity.

The remaining half (50%) of the farmers said that they planted after the first rains. These were mainly from Ithanga and some parts of Mithiini and they explained that before the rains come, the ground is too hard to be tilled. Subsequently, they have to wait for the rains to soften the ground. Planting early is also interfered with by lack of seeds and migrant labour to coffee estates in the area.

### 6.2.4.2 Growing Drought Resistant Crops

Interestingly, 80% of the farmers grow certain varieties of drought resistant crops, contrary to what may be expected in marginal areas where migrant farmers are involved.

A remarkable range of drought resistant crops is grown with slight variations across the agroecological zones; 60.8% of the respondents grew millet, 82.5% green grams and 51.7% pigeon peas. Whereas, 20% grew katumani maize only, 31.7% grew both Katumani and local maize while 25% grew local maize and 23% hybrid maize. The effectiveness of drought resistant varieties in drought aversion is nevertheless limited because they are grown in small quantities due to the small farm acreages. Sometimes, they are intercropped with maize and beans. Since the latter are the major staple crops, they occupy the largest acreage of individual plots in the study area (Ministry of Agriculture 1990).

Farmers in the coffee marginal zone (Kimorori) grew hybrid maize and beans intercropped with bananas. Few grew the traditional drought resistant varieties. This is probably because most farmers are still settling in the area; thus, have not adopted cropping to local conditions. Instead, they have transferred farming practises from their places of origin.

### 6.2.4.3 Katumani Maize Variety

The search for a maize variety that would do in Kenya's marginal areas started at Machakos Research Station. Katumani Composite A was released in 1964 and Katumani Composite B was released in 1967.

A question that may be asked is, 'if nearly 70% of the farmers in the study area grow katumani composite varieties, what then creates the food shortages even during mild drought?' Perhaps this can best be explained on the basis of what Wisner (1977) observed in Eastern Kenya. He concluded that Katumani maize has not been a break through in dryland farming. Wisner observed that the release of the Katumani composite varieties had to be accompanied by a package of husbandry practises recommended if a minimum of 10 bags of maize/acre was to be achieved. These include:

1. Preparation of a ridged seedbed
2. Planting before the rains begin
3. Row planting
4. Spacing 3 feet by 1 foot
5. Early thinning
6. Early weeding
7. At least three weedings
8. Monocropping
9. Dust against stock borer

10. Fertilizer, (Wisner 1977).

At least numbers 1, 3, 4, and 5 can be achieved by the peasant farmers with adequate advisory services (which is rarely available). Weeding might be hampered by lack of sufficient labour which was reported by 40% of the farm households. In order to get reasonable yields, the maize has to be monocropped. But such a recommendation is almost impossible where intercropping is the norm. The traditional Kikuyu farming system is to intercrop maize, beans, sorghum and peas. Yet if katumani is intercropped particularly with millet and sorghum, its yield declines. These are crops that root more deeper and earlier, increasing the probability of physiological wilting in the Katumani hence lowering the yield (Wisner 1977).

Moreover the small acreages mean that monocropping cannot be a possibility since other crops cannot be planted elsewhere. Inputs are rarely affordable by farmers in the study area. 56% of the respondents said they did not use fertilizer on their farms due to various reasons such as lack of money (32.5%), use of organic manure (12.5%), and because fertilizer spoils the soil (8.3%). The katumani maize seed may be too expensive for a low income farmer.

All these factors have rendered the katumani maize programme incompatible both ecologically and economically within the traditional

system complex.

### 6.2.4.4 Intercropping

This adaptive strategy was widely practised in the study area. The great number of crops intercropped is an attempt by farmers to reduce the risks. Inter-cropping, though often misconceived by agricultural experts, has numerous advantages. It ensures intense use of land particularly where acreages are small. It reduces the risk of complete crop failure if rain fails since some of the crops might be more resistant. Some of the crops in the complex are legumes which are vital in the nitrogen fixation process, hence sustaining soil fertility. The crop complex also forms a canopy that reduces evaporation, thus conserving soil moisture.

Intercropping is thus a commendable adaptive strategy that should be encouraged. Its crucial role should be reinforced by encouraging farmers to use organic manure.

### 6.2.4.5 Irrigation

Farmers in Gathungururu practise small-scale irrigation along valley bottoms. The Kakuzi company which gave a portion of their estate to Gathungururu farmers did a commendable job of ensuring that each of the 152 former employees got a 0.3 acre plot along the Makuyu river valley.

These plots have played a considerable role in checking drought losses and also raising the economic status of the farmers. The main crop grown is French beans and this forms a significant source of income for these farmers, though there were complaints of exploitation by middlemen who sell the crop to 'Home' Grown Company. The farmers also irrigate vegetables, maize, arrowroots and sugarcane. Table 4.7 showed that most farmers in Gathungururu depended on kales and arrowroots during the 1984 and 1992 droughts. No other case of irrigation was reported due to the limited number of permanent water sources in the study area. Some farmers with farms near the Miu river, when asked why they did not irrigate their crops, replied that it was almost impossible to water crops manually due to limited labour and the time and energy involved. They, however, suggested that they would do it if they were provided with water pumps.

### 6.2.4.6 Mulching

Mulching which conserves soil moisture through controlled evaporation seemed unknown to most farmers (67%). It was evident mostly among farmers growing irish potatoes. Others said that they did not mulch their crops because the mulch got eaten up by termites as soon as it was laid on the ground.

### 6.2.4.7 Tree Planting

Commendably, the majority the of farmers (80%) had attempted to grow trees on their farms. The main type were fruit trees such as mangoes, oranges, pawpaw and avocado. Others included Gravillea Robusta *Mibariti*, Palnus Africana *Muiri*, Cypress lustanica *Mitarakwa* and Croton mega Locarpus, *Mukinduri*. The most preferred tree species was Gravillen robusta which is ideal for agroforestry. Farmers plant trees for a variety of purposes; but mainly, to attract rain (43%), for construction (39.2%), shade (24.2%), firewood (66.7%) and controlling soil erosion (10.8%).

### 6.2.4.8 Cash crops

Very few (33%) of the farmers had cash crops on their farms during the time of study. Cash crops grown included oranges (11.7%), cotton (9.2%), tobacco (4.2%), castor (9.2%), French beans (17.5%).

Farmers who earn some money from cash crops have access to rural credit and may use some of the profits for fertilizers, pesticides and other farm inputs. This may increase farm yields and food production and hence improve household food security. This is because food can be stored and household financial needs met from cash crop sales.

Lack of a suitable cash crop for farmers in the study area has put them at a very vulnerable position to drought attacks. This is because, in

order to meet household financial needs, food crops are sold leaving little as food reserve for future use in case rain fails. 50% of the respondents said that they sold their crops before the next harvest. Conversely, the author observed that, the majority of households sold their crops immediately after harvest! Unfortunately due to the large supply in the local markets, the after harvest prices fetched are low. Maize was sold at KSh. 5 for a 2 kg tin, yet the same farmers buy the same quantity at Ksh.30 during times of scarcity. Thus, farmers get unfair prices for their crops mainly from traders from other parts of the country. Yet they had no choice other than sell their crops to earn money for fees and other household financial commitments. The food crops in the study area were more than just for subsistence; they served as 'cash crops' in a sense.

The majority of the households (65%) said they did not store food for various reasons; they sold it when in need of money (33.3%), harvests were not enough (38%), had many mouths to feed (15%) or that the crop could be eaten by weevils (2.5%). The author observed that many homesteads did not have a granary, and harvests were kept in bedrooms in sacks.

### 6.2.5 Responses to Diversify Loss

Another survival strategy was the distribution of loss through search for income generating activities such as rural business, wage earnings, food for work programmes, and non-farm economic activities such as sand

harvesting, charcoal burning, grass selling and sale of personal effects such as watches, bicycles and farm tools (see Table 6.0).

Of these adjustments, search for wage labour in estates and neighbouring farms recorded the highest response. Farmers mainly sought wage work in the large company and individually owned coffee estates in the division. Such estates included Kakuzi, Scofinaf, Gethumbuini and Athara. Kenya Canners (Delmonte) Limited also recruited casual labourers.

Farmers in the study area thus provide cheap labour to estate owners in Makuyu Division. In as much as this serves as a source of off-farm income to poor farmers, the wages given are too low to mitigate drought losses. Farmers complained that the daily wage given was below a living wage, mainly between KSh.25 and 30 per day, an amount that could not even buy a packet of maize meal. This was evident during the 1992 drought given the inflationary prices of basic food commodities. Interestingly, during one of the interviews,a farmer observed that the large farms have caused poverty and backwardness in the study area. He noted that large estates provided easy cash such that farmers preferred to work in the estates rather than till their plots. He complained that the problem is particularly noticeable in September before the fall of the short rains. This period coincides with the coffee picking season. Subsequently, entire families shift to earn the coffee money, giving little attention to their farms. Incidently, they plant late, leading to poor harvests. Yet the short rains

form the main season in the marginal areas (Downing 1989). Although this study lacks concrete data on this aspect, it appears significant and thus requires further investigation.

The problem of low wages was more pronounced during drought times, when the labour market is flooded with the individuals willing to take low wages, just for survival. The low casual wage has the effect of lowering the average rural wage, and consequently the general economic set up of the community.

The sale of possessions such as watches, bicycles and farm tools leads directly to loss which is a form of divestment. This divestment tends to be irreversible and increases vulnerability of a farmer and the entire household to drought hazard.

## 6.3 The Role of Socio-economic Variables in the Choice of Selected Responses to Drought

The preceding section endeavoured to link limitations in adjustment to misperception of the drought hazard. It did not look at the responses against the socio-economic background of the farmer. The latter forms the core of this section which investigates any possible association between selected farmer socio-economic and selected responses to drought. Thus the hypothesis; 'Farmer socio-economic characteristics has no significant

relationship with the choice of responses to drought' is examined. The selected socio-economic variables include age, educational level, income and farm size while the selected responses to drought include irrigation, drought resistant crops, storing food, mulching and cattle type. The responses selected are agricultural adaptions except storing food, and have got the long term effect of reducing drought harzard.

As discussed in the literature review, few studies in drought hazard research have considered the role of socio-economic factors in the choice of adjustments.

Table 6.2 shows the chi-square ($X^2$) relationship between the selected socio-economic variables and the selected responses. The study observed that at both 0.01 and 0.05 significant levels, no association existed between the selected response and the selected socio-economic variables.

The marked absence of relationship between irrigation, age, income and education can be explained on the basis of what was observed earlier in this chapter that the choice of irrigation as an adjustment was only open to farmers in Gathungururu who had access to irrigable low-lying marshy grounds. This suggested that a farmer did not have to be educated or have higher income to practise irrigation as the most important factor is accessibility to a water source.

No significant relationship was observed between age, income farm

size and storing food. Though older and younger farmers are likely to have surplus harvests due to smaller families and hence keep reserves, this did not seem to be the tendency in the study area. As discussed earlier in this chapter (section 6.1), food crops serve as the main source of income to most farm households due to lack of alternative sources of income. Thus any excess production rather than being stored is converted into cash for meeting household needs and school fees. Higher income would facilitate the storage of surplus harvests but as observed earlier, the majority of the respondents (70%) had farming as their main income source with meagre incomes of estimated less than Kshs. 2,000 per year.

Table 6.2: Chi-Square Relationships Between the Selected Socio-Economic Variables and Selected Responses to Drought

| | SOCIO-ECONOMIC VARIABLES | | | |
|---|---|---|---|---|
| RESPONSES | AGE | INCOME | EDUCATION | FARMSIZE |
| Irrigation | – | – | – | 0 |
| Mulching | – | 0 | – | 0 |
| type of cattle reared | – | – | – | 0 |
| Growing of drought resistant crops | – | 0 | – | 0 |
| Storing food | 0 | – | 0 | – |

– no significant relationship at 0.01 and 0.05 significant levels.

0 not considered.

**Source:** Fieldwork 1993.



Table 6.2 also shows an absence of distinct significant relationship between farm size and storing food. Though it would be anticipated that farmers with larger pieces of land would have surplus to store during good years, such could not be a possibility in the study area. This is because variation in farm sizes was very small among the farm households. The majority (70%) had 2 acres of land. In Ithanga sublocation, farmers had larger pieces of land, about 5 acres each. The study observed that most of the pieces or plots had been subdivided among members in the respective

households.

The lack of a significant relationship between age, educational level and the growing of drought resistant crops can be explained from various perspectives. Though age and higher educational levels could be associated with the adoption of new and better farming methods, this did not seem to be as significant as other factors. The most determining factor was observed to be the number of years a farmer had stayed in the area, which can be translated to be drought experience. Farmers who had stayed in the area for over twenty years particularly in Mithiini and Ithanga sample areas were observed to have adopted a variety of drought resistant crops including the Katumani maize variety. Those in Kimorori who are still settling (1992), grew mainly hybrid and local maize and beans. Thus the role of drought experience is hereby underscored in the growth of drought resistant crops than the age and educational level of a farmer.

The absence of a statistical relationship between cattle type, whether grade or indigenous can also be attributed to the role of drought experience. Only 8% of the respondents kept grade cattle and those were from Kimorori. The 28% who reared cross-breed cattle and the 45% who kept indigenous breeds were all recorded in Mithiini and Ithanga who have been in the study area longer.

With regard to mulching, the absence of a significant relationship with

age and education may be attributed to certain factors. Partially the homogenity in educational level among farmers meant that a relationship could not easily be discerned. Only 8.3% of the farmers had gone beyond primary education while the rest either had primary education (30.8%) or had no formal education (60.8%). Furthermore, as noted earlier in this chapter, mulching was mainly recorded among farmers who grew irish potatoes.

In retrospect, deductions can be made that the selected socio-economic variables seemed to play a very insignificant role in the choice of the related responses due to the explained overriding factors, such as drought experience, localized nature of some of the responses such as mulching and irrigation and the little variation among the socio-economic variables such as education and income among the farmers.

The conclusion to this section is thus summarized by the verification of the guiding hypothesis; that there is no significant relationship between the selected socio-economic variables and the selected responses in the study area.

## 6.4 Summary of Findings

The focus of this chapter has been on the identification and assessment of adjustment strategies adopted by farmers during the 1984 and the 1992 drought years. It is explicit that most of the adjustments practised in the study area were not effective in reducing vulnerability to drought impacts. The most practised adjustments lay in the category of bearing losses which simply involves a farmer accepting his loss as there may not be other possible alternatives.

The farmers also shared drought losses during the 1992 and 1984 droughts with friends, relatives, the government and non-governmental organizations. Relief food supplies is criticized as it is only a short-term solution that promotes vulnerability in the long run. Reciprocity in the study area seems to have declined in importance during droughts as families have little to offer to one another.

A number of agronomic adjustments were cited as practised when farmers detect drought. Early planting by farmers though vital, is sometimes interfered with by lack of seeds and search for wage work in estates. Drought resistant crops, though grown by majority of respondents' play minimal role in averting drought related farming due to low acreage grown under each. The katumani maize though adopted by 70% of the respondents was seen to be incompatible ecologically and

economically in a subsistence farming setting, hence its failure to avert famines. Intercropping was widely practised.

Cash crops were grown by a limited number of farmers. This situation has threatened food storage as farmers have to sell surpluses to meet household financial requirements. Mulching which can be vital in controlling drought effects seemed little known by farmers. Trees have been planted by most of the households for various reasons including attracting rains.

The 1984 and 1992 droughts resulted in considerable losses. In most cases, the adjustments practised by farmers were not particularly effective in reducing damage. The analysis in this chapter thus verifies the guiding premise that "the responses/coping mechanisms practised by farmers are not effective in averting vulnerability to drought.

# CHAPTER SEVEN

## 7.0 SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

### 7.1 Introduction

This study sought to investigate the small scale farmer perception of and response to drought in Makuyu division. Specifically, it looked at: the history and impact of drought; farmer perception of drought and its influence on mode of adjustment; nature of responses to the 1984 and 1992 droughts and their suitability in averting vulnerability to drought and the role of socio-economic variables in the choice of drought coping mechanisms.



### 7.2 Major Findings

A trace of the history of drought revealed that the study area is a drought prone area with recurrent drought attacks, at least for the last thirty years. An analysis of actual weather records for the years between 1962 and 1992 showed that the study area experienced a drought after every two years during the short rains and after every three years during the long rains period. The findings fit Downing's (1989) and Wisner's (1977) definitions of local drought. The farmers recalled the following drought years: 1943, 1953, 1961, 1964, 1965, 1968, 1970, 1971, 1972, 1974, 1975, 1976,

1977, 1980, 1981, 1982, 1983, 1984/85, 1987, and 1992. The reliability of these data was confirmed by the high correlations that were obtained between the perceived and actual drought years. The 1992 drought year was perceived by most farmers as the worst in their experience. This perception was associated with the recency of the 1992 drought year than to its magnitude (see Chapter 5).

It was observed that farmers named droughts as per their respective impacts or responses. The ability to recall drought years was found to vary across the sample villages, a phenomenon that was attributed to drought experience than variation in spatial climatic characteristics.

The 1984/85 and 1992 droughts had adverse impacts such as direct hunger and related diseases, change in dietary habits, children absenteeism from school, redundancy and scarcity of casual jobs. Effects were also felt in the decline of crop yields and livestock loss. The variation in the impact between these two years was, however, slight.

Farmers had limited knowledge of the processes that govern weather. Occurrence of drought was mainly attributed to teleological factors such as God and traditional spirits. Misperceived cause of drought limited the suitability of the responses. The tendency to affect the cause such as a teleological cause of drought was through prayer or sacrifice. Such responses on their own, though valid, have doubtful efficaciousness in

averting the drought hazard. In essence, they may perpetuate vulnerability.

Farmers were limited in perceiving drought probabilistically. Majority of respondents viewed drought as a random, hence unpredictable event. Constructs describing the interval of and next probable drought were varied and largely inconsistent with the analysis from actual rainfall records for the last thirty years, that showed a cyclic trend in the occurrence of drought within the period of analysis. Kates (1978) established that individuals refuse to deal with hazards as probabilistic events, since to do otherwise may be beyond human cognitive abilities. Inability to view drought probabilistically was interpreted to limit the sense of preparedness. When a farmer views drought as random or likely to occur in the next eight to ten years, he/she is likely to develop a sense of complacency and exacerbates vulnerability to the hazard.

The limited overall drought experience of the immigrant farmers may explain the limitations in drought perception. Little knowledge on drought symptoms was observed. Though the ability to diagnose the symptoms of drought is salient in forecasting, this seemed limited among Makuyu farners. Most of the perceived constructs on drought symptoms were those observed after the drought onset. This was mainly attributed to little drought experience as most of the farmers are recent immigrants. This agrees with Kates (1978) findings that the ability to extrapolate, with

certainty, symptoms of a hazard require many years in a place. Nevertheless some of the symptoms given such as "prolonged cool cloudy conditions" "worm or insect attacks" and failure of certain trees to flower, are worthwhile to agrometeorologists, and need further examination inorder to establish their validity.

An evaluation of responses to the 1984/85 and the 1992 droughts and the general adaptations in farming practice revealed that the responses that farmers make are not effective in averting vulnerability to drought. Majority of the coping mechanisms fell in the category of bearing losses, which entailed actions that individuals take when a disaster strikes. Responses in this category included buying food in the markets, selling livestock and other personal effects, involuntary fasting, food rationing, eating wild fruits and vegetables and eating food reserves. Such adjustments were generalized as weakening the household economy particularly when the farmer had to sell his personal property. Eating of wild fruits and vegetables was described as psychologically degrading.

Relief supply is a major response by the government and the Non-Governmental Organizations (NGO's) such as the Church and The World Vision International. This was not exclusive to the 1984 and 1992 droughts but as shown in Chapter 1, the study area suffers from persistent food shortages and is thus on permanent Relief Programme from the Government

(Were 1988). Relief on its own, is only a short-term solution, that tends to create and perpetuate dependency and complacency among the recipients.

Agricultural adaptations practised were limited and localized. Small scale irrigation was restricted to Gathungururu farmers, mulching and staggered planting were not widely known. Planting of drought resistant crops was widely practised contrary to most experts' view, but their role in drought aversion was limited due to small land acreages. Intercropping was commendably practised. The animals reared included goats, local and cross-bred cattle which were suited to the ecological zone but suffered pasture shortages during droughts due to scarcity of grazing land.

Perceived opportunities for adjustments were limited. A dependence syndrome seemed to have developed among the farmers who felt that the government was the only body that could alleviate drought-related problems. This can be partially attributed to limitations in perception of drought such that individuals use what Slovic et al. (1974) called information processing shortcuts. This entails people avoiding to make decisions regarding a hazard and instead rely on experts or higher authorities. On the other hand, this dependence syndrome was not due to ignorance or laziness. It is an attitude developed from government's perpetual relief programme with every drought and farmers' economic constraints not withstanding. Victims have actually lost confidence in themselves and their abilities. Hence, they look to outside interventions

and solution to drought.

No significant relationships were found to exist between the selected socio-economic variables such as age, income, educational level and farm size and the choice of selected responses which included irrigation, mulching, type of cattle and growing drought resistant crops. Slight variations in income and level of education controlled any associations. Experience of drought to the farmer was more accountable to these results.

## 7.3 Contributions of the Study

This study contributes to existing literature on drought hazard research. It has been possible to show the historical dimension of drought in a local setting as well as the local responses. Spatial scale of analysis is crucial in determining generalisation and application of results. This study has been able to examine the problem of drought in a smaller spatial setting, thus augmenting knowledge on this topic that has been examined chiefly at large scales: regional, national and international.

The study has also identified from actual rainfall records the years of drought in the study area for the last thirty years, since 1962. The time series rainfall graphs can be very useful for agrometeorologists and policy makers when making decisions related to agricultural development in the division.

The study has identified a key aspect in drought perception; that farmers are limited in assessing causes, symptoms, pattern controls and probability of drought. This is consistent with, and thus contributes to the findings of other studies (Kates 1978; Slovic et al. 1974; Kunreuther and Slovic 1986; Roder and Drupree 1974). The findings of this study thus add knowledge to the role of perception in adjustment to hazards in general.

The study has a wealth of information on the physical and human characteristics of the study area (Chapter 1) which should be useful to a general reader. Details of relief, geology, climate, vegetation, population, settlement and socio-economic activities are provided. Some of these are effectively illustrated by the use of maps and tables.

This study has also made contributions in the application of the repertory grid technique. This technique was used to construe farmers perception of drought. This is a technique that has met limited applications in Kenya particularly in agricultural geography, studies by Obara (1989), and Naulikha (1991) notwithstanding. This study hopes to add to the knowledge on the utility of the repertory grid technique which is commendable for perception studies.

## 7.4 Recommendations

This study has demonstrated that local droughts are a recurrent phenomenon in Makuyu division. Weak and shortlived coping strategies are factors exacerbating vulnerability to drought in the study area. The majority of the farmers are recent immigrants and thus their knowledge of drought is limited.

This suggest that if no action is taken, then the Makuyu farmers will persistently be victims of drought which will no doubt recur in the future. In view of this the following policy recommendations are made:

(a) Along term and sustainable solution in reducing drought susceptibility of the farmers in Makuyu should be set up. The current crisis management approach discussed in Chapter 6, where the government only spins into action when a drought strikes through relief operations is detrimental and inadequate. Relief does not provide protection for it does not prevent disasters from occurring again as observed earlier. It is only a short-term solution to the problem. Essentially pre-drought planning is the only formidable solution. This would involve a long range activity that eventually realizes sustainable coping strategies such that drought no longer becomes a hazard. Such a strategy can be achieved through various ways:

(i) Identifying and mobilising indigenous resources and infrastructure in the study area. Such can only be achieved with the help of the local community who know their environment best than outsiders. This calls for farmers participation in the decision making process and policy making. For instance, the study observed that Gathungururu has potential for small scale irrigation in wetlands. With adequate extension work and provision of the necessary farm inputs, the area can supply the rest of Makuyu division with vegetables, arrowroots and also french beans for domestic use and export. Ithanga and Kambiti can be homes for diverse fruits such as mangoes, oranges and passion, which can be grown economically on the observed small plots. With intensified research, horticultural activities could be developed to provide the farmers with an economic basis.

Ithanga has plenty of quarries, and sand in river beds. At the moment, these assets are managed by local authorities whereby Makuyu residents benefit minimally. A policy should be set ensuring that some of the revenue accrued from these assets is used to improve amenities in Makuyu. Kenya (1989) also records that Ithanga division has potential for silkworm

rearing. This should be harnessed fully, as it would go along way generating income for farmers at the same time controlling the sale of food crops.

(ii) Research on drought resistant crop varieties should be intensified. The suitability of Katumani maize variety has been hampered by small acreage and intercropping practices in the study area. This problem requires urgent attention. If possible, tolerant strains that do well in a crop complex need to be developed. Local varieties of sorghum and millet should be improved, selected and distributed for use. Rearing of cross-breed cattle and goats should be emphasized as these are more resistant to drought attacks than the exotic breeds. Guidelines and findings on crop combinations and time of planting for marginal areas given by Jaetzold and Schimdt (1989) could go along way in introducing sustainable varieties.

(iii) The government need to support in setting up a communal grain reserve or 'silo' at the village level in Makuyu. Currently, storage of food in the study area is hampered by the role of grain as a major income earner. This weakens household defences against drought. Farmers sell grains to unscrupulous traders at throw away prices after harvests. A farmer, may sell 2 kg grain at between KSh.2/50 and Ksh. 5 during harvest and

2. Farmers are only likely to take the necessary preparatory action against a hazard if they perceive it correctly. Subsequently, the farmer misperception of drought as rare and random need to be re-oriented through farmer educational programs. There is need to make the farmer's perceptions of drought accurate. Slovic et al. (1972) contend that in order to improve probabilistic perception of hazards, it is essential that historical records be kept, analysed and made available in an understandable form to all resource managers (farmers, in this case). They further advise that records should be continually updated and when a new development occurs that might render the historical data invalid, technical expert should estimate the effect of this change on the hazard. Perhaps the data obtained from existing weather records in Makuyu Division could form a beginning point in educating farmers in the study area that drought is a frequent recurrent phenomenon, which they need to prepare for.

3. Provision of a proper transport system should be done in Makuyu. The current road network in the area is very poor. Only the small section of the Thika-Sagana highway that passess through the division is graded. All the remaining are murram or earth roads which become impassable during the rainy season. Particularly a graded road should be constructed between Mithiini and Ngelelia markets.

4. The land problem in Makuyu requires immediate attention. Farm sizes are too small given the agricultural conditions of the area. An average of 2 acres also explains the vulnerability of the farmers to drought. Farmers cultivate every bit of their tiny plots year after year and this has in no doubt led to the impoverishment of the soils and declining yields. This study recommends that the government should negotiate with the large estate owners to release some of their land so as to provide the landless with land. Any policy geared towards sustainability will be futile if farmers plots are already too uneconomic for agricultural development. The issue of title deeds should be hastened as well. Few farmers have obtained their title deeds of afterland registration in 1990 as they are not aware of the procedures.

## 7.5 Areas for Further Research

(a) An assessment of the official (administrative and agricultural) perception of drought. Such a study would seek to look for any missing links between farmers' perception of drought and that of the officials. Harmony in perception is vital for any success of drought pre-planning policies.

(b) A study on the political economy of drought in Makuyu division. Such a study would seek to examine the history of settlement,

establishment of large farms, the rise of squatters and landlessness, the current position of the Makuyu farmer as the source of cheap labour to the estates. All these should be assessed against the drought-related problems and underdevelopment in the division.

(c) A study on small scale farmers perception and response to drought in Makuyu division, a revisit. A longitudinal approach to the study of any hazard is salient as it enable researchers to look out for any changes in response or perceptions with time in the study population.

(d) A study seeking the possibility of 'Harnessing the scarce environmental and agricultural resources for sustainable development of the Kenyan ASALs'. A study along the lines of the present, can be done ten years and above later to incorporate new changes and how they have affected adjustments to drought.

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## APPENDIX A1

## DROUGHT YEARS FOR TEN RAINFALL STATIONS IN MAKUYU DIVISION

## BETWEEN THE YEARS 1962 – 1992

| STATION | PERIOD | YEARS | |
|---|---|---|---|
| | | MILD DROUGHT | SEVERE DROUGHT |
| Athara | Long rains | 1969, 1973 | 1965, 1966, 1972, 1979 |
| | Short rains | 1972, 1970 | 1965, 1966, 1974, 1968, 1969, 1979 |
| | Annual Rains | 1962, 1969 | 1965, 1966, 1979 |
| Chui | Long rains | 1975, 1984 1992 | 1965, 1969, 1972, 1973, 1976, 1982, 1983, 1987, 1991. |
| | Short rains | 1969, 1971 1974, 1975 1991 | 1965, 1970, 1973, 1979, 1981, 1987, 1992. |
| | Annual rains | 1972, 1977 1980, 1981, 1982, 1985 | 1965, 1969, 1983, 1975, 1983, 1987, 1991, 1992. |
| Gethumbuini | Long rains | 1969, 1980 1992 | 1965, 1972, 1973, 1975, 1976, 1983, 1986, 1987, 1988. |

APPENDIX A1 CONTINUED

| Station | Period | YEARS Mild Drought | Severe Drought |
|---|---|---|---|
| | Short rains | 1964, 1972 | 1962, 1966, 1969, 1971, 1969, 1971, 1973, 1974, 1979, 1981, 1985. |
| | Annual rains | 1966, 1971 1992 | 1965, 1969, 1972, 1973, 1983, 1984, 1986, 1987, 1988. |
| Ithanga | Long rains | – | 1976, 1982, 1983, 1984, 1985, 1987, 1990, 1992. |
| | Short rains | 1983 | 1979, 1980, 1981, 1987, 1991, 1992. |
| | Annual Rains | 1980, 1990 1991 | 1976, 1983, 1984, 1987, 1992. |
| Kitito | Long rains | 1969, 1976 | 1972, 1973, 1985, 1986, 1987, 1988, 1989, 1990, 1991. |
| | Short rains | 1975 | 1970, 1973, 1974, 1990, 1991, 1988, 1989. |
| | Annual rains | 1985 | 1973, 1981, 1990, 1991. |

APPENDIX A1 CONTINUED

| Station | Period | Years | |
|---|---|---|---|
| | | Mild Drought | Severe Drought |
| MakuyuDo | Long rains | 1969, 1974, 1976, 1980, 1986, 1987 | 1972, 1973, 1984, 1987, 1969. |
| | Short rains | 1973, 1983 | 1969, 1970, 1971, 1974, 1984, 1987. |
| | Annual rains | 1970, 1974, 1976, 1980, 1991 | 1969, 1971, 1972, 1973, 1984, 1987. |
| Makuyu SS | Long rains | 1962, 1974 | 1965, 1969, 1972, 1973, 1976, 1983, 1984. |
| | Short rains | 1966, 1973 1983 | 1962, 1969, 1970, 1974, 1979, 1984, 1985. |
| | Annual rains | 1962, 1985 | 1965, 1969, 1973, 1976, 1980, 1983, 1984. |
| Mwitumberia | Long rains | 1966, 1986 | 1965, 1972, 1973, 1974, 1976, 1980, 1983, 1987. |
| | Short rains | 1966, 1979, 1981 | 1962, 1969, 1970, 1973, 1974, 1976, 1985, 1987. |

APPENDIX A1 CONTINUED

| Station | Period | YEARS Mild Drought | Severe Drought |
|---|---|---|---|
| Mwitumberia | Annual rains | 1962, 1966 | 1965, 1969, 1973, 1974, 1976, 1983, 1987. |
| Nanga | Long rains | 1965, 1966 | 1964, 1967, 1969, 1972, 1973, 1975, 1975, 1976, 1982, 1983, 1987. |
| | Short rains | 1962 | 1964, 1966, 1967, 1969, 1970, 1973, 1974, 1979, 1981, 1987. |
| | Annual rains | 1965, 1970 1982, 1983 | 1964, 1966, 1969, 1972, 1973, 1974, 1975, 1976, 1985, 1987. |
| Pundiamilia | Long rains | 1965, 1967 | 1962, 1969, 1972, 1973, 1976. |
| | Short rains | 1964 | 1962, 1969, 1970, 1971, 1973, 1974. |
| | Annual rains | 1962, 1969 | 1965, 1971, 1973, 1976. |
| Sassa | Long rains | 1971, 1988 | 1965, 1969, 1972, 1982, 1983, 1984, 1987, 1990. |
| | Short rains | 1979, 1981 | 1969, 1970, 1971, 1973, 1974, 1982, 1987. |
| | Annual rains | 1971, 1972, 1981, 1983 | 1965, 1969, 1976, 1984, 1987. |

## REPERTORY GRIDS

| | | |
|---|---|---|
| (i) | Element/Causes of Drought | Constructs/Farmers responses |
| (ii) | Element/Drought frequency | Constructs/Farmers responses |
| (iii) | Element/Year of next probable drought | Constructs/Farmers responses |
| (iv) | Element/Symptoms of drought | Constructs/Farmers responses |
| (v) | Element/Methods of controlling drought | Constructs/Farmers responses |

APPENDIX A3

QUESTIONNAIRE

I am Mary Kibathi, carrying out a study on drought in Makuyu and I have selected you as respondent to provide information on this report.

The aim of this questionnaire is to collect data on perception and response to drought in Makuyu division of Murang'a District. This data is being collected purely for academic requirements and therefore any information provided will be strictly confidential.

**Background of the Farmer**

1. (a) Location
   (b) Sublocation

2. Farmers (a) Age
   (b) Sex

3. Occupation (main source of income)
   01 Farmer [ ]
   02 Wager earner [ ] 03 Other (specify)_____

4. What is the size of your family?_____
   State the number of children_____
   State the number of wives/husbands_____

5. What is your education level?

   01 Primary [ ] 05 College [ ]
   02 Secondary [ ] 06 Not educated [ ]
   03 University [ ]
   04 High School [ ]

6. How many household members help in the farm:-
   (i) In daily work?_____
   (ii) From earned income?_____
   State whether fulltime (FT) Regularly (R)
   Occasionally (O)

**SETTLEMENT AND LAND FACTOR**

7. (a) When did you settle here?
   (b) Where did you immigrate from?
   (c) Who is the previous holder of this farm?

   _____

   (d) How did you acquire the land?

   | | | | | | |
   |---|---|---|---|---|---|
   | 01 | Inheritance | [ ] | 03 | Tenancy | [ ] |
   | 02 | Purchase | [ ] | 04 | Other (specify)____ | |

   (e) What is the size of your farm? _____(ha)

8. Do people in this area have any trouble with drought?

   Yes =Y [ ] Non = N [ ] Don't know=D [ ]

9. How many times has drought come to this place in the years you have lived here?

   (List years)_____

10. Which year do you consider as the worst drought year?_____ Give reasons for your answer_____

**IMPACT OF DROUGHT**

11. How did any of the drought years you have mentioned affect your family well being, crops, animals and other members of the community?

   A (i) Family well being

| | Year | Impact |
|---|---|---|
| Feeding habits | | |
| Employment | | |
| Health | | |
| Education | | |

(ii) Did your neighbours experience the same effects?

Yes = Y [ ] No = N [ ] Don't know = D [ ]

B CROPS

(i) How would you rate the harvest int he cited drought years?

| Year | 01 Good | 02 Bad | 03 Critical |
|---|---|---|---|
| | | | |

(ii) How would you compare maize and bean harvests in 1989 and 1992?

| Year | No. of bags/debes harvested | |
|---|---|---|
| | Maize | Beans |
| 1989<br>1992 | | |

C How was your livestock affected in the cited drought years?

| Effects | Years | | |
|---|---|---|---|
| Effects | | | |
| 01 Loss of weight<br>02 Sale<br>03 Death | | | |

RESPONSE TO DROUGHT OVER TIME

12. For the different drought years recalled, what did you do to get sufficient food and other daily needs of your family? (List adjustments)

| Year | Family |
|---|---|
| | |

13. For the drought years how did the various family members help in coping with drought?

| Member | Role |
|---|---|
| | |

14. If you have problems with drought whom do you go to help in recovering losses?

01 Relatives [ ] 03 Friends [ ]
02 Government [ ] 04 Other (specify) [ ]

15. Do you know anyone who has been helped by the Government after drought losses?

Yes [ ] No [ ]

If yes, what type of help was given?

_____

What criteria was used in distributing the help?

_____

16. If you detect the likelihood of a drought what pre- and post-sowing cultivation adjustment measures do you make?

| | | | | | |
|---|---|---|---|---|---|
| 01 | Delay sowing | [ ] | Post-sowing | | |
| 02 | Plan early maturing crops | [ ] | 01 | Irrigation | [ ] |
| 03 | Plant drought resistant crops | [ ] | 02 | Mulching | [ ] |
| 04 | Do nothing | [ ] | 03 | Any other | [ ] |
| 05 | Plant in wetlands | [ ] | 04 | None | [ ] |
| 06 | Drill wells at valley | [ ] | | | |

| Year | Family |
|---|---|
| | |

13. For the drought years how did the various family members help in coping with drought?

| Member | Role |
|---|---|
| | |

14. If you have problems with drought whom do you go to help in recovering losses?

01 Relatives [ ] 03 Friends [ ]
02 Government [ ] 04 Other (specify) [ ]

15. Do you know anyone who has been helped by the Government after drought losses?

Yes [ ] No [ ]

If yes, what type of help was given?

_____

What criteria was used in distributing the help?

_____

16. If you detect the likelihood of a drought what pre- and post-sowing cultivation adjustment measures do you make?

01 Delay sowing [ ]
02 Plan early maturing crops [ ]
03 Plant drought resistant crops [ ]
04 Do nothing [ ]
05 Plant in wetlands [ ]
06 Drill wells at valley [ ]

Post-sowing

01 Irrigation [ ]
02 Mulching [ ]
03 Any other [ ]
04 None [ ]

17. (a) What crops do you grow?
Food crops [ ] Cash crops [ ]

(b) What type of maize do you grow?
01 Hybrid [ ] 03 traditional [ ]
02 Katumani [ ]

18 How do you normally time the planting month for maize?

01 Plant once before start of rains [ ]
02 Plan at once after start of short rains [ ]
03 Plant in intervals after start of rains [ ]

19. (i) Do you own livestock? Yes [ ] No [ ]
(ii) If yes, how many heads of cattle?_____

01 Grade cows_____
02 Cross breed_____
03 Indigenous_____

What other livestock do you own? (Specify numbers)

01 Goats [ ]
02 Sheep [ ]
03 Donkeys [ ]
04 Other_____

20. Observe: How is the farm situated on the landscape?

01 Next to a stream/river [ ]
02 Partly wetland [ ]
03 Near a borehole [ ]
04 Not close to any water [ ]

21. Do you use fertilizer on your farm?

Yes =Y [ ] No =N [ ]

If yes, which crops do you mainly apply fertilizer?
Specify_____
_____.

22. Do you store any food from one year to the next?

Yes Y [ ] No = N [ ]

If yes, does the food stay up to the next harvest?
Explain_____
If no give reasons_____

23. If a warning was to be given that drought is coming next year, would you do anything different from what have done in previous years?

Yes = Y [ ] No = N [ ]

24 (a) Do you earn any off farm income?

Yes = Y [ ] No = N [ ]

b) If yes, what is the approximate amount per annum in Shillings (KShs.)?

| | | | | | |
|---|---|---|---|---|---|
| 01 | under 1,000 | [ ] | 06 | 5,001 - 6,000 | [ ] |
| 02 | 1,001 - 2,000 | [ ] | 07 | Over 6,000 | [ ] |
| 03 | 2,001 - 3,000 | [ ] | | | |
| 04 | 3,001 - 4,000 | [ ] | | | |
| 05 | 4,001 - 5,000 | [ ] | | | |

26. (a) Do you have access to loan?
Yes =Y [ ] No = N [ ]

(b) If yes, what use do you make of loans?
_____
_____

(c) If no, what is the main reason why you do not have access to loan?
_____
_____

APPENDIXA4

CRITICAL VALUES ON THE CHI-SQUARE DISTRIBUTION
SIGNIFICANCE LEVEL

| | 0.10 | 0.05 | 0.01 | 0.005 | 0.001 |
|---|---|---|---|---|---|
| 1 | 2.71 | 3.84 | 6.64 | 7.88 | 10.83 |
| 2. | 4.60 | 5.90 | 9.21 | 10.61 | 13.82 |
| 3. | 6.25 | 7.28 | 11.21 | 12.84 | 16.27 |
| 4. | 7.78 | 9.49 | 13.28 | 14.86 | 18.46 |
| 5. | 9.49 | 11.07 | 15.09 | 16.77 | 20.52 |
| 6. | 10.64 | 12.59 | 16.81 | 18.55 | 22.46 |
| 7. | 12.02 | 14.07 | 18.48 | 20.28 | 24.32 |
| 8. | 13.36 | 15.51 | 20.29 | 21.96 | 26.12 |
| 9. | 14.68 | 16.92 | 21.67 | 23.59 | 27.88 |
| 10. | 15.99 | 18.31 | 23.21 | 25.19 | 29.59 |
| 11. | 17.28 | 19.68 | 24.72 | 26.76 | 31.26 |
| 12. | 18.55 | 21.03 | 26.22 | 28.30 | 32.91 |
| 13. | 19.81 | 22.36 | 27.69 | 30.82 | 34.53 |
| 14. | 21.06 | 23.68 | 29.14 | 31.32 | 36.12 |
| 15. | 22.31 | 25.00 | 30.58 | 32.80 | 37.70 |
| 16. | 23.54 | 26.30 | 32.00 | 34.27 | 39.29 |
| 17. | 24.77 | 27.59 | 33.41 | 35.72 | 40.75 |
| 18. | 25.99 | 28.87 | 34.80 | 37.16 | 42.31 |
| 19. | 27.20 | 30.14 | 36.19 | 38.58 | 43.82 |
| 20. | 28.41 | 31.41 | 37.57 | 40,00 | 45.32 |
| 21. | 29.62 | 32.67 | 38.93 | 41.40 | 46.80 |
| 22. | 30.81 | 33.92 | 40.29 | 42.80 | 48.27 |
| 23. | 32.01 | 35.17 | 41.64 | 44.18 | 49.73 |
| 24. | 33.20 | 36.42 | 42.98 | 45.56 | 51.18 |
| 25. | 34.38 | 37.65 | 44.31 | 46.93 | 52.62 |
| 26. | 35.56 | 35.88 | 45.64 | 48.29 | 54.05 |
| 27. | 37.64 | 40.11 | 46.96 | 49.65 | 55.48 |
| 28. | 37.92 | 41.34 | 48.28 | 50.99 | 56.89 |
| 29. | 39.09 | 42.56 | 49.59 | 52.34 | 58.30 |
| 30. | 40.26 | 43.77 | 50.89 | 53.67 | 59.70 |
| 40. | 51.81 | 55.76 | 63.69 | 66.77 | 73.40 |
| 50. | 63.17 | 67.51 | 76.16 | 79.49 | 86.66 |
| 60. | 74.40 | 79.08 | 88.38 | 91.95 | 99.61 |
| 70. | 85.53 | 90.53 | 100.43 | 104.22 | 112.32 |
| 80. | 96.58 | 101.88 | 112.33 | 116.32 | 124.84 |
| 90. | 105.57 | 113.15 | 124.12 | 128.30 | 137.21 |
| 100. | 118.50 | 124.34 | 135.81 | 140.17 | 149.45 |

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

Source:Blallock H.M 1972)