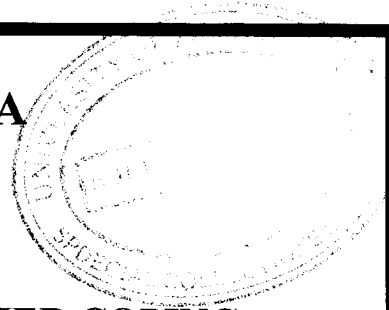


UNIVERSITY OF ZAMBIA



**FOOD SECURITY AND ERRATIC WEATHER COPING
STRATEGIES OF SMALL SCALE FARMERS IN RURAL
KITWE - ZAMBIA**

BY

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[94090823]

**A GEO 474 PROJECT REPORT SUBMITTED TO THE DEPARTMENT
OF GEOGRAPHY, SCHOOL OF NATURAL SCIENCES, UNIVERSITY OF
ZAMBIA, IN PARTIAL FULFILMENT OF THE BACHELOR OF
SCIENCE DEGREE IN NATURAL RESOURCES.**

DECLARATION

I, Musole Mwila Musumali declared that this project has been composed by myself and that all the work recorded is my own. The maps and diagrams were drawn by myself. And the sources of information referred to have been appropriately acknowledged.

This project has not been previously submitted for any academic award.

Signed: / *Musole Mwila Musumali*

Date:

DEDICATION

To my parents, Brothers and Sister , friends , uncle and Aunt who have been my source of support through my academic life. And most importantly , To God in whom I put all my trust.

ACKNOWLEDGEMENTS

There are many people to whom I am indebted.

Firstly, Mr. V.J. Volk, whom I thank for instructing me, correcting my mistakes, for being patient and tolerant of my mistakes and for giving me all the necessary advice in this project.

Secondly, I wish to thank the officials of the MAFF, who gave most of their time to provide me with the necessary information relevant for the study.

Thirdly, I thank my friends for their encouragement and ideas that were beneficial.

Lastly but not least, I thank Mrs Msoni for typing out the report.

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ABSTRACT

Small scale farmers produce 65% of the maize that constitutes national production (MAFF-1996)

Although they contribute such a large percentage to National Food availability, their individual household food availability is constrained by space a number of factors, one of which is rainfall.

The aim of the study is to analyse the influence of rainfall on crop productivity and the strategies they employ to reduced the impact of erratic climate, rainfall in particular. In additions, the aim is to investigate the strategies the farmers employ to ensure that they have access to food year round.

In order to achieve these objectives, the study made use of the following data collection methods.

Questionnaires for obtaining information relating to crop productivity in specified seasons (1988/89, 1991/92, 1999/95, 1997/98), the influence of rainfall and the strategies employed to reduce impact on field output. In addition the strategies employed to ensure food security at household level year round and the general nature of the constraints that hinder the attainment of food security.

Interviews were conducted with MAFF officials for the purpose of obtaining information on the ways in which farmers are assisted with respect to ensuring their food security.

The interval sampling method was used to obtain a sample from a population of small scale farmers in Luongo agricultural camp.

The study established that the food security status of the small scale farmers varies from season to season, dependant on the nature of the seasonal harvest, which is affected,

among other factors, by the nature of the rain season. The farmers in an attempt to ensure their food security have adopted the strategy of diversifying their income and food sources through a variety of both off-farm and on-farm activities. In addition they take measures to reduce the impute of erotic climate in their crop yields.

These strategies serve to make them less vulnerable to food insecurity.

CHAPTER 1

INTRODUCTION

Background to the Study:-

The concept of Food Security deals with the production, distribution and consumption of food. It refers to the ways in which people satisfy their food needs.

The manner in which households secure access to food varies within and between communities in any given country. While some households secure their food needs through domestic production by producing their own food, others achieve them through wage labour. Their ability to security food is influenced by factors such as climate, markets, extension services, availability of agricultural inputs with respect to domestic food production. And education, labour laws, wage levels, unemployment levels with respect to wage employment. The threats to food security on the whole therefore are not only a function of production failure alone but also to institutional, social and policy inadequacies.

With respect to the **Zambian Agrarian Culture**, Characterised by dependence on rainfed Agriculture, where crop yields depend on the amount and distribution of rainfall. Climate, becomes a very important factor in influencing food security.

For the small scale farmers in particular whose livelihood depend on what they produce from their fields, climatic shocks or anomalies are such a threat, they require effective strategies to support them through periods of hardships and to reduce their vulnerability.

Statement of the Problem:-

The attainment of food security refers to access at all times to enough food to an active life.

In rural Kitwe, the main income generating activity is farming. This means that the food security status of most of the rural dwellers is dependent on the level of Seasonal production or yield. In the sense that the amount of crop harvested determines how much they will retain for consumption purposes.

Many factors influence crop productivity, one of the most important is rainfall. This is because farming is dependent on the seasonal rain. Rainfall however is not a constant variable, it varies from season to season and within seasons. In a poor rainy season, Characterised by either severe wet or dry condition, the crop yields are affected. Low yields mean that fewer crops will be available for sale to generate money and consumption. Meaning that the food security situation of the farmers is compromised in that season . The problem that small scale farmers face is ensuring the availability of food in their homes, in the face of unpredictable climatic conditions that influence their crop yield.

Objectives:-

The objectives of the study are

- a. To access whether climate has an impact on agricultural productivity focusing on the seasons 1988/89, 1991/92, 1994/95 and 1997/98.
- b. To investigate the nature of the coping strategies adopted by the farmers to avert crop failure in response to climatic patterns.
- c. To investigate the nature of the coping strategies employed by small scale farmers to ensure their food security or to avert hunger.

Rationale:-

Small scale farmers are important to the Zambian Agrarian Sector. The investigation of the various ways and means through which they survive periodic food shortages is therefore important. The small scale farming communities in the country adopt various strategies can help them ensure their food security. These strategies can help economic planners and the government to design and implement effective policy and institutional measures to ensure the attainment of food security and alleviate the impact of climatic extremes country wide.

Definition of terms

Food Security - The term indicates the availability of food. According to the World Bank (1986) "Food Security refers to the access by all people at all times to enough food for an active and healthy life.

Food insecurity - Refers to the inability to access enough food at all times for an active and healthy life.

Small scale farmers - Refers to farmers who grow crops chiefly for sale and who keep the surplus yield for consumption.

Household - Refers to a group of people who live and eat together

Climate - Refers to the long-term aspect of atmospheric conditions with the period of averaging ranging from several days, months and years.

Erratic Climate - Refers to the irregular and unpredictable changes of atmospheric conditions [changes in meteorological elements such as rainfall, temperature, humidity, wind etc].

Strategy - Refers to a plan which gives an advantage over something, in this case food insecurity.

ORGANISATION OF THE STUDY

The food security coping strategies of small scale farmers in Rural Kitwe are discussed in six chapters.

- Chapter 1 Presents the background information to the study, it defines the problem and the objectives under consideration and gives justification for the study. In addition it provides the definitions of important terms used in the text.
- Chapter 2 Presents the literature review. The presentation of available literature on the concept of food security at the Regional and National level.
- Chapter 3 Presents the methodology. The methods by which the sample was selected and the data collected. The chapter also outlines the problems encountered and the limitations of the data collection.
- Chapter 4 Gives a description of the study area. It presents the geographical location of Luongo agricultural camp , Its physical and Socio-economic characteristics.
- Chapter 5 Presents the Major findings of the study. It gives outline of the strategies employed by the small scale farmers to ensure their food security and to reduce the effects of erratic climate upon their yield.
- Chapter 6 Presents the conclusions drawn from the findings and gives suggested recommendation based on the conclusions made.

CHAPTER TWO

LITERATURE REVIEW

FOOD SECURITY

According to a FEW [Famine and early warning systems] special Report of 22 December, 1998, Food Security is a measure of whether an individual, household, Community or population group has access to sufficient foods that meet dietary needs and preferences for an active life.

Food security is based on two distinctions:

Food Availability defined as the amount of food that is and will be, physically available in the country during the current consumption year through a combination of domestic production, stocks, or net imports.

Food Accessibility refers to a households ability to acquire available food for the current consumption year through a combination of its own production and stocks, market transactions, or transfers.

The report further defines food insecurity as the lack of access to enough food and identifies two kinds of Food insecurity

- Chronic (or long-term) food insecurity - This is a continuously inadequate diet caused by the inability to acquire Food. It affects households that persistently lack the ability either to buy enough Food or to produce their own.
- Current (or transitory) food insecurity - This refers to a temporary decline in a households access to enough Food. It results from instability in food prices, Food production, or household incomes. (Adopted from World Bank, 1986)

FOOD SECURITY, A REGIONAL PERSPECTIVE

According to a Regional Report on climate change (Climate change and Southern Africa - An exploration of some potential impacts and implications in the SADC region (1996 pg 1). Rainfall is one of the most important resources in southern Africa, changes in the supply of rainfall - whether in the total volume or in its frequency and variability, are said to have enormous consequences for a wide range of environmental and economic activities in Southern Africa. The report cites the seasons of 1991/92 and 1994/95, Seasons of drought as having reduced economic production and having worsened the quality of life for millions of people in the region.

An earlier Report on climate change in the region voices similar views and brings in the concept of food security. According to the proceedings of the SADC conference on climate change, held in Windhoek, Namibia 1992,

In the SADC Region the climate variable with the highest space-time variability and which is of the most importance with respect to the attainment of food security is rainfall.

‘The space time distribution of rainfall patterns is said to be linked to the space time distribution of food, water and other resources.’ It may therefore be said that the fluctuations in the food situation of SADC countries are greatly influenced by irregularities in the amount of rainfall, as most of the samples are grown through rainfed Agriculture.

Ian Scones (Hazards and opportunities, farming methods in dry land Africa (1986)), states that with the high variability in returns from Agriculture, crop incomes, may be high one year but non existent the next.

He further states that in the Southern Africa region, the rainfall levels appear to follow a cyclical pattern with a periodicity of between 13 and 19 years, possible related to the El nino - Southern Oscillation effect. Rainfall variation also, according to him, occurs within years, with mid-season drought being frequent occurrences.

Although crop yield is also affected by factors such as soil erosion and fertility; seed variety; pest attack etc, the main causes of the periodic shortfalls are usually linked to

climate. According to the IUCN Funded Publication “environmental input of the 1991/92 drought in Zambia “ by Tiffen and Mulele, there is said to be considerable evidence that elnino warm currents in the pacific Ocean are linked to the general below average rainfall in Southern Africa. The elnino influence is said to account for 25-30% of the climate variability in the region.

As the nature of the climate has a significant effect on yield, agricultural extension staff through out the region advise farmers to pursue risk reducing measures such as, advancing sowing dates to take advantage of the early rains; the planting of crops that require less rainfall such as Cassava, Sweet potatoes, small grains. (Fews Bulletin - August 25, 1997, Pg 5) and diversification.

The real food security issue of concern in the region is household food access rather than national food availability. This is because availability does not ensure food security at all levels (Melaku Ayalew - disaster Management and food security - independent consultant).

In the region, the term in which Food security is mitigated at national level, is through the provision of food aid from abroad and through the importation of grain to fill the deficit. Recently, a new mitigation method has been developing, climate forecasting. ‘The dissemination of clear and simple climatological information. (Few Bulletin - March 26, 1998 Pg 3).

According to Scones (1996), over the past decade, various early warning systems have been initiated, working at both the national and Regional level. The national early warning system is complemented by a regional food security and early warning unit under the auspices of the Southern African Development commission.

FOOD SECURITY OF SMALL SCALE FARMERS IN ZAMBIA

Agriculture has been acknowledged to be the main means through which food is made available in the rural areas of Zambia, with maize being the main crop grown for the purpose of generating cash.

In Zambia, the small scale farmers contribute 65% of the maize that constitutes national production (MAFF 1996) Maize is the most important staple food in Zambia. National Food self sufficiency is defined as sufficiency in maize production. However, as has been stated by Melaku Ayalew, National production does not guarantee Food Security at house hold level.

There are many factors that have an influence on food security, according to a Few's Bulletin publication, 'Poor infrastructure, isolation from markets make it difficult for some people to obtain sufficient food. (Issue March 26, 1998).

According to the opinion of Mkandawire and Halal (Food policy and Agriculture in Southern Africa, 1995) 'The lack of necessary instruments of productivity by small scale farmers are also constraints that are as a result of poverty.

According to Kajoba (1993), a prominent failure of Zambia's agriculture is its near exclusive dependence on weather for its satisfactory performance. The climate therefore is an important variable influencing the Food Security of farmers. Generally, during the last decade, the small scale farmers in the country have been exposed to three events of extreme climatic conditions that affected their productivity with varying severity. There were the droughts of 1991/92 and 1994/95 and the 'wet' season of 1997/98. Such severe climatic events have been known to expose farmers to higher levels of food insecurity.

Although they cannot afford to adopt strategies such as crop irrigation their responses are diverse. 'Very poor households reduce their number of daily meals; a common and well known strategy is the collection of wild foods, which historically has been an indication of food stress; less vulnerable households fall back on cassava consumption (FWES Bulletin - Nov 30, 1998 pg 3). Furthermore, 'Most farmers diversify their incomes through non-crop activities' (FEWS special Report 2, Feb. 26, 1998).

A form of assistance rendered to them is through Agricultural extension officers who advise farmers on when to plant and on the mix of crops, in an effort to help them achieve their Food Security. They provide this information based on seasonal forecasts, obtained

from meteorological departments. However, according to FEW (Bulletin of 28, 1998), there are conflicting views on their effectiveness to mitigate climatic extremes and only time will tell their effectiveness.

Tiffen and Mulele are of the opinion that the crop yield, disasters farmers have experienced have changed their attitudes towards crop diversification, while the farmers still appreciate the qualities of hybrid, they are also conscious of the dangers of over reliance on this one crop. As a result, greater interest is being shown in having a variety of crops, including the new sorghum varieties, legumes and roots such as cassava and sweet potatoes.

According to the institute of development studies (IDS) in its food security annual review of 1995 - 96)

“Achieving food Security for households and individuals is largely about helping people to establish secure and sustainable livelihoods, And that helping people to manage food stocks means helping them to develop livelihood strategies which are both less vulnerable to shocks and more resilient in the face of shock.’

CHAPTER 3

METHODOLOGY

This chapter gives a description of the methods of data collection used.

METHODS OF DATA COLLECTION

Primary data collection methods:

a. **Observation:-**

Based on the researchers observation in the field, first hand information on the nature of the farmsteads was obtained. Information on the nature of the technology they employed, whether they employed the hand held hoe or a tractor when farming ; their access to services such as electricity; nature of their establishments, whether the buildings were of concrete brick or mud brick and whether their roofs were thatched or had corrugated iron; nature of their silo's or storage rooms, whether they were intact or dilapidated; the nature of their dressing, cleanliness of persons and surroundings.

The purpose behind this form of data collection was to gauge the level of wealth or standard of living of the farmers.

b. **Questionnaire: ✓**

A Questionnaire was administered to all of the small scale farmers that constituted the sample by the researcher.[Refer to Appendix 1]. The nature of the administrative of the questionnaire was such that the questions were read to the farmers and their responses were filled in by the researcher. For the majority of the

farmers translation of the questionnaire from English into Bemba was required as most preferred to respond in vernacular. The questionnaires were administered to the farmers mostly in the vicinity of their habitation, for a minority, in their fields. The purpose behind the administration of a questionnaire was to obtain firsthand information directly from the farmers on the nature of the constraints that had an influence in their productivity, whether climate was one of the constraints. And in order to obtain information on the nature of the strategies they employ to reduce the impact of climate and other constraints; and also to ensure their food security year round.

c. **Interviews:-**

An interview schedule was prepared [Refer to appendix 2], and personal interviews were conducted by the researcher with two officials from the Ministry of Agriculture Food and Fisheries.

At the district level an interview was conducted with a Mr. A. Mulenga an extensions farming officer in charge of Luongo Camp of the Itimpi farming block of Kitwe District. The purpose of this interview was to obtain information on the nature of the farming in the Camp, on whether climate had an influence on the productivity of the farmers and the years in which farmers were affected and also information on the nature of assistance the Government Ministry gives to the farmers to help them achieve their food security. A second interview was conducted in Lusaka at the Ministry of Agriculture Food and Fisheries with a Mr. Nawiko a Senior economist under the National Early warning systems (NEWS) unit of the ministry. In this case, the interview schedule was slightly alteration the sense that the same questions were asked but with reference to the National level. The purpose of this interview was to obtain information on the nature of the assistance the ministry gives to farmers countrywide to enable them improve their food security status.

Secondary data collection methods

Other information related to the study was collected from documentary sources.

Library research was the main method, where books, articles and research documents and other related documents were reviewed.

The material was obtained from a variety of sources. The university of Zambia main library, Ministry of Agriculture Officials, United nations Library, the world wildlife fund library and the Internet. The purpose behind the documentary research was to discover and investigate the contents of the literature available that had been published pertaining to food security.

SAMPLE AND SAMPLING PROCEDURE

The study was done using one main sample of peri urban small scale farmers. The sample size of thirty two (32) respondent was selected from a population of farmers involved in small scale farming. To obtain the sample, the interval sampling method was used.

The population of small scale farmers in Luongo camp was found to be one hundred and nine (109). An questionnaire was administered to every third farmer.

Selection of Sample area

On the outskirts of Kitwe town, Kitwe peri-urban area, lies a farming block namely the Itimpi Farming Block. This farming block is comprised of three (3) farming Camps; Luongo Camp, Garneton Camp and Twatasha Camp.

The camp chosen in this study was Luongo Camp. Luongo Camp was chosen in preference to the other camps for several reasons. Firstly the main income generating activity for the majority of people of the areas is subsistence farming. Secondly, most of the farmers have plots of land of an average of 10 hectares and of this only a small promotion is cleared for farming by the majority of farmers. Thirdly Luongo is the more isolated of the three being serviced by a single main road, the Kitwe-Mufulira Road. It is also the least developed of the three camps with no shops and no clinic. These conditions exemplify the conditions under which most small scale farmers countrywide operate.

By contrast, the other camps, Garneton for instance are not so isolated, it has a but up area with schools, tarred streets, clinic regularly patterned streets, It is serviced by a regular bus network and the more generating activities of the people are varied. The farm plots are mostly larger than 10 Hectares, with most farmers being commercial or medium scale farmers.

Problems encountered during data collection

a. Accessibility

In the field it was discovered that the distances between adjacent farms was at times great. As a consequence, in a day the maximum number of respondent presented with a questionnaire was three or four. Farms are connected by bush paths.

- b. The farms do not occur in a regularly defined pattern in the field they are scattered in a non-regular fashion. As such an interval of 3 was tedious to maintain
- c. There was the problem of having to convince some respondents to answer the questionnaire. They were of the opinion that the whole procedure was a waste of time and would not result in any thing constructive for them to see.
- d. Another encountered problem was that the majority of respondents did not remember their exact produce for most years and therefore they gave estimates where they could.

Translation was required, this was because the respoendent referred to answer the questions questions in vernacular and researcher is not ver conversant with the vernacular language.

CHAPTER 4

DESCRIPTION OF THE STUDY AREA

This chapter describes the study area in terms of its Geographical location, physical characteristics and socio-economic characteristics.

Geographical location

Luongo agricultural camp is part of Kitwe district which covers an area of approximately 2040 Km. Refer to map 1. Kitwe is located in the Copperbelt province of the country an area closely bordering Zaire. Refer to map 2. The camp is located approximately 22Km from the Kitwe built up area.

Physical Characteristics

Luongo area is part of the Kafue river drainage net, the land is highly uneven and is cut by many mostly intermittent streams that drain into the Kafue river. The natural vegetation of the area is woodland which has been cleared in many areas to provide land for agriculture.

Luongo area falls under Agro-ecological Region III as has been illustrated in map 3. The region is Characterised by high annual rainfall with annual averages ranging from 1000 to 1400 mm. And long growing season of between 120 and 150 days. The temperatures range is from 18oC to 21oC.

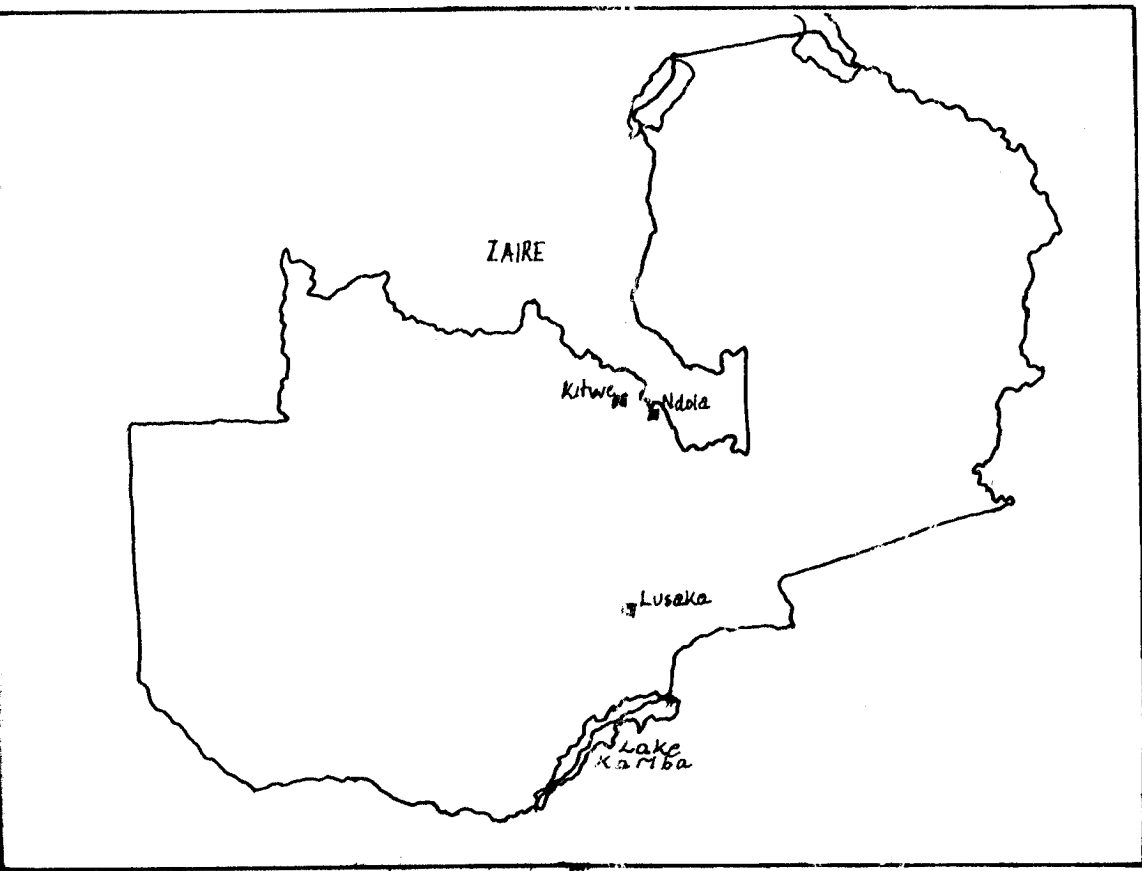
The region has soils which, according to the USDA, are classified as Oxisoils. These soils are relatively infertile soils due to their high content of iron and aluminum oxides.

Socio-economic factors

The camp has a population of approximately 800 people.. Agriculture is the main income generating activity employed by the people, although income is generated through other means as well such as informal and formal employment in Kitwe town. In terms of infra structural development, Luongo is not developed. The majority of farm steads are made of mud brick or crude home made concrete blocks. There is no school or clinic in the camp and the main transport route is the Kitwe Mufulira road. The mode of transport within the camp is walking facilitated by many man made paths through the woodland thick. Although the main electricity pole line crosses the camp area, few farmers have access to electricity.

LOCATION IN ZAMBIA

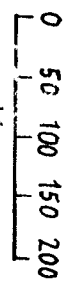
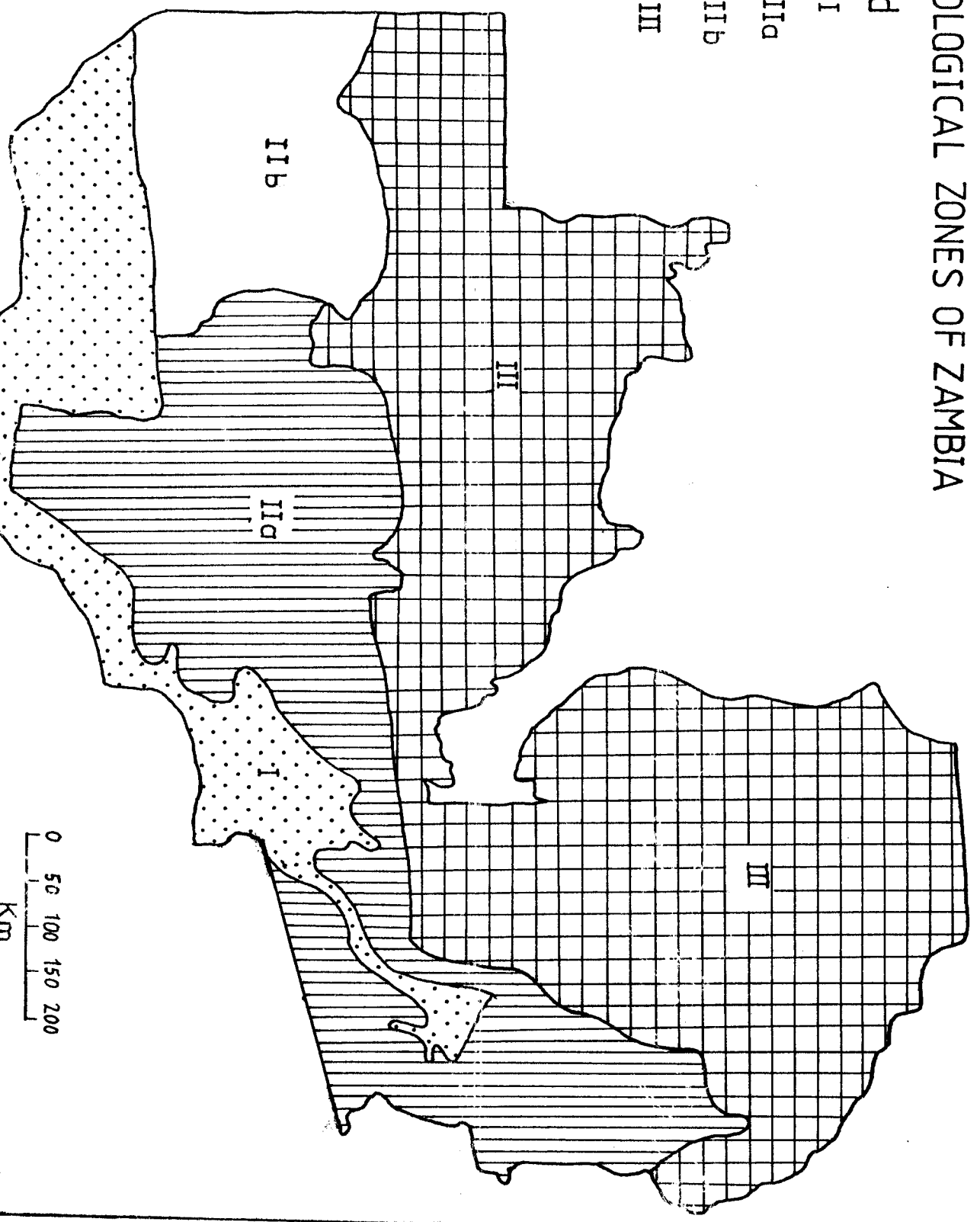
MAP 1



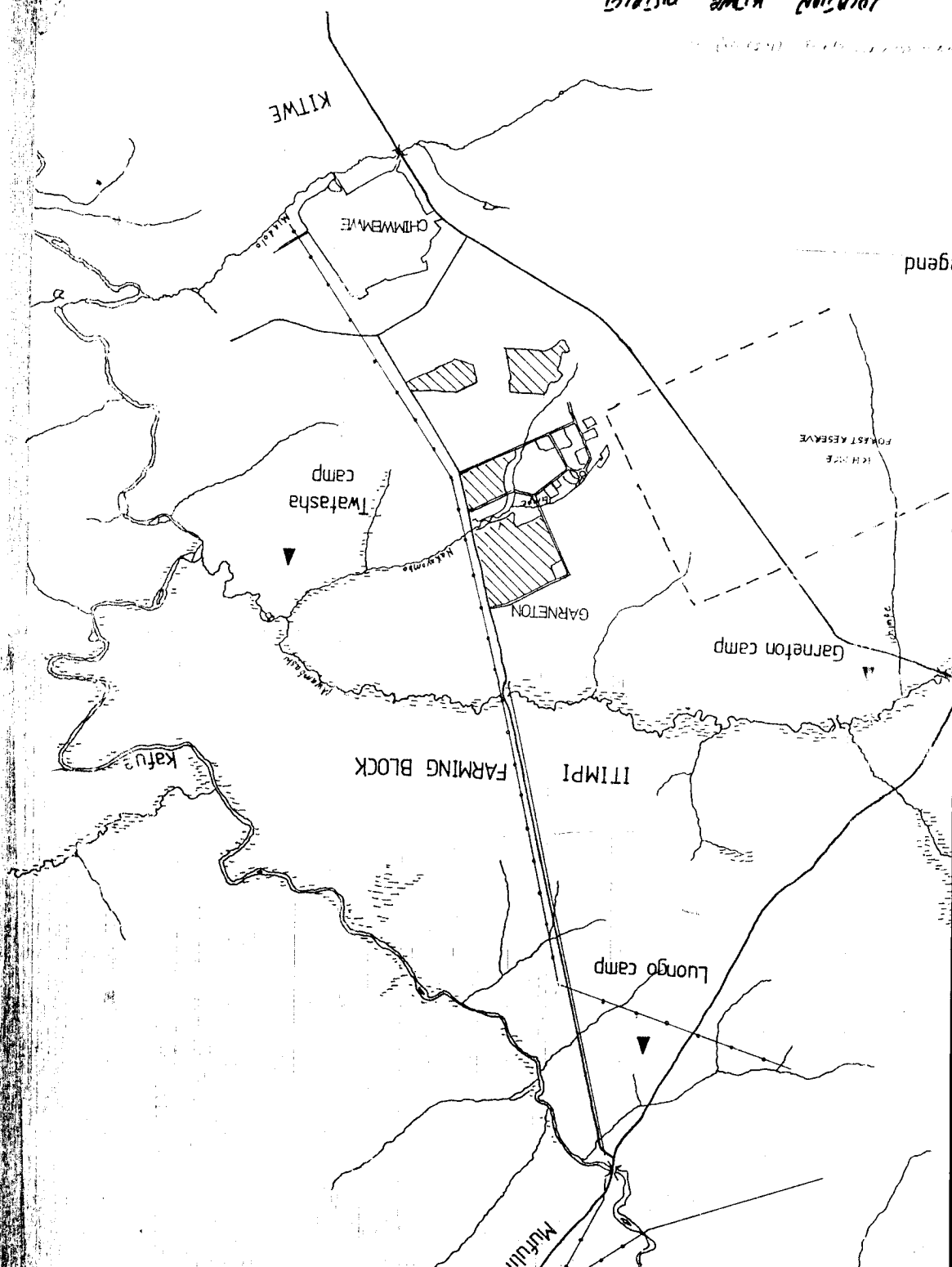
AGRO ECOLOGICAL ZONES OF ZAMBIA

Legend

- Region I
- Region IIa
- Region IIb
- Region III



LOCATION KITWE DISTRICT



gend

FOREST RESERVE

subint

CHAPTER FIVE

DATA PRESENTATION AND ANALYSIS

HOUSEHOLD CHARACTERISTICS

The main source of income for 94% of the households was found to be farming. It was also discovered that approximately 80% of the heads of the households had attained the age of fifty one years and were not involved in any Form of regular employment of a formal or informal nature. They are full-time farmers. They are land owners, owning plots of an average of twelve hectares which they cultivate. The portions they cultivate are mostly less than five hectares.

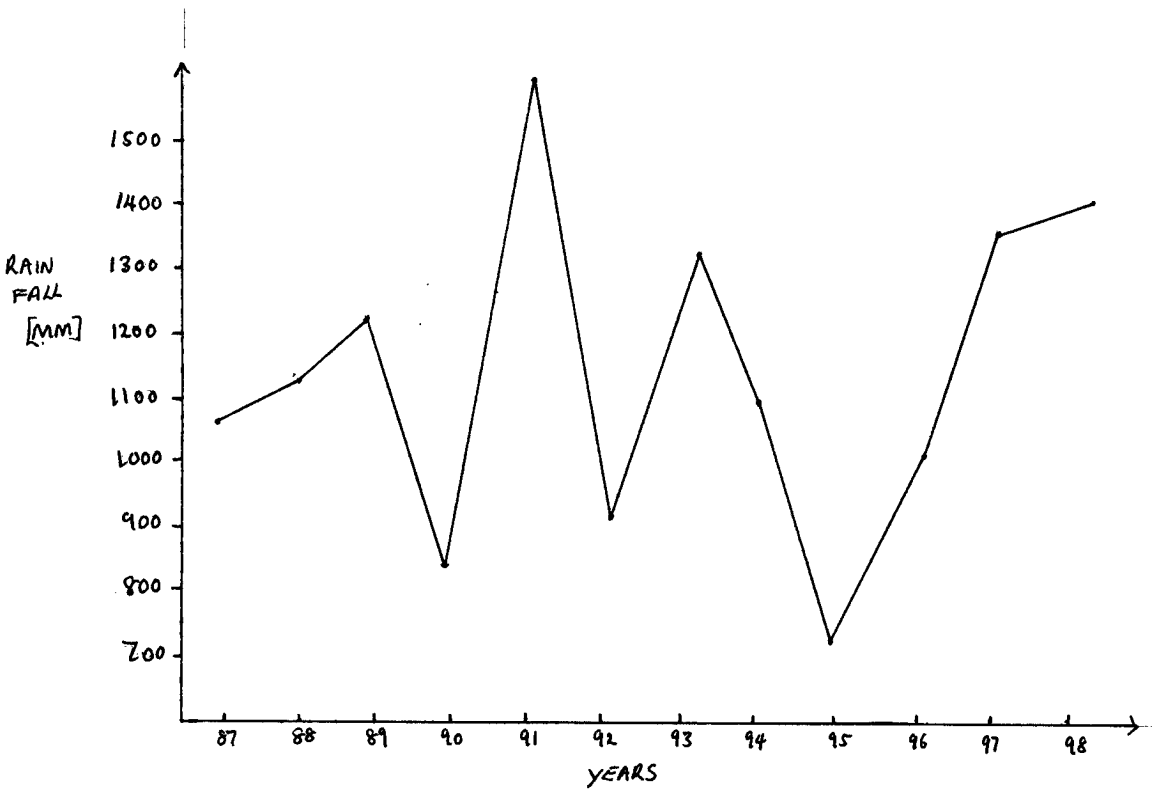
The majority of the households, 62.5% have an average of 6-10 members. Although they do employ piece workers, the farming operations are mostly undertaken with the use of family labour. The technology most households employ is the use of the handheld hoe, they sow both hybrid and local maize seeds and most apply fertilizer when they can afford to. They grow a variety of crops but maize is the main cash crop grown. It is grown by all households.

MAIZE PRODUCTION AND CLIMATE

One of the many factors said to have an influence on crop productivity is climate, particularly the factor rainfall. Annual rainfall values vary from season to season. Using data obtained from the meteorological department for the station nearest to the study area which is Kafironda agrometeorological station, it was found that the mean seasonal average for the area is 1210 mm. This rain comes between the months of September and May.

Graph 1

KAFIRONDA ANNUAL RAINFALL TOTALS FOR 1987-1998 (MM)



In my study, I want to investigate the effect of rain on maize production for the seasons 1988/89, 1991/92, 1994/95, and 1997/98. The value of the seasonal mean for the area is 1210 mm. The deviations for each of the seasons of interest are indicated below. In Table 1.

Table 1

DEVIATION FROM SEASONAL AREA MEAN OF 1210MM

YEAR	DEVIATION	COMMENT
1988/89	+30mm	Normal year
1991/92	-263mm	Below normal
1994/95	-471mm	Below normal
1997/98	+202mm	Above normal

When we look at the total seasonal maize production. Obtained by summation of seasonal maize yield of Farmers making up the sample, it can be observed that total production varies with annual rainfall totals. Refer to Graph 2.

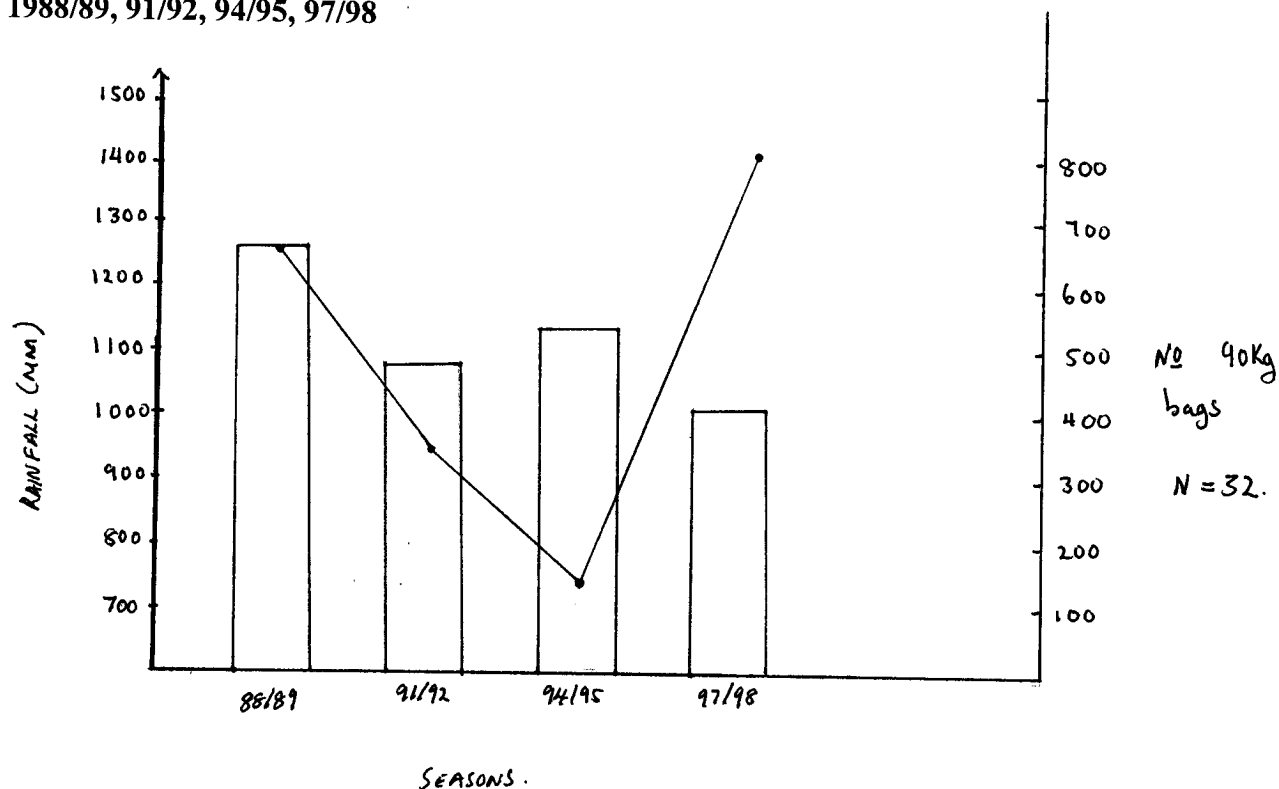
Table 2

**ANNUAL MAIZE PRODUCTION FOR SMALL SCALE FARMERS
1988/89, 91/92, 1997/98, IN 90KG BAGS**

88/89	91/91	94/95	97/98
642	487	521	411

Graph 2

**TOTAL PRODUCTION VARIATION WITH TOTAL RAINFALL VALUES
1988/89, 91/92, 94/95, 97/98**



In order to determine whether there is a significant difference between the production of the seasons of interest, the Analysis of Variance Test was used. It is a parametric test with the aim of analysing whether all the samples under consideration have been drawn from the same population or whether some of them came from other populations.

Anova estimates the probability of the sample means differing from one another by sampling error. It answers the question "Can the observed differences between samples be attributed to chance or are they indicative of actual differences between the means of the corresponding populations?"

THE ANOVA - F- TEST

It examines the variation within the whole group of sample means simultaneously.

Procedure

SEASON	88/89	91/92	94/95	97/98	ALL
n	27	29	31	30	117
ΣX	642	486	521	411	2060
\bar{x}	23.77	16.76	16.81	13.7	17.76
$(\Sigma X)^2/n$	15265.33	81144.69	8756.16	5630.7	37796.88
ΣX^2	20420	12668	12803	7869	53760

$$\text{correction factor } C = \frac{(2060)^2}{117} = 36270.085$$

$$= 36270.085$$

$$\text{Total sum of squares } SS = \Sigma X^2 - C = 53760 - 36270.083$$

$$= 117489.915$$

$$\text{Sum of squares for treatments } SST = (\Sigma X^2/n - c) = 37796.879 - 36270.085$$

$$= 1526.794$$

$$SSE = SS - SST = 15963.121$$

Table 3**TABLE OF VARIANCE ANALYSIS**

SOURCE OF VARIATION	SUM OF SOURCES	DEGREE OF FREEDOM	MEAN SQUARES
Samples	SST 1526.794	K-1 3	
ERROR	SSE 15963.121	K(n-1) 112	
$n=29$	SS 17489.915	Kn - 1 115	

$$F_{\text{obs}} = \frac{\text{SST} \times K(n-1)}{\text{SSE} \times K - 1} = \frac{1526.794 \times 112}{15963.121 \times 3} = 3.57$$

H_0 = There is no significant difference between means of Samples

H_1 = There is a significant difference between means of samples

$$F_{\text{crt}}(3,112) = 2.68 \text{ (at 0.05 level of significance)}$$

Rule is $F_{\text{obs}} \geq F_{\text{crt}}$ then H_0 is rejected

Therefore we conclude that there is a significant difference between the means of the samples.

Although by using the Anova test it has been established that there is a significant difference between the means of the samples. It is difficult to be certain that the variable causing this difference is rainfall.

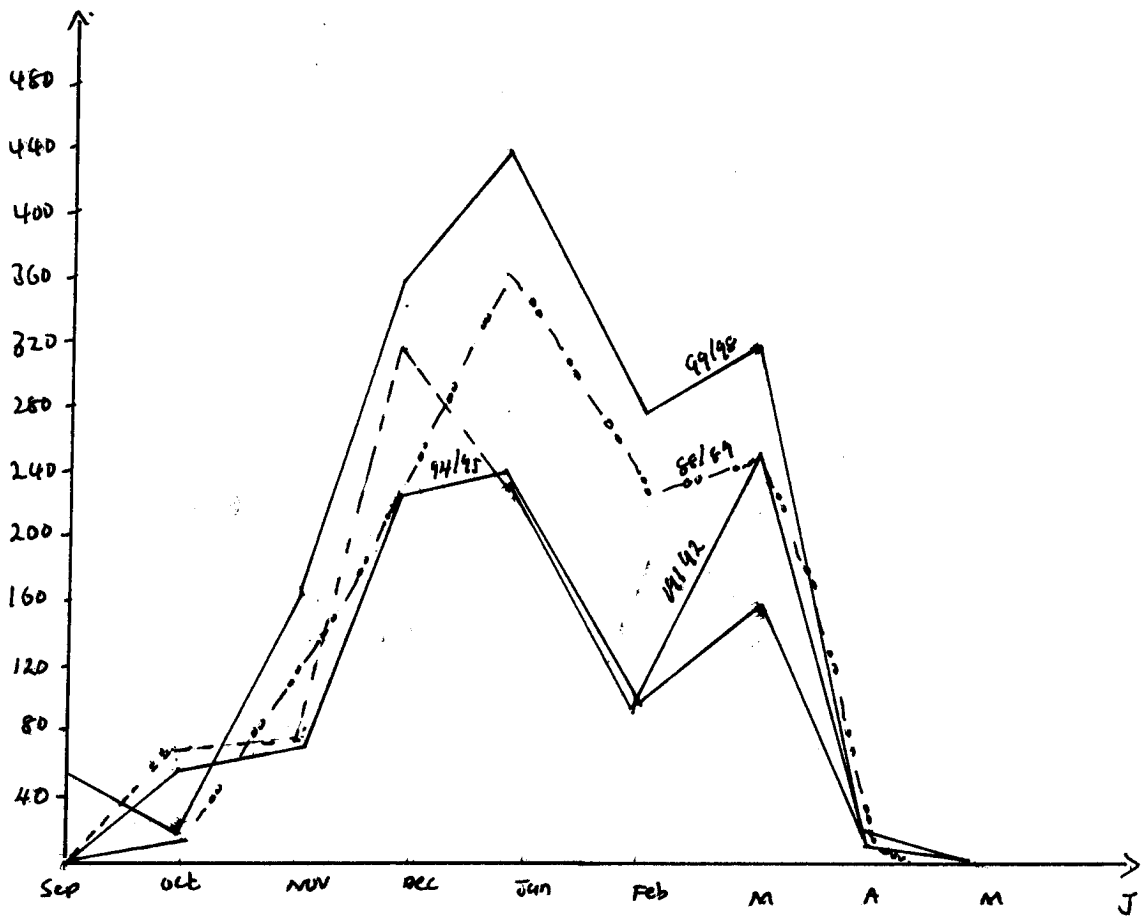
The assessment of the influence of rainfall on crop production would have been identified in the event that all other variables that influence crop production such as amount of land cultivated; soil fertility; variety of seed sown; application of fertilizer had been held

constant. In the sample the extent to which these variables varied was difficult to measure but rainfall does have an effect on crop production

when we take into consideration the experiences of the farmers in each of the seasons of interest we may conclude that Rainfall has an influence.

Graph 3

RAINY SEASON CHARACTERISTICS {1988/89, 11991/92, 1994/95, 1997/98}



The nature of the seasons is represented in graph.3 above.

EXPERIENCES.

In the 1988/89 season most farmers had a good harvest. There were no complaints, voiced.

In the 1991/92 season the crop yield declined. According to the farmers the maize crop yellowed and in some cases it wilted. The maize did not grow well. The farmers who planted late failed to make a good harvest. The rain was unfavourable.

In the 1994/95 season – Crop yield for most of the farmers declined the maize plants did not grow well ,for some they were stunted. The rain was late and it ended early.

In the 1997/98 season - Crop yield for most farmers declined. For some farmers their fields became water logged, the maize crop fell or was uprooted. The beds were destroyed by water, soil was washed away, fertilizer was washed from the fields. The rain was too much.

With respect to the seasons 1988/89, 1991/92 and 1997/98 ,quite a large proportion of farmers 56.25% stated in one way or another that the rains reduced their crop yields.

MAIZE PRODUCTION AND FOOD SECURITY

As has been stated already , the main income generating activity of the farmers is crop production.

From their total annual production, they sell a greater proportion to generate cash and they retain the rest for consumption purposes. Table 4 below illustrates the total production of maize for the season of interest in 90kg bags .

Table 4**TOTAL ANNUAL PRODUCTION OF MAIZE (90KG BAGS)**

TOTAL	PROPORTION OFFARMERS			
	1988/89	1991/92	1994/95	1997/98
No of 90Kg maize bags produced				
0-10	9.4%	43.8%	25%	43.8%
11-20	37.5%	211.9%	46.9%	34.8%
21-25	12.5%	12.5%	9.4%	3.13%
>25	25%	12.5%	15.63%	12.5%

On looking at table 4 we may observe that with respect to total annual maize production. In the 1988/98 season, the majority of farmers harvested more than Ten 90Kg bags of maize. Only 9.4Kg% of the farmers had a total yield equal or less than Ten 90kg bags.

In the 1991/92 season, approximately 65% of the farmers harvested a maximum of twenty 90kg bags of maize.

In the 1994/95 season, approximately 70% of the farmers harvested a maximum of twenty bags, with the remaining percentage harvesting more.

In the 1997/87 season , approximately 78% of the farmers harvested a maximum of twenty bags.

Out of their Total production they retain some bags specifically for consumption.

TABLE: 5 Illustrates the proportion retained for consumption

90KG BAGS OF MAIZE RETAINED FOR CONSUMPTION

TABLE 5

NO OF BAGS RETAINED	% PROPORTION OF FARMERS				
	1988/89	1991/92	1994/95	1997/98	DURATION OF STOCK
0-2	22%	22%	19%	13%	July - August
3-6	25%	31%	31%	41%	September - November
7-9	13%	13%	19%	16%	December - February
10-12	16%	13%	9%	13%	March - April
> 12	9%	9%	19%	13%	Next harvest

From the tabulated data it may be observed that the largest proportion of farmers retain a maximum of 9 [nine] 90Kg bags specifically for Consumption. In the 1989 consumption year 60% of the farmers retained 9 bags or less, 1992 the percentage was 66%, for 1995 the % was 69% and that for 1998 was 70%.

The last column on the table was created based on the information obtained from the farmers themselves that they consume approximately one[1] 90Kg bag of maize per month. It follows therefore that for consumption to be continuous from one harvest to the next, each household should retain at least twelve 90Kg bags of maize. However as has been stated already, the majority retain 9 bags or less.

On extrapolating this value on to the seasonal cropping calendar, it may be said that 9 bags of maize are exhausted by the month of January. It may be also assumed that households that retain fewer bags exhaust their stock sooner.

From the above it may be tentatively concluded therefore that most of the households in Luongo have the lowest food reserves with respect maize from the months of September

to may . A point worth noting is that from the individual data it was observed that quite a number of farmers keep an almost constant number of maize bags specifically for consumption each harvest season irrespective of the failure or success of their harvest. In cases some farmers did not sell any bags of maize at all.

The farmers obtain cash from the sale of maize and the various other crops they grow such as sweet potatoes, Groundnuts, cassava and sorghum. The cash generated from crop sales is mostly used for purchases of implements and imports for the next season; Payment of school fees, settling of debts etc. A small percentage is used for the purchase of food. The money generated is never enough.

Faced with so many constraints affecting their food security and general quality of life, the farmers were found to adopt the following strategies.

STRATEGIES

STRATEGIES EMPLOYED BY SMALL SIMPLE FARMERS TO REDUCE THE IMPACT OF ERRATIC CLIMATE ON CROP YIELD

Because rainfall has an effect on yield, in that drought and flood spells tend to reduce yield. The farmers employ what may be termed preparedness strategies in order to reduce the influence of climate on their productivity.

- a. Early planting - This is done in order to take advantage of the early rains of the growing season.
- b. Diversification and mixed cropping - The farmers have become more conscious of the dangers of over reliance on maize. They therefore plant a variety of crops which are not so dependent on rainfall such as cassava and small grained crops such as millet and sorghum.

- c. Reduction of area planted under maize - not a common practice as most farmers maintain the same area planted under maize each season. However, as crop diversification is being adopted the area being portioned to maize is declining.
- d. Farming of a nursery whilst awaiting the rains - This is a rare practice. Only one farmer in the sample mentioned this strategy. It involves the transplanting of Germinated plants to the field when the rains have began.
- e. Replanting - In the event of seeds failing to Germinate or a crop failing to grow well ,early in the season, the farmers choose to replant.
- f. Construction of ridges or beds in such a way as to block off or re channel rain water to prevent soil erosion and fertilizer being washed away and to prevent the water logging of the fields when rain is heavy.

ROLE OF THE GOVERNMENT

According to the farmers, none of them receive any form of assistance from the government, through the ministry of Agriculture food and fisheries (MAFF).

Never the less according to the information obtained through the interviews with the employees of the Ministry of Agriculture, it was discovered that the Government does attempt to influence the strategies adopted by food producing households ,providing guidance through normal extension channels, the media and Radio broadcast programmes.

The extension services focus on planting schedules and on appropriate mix of crops. The farmers are advised to plant early and to plant drought tolerant crops.

STRATEGIES EMPLOYED BY SMALL SCALE FARMERS TO ENSURE THEIR FOOD SECURITY

As agricultural productivity is the main source of livelihood for these households, their access to and availability of food, and their food security can be measured by their food stocks. As was established earlier from table 5, the food stocks for most farmers are highest between the months of June to December. Beyond this time of year with the cash income generated from that years harvest used to satisfy other needs, they require a stable source of food or income to enable them to avert hunger till the next harvest.

Table 6 Illustrates the various strategies the households employ.

Table 6

STRATEGIES EMPLOYED BY FARMERS AND PERCENTAGE OF FARMERS EMPLOYING ACTIVITY TO ENSURE THEIR FOOD SECURITY

STRATEGY/ACTIVITY	% FARMERS
Vegetable Gardens	53.13%
Trade	12.5%
Poultry keeping	34.4%
On farm work	21.8%
Off farm work	6.25%
Collection of wild food	3.15%
Savings	9.4%
Multiple/mixed cropping	40.64%
Food Preservation	78.1%
Replacement of staple	15.63%
Remittances	37.5%

All the households have employed a combination of the activities illustrated in the above table.

Vegetable gardens - The majority of farmers grow vegetables. Those with streams passing through their land area ,have extensive vegetable gardens. The vegetables are mostly grown for consumption, thus improving food security through direct consumption. However on occasion they are taken to Nakadoli market in Kitwe for sale.

Trade - Few of the farmers are involved in this form of activity. Trade is in the commodities sugar, salt and fish. . This was the case with one farmer. Another farmer owns a small shop, the rest said they had a business.

Poultry - The majority keep poultry specifically for consumption .Chickens and ducks. The chickens are those termed village chickens and are not of the hybrid variety. The chickens or ducks sold are sold locally.

On farm work - When the food situation in the households declines severely , the adult members of the households, 16 years and above, find piece work on neighbouring farms. They weed, prepare the fields and do other forms of manual work.

Off farm employment - As indicated in the table , few households are engaged in any form of fulltime income generating activity. For the majority who find some form of wage employment, it is usually on a temporal basis for example , brick laying, labourer.

Collecting of wild food - This is not a commonly adopted strategy. When it does occur, it involves the collection of mushrooms, and wild fruits. It is adopted by the poorer households mostly , who even reduce the number of meals they have in a day.

Savings - Few farmers have bank accounts. However those who do withdraw money to facilitate the purchase of food.

Mixed cropping - The cultivation of more than one crop. This serves to ensure the availability of a variety of food sources. Maize is grown with other crops such as groundnuts, sweet potatoes, cassava, sorghum, beans.

Crop preservation - The dominant activity. Crops are preserved. They are usually dried and then put in storage for future consumption. Some farmers apply chemicals to prevent spoilage by pests. The crops mostly stored include maize, sweet potatoes, cassava and ground nuts.

Replacement of staple - Due to the frequent poor harvests some households are replacing maize with crops such as cassava and sweet potatoes as their staple. They are consuming more of other crops.

Remittances - Refers to cash or the direct provision of food as gifts from friends and relatives. A significant proportion of the households (80%) are headed by persons who have attained or exceeded the age of 51 years. As such many have adult children in full time employment sending money to them occasionally.

The strategies they employ serve to enable them improve their food security status. Diversified food sources directly improve their food security through direct consumption. And the diversified income sources serve to make available an income that may be used for the purchase of food.

There are many factors which influence the attainment of food security. According to the farmers own opinions, the majority approximately 75% stated that the lack of finances hindered their attainment of food security. Without financial capital, they were unable to expand their fields, to purchase all the required inputs and farming implements, hire

labour or tractor for cultivation. The other factors they mentioned in order of importance were crop thieves, storage problems and dependants. With respect to the last factor mentioned,

More people in the home means that more food must be provided .

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

This chapter draws conclusions from the major findings and provides recommendations on what needs to be done in order to alleviate the problems that small scale farmers have in securing their food security.

Conclusions

Despite their role in contributing the largest percentage to national food production or availability, small scale farmers are generally food insecure at household level.

Most experience what was defined as current or transitory food insecurity which is a temporal decline in households access to food resulting from instability of food prices, food production and household incomes.

In this study food production and household income were observed to be the unstable variables. It was found that most farmers do not retain enough food from their harvest to sustain their needs through till the next harvest season. The reason being that most of the crops are sold to generate cash income required to satisfy other needs. The study established that Rainfall has a direct influence on food security in that it has an influence on the crop yield on which the farmers livelihood depends. In an attempt to reduce their vulnerability to this climatic factor, the farmers were found to adopt a number of strategies.

These were found to be :

- i. Early planting
- ii. Crop diversification
- iii. Reduction of land under cultivation
- iv. Replanting

Their purpose is to ensure a successful harvest.

It was also established that the small scale farmers in an attempt to ensure their year round food security employ the strategies of diversifying their Food sources and their income sources.

The diversification of food sources improves food security through direct consumption.

The diversification of income sources, such as through poultry and vegetables sales; trading; provide small amounts of money but on a regular basis enabling the purchase of groceries and other daily necessities. It may be concluded that households with a larger number of income sources are more likely to have an extra income to spend on food.

Another major factor according to the farmers own opinion that is a constraint is the lack of financial resources. This lack hinders them from making any lasting improvement to their food security status.

RECOMMENDATIONS

The conclusion established that the diversification of food sources and income sources were the main strategies employed by the small scale farmers to improve their food security. And that a major constraint apart from climate was their lack of financial resources.

The government therefore through Macro-economic policies can help increase off-farm employment opportunities in areas such as Luongo , by either developing these areas or encouraging investment in them. In addition the government can assist the farmers through direct financial assistance to enable them expand their fields and purchase the required implements to improve their agricultural productivity. This could be done through the establishment of Loan agencies and Co-operatives.

With respect to erratic climate, the conclusion established that it has an influence on crop production. The strategy to counter the influences of erratic weather would have to be

enhanced preparedness. This could be achieved through improved climate forecasting by the meteorological stations of the country and the already established national early warning and food security unit of the Ministry of Agriculture Food and Fisheries.

- They could:
- i. Gear the time frame of forecasts to the agricultural calendar.
 - ii. Provide more detail in forecasts. The on set of the rains. And the timing and duration and intensity of mid season dry spells, which have a greater significance to agricultural conditions than the total rainfall experienced within a given period.
 - iii. Anticipate extreme climatic events

(Adapted from FEWS 1998)

The national early warning unit once such data is made available, should disseminate clear, timely and simple, relevant climatic information to the farmers countrywide so that the farmers can integrate this information into their activities.

APPENDIX ONE

QUESTIONNAIRE

RESPONDENT NO-

1. GENDER M F
2. AGE:
3. MARITAL STATUS: SINGLE MARRIED
SEPARATED
DIVORCED WIDOWED
4. LEVEL OF EDUCATION PRIMARY SECONDARY
TERTIARY
NONE
- EMPLOYMENT STATUS FORMAL
INFORMAL
- Total Household size:
- Number of member of household above the age of 16:
- Main source of household income:

SECTION B AGRICULTURAL PRODUCTION

- Did you grow any crop over the period
- | | | |
|-------------|-----|----|
| 1988- 1993? | Yes | No |
| 1993- 1998? | Yes | No |

Name them

Which is the main crop you grow for sale?

12. What was the quantity of the crop produced
- | crop | 88-89 | 91-92 | 94-95 | 97-98 |
|------|-------|-------|-------|-------|
| a) | | | | |
| b) | | | | |
| c) | | | | |
13. *How much land do you cultivate?*
14. What is the quantity of fertilizer you use on this land.
- A Basal dressing
- B Top dressing
- C Others
15. What quantity of seeds do you sow?
16. How much labour do you use to harvest?
17. Do you engage in any other agricultural activity?
18. Do you think your agricultural activities have been affected in any way by erratic weather patterns with respect to the seasons below
- a) 1988/89
- b) 1991/92
- c) 1994/95
- d) 1997/98
- How did you respond

SECTION C: FOOD SECURITY STATUS

19. Of the (number of bags) quantity produced (Q12) how much did you sell

Amount sold

Crop	88-89	91-92	94-95	97-98
a				
b				
c				

20 At what prices did you sell your produce

		Price		
Crop	88-89	91-92	94-95	97-98
a				
b				
c				

21. How much of the total sales did you allocate for the purchase of other food?

Crop	88-89	91-92	94-95	97-98
a				
b				
c				

22. What happened to the crops that were not sold?
Explain

23. Do you grow any crops specifically for your own consumption?
Yes No

24. If yes to Q 23. What are these?

25. Are any of the adult members of your household involved in any income generating activity apart from agriculture?
Yes No

26 What are these?

27. What is this income used for?

28. Does the level of agriculture activity dictate the occurrence of these other income generating activities?
Yes No

SECTION D: STRATEGIES

29. Do you adopt any strategies to ensure good agriculture productivity with respect to erratic weather?

30 What are these strategies?

31. Do you adopt a strategies to ensure your food security?
Yes No

32. What are these strategies?
33. According to your own experience . What is are the major factors affecting your food security?
34. Does the government assist in any way to enable you ensure your food security?
Yes No
35. If yes to Q34 How?
36. when faced with a food crisis how do you survive?
37. Have you ever received assistance food wise from an NGO or from foreign aid?
Yes No
38. If yes to Q37. When and in what form? Explain

APPENDIX TWO

INTERVIEW SCHEDULE

1. What has been the trend in agricultural production in Luango Camp in the last ten years?
2. Which have been the worst production seasons in the last 10 years and why?
3. How did small scale farmers fair during those seasons?
4. Did they receive any assistance from the Ministry of Agriculture during those seasons and in what form?
5. How often is foodaid received in the district and in what form is it received?
6. Does the agricultural department believe that in its current state agriculture in Zambia is a reliable form in income generating with respect to the populations attainment of food security?
7. What strategies does the Ministry of Agriculture encourage small scale farmers to adopt in order to ensure their food security?

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