TITLE OF THESIS:

Human adjustments to the Drought Hazard - A Case Study of Gwembe Valley in the Southern Province of Zambia

by

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Declaration by student

This thesis represents my own library and fieldwork research. It has not previously been submitted for a degree at this or another university. All maps, diagrams and tables, unless where stated are as a result of fiedwork conducted by me for the sole purpose of producing this thesis.

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APPROVAL

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ABSTRACT

This thesis, with its focus on the Gwembe Valley, an area that has a long history of drought conditions in the country and one of those that was severely affected during the recent three year running drought (1981-84), attempts to find out about peoples' responses and adjustments to the drought hazard in the region. It investigates as well, many aspects relating to drought perception. Specifically, the present study was guided by three broad objectives, which sought to:

(i) determine the nature and extent of the drought hazard in the Gwembe Valley.

(ii) examine the full range of human adjustments to the drought hazard.

(iii) examine and establish a relationship between peoples' perception of the hazard and rainfall periodicity as recorded at the rain gauge stations in the study area.

Three main working hypotheses, (from which 41 null hypotheses were formulated and tested using the chi-square test of independence at 0.05 level of significance) were also advanced. These are listed as follows:

1. the awareness of the drought hazard is a function of magnitude, frequency of the hazard, recency and frequency of personal experience.
2. the evaluation and adoption of adjustments to drought by individuals is the function of the perception of the hazard and the perception of the alternatives available.
3. farmers response to drought involves a variety of simple adjustments, which attempt to work more in harmony with nature than human control over nature.

In pursuing the study both field and library research were employed. Data from the field was based mainly on an interview schedule survey. This survey was administered to a sample of 180 peasant farmers and the results yielded from it formed the basis of our data analysis, with supplementary information arising from other forms of field inquiry and secondary materials.

The key findings of the study include the following:

Essentially, the people in the study area hold similar views on the drought hazard and practise a wide range of drought adjustments. They look upon droughts as being generated by external physical forces, frequent in their occurrence,

unpredictable in nature and problematic because of their effects on crop production.

The drought adjustments practised by the people are simple in character and are deeply rooted in their agricultural and social systems. They include the planting of drought tolerant crops; millet and sorghum, rain making and the selling of livestock. Except for a few, all the adjustments are of an individual centred nature and are widely viewed as being very useful in mitigating drought effects.

The chi-square results generally indicate that several factors (e.g. personal drought experience, the frequency of drought occurrence and socio-economic variables were responsible for the high drought awareness amongst the sample population. But contrary to what was anticipated, the chi-square results fail to pin-point the importance of perception variables in the adoption of drought adjustments.

The study concludes among other things that:

people living in high drought prone areas exhibit little variation in their perception of the hazard; employ a variety of purposive adjustments for ameliorating its effects and that apart from the adjustments they undertake peasant communities usually offer a limited range of alternative adjustments.

Recommendation to both policy makers and future researchers included some of the following:

i. The present agricultural policies in the region should be re-addressed as these favour the cultivation of maize and cotton, instead of the traditional drought tolerant crops.

ii. An early drought monitoring system should be established in the country.

iii. Peasant farmers must be educated on the need to construct proper grain storage bins.

iv. Proper documentation of past droughts must be carried out.

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CHAPTER 1

INTRODUCTION

1.1. Introduction

In recent years, drought has undoubtedly become one of the major natural hazards affecting man world wide. As in all cases it is a joint product of man and nature related to both the variability of climate and man's degree of adjustment to such variation (Berry et al, 1974 p.4). Because of its disastrous effects on peoples lives and national economies, great public and academic attention is drawn into this area. The main studies carried out have emphasized the complex series of individual and societal adjustment to the hazard (Burton et al 1978). Existing theory suggests that there are basically three types of adjustment: folk or pre-industrial response, involving a wide range of adjustments requiring more modifications in behaviour and harmony with nature rather than control of nature and being flexible, easily abandoned, and low in capital requirements; modern technological or industrial response, involving a much more limited range, high

in capital requirements and requiring inter-dependent social organization; and comprehensive or post-industrial, response combining features of both of the other types, and involving a large range of adjustments, greater flexibility and greater variety of capital and organization requirements (Kates, 1970). In Zambia the Gwembe Valley in the Southern Province has a long tradition of drought conditions (Scudder, 1962, p.2 15-223). And during the recent three-year running drought of 1981-84 which the country underwent the valley was amongst the most affected areas (Government Report, 1984, p.3). Hence there is need to find out how people in this area have adjusted to the hazard. Equally important too, is to find out the kinds of short-term responses or adjustments which the Gwembe Valley people employ in their fight against drought effects, by making reference to the 1981-84 drought. The findings from this study will enable us not only to discover the various ways in which the people have adjusted or adjust to the hazard but also how they perceive it. From the findings we could come up with appropriate means and ways of coping with the hazard in the area. For example, farmers could be helped in their decisions about what, where and when to plant and how to budget their food stores. On a broader scale, the findings of such a study would help us to build upon the existing knowledge on drought adjustments,

which will go a long way in understanding the phenomena and how to deal with its effect.

1.2 Objectives

There are three broad objectives of this study. These are:

1. To determine the nature and extent of the drought hazard in the Gwembe Valley.
2. To examine the full range of human adjustments to the drought hazard.
3. To examine and establish a relationship between people's perception of the hazard and rainfall periodicity, as recorded at the rain gauge stations in the study area.

1.3. Hypotheses

The main working hypotheses of this research are as follows:

1. The awareness of the drought hazard is a function of magnitude, frequency of the hazard, recency and frequency of personal experience.
2. The evaluation and adoption of adjustments to drought by individuals is the function of the

perception of the hazard and the perception of alternatives available.

3. Farmers response to drought involves a variety of simple adjustments, which attempt to work more in harmony with nature than human control over nature.

1.4. Background to the Study and Choice of Study Area

Many factors came into play in choosing this study. Personal interest, which viewed the study as challenging was the first dictate for the choice. Secondly, drought as a stumbling block to stable agriculture and the precursor of famine is an interesting geographical topic, involving both physical and human aspects. Thirdly, with the recent prolonged drought conditions in the country, it was felt that the study is a significant practical problem which requires an urgent solution. Again, in the absence of detailed studies on drought in the country, the need to initiate one, was viewed as more than just an academic exercise. Through an increased knowledge on the choice of adjustments and perception of the hazard, our planners and decision makers could be helped to come up with proper ways of dealing with the drought problem. Finally, the

desire to open a new chapter on natural hazard studies in Zambia and the fresh memories of the current drought situation in Ethiopia and many other Sahelian countries, where thousands of people have died and many more are at the risk of death, reinforced the idea to undertake the study.

The Gwembe Valley was chosen primarily because it is one of the main areas in the country, where drought is a recurring hazard. Apart from this, other important considerations for its choice were based on the fact that it has records of rainfall data, as far back as 1954. The researcher's familiarity with the area also played an important role for its choice.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

This chapter serves the purpose of providing us with the background theoretical material relevant to this study. It is organised into three main parts. The first one, presents an overall view of natural hazards, bringing to our attention its definition and research outline. Then, the second part deals specifically with the drought hazard. Important themes under review include the drought concept, causes, effects and works relating to perception and drought adjustment. Closing this chapter, is a discussion on rainfall and drought conditions in Zambia.

2.2. Natural Hazards in Context

2.2.1. Definition

A review of the literature on natural hazards sharply demonstrates that almost all scholars are satisfied with the following definition;

that a natural hazard is an extreme event in

> nature, hazardous only when it affects people (Burton et al,1978, p. 19-20).

What this implies, as White explicitly puts it, is that "by definition no natural hazard exists apart from human adjustment to it" (1974, p.3). The point to stress is that hazards are joint outcomes of the state of nature and the nature of the society. That is, they are an aspect of the interaction of man and nature and should not be confused with ordinary extreme events.[1] Thus for example, without man's occupance of flood plains, floods would not be hazards. Similarly, droughts would not be hazards if the human use system in a given area of occupance was in accordance with the variable nature of climate, especially rainfall. In general, by his occupance of flood plain areas or in extremely variable climatic regimes he establishes the damage potential and may as well alter the nature of the hazard itself (White, 1974, p.3). To sum up, it should be emphasized that neither droughts nor any other kinds of natural hazards are events located in the physical environment, but rather they are part of a complex interaction that is governed by the co-existent state of adjustment and the state of nature in the human use system and natural

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1. An extreme event is taken to be any event in the natural system displaying relatively high variance from the mean. (White, 1974). The events in question operate independently of human activities i.e. they are located outside of the human use system.

systems respectively.

2.2.2 Research Outline:

Natural Hazards Research is a recent field of geographic inquiry concerned with the human occupance of hazardous environments (Mitchell, 1974, p. 311). It is interdisciplinary in nature in that it interests natural, social and policy sciences. Amongst its varied phenomena, geographers are primarily interested in geo-physical (climatological and geological) hazards, as opposed to biological ones. With its focus on topical and significant practical problems, natural hazards research allows geographers not only to be engaged in inter-disciplinary cooperation but also provide an apportunity for geographers to bring together disparate strands of geographical theory on man-environmental relations (Mitchell, 1974). The development and advancement of this research area is associated mainly with the works of three scholars; Gilbert White, Ian Burton and Robert Kates. These early researchers began serious work in the 1950's and were primarly interested in finding out why people continued occupying flood prone areas, despite the losses they incurred (White

1964). Another focus was on the reasons for the failure of many flood protection measures, such as the construction of dams, instituted to reduce the flood losses in several places by the U.S.A.'s federal and local governing authorities (White, 1964). The results of these investigations on floods stimulated interest in other natural hazards and thus in 1967, a collaborative programme of research was launched in the U.S.A., which attempted to explore the applicability of the findings from the flood studies to other geo-physical hazards and to investigate the interaction of social and natural systems in a variety of environments (White, 1974, p. 4). In this drive to explore other natural hazards, the role of the International Geographical Union's Commission on Man and Environment needs to be mentioned, as it was very instrumental in initiating and co-ordinating various hazards researches in many countries. Through the works of the commission, we can as exemplified by White, (1974) and Burton et al, (1978) boast today of a wide range of hazard studies done in different parts of the world.

The natural hazard research paradigm is dominated by five themes, which as put forward by Burton et al (1978) seeks to:

(a) assess the extent of human occupance of hazard zones.

(b) identify the full range of possible human adjustments to hazards.

(c) examine how people perceive and estimate the occurrence of the hazard.

(d) describe the process of adopting hazard adjustments.

(e) estimate the optimal set of adjustments and its social consequences.

In addition to these themes, Mitchell also states that researchers have began to investigate aspects of collective adjustments decisions, a previously neglected field of inquiry (Mitchell, 1974, p. 313). Generally, research work into the above themes is still in its developmental phase, with the study on how man perceives and estimates the hazard as probably having received much more attention than the rest. But recent research, however indicates a bias towards adjustments or responses as opposed to perception.

So far, in most natural hazard research, the main research objectives as writes Gould (1980, p. 213) have been to gain more complete view of the global extent and range of natural hazards, to attempt comparative analysis

of different types of hazard and of the same hazard in different cultural contexts, and to maintain the systematic development of the method. In trying to meet the desired objectives, natural hazard researchers have tended to base their methodology on a standardised questionnaire/ interview survey,[2] developed by the International Geographical Union (I.G.U.). And to supplement this, site description tends to be widely used (White , 1974). The usage of the standardised questionnaire/interview survey which was born out of the early research work in North America possess certain weaknesses. Saarinen (1974) observes that there are difficulties of adapting it to cultures outside North America. It is pointed out that due to language differences between different cultural groups, the initial meaning of some questions tends to be lost. In addition to this, it is said that the sentence completion test included in the questionnaire presents difficulties in interpretation and also that hypothetical questions and those requiring precise numerical answers were of limited utility in areas where most of the respondents were illiterate. To overcome all these, Saarinen suggests that several modifications must be made

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2. In this research, the full standardised questionaire/ interview survey has not been employed, but reference to it was made when drawing up questions for the study (see Appendix 1).

to the questions to suit local conditions (Saarinen, 1974, p. 180-84). Another short-coming on the methodology, as writes Waddel (1977) has been its avoidance or failure to include a historical approach when examining people's responses to hazards. The argument put forward is that the effectiveness of people's adjustments to the hazards is not only related to the magnitude or intensity of the hazard but also to the broader political economy subjected to the people at a given time in a given society. Of late, judging from such studies, Watts (1983) and Campbell (1984), Waddel's approach seems to be gaining ground especially in drought studies.

2.2.3 Types of Natural Hazards

The term natural hazard, although no controvercy surrounds its definition, covers a diverse group of phenomena such as droughts, floods, volcanic eruptions, earthqu akes, tropical cyclones and many others, which vary greatly in their formation, physical character and impact. A comprehensive list of some of the common types of natural hazards is presented in Table 2.1. The principal

Table 2.1: Common Natural Hazards by Principal Causal Agent

Geophysical		Biological	
Climatic and Meteorological	Geological and Geomorphic	Floral	Faunal
Blizzards and Snow	Avalanches	Fungal Diseases for example:	Bacterial & Viral
	Earthquakes	Athlete's foot	Diseases
Droughts		Dutch elm	For example:
	Erosion	Wheat stem rust	Influenza
Floods	(including	Blister rust	Malaria
	soil erosion		Typhus
Fog	and shore and		Bubonic
	beach erosion)	Infestations:	Plague
Frost		For example	
	Landslides	Weeds	Venereal
		Phreatophytes	Disease
Hailstorms		Phreatoph	Rabies
	Shifting Sand	Water hyacinth	Hoof and
Heat Waves			Mouth disease
	Tsunamis	Hay Fever	Tobacco
			Mosaic
Hurricanes	Volcanic	Poison Ivy	Infestations
	Eruptions		for example:
Lightining Strokes and Fires			Rabbits
			Termites
Tornadoes			Locusts
			Grasshoppers
			Venomous Animal Bites

Source: Burton et al, 1978, p. 21.

hazards under consideration by geographers are those of the geo-physical type, and within this group much attention by natural hazard researchers seems to be centred on droughts, earthquakes, floods and tropical cyclones. Apparently, these contribute on average about 90% of the world's annual natural disasters, which is distributed as; 40% (floods), 20% (tropical cyclones) and 15% each for droughts and earthquakes (Burton et al, 1978, p.2). It is straight forward from the above that the burden of natural hazards is climatic in origin

As regards their occurrences, most of the geo-physical hazards can occur in any part of the world. But however, events so far have shown that wide-spread occurrences of these is limited to certain environments (see Sheehan and Hewitt, 1969, White 1974, Burton et al, 1978). Looking at the Zambian situation, the country could be said to be relatively safe from many of the geo-physical hazards listed in Table 2.1. The only hazards of local significance are droughts and floods, with the former being much more of a problem, and therefore deserving more attention.

2.4. The Drought Hazard

2.3.1. Definition

The term drought, which is derived from the Anglo-Saxon 'drogoth', meaning 'dryland' has different connotations in various parts of the world[3] and arouses endless academic arguments as regards its precise meaning or definition. Numerous and varied definitions exist, mostly designed to approach the study of drought in a particular way that suits the interest and background of the scholar. At the centre of all this, seems to be the conditions that constitute drought itself. These conditions vary considerably in both space and time, making it extremely difficult to establish a definition that will have a universal acceptance. A comprehensive list of some of the common definitions in use including the parameters used to define them is provided by WMO (1975). A small fraction of them, plus those obtained elsewhere is given below.

Hushe in 1959 defined drought as a period of abnormally dry weather sufficiently prolonged for

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3. For instance, in Bali a period of 6 days without rain is drought, in parts of Libya droughts are recognised only after 2 years without rain and in Egypt any year the Nile river does not flood is a drought, regardless of rainfall (Ven Te Chow, 1964, p. 18-1)

lack of water to cause serious hydrological imbalance (i.e. crop damage and water supply and storage). Writing in the same year Linsley, et al defined it as a sustained period of time without significant rainfall. In 1967 Subrahmayan defined the term from three viewpoints; (i) to the meteorologist drought is a rainless situation for an extended period during which some precipitation should normally have been received depending on location and season, (ii) the agriculturalist considers drought as a shortage of moisture for his crops and (iii) to the economist drought means a water shortage adversely affecting the established economy of a region (All the definitions quoted by WMO, 1975). The British Weather Bureau, on the other hand makes two distinctions in their definition of drought, one as 'absolute drought' (a period of at least 15 consecutive days with less than 0.25mm of rain on any day) and the other as 'partial drought' (a period of 29 days of which some may experience slight rain but during which the mean daily rainfall does not exceed 0.25mm) (Wittow, 1984, p. 155). Others like Gibbs (1975), WMO (1975) Lee (1978) and Sandford (1978) define drought in the context of supply and demand for water. To them lack of water sufficient to meet requirements is seen as a satisfactory definition as any other. An expanded version of this definition is that "drought is a rainfall induced

shortage of some economic good brought about by inadequate or badly timed rainfall" (Sandford, 1978, p. 34). This kind of definition which the present study also adopts places emphasis on the point that drought is not an absolute condition but is relative to human demand for water for a multiplicity of purposes.[4]

To sum up, we see from the above definitions that though the term drought is defined differently, the key unchanging factor in all situations is water availability or rather lack of it. But to say drought is simply lack of water is not enough. A more complete and less confusing interpretation of the term is when we introduce the aspect of supply and demand. It is logical to say that what is regarded by a farmer growing maize to be drought may not necessarily cause concern to a farmer rearing sheep. Indeed as writes Beran and Rodier depending on the range which normal farming practices allow, drought would be declared at different times by different farming systems (Beran and Rodier, 1985). Also important to note is that when the idea of supply and demand is introduced in the definition as argued by Sanford "it means that any drought incidence depends not only on rainfall but also on trends

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4. Reference for the present study is made to agricultural activities.

or fluctuations in requirements and on the factors other than weather which influence supply" (Sandford, 1978, p. 34).

2.3.2. Characteristics

It is evident from the foregoing discussion that drought is a relative term rather than an absolute condition. The essential feature to note about the drought concept is that it is tied to the idea of a deficit in the supply of water for some specific purpose.

Droughts unlike other climatic hazards do not develop overnight; they are usually the culmination of a set of weather sequences that require extended periods of time to develop (Winstanley, 1976, p. 193). Because of the slow build up, Wilhite best describes the hazard as "a 'creeping phenomena', whose consequences accumulate slowly over periods of time" (Wilhite, 1982, p. 333). In relation to the above observations, it must be borne in mind that the onset and end of the hazard is rather vaguely defined. The thing is, it is difficult to tell at what date a drought started and what date it ended and even how long it lasted. For instance,

the famous Sahelian drought which began in the late 1960's is claimed in some quarters to have ended in 1974 (UN, 1977, p. 4) but this is disputed by some other people who say it continued up to the 1980's (Hare, 1984, p. 288-90). But what is obvious about drought is that its duration compared to other climatic hazards is relatively much longer.

Last but not least, it must be pointed out that droughts are highly unpredictable events both in space and time. They may occur in any part of the world, but their nature may differ from place to place due to different physical conditions and the human use-systems.

2.3.3. Causes of Droughts

Studies that have focused on the causes of droughts are numerous and varied (e.g. Lydolph, 1964; and Macleod, 1976). They date as far back as the early 20th century, but a comprehensive study on the subject can be traced to Tannehill (1947). Like the drought concept, the causes of drought also form one of the main areas of controversy in drought studies. Up to date there is no universally

accepted explanation on the matter. In a way, as we shall see later this kind of situation is not surprising since many factors come into play in producing drought conditions.

A general survey of the exisiting literature shows that three main explanations are advanced on the causes. These being: (i) that droughts are cyclical events and are related to global natural trends of weather and climatic phenomena. Tannehill (1974), the chief architect in this school of thought, argues that droughts are not mere chance occurrences but are part of a physical process and their cause should be seen in the context of the general theory that climate is controlled by variations in solar radition.

(ii) that droughts are random events. This view point maintains that droughts do not follow a particular pattern of occurrence and that they are a reflection of climatic inconsistances or fluctuations in weather and climate. Roberts and Lansford (1979) write that various processes and forces, arising from the interation of the three terrestrial components; the atmosphere, the hydrosphere and the cryosphere are involved in producing weather and climatic fluctuations, of which a full comprehension is lacking at the moment.

(iii) that droughts are caused by a combination of climatic fluctuations and anthropogenic factors. The Sahelian drought, as we shall see in detail later, is cited by many; Glantz (1975), Winstanley (1976), Ofori-Sarprong (1983) and Hare (1984) as a clear example where both physical and human factors have equally contributed to the disastrous drought situation.

Essentially the cause of drought as many would argue is triggered by atmospheric factors. Supplementing this idea Obasi points out that in any drought situation the usual factors that we come across include: "(i) lack of adequate moisture in the area affected, (ii) absence or weakned organized atmospheric rain generating systems during the rain season and (iii) persistent wide-spread subsidence which often results from large scale global circulation (Obasi, 1984 p. 1). Whilst the atmospheric factors are the main driving force behind droughts, it can not be denied that anthropogenic factors also play an important role. In fact, recent research especially in the Sahel suggests that anthropogenic factors cannot be isolated from climatic ones. Bryson (1976) looks at the shift of the Monsoons southwards as something that has probably been initiated by industrial pollution and the burning of fossil fuels. Macleod explains that the large

scale presence of dust in the Sahel, (a product of poor agricultural practices) prevents the normal development of rain-producing clouds within the Monsoon winds despite the presence of normal amounts of atmospheric moisture and hence increase the probability of droughts. It is further said that "the presence of dust in the region increases the southernly dimension of the trough of easternly winds, which prevents the ITCZ moving into a more northernly or normal position and thus prevents rainfall from occuring in a normal pattern; that is it produces a tendency toward drought in the Sahel" (Macleod, 1976, p. 230). Others as writes Hare (1984) introduce the albedo hypothesis, which supposes that the reduction of plant cover raises the reflectivity of the earth's surface to solar radiation (albedo). This in turn intensifies subsidence in the overlying airstreams and hence leads to the dispersion of cloud and the supression of convection.

The above, provides us with a broad picture on the main explanations regarding the causes of drought. Equipped with this, let's now briefly focus our attention on rainfall, which is by far the single most important factor in any drought situation. This will be done with reference to Southern Africa, as this is the region that matters most for the present study.

Rainfall over Southern Africa, except for a small

area around the south-western cape is a summer phenomena. The dominant rain producing mechanism over the sub-region (see 2.5.1 for details) is the Inter-tropical convergence zone. This zone is not static and maintains a fluctuating state of behaviour. Rainfall distribution is thus greatly affected by it. Because of its changing position and behaviour, rainfall variations are considerable in the sub-region. (See Table 2.2.). These variations are random and cannot entirely be predicted in advance. With most of the agricultural systems of the sub-continent being adapted only to a certain range of rainfall conditions, any shortfall of rainfall from the normal or badly timed rains brings disastrous effects on crop production and other agricultural activities. The sub-region's agriculture is highly sensitive to seasonal and yearly variations of rainfall; the problem of rainfall variability is therefore crucial in explaining drought occurrences in southern Africa.

In summary, to what has been discussed in this section, it is important to bear in mind that although droughts are triggered by atmospheric phenomena , their causes cannot be explained in terms of the physical factors alone. Human factors too need to be considered. After all, as mentioned earlier there are an aspect of the interaction between the natural and human use system.

TABLE: 2.2 MEAN MONTHLY AND ANNUAL TOTAL OF PRECIPITATION (mm) FOR A FEW SELECTED STATIONS IN SOUTHERN AFRICA

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
KOTA KOTA (MALAWI)	298	336	528	57	14	8	5	6	4	22	54	267	1,599
HARARE (ZIMBABWE)	193	178	115	29	12	2	1	2	6	27	94	172	831
MKUSHI (ZAMBIA)	191	150	160	24	2	0	1	4	2	11	79	234	958
FRANCIS TOWN (BOTSWANA)	113	60	81	19	7	2	1	1	3	25	56	87	455
ZUMBO (MOZAMBIQUE)	130	188	110	4	1	1	0	0	0	4	56	156	770
MBABANE (SWAZILAND)	255	214	199	72	33	20	23	27	62	162	171	209	1,442
MASERU (LESOTHO)	99	92	94	54	25	13	13	16	21	56	77	76	636
UPINGTON (S. AFRICA)	16	25	42	19	13	2	2	3	3	7	11	13	156
KOMAT POORT (S. AFRICA)	131	114	114	38	17	7	10	8	19	45	85	93	684
WINDHOEK (S.W. AFRICA)	77	74	83	40	7	1	1	1	2	12	24	48	362
WALVIS BAY (S.W. AFRICA)	0	1	6	2	1	0	0	0	0	1	1	0	12

SOURCE: Lebeder (1970) p.152-193.

2.3.4. Impacts of Droughts

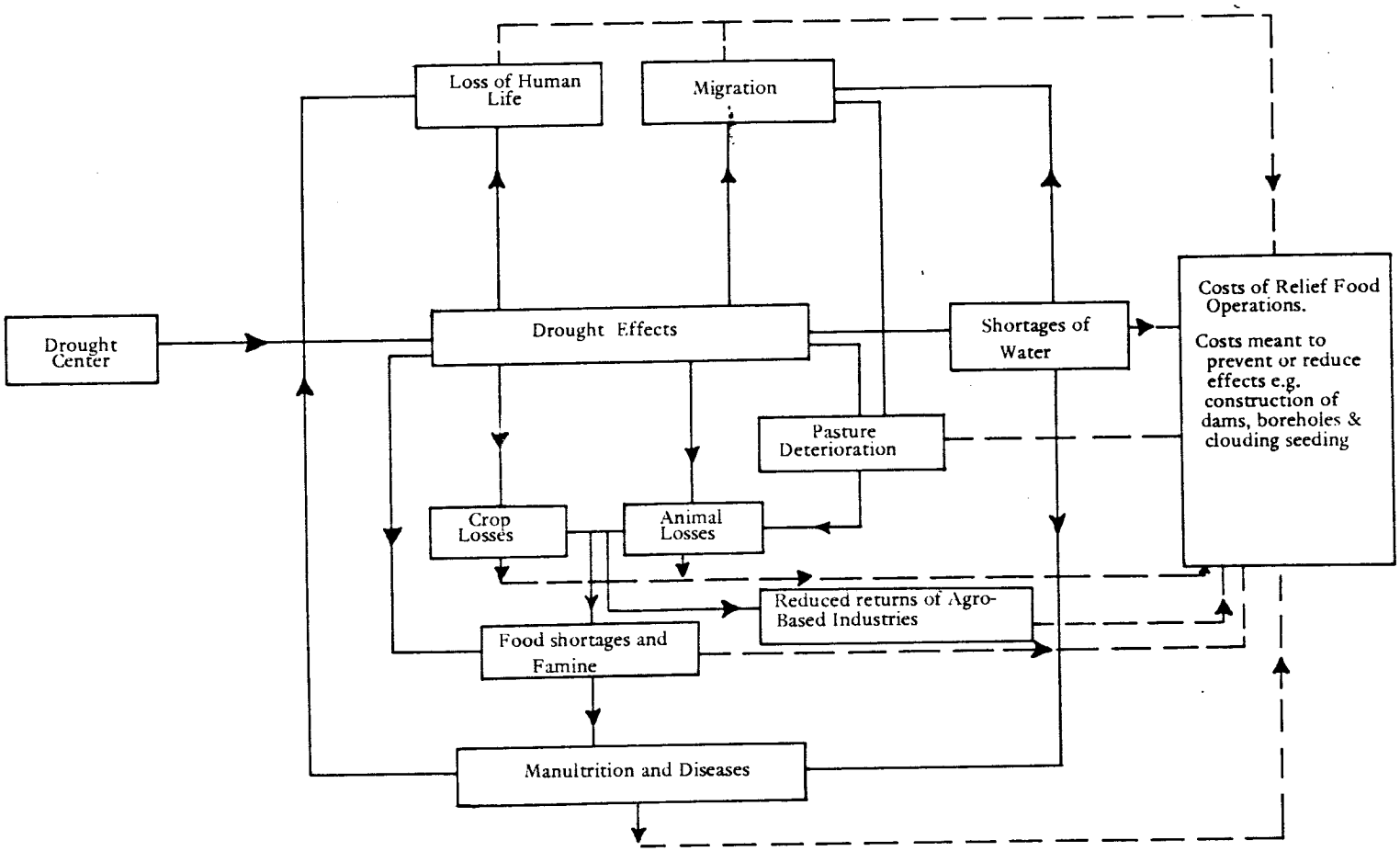
Extensive literature, originating as far back as the 19th century exists on this subject. Drought impacts or effects have been examined for a long time at both micro and macro levels, but still continue to attract public and scholarly attention. Scholarly interest in this area is mainly reinforced by the fact that droughts whether of the same magnitude or not generate contrasting effects in both space and time. Furthermore, since time immemorial droughts have continued to be one of mans worst natural enemies despite the many thrusts that have been made in the various fields of human endeavour. For example, the Sahelian drought of 1968-73 resulted in the death of people estimated at more than 100,000 and left thousands suffering from malnutrition and drought induced diseases (UN 1977, p. 4). The recent African drought of the 1980's, which is still causing havoc on people's lives and national economies in much of the Sahel, had between 1981 and 1984 brought more than 150 million people in 24 western, eastern and southern Africa to the brink of starvation and claimed thousands of lives

(Sunday Times of Zambia, 6 Jan. 1985, p. 3).

Fig. 2.1 illustrates that drought impacts are of various forms. The most obvious and direct ones include; loss of life, livestock deaths, famine, migration, pasture deterioration, reduced food outputs and returns of most agricultural products and domestic and industrial water supply (WMO, 1975, p. 1). Most of the impacts as seen above centre around agricultural activities, which in turn produce a series of secondary or host consequences such as the cost of efforts expended to prevent, reduce or replace the main losses. It is noteworthy to mention at this point that drought effects usually tend to spread out to many areas of the local or national economy, other than say agricultural and pastoral industries. Also at stake nowadays is that these effects are not only felt by the local inhabitants or nations in the affected regions but by the international community as well. For instance, massive relief from technologically advanced nations are usually applied each time there is a major drought occurrence in Africa (like the ones cited earlier on) or in some parts of the 'Third World', to avert starvation and other drought related problems.

As previously indicated each drought episode is marked by dissimilar impacts. Early studies attributed

FIG. 2.1 : GENERALISED DIAGRAM ON THE EFFECTS OF DROUGHTS



this variation mainly to the physical characteristics of the hazard alone, but recent studies such as Copans (1975), Lofchie (1975), Watts (1983), Ofori-Sarprong (1983) and Campbell (1984) show that there are also related to social, economic and political factors.

2.3.5. Drought Perception and Adjustments

Literature on drought studies, involving perception and adjustment,[5] the two key areas of natural hazard research, is not extensive and dates back to a few years around the 1960's. Though research in this field is relatively recent and still in its developmental stages, great advances have been made, which have contributed significantly towards the understanding of the drought concept and in dealing with drought related problems. Below is a brief outline of some of the most important studies done.

The studies on drought perception and adjustment start with Saarinen (1966), who carried out his investigations in the great plains (U.S.A.). This study apart from employing the traditional

natural hazard research techniques, introduced for the first time a comprehensive perceptual approach to natural hazard studies. In general Saarinen's study showed that perception albeit being subjective in nature was important in explaining the kinds of agricultural decisions the farmer makes in the face of drought or any other hazard. Similarily, Heathcote (1969), while examining the problem of droughts in Australia found that perception was not only vital in the interpretation of the drought concept but also in explaining man's occupance of drought prone areas and why he often fails to respond effectively to the hazard.

The study of Berry et al (1972) on the human adjustments to the agricultural drought in Tanzania advances a theoretical model of choosing optimal set of adjustments and observes that communities in the

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5. Within the natural hazard research field, these terms are defined as follows;

> Perception implies the individual organization of stimuli to an extreme event and it is usually revealed in the language people use to describe the event, their ability to remember and describe past events and their attitude towards its occurrence.
> The term adjustments on the other hand refers to those human actions intended to reduce or minimize the negative impact of an extreme event. (White, 1974).

affected areas practiced a wide range of adjustments. The study re-affirms earlier conclusions drawn from flood hazards that in areas of recurrent hazards man tends to adopt better ways of dealing with the hazard than in less hazardous environments (White, 1964,). Heijnen and Kates (1972) and Hankins (1974) in separate studies on drought hazard experiences in Central and North-Eastern Tanzania, point out among other things that whilst differences in moisture within the drought prone areas produced some contrasting ecological adaptations or longterm adjustments, short term adjustments remained universally the same. But it is also pointed out that although short term responses tend to be the same, the flexibility of such responses tends to vary according to moisture.

Hitchcock (1978) studying traditional response to drought in Botswana notes that despite their simplicity, traditional responses act as important mechanisms for alleviating social stress among the affected persons. He also demonstrates that the well being of these responses or adjustments can not be isolated from the general political economy of the areas under study.

In a study entitled, 'Some sociological aspects

of drought' Prah (1978) states that traditional societies in different historical epochs had created certain socio-cultural features in their fight against drought and aridity, which were in balance with the natural environment. He argues that some of the contemporary social problems of drought have arisen simply because the natural balance between societies has been rapidly altered without the culture having adjusted to the provisions of the environment.

Lastly, Campbell (1984) in a follow up of those who have incorporated a historical approach observes that people living in drought prone areas tend to develop a range of strategies for reducing its effects, but that their effectiveness, apart from being related to such things as the magnitude of the hazard, has also to do with their viability within the changing broader social, economic and political environment.

2.4 . Rainfall and Drought Conditions in Zambia

2.4.1. Rainfall

Lying between 8^{o} and 18^{o}S, Zambia is subjected

to the prevailing winds from the south-east, north-east and from the west (the Zaire air). The south-east airstreams bring predominantly stable airmasses, while the other two carry equatorial air which is usually unstable and humid. These three airstreams, converge over southern Africa during the summer period (see Fig. 2.2.), a situation that is primarily responsible for rainfall in the sub-region. The convergence zone of the named airstreams, popularly referred to as the inter-tropical convergence zone or simply the ITCZ is never static, it fluctuates or shifts according to the prevailing atmospheric conditions. In as far as Zambia is concerned, the ITCZ becomes well established during December and remains so until February. Before December, the bulk of the country's rainfall is associated mainly with the incursions of a moist north-westerly airstream (Zaire air), which starts to affect the north-western parts of the country as early as September. It is worthy to emphasize at this point that much of the country's rainfall is associated with the position of the ITCZ and the movement of the Zaire air, which in addition to being very moist, remain much longer in the country than the other two airstreams. According to Mumba and Chipeta "the preferred

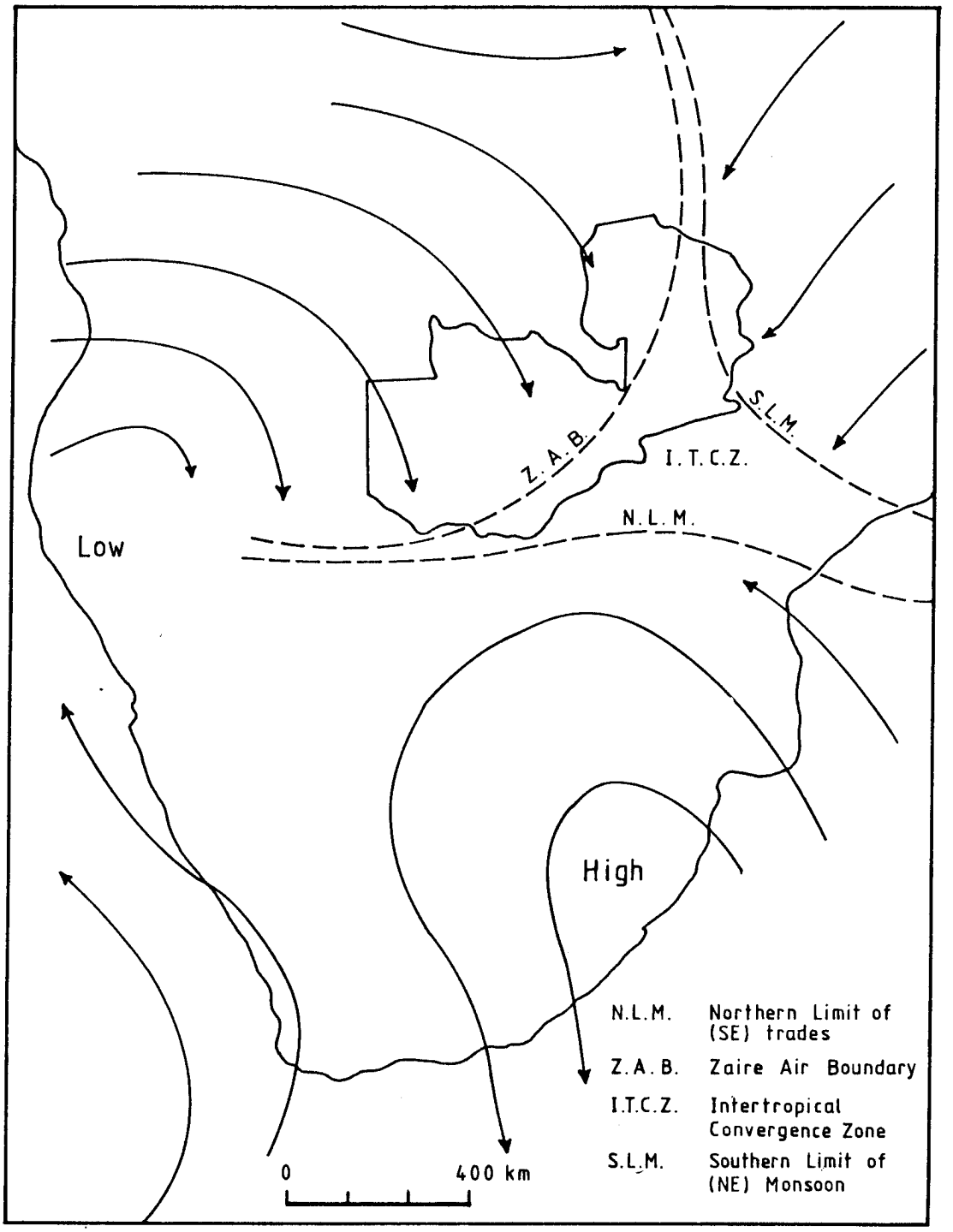


FIG. 2·2: GENERALISED PATTERN OF AIR FLOW OVER ZAMBIA DURING SUMMER.

Adapted from Mumba Z.L.S & Chipeta G.B. (1984)

position of the ITCZ is about 17°S, (an area close to or along the Zambezi Valley) as more northerly position than this usually results in drought conditions particularly in the southern half of the country and a mean position of 18-20°S is characterised by very wet conditions throughout the country" (Mumba and Chipeta, 1984, p. 4). The significance of the moist Zaire air mass can be seen by the fact that they contribute to the high rainfall received in the northern parts of the country. And since they progress from north to south over Zambia during October and November and leave the country in the opposite direction in March or April, they greatly influence the distribution of rainfall, allowing a decreasing rainfall gradient from north west to south east.

Rainfall in Zambia is seasonal in character, ranging in duration from mid-November to mid-March (120 days) in the south and from late October to mid-late April (170-185 days) in the north-west and north. Illustrating this point are Figs. 2.3, 2.4 and 2.5 which show the mean duration of the main rains and the onset and retreat of rains in the country. The dates shown on the maps for the onset and retreat of rains should

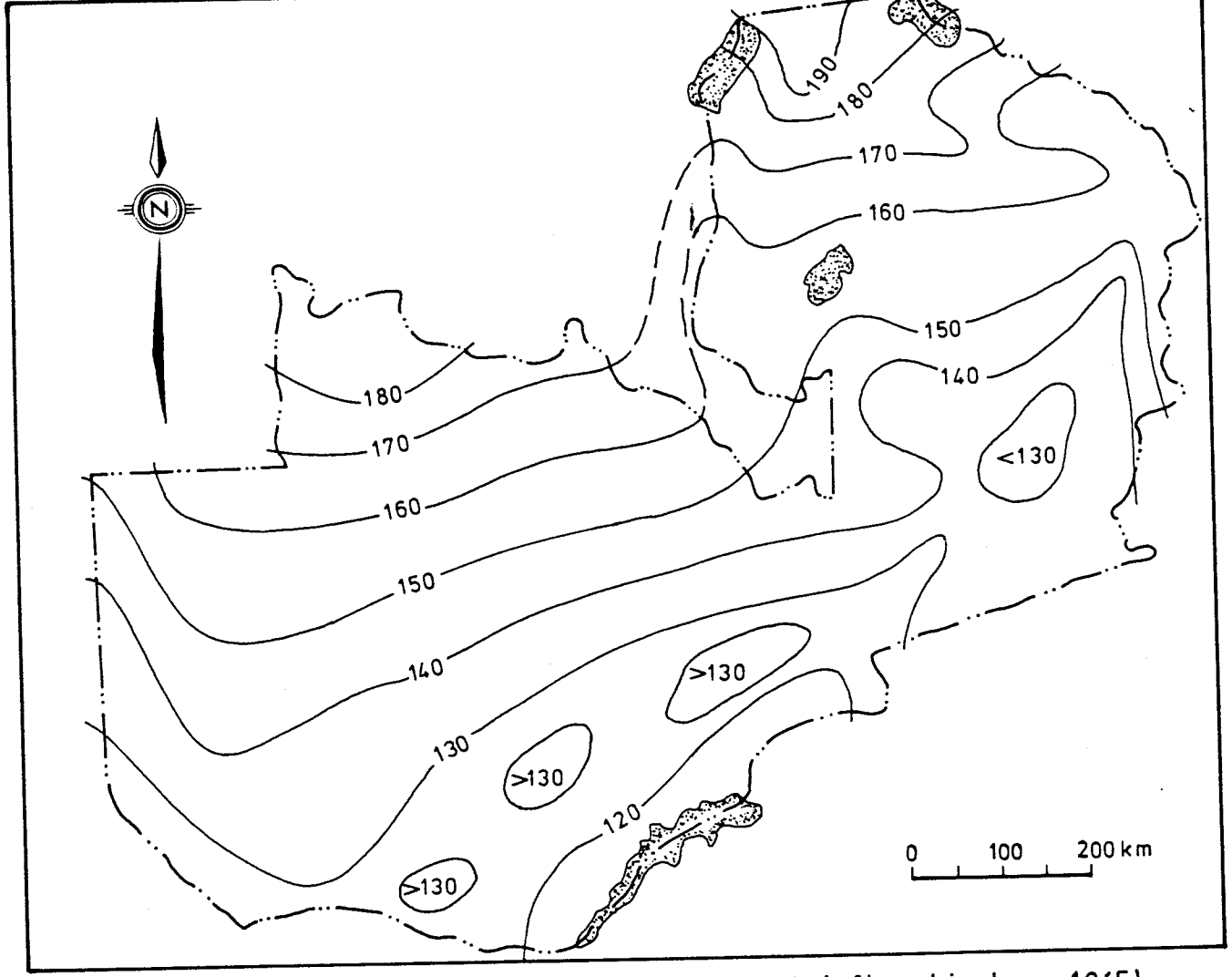
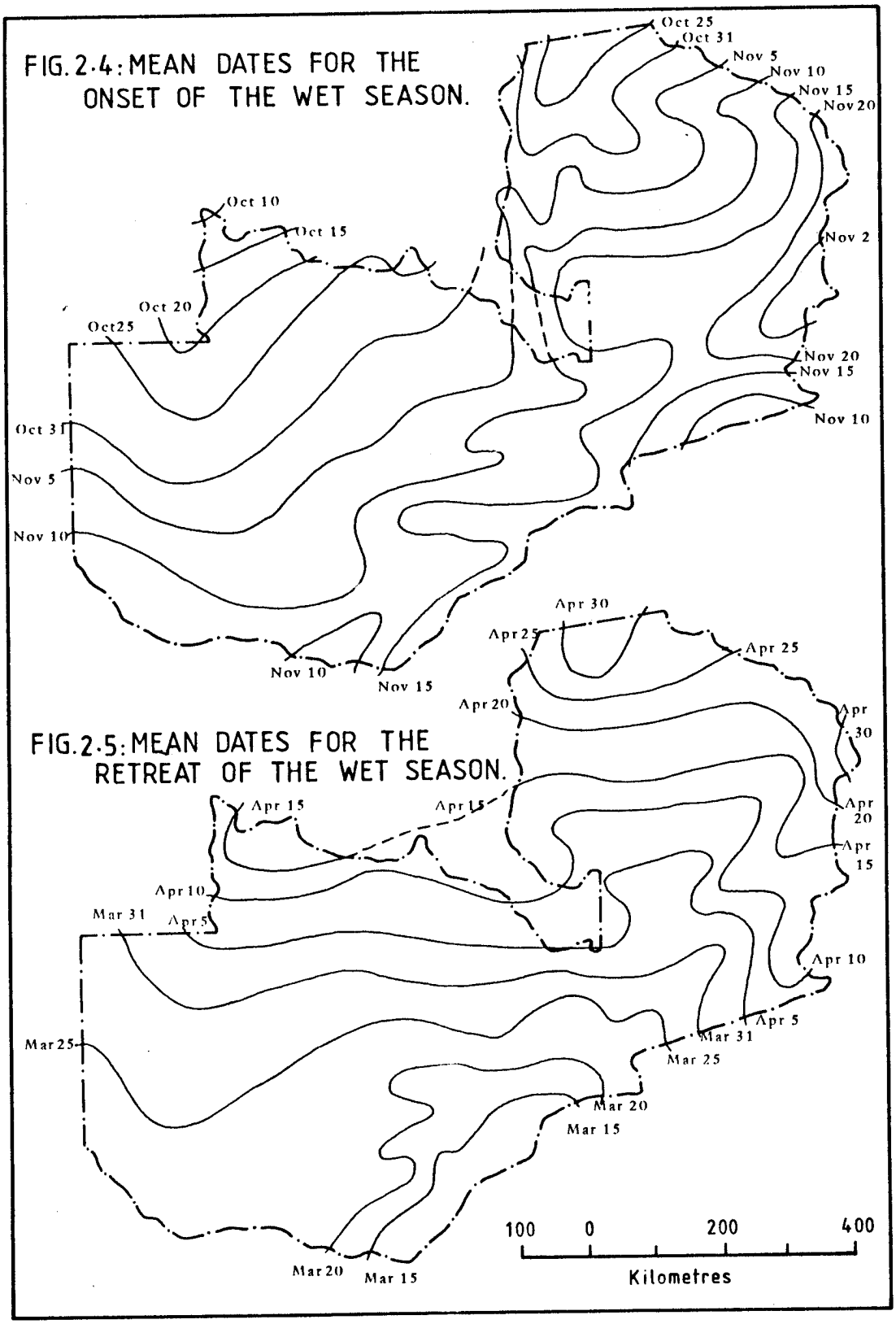


FIG.2-3: MEAN DURATION OF THE RAINY SEASON (after Lineham, 1965).



Source: Hutchinson, 1974.

not be seen as enclosing all the rains in the country, as before and after, isolated showers may occur. It is also worth noting that rain within the rainy season is not continuous. Periods of dry spells are quite common even in wettest months.

The average annual rainfall varies from 1100 to 1500 mm per year and across the country, as illustrated by Fig. 2.6, it ranges from about 1400 mm in the north and north-west to 700 mm in the south (Hutchinson 1974). Thoug the pattern of the mean annual rainfall distribution maintains a decreasing gradient from north-west to south-east, there are some anomalies with it. Anomalies to this pattern are largely attributed to variations in surface relief (Lineham, 1965 and Hutchinson 1974).

Rainfall variability in the country, as briefly outlined above should not only be seen in the context of say annual rainfall totals but also of variations that occur from year to year on a monthly basis. These variations too are very pronounced (see Table 2.3). In all, rainfall variations are greatest in the southern parts of the country and are largely as a result of the movement of the ITCZ, with altitude playing a minor role (Nieuwolt, 1972, p. 47-56).

In summary, we note from the above discussion that

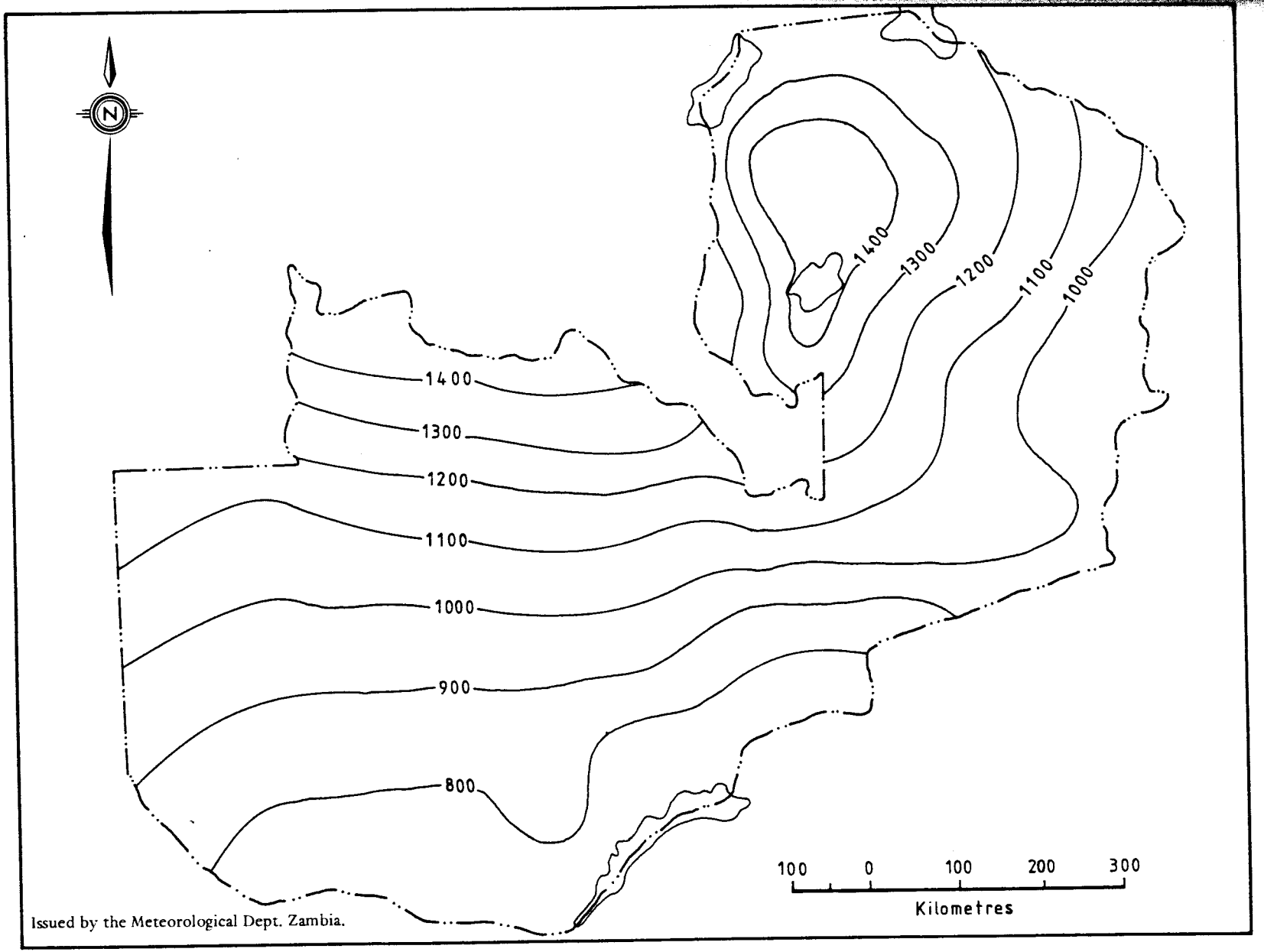


FIG. 2·6 : MEAN ANNUAL RAINFALL (mm).

TABLE 2.3 MONTHLY RAINFALL TOTALS FOR A FEW SELECTED PLACES IN ZAMBIA

PLACE	YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
MBALA(MET.)	1971–72	–	–	30.0	21.1	213.1	337.6	249.9	239.8	260.9	99.8	16.8	–	1,470.0
($8^{o}51'S$)	1972–73	–	2.3	2.0	38.6	176.3	217.7	273.6	264.8	88.2	107.5	70.7	–	1,241.1
	1973–74	–	–	0.8	11.4	49.3	215.6	180.2	112.9	130.8	211.6	143.6	1.0	1,057.2
	1974–75	0.5	–	0.8	16.8	119.7	259.9	256.9	117.3	297.8	208.5	2.5	–	1,281.1
KABWE RESEARCH STATION	1971–72	–	–	–	6.6	109.8	250.5	304.5	101.6	61.5	12.9	–	–	847.4
($14^{o}24'$)	1972–73	–	–	–	22.6	30.8	112.2	83.7	250.3	29.4	7.8	–	–	536.8
	1973–74	–	–	1.0	26.2	140.9	345.3	371.4	111.3	99.2	14.2	42.0	–	1,231.5
	1974–75	–	–	–	–	142.4	334.6	202.1	244.2	128.8	6.2	–	–	1,058.3
LIVINGSTONE (MET)	1971–72	–	–	–	1.0	80.8	134.6	314.7	105.4	145.0	51.8	–	–	833.3
($17^{o}50'$)	1972–73	–	–	6.9	47.5	24.1	113.5	181.3	82.1	11.1	24.7	2.0	–	493.2
	1973–74	–	–	1.5	26.7	107.7	358.0	309.4	196.4	31.2	3.5	1.8	–	1,036.2
	1974–75	–	–	7.8	10.7	111.6	329.8	219.4	118.8	88.0	4.5	22.3	–	911.9

Data Supplied by Meteorological Dept.

the annual rainfall over much of the country is moderate to meagre, with both regional and seasonal differences being considerable. The southern parts of the country are less favoured and any shortfall in rainfall could have disastrous effects on crop production.

2.4.2 Drought Conditions

Preliminary analysis of drought occurrences or incidences in Zambia show that drought is a highly localised phenomena. It is very uncommon to find the whole country subjected to drought conditions at any given time. Going by Simango and Das' study, variations in drought incidences in the country are quite pronounced at both district and provincial levels, with some areas for instance, experiencing drought conditions at an average of two in every three years, while in some other areas it is at an average of one in every four years (Simango and Das, 1977).

A survey of the country's annual meteorological reports and district and provincial agricultural reports indicate that drought incidences are a common feature in areas of erratic rainfall (see

Fig. 2.7). Typical areas with such rainfall conditions include; the extreme southern parts of Southern Province (Gwembe Valley mostly), the Luangwa Valley and the south western parts of western province. In these areas, as writes Muchinda "rainfall rarely exceeds the potential evapo-transpiration (PET) and any departures from the normal, especially in places of lighter soils tends to generate serious drought conditions" (Muchinda, 1985, p. 176). Elsewhere in the country rainfall reliability and stability is relatively good and droughts tend to occur only when there is a substantial drop in rainfall from the normal.

2.4.3 The 1981-84 Drought.

As highlighted above, drought incidences in Zambia are highly localised in character. But in the early 1980's wide spread drought conditions were experienced in the country, probably for the first time.[6] This drought was not only perculiar

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6. In as far as the written records are concerned, wide spread drought conditions are not known to have occured in Zambia. This 'unsual drought' to Zambia formed part of the recent prolonged drought conditions in much of Western, Eastern and Southern Africa.

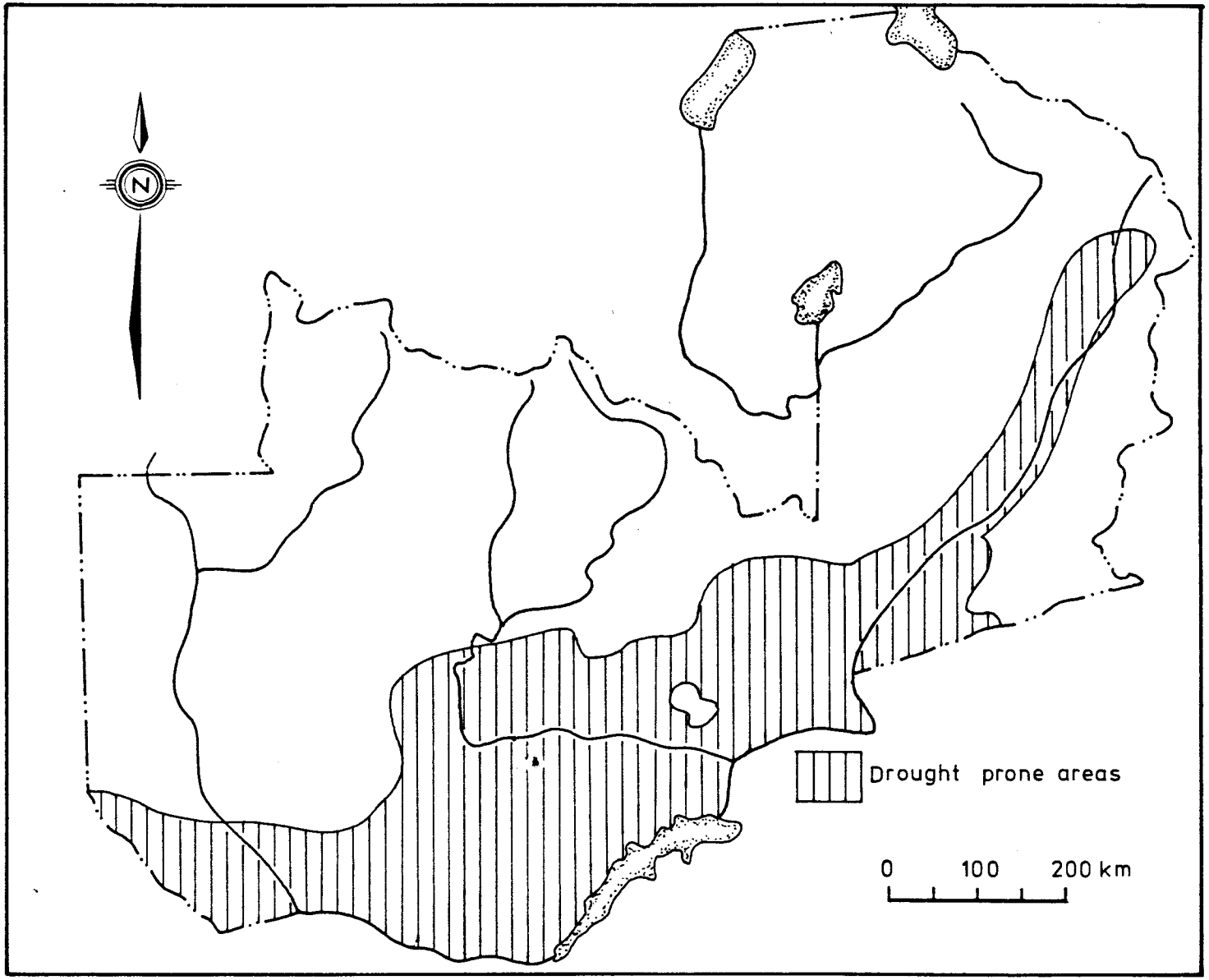

FIG. 2·7: DROUGHT PRONE AREAS OF ZAMBIA.

N.B. Compiled from various sources

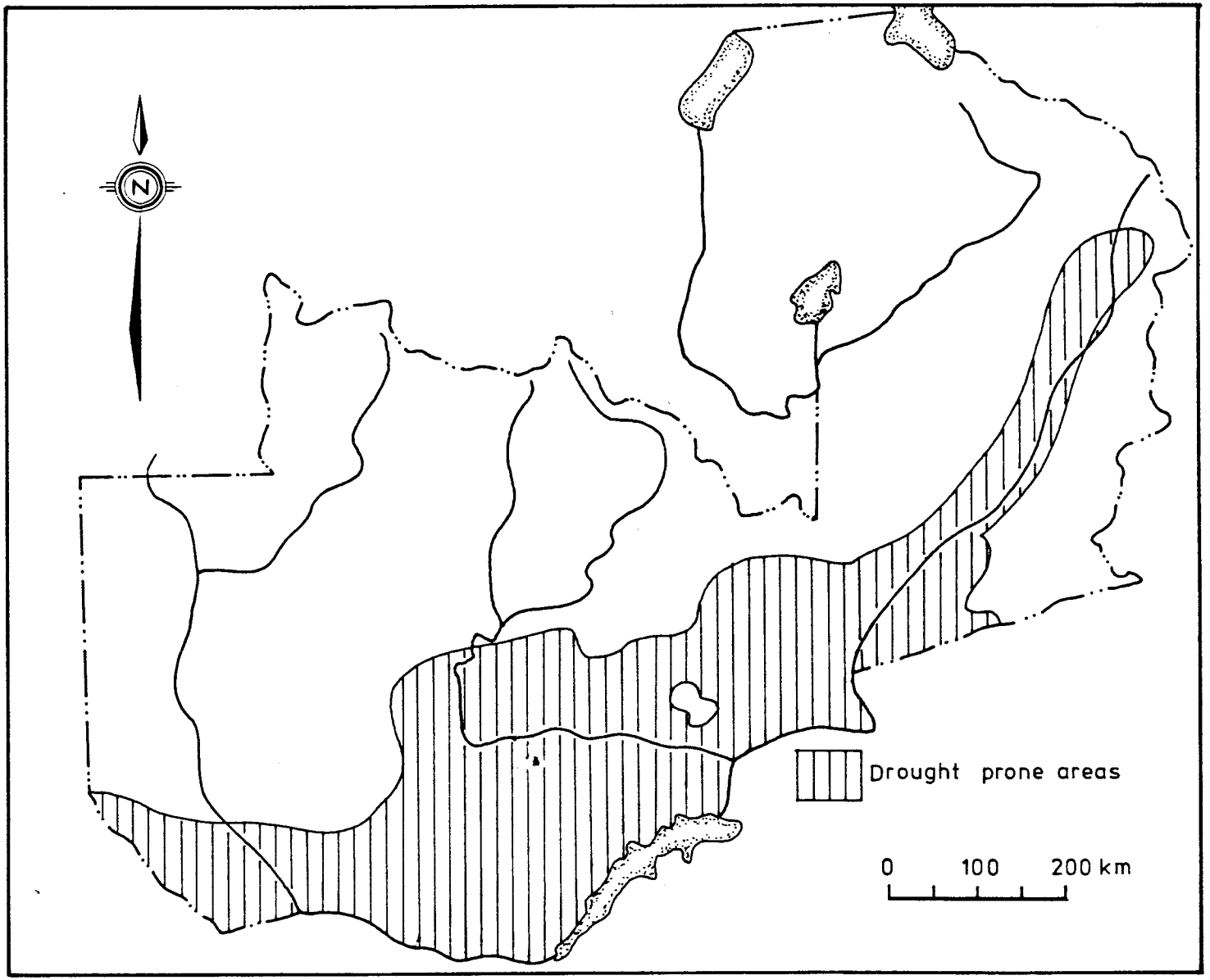

FIG. 2·7: DROUGHT PRONE AREAS OF ZAMBIA.

N.B. Compiled from various sources

in terms of its area of extent but also in duration and impact. Basically, it was brought about by poor rainfall conditions. The seasonal rainfall was in most cases far below normal. Figs.2.8, 2.9 and 2.10 illustrate this point. In addition to this and perhaps more important is the fact that the rains were at large badly distributed during the wet seasons. At times the rains came late or ended early, while in some other situations they were interrupted by long dry spells or tended to fall in heavy showers mostly.[7]

The drought under mention, had far reaching consequences and aroused awareness amongst the Zambian people that although the country has generally a good climate, she is not free from the vagaries of weather. The impact of the drought was greatest on the rural populations in some areas of the six provinces; Southern, Western, Northern, Lusaka, Eastern and Central (see Fig. 2.11), where most peasant farmers had poor or no harvests at all for the three consecutive years. In the Gwembe and Luangwa Valleys in particular, where the drought effect were the severest, most people had no

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7. For details on this factor (distribution) see rainfall summaries done on a ten day basis by the Meteorological Department.

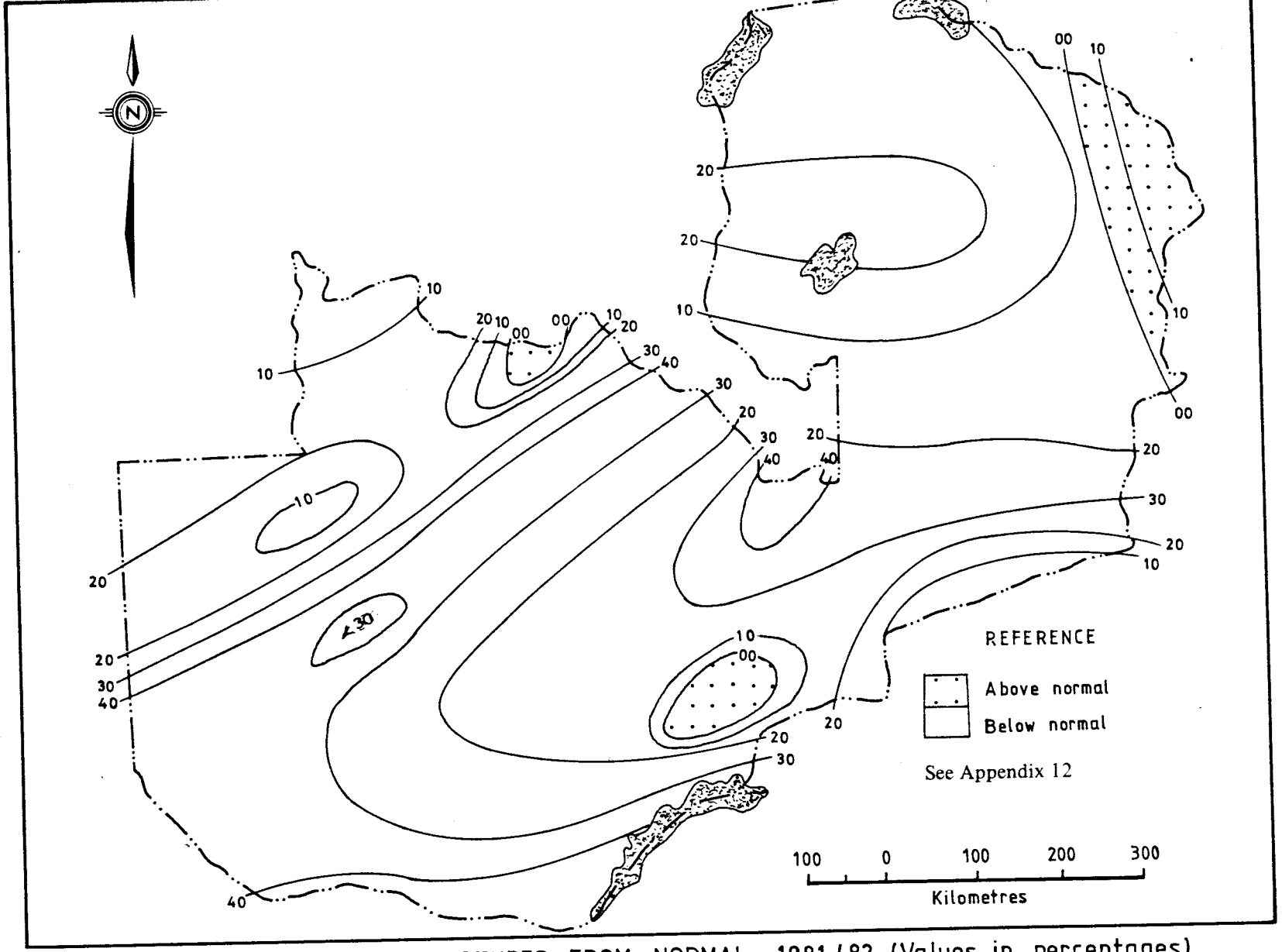


FIG. 2.8: ANNUAL RAINFALL DEPARTURES FROM NORMAL 1981/82 (Values in percentages).

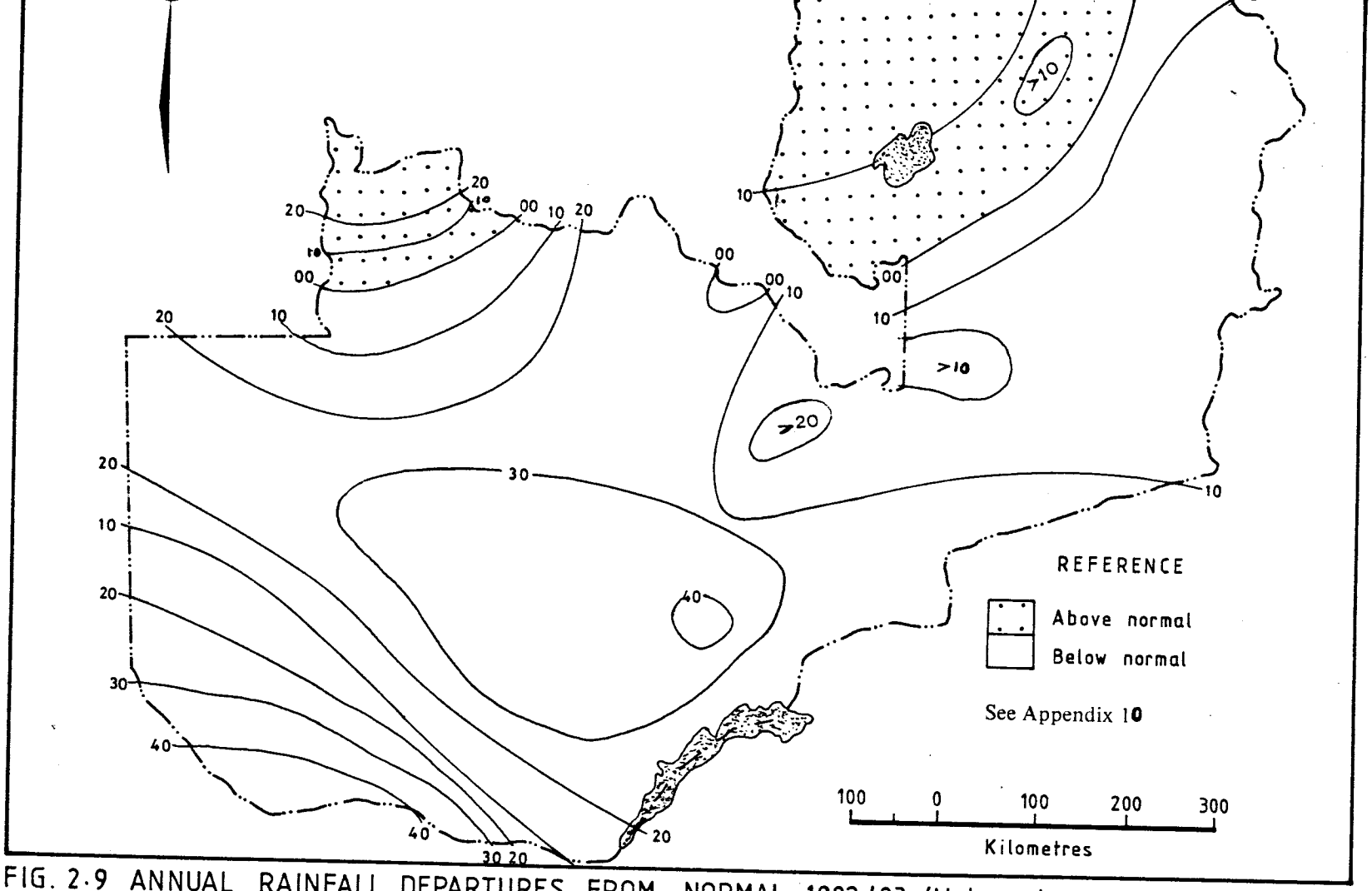


FIG. 2.9 ANNUAL RAINFALL DEPARTURES FROM NORMAL 1982/83 (Values in percentages).

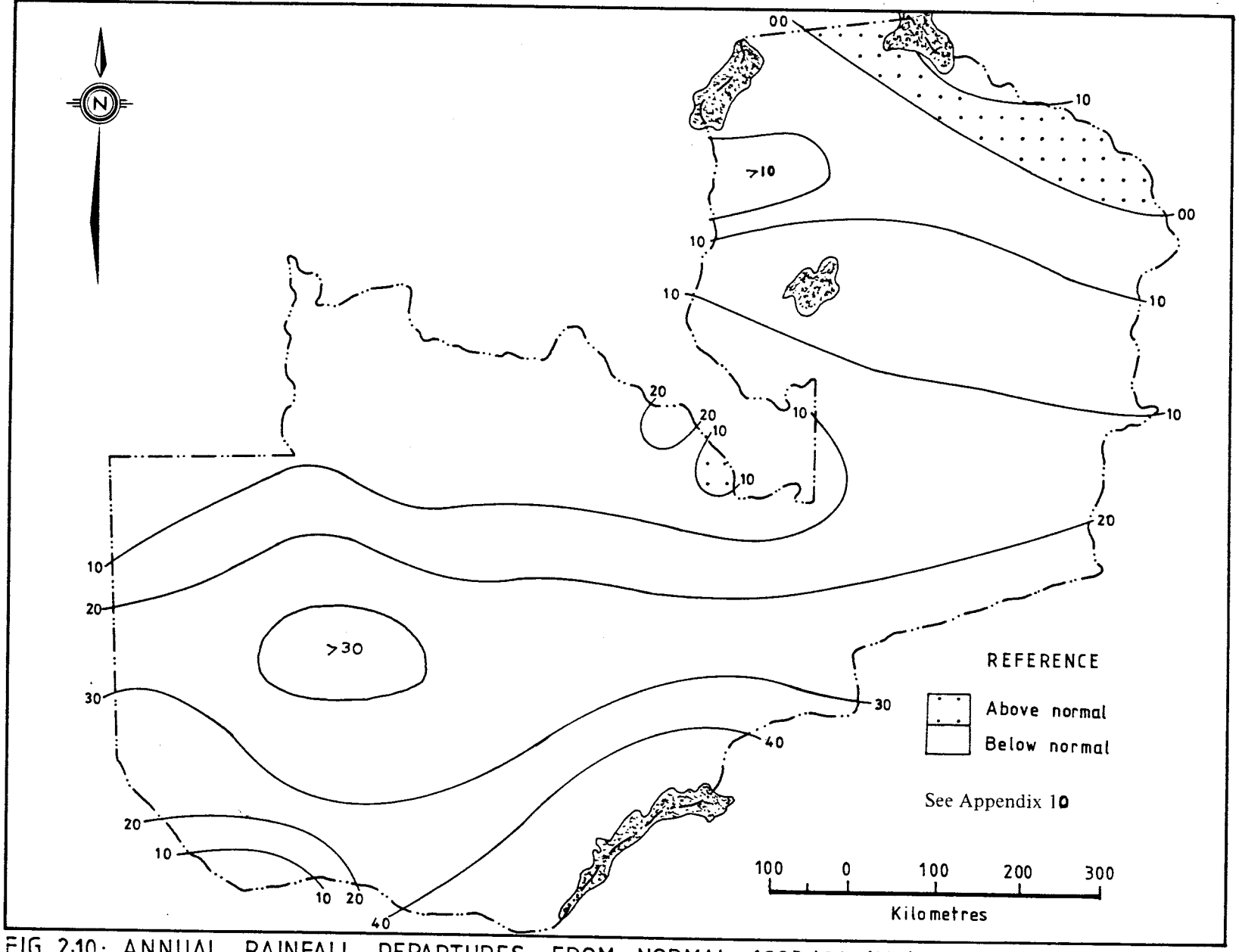


FIG. 2·10: ANNUAL RAINFALL DEPARTURES FROM NORMAL 1983/84 (Values in percentages).

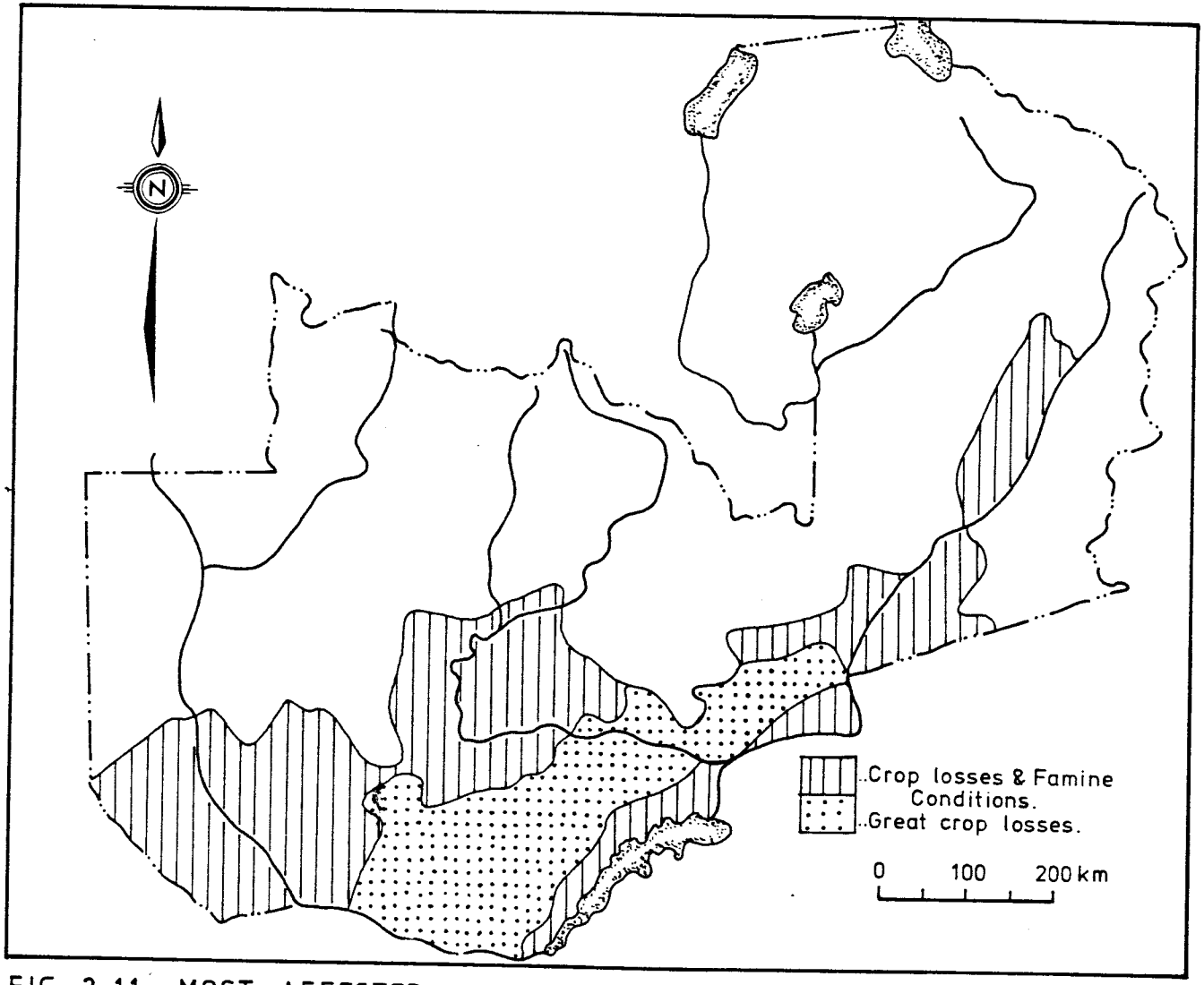


FIG. 2·11: MOST AFFECTED AREAS DURING THE 1981-84 DROUGHT.

food of their own and had to rely heavily on relief food for their survival. On the national level, the losses incurred from this drought were enormous. For example in the 1982-83 agricultural season alone losses from major crops were estimated at a value of 21.7 million U.S.A. dollars (Government Report, 1984, p. 5). With a fall in crop production, large importations of food stuffs, especially food grains were made. In addition to this there were many other losses that were met by the government, which included the construction of dams and wells in the Southern Province and the provision and transportation of relief food to affected areas.

CHAPTER 3

STUDY AREA: BACKGROUND INFORMATION

3.1 Introduction

The Gwembe Valley, sometimes referred to as the Mid-Zambezi Valley, roughly forms the present administrative area of Gwembe district, extending from the Batoka gorge in the west to either Kariba gorge or the Kafue confluence in the east (see Fig. 3.1). Its latitude and longitude locations are about 16-18^{o} and 27-29^{o} respectively. The Valley is aligned in the south west-North East (SW-NE) direction and is about 265km in length and 65km in width at the widest point.

As reflected in the locational map, the Gwembe Valley has since colonial times been divided into seven chief's areas namely; Munyumbwe Chipepo, Simamba, Singogo, Sinadambwe, Sinazongwe and Mwemba. But for administrative purposes these are grouped into three blocks and are termed as Gwembe Central, Gwembe North and Gwembe South with the administrative centre being at Gwembe

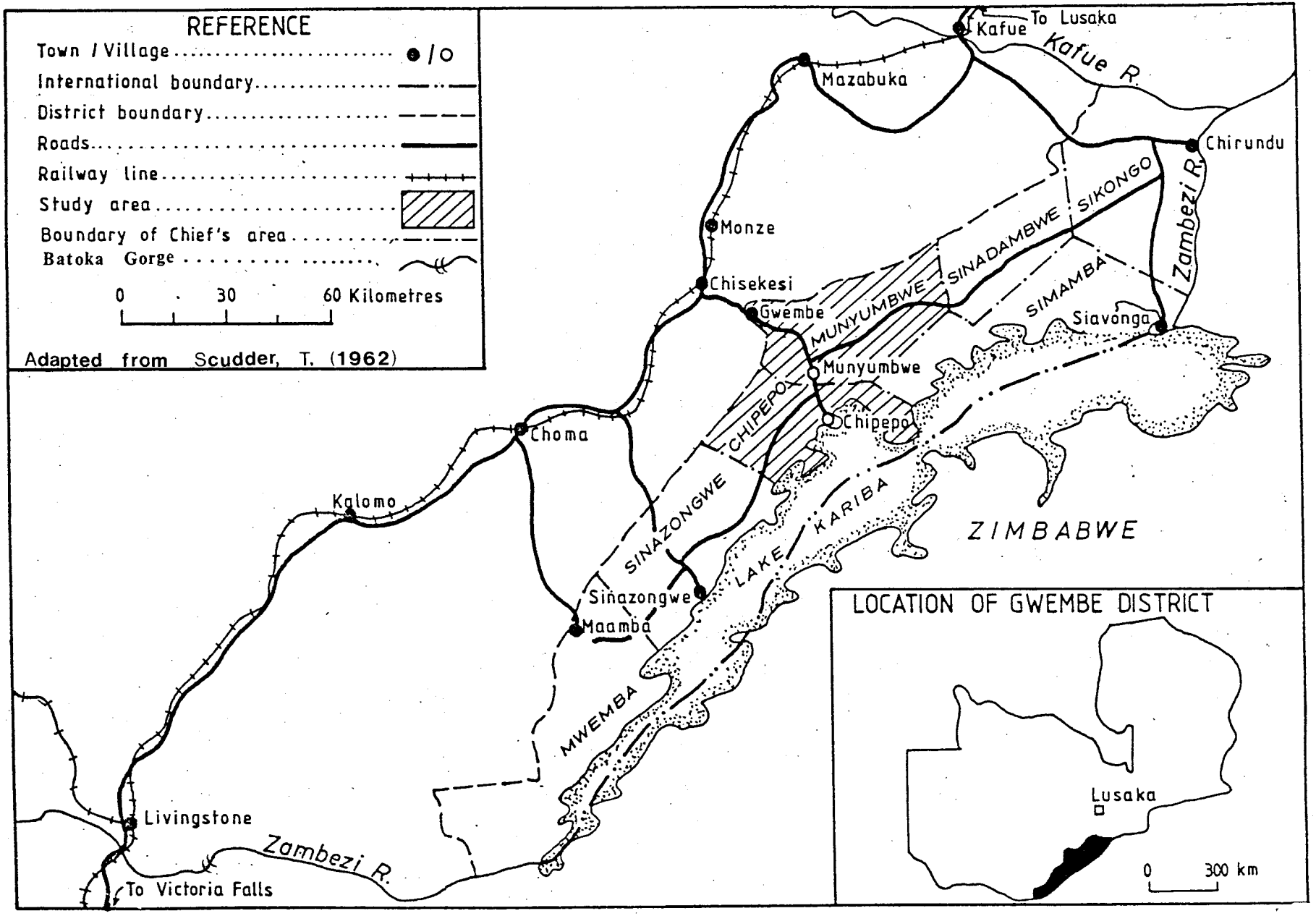


FIG. 3-1: GWEMBE DISTRICT: LOCATION OF THE STUDY AREA

(see Fig. 3.1). The areas of interest for this research are Chipepo and Munyumbwe (Gwembe Central).

3.2 Relief and Drainage

The Gwembe Valley is essentially a hilly country, consisting of an escarpment zone near the plateau and a series of steeply sloping ridges often 300 to 400 m high. According to Money (1974) this escarpment is not a proper escarpment in the strict sense of the term but rather is a zone of deeply dissected country. The higher parts of the valley range from 900 m to 1200 m high while the floor of the valley lies at a height of between 360-500 m above sea level. Much of the lowlying area formerly part of the flat flood plain of the middle Zambezi river is today occupied by lake Kariba. The formation of lake Kariba in 1959 caused large land areas of the valley to be drowned. It is estimated that an area of about 5,200 square kilometres, involving most of the land below 480 m contour was claimed by the lake.

In terms of drainage, the Gwembe Valley is

drained by several rivers, which were former tributaries of the Zambezi river, but now flow directly into Lake Kariba (see Fig. 3.2). All the rivers with an exception of the Zongwe river are seasonal in flow. This has to do mainly with two factors; the regions topography and geological structure allows rapid runoff.

3.3 Soils

The soils in the Gwembe Valley are of a varied character, developed over Karoo rocks and in colluvial sediments washed from them. Brammer recognises three basic types: (a) "the brown valley soils, which are well-drained and little leached, (b) brown podzolic soils which are well drained and mainly strongly leached and (c) solonetzic or hard pan soils, which have impeded drainage (Brammer, N.D., p. 38).

The brown valley soils, have their textures ranging from sandy loam to sandy clay loam, with a uniform brown or reddish brown colour. Their physical character is underlined by a high content of magnesium, calcium and other nutrients and their

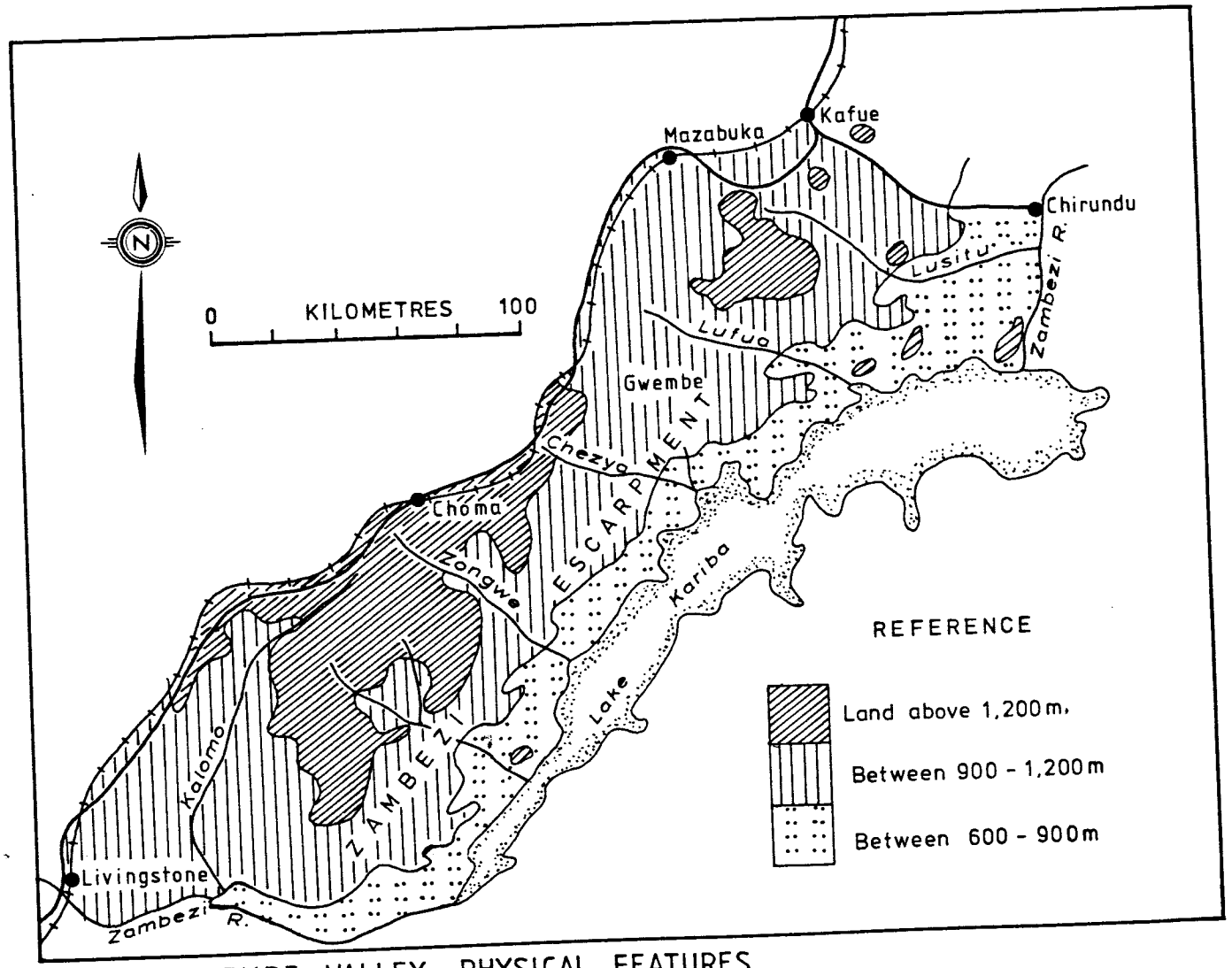


FIG. 3·2: GWEMBE VALLEY : PHYSICAL FEATURES

clay is of a type which holds nutrients. Hence they are potentially very fertile soils and can support a variety of crops, such as bananas, groundnuts, fodder crops and sugar cane, but their main problems as argued by Brammer is the hot and dry climate in which they occur (Brammer, N.D. p. 39). With soil moisture being a serious problem in the valley, their full potentials are not exploited. At present they are utilised mainly for the cultivation of food crops; sorghum, millet and even maize.

The brown podzolic soils are generally poor agricultural soils, although they support the cultivation of bulrush millet, sorghum and sweet potatoes. They are mainly sandy, with a small amount of clay and lack nutrients because of heavy leaching.

Lastly and least in terms of soil fertility are the solonetzic soils which range from dark-coloured clays under mopane woodland to grey sandy or loamy hardpan soils under grassland. These soils are found mainly in basin areas and pans and tend to be very compact in nature, sufficient to cause problems of root penetration and waterlogging conditions. Another serious setback of these soils is that they posses a high sodium

content, a thing that makes them extra difficult or hard to cultivate. Thus they are of little agricultural use, but nevertheless they could be developed for transplanted rice cultivation, as long as irrigation is applied.

3.4 Climate and Drought Conditions

3.4.1 Introduction

The climate of the Gwembe Valley is characterised by high and uniform temperatures and variable rainfall. The mean annual temperature is roughly 21.7°C. During summer in the months between September and December, the mean monthly maximum temperature ranges between 32°C and 38°C, while in the coolest months, June and July it is about 30°C. Rainfall is by far the most important element of climate and its distribution in both space and time has a large influence on human life and prosperity in the region. Throughout the region, rainfall is generally unreliable and poor. Scudder writes that "several dry spells may characterise a single season, of which some

are localised, while others affect the entire valley" (Scudder, 1962, p. 220-21).

The mean annual rainfall is roughly around 750 mm. Fig. 3.3 shows that the highest rainfall is experienced in the escarpment belt and decreases southwards. This pattern is dictated largely by the relief factor. Although the southern end of the Gwembe Valley suffers from the rainshadow effect, it is claimed by Hutchinson that the formation of lake Kariba has had some positive impacts on the rainfall of the surrounding areas. The surrounding areas of the lake are said to have gained substantial increases in rainfall (Hutchinson, 1975, p. 49-50).

Figs. 3.4, 3.5, 3.6 and 3.7 illustrate that rainfall varies considerably in the Gwembe Valley. These variations are of great concern because they act as a stumbling block to stable agriculture.

3.4.2 Drought Conditions

The Gwembe Valley as noted above is one of the main drought prone areas in the country. The droughts in the valley arise partly because

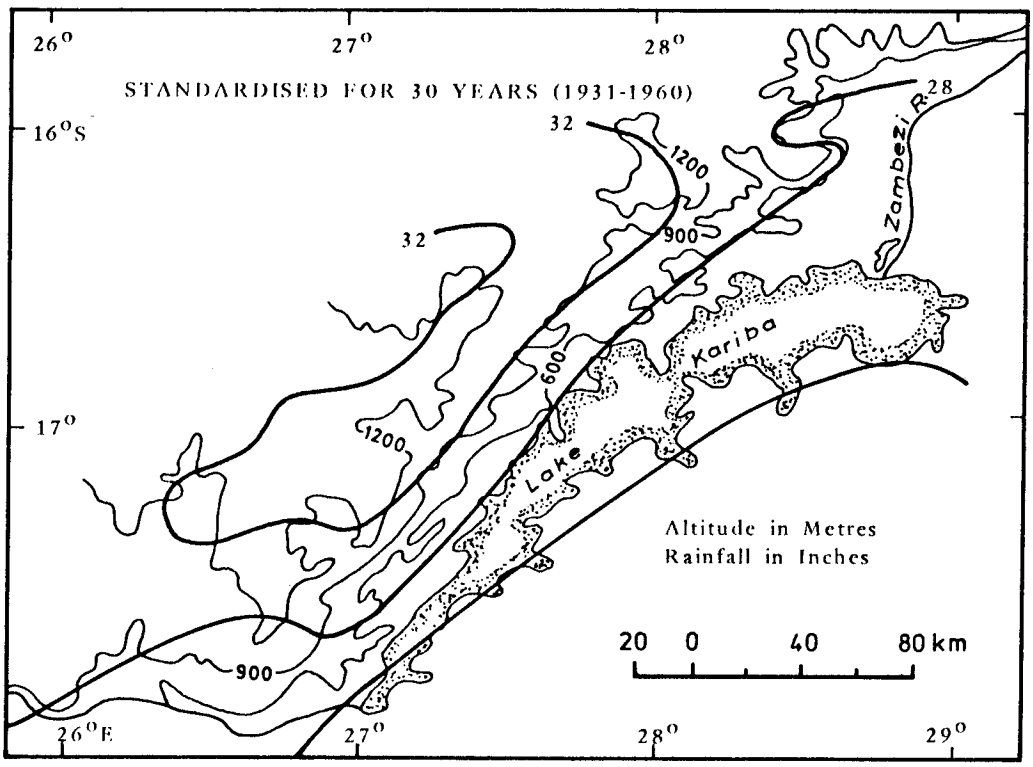


FIG. 3·3: ANNUAL RAINFALL AND TOPOGRAPHIC CONTOURS.
Source: Hutchinson (1975) p. 49.

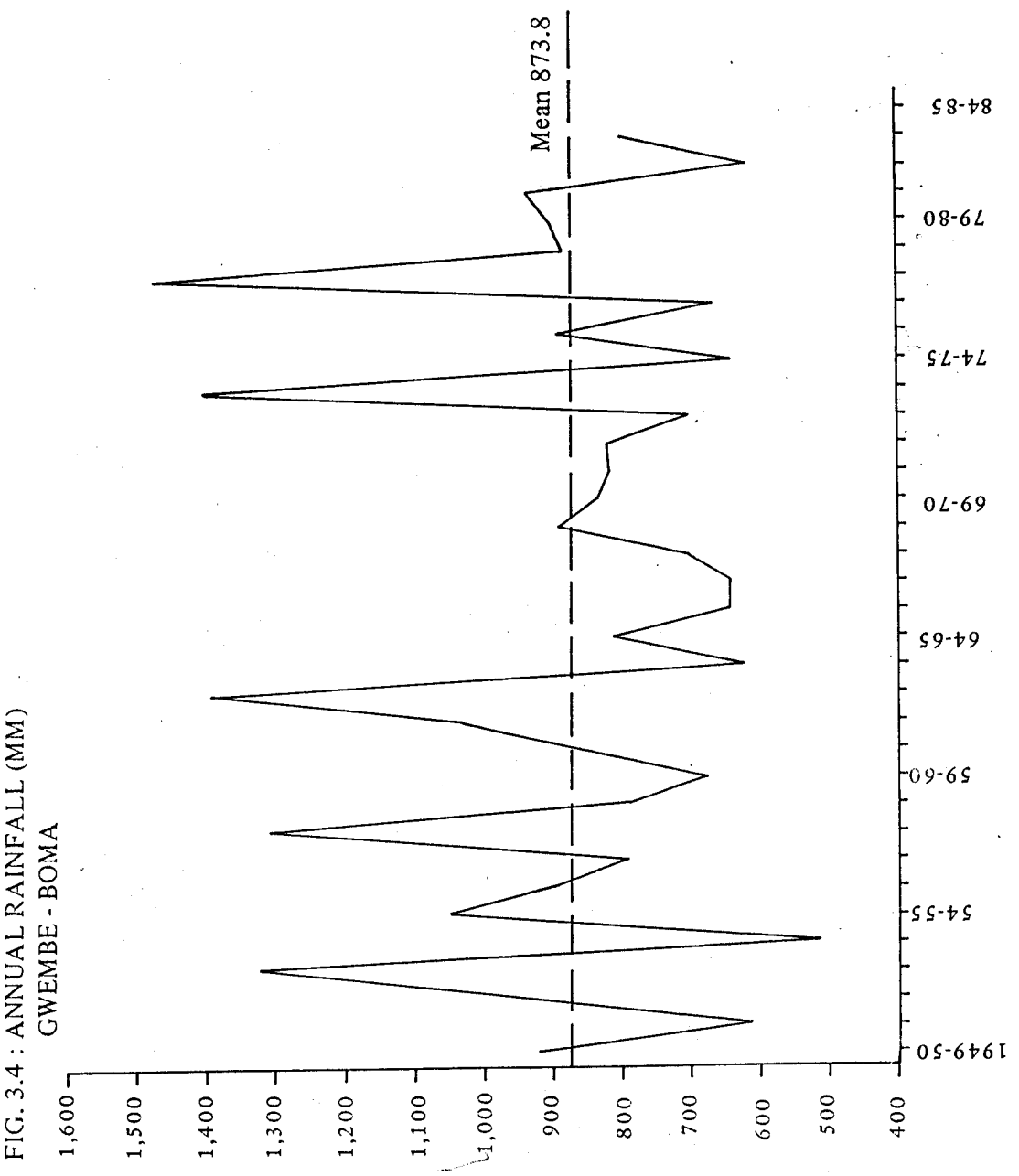


FIG. 3.4 : ANNUAL RAINFALL (MM)
GWEMBE - BOMA

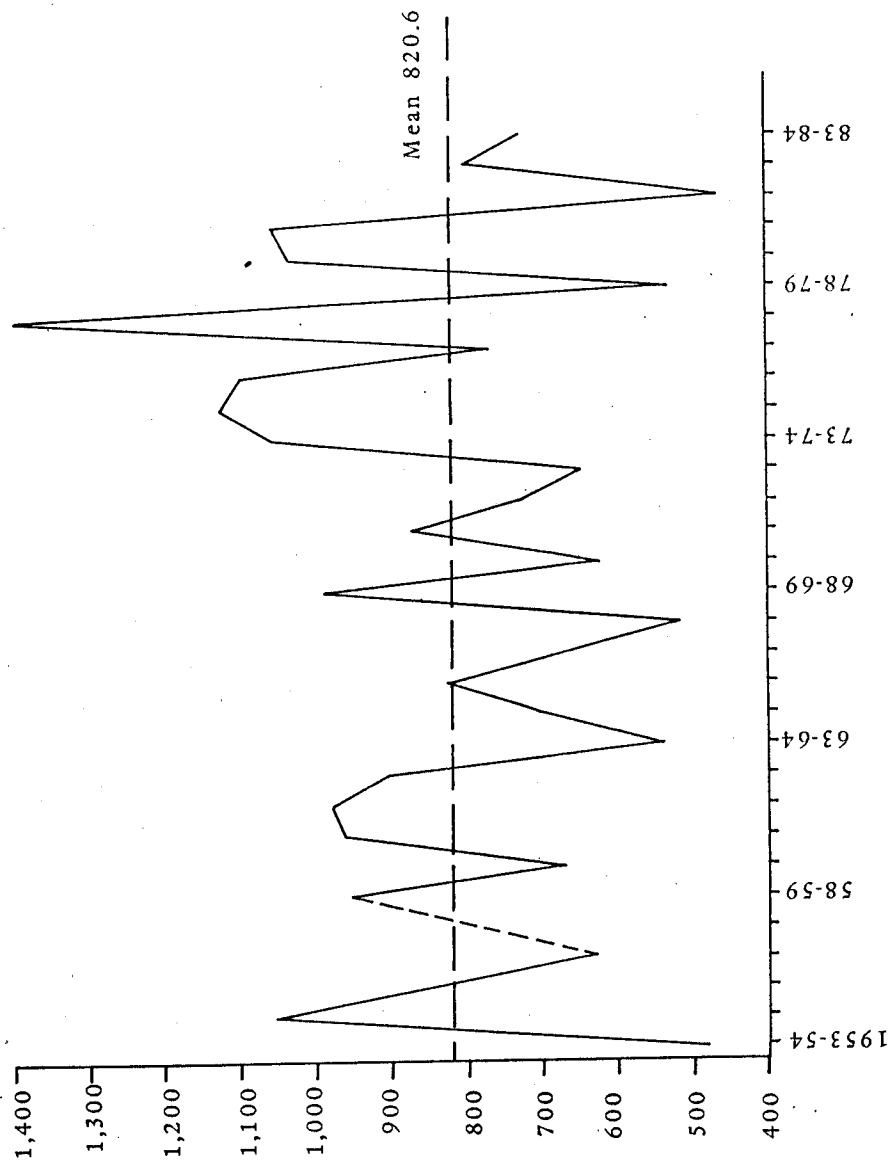
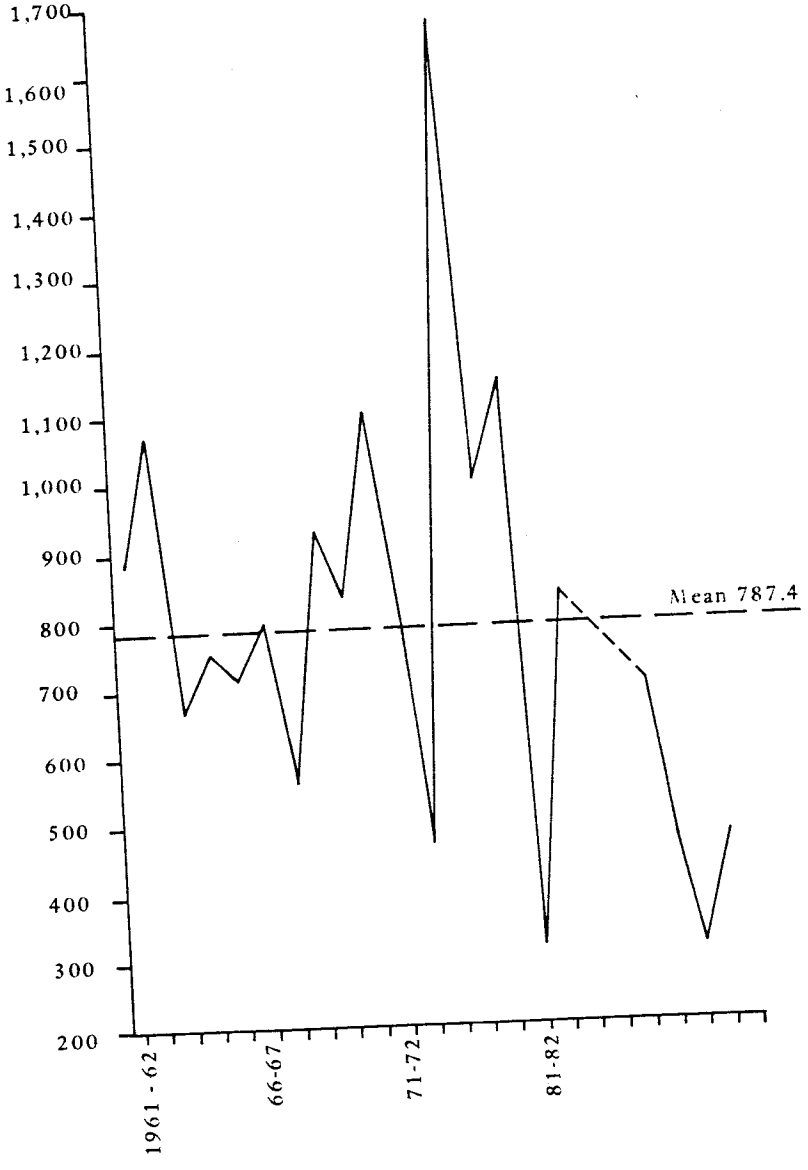


FIG. 3.5 : ANNUAL RAINFALL (MM) : GWEMBE MUNYUMBWE

FIG. 3.6 : ANNUAL RAINFALL (MM) ; GWEMBE - CHIPEPO



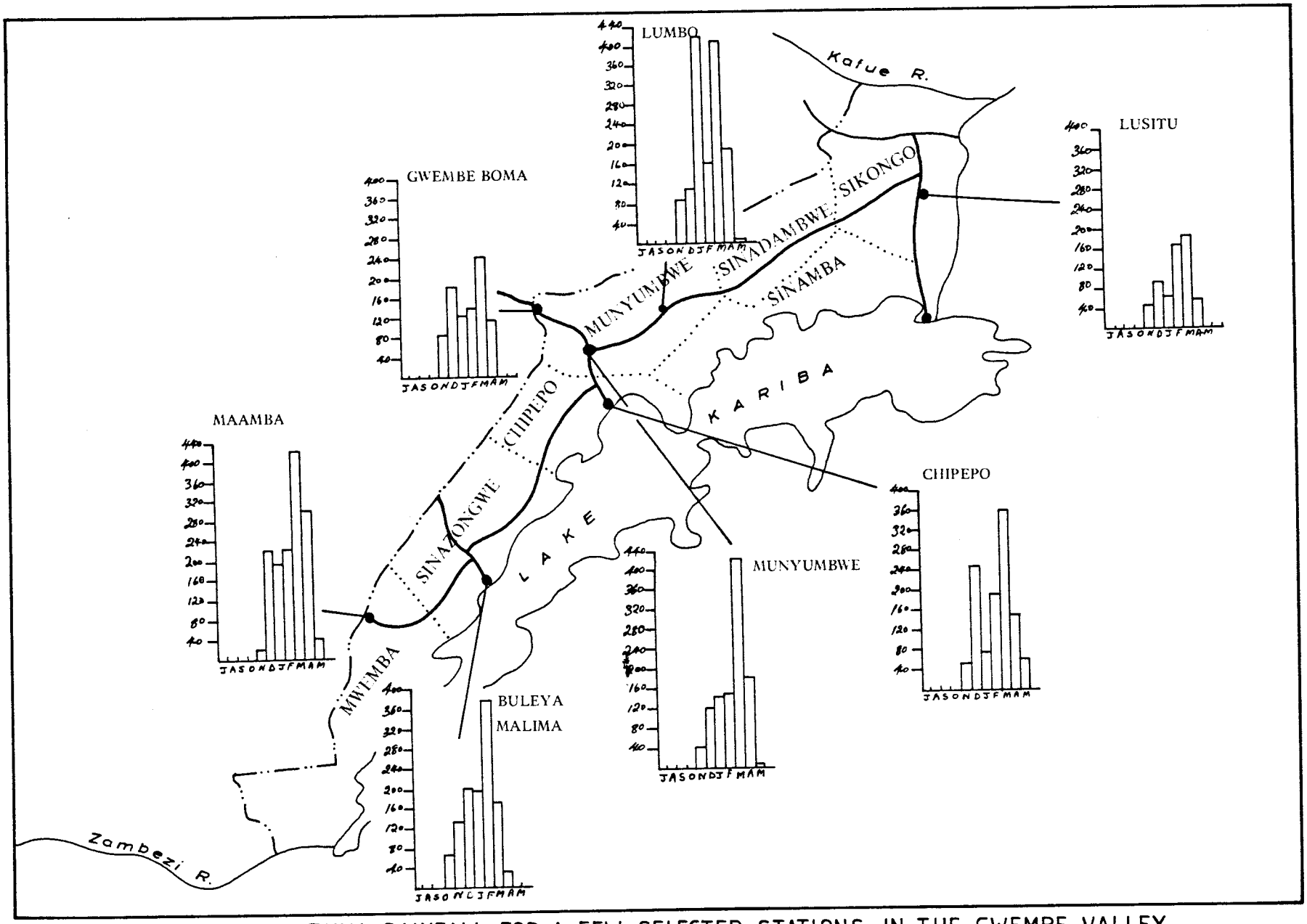
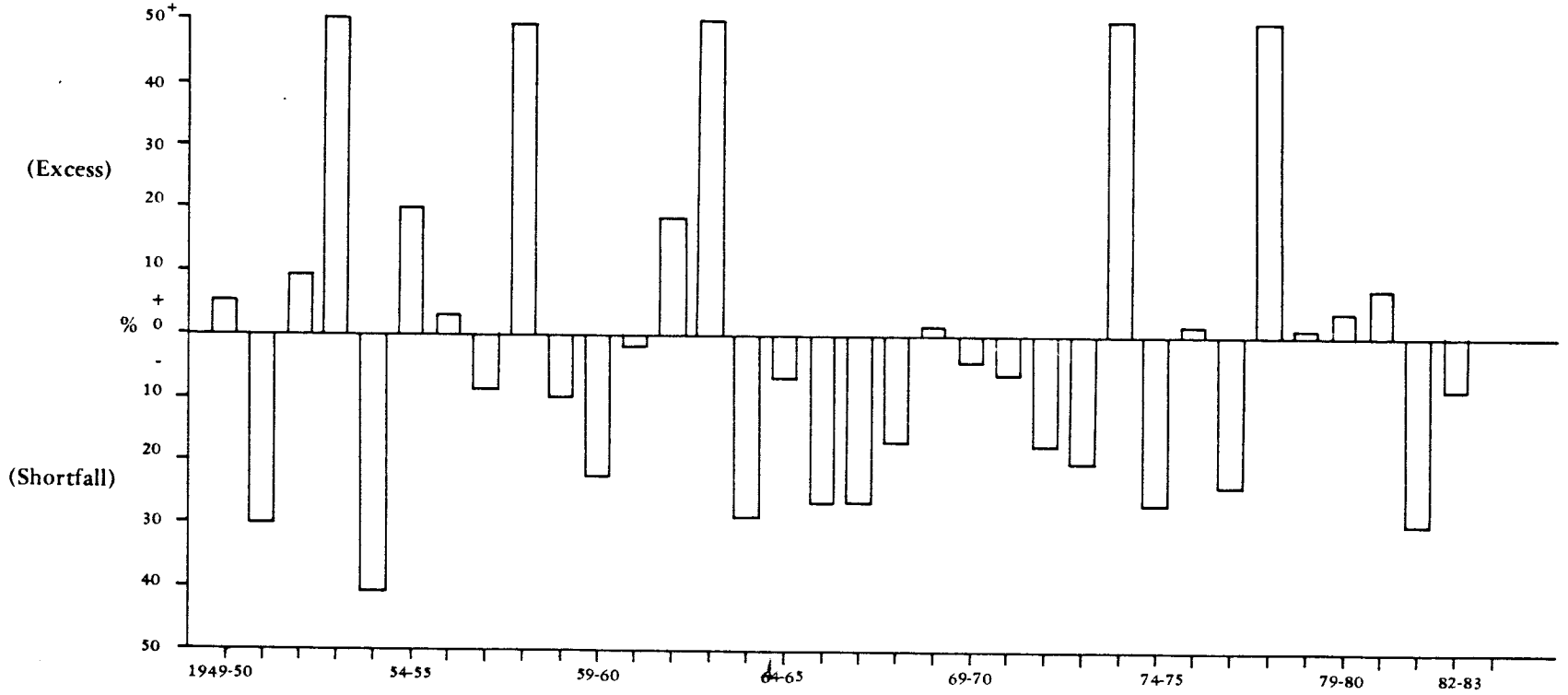


FIG. 3·7: 1975/76 MONTHLY RAINFALL FOR A FEW SELECTED STATIONS IN THE GWEMBE VALLEY.

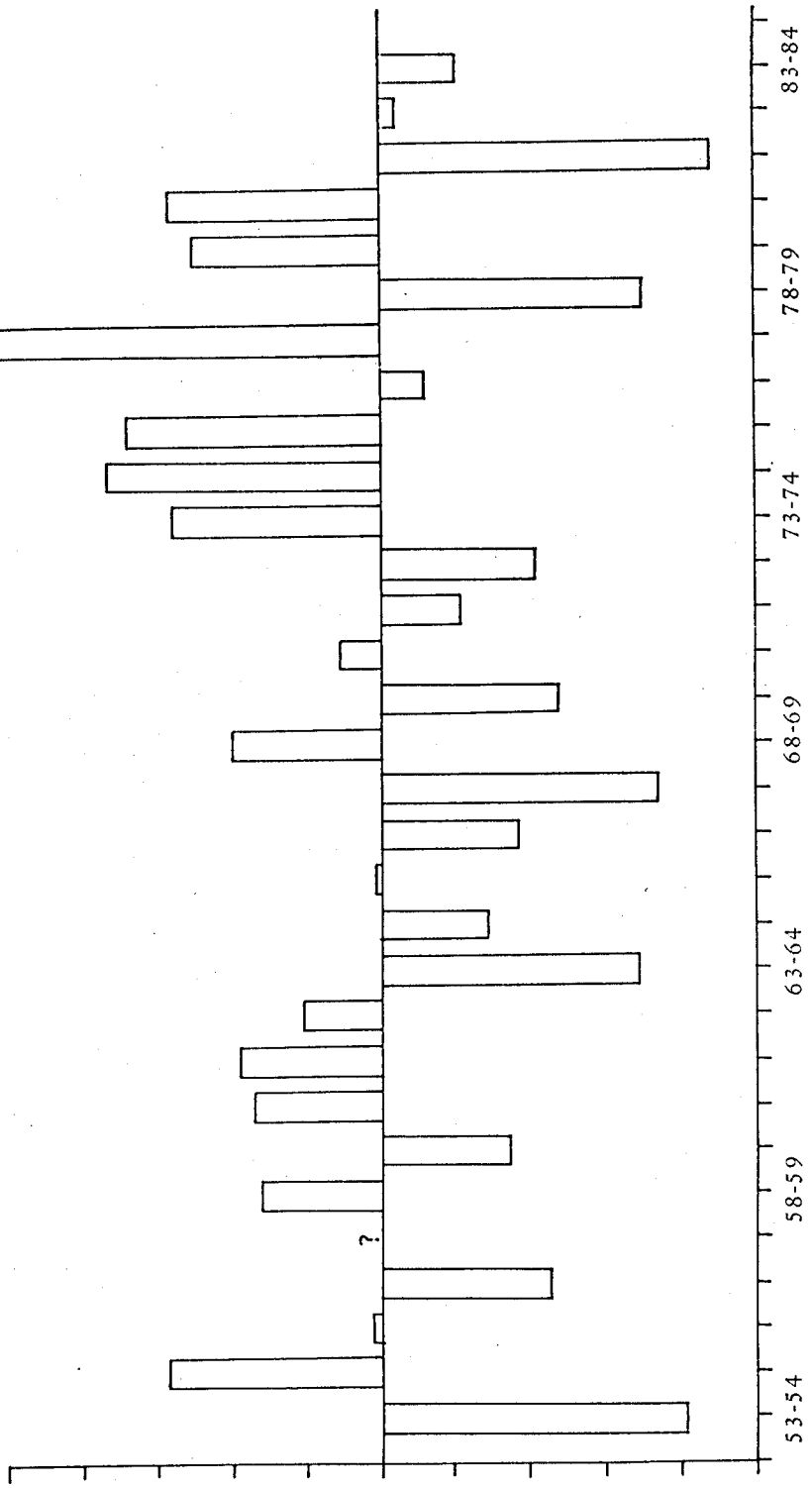
of poor rainfall conditions. An examination of rainfall data shows that rainfall is poor in both quality and quantity. In terms of quantity, we see from Figs. 3.8, 3.9, and 3.10 that significant shortfalls of seasonal rainfall are frequently experienced in the region. The same kind of picture is presented when we take into account the five-year moving averages (see Figs. 3.11, 3.12 and 3.13). It is also noted from these moving averages that there is a tendency for a substantial number of dry years to follow one another. With the annual rainfall itself being moderate to meagre, the downward departures from the normal tends to bring about disastrous drought effects. Scudder (1961) points out that in almost all the drought situations that have been reported in the valley, shortfalls of rainfall from the long term mean have always been detected. Turning to quality, we see that rainfall is at large poorly distributed within the rainy season. The bulk of it falls in heavy storms and is rapidly lost through runoff. Long dry spells are typical during the wet seasons and as such crops do not fully benefit from the total seasonal amounts. Other points on this factor concern the fact that the region suffers from a delayed on-set of the rainy season and an early end of the main rains.

FIG . 3.8 : ANNUAL RAINFALL DEPARTURE FROM THE MEAN
GWEMBE - BOMA



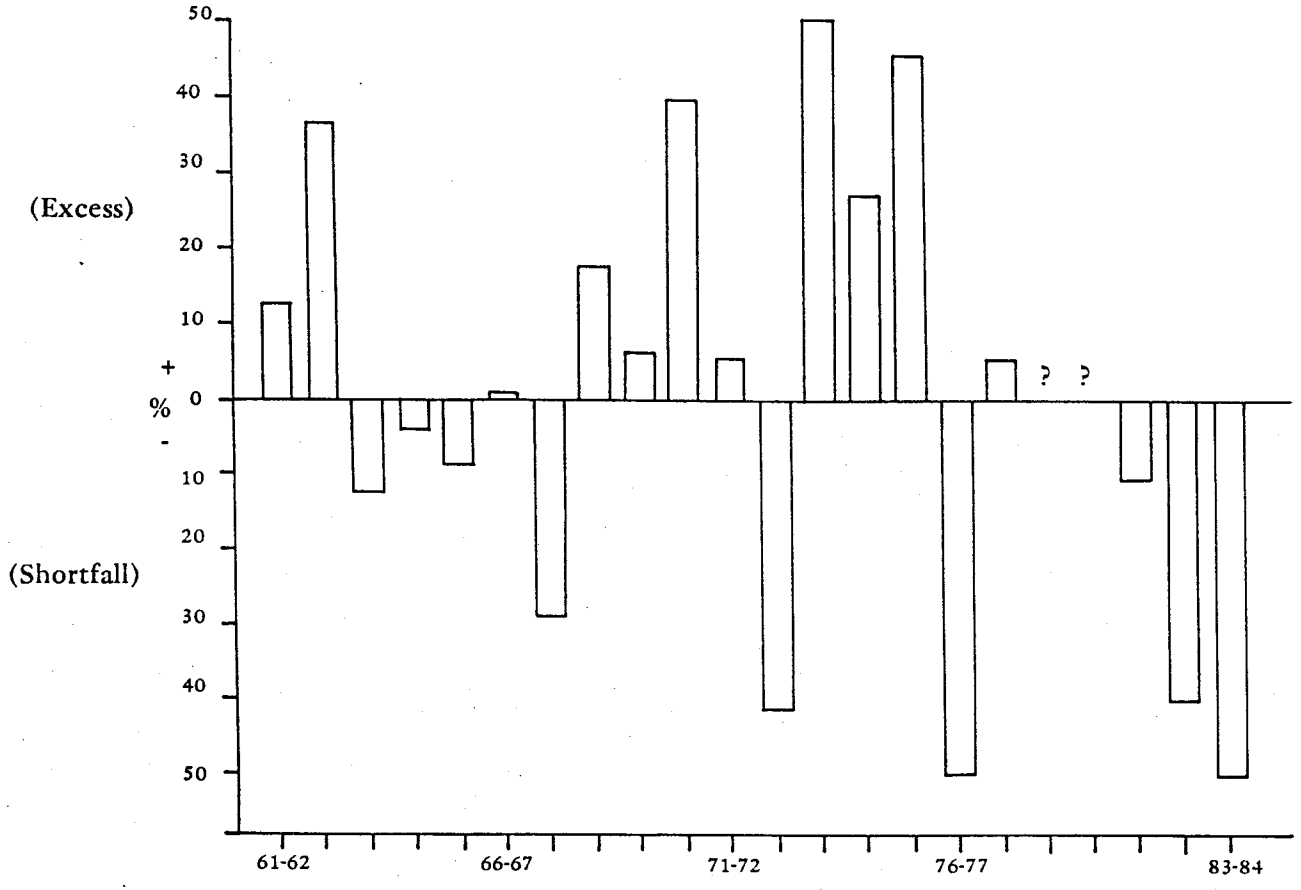
N.B. See Appendix 11.

FIG. 3.9 : ANNUAL RAINFALL DEPARTURE FROM THE MEAN
GWEMBE - MUNYUMBWE



N.B. ? Missing data
SEE APPENDIX 13.

FIG. 3.10 : ANNUAL RAINFALL DEPARTURE FROM THE MEAN
GWEMBE - CHIPEPO



N.B. ? Missing data

See Appendix 13.

FIG. 3.11 : RAINFALL (MM) : FIVE YEAR MOVING AVERAGES

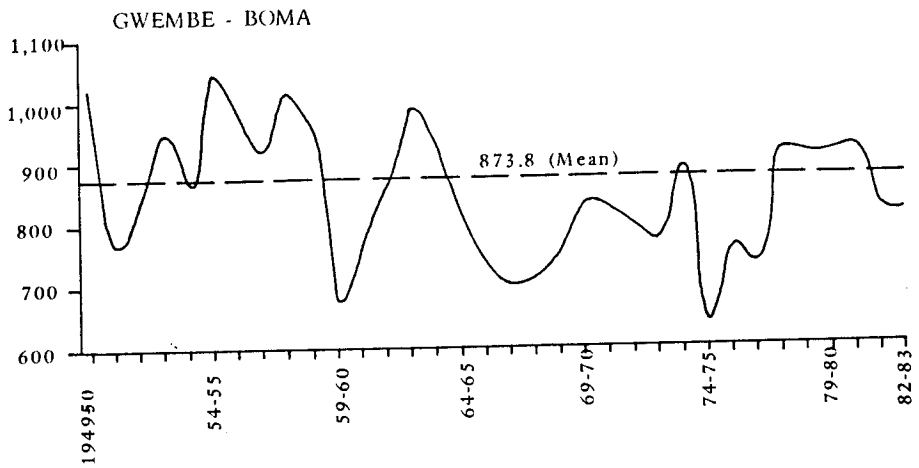


FIG.3.12 GWEMBE - MUNYUMBWE

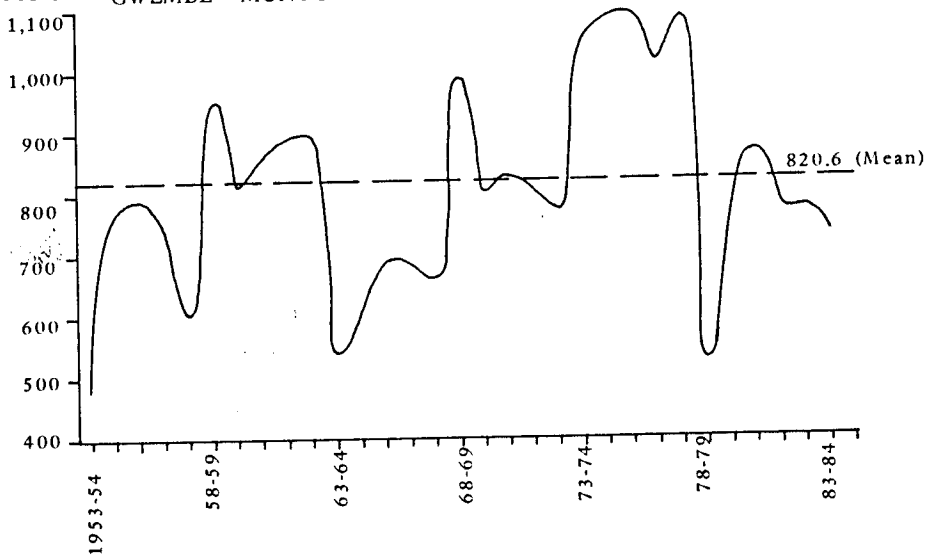
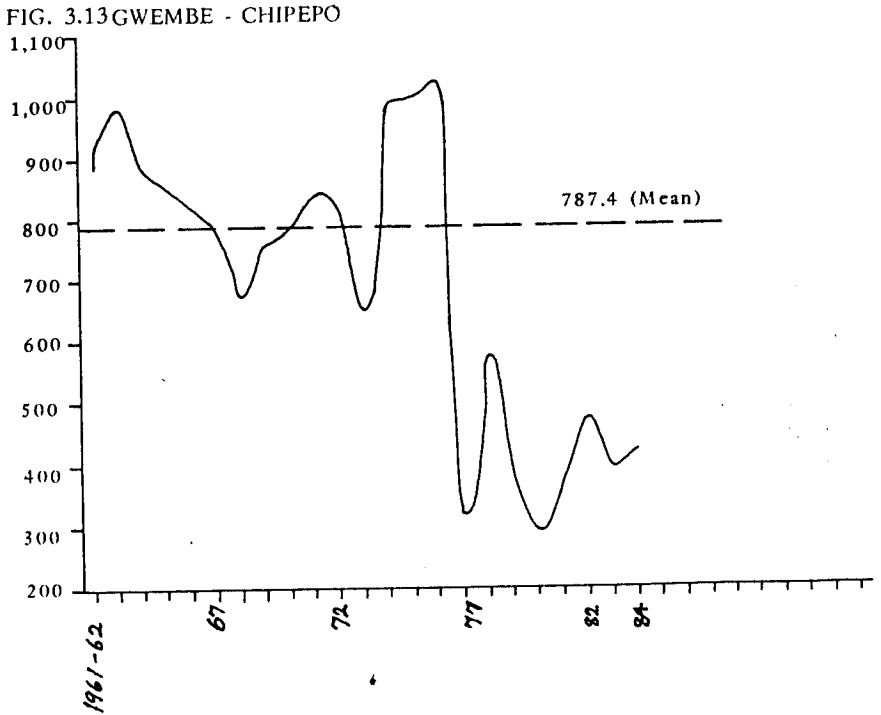


FIG. 3.13GWEMBE - CHIPEPO

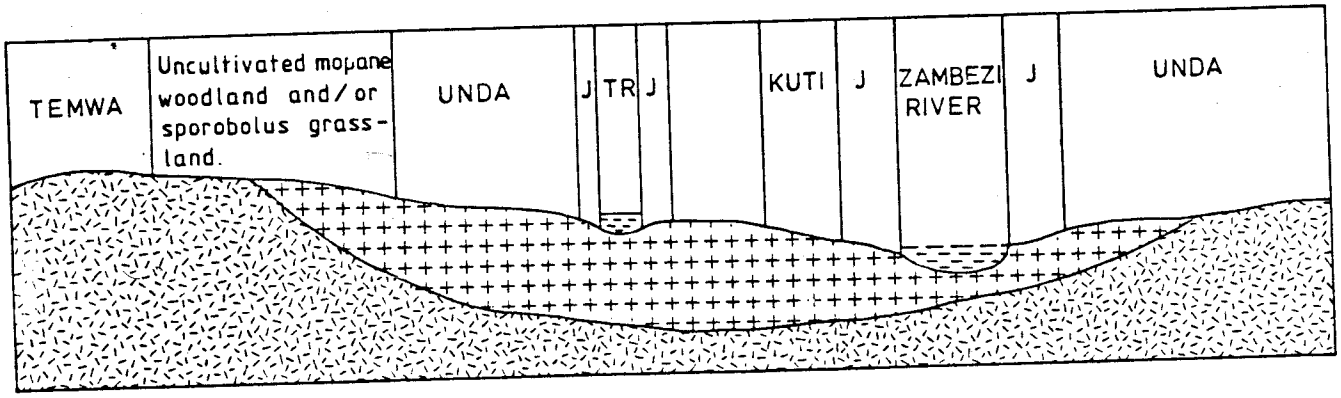


Because of its position in relation to the ITCZ, the main rains are concentrated between the second weeks of December and February. This makes the growing season to be abnormally short for most of the crops.

3.5 Agricultural Activities

The Gwembe Tongas are traditionally crop cultivators and cattle keepers. Long before the Livingstones came to the area in 1860, these people practised sedentary hoe cultivation and lived largely in permanent or semi-permanent villages along the Zambezi and its major tributaries. Advantaged by their geographical position they cultivated the rich riverine alluvial soils and maintained a three-field crop system (See Fig. 3.14). Apart from Summer cultivations crops were grown in the dry season as well. Their agricultural system, which was by large dominated by the cultivation of millet, sorghum and other food crops gave them all the necessary food and dictated the yearly round activities (Colson, 1960, p. 198). They also reared large herds of cattle, which grazed the rich flood plain pastures of the Zambezi.

FIG. 3.14 A CROSS-SECTION OF GARDEN TYPES IN THE GWEMBE VALLEY BEFORE THE FORMATION OF LAKE KARIBA.



ALLUVIUM MATERIAL

KARRO SEDIMENTS

TR – TRIBUTARY CHANNEL

J (JELE)– Zambezi river bank gardens cultivated primarily during the dry season.
KUTI – Annual inundated floodplain gardens cultivated during both the wet and dry seasons. Like the river bank gardens they can be cultivated on a perennial basis without fallowing.
UNDA – Rains gardens cultivated on rarely inundated Zambezi and tributary alluvia or on adjacent Karoo sediments.
TEMWA – Rains gardens cultivated on Karoo sediments further removed from the river system and more often than not separated from Unda and associated villages by an uncultivated area of infertile land.

Source: Adapted from Scudder, 1971, p.12.

Although the basis of their subsistence economy has remained up to the present day, more or less the same, significant changes to their agricultural system and practises have occured. These changes happened very recently in the 1950's and are largely associated with the constructuon of Kariba dam.

It must be briefly stated that the decision in 1955, together with its quick implementation (1956-59) by the Federal Government (Nyasaland, Northern and Southern Rhodesia) to construct a dam at Kariba gorge brought fundamental changes, both directly and indirectly to the peoples lives. The ecology of the region underwent serious changes as well. Because of the dam lake Kariba was formed in 1959. Slightly before this, the riverine communities were forcibly resettled by the authorities elsewhere in the formely upland areas of the valley, to give way to the lake. Thousands of families were involved in the resettlement programme (see Table 3.1). Such

Table 3.1 Families Requiring Resettlement, by Chief's Areas

CHIEF'S AREA	NUMBER INVOLVED
Chipepo	8,866
Simamba	2,000
Sinazongwe	9,000
Mweemba	9,000

Johnston, D.S. (1974).

developments imposed many problems on the Gwembe people. On the agricultural front, they lost their celebrated three-crop system and the rich alluviam riverine fileds. Dry season farming of food crops came to an end also. Further, there was a general increase in population pressure on the scarce upland fertile areas of the valley. These, as we shall see later greatly undermined their agricultural base.

As at present, peasant agriculture in the region is wholly rain-fed. Maize, millet and sorghum are the principal food crops, but groundnuts, bananas and other fruits are also grown and are of importance locally. In addition to these food crops, a variety of relish crops are cultivated. Cotton and sunflower are the main cash crops, but maize and other food crops are also sold by farmers in times of good yields. Crop statistics presented in Table 3.2 clearly show the level of their involvement in agriculture.

Other than cattle, goats and pigs are widely reared in the region. Livestock here constituents the main capital stock for most farm families. Cattle in particular is of paramount importance and is jealously guided by the people. It is used for ox-ploughing (in the case of oxen) and for meeting bride wealth

TABLE 3.2: CROP STATISTICS FOR MAIN CROPS GROWN IN THE GWEMBE VALLEY

BLOCK	CROP TYPE	1981-82			1982-83		
		NO. OF GROWERS	HACTRES	SALES (KG)	NO. OF GROWERS	HACTRES	SALES (KG)
GWEMBE NORTH	MAIZE	642	1,116.00	36,450	340	400.00	13,500
	SORGHUM	1,449	1,000.00	NIL	1,040	700.00	NIL
	SUNFLOWER	144	97.00	49,950	176	333.70	49,250
	COTTON	868	1,760.00	786,974	503	1,612.00	600,244
	BULRUSH MILLET	438	398.00		412	416.00	NIL
GWEMBE CENTRAL	MAIZE	461	265.00	209,430	500	650.00	4,590
	SORGHUM	500	400.00	NIL	700	900.00	NIL
	SUNFLOWER	275	102.00	44,800	123	151.00	30,050
	COTTON	1,321	1,373.00	755,456	944	915.40	650,069
	BULRUSH MILLET	370	105.00	NIL	350	350.00	NIL

Table 3.2 (Contd.)

BLOCK	CROP TYPE	1983-84 NO. OF GROWERS	HACTRES	SALES (KG)
GWEMBE NORTH	MAIZE	900	458.00	NIL
	SORGHUM	699	1,067.00	NIL
	SUNFLOWER	258	397.00	6,150
	COTTON	2,838	2,080.00	583,830
	BULRUSH MILLET	780	1,120.00	NIL
GWEMBE CENTRAL	MAIZE	900	458.00	54,270
	SORGHUM	310	400.00	360
	SUNFLOWER	252	363.00	174,750
	COTTON	940	1,521.00	1,326,755
	BULRUSH MILLET	215	165.00	NIL

Table 3.2 (Contd.)

BLOCK	CROP TYPE	1981-82			1982-83		
		NO. OF GROWERS	HACTRES	SALES (KG)	NO. OF GROWERS	HACTRES	SALES (KG)
GWEMBE SOUTH	MAIZE	320	570.00	NIL	120	130.00	NIL
	SORGHUM	450	350.00	NIL	600	250.00	NIL
	SUNFLOWER	130	333.00	250,000	253	436.00	272,700
	COTTON	2,000	1,562.00	1,474,884	846	786.80	931,803
	BULRUSH MILLET	N/A	N/A	N/A	250	160.00	NIL

Source: Gwembe District Agricultural Annual Reports (1981-84).

Table 3.2 (Contd.)

BLOCK	CROP TYPE	1983-84 NO. OF GROWERS	HACTERS	SALES (KG)
GWEMBE SOUTH	MAIZE	1,380	1,376.00	NIL
	SORGHUM	2,107	2,499.00	NIL
	SUNFLOWER	819	1,046.00	780,850
	COTTON	3,527	4,326.50	2,634,925
	BULRUSH MILLET	347	274.00	NIL

Source: Gwembe District Agricultural Annual Reports (1981-84).

obligations and other social activities.

Nearly all the farmers in the valley use ox-drawn implements. Hand cultivators constitutes a small percent, about 2%. For all their annual farming activities which are summarised by Table 3.3, the majority of the Farmers, if not all depend on farm household labour.

Though, their crop yields are lower than optimum, on average the Gwembe Tongas produce more than enough for household consumption or use and are therefore able to sell surplus production to the market.

TABLE. 3.3 : CROP CALENDAR

MAIN CROPS	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MARCH	APR	MAY
MAIZE (Mapopwe)	HARVESTING →					PLOUGHING, SOWING →		WEEDING →				
SORGHUM (Maila)							PLOUGHING, SOWING →		WEEDING →		HARVESTING →	
SORGHUM (Lusili)					PLOUGHING, SOWING →		WEEDING →		HARVESTING →			
BULRUSH MILLET (Inzembwe)						PLOUGHING, SOWING →		WEEDING →	HARVESTING →			
COTTON (Buluba)		PICKING →			REMOVING STUBBLES →		PLOUGHING SOWING →		WEEDING →		PICKING →	
BEANS (Chimbambwa)							PLOUGHING, SOWING →		WEEDING →	HARVESTING →		
GROUNDNUTS (Indongwe)							PLOUGHING SOWING →		WEEDING →		HARVESTING →	
SUNFLOWER	HARVESTING →						PLOUGHING, SOWING →		WEEDING →			
SWEET POTATOES (Chimbwali)		HARVESTING →					PLOUGHING SOWING →					
FINGER MILLET (Mabele)							PLOUGHING SOWING →		WEEDING →		HARVESTING →	

N.B. (1). Local names of crops are indicated in brackets.
(2). No orderly arrangement of crops is observed.

CHAPTER 4

METHODOLOGY

4.1 Methods of Data collection

A variety of methods were employed in data collection. Fieldwork, which formed the empirical basis of the research was done in October and November 1985 and consisted of a pilot survey, intensive interviews (based on an interview-schedule and interview guide surveys) and field observation.

The pilot survey was used to prepare the ground work for the main research. Important to mention is that during this survey, the interview-schedule was administered to a few people, with the aim of identifying its short-comings.

The interviews were dominated by an interview schedule survey, which was administered to 180 persons. This interview-schedule (see Appendix 1) was designed to provide information about the socio-economic aspects of the house holder, his perception and estimation of the

drought hazard, the conditions under which he makes decisions in the face of drought and the precise types of adjustments which are made or which are seen or perceived to be made by others, including the factors behind particular adjustments.

Interviews based on an interview-guide (see Appendix 2) were held with relevant government departments and personalities, with the view of obtaining official or semi-official information on various aspects pertaining to drought in the country, particularly in the study area.

Lastly on field work was field observation which like the interview-guide was designed to supplement information collected by the interview-schedule. What was involved here, was the collection of useful geographical data (such as land-use practices, relief, drainage and soils) noticeable in the field.
In addition to data collected in the field, data from various secondary sources was also collected.

4.2 Sample Design and Procedures

When drawing up the sample for the interview-schedule, a stratified random sampling procedure

was followed. This involved first dividing the population into two stratas. Stratification here was based on the geographical location with respect to lake Kariba: areas in close proximity to the lake (about 20 km) were grouped as one and vice versa for the distant locations. The use of Lake Kariba was arrived at, because of its special influence on the climate and human activities in the surrounding areas. It was envisaged that by using it, this would enable us overcome some of the bias, in case of hidden differences between the two areas and offer us in the process a sample that adequeately represents the region. From these two stratas six study sites (villages), three from each region (see Fig. 4.1) were then randomly selected, before making a selection of respondents. The respondents were drawn at random, with the researcher interviewing any head of household, who was found at home at the time of the research. An equal number of 30 respondents were interviewed from each village.

4.3. Description of Subjects

With the study area being predominantly a

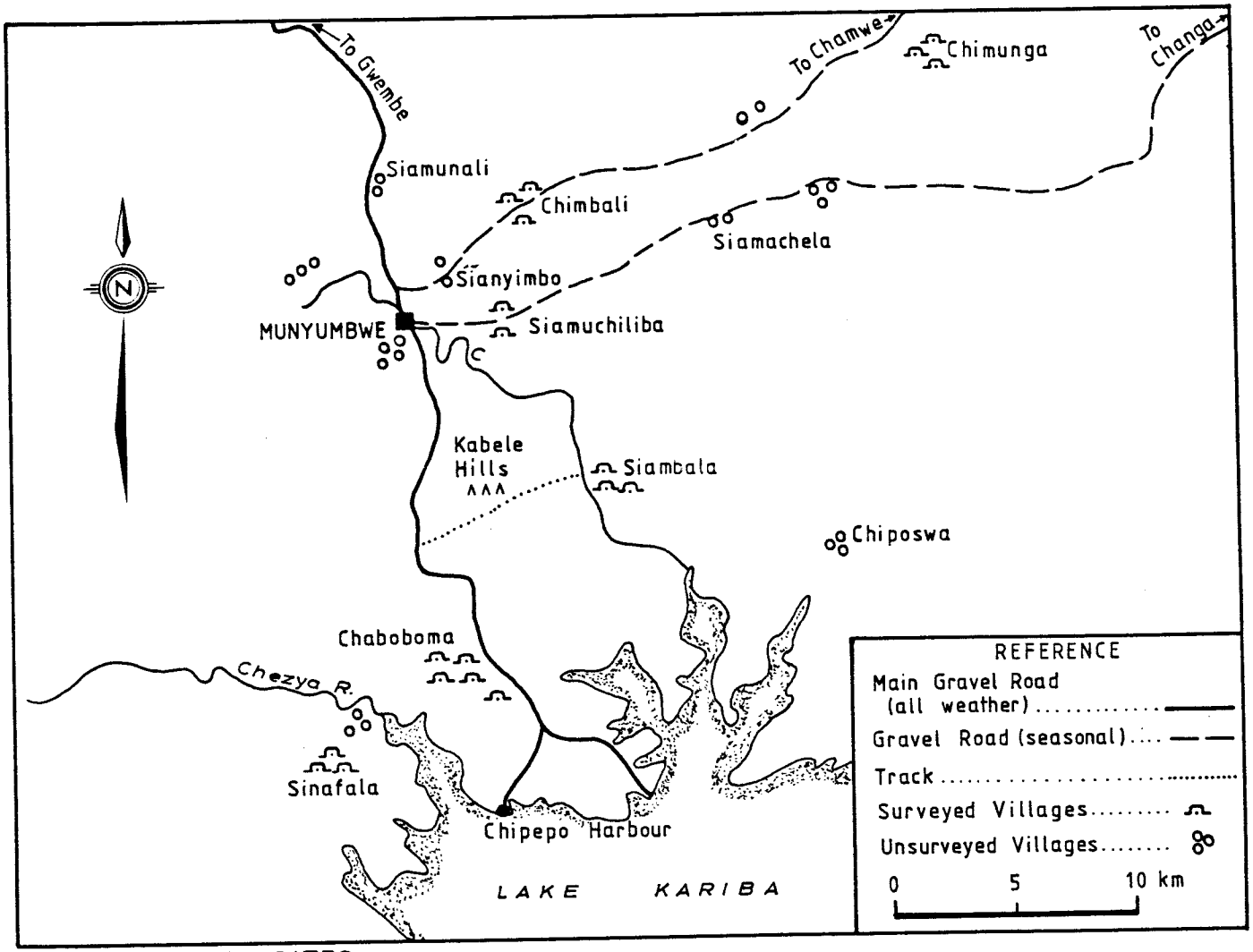


FIG. 4.1 : STUDY SITES.

peasant farming community, the main subjects of the research were peasant or small-scale farmers. In administering the interview-schedule to these farmers, only heads of households were considered, so as to maintain uniformity amongst the interviewees. In the case of the interview-guide, the subjects included, high ranking government officers in the Ministry of Agriculture and Water Development and the Meteorological Department and Gwembe members of parliament.

4.4 Methods of data analysis

In analysing data, the use of a computer was first sought, for the purpose of generating basic statistics from the interview-schedule survey. The responses from this survey had to be quantitatively expressed and presented in tabular form before any meaningful analysis could be done. The results yielded from the interview schedule survey formed the basis of our data analysis, with supplementary information arising from other forms of field inquiry and secondary materials. The two strata of people were never compared, as no major differences were noticed between them.

CHAPTER 5

RESEARCH FINDINGS AND INTERPRETATION OF RESULTS

5.1 Basic Characteristics of the Sample Population

By design, one hundred and eighty (180) peasant farmers were interviewed and through the selected sampling techniques, all with an exception of 6 were found to be male heads of household.[1] A fairly high proportion of this sample consisted of people of the middle and old age groups. Table 5.1 shows that about 68% were of the age of 38 and above and out of this the majority were above 51 years of age.

Generally, the sample population had big family units. The average size of people per household was 8.16, which is well above the national average of about 6. On the whole, the females constituted the largest number of persons in the household sampled than males (see Table 5.2). From the same Table 5.2, we also note that the

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1. Female headed households, were probably under estimated. It is some kind of customary behaviour, for them not to discuss or to be seen discussing matters of a serious nature, like the research itself, with unknown persons.

population of the sampled families was slightly dominated by those below the age of 15. These accounted for over 50%.

A large number of the interviewees, as can be seen from Table 5.3 have lived or stayed in the region for a considerable period of time. About 61% have lived for over 30 years, with another 22% between 21 and 30 years. The data is self explanatory that the respondents maintained a high degree of residential stability. There is little doubt to suggest that this arose mainly from the fact that all of them are permanent residents of Gwembe Valley.

The literacy level amongst the respondents was fairly high (See Table 5.4). Being a rural set-up and also taking into consideration the age composition of the respondents, it was very encouraging to find that about 64% of the respondents had some formal education.

More than four-fifths of the interviewees (see Table 5.5) claimed individual ownership of plots of land (farmlands) but maintained communal grazing grounds. Only about 13% had no plots of their own. These cultivated plots owned by their kinsmen.

Table 5.1 Age of Respondents

Age Group	No.	%
≤ 30 years	38	21
31 - 37 "	19	10.6
38 - 44 "	27	15
45 - 51 "	21	11.7
Above 51 years	75	41.7
TOTAL	180	100

Table 5.2 Household Population Characteristics

Age Group	Males	Females	Average No.
≤ 5 years	88	97	1.04
6 - 10 "	142	156	1.66
11 - 15 "	161	186	1.93
16 - 25 "	149	169	1.76
Over 25 "	59	26	1.78
TOTAL	599	869	8.17

Table 5.3 Length of Stay

Period of Stay	No.	%
≤ 10 years	11	6.1
11 - 20 "	24	13.3
21 - 30 "	39	21.7
Above 30 "	106	58.9
	180	100

Apparently, this group of respondents who had no individual claim to land was mainly of young people. This was so because land in the region is acquired through inheritance.

As indicated in Table 5.6, almost all of the respondents rely heavily on crop cultivation for their livelihood. Though livestock rearing, especially cattle and goat keeping is widely practised (See Appendix 3,4, 5 and 6) it acts as a minor source of income. None of the persons interviewed entirely depended on it for their living.

5.2 Drought Awareness

An inspection of Table 5.7 shows that nearly all of the respondents are aware of the drought hazard in the region. Out of a sample of 180 people, only 23 failed to pinpoint the hazard as one of the major problems they face in their area of locality.

The high drought awareness demonstrated by the people is something that one can easily speculate or find an explanation to. First and foremost all the respondents are permanent

Table 5.4 Level of Education

Category	No.	%
No formal education (cannot read and write)	57	31.7
No formal education but can read and write	7	3.9
Formal schooling of 7 years and less	69	38.3
Formal schooling of 7 years but less than 10 years	47	26.1
Formal schooling of 10 years and above	0	0
TOTAL	180	100

Table 5.5 Tenure of Land

Type	No.	%
Owner	155	86.1
Tenant	0	0
Unclassified	25	13.9
	180	100

Table 5.6 Major Source of Income

Type	No.	%
Crop cultivation	157	87.2
Pastoral Farming	0	0
Crop and Pastoral Farming	23	12.8

residents of this hazardous environment and as such they have at one time or another suffered from drought effects. In fact, to be more specific, it is shown in Table 5.8 that the whole sample population has had some degree of exposure to the hazard. Another crucial factor to point out is the recency of the last drought (1981-84). Actually, the memories of this drought are still fresh in the minds of many people. Lastly, the fact that most people rely on rainfed crop cultivation for their livelihood also increases their awareness of drought.

5.3 Perception of Drought

An insight of the way the Gwembe people perceive and interpret the hazard was obtained by examining some of the following:

(a) causes of drought:

From the interview data in Table 5.9, about 70% of the respondents see droughts as acts of nature and explain in very clear terms that they are products of poor rainfall or a combination of poor rainfall and high

Table 5.7 Major problems of farming cited by the respondents

Problems of farming	No.	%
(a) Drought	156	86
(b) Poor infrastructure	96	53.3
(c) Poor farming land	41	22.8
(d) Scarcity of drinking water for both people and animals	78	43.3

* Multiple answers are recorded; each category was treated as an independent case and percentages worked out of the total number of respondents

Table 5.8 Drought experience

Experience of drought	No.	%
(a) 2 times	0	0
(b) 2-5 times	56	31.1
(c) 6-10 times	67	37.2
(d) Above 10 times	57	31.7
Total	180	100

Table 5.9 Perceived drought causes

Causes of drought	No.	%
(a) Poor rainfall	98	54.7
(b) Poor rainfall and high temperatures	27	15.1
(c) Will of God	13	7.3
(d) Don't know	41	22.9
Total	179	100

* missing value = 1

temperatures. Of the remainder, 23% could not tell or reveal what they thought caused droughts, while 7% attributed it to God's will. The main point to put forward here is that most of the respondents look upon droughts as being produced by external forces. They limit themselves heavily to external physical forces and in so doing they demonstrate their ignorance as regards the importance of human factors.

(b) Frequency of drought:

The findings in Table 5.10 clearly show that a significant proportion of the respondents are inclined to the view that droughts are more or less frequent in the area. Whether this is an accurate perception or not, remains a matter for later discussion. Out of those holding contrary views about 19% saw them as occasional or rare events and 5.6% declined to give their opinion.

(c) Magnitude of drought

The repondents were tested for their understanding of this concept in two respects. Briefly, they were first required to make a review of all the droughts they had experienced in the region and

Table 5.10 Frequency of Droughts as perceived by the Respondents

Frequency of Label	No.	%
(a) Occasional, but regularly in the last 3 - 5 years Recurrence 10 - 15 years	34	18.9
(b) Frequent, regularly in the last 3 - 5 years. Recurrence 5 - 7 years	77	42.8
(c) Very frequent, regularly in the last 3 - 5 years. Recurrence 1 - 5 years	59	18.9
(d) Not stated	10	5.6
TOTAL	180	100

come up with one which they thought was the worst of them all. And secondly, they were made to throw some light on their interpretation of severe, moderate and weak drought.

Looking at the first aspect, it is fairly clear from Table 5.11 that a large number of the respondents had made references to the recent drought (1981-84) as having been the worst they had ever experienced in their life time. The number of people involved was about 60%. The other worst drought years cited by the respondents in a decreasing order were as follows: 1947, (10.5%), 1954 (8.9%), 1972 (7.8%), 1957 (6.7%) and 1951 (6.1%). Two things could perhaps be of paramount importance here, in explaining why most people regarded the 1981-84 drought as being the worst they had ever experienced in the region. These are the recency and the duration of the hazard. As a matter of fact, it is very common amongst any group of people to give much weight to recent events than past ones. These tend to be remembered better than the latter. The same applies to hazards of a longer duration, even though in physical terms, as well as, their impact, they may not necessarily be worse off than those of a shorter duration. In addition to the above it is also of crucial importance to mention that

because of time factor, certain past drought events were never really felt or experienced by some of the respondents, who could either have been too young or simply not there. It is quite obvious that some of the events owe their low position because of this factor.

Table 5.11 Worst Drought Years cited by the Respondents

Worst Drought Years		No.	%
(a)	1947	19	10.5
(b)	1951	11	6.1
(c)	1954	16	8.9
(d)	1957	12	6.7
(e)	1972	14	7.8
(f)	1981-84	108	60
TOTAL		180	100

On the terms severe, moderate and weak drought, it must be mentioned first that the last two (i.e. moderate and weak drought) were used interchangeably by most of the respondents. A clear distinction between them could not be drawn and as such this research

treats them as one.[2]

Table 5.12 shows that most of the respondents (over 60%) interpreted severe drought, as the type which involves large scale crop failure and wide-spread food shortages or famine. Another 6.7% of the respondents added to this list, the scarcity of drinking water. Now for the remaining number of the respondents, 27% expressed their understanding in physical terms, while 3.3% did not give us their views. Those giving a physical interpretation made references to parameters such as rainfall and temperatures. To them, severe drought simply meant when conditions of rainfall and temperatures are

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2. In drawing a distinction between these terms, the author has in mind two things; (i) agricultural activities and (ii) the occurence of the hazard being centred in a peasant community.

   Severe drought:

   - Extensive losses of agricultural activities, leading to great food shortages and the creation of famine conditions.

   Moderate Drought:

   - Substantial losses of agricultural activities, particularly crops. Food shortages are common and prolonged drought effects could easily lead to famine conditions.

   Weak Drought:

   - Slight damages or losses of crops.
   - Isolated cases of food shortages

extremely unfavourable for the growth of crops. These conditions are given as long dry spells or scanty rains and excessively high temperatures.

Moderate or weak drought on the other hand (see Table 5.13) is widely seen as the type involving little damages or effects on crops and that generally the society suffers less in terms of food shortages. This kind of outlook was given by about 73% of the respondents. Of the remainder 19.3% gave us a physical interpretation and stated that it is when the rainy season is characterised by short dry spells and poorly distributed rains which causes improper growth of crops. The other group of respondents about 6.7% did not disclose their viewpoint.

In all, whether be it severe or moderate/ weak drought, we see that these terms are viewed largely from a human perspective and the areas that are cited are those that suffer a direct effect from the hazard.

(d) Problems caused by droughts

In discussing drought problems, we see from Table 5.14 that the effects of the hazard bite most in the field of crop production. Over four-fifths of the respondents cited poor harvests and

Table 5.12 Perception of Severe Drought by the Respondents

		No.	%
defined in terms of effects climatic definition	(a) Mass crop failures, famine or large scale food shortages	112	62.2
	(b) Scarcity of drinking water, mass crop failure or famine	12	6.7
	(c) Very poor rains and high temperatures	50	27.8
	(d) Not stated	6	3.3
TOTAL		180	100

Table 5.13 Perception of Moderate/weak drought by the Respondents

definition in terms of effects climatic definition	(a) Little crop damage minor food shortages	133	73
	(b) Short dry spells, light rains or slightly poor rains	35	19.3
	(c) Not stated	12	6.7
TOTAL		180	100

Table 5.14 Perceived Drought Problems

Drought Problems	No.	%
Poor Harvests and Food shortages/famine	156	86.1
Scarcity of drinking water	14	11.1
Poor Pastures	5	3.3
Others	5	2.8

Note: Multiple answers recorded

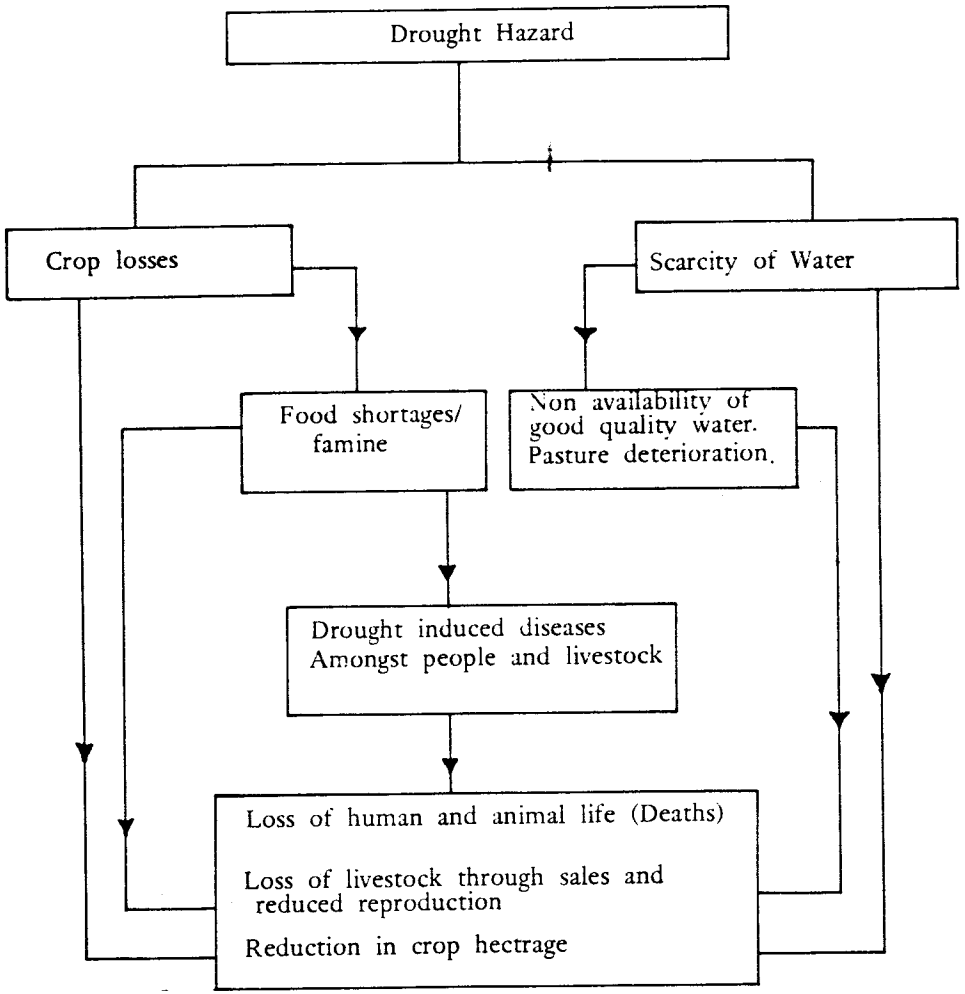
its by-product; food shortages/famine conditions as the most pressing problems. Other problems that were raised, but by a very small number of the respondents included the scarcity of drinking water and the deterioration of grazing pastures. For a more detailed picture on drought related problems in the region see Fig. 5.1.

From the responses given, it is quite understandable why emphasis is placed on crop losses. As a matter of common knowledge, droughts, normally begin by affecting crop production, before exerting their effects on other areas. Now, since crop cultivation forms the main source of income for the majority of the people, naturally drought incidences tend to have a direct impact on their lives. Thus much concern is expressed in this area.

5.4 Drought Expectancy and Prediction

As depicted by Table 5.15, the sample population maintains an extremely high drought expectancy. We see here, that more than four-fifths of the respondents expected droughts to occur in future. Of the remaining number, only 2.8% did not anticipate

FIG. 5.1 : MAIN EFFECTS OF THE 1981 - 84 DROUGHT IN THE STUDY AREA.



the hazard to occur, while 14.4% were either uncertain about the possibilities of its occurrence or simply declined to give their opinion.

The high drought expectancy displayed by the respondents is something that should not be treated as a surprise at all. As shown already, all the respondents have experienced droughts in the past and as such they have come to learn or be aware that the area in which they live in is a hazardous one. Of course, with their past hazard experiences, they have all the reasons to think that even in future droughts will occur.

Turning to drought prediction, (i.e. estimating when the next drought would occur) it is seen from Table 5.16 that approximately two-thirds of the respondents were unable to do so. The few who did, about 10% and 11% indicated that this would happen within two and five years respectively.

In all fairness, it is very unfortunate indeed that only a few respondents were able to give us a time scale, as to when the next drought would occur. This is against the background, that earlier on when dealing with the frequency of droughts, (see Table 5.10), they had given us a hint on the recurrence periods of the hazard.

Table 5.15 Drought Expectancy

	No.	%
(a) Yes	149	82.8
(b) No	5	2.8
(c) Not sure	6	3.3
(d) Not stated	20	11.1
Total	180	100

Table 5.16 Drought Prediction

	No.	%
(a) Very soon (about 2 years)	15	10.1
(b) In 5 years time	16	10.7
(c) In 10 years time	0	0
(d) Not sure	118	79.2
	149	100.00

Again with the high drought expectancy they exhibited, a more positive outcome than this should have been the case.

Their failure to come up with a prediction (see Table 5.17) had to do mainly with their strong beliefs in supernatural powers. It was generally felt that the time of occurrence of such events, all depended on God's will. A few others however stated that the event was highly unpredictable and thus they could not commit themselves to any kind of prediction.

5.5. Drought Adjustments Practised by the Sample Population

It is clear from Table 5.18 and Fig. 5.2 (a&b) that the sample population practises a wide range of drought adjustments. The adjustments, were selected by the respondents from a checklist, provided in the interview shedule survey. However, the adjustments that they perceived or thought to be practised by others were relatively few. These are diagramatically shown in Fig. 5.3 and 5.4[3].

Table 5.17 Reasons for Failure to Predict the Occurrence of the next Drought.

Reasons	No.	%
(a) Will of God	69	59.9
(b) The hazard is unpredictable	32	27.3
(c) Not stated	17	12.8
	118	100

Table 5.18: Drought Adjustments Practised by the Sample Population.

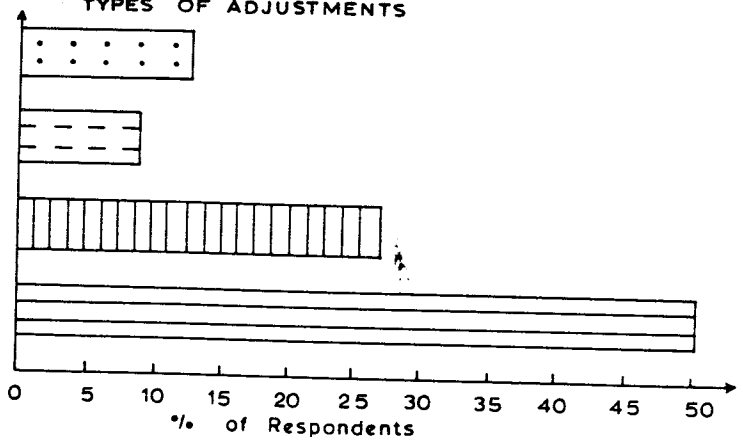
Types of Adjustments		No.	%
A.	Adjustments that affect the cause of the hazard.		
	(i) consult rain makers (rain making)	140	77.8
	(ii) pray to God for rains (prayers)	130	72.2
B.	Adjustments that modify the hazard		
	(i) Have plots in different places	83	46.1
	(ii) plant crops in wet places	103	57.2
	(iii) Migrate to wetter areas	6	3.3
	(iv) move cattle to wetter regions	20	11.1
C.	Adjustments that modify the loss potential		
	(i) plant drought resistant crops	178	98.9
	(ii) plant different varieties of the crop	156	86.7
	(iii) practise intercropping	98	54.4
	(iv) observe early planting time of crops	157	87.2
D.	Adjustments that accept/distribute the losses		
	(i) Depend on help from government	180	100
	(ii) Depend on wild products		
	(a) gathering	119	66.1
	(b) hunting	12	6.7

(iii)	Do small economic activities e.g. selling of fish and crafts to raise money for food.	140	77.8
(iv)	Sale livestock to buy food	128	71.1
(v)	seek or depend on help from relatives		
	(a) ask for assistance	117	65
	(b) receive help	110	61.1
(vi)	Stock enough food during periods of good harvest.	171	95
(vii)	Use savings to buy food	45	25
(viii)	Work for wages or food	89	49.4

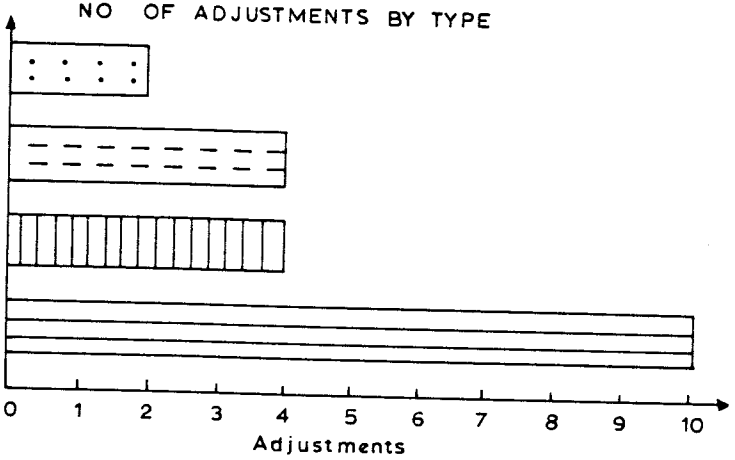
N.B. (i) Group D adjustments - reference made only to the 1981-84 drought.

(ii) Each adjustment was treated independently and percentages worked out of the total numbers of respondents.

(a).



(b).



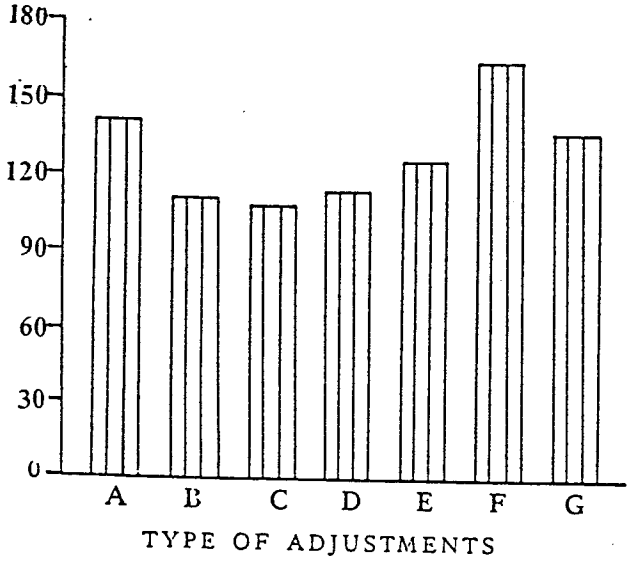
Adjustments that affects the cause of the hazard.

-Adjustments that modify the hazard.

Adjustments that modify the loss potential.

Adjustments that accept / distribute the losses.

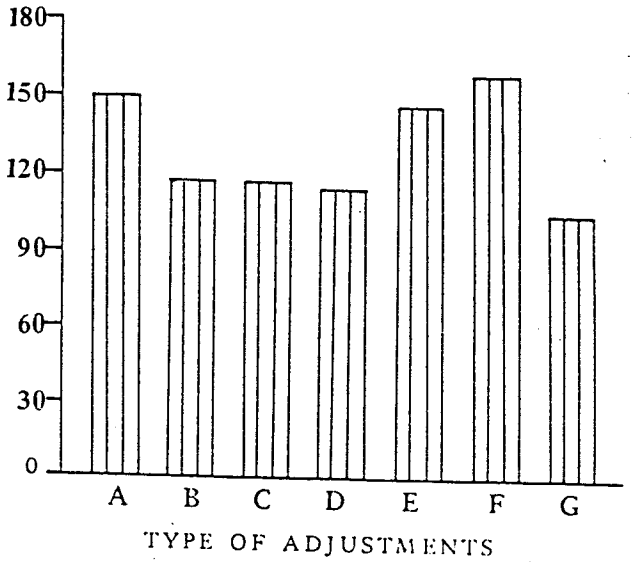
Fig.5.3 : DROUGHT ADJUSTMENTS PERCEIVED BY THE RESPONDENTS.



KEY

A Consult rain makers
B Conduct small economic activities (e.g. Selling of crafts and fish).
C Depend on help from others (e.g. relatives, government etc.)
D Gather wild fruits, grasses and roots
E Pray to God for rains
F Sell livestock to buy food
G Work for wages / food

Fig .5.4 : DROUGHT ADJUSTMENTS PERCEIVED AS BEING DONE BY OTHERS IN THE SAMPLE COMMUNITY.



For easier description, the overall range of adjustments practised in the region are arranged into four categories. The adopted classification, as demonstrated below and in Table 5.18 forms part of the general grouping of human adjustments to any natural hazard. A full account of them is as follows:

5.5.1 Adjustments that affect the source or cause of the hazard:

Only two adjustments of this nature, namely consulting rain makers (rain making) and praying to God for rains were involved. More than two-thirds of the people interviewed practised both of them. These adjustments were widely applied soon after the onset and during the early stages of the hazard. Whenever signs of drought

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3. The perceived adjustments are mostly those that are adopted during or soon after the onset of the hazard. They are all short term responses and apart from rain making and praying to God for rains, these adjustments merely attempt to cushion the losses inflicted by the hazard. Long term adjustments, with strong links to the agricultural system are not at all perceived, although widely practised by the respondents.

surface the adjustments in question are usually amongst the first that individuals and the community at large adopts. This is done in the hope of making God or the ancestral spirits observe their plight and change the course of events, before the drought situation worsens.

Judging by the popularity of the two adjustments, it seems quite obvious that most people have strong beliefs and faith or trust in the super-natural powers. They think that by invoking either God or the ancestral spirits, rainfall could come to the drought affectd areas. Whether any successes are scored through such adjustments remains unclear, although the people interviewed did cite some past events where some rewards were met.

5.5.2 Adjustments that modify the hazard

Basically, this comprises measures that attempt to avoid the drought losses. Four such measures were identified in the study area and these are:

(a) Planting crops in wet places. This was the most widely adopted adjustment, involving

about 57% of the sample population. The majority of the people who practised this adjustment, were quite aware of the need to plant some crops in the wetter parts of the region. Many respondents wanted to have at least one field of crops located in the wet dambo and valley areas, for reasons that in such places they were assured of obtaining a much higher yield in times of drought than in the dry upland areas. Had it not been for the limitation in the availability of wet places especially in Munyumbwe area, the number undertaking this measure would probably have been higher.

(ii) Having plots in different places.

About 46% of the respondents were found to undertake such an adjustment. One thing that was established in the field is that the majority of these people who indicated carrying out the adjustment did not do it purposely. This is so because they did not regard it as a drought adjustment. They actually gave totally different reasons for undertaking it. To many of them, it owned its existence primarily because of the hilly

relief. Large pieces of flat land are indeed rare in the study area and as a result people are forced to have plots in scattered places.

(iii) Move cattle to wetter regions:

This was carried out by about one ninth of the sample population. It was unpopular adjustment largely because not so many respondents owned large herds of cattle (see Appendix 3). With small herds of cattle those located far from Lake Kariba in particular, are not compelled to risk travelling long distances, even if the problem of water and pastures might be very critical in their areas of locality. The other point to raise is that for those who were in close proximity to Lake Kariba, to them this of course, did not occur as a drought adjustment because their animals grazed within their vicinity.

(iv) Migrate to wetter areas:

It was the least adjustment cited by the respondents throughout all the groups. The number that had ever taken it up amounted to about 3% only. This result clearly shows that there is a high degree of unpreparedness on the part of the

respondents to resort to such an action in the face of a calamity. But more than this, it shows in general that the respondents have a strong attachment towards their area of locality, in spite of the droughts that they are subjected to from time to time.

5.5.3 Adjustments that modify the loss potential:

These are somewhat long term actions, designed to prevent or reduce the injurious effects of the hazard. As seen in Table 5.18 all four listed adjustments here, are deeply rooted in the agricultural system and reflect to a large extent the people's ability to adapt themselves to the prevailing weather conditions. An individual account of these adjustments is given below.

(i) Planting drought tolerant crops:

All the respondents with the exception of two carried out this form of adjustment. The main drought tolerant crops planted were millet and sorghum. These two crops have been in existence for a very long time and are amongst the most important food crops grown

in the region.

Going by the findings and what came out of both the formal and informal discussions held with them, there is need to emphasize the point that the sample population attaches great importance to these crops for strategic purposes. It is a well known fact amongst the respondents that millet and sorghum are able to withstand some of the climatic hazards they face.

(ii) Observe early planting time of crops.

This too, was a very popular adjustment, involving 87.2% of the respondents. Most of the crops tend to be planted soon after the commencement of sowing rains. This is either at the end of November or at the beginning of December. For certain varieties of millet and sorghum planting was undertaken before the start of the rainy season. (See Table 4.2). The significance of planting early is well understood by the majority of the respondents. By planting early, they avoid unnecessary crop losses in case of an abrupt end of the rainy season. In fact for this region it is logical for one to observe an early planting time of crops because the rainy season is of

a short duration.

(iii) Planting different varieties of the same crop:
It was found to be done by about four-fifth of the respondents. Indeed, like the above it was one of the commonest adjustments adopted by the people. The crops involved were mainly food crops like millet and sorghum. For instance, two traditional different varieties of millet (maila and lusili) and sorghum (zembwe and mabele) with different periods of maturation are normally cultivated in each growing season, as separate crops. The idea behind this is to eliminate the chances of experiencing a complete crop loss in the event of some abnormalities in rainfall. What is encouraging to note about the finding is the fact that it is another positive indication of the deliberate actions that many of the respondents make in their effort to try and reduce crop losses from the drought hazard.

(iv) Practise inter-croping:
Slightly, over half of the respondents revealed carrying out such an action. The usual crop combinations were, (a) millet, pumpkins and watermelons; (b) maize and beans; (c) groundnuts, maize and

watermelons; and (d) sorghum and maize. In all cases the dominant crop is listed first. By cultivating more than one crop in the same field, the respondents pursued some degree of precaution against total crop losses. Most of them seemed to be aware of the fact that these crops have different moisture requirements.

5.5.4 Adjustments that accept or distribute the losses:

These consist in general of short term measures, which are adopted to offset or cover up the crop losses incurred from the hazard. Most of them, if not all, as seen in Table 5.18 can be treated as emergency type of adjustments. In total, eight adjustments were identified here. These are:

(i) Depend on help from government:

It was found that whenever there is drought or famine in the region, the government through the services of various organisations helps out with relief food to alleviate the sufferings of the people. Because of this, all the respondents looked forward to being helped by the government in the face of a disaster and strongly felt at

the same time that it was government's responsibility to assist them in difficult times.

Government's action of assisting drought victims is recommendeable. But, going by the experience of the just ended drought, there is need to improve its effectiveness. As the case was in the 1981-84 drought, the government took long to respond to the situation. Relief food started pouring into the area towards end of 1982, long after the onset of the hazard. Another anomally, was that food was distributed equally to all heads of households regardless of their family sizes and the degree to which they were affected by the hazard. In future, steps to correct these mistakes must be taken so as to ensure timely distribution of food and that food should be given only to those who are badly affected by the hazard.

(ii) Stock enough food during periods of good harvest. Almost all of the respondents reported undertaking it. The number that did not account for this, was 5% only. It is interesting to note that the respondents normally reserve large stocks of food each time they have a good harvest and carry it forward to the next harvesting season before they can

think of selling the surplus. An explanation to this is not difficult to find. The surplus is not easily disposed off because of fears that they might have a bad crop in the ensuing year. In so doing one sees that they tend to plan ahead for future drought losses. However, this particular adjustment suffers one great setback and that is the lack of proper grain storage facilities. Local agricultural experts do acknowledge the fact that because of the poor state of storage facilities, grain losses through pests is very rampant in the study area. As a matter of necessity and urgency, both peasant farmers and planners need to address themselves to this problem if they are strengthen this adjustment and avoid unnecessary grain losses.

(iii) Conduct small economic activities to raise money for food:

Various activities such as crafts production, brewing and selling of beer, fish trading and the selling of wood and charcoal, all meant to supplement family incomes are widely carried out by the people in the area. When there is drought, these play a very important role as they enable families raise

money for food. In the 1981-84 drought about 77% of the respondents reported having based part of their food purchases through such activities.

(iv) Sell livestock:

More than two-thirds of the respondents adopted such a measure during the 1981-84 drought, with the main animals sold being cattle and goats. This finding was considerably high since not all the families reared animals (see Appendix 6). It must be said right away that for the families that reared animals, almost all had resorted to this action. Appendix 7 illustrates this point. The sell of livestock is in fact one of the most reliable sources of income available to the majority of the people for the purchase of cereals and other foodstuffs. Many respondents indicated during the interviews that had it not been for the animals they kept, their survival in the three year running drought would have been extremely difficult. One important aspect that needs to be raised is that even though, they heavily depended on the sales of livestock to buy food, many of them did not regard the move as worthwhile, especially where cattle sales were concerned (see Appendix 9). They considered the sell

of cattle for such purposes, as a blow to their supposedly role in society. As mentioned earlier, cattle are widely used by the Gwembe people for settling bride wealth obligations. The traditional view that it is kept mainly as a sign of wealth might be of some relevance too. Besides this, it is increasingly becoming a fashion nowadays for people to use it for the buying of clothes and sending their children to schools. Thus cattle assumes very important roles, which if disturbed would be very difficult to replace. As things stand, it is very frustrating for them to see food purchases come-in in the line of the roles of cattle, when in actual fact their intentions and practises are and have always been to produce enough food for home consumption.

(v) Depend on wild products:

According to the interview data, about two-thirds of the respondents had used food gathering in the 1981-84 drought to meet part of the food requirements. And less than 10% reported doing some hunting activities, as a means for raising food.[4] In the past

4. This adjustment appears to have slightly been underestimated. Some respondents were not very free, when it came to discussing this issue. Probably, they feared that the researcher was a government officer and could report those involved in illegal hunting activities.

hunting was an equally important activity, which most people in the area tended to do in times of drought and famine. Like its counterpart, it was also used in normal years to supplement their diet. But today due to fewer numbers of animals and the removal of traditional hunting rights, it occupies a very low position. On gathering, as can be seen by the number of the respondents who undertook it, there can be no overemphasizing the point that the adjustment is still of paramount importance in the region. One relevant point which needs to be raised here is that the people in the area take full advantage of the existing flora, which is blessed with many edible plants. Appendix 8 shows some of the most important plants which the respondents had used during the 1981-84 drought. For a more comprehensive list on the plants that have been used at various drought times in the Gwembe Valley see Scudder, 1971 .

(vi) Request help from relatives or friends:
Seeking assistance from relatives and friends is something that was found to be a normal practise amongst the respondents. Very strong family ties are maintained and it is part of their culture to

assist each other whenever the situation dictates so. The interview data shows that in the 1981-84 drought about 65% of the respondents had asked for help, while the number that got assisted totalled 61%. Assistance is sought both from within and outside the area of residence. While in the past help was obtained mainly from wealthy families within the Gwembe Valley itself and the surrounding Tonga Plateau, today it seems as if much of it is coming from their relatives and friends who are employed in the towns (see Table 5.19).

Table 5.19: Assistance from Relatives and Friends

	Source of Origin		
	Within the Gwembe Valley and the Surrounding Tonga Plateau areas	Urban areas	Others
No. of Household	68	89	14

Note: Multiple answers recorded

Assistance was both in kind and cash. Due to data problems, the amount and type of assistance obtained from each source could not be quantitatively expressed.

(vii) Work for wages or food:

Nearly half of the respondents undertook this adjustment during the drought of 1981-84, in an unusual circumstances, for the purpose of overcoming food shortages created by the hazard. Though one of the most widely perceived drought action (see Fig. 10 and 11), it probably failed to command a high position because of limited job apportunities in the region.

(viii) Use saving to buy food:

This is of a recent origin and was reported to have been first used during the last drought of 1981-84, by 25% of the respondents. The predominant economy is a subsistence one, with a bias towards food crops and therefore little money is available for savings. However, with the recent introduction of cash crops (mainly cotton) the financial position of most peasant farmers may be boosted. Hence savings could become an important adjustment in future.

5.6 The Adoption of drought adjustments

We have seen from the previous discussion that it is a common practise amongst the respondents to observe an early and appropriate planting time of crops and to plant drought resistant crops; bulrush millet and sorghum at every growing season. These adjustments as we have said are part and parcel of the traditional farming strategies of the people. But still at the start of the growing season, the farmer is faced with the critical question of what crops to grow or leave out. Another problem, involves the amount of time and hectrage to devote to each crop. The decisions the farmer makes are usually guided by his previous experience. Things that matter most here, include; crop performance, the availability of labour, seeds and farm implements (ox-plough). Other things that also play an important role, are the kinds of short/long term weather and climate forecasts the farmers make before the start of the rainy season and the advice they get from the extension officers. Then depending on all these things, once the rainy season commences, the farmers go ahead with their business and do things according to their assessment

and ability. Both rational and irrational decisions are made in the process.

When it comes to actually adopting drought adjustments, it is illustrated by Fig. 5.5 that those actions that are designed to prevent or reduce its damage potential may be taken prior to the occurrence of the hazard or soon after the hazard has been detected or perceived as being harmful. Because of past experience and the diverse local weather and climate forecasting techniques the farmers are usually aware and knowledgeable about the kinds of natural problems that prevail in their environment[3]. Hence they purposively take such

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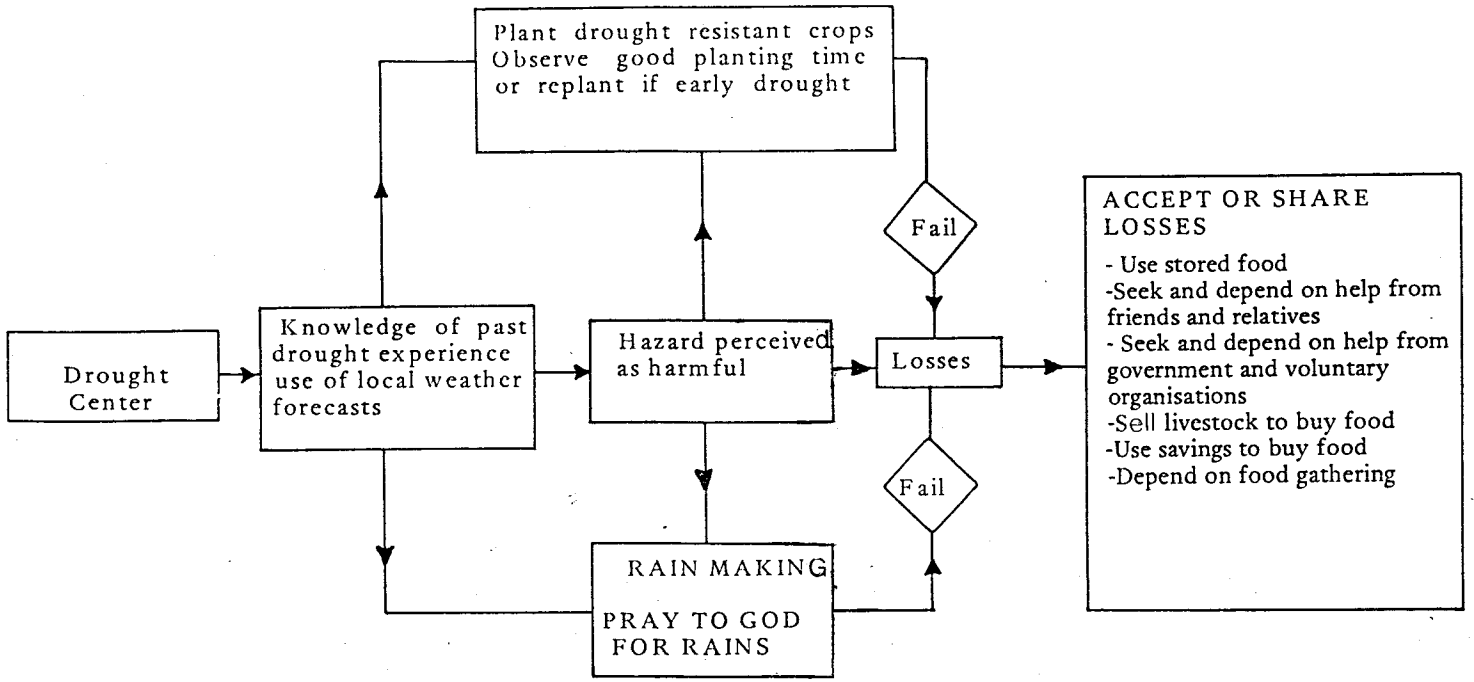
3. A variety of local weather forecasting techniques are known and employed by the Gwembe Tongas. The people use for instance, the flowering and leafing out of several plant species such as the Mukuyu (Ficus capensis) and Musangu (Acacia Albida) to indicate the end of the hot season and the onset of the main rains. The appearance of migratory birds from the north such as Swallows (Tumembya in Tonga) and the behaviour of red ants (locally called Nsibili) are also widely used. Interesting to note too, is that the people closely monitor the position of a morning star, popularly known as "Ntanda' and the production of fruits by certain plants like Mutondo (Cordyla africana) and Musikili (Trichilia emetica) for predicting the nature of rains and drought incidences in a given year. The presence of the 'Ntanda' in the west and the failure by Mutondo and Musikili plants to produce sufficient fruits or nothing act as indicators of a bad rainfall year.

FIG. 5.5 : ADOPTION OF DROUGHT ADJUSTMENTS : THE PEASANT FARMERS OF GWEMBE VALLEY.



adjustments like the planting of drought resistant crops, rain making activities and church prayers, sometimes well before the hazard occurs. In the course of failure by these measures to contain the drought situation, either due to their inability to change things or because of the persistence/severe nature of the hazard, losses are encountered, forcing the farmers to turn to the loss-bearing forms of adjustment. These adjustments such as the s of livestock to buy food and food gathering are taken up in order to offset loses incurred from the hazard. The same is repeated almost every time, when they are faced with the hazard.

5.7 Alternative strategies for combating future droughts

The interview data in Table 5.20 illustrates, that apart from the existing forms of adjustment, a very large proportion of the sample population are not aware of other possible adjustments which they could introduce on their own without outside help. Many respondents seem to think that it is only the state that has the capacity to bring about new and effective types of adjustments. They want

Table 5.20 Alternative strategies for combating future droughts

Individual Measures		No.	%
(a)	Increase livestock herd	31	17.2
(b)	Concentrate on cotton cultivation	9	5.0
(c)	Migrate to better areas	11	6.1
(d)	Embark on irrigation	7	3.9
Government Measures			
(e)	supply of early maturing/drought resistant grain varieties (free of charge or at a reduced rate)	136	75.5
(f)	construct dams and boreholes	109	59.4
(g)	provide irrigation facilities.	109	59.4

* Multiple answers recorded.

the government to take the initiative and establish capital and technologically advanced adjustments. These adjustments include: the supply of early maturing/ drought resistant grain varieties (free of charge or at a reduced rate), construction of dams and boreholes and the provision of irrigation facilities. They hold these adjustments in high esteem and feel that once introduced, all their sufferings would come to an end. For the immediate future it is very unlikely that the government will respond effectively to their needs. These will take time to be established because of the poor state of the national economy. In the case of grain varieties, the situation is slightly different because we have at least some improved ones in the country, but the problem is that these are very expensive and cannot be afforded by most peasant farmers. Furthermore as suggested by the agricultural officers in the area, the supply of grain seeds is very poor - at times the region gets varieties that are best suited to areas of high to moderate rainfall, while at some other occasions the seeds are distributed well after the commencement of the sowing rains. With these problems at hand, the farmers ususally resort to the usage of seeds from their previous harvest, instead of certified ones. This should

immediately be looked into, as it tends to lower their crop output.

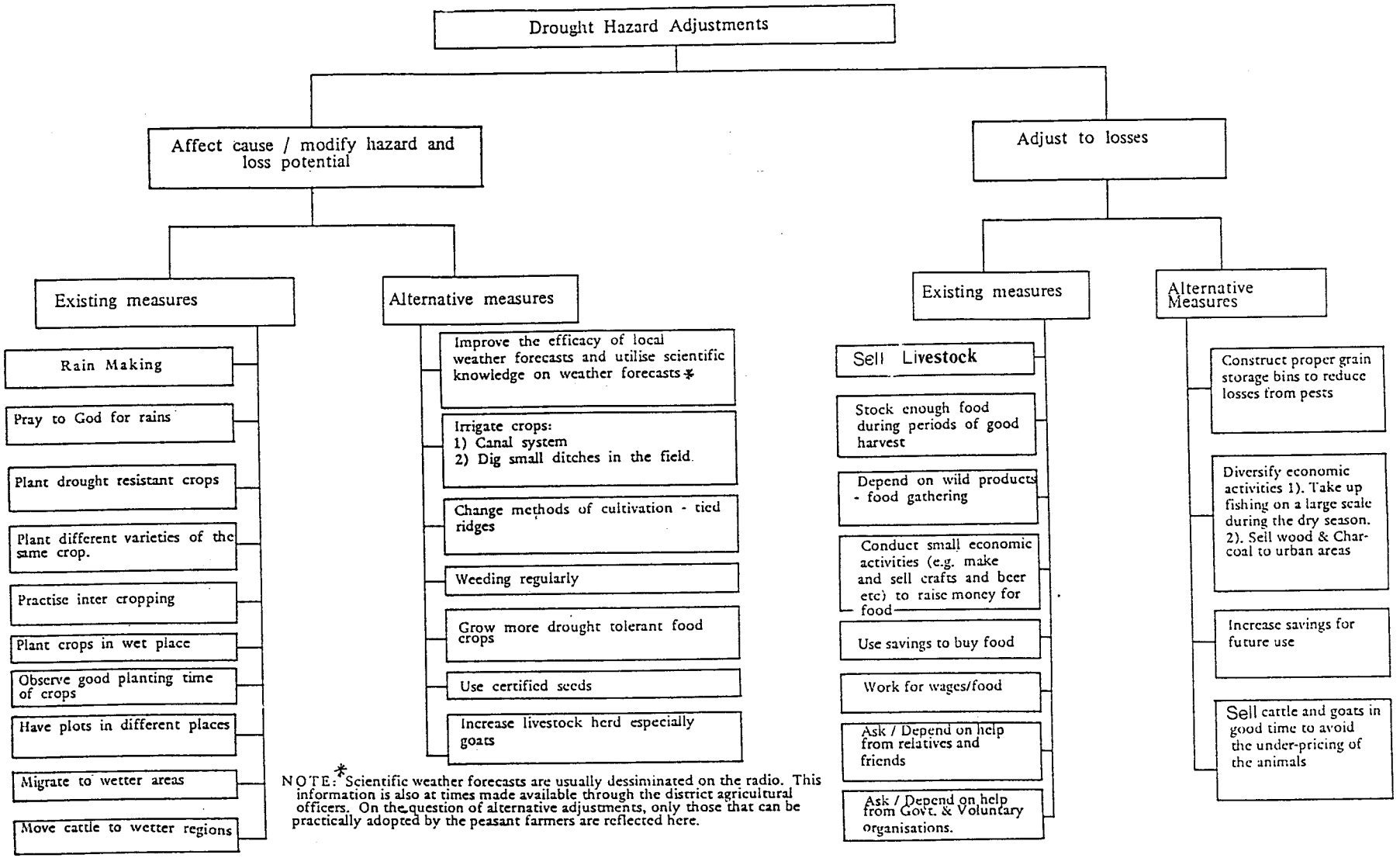
A view at the individual oriented alternative adjustments, as advanced by the few respondents, provide us with some interesting piece of information, which adds to our belief that greater opportunities exist for individual households to increase or strengthen their forms of adjustments (see Fig. 5.6). For the sake of detail, these adjustments are discussed separately below.

(a) Increase Livestock Herd.

By embarking on this strategy, the respondents genuinely believe that they would be in a much better off position to deal with the drought hazard, as past experience has shown them that the livestock they raise (goats and cattle) are not very vulnerable to droughts and that they assist greatly when it comes to buying food to meet the deficits or shortages.

The idea to increase livestock herd, particularly goats which are well suited to the environmental conditions that prevail in the valley, is a step in the right direction and should be given all the encouragement. But if this were popularised

FIG 5.6: RANGE OF ADJUSTMENTS TO THE DROUGHT HAZARD IN THE STUDY AREA



NOTE: * Scientific weather forecasts are usually dessiminated on the radio. This information is also at times made available through the district agricultural officers. On the question of alternative adjustments, only those that can be practically adopted by the peasant farmers are reflected here.

without making some structural adjustments to the land tenure system, the problem of land degradation caused by communal grazing would worsen and become unmanageable.

(b) Concentrates on cotton cultivation:

The general argument for advancing this strategy stems from their deep realisation that since its inception in the 1960s, cotton has never really failed them, despite the odds like poor rainfall conditions, high temperatures and stoney soils. Hence by concentrating on it the farmers hope to avoid the risks and losses involved in the cultivation of some other crops that are not well suited to the environment. In addition to this, and perhaps much more important factor at stake, is the fact that there are many economic advantages that accrue from the cultivation of this crop. Unlike growers of some other crops, cotton farmers have an easy access to loans. They further enjoy favourable producer prices, good marketing and distribution arrangements for their produce and inputs respectively. Payments for their produce are also made promptly.

With the many advantages surrounding the cultivation of the crop, it is not surprising at all to find that some of the respondents have plans to grow more cotton, as a way of averting some of the hardships the hazard imposes on their lives. A point of caution, is that cotton cultivation must never be taken at the expense of food crops. Otherwise, with the poor roads and distribution of food in the area, even if one has money, there is no guarantee that the food will be readily available and thus might lead to disastrous effects (famine conditions) in times of drought.

(c) Migrate to better areas:

The interviewees, who advanced this strategy, (mostly young people) pointed out that in the event of a severe drought in future they would shift from the Valley and settle on permanent basis in other parts of the country which are free from the hazard. In so doing, they hope to avoid losses and the hazard altogether. They had in mind places as far as Northern and Luapula provinces. Generally, they demonstrated an awareness of good alternative places, where they would not be bothered with the hazard. As a concluding remark it should be stated that there

are many large expanses of virgin land in the country, where conditions are far much better than those in the valley and it would do the country no harm if some of the people from the Gwembe Valley settled in such places. But as a form of drought adjustment, it should be the last option because there are many other adjustments which could be initiated or improved upon. (See Fig. 5.2).

(d) Irrigate crops.

These respondents, who made such a proposal, intend to do it in two respects. Some of them suggested that they would try to buy small water pumps which they could use to irrigate a few of the crops they grow along the river valleys and the surrounding areas of Lake Kariba. Another suggestion was that they would attempt to block off the waters of some of the streams and divert them into dug-out canals leading to their fields. Both appear difficult to achieve, but if some farmers have the means to do so, they should be given the necessary encouragement and support.

5.8 TESTING OF HYPOTHESES

From the three main working hypotheses (see Chapter I), several null hypotheses were formulated and tested using the chi-square (X^2) test of independence at 0.05 level of significance. The

null hypothesis in all cases read; there is no significant relationship between the variables. Two major sets of variables were paired against each other. The first, included socio-economic indicators (i.e. age, education, length of stay, tenure of land, and source of income). The other group had variables such as personal drought experience, awareness of the hazard, drought expectancy and prediction, the magnitude and frequency of the hazard (perception) and the range of adjustments.

In employing the X^2 test, one important factor that dictated its choice was the nature of the data itself. Nominal type of data was involved. As such, parametric tests and others based on interval or ratio and ordinal levels of measurement could not be used. Attempts to transform the data into other levels were made, but found unsuitable. This limited the choice then, on the X^2 test, which is one of the most powerful non-parametric tests and very useful in the testing of associations between variables.

Out of the 41 X^2 tests that met the necessary conditions for the testing of significance, the null hypothesis could only be rejected on 14 occasions. Statistically, what this implies is that fewer variables were related to each other. A more detailed

picture on these variables with significant relationships is shown in the contigency tables below.

In reference to the three main working hypotheses, the chi-square results generally point out the following:

(a) that the frequency of drought occurrence and personal experience is largely related to the awareness of the drought hazard (see Tables 5.21 and 5.22). With the high personal experience of droughts and the seemingly high rate of drought occurrences (based on peasant's perception), one can not doubt such a relationship. We may further state infact, that in the actual awareness business of the hazard, the frequency of drought occurrence and personal experience played an important role. The fact that more than 80% of the respondents displayed their awareness of the hazard, is indicative enough that this could not have been by chance or accident, but as a result of factors like the ones stated here. On the other hand, the perceived frequency of drought occurrences was greatly influenced by several factors such as age, length of stay, type of tenure, and personal experience of the

Table 5.21: Awareness of the hazard by frequency of droughts

	Occasional	Frequent	Very frequent	Row Total
Not aware	11 32.4	4 5.2	6 10.2	21 12.4
Aware	25 67.6	73 94.8	53 89.8	149 87.6
Column total	34 20.0	77 45.3	59 34.7	170 100

^{2} = 16.4650, df = 2, $p < 0.05$

3 Most of the respondents, who were aware of the hazard perceived its occurence as either being frequent or very frequent.

able 5.22 Awareness of the hazard by personal drought experience

	2-5 times	6-10 times	Above 10 times	Row Total
Not aware	16 31.4	4 5.9	2 3.3	22 12.2
Aware	35 68.6	64 94.1	59 96.7	158 87.8
Column total	51 28.3	68 37.8	61 33.9	180 100.0

= 24.5292, df = 2, $p < 0.05$

The majority of the respondents who were not aware of the hazard, had fewer encouters with it. (2-5 times)

hazard (see Tables 5.23 - 5.27).

(b) that socio-economic indicators i.e. age, length of stay and education are directly related as well to the awareness of the hazard (see Tables 5.28, 5.29 and 5.30). Though they were disregarded in the main hypotheses, the revelation by the X^2 results make us believe now that in one way or another their role in the awareness process was of crucial importance. At large, the sample population consisted of people of middle and old age groups, commanding at least some elementary form of education and long periods of stay in the hazardous environment. Such background, rich as it is, provides room for the observed relationship whereby, awareness tends to increase particularly with age, and length of stay.

(c) that the magnitude of droughts is not at all related to the awareness of the hazard. This revelation by the X^2 test is contrary to what had been anticipated. As regards, its relationship with socio-economic indicators, only age was linked to it. The X^2 results shown in Table 5.31, therefore suggest to us that age was an influencial factor in the perception

Table 5.23: Frequency of droughts by education

	No formal Education	Formal Education (7 years)	Formal Education (7-10 years	Row Total
Occasional	7 11.7	11 16.7	16 36.4	34 20.0
Frequent	17 28.3	40 60.6	20 45.5	77 45.3
Very frequent	36 60.0	15 22.7	8 18.2	59 34.7
	6o 35.3	66 38.8	44 25.9	170 100

X^2 = 32.8193, df = 4 $p < 0.05$

Table 5.24: Frequency of doughts by length of stay

	20 years	21-30 years	Above 30 years	Row Total
Occasional	9 30.0	17 45.9	8 7.8	34 20
Frequent	16 53.3	8 21.6	53 51.5	77 45.3
Very frequent	5 16.7	12 32.4	42 40.8	59 34.7
Column total	30 4.1	37 13.5	103 21.8	170 60.6

X^2=31.4919, df=4 $p < 0.05$

NB The majority of the respondents, with many years of stay in the hazardous region (21 years and above) viewed the hazard as being more or less frequent in its occurence.

Table 5.25 Frequency of Droughts by Type of Tenure

	owner	unclassified	Row Total
Occasional	18 12.4	16 64.0	34 20.0
Frequent	73 50.3	4 16.0	77 45.3
Very Frequent	54 37.2	5 20.0	59 34.7
Column Total	145 85.3	25 14.7	170 100.0

$x^2 = 35.75$, df = 2, $p < 0.05$

N.B. The majority of the respondents who perceived the occurrence of the hazard as being occasional or rare, had no farm lands of their own. This group of respondents, was dominated by young people.

Table 5.26 Frequency of Drought by Age

	30 yrs	31-37yrs	38-44yrs	45-51yrs	Above 51 yrs	Row Total
Occasional	19 54.3	8 44.4	0 .0	3 14.3	4 5.8	34 20.0
Frequent	10 28.6	4 22.2	22 81.5	9 42.9	32 46.4	77 45.3
Very Frequent	6 17.1	6 33.3	5 18.5	9 42.9	33 47.8	59 34.7
Column Total	35 20.6	18 10.6	27 15.9	21 12.4	69 40.6	170 100.0

$x^2 = 59.76$, df = 8, $p < 0.05$

N.B. Most of the young respondents (less than 37 yrs) perceived the hazard as being occasional or rare in its occurrence.

Table 5.27 Frequency of Droughts by Personal Drought Experience

	2-5 times	6-10 times	Above 10 times	Row Total
Occasional	23 51.1	10 14.9	1 1.7	34 20.0
Frequent	14 31.1	42 62.7	21 36.2	77 45.3
Very Frequent	8 17.8	15 22.4	36 62.1	59 34.7
Column Total	45 26.5	67 39.4	58 34.1	170 100.0

$x^2 = 59.01$, df = 4, $p < 0.05$

N.B. Most of the respondents, who perceived the hazard as being occasional in its occurrence, had fewer encounters with it (2-5 times)

Table 5.28 Awareness of the hazard by length of Stay

	Less than 30 yrs	Above 30 years	Row Total
Not aware	18 24.3	4 3.8	22 12.2
Aware Total	56 75.7	102 96.2	158
Column Total	74 41.1	106 58.9	180 100.0

$x^2 = 17.15$, df =1, $p < 0.05$

N.B. Awareness of the hazard tended to be higher amongst those who have stayed longer in the region, than those with a short period of stay

Table 5.29 Awareness of Hazard by Age

	Less than 44 years	Above 45 years	Row Total
Not Aware	18 31.6	4 3.3	22 12.2
Aware	39 68.4	119 96.7	158 87.8
Column Total	57 31.6	123 68.4	180 100

$x^2 = 29.13$, df = 1, $p < 0.05$

N.B. Respondents in the old age groups were more aware of the hazard than the young ones.

Table 5.30 Awareness of the hazard by Education

var 04 var 09D	No formal education	Formal education (7 yrs)	Formal education 7-10 yrs)	Row Total
Not aware	7 12.3	2 2.9	13 27.7	22 12.2
Aware	57 87.7	67 97.1	34 72.3	158 87.8
Column Total	64 31.7	69 38.3	47 26.1	180 100.0

3.9

$x^2 = 16.13$, df = 2, $p < 0.05$

Table 5.31 Severe Drought by Age

	Below 30 yrs	31-37 yrs	38-44yrs	45-51 yrs	Above 51 yrs	Row Total
Mass crop Failure & Famine	20 52.6	16 84.2	20 74.1	20 95.2	48 64	124 68.9
Very poor rains & high temperatures	18 47.4	3 15.8	7 25.9	1 4.8	27 36	56 31.1
Column Total	38 21.1	19 10.6	27 15	21 11.7	75 41.7	180 100.0

$x^2 = 14.7452$, df = 4, $p < 0.05$

N.B. People in the middle and old age groups (38 years and above) interpreted or defined severe drought mainly in terms of effects.

of the magnitude of the hazard. Elderly people tended to have a better and clearer perception of the hazard than the young ones. By virtue of their age, elderly people have had many encounters with the drought hazard. Hence the being of such a relationship between the two variables.

(d) interms of the adoption of adjustments, the X^2 results do not bear evidence of any kind, that this variable is related or is a function of the perception of the hazard, let alone the socio-economic indicators and the frequency of personal drought experience. From a practical point of view this is difficult to accept. It was widely thought infact, that significant relationships would be established especially between drought adjustments and the perception of the hazard and the frequency of personal experience.

Perhaps, the situation would have been different had the chi-square involving the perception of alternative drought adjustments qualified for the testing of significance and if various aspects of drought adjustments (e.g. types of adjustments and peasants assessment of the adjustments undertaken) were also included. Nevertheless, basing our judgement on what was practically possible for us, these

X^2 results present a vexing problem which is well acknowledged in hazard studies. Statistical manipulations have often shown perception to be blurred or non-existent, even though its role in the adjustment process is unquestionable. It tends to be obscured by several factors, especially those pertaining to the human and hazard characteristics.

Despite the many X^2 tests, one can certainly see that a few relationships outlined in the main hypotheses are missing. For reasons beyond the capability of this research, it was not possible for instance to test the relationship between the recency of drought experience and the awareness of the hazard (see 1st hypothesis). This required at least two contrasting drought periods i.e. one long period with no drought occurrence and the other being during or soon after drought occurrence. Variables in the third main hypothesis were also not tested for significance. Statistically, this proved rather difficult because of the fact that all of the existing adjustments fell in one class i.e. interms of the general theoretical grouping of adjustments. Like what was hypothesized, all the adjustments belong to the folk or tradition type. They are simple in character and involve very little capital. Unlike, the modern technological and post-industrial adjustments such as the use of boreholes, dams

and water reserves for irrigation, this range of adjustments do not seek a confrontation with nature and by large can not change or alter drought characteristics. In other words, they operate within the framework of a given set of natural conditions and the state of the drought hazard itself. Again, we see an absence of heavy farming equipment and the heavy application of chemicals and crop insurance policies as further indicators of the simplicity and the low capital requirements of these adjustments.

5.9. DROUGHT ADJUSTMENTS - A CRITICAL ANALYSIS

In the last 3 to 4 sections, much attention has been paid to the field findings with respect to drought adjustments. By making reference to simple statistical tables, we were able to gauge the kinds of adjustments that are popular in the area and also advance the ones that are of practical importance, including those that are not yet in practise but are theoretically possible. At least a base for understanding the whole range of drought adjustments emerges from these sections. A critical review of the subject matter, which brings into light some

historical factors and present conditions surrounding the state of adjustments is, however lacking. This particular section takes care of such a problem. It's inclusion as per design, is intended to put us in a much clearer position as regards the nature of adjustments vis-a vis their position in relation to the present socio-economic climate.

Prior to the late 1950's (i.e. before Kariba dam/ lake came into existence), the majority of the Gwembe Tongas lived along the Zambezi river and its major tributaries, cultivating the rich riverine alluvial soils. They lived up to this period largely as a closed society, with minimum influence from the outside. Hence their survival mechanisms, built around the three-field agricultural system went on undisturbed for a very long time. This system of agriculture which the Livingstones had found (see Chapter 3) provided them with all the necessary food. By all standards it was very superior, as it allowed them to have crops scattered in different ecological zones. Another added advantage was that food crops were grown in the dry season as well. But all this came to pass, with the construction and formation of Kariba dam and lake respectively.

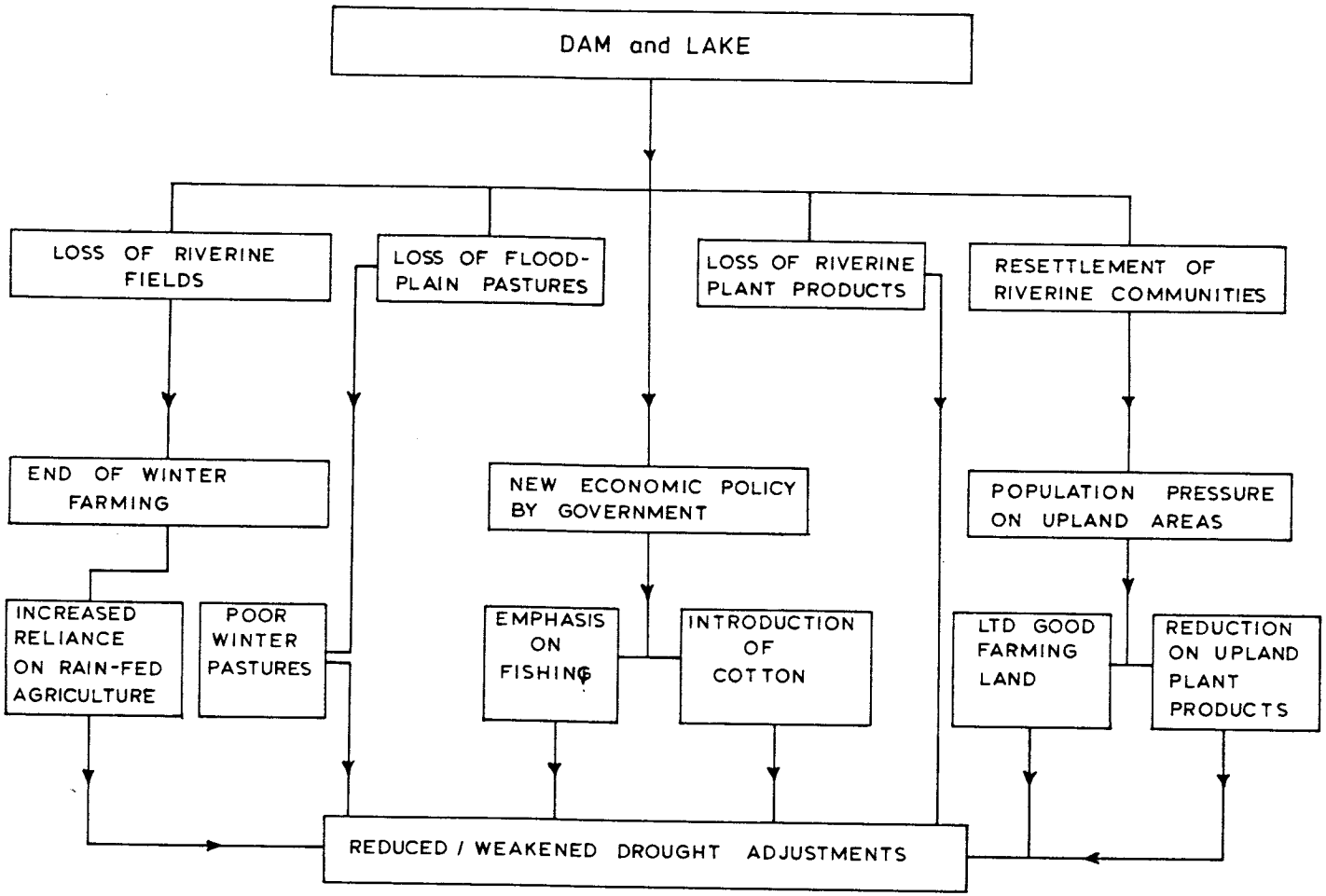
Having lost the riverine wetlands and the three-

field agriculture system in general, their carefully worked out adaptation to the environment came to an abrupt end. Hence today the Gwembe Tongas entirely depend on rain-fed agriculture, which is restricted between the end of November and early April. Worse still, they can not cultivate the same gardens year after year, as they did on the rich alluvial soils. In most upland areas of the valley, the soils require a lengthy period of fallow of six years and above. Practically, this resting period of land is difficult to achieve taking into account the limited fertile soils and the high population density that came with resettlement (see Chapter 3).

The above, are self indicative of the fact that Kariba dam/lake, brought in serious irreversible damages to the peoples overall defence mechanisms against the hazard. Fig. 5.7 illustrates this point and a more detailed picture is given below.

The effects of the lost agricultural system did not only apply to the people along the Zambezi and its major tributaries but also to the upland communities. Through the exploitation of kinship and lineage ties upland dwellers obtained food from riverine communities during drought times. Barter trade of household products

FIG. 5.7 : CHANGES ASSOCIATED WITH KARIBA DAM/LAKE AND THEIR EFFECTS ON DROUGHT ADJUSTMENTS.



like pots and baskets for food was common and carried out by both groups in difficult times (Scudder, 1971 p. 18). Another benefial aspect to the upland communities involved the grazing of their animals on the rich flood plain pastures in winter. Though such kind of movement of cattle persists even today and was reported by the respondents, it is very unlikely that the pastures obtainable around the lake are as palatable and nutritious as the latter. The period at stake is too short for good pastures to develop.

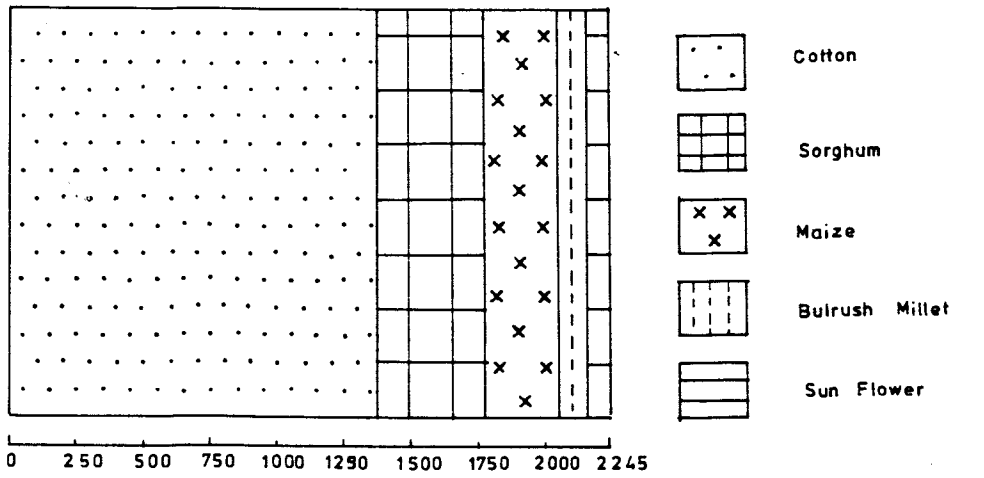
Coming to plant based products, the Gwembe people suffered another tragedy by losing the rich and diverse group of wild fruits, grasses, roots and tubers both along the Zambezi river and in upland areas. In upland parts of the valley the loss was not a complete one, but the resources had greatly dwindled because of increased population which saw mopane woodland areas being cleared for cultivation. Elders in the area complained of the lack of sufficient leaf relishes such as the Mandoili (Triplochiton Zambesiacus) Kakonkwa (Corchorus olitorius), Isungwa (Cleome gynandra) and bowa (assorted types of mushrooms), and maintained that in the past, plant products formed a major supplementary source of food, especially in the rainy season as well as during periods of famine.

Its importance sharply declined with the events following the construction of Kariba dam.

The policies that the colonial government pursued after resettlement added further problems to the people of Gwembe . They were not helped to re-establish themselves as successful farmers. The colonialists took no interest in this direction and came to regard them as an expensive nuisance, whose position and problems were incomparable to the economic benefits that would accrue from the dam and lake (Brokensha and Scudder, 1968). The authorities ignored the plain truth that the Gwembe Tongas are by nature agricultural people and instead worked out policies that were aimed at making them become commercial fishermen and even evisaged the future prosperity of the valley to be based on fishing. In the drive to achieve their well calculated but ill-designed plans, they established fishing camps and training centres in the area exclusively for the people of Gwembe. Furthermore, facilities for large-scale fishing such as landing sites and ice plants were constructed at Chipepo and Sinazongwe. With all these, confusion reigned over the people on what to do and in the first few years government's plans seemed to yield the desired results especially amongst the young and middle aged people. For various reasons, by the end

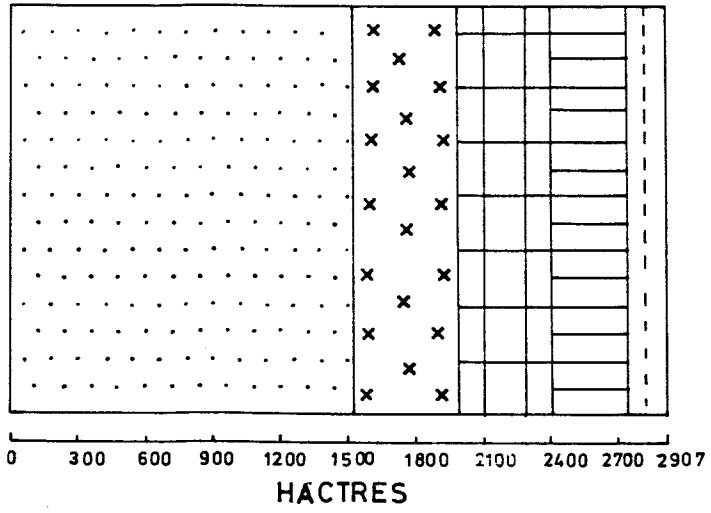
Fig 5.8 CROP HACTREAGE FOR SELECTED CROPS IN THE STUDY AREA

(A) 1981/8 AGRICULTURAL SEASON



NB The selected crops are the most important ones grown in the area

(B) 1983/84 AGRICULTURAL SEASON



they thought of putting up by 1970 is now a reality. Work on this is in progress at Gwembe, the Chief administrative centre of the region. It has already been made clear that since the area is underdeveloped food production must come first before anything else. The state of the matter is that cotton can never really save the people from starvation once drought situations of a severe magnitude take their toll.

The events following the construction of Kariba dam and the formation of the lake were really a sad affair. Whilst we join the Gwembe Tongas in moaning over their losses, especially the three-field agricultural system, nevertheless, it would be unfair if we failed to mention a few positive things that came to surface. These included: the wide scale usage of ox-drawn implements, the spread of the pig culture, the introduction of new varieties of sorghum (locally known as cigaligali), early ripening varieties of millet and maize inclusive and the popularisation of fruit crops like mangos, bananas, pawpaws and sugarcane. Colson observes that innovations like the spread of the pig culture and the usage of ox-drawn implements came without much government encouragement but was as a result of influence from plateau Tonga and the peasant's own initiatives to revolunize their agriculture

(Colson, 1971, p. 163-4). It is interesting to note that the peasants easily copted these new things into their accustomed traditional ways of life. Though limited in number, the new innovations have helped the people in a way in trying to consolidate the new agricultural system that came into existence. But of course they provide a very narrow range of opportunities or options for strengthening their drought adjustments.

All, in all, it can strongly be argued that the disruption that came into effect after the birth of Kariba dam and lake, created serious loopholes in their adaptations to the environment. Problems emanating from this, are still far from being over. For instance it is reported by Nanchengwa and wood that agriculture in many parts of the valley has not yet adjusted to the difficult conditions (i.e. re-settlement and population growth), arising from the dam and the lake (Nanchengwa and Wood, 1984, p. 40). Their inability today to exploit the rich alluvial soils and cultivate some crops in the winter season is reflected in the rising cases of food shortages and the rate and extent of drought incidences, including their effects. The picture obtained from the district's agricultural annual reports on the above increased cases is alarming. Nanchengwa and Wood (1984) make similar observations. The

situation surrounding drought incidences and food output has been further aggrevated by the fact that wrong policies are at work in the region. Cotton is given more priority than the food crops. Even amongst the food crops government's policy is not straight, for it puts maize above sorghum and millet, the traditionally drought resistant crops. Many hybrid maize varities in use, are not well suited to the area. Both respondents and agricultural experts hinted during interviews that these do not adequately withstand the dry spells of five to seven days, which are quite normal in the area. It was also pointed out that they are an easy prey to diseases.

In view of the above, the government is called upon to arrest the situation and advance appropriate policies and measures. It must be recognised that peasant agriculture is by large very sensitive to states of nature and as such the success of food production must be ensued before the introduction of cash crops. Deliberate policies to boost the production of millet and sorghum are a must for this area. Attractive producer prices, loans to farmers and the creation of special marketing arragements for these crops are some of the things that can generate the desired results.

The problems of poverty and underdevelopment must also be looked into, as these affect both food productivity and drought adjustments. A sense of seriousness and commitment must be attached to the ways and means in which peasants strategic adjustments can be made more effective. Amongst the many things that one can advocate, it is essential that peasants are helped in the acquisition of seeds, fertilisers and loans, educated properly on scientific methods of farming and the storage of grain and efforts to monitor the crops they emphasize and the attention they give to each and at what time and cost should be carried out if we are to re-organise their agriculture. In addition to the afore-mentioned, research efforts into producing better varieties of cereals must be intesified. Equally, research attempts should be made to try and design a system of rain-fed agriculture which would be most suitable for this area. The government should also go flat-out to improve roads and transportation means in the region, which at present leave much to be desired. Last, soil, water and pasture conservation practices should also be looked into, as reported cases of erosion are on the increase. Simple means, such as the application of kraal manure (currently under-utilised) and composite

manure should form an important component of the conservation measures. By tackling all the above problems simultaneously, we can hope to strengthen many of the drought adjustments and improve food production in the region.

CHAPTER 6

SUMMARY AND CONCLUSION

6.1 Summary of Results

From the foregoing chapter, it is observed that the people in the study area hold more or less similar views on the drought hazard and practise a wide range of drought adjustments.

The hazard, locally referred to as 'danga' or 'ichilanga' is largely perceived by the peasant farmers to be an external nature generated phenomena, whose occurrence is difficult to predict or estimate. Amongst the forces held responsible for it, the rainfall factor emerges as the most important one. Although this observation is undisputable, their explanations on the causes of the hazard are rather incomplete, for they fail to recognise the importance of human factors. As we have argued elsewhere, drought incidences cannot be explained by physical factors alone.

It is widely viewed by the local people that drought occurrences are quite frequent in Gwembe-Central.

From the climatological stand point, the data on rainfall departures from the normal portrays the same image.

Amongst the many drought years identified in the region, the 1981-84 drought is perceived as having been the severest of them all. The rainfall data for the three rainfall stations generally shows substantial shortfalls in rainfall at some time during this period. But this is not to say, the data supports the perception maintained by the people, as they were other years when significant departures from normal were experienced. Even in the absence of this, still a proper correlation between the perceived drought severity and climatological data is difficult to achieve because the rainfall statistics adopted here conceal a lot of information.

The peasants' perception on the above matter, as we have stated in the previous chapter could have been greatly influenced by the recency and the duration of the hazard. And if ever, the 1981-84 drought was the severest one, there is little doubt to suggest that apart from the duration and intensity of the hazard, the disruption in the socio-economic environment that followed after the formation of Lake Kariba played a leading role.

The peasants no longer enjoy the agricultural diversity they had: crop production is now restricted to a single season unlike in the past when they grew some of their crops (along the Zambezi flood plain) in the dry season as well.

The peasants' understanding of the different forms of drought is broken into two; severe and moderate/weak. Severe drought is associated with large scale crop failures, particulary food crops, together with wide-spread food shortages or famine conditions and vice versa for moderate/weak drought. In connection to the above, it must be emphasized that drought is considered as problematic mainly from the viewpoint that it affects crop production (i.e. causing crop failures) and consequently bringing about famine conditions. Suffice to say, the hazard tempers greatly with their lives because it affects their main source of livelihood.

The drought adjustments practised locally are many and varied but simple in character. They involve very little capital and are deeply rooted in the traditional farming and social systems of the people. A number of them have envolved through long period of habitation in this hazardous environment. It is also noteworthy to

mention that in the course of time, many changes have occurred to the state and nature of the adjustments.[1]

All the adjustments identified here, are basically individual centred, except for a few which are of a community or government sponsored nature. The latter includes rain making, church prayers and famine relief aid. A considerable point of importance to note at this juncture, is that the decision on what type of adjustments to employ against the hazard rests very much with the individual family unit.

The general consensus held by the peasant farmers over most of the adjustments is that there are very useful in mitigating the drought effects (see Appendix 9). From a practical point of view agricultural based adjustments such as the planting of drought resistant crops, the planting of different varieties of the same crop and an observance of early and appropriate planting time are somehow the most important ones, as these

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1. We learn from Scudder for example, that in the past it was a common practice to find entire families migrating to areas of better harvest (within the Valley itself or the plateau) and seek refuge amongst relatives and friends. (Scudder, 1971, p. 18). Today, this is a rare form of adjustment. The same applies to hunting. While some have ceased to exist or declined in importance, new ones such as the use of savings to buy food have emerged.

the other hand, supplemented the largest amount of food but were poorly timed and distributed. In many cases relief food came long after the critical periods had passed and was distributed even to people who had enough.

The X^2 results reveal that several factors such as personal drought experience, the frequency of drought occurrence and socio-economic indicators were responsible for the high drought awareness amongst the respondents. As regards the adoption of drought adjustments, both perception and socio-economic variables were found not to be important.

6.2 Conclusion

This study of human adjustments to the drought hazard in the Gwembe Valley includes as well, many aspects of drought perception and utilises data both from the field and secondary sources. That from the field was based mainly on an interview schedule survey and was supplemented by data gathered through an interview guide survey and field observation.

The findings illustrate that people living in high drought prone areas exhibit little variation

in their perception of the hazard and that the minor variations that occur can be explained by both socio-economic variables and drought experience.

The study observes that people in drought prone environments are not only aware of the recurring nature of the hazard but are also aware of the forms of adjustments they would take when confronted by it. Individually, they have in mind at least one form of adjustment, which in most cases turns out to be that of a loss bearing type. More crucial than this is the fact that they do not sit idle and wait for events to take their course when the hazard occurs. This goes contrary to such studies like Berry et al (1971) which have listed and suggested 'doing nothing' as some form of drought response. Again in contrast to other studies (e.g. Saarinen, 1966 and Henthcote, 1969) this study fails to establish the importance of perception variables in the adoption of drought adjustments. Like other studies done elsewhere, Heijnen and Kates, 1972 and Campbell, 1984) the present study also demonstrates that peasant communities living in areas of frequent drought occurrences employ a variety of purposive adjustments for mitigating its effects. Though the adjustments may not

necessarily be very effective in combating the hazard, there are all the same very important locally, for they form part of the people's agricultural and social systems. Presently, a number of vital adjustments (agricultural based types) seem to have been greatly weakned by the socio-economic changes that have taken place, especially after the formation of Lake Kariba and could possibly be one of the main causes of the recent increased cases of drought and famine in the region.

Final, the study concludes that apart from the adjustments they undertake peasant communities usually offer a limited range of alternative adjustments, which are in most cases government oriented actions.

6.3 Recommendations

The drought problem in the Gwembe Valley and of course in some other parts of the country could effectively be tackled, if the recommendations outlined below were given a consideration.

I. To Policy Makers:

1. The present agricultural policies in the

region should be re-addressed, as these favour maize and cotton cultivation, instead of the traditional drought tolerant food crops; bulrush millet and sorghum. By emphasizing maize and cotton, the society is placed in a much more vulnerable state to the droughts. The risk of getting a bad crop out of the current maize varieties is very high because there are an easy target to droughts. Although cotton is well suited for the area, it still remains a bad policy in that you cannot emphasize the production of a cash crop in a remote area before ensuring reasonable surplus production of food crops. In times of calamities, the cash crop becomes of little value, as it cannot help them very much in the acquisition of food, since food is expensive and not readily available in the area. In order to correct the situation, the government should among other things provide competitive producer prices for bulrush millet and sorghum, establish proper marketing arrangements for these crops and extend loan facilities to the growers of these crops as well.

2. The government should ensure that a proper drought monitoring system is established in the

country. The system to be established should allow us to quickly identify and respond to areas of crop short-falls/food shortages and even water deficit areas well in good time before disastrous affects spread out to the majority of the population. Presently, the one under use, (based on Satellite weather/crop forecasts and operated by FAO on behalf of the government) falls far too short of this. Since drought is localised in character, any meaningful system must include therefore detailed village level data on rainfall, crop production, food availability and nutrition assessments before and after the harvest period. Weather and climate forecasts based on local forecasting techniques must also form an integral part of the system. Further, as rightly put forward by Edwards data involving direct observation of people's behaviour (such as the selling of cattle and other capital goods to buy food) should also be included because they provide an important clue to the deteriorating drought situation (Edwards, 1984, p.4).

3. The government must ensure that in future drought

occurrences, proper timing and distribution of relief food is followed. This calls for a change in the present day relief food policies and operations. The policy of giving free food to every head of household, (except for those engaged in meaningful employment) should not be allowed to continue. A lot of food tends to be wasted, as it is given even to those who have enough and may in the long run kill local initiatives as people may become more dependent on it. This food must be provided only to the needy and efforts to make people work for it must be looked into.

4. The Ministry of Agriculture and Water Development in conjunction with other relevant government departments should make serious attempts to try and educate the peasant farmers on the need to construct proper storage structures for their crop produce. Crop losses from pests would greatly be minimised if government recommended grain bins were set up in the area. Unnecessary crop losses in an unpredictable environment must be avoided at all costs, not only as a rule, but as a strategy for overcoming

future drought losses.

5. Rural development programmes such as the improvement and construction of roads must be initiated in the Valley to boost local trade, crop production and facilitate the transportation of relief food in times of drought and famine.

6. The government should continue with its current efforts of trying to produce better grain varieties of an early maturing and drought tolerant nature.

7. Last but not least, the Ministry of Agriculture and Water Development and the Meteorological Department should look into the possibilities of formulating a national drought policy and the identification of proper drought areas in the country.

II. For Further Research

1. There is need to critically examine, the effectiveness of the many drought adjustments undertaken in the area, in the context of the present socio-economic situation, for

the purpose of identifying new ones and those that should be retained, strengthened or improved upon. People's attitudes and perception of each and every existing and possible adjustments should also from part of such an investigation, as this would greatly help us draw proper conclusions on why certain adjustments are favoured or disliked by people.

2. Attempts should be made to try and document all past droughts in the various parts of the country. In the pursuit of such, attention must be paid to both physical and human features underlying these droughts. Through such works, we might be able to build a rich source of information on the behaviour of the phenomena in the different parts of the republic.

3. Investigations into weather lore, should be initiated if we are to understand how peasant communities in drought prone areas predict drought incidences and the nature of the rains before the start of the rainy season.

In the absence of an early warning drought system and weather stations in many parts of the country and also taking into account the traditional attachment to local forecasting techniques, information on this would render itself useful for both academic and planning purposes.

4. Last but not least, researchers are encouraged to make some improvements to the study's interview schedule survey. Detailed probing into the peasants' farming practices, drought losses and their general behaviour to drought situations is required. Also, categorization of choices and the ommission of mutually exclusive classes should receive serious attention, if problems in data analysis are to be minimised.

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APPENDIX I

INTERVIEW-SCHEDULE SURVEY

INTRODUCTION

This research as shown by the introductory letter has the approval of the University of Zambia and is part of my Masters of Science (M.Sc.) programme in Geography. The research attempts to examine some of the major problems you face in farming in this area. Although it is an academic exercise, it is hoped that the findings will be made available to government planners. Hence, your contributions, apart from being of direct importance to the success of the research, may indirectly play an important role in the developmental process of the area as a whole.

The interview will take only a few minutes and your co-operation will be highly appreciated. Information relating to personal details, like names will strictly be treated in confidence. To this end, you are informed that no names of respondents will appear in the final report.

Name of Interviewer: . . . . . .

Name of Respondent: . . . . . .

Study site: . . . . . .

---

1. Sex of respondent: Male ( ) Female ( )

2. Marital status: (1) Single ( ) (ii) Married ( )

   (iii) Divorcee ( ) (iv) Widow/Widower ( )

3. Age of respondent

   (A) Less than 30 years

   (B) 31-37 years

   (C) 38-44 years

   (D) 45-51 years

   (E) Above 51 years

4. Level of education

   (a) Never been to school (cannot read and write)

   (b) Never been to school but can read and write

   (c) Formal schooling of less than seven years

   (d) Formal schooling of seven years or more, but less than 10yrs.

   (e) Formal schooling of 10 yrs and above.

5. Number of persons in household

Age Group	Male/Female
0-5	( ) ( )
6-10	( ) ( )
11-15	( ) ( )
16-25	( ) ( )
Over 25	( ) ( )

6. Occupation (major source of income)

   (a) Crop cultivation

   (b) Pastoral farming

   (c) Both A and B

   (d) Other (specify) . . . . . .

7. Tenure of land: (a) owner ( ) (b) Tenant ( )
(c) unclassified ( )

8. For how many years have you lived in this area?
. . . . . .

9. What major problems do you face by living in this area?
. . . . . .
. . . . . .
/list of hazards noted by the respondent . . . . . .
. . . . . .

10. What crops do you grow? . . . . . .
. . . . . .

11. What animals do you rear? . . . . . .
. . . . . .

12. What agricultural activities do you do in a year? (indicate time for the preparation of fields, cultivation and planting of crops, weeding and harvesting)
. . . . . .
. . . . . .
. . . . . .

13. For each crop you grow, what is the most appropriate period for planting? . . . . . .
. . . . . .
. . . . . .

14. Do you normally plant your crops at the right time . . .
. . . . . .
If no, are there any special reasons for not doing so?
. . . . . .
What is the hectrage size of your fields for the named crops? .....
.....
Do you always cultivate enough food crops to meet family requirement .....
..... If no,
give reasons .....

15. Is this a suitable place to be a farmer? . . . . . .

Why? . . . . . .

. . . . . .

16. Do you often experience poor and unreliable rains in this area? . . . . . .

If yes, how often is it . . . . . .

. . . . . .

17. Do you think drought is a problem . . . . . .

. . . . . .

Give reasons . . . . . .

. . . . . .

18. How many times have you experienced drought during your stay here . . . . . .

Listing of the actual years . . . . . .

19. When was the worst drought experienced . . . . . .

20. What do you consider as a

(a) severe drought

(b) moderate drought

(c) weak drought

. . . . . .

. . . . . .

21. When there is drought, what is the reason for it. . . .

. . . . . .

. . . . . .

. . . . . .

22. In what way, were you affected by the recent drought

. . . . . .

Estimated crop losses . . . . . .

Estimated animal losses . . . . . .

Other (specify) . . . . . .

3. Do you anticipate any drought in future . . . . . .

. . . . . .

4. If yes, when do you think the drought will come again . . .

(a) very soon (less than two years)

(b) In five years' time

(c) In ten years' time

(d) After ten years

What makes you think so . . . . . .

. . . . . .

. . . . . .

25. Are there any drought indicators . . . . . .

If yes, what are these . . . . . .

. . . . . .

26. When there is drought what can one do

	(Good)	(Bad)	(Not sure)
(a)	( )	( )	( )
(b)	( )	( )	( )
(c)	( )	( )	( )
(d)	( )	( )	( )

Give reasons . . . . . .

27. What do you usually do when faced with drought

	(Good)	(Bad)	(Not sure)
(a)	( )	( )	( )
(b)	( )	( )	( )
(c)	( )	( )	( )
(d)	( )	( )	( )

Give reasons . . . . . .

. . . . . .

28. What do other people of this area do when faced with drought:

	(Good)	(Bad)	(Not sure)
(a)	( )	( )	( )
(b)	( )	( )	( )
(c)	( )	( )	( )
(d)	( )	( )	( )

Give reasons . . . . . .

. . . . . .

29. Are you going to do anything different in future?

	Why
(a)	. . . . .
(b)	. . . . .
(c)	. . . . .
(d)	. . . . .

30. Which of the following do you do when faced with drought?

(a) Change place of residence (migrate to wetter areas)

(b) Plant crops in wet places (dambos and river valleys)

(c) Have plots in different places

(d) Plant different varieties of the crops

(e) Practice inter-cropping

(f) Plant drought resistant crops

(g) Adjust planting time (Early planting is observed)

(h) Abandon farming and do other things (e.g. charcoal burning, fishing etc)

(i) Work for wages to buy food

(j) Sell cattle to buy food

(k) Depend on help from relatives/friends

(l) Depend on help from the government and voluntary service organisations like Red Cross.

(m) Use savings to buy food.

( ) Consult rain makers

( ) Pray to God for rains

( ) Irrigate crops

( ) Stock enough food during periods of good harvest.

( ) Depend on wild fruits, insects and animlas

31. Do you think that some of these things you don't do are useful . . . . . .

If yes, which ones — Give reasons

(i) . . . . . .

(ii) . . . . . .

(iii) . . . . . .

(iv) . . . . . .

32. Do some of the people in this area do some of the above mentioned things (q 30)

	(good)	(Bad)	Not sure)	(Reason)
(i)	( )	( )	( )	( )
(ii)	( )	( )	( )	( )
(iii)	( )	( )	( )	( )
(iv)	( )	( )	( )	( )

33. Has the government or the voluntary agencies (e.g. churches) introduced any measures of dealing with drought?

(i) Government ( ) (ii) Voluntary Agencies ( )

34. If yes, what are these:

(i) Government . . . . . .

. . . . . .

(ii) Voluntary Agencies . . . . . .

. . . . . .

35. Have you adopted some of these measures

36. If yes, which ones are these? . . . . . .

. . . . . .

. . . . . .

37. Do you think that these measures which the government or the voluntary agencies have introduced are useful

. . . . . .

Give reasons . . . . . .

. . . . . .

38. Is there anything or anything else that the government can do to prevent damages from drought? . . . . . .

. . . . . .

. . . . . .

39. Are there any measures that you take locally here as a community?

If yes, what are these measures . . . . . .

. . . . . .

. . . . . .

40. Do you think that they are good measures.

Give reasons . . . . . .

. . . . . .

. . . . . .

41. Is there anything or anything else that your community as a whole can do to prevent damages from drought?

. . . . . .

. . . . . .

. . . . . .

42. Do you have any questions to ask me? . . . . . .

. . . . . .

. . . . . .

Thank you very much for the information and for your time.

END

APPENDIX 2.

INTERVIEW GUIDE

A. DISTRICT OFFICIALS (OFFICE OF THE DISTRICT GOVERNOR)

1. History of drought/famine in the area
2. The impact of the recent drought, 1981-84, in the district.
3. Areas badly affected by the recent drought
4. Efforts or measures being made to combat drought effects by the council and the government
5. Future plans of dealing with drought problem by the council and the government.

B. MINISTRY OF AGRICULTURE AND WATER DEVELOPMENT (GWEMBE)

1. Main agricultural activities in the area.
   - crops grown/livestock kept
   - types of farmers
   - major source of income
   - farming practices (tillage methods)
   - pasture management
2. Nature of soils and climate.
   - soil conditions vs crops
   - rainfall conditions vs crops
   - temperature conditions vs crops
   - best time for planting the main crops

3. History of drought/famine in the district
4. Nature and causes of the recent drought
5. Drought effects on agriculture.
   - crop losses
   - animal losses
   - other losses
6. Specific measures of combating drought effects.
   - individual actions
   - collective actions
   - government actions
7. Future plans of dealing with drought
8. Interviewee's perception of drought
9. Farmers' perception of drought

C. MINISTRY OF AGRICULTURE AND WATER DEVELOPMENT (LUSAKA)

1. Government policy on drought and definition
2. Nature and effects of the 1981-84 drought conditions in Zambia (all known areas)
3. Government measures and future plans of combating drought effects.
4. Response of people to government measures.

D. DEPARTMENT OF METEOROLOGY (LUSAKA)

1. Nature and causes of the recent drought in Zambia (including technical hydro-meteorological explanations)
2. Official government policy and definition of of drought
3. Drought forecasting and warning systems in Zambia (prone areas)
4. Measures and future plans by the department in dealing with drought problem.

E. GWEMBE MEMBERS OF PARLIAMENT

GWEMBE-MUNYUMBWE/GWEMBE-SOUTH AND GWEMBE-NORTH

1. History of drought/Famine in the valley
2. Causes of drought/Famine in the area.
3. The impact of the recent drought, 1981-84 in the valley.
4. Areas badly affected by the recent drought.
5. Efforts or measures being made to combat drought effects by the Local inhabitants, the District Council, the Voluntary Agencies and the Government.

Appendix 3: Distribution of Cattle per Household

Number of Cattle (Grouped)	Respondents Owning Cattle	
	No.	%
1-4	11	6.11
5-9	14	7.78
10-14	32	17.78
15-19	15	8.33
20-24	11	6.11
25-29	9	5
30+	12	6.67
Total	104	57.8

Appendix 4: Distribution of Goats per Household

Number of Goats (Grouped)	Respondents Owning Goats	
	No.	%
1-4	15	8.33
5-9	8	4.44
10-14	16	8.89
15-19	24	13.33
20-24	8	4.44
25-29	11	6.11
30+	15	8.33
Total	97	53.9

Appendix 5: Distribution of Other Livestocks per Household.

Number of Other Livestocks (Grouped)	Respondents No.	%
1-4	10	5.56
5-9	23	12.78
10-14	16	8.89
15.19	Nil	Nil
20-24	1	0.55
25-29	Nil	Nil
30+	Nil	Nil
Total	50	27.8

Appendix 6: Summary of the Distribution of Livestock per Household

Livestock	Household No.	%	Average size of Livestock
Cattle	104	57.8	10.8
Goats	97	53.9	12.1
Others	50	27.8	2.9
Nothing	43	23.9	-
Total			

N.B 1. Figures on livestock are most likely to have been underestimated. Apart from being some kind of a taboo to reveal the actual numbers of animals one owns, the respondents were hightly suspicious of the research thinking that it was part of governments plan to nationalise or force them to sell their animals.

Appendix 7: Livestock sales per household

Type of Livestock	Livestock (Grouped)	No. of Livestock sold	No. of Households
Cattle	1-4	79	57
	5-9	92	16
	10-14	24	2
	15+	-	-
	Total	195	
	Average	1.52	
Goats	1-4	116	63
	5-9	102	18
	10-14	107	10
	15+	56	3
	Total	381	
	Average	2.98	
Others	1-4	23	16
	5-9	20	3
	10-14	-	-
	15+	-	-
	Total	43	
		0.34	

N.B. Multiple answers recorded, from a sample population of 128 people. This is the group that sold part of their livestock as a form of drought adjustment. Averages are worked out from the under mentioned population size.

Appendix 8: Important wild fruits, Grasses and roots which served as famine food during the 1981-84 drought.

Tonga Name	Scientific Name	Time used
Musikili	Trichilia emetica	End of Nov.-Jan.
Mpunga	Urochloa Mossambie censis	Jan-Early March
Muswezu	Maerua glauca	August-October
Hamvwambwa	-	Not stated
Inzibaiba	Echinocloa Colona	Jan.-Feb.
Nkona	Arum Family	Probably year round
Lukuli	Imomoea shirambeshi	Nov.-Dec.
Munga	Acacia albida	July-October
Kanzienzie	Craspedorphachis Uniflora	Jan-Early March

N.B. No orderly arrangement is maintained.

APPENDIX 9: Adopted Drought Adjustments and How They are perceived by the sample population

Type of Adjustments	Good	Bad	Not sure
A. Adjustments that affect the cause of the hazard.			
(i) Consult Rain Makers (Rain making)	*		
(ii) Pray to God for rains (prayers)	*		
B. Adjustments that modify the hazard.			
(i) Have plots in different places	*		
(ii) Plant crops in wet places	*		
(iii) Migrate to wetter areas		*	
(iv) Move cattle to wetter regions	*		
C. Adjustments that modify the loss potential			
(i) Plant drought resistant crops	*		
(ii) Plant different varieties of the same crop			
(iii) Practise inter-cropping			
(iv) Observe early planting time of crops	*		

D.	Adjustments that accept/ distribute the losses				
(i)	Sale of livestock to buy food				
	(a) cattle		*		
	(b) other livestocks				*
(ii)	Stock enough food during periods of good harvest	*			
(iii)	Depend on wild products				*
(iv)	Conduct small economic activities e.g. selling of beer, fish and crafts				*
(v)	Use savings to buy food	*			
(vi)	Work for wages or food	*			
(vii)	Depend on help from friends and relatives				
	(a) Ask for assistance		*		
	(b) Get assistance	*			
(viii)	Depend on assistance from the government and voluntary organisations	*			

APPENDIX:10 RAINFALL DEPARTURES FROM NORMAL DURING THE 1981-84 DROUGHT

PROVINCE	STATION	NORMAL RAINFALL (mm)	ANNUAL RAINFALL (mm)			DEPARTURES FROM NORMAL (mm)			DEPARTURES FROM NORMAL (%)		
			1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84
NORTH WESTERN	MWINILUNGA	1379	1278.3	1676.6	1178	100.7	+297.5	201	7.30	+21.4	14.6
	SOLWEZI	1354	1364.5	1108.1	1270	+10.5	245.9	84	+0.8	68.2	6.2
	KASEMPA	1166	709.2	889.1	1012	456.8	276.9	154	39.2	23.7	13.2
	KABOMPO	1123	979.6	920.9	929	143.4	202.1	194	12.8	18	17.3
	ZAMBEZI	1049	844	881.5	909	205	167.5	140	19.5	16	13.3
WESTERN	MONGU	946	557.2	829.9	625	388.8	116.1	321	41.1	12.3	33.9
	KAOMA	947	769.4	659.6	939	177.6	287.4	8	18.8	30.3	0.8
	SESHEKE	717	440	463.4	624	277	253.6	93	38.6	35.4	13.0
COPPERBELT	KAFIRONDA	1356	934.9	1390.8	1101	421.1	+34.8	255	31.1	+2.6	18.8
	NDOLA	1193	932.7	1088.3	1262	260.3	104.7	+69	21.8	8.8	+5.8

PROVINCE	STATION	NORMAL RAINFALL (mm)	ANNUAL RAINFALL (mm)			DEPARTURES FROM NORMAL (mm)			(%)		
			1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	83/84
CENTRAL	SERENJE	1170	934.3	979.1	1045	235.7	190.9	125	20.1	16.3	10.7
	KABWE	957	651.0	871.7	747	306	85.3	210	32.0	8.9	21.9
	KAPIRI MPOSHI	1060	633.7	525.1	965	426.3	534.9	95	40.2	49.5	9
LUSAKA	LUSAKA	837	850.1	580.3	549	+13.1	256.7	288	+1.56	30.7	34.4
	KAFUE	793	817.3	503.7	500	+24.3	333.3	293	+3.1	42	36.9
SOUTHERN	CHOMA	833	555.6	628.3	539	277.4	204.7	294	33.3	24.6	35.1
	LIVINGSTONE	760	430	724	486	350	56	294	44.9	7.2	37.7
LUAPULA	MANSA	1093	922.3	1225.4	1006	170.7	+132.4	87	15.6	+12.1	8.0
	KAWAMBWA	1344	1173.2	1481.6	1046	170.8	+137.6	298	12.7	+10.2	22.2
NORTHERN	ISOKA	1118	1195.4	1001.9	1145	+77.4	116.1	+27	+6.9	10.4	+2.4
	KASAMA	1277	1031.4	1469.4	1158	245.6	+192.4	119	19.3	+15.1	9.3
	MBALA	1189	1118.9	1337.5	1276	70.3	+148.5	+87	6	+12.5	+7.3
	MPIKA	1069	989.1	936.4	994	79.9	132.6	75	7.5	12.4	7.0

PROVINCE	STATION	NORMAL RAINFALL (mm)	ANNUAL RAINFALL (mm)			DEPARTURES FROM NORMAL (mm)			DEPARTURES FROM NORMAL (%)		
			1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	83/
CENTRAL	SERENJE	1170	934.3	979.1	1045	235.7	190.9	125	20.1	16.3	10.
	KABWE	957	651.0	871.7	747	306	85.3	210	32.0	8.9	21.
	KAPIRI MPOSHI	1060	633.7	525.1	965	426.3	534.9	95	40.2	49.5	9
LUSAKA	LUSAKA	837	850.1	580.3	549	+13.1	256.7	288	+1.56	30.7	34.
	KAFUE	793	817.3	503.7	500	+24.3	333.3	293	+3.1	42	36.
SOUTHERN	CHOMA	833	555.6	628.3	539	277.4	204.7	294	33.3	24.6	35.
	LIVINGSTONE	760	430	724	486	350	56	294	44.9	7.2	37.
LUAPULA	MANSA	1093	922.3	1225.4	1006	170.7	+132.4	87	15.6	+12.1	8.0
	KAWAMBWA	1344	1173.2	1481.6	1046	170.8	+137.6	298	12.7	+10.2	22.2
NORTHERN	ISOKA	1118	1195.4	1001.9	1145	+77.4	116.1	+27	+6.9	10.4	+2.4
	KASAMA	1277	1031.4	1469.4	1158	245.6	+192.4	119	19.3	+15.1	9.3
	MBALA	1189	1118.9	1337.5	1276	70.3	+148.5	+87	6	+12.5	+7.3
	MPIKA	1069	989.1	936.4	994	79.9	132.6	75	7.5	12.4	7.0

PROVINCE	STATION	NORMAL RAINFALL (mm)	ANNUAL RAINFALL (mm)			DEPARTURES FROM NORMAL (mm)			DEPARTURES FROM NORMAL (%)		
			1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84
EASTERN	CHIPATA	1022	743.3	939.1	821	278.7	82.9	201	27.3	8.1	19.7
	LUNDAZI	855	900.1	718.6	783	+45.1	76.4	72	+5.3	+8.9	8.4
	PETAUKE	942	876.9	830.6	719	65.1	111.4	223	6.9	11.8	23.7

N.B. (i) + Departures above normal. Those without a + sign are below normal.

(ii) All figures have been rounded to the 1st decimal point.

(iii) Raw data was supplied by the Meteorological Department.

APPENDIX 11 RAINFALL DEPARTURES FROM NORMAL - GWEMBE STATIONS

GWEMBE BOMA			CHIPEPO			MUNYUMBWE		
YEAR	DEPARTURES		YEAR	DEPARTURES		YEAR	DEPARTURES	
	mm	%		mm	%		mm	%
1949-50	+45.4	5.2	1961-62	+98.3	12.5	1953-54	-340	41.4
1950-51	-259.6	29.7	1962-63	+286.9	36.4	1954-55	?234.1	28.5
1951-52	+80	9.2	1963-64	-98.6	12.5	1955-56	+11	1.3
1952-53	+448.5	51.3	1964-65	-35	4.4	1956-57	-190.9	23.3
1953-54	-358.8	41.2	1965-66	-76.6	9.2	1957-58		
1954-55	+172.6	19.8	1966-67	+5.4	0.7	1958-59	+132.1	16.1
1955-56	+26.2	3	1967-68	-227.9	28.9	1959-60	-144.4	17.6
1956-57	-79.1	9.2	1968-69	+138.6	17.6	1960-61	+140.2	17.1
1957-58	+430	49.2	1969-70	+47.8	6.1	1961-62	±155.4	18.9
1958-59	-87.6	10.0	1970-71	+311.7	39.6	1962-63	+85.7	10.4
1959-60	-198.1	22.7	1971-72	+41.5	5.3	1963-64	-282.6	34.4
1960-61	-16.6	1.9	1972-73	-322.8	41	1964-65	-118.6	14.4
1961-62	+160.4	18.4	1973-74	+883.8	112.2	1965-66	+4.4	0.5

GWEMBE BOMA

YEAR	DEPARTURES mm	%
1962-63	+515	58.9
1963-64	-253.6	29.0
1964-65	-62.7	7.2
1965-66	-231.8	26.5
1966-67	-229.6	26.3
1967-68	-151.3	17.3
1968-69	+13.7	1.6
1969-70	-38.6	4.4
1970-71	-56.1	6.4
1971-72	-153.9	17.6
1972-73	-177.8	20.3
1973-74	+516.7	59.1
1974-75	-236.5	27.1
1975-76	+ 14.2	1.6

CHIPEPO

YEAR	DEPARTURES mm	%
1974-75	+210.4	26.7
1975-76	+354.2	45
1976-77	-471.4	59.9
1977-78	+40 .7	5.2
1978-79		
1979-80		
1980-81	-83.7	10.6
1981-82	-313.8	39.9
1982-83	-477.2	60.6
1983-84	-313.2	39.8

MUNYUMBWE

YEAR	DEPARTURES mm	%
1966-67	-153	18.6
1967-68	-305.6	37.2
1968-69	+165.2	20.1
1969-70	-196.9	24
1970-71	+46.3	5.6
1971-72	-88.1	10.7
1972-73	-174.4	21.3
1973-74	+229.8	28
1974-75	+301.4	36.7
1975-76	+277	33.8
1976-77	- 47.6	5.8
1977-78	+569.1	69.4
1978-79	-287.6	35.0
1979-80	+208.5	25.4

GWEMBE BOMA			MUNYUMBWE		
YEAR	DEPARTURES		YEAR	DEPARTURES	
	mm	%		mm	%
1976-77	-208.9	23.9	1980-81	+233.2	28.4
1977-78	+599.9	68.7	1981-82	+359.6	43.3
1978-79	+10.6	1.2	1982-83	-17.7	2.2
1979-80	+33	3.8	1983-84	-86.5	10.5
1980-81	+65.2	7.5			
1981-82	-25.8	29.5			
1982-83	-73.6	8.4			
1983-84					

Note: Mean Annual Rainfall for these stations:

(i) Gwembe Boma - 873.8

(ii) Gwembe Munyumbwe - 820.6

(iii) Gwembe Chipepo - 787.4