IUCN Environmental Assessment Service

The Environmental Impact of the 1991-92 Drought on Zambia

Mary Tiffen and M.R. Mulele

IRISH AID

IUCN
The World Conservation Union

The cover is taken from a calendar prepared for the US Agency for International Development's Famine Early Warning System. The authors are grateful to the Agency for permission to use it. The images are one month composites of Normalised Difference Vegetation Index (NDVI) values computed from a mathematical transformation of NOAA Advanced Very High Resolution Radiometer (AVHRR) data. Increasing NDVI values are generally related to increasing amounts and vigour of growing vegetation. Highest values recorded are dark blue (0.61-0.80), with values becoming progressively lower in the colour sequence; blue, green, yellow, light and dark orange. The latter represents an NDVI of 0.01-0.10. It strikingly illustrates the seasonal and annual variations in vegetation. It should, however, only be taken as indicative; accuracy of coloration has been reduced in the process of reduction and reproduction, particularly in relation to the column for April, where the red is exaggerated. The original data source was NASA Goddard Space Flight Center GIMMS Project, and the original artwork was prepared by the US Geological Survey EROS Data Center.

Published by IUCN, Gland, Switzerland and Lusaka, Zambia

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Support to the environmental sector is a fundamental principle of Irish Aid. This was reaffirmed by the Strategy Plan, Irish Aid: Consolidation and Growth, launched in July 1993.

The Environmental Impact of the 1991-92 Drought on Zambia

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Published with the financial assistance of IRISH AID,
the Development Co-operation Division of the Government of Ireland

IUCN - The World Conservation Union
1994

Published by: IUCN, Gland, Switzerland and Lusaka, Zambia

Citation: Tiffen, Mary and Mulele, M.R. 1994. *The Environmental Impact of the 1991-92 Drought on Zambia.* IUCN, Gland, Switzerland and Lusaka, Zambia. x + 108 pp.

ISBN: 2-8317-0216-X

Designed and typeset: Samara Publishing Limited, Cardigan, Dyfed SA43 2JG, UK

Available from: IUCN Publication Services Unit, 219c Huntington Road, Cambridge CB3 0DL, UK or IUCN Communications and Corporate Relations Division, Rue Mauverney 28, CH-1196 Gland, Switzerland or IUCN Zambia, Astonian House, 1st Floor, Kabelenga Road, Lusaka, Zambia

Acknowledgements: This study was funded by IRISH AID - the Development Co-operation Division of the Irish Government. IUCN is very grateful for the support and assistance received from IRISH AID staff and consultants. In addition to IUCN staff in the Zambia National Office, the Regional Office for Southern Africa in Harare, Zimbabwe and in HQ, valuable help and guidance was provided by Adrian Wood of the University of Huddersfield, UK and Eric Feron of CAMPFIRE, Zimbabwe

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Preface

In 1991-92, many countries of Southern Africa suffered a drought which led to significant food shortages and attendant social problems.The immediate response of governments, external international aid agencies and non-governmental organisations (NGOS) was, quite properly, to alleviate human suffering. In a number of countries, including Zambia, the coordinated activities of governments, aid agencies and NGOs was successful in preventing a human disaster.

IUCN - The World Conservation Union has been active in Zambia for many years; indeed Zambia was one of the very first countries to prepare a National Conservation Strategy and to initiate implementation. In Zambia, therefore, there has been a long history of fruitful collaboration between the Government and IUCN. In 1992, the Ministry of Agriculture asked the Environmental Assessment (EA) Service of IUCN to help undertake an assessment of the environmental impacts of the drought. IUCN was pleased to assist not least because of the opportunity it presented to develop fresh perspectives on tackling problems associated with severe drought. Funding for the study was provided by Irish Aid - the bilateral aid programme of the Irish Government. Irish Aid has a strong programme of assistance to Zambia and its support was greatly welcomed.

Why was this study innovative and what is the importance of its results and recommendations? Studies of the drought have taken place already; indeed some are still in progress. Most of these, however, are sector specific, that is they focus on such issues as the impacts on wildlife or the national economy. From the outset the EA Service, with the support of the Zambian authorities, was determined to take a wider and more holistic viewpoint - in other words to stand back and look at the drought in a wider historical context beyond the obvious impacts and their cumulative interactions. On the basis of this analysis the study team has been able to set the significance of the impacts in context and, most importantly, formulate a set of practical and policy recommendations to help the Government of Zambia deal with the continuing effects of the drought and try to avoid future similar problems should the drought recur. The results and recommendations will be useful to other national governments of sub-Saharan Africa, international aid agencies, members of the UN family and, of course, NGOs working in the field.

This study is not an environmental assessment (EA) in the pure sense of the term. Rather it is an analysis and evaluation of the impacts of a past event. Many of the principles and practice of EA have been, however, applied to this study, including:

- a broad definition of the term "environment" to include socio-economic and health dimensions as well as biophysical factors;
- identification of "baseline" environmental conditions and trends;
- an emphasis on identification and evaluation of impacts in term of their specific characteristics;
- special consideration of cumulative impact interactions across sectors; and,
- formulation of mitigation measures (in the form of policy recommendations) based on the significance of the impacts. These measures are aimed not only at dealing with adverse impacts, but also with enhancing impacts which have been beneficial (such as increasing community responsibility for local resource management).

This study can stand alone in terms of its relevance for Zambia and elsewhere. However, it was initiated as a component part of a developing programme of major IUCN activities in Zambia. The emphasis of this integrated programme is on environmental planning, EA and related capacity building. For example, in the autumn of 1993, IUCN, in conjunction with the Environment Council of Zambia, organised a workshop on EA at Siavonga to develop a basic policy framework for implementation of a national EA system. The draft findings of the Drought Report were an input to that workshop. In the early Spring of 1994 two major projects will be initiated in Zambia. First, a three-year project to strengthen EA, environmental planning and environmental economic capacity in central governments will be initiated. At the same time a project will be underway in Western Province focusing on environmental management of wetlands. This provincial project has an important EA component which will be implemented in sequence with the national-level activities. The drought study will be an important demonstration project and a resource for both these related activities.

The use of certain elements of standard EA practice in this study and its comprehensive, cross-sectoral nature has resulted in a report which makes a positive contribution toward informing governments, agencies and NGOs of actions that need to be taken to reduce significantly the adverse effects of future droughts. Equally important, it suggests some immediate measures to consolidate and expand existing positive policy and local-level responses which resulted from the drought experience. By showing us how to minimise damage and enhance benefits, this study makes an important contribution toward assisting all interested parties in the long journey toward achieving sustainability in sub-Saharan Africa.

David McDowell
Director General

Acronyms

AEZ	Agro-ecological zone
AIDS	Aquired Immunity Deficiency Syndrome
ARPT	Adaptive Research Planning Team
CSO	Central Statistical Office
DIMS	Drough Impact Monitoring System
FAO	Food and Agriculture Organisation
FEWS	Famine Early Warning System
FFW	Food for Work
GoZ	Government of Zambia
HEPS	High Energy Protein Supplement
IFAD	International Fund for Agricultural Development
ITCZ	Inter-Tropical Convergence Zone
IUCN	International Union for the Conservation of Nature
JICA	Japan International Cooperation Agency
Kw	Kwacha
LINTCO	Lint Company of Zambia
LWF	Lutheran World Federation
MAFF	Ministry of Agriculture, Food and Fisheries
MCH/FP	Mother and Child Health/Family Planning
MMD	Movement for Multiparty Democracy
NAIS	National Agricultural Information Service
NDVI	Normalised Difference Vegetation Index
NGO	Non-Governmental Organisation
NORAD	Norwegian Development Agency
OXFAM	Oxford Famine Relief Acency
PAM	Programme against Malnutrition
PAO	Provincial Agricultural Officer
PPM	Programme for the Prevention of Malnutrition
SADC	Southern African Development Community
SCAFE	Soil Conservation and Agro-Forestry Extension Programme
SSRP	Smallholder Services Rehabilitation Project
TOR	Terms of Reference
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WFP	World Food Programme
ZAMSEED	Zambian Seed Company Ltd
ZCF	Zambian Cooperative Federation
ZESCO	Zambia Electricity Supply Corporation Ltd
ZEWU	Zambia Early Warning Unit

Executive summary

Introduction

The impact of the 1991-92 drought on the environment and human welfare has to be separated from other influences leading to environmental deterioration. Important amongst these were a greater increase in rural population in 1980-90 than in any previous inter-censual period; macro-economic policies which had favoured concentration on hybrid maize in all parts of the country; and a deteriorating economy which was also affecting the efficiency of government services. There was considerable malnutrition in Zambia before the drought began, and many rural water facilities were not functioning. Many rural areas of Zambia have a very low population density, which makes marketing costly, and which does not provide inçentives for careful husbanding of the land resource. AIDS amongst humans and East Coast Fever in cattle were other negative factors.

We distinguish the immediate effects of the drought in 1991-92 and the degree of recovery after the good rains of 1992-93. Changes in crop production, river flows, and reservoir storage have been quantified. Livestock data has many uncertainties. In many spheres we can only say whether the probable impact of the drought was mild or severe, due to the unavailability of information on the status of resources before, during and after the drought.

We were not asked to make, nor have we attempted, an assessment of the impact on the total economy, which was undergoing stresses from an inheritance of mismanagement and struggling to make radical change under a new government with a new economic programme, at the same time as it had to cope with the effects of the drought on agricultural production and power generation.

The nature of the drought

The drought mainly affected the southern parts of the country, which have less rainfall which is more erratic, than the north. Evidence is presented which may indicate cyclical patterns in the rainfall. Since 1980 rainfall has been on a downward trend that may be due for reversal. The total amount of rainfall was not unprecedentedly low and occurred before, in the 1920s. The drought was, above all, a failure of rains in the southern part of the country in January and February. The rains of 1991-92 had begun well, and there were late rains in March. The effect was to ruin the 1992 maize crop, which had mostly not been

planted until December 1991 and also long-season sorghum and pulses. The January and February rains normally fill the rivers and replenish the groundwater. Therefore, many streams, dams and wells dried up. Since this drought came at the end of a dry decade, large reservoirs such as Lake Kariba were already low, and the drought led to a crisis for the electricity generating industry. The rains of 1992-93 have been both plentiful and well distributed.

Biophysical impacts

Reservoirs and groundwater levels have partially recovered. Vegetation and wildlife appear to have made an almost complete recovery. There was more cutting for charcoal and wood fuel during the drought, but these activities have only minor, temporary effects on vegetation. Since pastures benefitted from the late rains in March 1992, wildlife and domestic livestock suffered more from distance to drinking water sources than from lack of pasture. Wildlife appear to have recovered their former condition and to be breeding well; the most affected were the hippopotamuses. The effect on fish stocks of the low water levels of 1991-92 was bad; it is not certain how far a more abundant supply of nutrients in 1992-93 will enable populations to recover. Cattle numbers have been greatly reduced, primarily because of the impact of Corridor Disease, an epidemic particularly affecting Southern Province which does not seem to have been connected with the drought and secondarily, because farmers were forced to sell livestock to buy food. A less important reason for livestock sales was fear of loss from the stresses due to water scarcity and pasture reduction. Soil fertility was on the decline before the drought, and there was no noticeable drought impact.

Management and impact on human welfare

The government of Zambia reacted swiftly to the failure of the rains and immediately began importing grain and requesting food aid. In consequence, the drought did not lead to food shortage amongst the urban population, which normally relies on purchases. Food distribution in the rural areas was organised through non-governmental organisations, who set up village committees. These helped in planning the objectives of food for work programmes, and in identifying those who should receive relief without work. The operation, involving importation of food over long distances and distribution to remote villages, went remarkably well. However, although food supplements were distributed to the vulnerable through clinics, it did not succeed in preventing malnutrition. The improved monitoring system put in place has shown that malnutrition amongst young children has continued to increase in 1993; a possible major reason is prolonged protein defi-

ciency, which has affected pregnant women and nursing mothers. The normal legumes that accompany the staple diet of maize and the normal supply of milk during the rains have both been absent from the diet. There was extra fishing, but this did not affect all villages, and most catches were sold. Livestock were sold, not eaten.

The rural population, for whom crops formed a major part of income, suffered loss of both income and assets in 1992. They entered the 1992-93 season without seed, with insufficient draft oxen and without cash. Their normal emergency assets, livestock, had been reduced by disease. Thanks to seed distribution by the agencies responsible for food relief and the well-distributed rains, most have had some harvest. However, only those who were able to obtain loans to purchase fertiliser have had large harvests. The latter are now well on the road to recovery; other families will run out of food before the 1994 harvest. Legume seed has remained in very short supply. Rural inequality has probably increased.

The relief programme was organised in such a way that village capacity for organisation and self-help has been strengthened and the food for work programmes have improved some local facilities. The government programme for the rehabilitation of rural water facilities suffered from lack of funding, as well as inadequate knowledge at the start of the drought, of the state and location of facilities.

Recommendations

While a very severe drought will always necessitate outside help and relief, milder droughts are to be expected in the southern part of the country and could be mitigated by appropriate policies and investments. Recommendations are made for improving knowledge of weather cycles, water and soil conservation in agriculture (in preference to any large-scale investment in irrigation) and investment in additional medium-scale reservoirs and smaller dams for storing water for humans and livestock. It is urged that recognition be given to the importance of veterinary services in maintaining livestock health, since rural people depend on being able to sell livestock in emergencies. Legumes deserve a bigger place in the farming system, both as foods and because of their role in maintaining soil fertility. The shock of the drought has made people ready to consider both crop diversification and soil and water conservation. It is recommended that the government consider methods of improving budgeting, and the funding of operation and maintenance, since services which cannot function well in normal circumstances cannot cope in emergencies.

1 Introduction

Terms of reference

Our terms of reference required us to concentrate on the impact of the drought on the rural rather than the urban environment, including social and health impacts. While we have quantified impacts as far as the data allows, it should be noted that we were not asked to measure the economic impact of the drought on Gross Domestic Product. However, since an economy exists as an integrated whole, we have examined briefly the impact on industry and the urban population, particularly in relation to their ability to provide resources to assist the rural population which was most directly affected. The TOR also required field visits to selected drought affected areas. These were made to areas of Southern and Eastern Provinces. As the available time for the study was only 30 days, it was inevitably limited and we have been dependent on information collected by others, available in written reports, or given verbally. People met and the schedule of visits are shown in Annex 1. Summaries of meetings with farmers are given in Annex 2. The literature consulted is listed in the Bibliography.

Factors influencing environmental management

The main managers of rural environment, in respect to land, are farmers, large and small, although, in relation to bodies of water, and to mineral resources, there may be other managers, particularly government or commercial organisations. The state is also an important land manager in Zambia.

In order to understand why farmers manage the rural environment in the way they do, we have to examine three main influences on their choice of strategies. These are:

- the natural resource base, including the climate, and any variations that may occur in this, such as severe drought;
- population density, which makes extensive or intensive agricultural practices logical in the face of land/labour relationships and which also affects distance to centres of specialisation and marketing;
- the government's macro-economic policies, especially in relation to pricing of agricultural inputs and outputs, the balance it maintains in its services between personnel and operational resources, and land tenure.

While farmers' skills and strategies are developed in relation to their particular situation in regard to their natural resources, land-labour relationship and market situation, farming methods may be temporarily influenced by epidemics amongst humans and animals. These may or may not be related to macro-economic factors.

Structure of the study

The interaction between severe climatic conditions, growth in population density, and macro-economic conditions forms the theme of this report. We attempt to differentiate clearly between the changes brought about by the drought, and those that are on-going, due to other influences. Chapter 1 sets out briefly the impacts of population density, changes in macro-economic policies and AIDS. The influence of an livestock disease is discussed in Chapter 3.

Zambia is, generally, divided into three agro-ecological zones (AEZ), with ascending rainfall from AEZ I to III, as shown in Figure 1. The drought has to be seen as an aspect of climatic variability, which will be examined in Chapter 2, together with the effects on water stored in rivers, lakes, dams and as groundwater. The biophysical impact on natural resources and crop and livestock production will be quantified as far as possible in Chapter 3. We distinguish the immediate effects and the status in 1993, after one year of good rains. Its impact on humans was modified by the management structure put in place and the resources brought in to deal with it. These will therefore be described briefly in Chapter 4, before examining the impact on human wealth and welfare in Chapter 5.

Chapter 6 makes recommendations on future policy to deal with drought. It concludes that many of the biophysical impacts proved temporary, due to the resilience of the natural resource base and the, fortunately, good rains that followed. The impact on human income and social systems will last longer. Although the immediate impact on these was severe, it appears also to have triggered a realisation of the need for new types of resource management, at the local level. In combination with adaptation to continued population growth and supportive macro-economic policies this may lead to a more sustainable and productive rural environment, better able to withstand future droughts.

Population density

Characteristically, when population densities are very low, land is plentiful and people live in small, scattered settlements. The best return when labour is scarce, is achieved by shifting cultivation sites when fertility declines and using uncultivated lands for open access grazing.

This leads to low investment in housing and storage facilities, since the site may be quitted. It means little or no investment in planted trees, wells, or land improvements. Such systems are quite sustainable while population density remains low, say under 10/km^2 (although this will vary according to the natural potential of the land). They begin to come under pressure when the population grows and fallows shorten. Further characteristics of low population densities are long distances between settlements and between rural settlements and any major town. Consequently, the high costs of building and maintaining roads and for marketing mean that most output is destined for local subsistence and there is little incentive for producing surpluses for sale. Since a surplus is not the normal aim, the system is vulnerable in adverse seasons and, without external assistance, many people may die in droughts. This is probably one of the reasons why population density in Zambia remained low before this century.

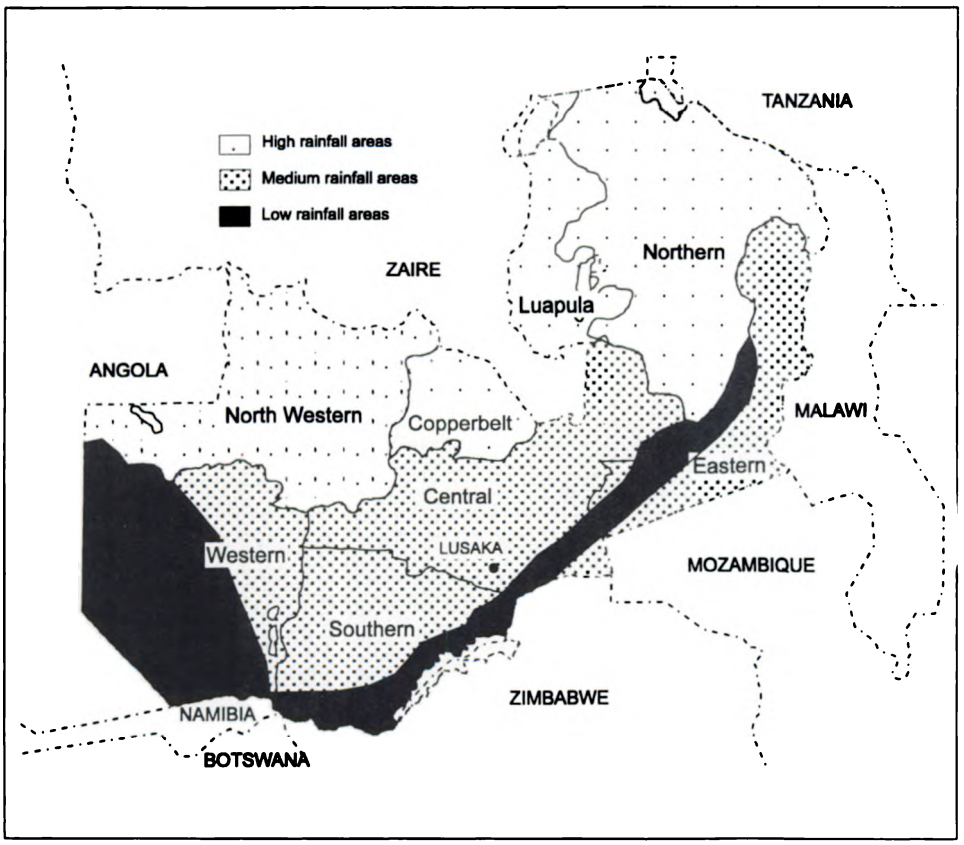

Figure 1 **Zambia: Provinces and agro-ecological zones (simplified)**
(Source: IFAD, 1993, Vol. 1: 10)

As population density rises, land becomes scarcer, substitutes for fallows have to be found and fields become permanent. The first result of an increased population density may be falling fertility in arable lands, degradation of surrounding grazing land and the disappearance of trees which are being removed to facilitate cultivation, and cut for fuel, housing, kraals, etc. This is visible in parts of Zambia today. Usually, after a period of adjustment and experimentation, people find new ways of maintaining fertility by using organic and inorganic fertilisers, by more careful husbandry and by investments in land improvements, such as soil conservation structures. Investments are also made in more permanent housing, better stores, wells, etc. Usually, custom evolves in the direction of private, heritable and eventually saleable land rights, first for cultivated land and then for grazing land, as people find it necessary to protect the latter to maintain their animals. As the area available for grazing is reduced, investments in improvements spread to grazing land, with fencing or hedging, since livestock and arable activities become more closely integrated and there is protection, or planting, of useful trees.

At the same time, the higher population density leads to more small concentrations of population, in which some people specialise in non-agricultural occupations and create a demand for food. With shorter distances between growing towns, marketing becomes cheaper, and the production of a surplus more worthwhile, stimulating further investments in agricultural intensification and land improvements (see Boserup, 1965; Ruthenberg, 1980). People acquire purchasing power to acquire a more varied diet, better clothing, medicines, etc. With substantial population density, say 100/km^2, the change is usually for the better, with a new sustainable system based on higher inputs of effort and capital per unit of land. However, the initial stages of adjustment are the most difficult, partly because of still high marketing costs and a consequent lack of resources and incentives for investment of labour and capital. There can be considerable problems of degradation of the soil and vegetation of grazing lands before people adopt new management strategies (see Tiffen *et al.*, 1994). It has been suggested based on a comparative study of Asia and Africa, that a population density of at least 50/km^2 is the threshold above which some stimulation from cheaper infrastructure and easier marketing is normally felt (Haggblade *et al.*, 1989).

Population densities are still below this in many parts of Zambia, as Figure 2 shows. Nevertheless, they are rising fast by the standards of the historical experience in Europe and Asia. Although Zambia has experienced one of the highest degrees of urbanisation in Africa, 58% of the population live in rural areas. Urban growth rates declined from 5.6% per year between 1969 and 1980 to 3.7% per year between 1980 and 1990, while rural growth rates accelerated from 1.6% per year to

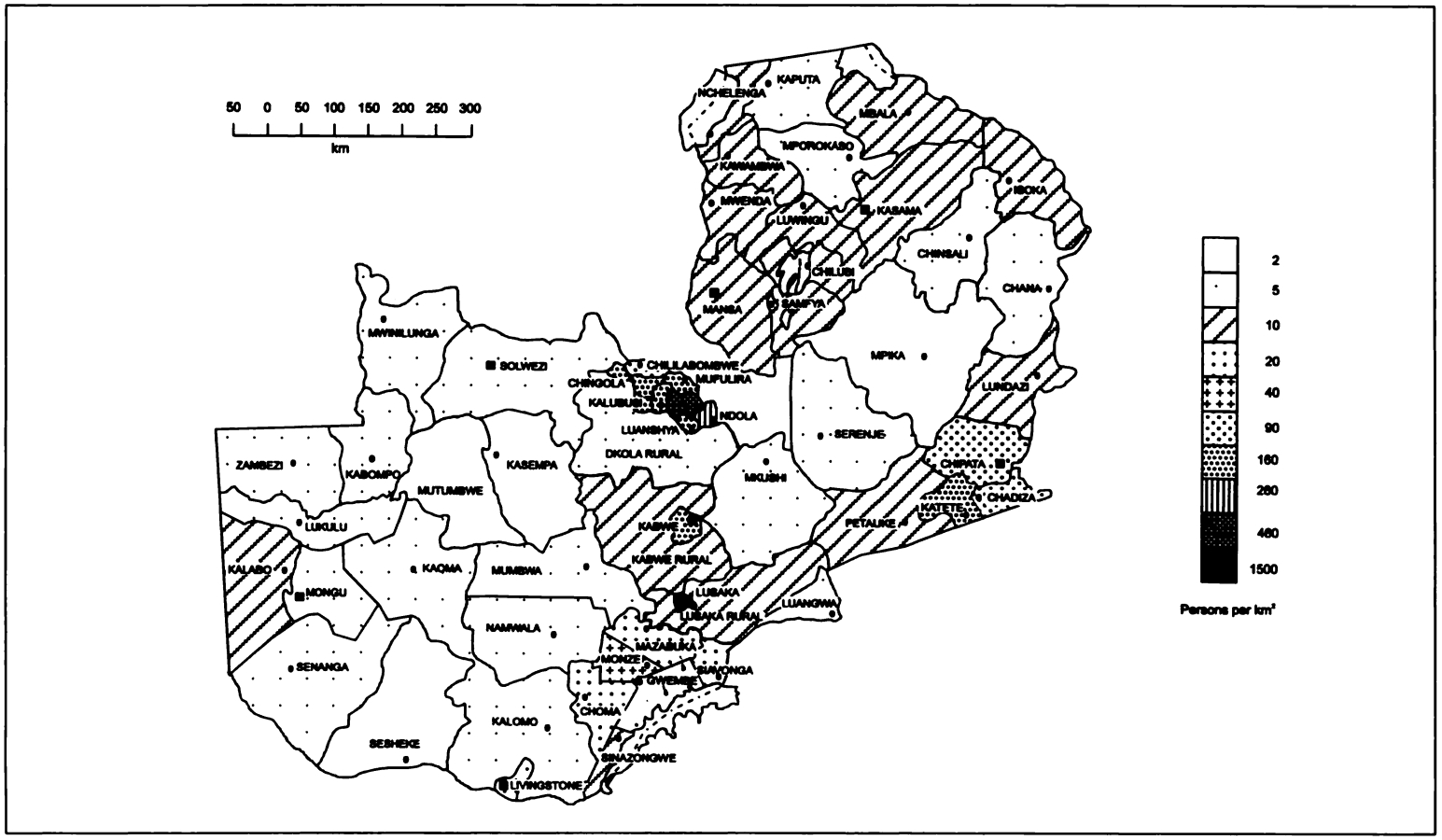

Figure 2 **Population density by district, in 1990**
(Source: CSO, 1990)

2.8%, respectively. The rural population in the decade 1980 to 1990 increased by more than 1 million, from 3.4 million to 4.5 million (CSO, 1990, Table 3.2). The impact of the drought has to be distinguished from the impact of a rapidly increasing rural population density in the decade 1980-90, which, however, has still not reached the point where infrastructure and marketing costs per capita begin to fall substantially. In many parts of rural Zambia it is likely that a transition to new management strategies is necessary, but that the incentives, knowledge and changed institutions needed are not yet developed. Droughts can trigger the realisation that new methods are necessary.

Although densities are generally low, there are pockets of higher density. The urbanisation of Zambia has come not so much from agricultural growth, as from mining and industry, leading to the development of towns along 'the line of the rail' from the Copperbelt to Livingstone. Here another factor enters in - tenure. Large commercial farms have alienated the land near the main railway and trunk road. Some of these farms produce crops which require much labour to cultivate and process, in which case they may lead to a diversified local economy, with people able to make a living from shops and small businesses as well as from wage labour on the estate, as around the Nakambala Sugar Estate. Others are extensively run ranches, producing a very low return per hectare in comparison with small-holder mixed farms immediately adjacent to the ranch boundary. Both types can produce localised areas of land shortage, the latter without the compensation of employment opportunities.

There are other local factors. People tend to want to stay in reach of facilities that will increase their wealth and welfare, such as roads, clinics, schools. There is a noticeable concentration of population, for example, around Chikankata Mission in Mazabuka District, with its good hospital and schools, despite its distance from the main road. Localised areas of high population density are remarkable for the reduction in tree cover, to almost zero in the fields around the Mission. It is still preferable to collect fuel from the bush a few kilometres away than to make the transition to planted wood lots and hedges, although a few of the latter are beginning to appear around houses.

In the process of change there will be gainers and losers. With good management and policies, society will be able to move to a more productive economy, capable of affording a better standard of living to more people.

Macro-economic policies

The 1991-92 drought hit Zambia when it was in the midst of an economic and political transition. The economy had for long depended on copper and cobalt, which provided revenues with which the gov-

ernment could promote industrialisation, and subsidise maize production. The previous government reacted slowly to the collapse of copper prices in 1974-75, and continued lower levels since. Copper had provided the bulk of government revenue. By 1986 the maize subsidy was largely out of control, and the effort to get the maize harvests into safe storage before the rains was constantly plagued with problems (Kydd, 1988). This was in part because the maize price was fixed on a pan-territorial basis, making it the most profitable crop even in remote parts of the country, where, on the basis of transport costs, the production of a diverse range of crops to meet local needs would have been both economically more logical, and a safer strategy to meet local food needs in face of varying rainfall. The pan-territorial maize price and the subsidies on chemical fertiliser meant that most farmers were encouraged to monocrop hybrid maize which gives high yields if combined with fertiliser, to sell most of this production as soon as they could, and to buy back subsidised maize meal during the year. Centralised marketing meant maize often travelled long distance both from and to rural areas. It also meant that maize was grown in areas ecologically more suited to other dietary staples. Nevertheless, Table 1 shows that agriculture was the only growing sector of the economy from 1982-91.

Despite, or because of, the subsidies, a 1969-72 survey showed about 23% of children aged 0-4 suffered from moderate to severe malnutrition, especially in the scantily populated Northern, Northwestern, Luapula, Western and Eastern Provinces, as well as in the shanty towns. Malnutrition indicators increased in the 1980s, although there are some difficulties in comparability with the earlier survey (personal communication, Dr Graham Eele and Simon Hunt). Some groups suffer from chronic malnutrition, with diets deficient not only in calories, but also in protein and essential vitamins and minerals; others from repeated seasonal malnutrition; others from transient malnutrition due to climatic risks in the rural areas and income insecurity in towns. FAO estimated in 1991, before the drought, that about 2.6 million Zambians suffered from some form of food insecurity, including about 1 million in the rural areas (FAO, 1991). Nevertheless, it also concluded

> For the past few years, as an average, Zambia has been self-sufficient in maize. Central and Lusaka Provinces as a whole were self-sufficient; Southern and Eastern Provinces were structurally surplus areas; Copperbelt Province as well as Luapula, Northwestern and Western Provinces had a high structural deficit; Northern Province was also a deficit area, but to a lesser extent.

Table 1 **Gross Domestic Product by kind of economic activity at 1977 constant prices, 1982-1991**
(Source: CSO, 1992a)

Economic activity	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991*
Agriculture, forestry, fishing and hunting	290.3	314.6	332.2	343.8	373.8	365.6	436.2	424.5	386.7	406.7
Mining and quarrying	215.2	221.7	200.0	185.9	176.5	184.2	160.4	175.6	162.7	165.5
Manufacturing	415.1	384.5	309.3	421.6	425.3	462.9	547.0	544.1	586.7	524.3
Electricity, gas and water	75.8	72.2	70.9	72.7	71.1	62.2	61.3	49.9	58.8	63.8
Construction	84.0	88.6	88.6	77.1	81.1	77.3	70.3	63.3	62.6	61.8
Wholesale and retail trade	178.5	171.8	167.9	174.7	174.4	181.5	185.3	186.8	180.7	181.1
Hotels, bars and restaurants	53.3	55.8	49.0	51.3	46.8	46.5	48.6	46.2	54.2	54.3
Transport, communication and storage	118.8	119.4	116.2	109.2	110.1	114.5	113.3	110.2	102.1	97.1
Financial institution	70.8	66.2	62.5	60.6	56.8	50.8	60.0	52.9	53.8	54.3
Real estate and business service	155.7	160.3	179.5	179.0	178.6	189.2	191.1	192.7	182.7	178.1
Community, social and personal service	393.9	355.7	340.9	365.6	357.9	371.5	373.5	375.6	381.5	387.6
Import duties	27.7	18.5	18.0	19.9	22.5	23.1	16.7	17.0	15.9	14.5
Less imputed bank service charges	19.8	18.5	17.5	16.8	15.8	14.1	16.6	14.6	14.8	15.1
Total GDP	2 059.3	2 010.8	1 917.5	2 044.6	2 059.1	2 115.2	2 247.1	2 224.2	2 213.6	2 174.0

* Provisional; estimates are based on partially available data and are likely to undergo major changes

On the whole, it was the surplus provinces that were most hit by the drought, followed by the self-sufficient. Except for Western Province, the deficit provinces were much less affected, being in the high rainfall area. While maize production on the whole kept in line with population increase, there were large swings between surpluses and deficits in the 1980s, due to climate, and difficulties in managing and financing storage between surplus and deficit years. Very large surpluses of maize in 1988 and 1989 were followed by a poorer harvest in 1990. Imports in excess of 20,000 tons were necessary in 1984, 1986, 1987 and 1989, although they were always less than wheat imports. National self-sufficiency is no guarantee of household self-sufficiency and, within households, some are especially vulnerable, either due to absence of adult male labour, or to a high proportion of young, sick or elderly members. Some 23% of rural households are headed by females, who tend to be short of resources such as draft power and to have less labour available than male-headed households. The extent of chronically undernourished children under 5 by province in 1992 is shown in Figure 3. It will be noted that the percentage was particularly

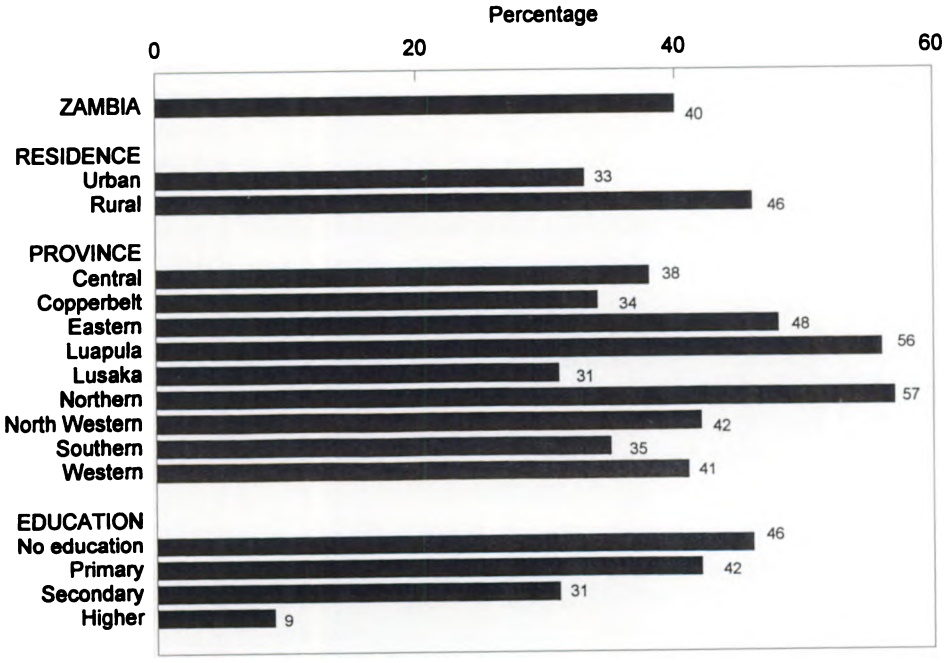

Figure 3 **Percentage of children under five who are chronically undernourished (stunted)**
Chronically undernourished children are those whose height-for-age z-score is below -2SD
(Source: Gaisie *et al.*, 1993; Demographic Health Survey, 1992)

high in Luapula and Northern Provinces, both unaffected by drought (Gaisie *et al.*, 1993).

There is no doubt that any reduction in subsidies causes urban pain, particularly amongst the urban poor, as demonstrated by the riots in December 1986, which greeted a first effort at mild reform. However, growing food subsides in the face of declining mining revenues put a further squeeze on government resources for essential services. As in many other countries, the personnel element in budgets tended to remain constant, while the operational and maintenance elements declined. The consequence was a continuing diminution in the quality of government services, notably in the water sector and rural roads, but also in agriculture, health, education, etc. By 1990 the real operational and maintenance budgets of most departments of the Ministry of Agriculture, Food and Fisheries (MAFF) had declined by some 35% per year since 1985 (World Bank, 1992, Vol. 2, Table 5.14).

Budget deficits led to "high and accelerating rates of... inflation, which reached 125% in 1989 and fell to 93% in 1991" (IFAD, 1993: 6). By this time, some structural adjustment policies had been introduced, in a rather stop-go fashion. Inefficiencies remained gross in the centrally managed marketing system. In September 1991, 27,000 bags of maize were set on fire 100 km west of Lusaka, probably as an act of protest, and 500,000 bags of maize were reported to be soaked and wasted (Geisler, 1992: 116). On 31 October 1991 the Movement for Multi-party Democracy (MMD) won a landslide victory, displacing Kenneth Kaunda and UNIP. The new party generally agreed on the need for liberalisation of the economy, increased reliance on the private sector, not merely decentralisation but also devolution to local authorities and the encouragement of community self-help, but it could scarcely have inherited a worse economic situation. In the best of circumstances a new economic framework relying more on market forces would have led to short-term disruptions and suffering by the groups most reliant on subsidy, before it began to stimulate effective responses. In fact, the reforms were accompanied by the worst drought in living memory, when the rains stopped in January 1992, at the point in the growing season most crucial for maize.

The impact of the drought has to be seen against this background of an economy in which government services had run down, peasant farmers had become over-reliant on a single crop, hybrid maize, for both food and cash and in which their urban relatives were impoverished by growing inflation, unemployment, and general poverty. The stagnation is well illustrated by the failure of GDP to grow between 1982 and 1991, when measured in constant 1977 prices, as shown in Table 1. As population was growing at 3.2% annually, this means that per capita income was falling by a similar amount. Table 1 also illustrates the

importance of mining and quarrying, manufacturing and services in the economy.

It was also an economy in which there were glaring differences in wealth. On the whole the urban sector was better off than the rural, and enjoyed better access to services. This is shown by the better nutritional status of urban children in Figure 3. Within both urban and rural sectors there were, and are, extremes of wealth and poverty.

Land tenure

Land tenure vitally affects incentives for investments in land improvement and good environmental management. Land ownership is officially vested in the State. Part is managed by the State, as game parks or otherwise. A portion is leased to large-scale commercial farmers for 99 years. Access to land in the area known as Trust or Reserve Land is controlled by traditional authorities (generally lineage chiefs). Custom provides relatively secure usufructuary cultivation rights to the traditional inhabitants. Under most customs, married women receive a separate field for their own cultivation, and single women generally also have a right to land. About 30% of Reserve Land has been allocated by government, with the consent of the chief, to individuals under formal lease. Women generally have more difficulty in obtaining such leases (IFAD, 1993, Vol. 1: 9).

This leaves a large amount of land for which individuals have no clear permanent rights. Uncultivated bush outside the commercial large scale sector and the gazetted and protected forest land is used for communal grazing. In some cases the community may have institutions which manage the rotation of nearby grazing areas, or access to wetlands; but in most areas it has either not developed such institutions, or a traditional system has broken down.

AIDS

Malnutrition and susceptibility to disease interact. An additional disease factor in the last few years is the spread of AIDS, which has hit disproportionately the working age groups, and increased the ratio of dependents per active adult.

While AIDS is more serious in urban than in rural areas, about 18-20% of blood donors at Monze Hospital in Southern Province were seropositive in 1991, which indicates the extent of the threat. AIDS cases tend to cluster in families, who can be heavily hit by the loss of adult labour and an increased burden of care for orphans and invalids (Foster, 1993). Monze is a rural hospital, and this part of the country has low rates of rural-urban migration. Rural areas with more interaction with urban areas may have more cases of AIDS. Increases in poverty and

neglect of good environmental management are occurring in Zambia from this cause as well as from drought.

Summary

The drought hit Zambia at the end of a decade in which incomes had been declining due to economic stagnation. Government revenues had fallen, and its services were operating at low efficiency. Maize policies had induced undue reliance on hybrid maize which required (subsidised) fertiliser, and discouraged diversity of crops and local self-reliance in areas where marketing was inherently costly. Population density was low, but was growing fast in rural areas between 1980 and 1990, as urban employment dried up. In many areas it was reaching a level at which traditional methods of land management required change to avoid degradation of the environment, but the incentives for investments in land improvement were still lacking. The rural environment was, therefore, under pressure before the drought, which hit both the environment and human welfare when they were already in decline. The impact of AIDS may also have begun to affect rural income systems and labour availability.

2 Rains and water storage

Nature of the drought and areas affected

There are several definitions of drought. Agriculturally, it is a shortage of moisture such that plant growth is affected. Hydrologically, it is a depletion of normal stream flows and water storage. Neither definition permits statistical analysis. As it can be assumed that farming systems respond to average conditions, Parry *et al.* (1988) define a drought index (*DI*) as:

$$DI = \frac{P - \overline{X}}{S}$$

where P = seasonal precipitation

$\overline{X}$ = the long-term average for that season

S = the seasonal standard deviation from P

This has the advantage also that it can be modified to examine monthly or ten yearly rainfall. Droughts can then be categorized as severe, moderate or light, according to the degree of deviation from the average (for an example see Tiffen *et al*, 1994). A definition based on deviation from the average has not yet been applied to Zambian rainfall statistics and the DI for the season or for January and February 1992 cannot be given. However, it is without doubt that a drought occurred in both the hydrological and agricultural sense.

Rainfall in Zambia is unimodal, due to the southern movement of the Inter-Tropical Convergence Zone (ITCZ). It decreases from an average of 1,400 mm in the upper north to 600 mm in the lower south. Rain falls mainly between October and March. Figure 1 shows the areas worst affected by the drought. Comparison with Figures 1 and 2 shows that the main areas affected were the low and medium rainfall zones, which include some of the more highly populated rural areas of Zambia, and the provinces normally producing a surplus of maize for sale to urban areas.

Rainfall patterns

Long-term trends and drought frequency

Ten-year rainfall means going back to 1951-60 have been analysed for selected stations in Zambia (Muchinda, 1992). These are shown in Table 1. For many stations 1981-90 was the driest of these four decades. However, 1991-92 was not the lowest rainfall on record.

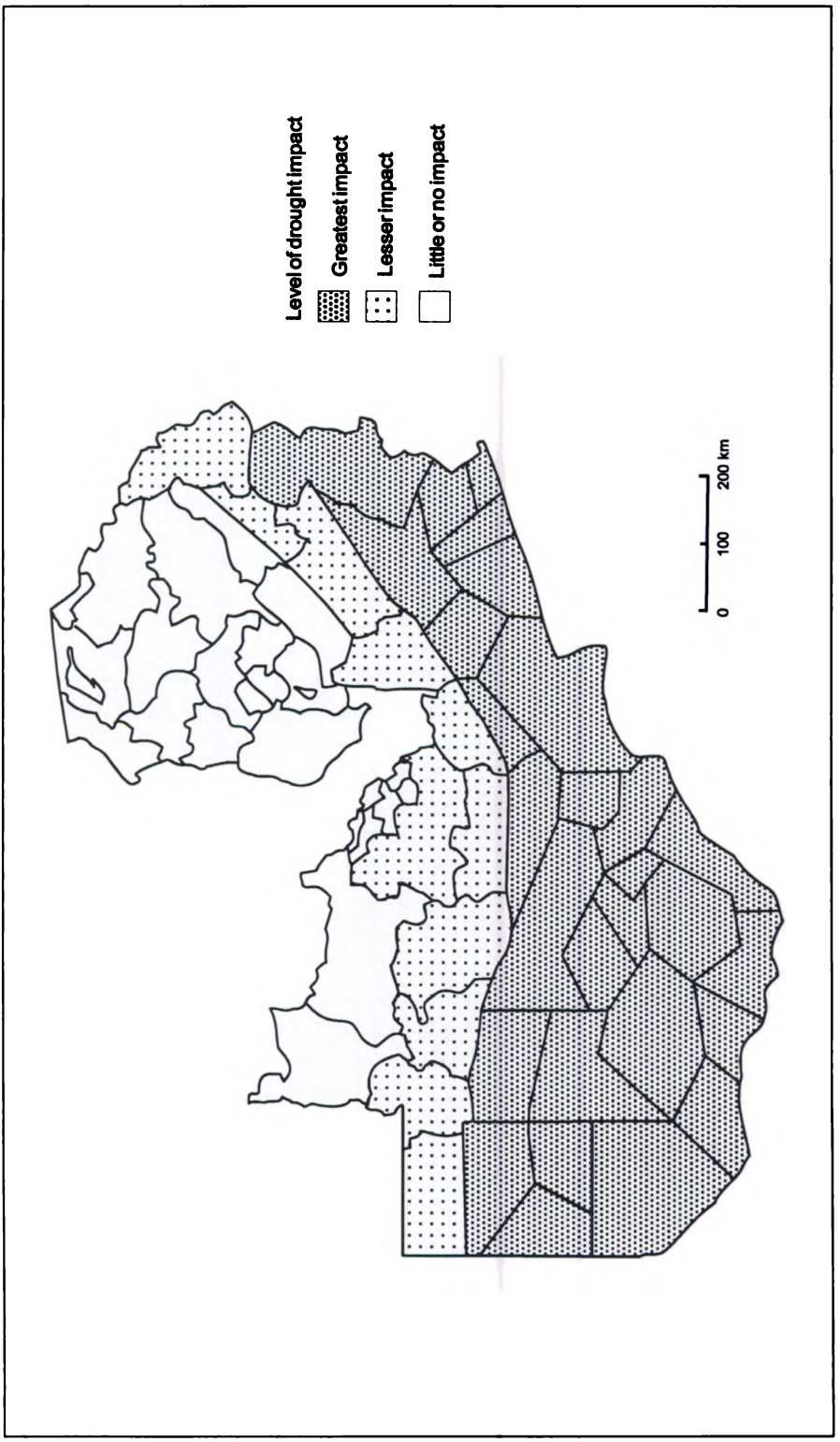

Figure 1 **Areas affected by the 1992 drought**
Sources: IFAD, 1993, Vol. 1:10; Programme Against Malnutrition, 1993a)

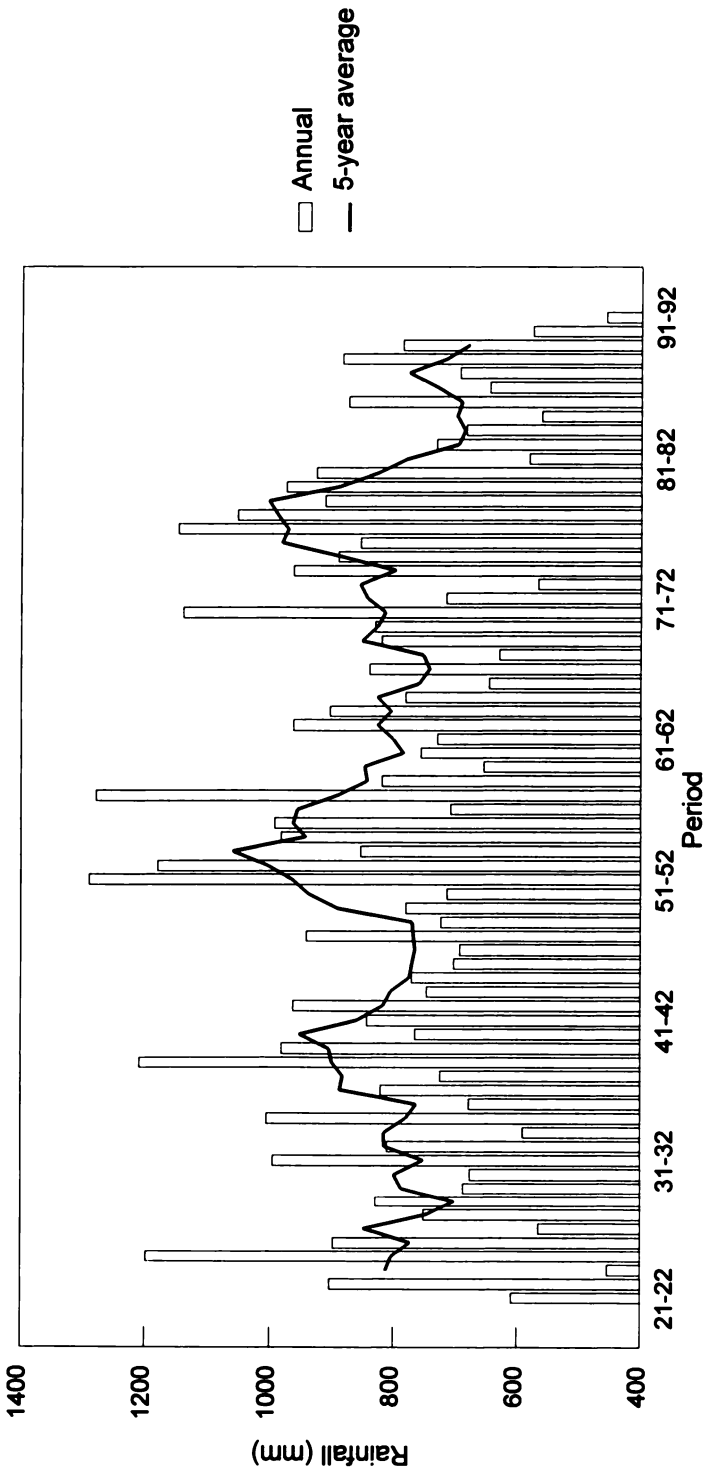

Figure 2 **Rainfall, annual and 5-year average, 1921-22 to 1991-92, Monze, Zambia**
(Source: Foster, 1993 - data from The Moorings, near Monze, as supplied to S. Foster)

Table 1 **Ten-year annual rainfall means for selected Zambian stations (mm)** (Source: Muchinda, 1992)

	1951-1960	1961-1970	1971-1980	1981-1990
Chipata	996	1,047	1,068	**959*
Choma	879	821	849	**755*
Kafue	881	758	797	**702*
Kaoma	–	945	943	**839*
Livingstone	863	697	743	**646*
Mt Makula	–	773	**859*	879
Zambezi	–	1,085	1,037	**978*

* Lowest during last 30 years ** Lowest during last 40 years

Figure 2 shows annual rainfall, and 5-year running averages, at a farm in Monze District, Southern Province, where records have been kept since 1921-22 (data provided by Susan Foster[1]). It shows considerable annual fluctuations. Periods of higher and lower rainfall have succeeded each other, without any clear cyclical pattern. The low rainfall of 1991-92 is similar to that of 1923-24 .

The Zambian meteorological office has recently examined data from some of its older stations to see whether 11-year running averages show any changes in trend. Neither Chipata, Eastern Province (data from 1905) nor Choma, Southern Province (data from 1918) show any clear trend upward or downward, though they do show the downward movement in the last decade, which is also seen in Figure 2. However, there are wet and dry periods; the low average rainfall of this decade has also been experienced earlier, in Choma around 1925, 1932 and 1944, and in Chipata around 1920 and 1925.

When monthly totals are examined, Choma shows apparently long cycles of about 20 years for March and less distinct, but possibly shorter cycles for November. In Chipata the cycles are less distinct. This may be related to the divergence in rainfall patterns for the boreal summer months (June, July, August) and winter months (December, January, February) over the last sixty years (Hulme, 1993).

The markedly lower rainfall in the Sahel, 1965-1992, as compared with the period 1900-1965, has not been experienced in either East Africa or southeast Africa (defined as Zimbabwe, eastern Botswana, southern

1 The meteorological office could also have provided long-term data for some of its stations, but this was not in the original request to them. During the course of the study, however, it was decided to examine trends over a longer run of years.

Mozambique and northern South Africa). The latter has in the past shown a quasi-periodicity over about 18 years. Hulme (1993) notes

> The severe drought of 1991/92 in this region was therefore especially noteworthy, not so much for its magnitude (a number of other years have been similarly dry in the region, for example, 1946/47 and 1972/73), but more for its occurrence at the beginning of a supposedly wetter sequence of years.

However, if there are underlying weather cycles, 1991/92 should be an exception in what may be a wetter decade.

Some people think that longer, 60-year cycles, can also be discerned; if so, the dry decade, beginning 1981, may be related to what looks, from the eleven-year running means, to have been a dry decade in the 1920s. However, climatologists are still far from agreeing whether there are weather cycles, and if so, of what length, and how they are related to other phenomena such as sunspots and el Niño. Great irregularities from year to year mean that in any case cycles cannot be used to predict weather for a particular year, though with better understanding we might be able to forecast whether a spell of below or above average years, in either the last or the first quarter of the year, is likely. Cycles may themselves be affected by any trend which is associated with global warming.

Rainfall reliability and distribution and effects on crop yields

AEZ I suffers not only low rainfall, but also poorly distributed rainfall within seasons and considerable year-to-year variation in rainfall totals, as illustrated in Figure 2. Rain falls in heavy storms separated by dry periods. Figure 3 shows these dry spells at Mochipapa Research Station, Choma District, 1972-73 to 1987-88. Masi (1991) reported that rainfall in 1972-73 and 1986-87 was inadequate for any maize variety. Three other seasons would have been barely adequate for a short season variety requiring 100 days to maturity (which, however, was not available to farmers). If planted early, 70% of seasons were adequate for varieties MM504 and 60% for MM604; but if planted at or after mid-December 63% and 75% of seasons would be **inadequate**. The importance of early planting in November is apparent, but even with early planting, three out of ten seasons in the drier parts of Southern Province will have maize failures. However, quite often, farmers do not receive hybrid seed until early December. 1991-92 suffered a prolonged dry spell in January-February 1992, which is the most crucial period for maize. Temperatures rose, causing increased evaporation of surface water. This was followed by late rains in March, too late to save the maize, but enough to save the grasses, trees, deeply rooted crops like cotton and to refill the ponds. 1991-92 was, above all, a maize drought. In Figure 4 monthly total rainfall for 2 stations, Chipata and Livingstone, is given for all of 1991-92 and for 1992-93

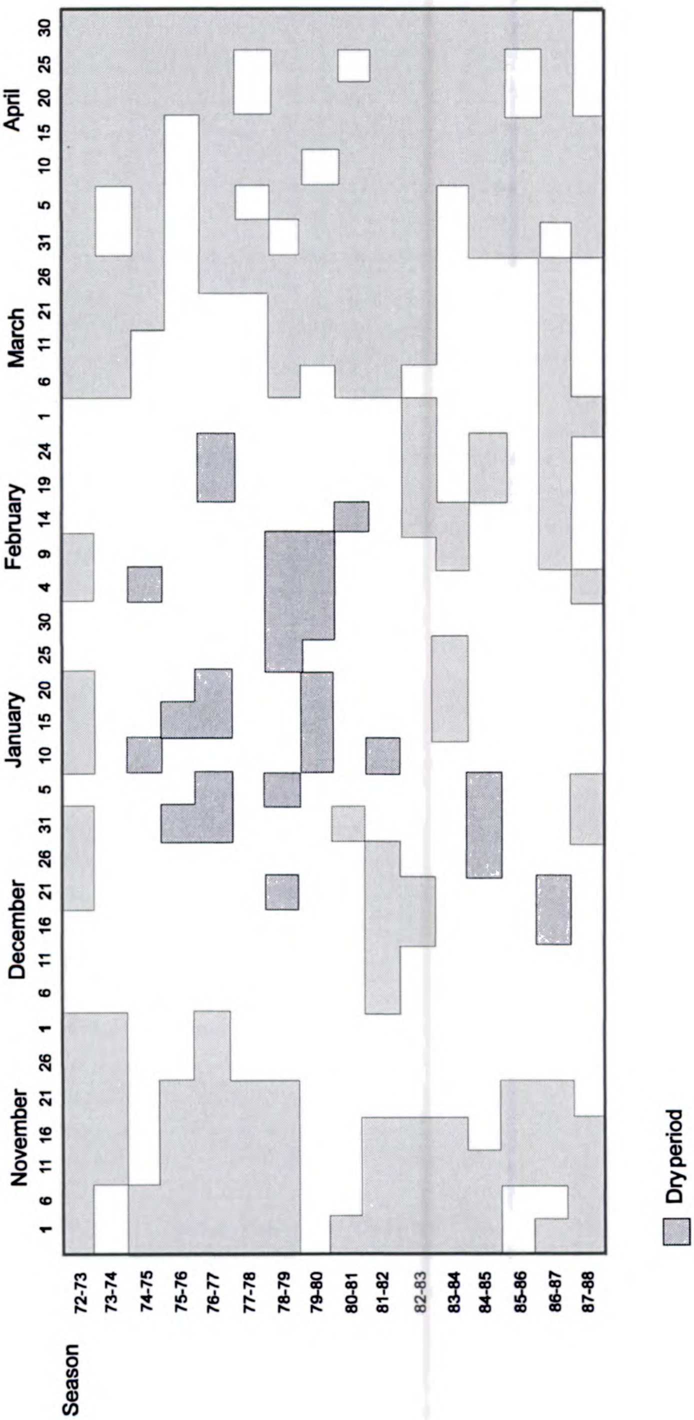

Figure 3 **Pentade analysis of rainfall at Mochipapa Research Station, Southern Province, 1972-73 to 1987-88**
(Source: Masi, 1991: 21)

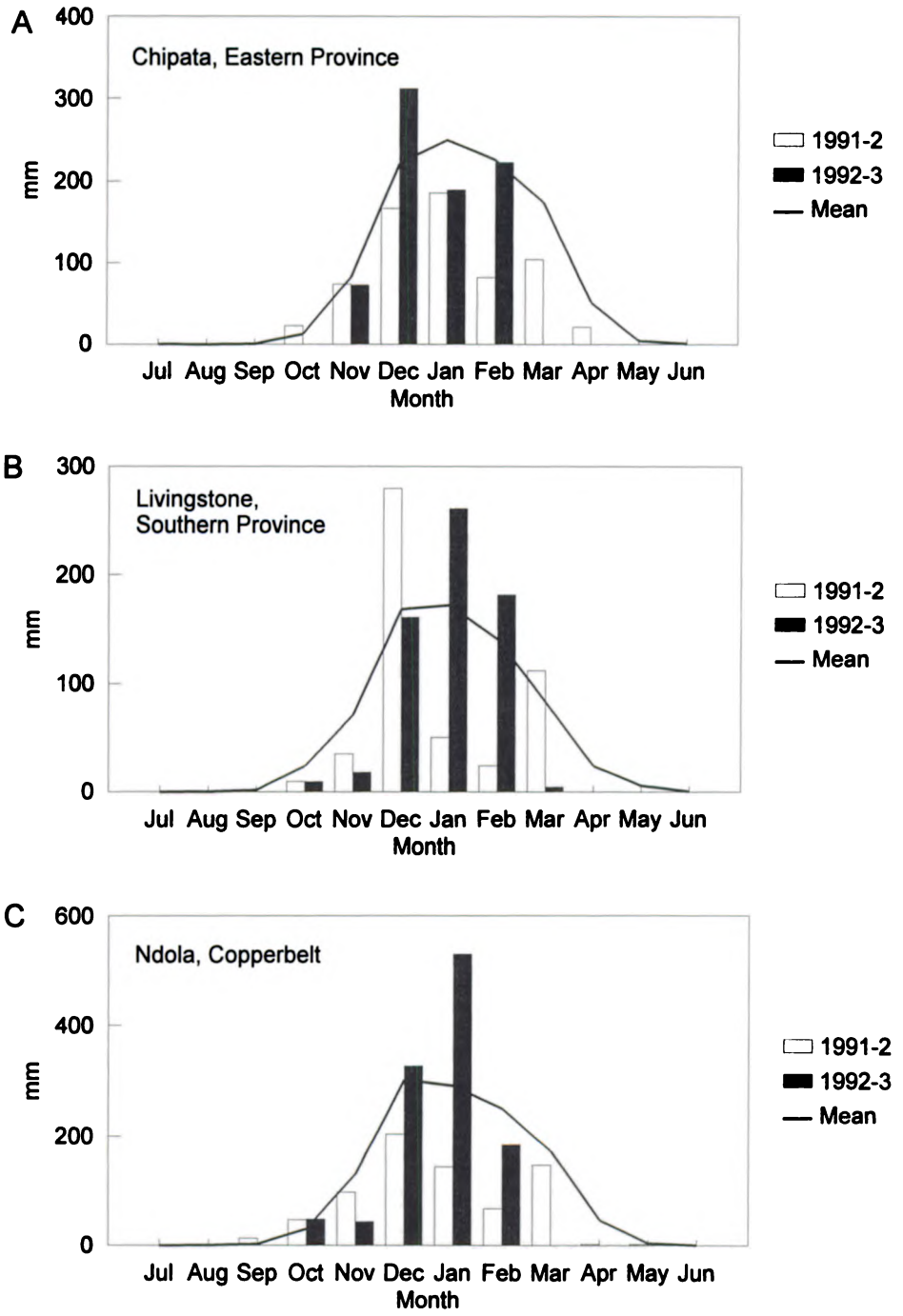

Figure 4 **Rainfall 1992-92, 1992-93 (until February 1993) and 30-year mean**
(Source: Constructed from rainfall data supplied by the Meteorological Department)

Table 2 **Dry ten-day periods at three stations, December 1991 to February 1992 (less than 30 mm rainfall)**
(Source: Meteorological Department)

Station	December 1991			January 1992			February 1992		
Chipata	–	–	–	–	–	X	–	X	–
Livingstone	–	–	–	X	X	X	X	X	X
Choma	–	X	–	X	X	–	X	X	X

X = Dry period

up to February 1993, in comparison with the long term average. Eastern Province (Chipata) had better rain than the area around Livingstone in Southern Province, but it has to be remembered that in both provinces different areas would have received different quantities. Parts of Eastern Province received less rain than Chipata. Figure 4 is merely illustrative of the distribution. It also shows how rains of 1992-93 were far greater in the crucial months of January and February. Figure 4 also gives the same information for Ndola in the Copperbelt Province in the high rainfall AEZ III. This area was unaffected by the drought, in the sense that rainfall was sufficient for the crops, even though it was below average in January and February.

Table 2 gives ten-day periods with insignificant rain at two stations in Southern Province and one in Eastern Province from December 1991 to February 1992. Livingstone had no rain in January and Choma was without any rain for 20 days. Chipata appears slightly better off, but rainfall in the first ten days of February only totalled 31.5 mm, not enough in the hot conditions to revive the crops.

Surface water

Quantity

Recorded flows on the Kafue River

Figure 5 shows the mean monthly river flow for the years 1905/06-1991/92 at Hook Bridge, on the Kafue River above the Itezhi-Tezhi Dam (data provided by Mr Mukosa, Hydrological Department). A five-year running average shows no clear cyclical pattern. However, it is noticeable there was less annual variation during 1905-55 than during 1955-92. It also shows that average flows were higher after 1955 than before 1955, but that there was a steady decline in the ten years since 1981. As Mukosa (1993) reports, using another methodol-

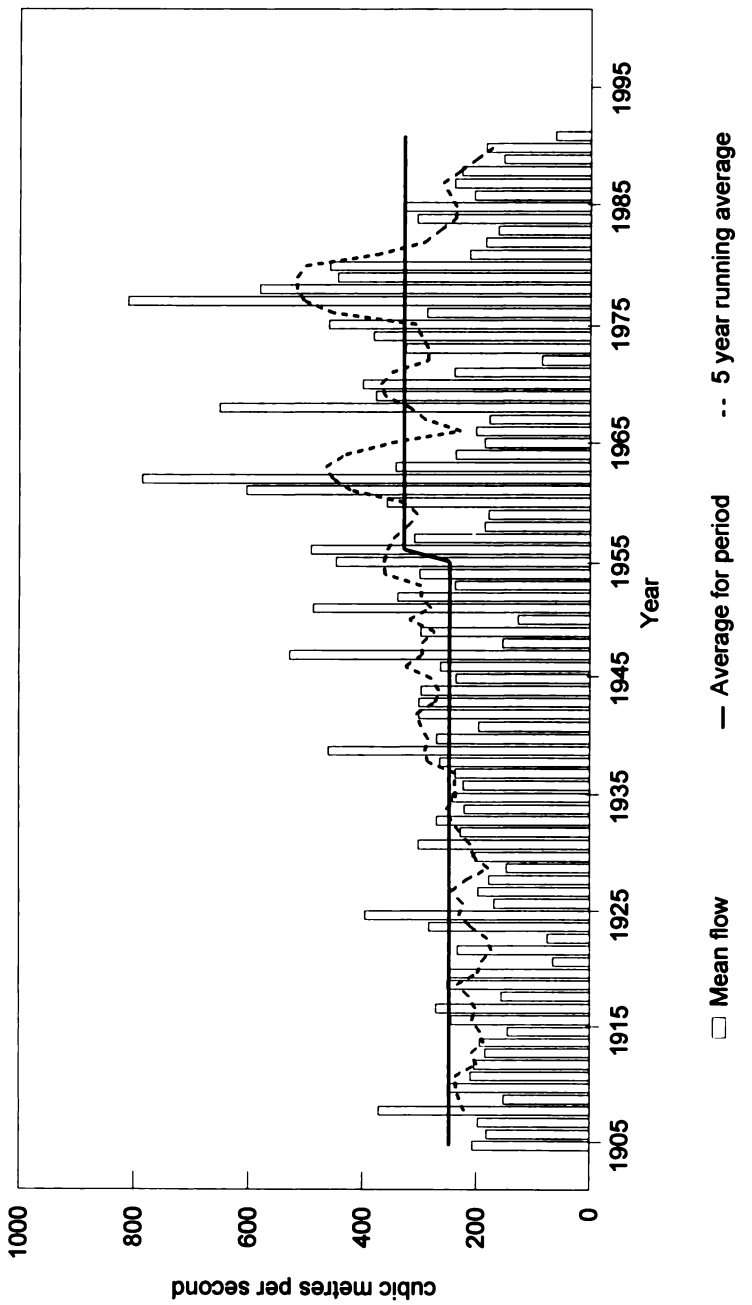

Figure 5 **Mean monthly annual flow, Kafue River, at Hook Bridge, 1905-1992 in cubic metres/second**
(Source: Constructed from data in Mukosa, 1993)

ogy, from around 1955 there was an upward trend in river flows, followed by a downward trend after 1980.

While river flows are related to quantity of rainfall, they are also affected by many other factors. Although the vegetation in the catchment has not changed much recently, nor are there major dams above it, it is not safe to make any deduction about increase in variability from this evidence alone, particularly as it is not evident in the rainfall records. We can note, however, that although the mean flow in 1991-92 was the lowest on record, it was nearly paralleled in two years in the 1920s.

Flows in the main rivers

Figure 6 compares the average flows in the Kafue at Hook Bridge and the Zambezi at Victoria Falls, above the main reservoirs, with the actual flows in 1991-92. The measurement points can be seen in Figure 7. While rainfall is normally at its highest in December, January and February, river flows peak later in March on the Kafue and April on the Zambezi. The early rains infiltrate into the dry ground, with relatively little run-off into the river systems. By December-January the surface soil has often reached its full water-retention capacity and water drains into the river systems, for capture by the large reservoirs which now regulate them.

The lower rainfall of January and February 1992 meant that rivers did not receive the usual run-off. Figure 6 shows the substantial water deficit in the Kafue and Zambezi. River flows, like rainfall, were on a falling trend since 1980. This is shown for the Kafue in Figure 5, the Zambezi was similarly affected. The flows were particularly low in 1991-92 compared to the average. The Kafue rises in the high rainfall areas of the north, but Figure 4 has already shown that areas such as Ndola received less rain than usual, resulting in less run-off from the catchment. Both rivers are regulated by dams, the Zambezi by the Kariba (in so far as Zambia is concerned) and the Kafue by the Itezhi-Tezhi, as shown in Figure 7. Normally, rainfall run-off is stored in these dams to enable power generation to continue throughout the year at Victoria Falls and the Kafue Gorge stations respectively. The Kafue Gorge is designed to generate 600 MW. Generation had to be severely cut back, in order to conserve water until the onset of the next rains. At one stage they were only generating 200 MW, and the water was getting dangerously low. The Kariba Reservoir also fell to a dangerous level in December 1992, as shown in Figure 8. There was power rationing and load shedding between October/November 1992 and February 1993. This affected industry, and also the domestic supply for cooking in the urban areas. Zambia had to import electricity from Zaire, whereas it normally exports it.

Water shortage also affected the release of water to the Kafue Flats, an important wetland and grazing area in Southern Province. Normally,

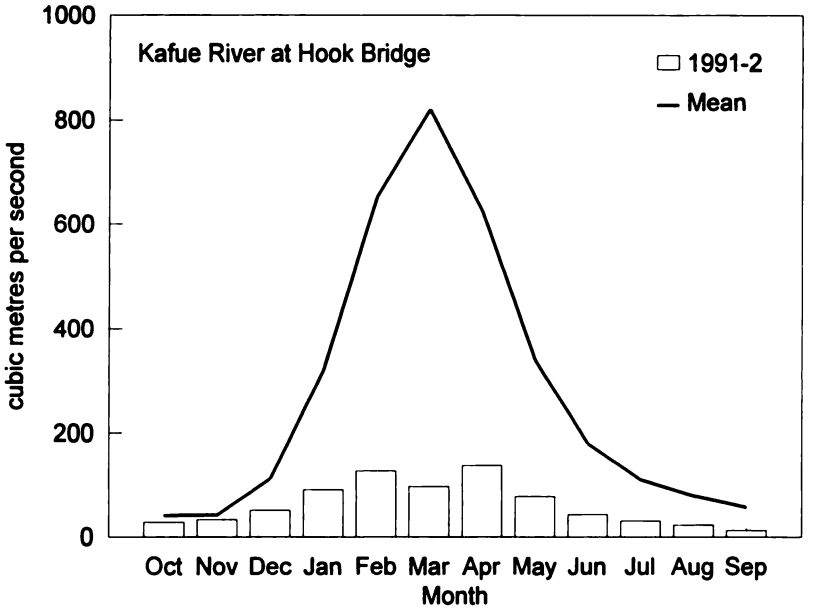

Figure 6a **Kafue River at Hook Bridge, flows in metres per second**

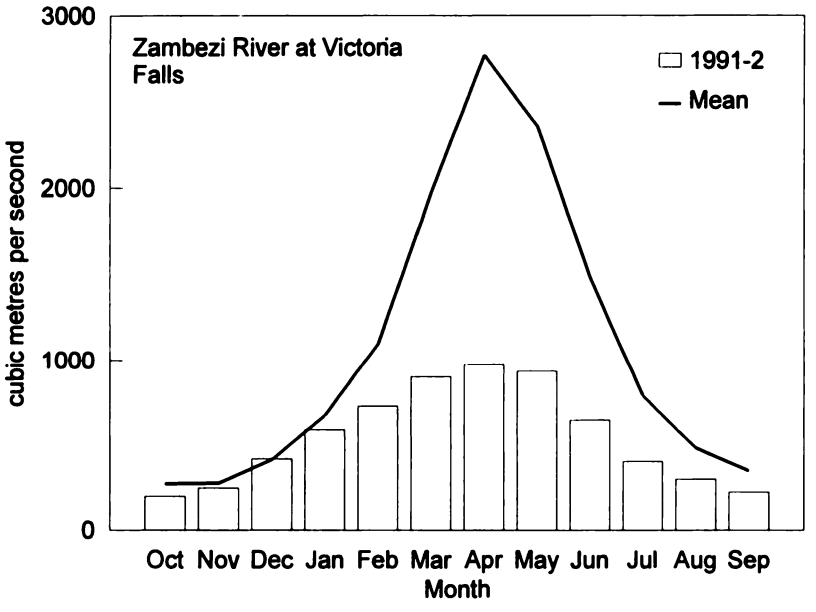

Figure 6b **Zambezi River at Victoria Falls, flows in metres per second**

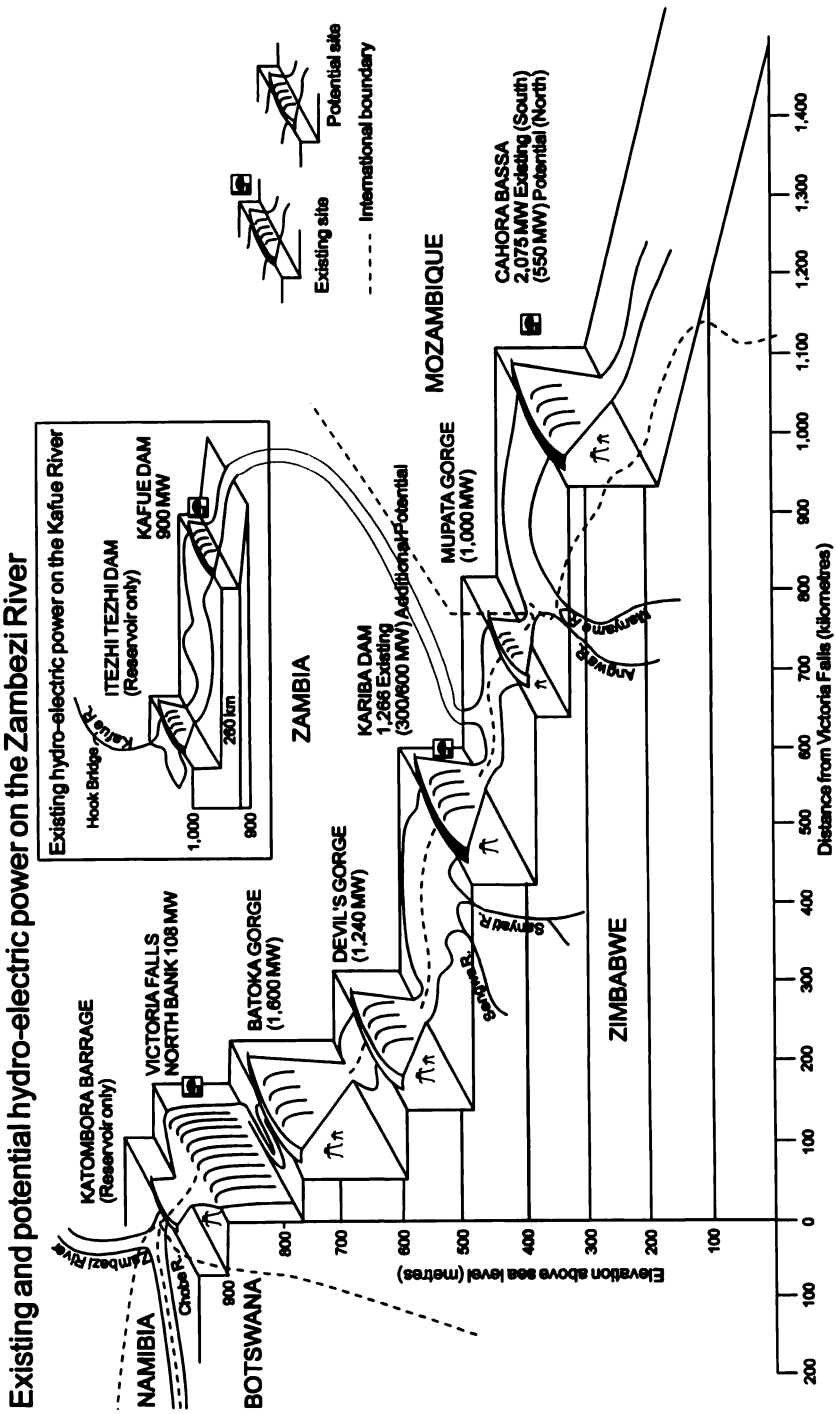

Figure 7 **Structures on the Zambezi and Kafue Rivers**
(Source: Zambezi River Authority Annual Report and Accounts for the year ending 30 June 1991)

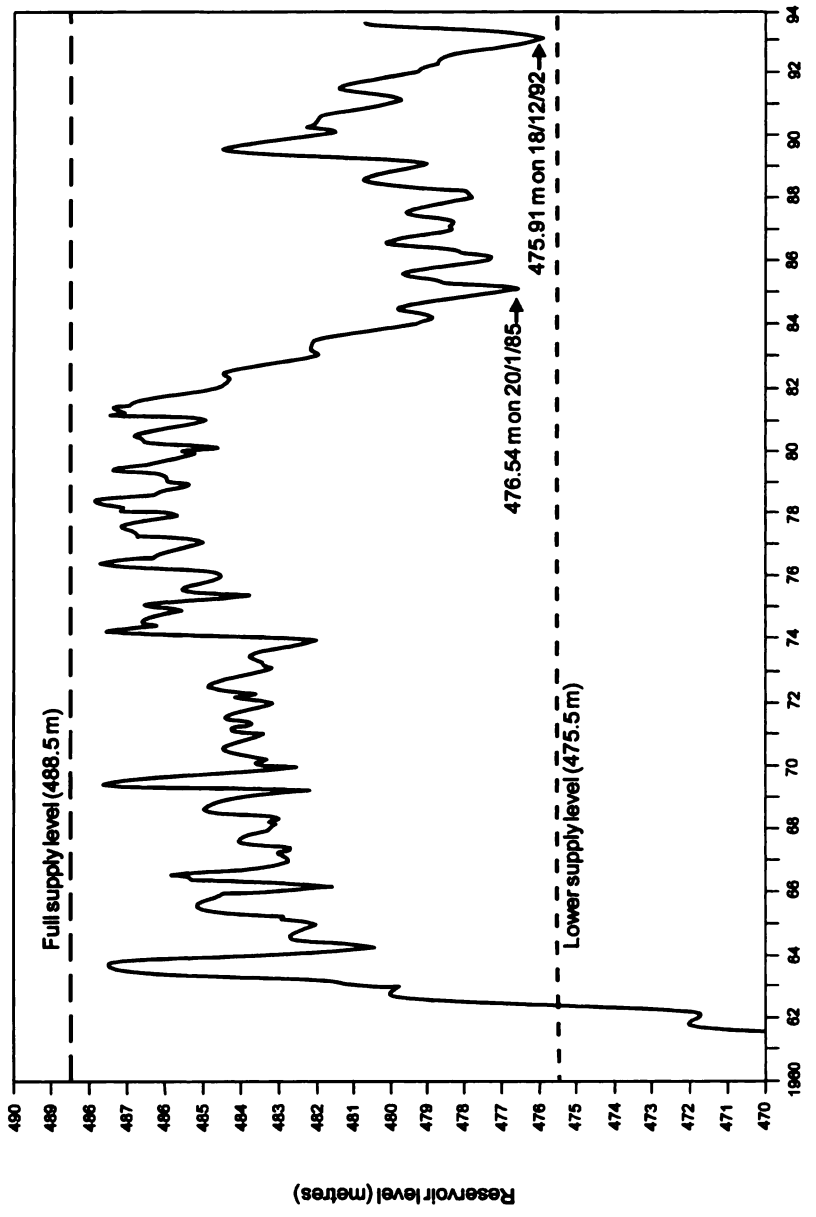

Figure 8 **Kariba Reservoir, recorded end-of-month levels, May 1961 to July 1993, impoundment started December 1958**
(Source: Zambezi River Authority)

ZESCO release 300 m^3/s into the Flats in March. However, in March 1992 they only had 96 m^3/s coming into the reservoir, and released only 120 m^3/s. As outflow was more than inflow, the dam slightly moderated the drought impact downstream.

Thus, the January-February drought had a delayed impact on the rivers, manifesting itself in lower river flows in March-May, and an acute shortage of water in the main reservoirs later in the year.

Streams and small dams

Streams, small dams and wetland areas in the valleys (*dambos*) dried up, a process accelerated by high temperatures and evaporation. Only the larger dams in the affected areas retained water throughout 1992. This reduced water for human consumption (where the community had depended on a stream or dam), livestock use and vegetable production. Some farmers near the streams were able to continue to grow vegetables for a few months and to sell these to buy maize. A farmer with a banana plantation in a valley in Southern Province continued harvesting fruit throughout 1991-92, though a reduced quantity.

For some people, the situation was saved by access to a medium-sized dam, storing more than a year's water supply. Generally, the small towns in Southern Province are served by such dams, and there was also one near the densely populated area of Chikankata Mission. People in Eastern Province seem to have been more dependent on streams and shallow wells and were severely affected.

Status in 1993

Itezhi-Tezhi and Kariba Reservoirs, and the Kafue Flats

As a consequence of the heavy rains of 1992-93, the Itezhi-Tezhi Reservoir rapidly refilled. There was so much more water coming in than usual that the management released 360 m^3/s into the Kafue Flats and, at one point, was having to release even more, going up to 900 m^3/s in April. This was cut down in stages to 120 m^3/s in June. Thus, the Flats were flooded in 1993 to a much greater extent and depth than at any time in the past decade.

Kariba also received more water and recovered to its 1990 level. However, it will take at least three more good rains to recover to levels common in the 1970s (Figure 8). It has been dangerously low twice in recent years.

Streams and small dams

Most observers think that the streams are drying up in 1993 earlier than usual, despite the good rains. It is possible that this is due to increased percolation and less run-off, because of what farmers describe as the thirstiness of the land. However, in the first part of 1993, most farmers were able to cultivate *dambo* land again, and in some places there was, indeed, a glut of vegetables. Many small dams had refilled or over-

filled: some dams in Southern Province had suffered damage and breakage due to the heavy rains. Mr Parry, Macha Hospital, estimated 60% of small dams in his area were damaged or non-functional.

By March 1993 the Department of Water Affairs had rehabilitated only six small dams, although some others had been surveyed (Table 3).

Quality

Quality of drinking water in the rural areas suffered as people had to dig for water in stream beds and *dambos* and share water sources with their animals.

Data is not available on changes in water quality in the Kafue River in 1992 or any effect on urban water supplies. JICA (1992) sampled water at 56 points on the Kafue, 8 on the Zambezi and 2 on the Luangwa, in two dry seasons (1990 and 1991) and one wet season, 1990-91. They found:

- The main pollutant source, organic and non-organic, is waste water from the Copperbelt, produced from mining and related activities.
- The pollution in the upper Kafue from this source has been self-purified by the middle and lower stretches of the river.
- Some tributaries around Lusaka have organic contamination by municipal waste water, leading to overgrowth of plants and algae, causing eutrophication and some dead water areas.
- The water quality of the Zambezi and Luangwa is good.
- In the rainy season there is greater turbidity, but chloride ion is generally lower.
- Organic pollution on the upper Kafue is not a great problem, although there are offensive odours near Kitwe and Ndola. There is active overgrowth of plants and algae near Ndola Dam, and eutrophication.
- Ultimately the deposits of metallic components at the bottom of the river may become a problem.

It has been reported elsewhere (Charman, 1990) that sulphate concentrations in the upper Kafue were on a rising trend, 1986-90, and that if this continued, it could become a problem in the dry season when dilution is less. However, it is not known if this was experienced in 1991-92. The Department of Water Affairs has insufficient staff for regular monitoring. The Charman Report (1990) said that about 90% of the spillage problems (of waste from mining companies) are caused by maintenance failure, due to shortage of spares and slashed budgets.

The same applies to treatment of urban water, where problems of pollution remained much more due to shortage of materials and organisational problems than to the drought. Normally, there is a higher percentage of organic solids in the dry season. However, those we

Table 3 **Progress of drought relief activities in the water sector overall programme to March 1993**
(Source: Department of Water Affairs)

Province	District	Shallow well rehabilitation		New shallow well	Handpump repairs		New boreholes		Dry boreholes	Dam rehabilitation
		Plan	Done	Done	Plan	Done	Plan	Done	Done	Done
Central	Kabwe	292	25	6	41	24	41	68	-	4
	Mumbwa	220	41	-	20	10	35	40	-	1
	Kabwe urban	60	2	-	15	5	10	1	-	-
	Serenje	50	16	1	20	26	20	0	-	1
	Mkushi	100	7	2	13	4	15	0	-	-
Eastern	Nyimba	-	-	-	-	-	-	-	-	-
	Petauke	266	53	-	77	60	40	21	-	-
	Katete	256	17	-	87	44	35	18	-	-
	Chama	75	99	-	58	13	32	-	-	-
	Chadiza	474	44	-	132	30	35	-	-	-
	Chipata	630	68	-	46	22	45	-	-	-
	Lundazi	194	65	1	11	4	36	-	-	-
Lusaka	Luangwa	100	3	1	88	17	65	1	-	-
	Lusaka R.	232	16	14	99	43	87	10	-	-
Southern	Mazabuka	50	61	-	37	63	43	20	3	2 surveyed
	Monze	132	29	-	85	76	54	6	2	2 surveyed
	Choma	150	42	-	66	89	54	25	3	6 surveyed
	Kalomo/ Livingstone	102	68	-	52	132	54	10	-	-
	Namwala	50	11	-	37	42	30	15	-	-
	Siavonga	24	8	-	15	25	20	5	-	-
	Gwembe	44	15	-	14	37	30	26	-	-
	Sinazongwe	34	33	-	3	28	15	9	3	1 under
Western	Mongu	10	-	-	-	-	22	10	-	-
	Kaoma	64	11	-	-	-	10	-	-	-
	Senanga	395	296	-	-	-	14	-	-	-
	Sesheke	-	-	-	-	-	9	7	-	-
	Kalabo	-	-	-	-	-	5	5	-	-
	Lukulu	-	3	-	-	-	20	-	-	-
Total		4,004	1,033	25	1,016	794	876	297	11	6 completed

Boreholes rehabilitation not quantified. Most of those so classified previously are handpump repairs. Borehole cleaning needed in a few cases as an emergency action usually as a result of vandalism

Date: 9 March Total sources brought into use 1,911
DWA/UNICEF Total planned 5,165

spoke to did not think drought would have contributed in any major way to pollution levels in urban water supplies.

It will be noted that most of the pollution problems are connected with the mining industry or with urban conglomerations such as Lusaka. Most occur in the high rainfall area and, therefore, there was little drought effect. Cholera epidemics in Kitwe cannot be blamed on the drought; cholera in some rural areas of Southern Province was, however, related to the shortage of clean water for drinking and washing.

Many people have noticed an increase in sedimentation and reeds in the Kafue River near the new Kafue road bridge. Most knowledgeable people we spoke to attributed this to the temporary works which partially blocked the river during the construction of the new bridge in 1991-92, rather than to a drought-related cause.

Groundwater

Status in 1992 Groundwater is the generally recommended source for drinking water.

It is not possible to provide quantifiable data on the impact of the drought on groundwater levels. The Water Affairs Department does not have the staff to monitor this regularly. Indeed, one of the problems at the onset of the drought and the realisation that there was going to be a water problem, was the lack of data on where boreholes were sited and the condition of their equipment (personal communication, Mr M. Henderson, UNICEF).

Japanese consultants carried out measurements on 19 observation wells during their 1990-91 study, and found groundwater levels had 8 types of relationship with river water levels (JICA, 1992). We cannot, therefore, make any generalisation from our knowledge of river water flows to the status of groundwater. However, the general experience following the poor rainfall of January and February 1992 was of a fall in groundwater level due to less run-off and less deep percolation. This meant that many shallow hand dug wells dried, as did many boreholes.

Problems associated with limited access to safe drinking water were exacerbated by the fact that four thousand boreholes and wells were already out of action, due to missing spare parts. These are shown in Table 3 under the head 'Plan', which indicates some need for repair. In some cases this was simply a bucket or rope. Communities had not attempted to replace even these simple items themselves, because no local person or body was responsible and the wells were regarded as belonging to the government. The Lutheran World Federation monitored 400 wells in Eastern Province in June 1992 and found that, in March 1992, 80% of handpumps were not functioning. In Monze District, Southern Province, a survey identified ninety boreholes with

no working pump (Sutton, 1992). More and more people came to take water from the working wells, which were in operation 24 hours a day, leading to more wear and tear and to faster depletion of the local water table.

Status in 1993

Because of lack of monitoring, it is not possible to say if groundwater levels have gone back to normal, but the general impression is that, while higher than in 1992, they have not recovered yet to pre-drought levels.

However, some facilities are now in better shape. Table 3 shows an estimate of facilities needing work (plan) and facilities completed (done). It shows that 1,033 shallow wells repaired, 25 new ones provided, 794 handpumps repaired, and 297 new boreholes. A change in attitude amongst communities to these facilities has been noted (see Chapter 5).

Summary: rainfall, water storage and management in the 1991-92 drought

Droughts are often described in terms of the deviation of the rainfall from the average. It can be seen from Figure 4 that 1991-92 did not experience a severe drought in terms of the early and late rainfall. The marked deviation from the average occurred in the January and February rainfall, in both the high and low rainfall areas of the country. In AEZ I and parts of AEZ II, this was sufficient to kill maize, which is very sensitive to lack of rain at this period. In this sense, it was a maize drought, not a total drought.

Rainfall normally cools the high temperatures that would otherwise be experienced while the sun is in the southern tropics. Lack of rain in January and February, therefore, led to unusually high temperatures, increasing evaporation and evapo-transpiration, thus accentuating the effects of a shortfall in rainfall on crops and on run-off.

In AEZ I seasons with low total rainfall, or periods of no rainfall, occur frequently, and farming needs to be adapted to this condition. In terms of total rainfall 1991-92 was not unprecedented and can be compared to years in the 1920s. It followed a dry decade, in the 1980s. There is some evidence of cyclical trends in rainfall, the nature of which needs to be better understood. The low rainfall of 1992-93 could be repeated again quite soon, as seems to have been the case in the 1920s. Alternatively, the worst of the low-rainfall period may now be over, and a new upward trend may be beginning. The implications of possible cyclical patterns for drought management, in the context of present knowledge are discussed in Chapter 6.

The drought had a major impact on the volume of water in streams, lakes and reservoirs, because it occurred when most run-off and drainage into the river systems normally takes place. It appears that groundwater levels had still not fully recovered after the good rains of

1992-93. The impact was on water supplies for humans and livestock, on fish habitats and on electricity-generating capacity. The smaller dams, most of which emptied during the drought, have now refilled, but Lake Kariba has not yet returned to pre-1980 levels. Medium-sized dams with more than a year's supply proved their worth. Because water storage was low at the outset, after a dry decade, the major dams could not be used to maintain normal generating capacity and downstream water supplies. The importance of managing them to allow for a sequence of two or three bad years is clear, and operational manuals may need revision after a fuller study of rainfall variations.

While climatic variation was the main cause of lack of water in storage, we can also see the effects of poor macro-economic policies, particularly in relation to the smaller water facilities. These require constant maintenance, and the impact of the drought was made worse by the bad condition in which they were at its start. Government had failed to manage them, and communities had felt no responsibility for them.

3 Biophysical impact

Crop data are relatively well reported, especially for maize. For the impact on natural vegetation, planted trees, livestock, fish, wildlife, including insects, and soil erosion we were more dependent on our own observations and data collected from informants in the field.

Crop production

Crop production in 1991-92

Table 1 shows production of major crops. Maize production in 1990-91 was about average for the dry decade of the 1980s, but half the amount obtained in the good years of 1988 and 1989. Production in 1991-92 was less than half the 1990-91 figure.

Table 1 does not include millet and cassava, where the figures looked unreliable. These are minor crops on the national scale; maize is the main smallholder food and cash crop. Some of the other crops are grown mainly for consumption; these include mixed beans in the wetter north and groundnuts in the dryer south. Wheat was unaffected, being an irrigated winter crop, mainly grown by large-scale farmers. Amongst the crops grown mainly for cash, Burley tobacco is a small farmer crop in the wetter provinces, while Virginia tobacco is often assisted by irrigation on larger estates. Cotton is a small farmer crop in the drier provinces; it was hit, but not as badly as maize.

National figures do not give a true picture of the impact of the drought in the worst affected provinces, since less rain produced better, not worse, crops than normal in the northern provinces where crops often suffer leaching of nutrients by excessive rain. Crop areas affected by drought loss were estimated as 85% in Southern Province, 67% in Lusaka Province, 61% in Western Province, 37% in Eastern Province and 51% in Central Province (MAFF & CSO, 1992). We take Southern Province as an example, since it was the worst hit.

A survey by the Adaptive Research Planning Team (ARPT, 1992a: 7-8) reported

> The part of the country most severely affected by the drought is Southern Province. The crop failure was almost total in the valley areas (AEZ) I and still less than 20% of average production over much of the plateau area (AEZ II). ...Sorghum yields were almost non-existent in the valley area because of the long maturity period of the local varieties. Poor maize yields...were exacerbated by the fact that the earlier maturing hybrid

> varieties in the MM 500 series have not been delivered to the province in the past two seasons...over the last few seasons Zamseed and the Southern Province Cooperative Union have not been distributing the right mix of seed varieties. There has been some seed of the open pollinated variety MMV 400, particularly in the valley areas, but it should be understood that this is a crop suitable for fresh maize consumption only...not...nshima.

ARPT's assessment of the impact in the areas it surveyed in the other provinces was in broad agreement with the MAFF & CSO estimates. It illustrates the way in which national maize policies and inefficient institutions made the impact of the drought worse.

Farmers and officials stressed to us in Southern Province that the previous decade had been drier than average (as illustrated by Figure 2, Chapter 2). The losses of 1991-92 followed a year in which many farmers had experienced low production and food shortages. Three districts had been affected by drought in 1990-91 (Foster, 1993). The valley areas of the province always face a hazardous crop situation and depend heavily on fishing, livestock, and other income sources. Table 2 shows that in 1991-92 the maize crop was only 13% of the below average 1990-91 crop. The small production of legumes was cut back still further; the Gwembe valley area lost its cotton crop (ARPT, 1992a) although other areas did better. Figures for sunflower are unclear.[1] Virginia tobacco under irrigation was unaffected.

Seed retention and genetic diversity

A result of the drought was that many families either had to eat the seed they normally retained for next year's planting or, lost the crop and, with it, next year's seed. It is customary for farmers to plant first local open-pollinated maize varieties, from retained seed. These are preferred for local consumption, for their taste and their better storage qualities. Most have a long maturity time and, despite being planted relatively early, they were caught by the cessation of the rains. Amongst 13 women farmers we interviewed at one place in Southern Province, one had been able to save a half bucket of the local seed, and one had managed to buy a bucket for planting in 1992-93 (a bucket is the customary, local measure, containing approximately 20 litres). Normally all would have planted some.

1 Crop figures are collected both by MAFF and CSO. The MAFF figures are based on area estimates of planting by its 'camp' staff (the lowest administrative unit), followed, in April, by an estimate of potential yield and, therefore, production. The CSO figures are based on a sample of farmers. The MAFF takes the CSO figures into account when making its final forecast. They are now working towards a more unified system with the 1992/93 figure published jointly.

Table 1 **Production of some important crops, 1990-91 to 1992-93 (tons)**
(Source: MAFF, 1992 for 1990-91; CSO, 1993 for 1991-92 and 1992-93)

Crop	1990-91	1991-92	%*	1992-93
Maize	1,095,908	483,492	44	1,597,767
Sorghum	20,957	13,007	62	35,448
Irrigated wheat	53,601	54,490	102	69,286
Mixed beans	14,123	20,401	144	23,534
Groundnuts	28,188	20,504	73	42,301
Soyabeans	27,713	7,006	25	28,026
Tobacco, Virginia	865	1,258	145	4,138
Tobacco, Burley	811	1,050	129	2,514
Seed cotton	48,721	25,899	53	58,324

* 1991-92 as percentage of 1990-91. Owing to large discrepancies between sources, figures for millet and sunflower are ignored

Table 2 **Crop production, 1990-91 to 1992-93, Southern Province (tons)**
(Source: MAFF, 1992 for 1990-91; CSO, 1993 for 1991-92 and 1992-93)

Crop	1990-91	1991-92	%*	1992-93
Maize	187,507	25,215	13	462,637
Sorghum	5,357	136	3	6,104
Irrigated wheat	18,891	13,150	70	21,600
Mixed beans	15	11	74	21
Groundnuts	4,008	2,906	73	3,382
Soyabeans	4,910	2,630	54	7,801
Tobacco, Virginia	190	412	217	1,478
Tobacco, Burley	21	10	49	19
Seed cotton	9,899	4,639	47	6,960

* 1991-92 as percentage of 1990-91. Owing to large discrepancies between sources, figures for millet and sunflower were ignored

This indicates the likelihood that some local varieties will have been lost, unless they have been stored at the SADC Gene Bank established at Chalimbana Research Station.

Hybrid maize, which has to be bought afresh each season to give good results, often does not arrive until December, although farmers know they get better results if they can plant as soon as possible after the first good rains. Hybrids can be grown without fertiliser, although their yield is substantially less than that of hybrid in combination with fertiliser. As shown by the quotation above, the shorter maturing hybrids had not been delivered. In areas of Eastern Province, where ARPT conducted interviews, farmers normally rely on purchased hybrid seed.

Local sorghum varieties have a long season and suffered most in the drought. The new improved variety with a shorter maturity time had been requested. Farmers said the availability of groundnut, bean, cowpeas and other seeds important for a varied and balanced diet is always a problem and that they had virtually no stocks by the end of 1992. The ARPT survey found groundnuts one of the most critical seed shortages in Southern Province, emphasised by farmers and Government and NGO officials. Chingumbe and Lof reported a similar situation in Senanga District of Western Province, where "sorghum, B. millet and cowpea seed is virtually not available" (ARPT, 1992a). However, in Sesheke District of Western Province some blocks still had groundnuts, cowpeas and cassava sticks, which could be purchased for distribution to blocks with deficiencies. In the more remote areas there was a need for maize and white sorghum. In one isolated area of Lusaka Province, farmers reported that they had lost the seed of their local sorghum variety.

Degree of recovery as at August 1993

Thanks to the good rains in 1992-93 and the distribution of maize seed (see Chapter 4), many farmers have had a good harvest, as illustrated in Tables 1 and 2. Nationally, the main problems in 1993 were connected with marketing and storage. However, some farmers had poor crops, either because they could not obtain credit (see Chapter 5) or lack of draft power resulting in late planting (see 'Livestock Production', below) In addition, in some areas, there were attacks by army worm or armoured crickets (see 'Wildlife', below).

In Southern Province agricultural officials said that sunflower seed had been available and estimated that hectarage had increased and production was substantially up. They estimated groundnut area was down by 37%, due to lack of seed. Although yields were good, production had not recovered even to the poor 1990-91 level (Table 2). Beans remained a minor crop. Groundnuts are a woman's crop, used for feeding the families. Sorghum production was up, helped by seed distribution, and farmers' willingness to plant the new short season variety.

In Eastern Province hectarage of all the main crops had increased slightly and yields substantially. Some groundnut seed was distributed in this province. Seed or planting material shortages were mainly of soyabean, sunflower, cassava, sweet potatoes and vegetables.

Natural vegetation

Land use and management in Zambia

As already described, land in Zambia is divided into State land, which includes National Parks, urban areas, land leased to large-scale commercial farmers or parastatals, and Reserve land. On the latter, families have rights of control while the land is under cultivation, including the right to resume cultivation after a short fallow. However, land under fallow can be used by anyone for grazing or for the collection of wild plants used as vegetables. If fallowed for several years it becomes woodland again. The chiefs are responsible for allocating bush land for cultivation and settlement, as the population expands. Around expanding settlements, trees are cut down and stumped out to ease ploughing and to provide timber for new homes and kraals. Chiefs do not regulate utilisation of uncultivated land. In the past some chiefly authorities had some rights to control hunting and to protect sacred trees and some, such as those of the Lozi, are said to have regulated grazing, but their authority has been eroded and replaced by government regulations during and after the colonial period. The Government, however, does not have the resources to police and enforce these. Thus, outside the State lands, grazing land and woodland are virtually open access land; this is quite different from common property where a communal authority exists to regulate use and access (IUCN, 1989). Under open access, individuals have no incentive to conserve resources, since others may reap the benefit.

The Government has established Forest Reserves, within which the Forest Department is supposed to regulate wood fuel cutting and charcoal burning by licensing. In fact, it has been estimated that licensed charcoal production represents only 3% of the total (Chidumayo, personal communication).

Grazing land merges into woodland. As trees become older and thicker, their canopy discourages grass regeneration. When the area is grazed mainly by cattle, the grass may be eaten down (over-grazed) if use is not regulated, the remaining woody vegetation gradually increases. Eventually, the area becomes almost useless for cattle. Goats are browsers and may retard the regrowth of woody species. In an alternative scenario, over-grazing reduces the grass cover and can leave the soil exposed to erosion by the next heavy rains. Particularly in semi-arid areas, this can inhibit the re-establishment of grass and, thus, the spread of bare, barren patches.

Fire is an important management tool. Early burning does not harm woody regrowth. It is, officially, encouraged, as it removes grass that may burn more damagingly later. Later burns tend to be hotter, and to inflict permanent damage on young trees. Burning is also used to remove old dead grass and to encourage a flush of young grass for cattle. It is also used to facilitate hunting and, in this case, may be during periods when it is damaging to grass or shrub regrowth.

Vegetation types

Natural vegetation varies by soil type and AEZ. The main plateau soils are covered with *miombo* woodland, dominated by *Brachystegia, Julbernardia* and *Isoberlinia. Dambo* soils carry grassland. The upper valley soils are covered with *munga* woodland, with *Acacia* and *Combretum*. The floodplain alluvial clays are covered with tall wetland grass and woody thickets on termite mounds. The lower valley soils support mopane woodland dominated by *Colophospermum mopane* (Serenje *et al.*, 1993).

Direct impact of the drought on grassland and woodland

There has been no long term monitoring of the productivity of the range and woodland. It is, therefore, difficult to quantify the impact of the shortfall in rain in early 1992. Change in productivity is a constant process, affected by the level of human and livestock use and, in some cases, by changes in the population of elephants and other wild herbivores.[2] The degree of cover also varies over the season and from year to year, depending on climate, as is well illustrated by a series of Landsat images, 1984-85 to 1991-92 (on the cover of this report).

Fortunately, some *miombo* woodland sites in Central Province were being monitored during 1991 and 1992 in connection with a study on the effects of charcoal burning. Peak biomass was lower in 1992 than in 1991, but the difference was not statistically significant, due to large standard deviations. In the opinion of the researcher (E.N. Chidumayo, who has long been involved in vegetation studies in Zambia) the impact of the drought was minor: partly because the productivity of the grasses had been completed by March and they had already flowered; partly because the drought was largely confined to the drier areas, where intervals without rain are regularly experienced (see Figure 3,

2 At the time of the drought, populations of certain species of game were increasing. For example, in North Luangwa National Park, the popultion of elephants was estimated at 1,500 in 1992 and 2,200 in 1993. Protection given by the Mumbwa Game Management Area allowed the elephant population to reach 2,000 by 1993. Good game management demands that appropriate action be taken periodically to reduce the pressure on natural vegetation. The Department of National Parks and Wildlife is currently trying to determine the optimum carrying capacity in each Game Area, so that appropriate wildlife management can be employed.

Chapter 2) and partly because total rainfall was within 70% of the average. Also, the level of nutrients in the soil remained higher than usual because there was less leaching by rain. To an unknown extent this may have counter-balanced the effects of water-stress on growth.

Low rainfall areas have a better quality of grazing than high rainfall areas, (*cf.* in the Sahel, IUCN, 1992) and less animal disease. Southern Province contains a high proportion of the national livestock. The vegetation is adapted to the customary variation in aridity. Villagers to whom we spoke felt that there had been no marked effect on local grazing. Many grasses are tuberous and can withstand drought. Farmers had not had to remove their livestock (Annex 2). However, in some areas it was necessary to move cattle earlier than usual to the Kafue Flats, or to take them to more distant pasture. In some areas of Kalomo District, in Southern Province, grass did not seed (Middleton, 1993). The Provincial Natural Resources Officer thought that in some areas there had been over-grazing, because cattle had been concentrated near streams or near Lake Kariba, partly in order to have access to water. This would have increased erosion locally.

Trees, with their deeper roots, began to be affected during the dry season because the deep soil moisture was not recharged. In Lusaka Province many of them lost leaves in April-May, rather than in September, as normal. This may have been triggered by high temperatures, not normally experienced until September (Chidumayo, personal communication). In other cases, in Southern Province, new growth started later than usual. Die-back on ridges in Kalomo District was observed (Middleton, 1993). Middleton also commented on the total leaf drop from the end of June until the beginning of the December rains.

The observation of early leaf fall was confirmed in Southern Province by villagers. They also observed that one of the main trees providing wild fruit failed to yield in October 1992. However, another type actually fruited twice (Annex 2).

Forest Department officials at Provincial and District level in Southern Province and villagers thought there had been no significant tree death. A large-scale farmer thought he had observed more dead trees in flying over the bush, but some may have just been defoliated.

Impact after the 1992-93 rains

Villagers say that the main trees valued for wild fruit look as if they will bear well in 1993. Observation suggests that grass cover is now good. The Kafue Flats is reported to have recovered from any impact of over-grazing in 1992, because of the much larger flooding than usual in 1993 (as noted in Chapter 2). While some tree seedlings may have died in the drought, this will have given more room for others to develop and will not, therefore, have a long-term negative impact.

Indirect impact of the drought on woodland

Two indirect impacts of the drought may have occurred. First, more charcoal burning and wood fuel sales to generate income to replace that lost from crops sales. Second, more fires, due to the dryer status of the woodland and range. A third possible impact was also mentioned - a reduced stock of wild foods due to increased use in the drought. However, due to the extent of woodland in Zambia, it is highly unlikely that this led to permanent loss of genetic resources.

Charcoal and fuel wood cutting

Many observers have commented on an apparent increase in charcoal burning and wood cutting. It is not known whether more people than usual engaged in this occupation, but sold on average smaller amounts. The activity will have been limited by the extent of demand for fuel. There is some reason to suppose that demand may have increased slightly. In rural areas, where wood is the main fuel, there may have been more cutting for fuel due to the absence of maize cobs and stalks which normally form part of the household fuel resource. Charcoal use may have increased slightly amongst the urban population due to electricity cuts; there is always a shortage in the rains and dealers may have taken advantage of more production to stock-pile against this season. If the average price fell after discounting inflation, some families may have increased their use of fuel. Nevertheless, it is difficult to imagine that demand for charcoal would have been substantially more than usual. Demand for rural wood fuel and for urban charcoal is on a steady upward trend due to increase in population and formation of new households.

There was a substantial increase in the number of charcoal bags taxed. The Forest Department knows that it fails to catch more than a fraction of production. The Forest Department in Southern Province taxed 290,000 bags in 1992 as opposed to 110,000 the previous year; in Eastern Province, the figures show an increase from 15,000 in the calendar year 1990 to 25,000 in each of the calendar years 1991 and 1992. To an extent, this may be due to more 'amateur' charcoal-burners; the professionals probably know how to evade tax.

The following discussion of the likely impact of a doubling of charcoal burning is based on discussions with Mr E.D. Chidumayo, who is in process of finalising a report (with Serenje *et al.*) on the impact of charcoal burning in central Zambia. As most of Zambia is covered by forest and woodland, the impact of charcoal burning is not great. In the mid-1980s, the Natural Resources Department estimated the annual loss of woodlands in Zambia to be 0.5% per year (Monõ, 1993). However, most of this loss occurs through the increase in urban areas and through clearing for cultivation in densely settled rural areas where long fallows are no longer practised. In central Zambia, only 2.5% of the annual loss is due to charcoal production. If charcoal burning doubles, it will still only account for 5% of an annual woodland loss of 0.5%.

Natural regeneration takes place more slowly at charcoal burning sites, because of the reduction of root stock and seed. However, the fertility of the soil is good, and the site is often used to grow maize, vegetables and hemp in the first year. Some of Chidumayo's sites had been cleared 29 years previously and showed no long term effect. The reduction in canopy and increase in light occasioned by cutting for charcoal stimulates seedling shoot growth once an adequate root system has been established. Regeneration is mainly from coppice of stump and root origin and from stunted seedlings in the grass. Species density may be higher in regrowth than in old growth *miombo*. Herbage production in regrowth *miombo* of 2-4 years is 3-4 times the biomass in old growth *miombo*. From this it can be seen that charcoal burning, even if it increased in the drought, would have had, by itself, no long term impact on the environment.

Fuel cutting normally has little environmental effect, as people take branches and trees regrow. Cutting for building poles around settlements has more effect, and clearing for cultivation even more, but this is an effect of population growth, not of drought.

Changes in canopy cover due to clearing have been shown to lead to **increased** aquifer recharge rates, due to less evapotranspiration. In erosion-sensitive areas reduction in canopy without rapid grass or other regrowth could lead to increased soil erosion, which may also be affected by the tracks made by the charcoal makers. However, it does not seem likely that in Zambia this erosion effect, from charcoal burning, would lead to such widespread bare areas and increased heat reflection that there would be interference with the action of the ITCZ.

Fires

The Forest Department was worried that the dryer state of the environment would lead to more extensive fires. However, since officers are mainly confined to post, they had no way of monitoring this. The general impression is that there may have been a slight increase in fire damage. Fires, however, always occur, due to hunting, honey-gathering and carelessness. On Mr Chidumayo's study plots the extent of burning was not very different to previous years. One site burnt at the end of October, with severe damage. He observed that the moisture content of the grass was certainly less than in the previous season, but this was to an extent buffered by the fact that there was slightly less grass.

Conclusion

As far as we can see, the natural vegetation has generally recovered after a year of good rains. There may have been an increase in charcoal manufacture, but this has relatively little long-term effect on vegetation. What does have an impact and can lead to an increase in erosion, is an increase in tree felling over a wide area. However, this is associated with population growth in agricultural settlements, rather than charcoal manufacture.

Planted trees

The Forest Department and a commercial farmer in Southern Province agreed that the drought killed some young planted trees, particularly those aged 4 years or less. Species of *Eucalyptus* and *Euphorbiaciae* were mentioned. Forest Department nurseries were adversely affected by lack of water. Farmers, for obvious reasons, were unresponsive to campaigns to plant trees during the drought affected year.

Livestock production

The position before the drought

Livestock statistics are available, but their accuracy is doubtful. In both Southern and Eastern Province we were told that figures for numbers, sales, deaths, etc. were known to be incomplete. The most recent national figures show 2,700,000 cattle in 1988, with a slight rising trend from 1984, together with 560,000 sheep and goats, and 206,500 pigs (CSO, 1992a). About 80% of the cattle are held by small-scale farmers, the rest are on large-scale ranches. About half the national cattle herd is in Southern Province. Cattle are important for draft; they are also important assets for the store of wealth, unaffected by inflation. A traditional coping strategy in the case of bad years is to sell livestock; generally small stock before the cattle, but in case of necessity, the cattle also. Some farmers part with cattle reluctantly, for they are bound up with social prestige, but their chief value is economic.

Unfortunately, Southern Province was affected by an epidemic of virulent East Coast fever or Theileriosis, a tick-borne disease usually called Corridor Disease in Zambia. This started in the plateau areas in the late 1980s, before the drought. It appears that many farmers neglected dipping, which normally slows the spread of the disease, when a charge was made in 1990-91. Many animals died either before, or during the early stages of the drought. Tick numbers were reduced by drought conditions in early 1992, and the dipping charge was lifted. Although some dip tanks were unable to function because of water problems, the disease situation had improved by 1993 (Principal Veterinary Officer, Southern Province). In 1992 Corridor Disease had spread into Gwembe valley, but here, farmers have always relied more on goats. In general, in Eastern Province the impact of Corridor Disease was less and occurred later, mainly in 1992.

Effects of the drought

The direct effect of the drought on domestic livestock was due to lack of water supplies, which meant they had to be trekked further. Together with a decline in the quality of grazing in some areas, this caused stress, and left them more susceptible to disease. In a ranch in Southern Province, despite the supply of water and attention to dipping and some supplementary feeding, cattle had become markedly emaciated by

October-November 1992. There was an increase in Downer Cow Syndrome, when cows fail to stand after giving birth, and eventually die. This was also noted in smallholder animals in the same province. However, livestock officers, hampered by lack of funds, were prevented from touring to gauge the extent of the problem. Some cattle were said to have died after the 1992-93 rains began, after ingesting large quantities of nitrogen-filled young grass sprouts, leading to lethal bloating.

Smallholder cattle are more mobile than ranch cattle and in some cases, they made their seasonal move to the Kafue Flats or to the lake shore earlier than usual. In other places, there was sufficient local grazing, thanks to the late rains and also because cattle numbers had been reduced by Corridor Disease.

An indirect effect of the drought was an increase in sales, either because farmers were in urgent need of cash, or because they feared losses, due to the water shortage. Animals had to be exported live from Southern Province, since there are no industrial abattoirs in the province. To prevent the spread of Corridor Disease, animals arriving in other provinces had to be slaughtered within 24 hours of arrival. This led to congestion at the abattoirs and more sales locally at small butchers, from whom data are difficult to collect. The impression gained by the Veterinary Department was that forced sales were reduced once yellow maize and 'Food For Work' became available. Table 3 gives total population figures for 1991 and 1992 for Eastern Province and 3 districts in Southern Province (1992 figures for the other districts had not arrived at provincial headquarters). Table 4 gives sales figures, local and exported from the province, for the same areas.

The relatively small difference in total numbers and sales between the two years does not accord with the impression gained by observers, or with the reports of the farmers that we interviewed. It is entirely possible that the number of livestock in 1991 was under-recorded, since they are generally counted at dips. Sales to local butchers are difficult to monitor. Table 5 gives figures on losses as stated by farmers interviewed by ARPT in Gwembe, in 1992. Gwembe was one of the worst hit areas, and losses there may have been greater than elsewhere.

Conclusion: position in 1992-93

Generally, the ARPT teams found that the condition of the cattle was not too bad in October 1992. This is what we should expect, given the limited impact of the drought on the pasture and browse, and the mobility of smallholder cattle who can be moved to water. Our own observations in August 1993 were that cattle appeared in good condition after the good rains of 1992-93. There had been serious losses of cattle including draft oxen in Southern Province due to disease; elsewhere, there were some shortages of draft animals due to losses or sales. This picture was confirmed by further interviews in Southern

Table 3 **Total livestock, 1991 and 1992**
(Source: Provincial Veterinary Officers)

	Cattle	Goats	Pigs
Southern Province (3 districts)*			
1991	29,459	63,455	21,088
1992	198,324	68,986	19,234
Eastern Province			
1991	243,006	177,089	162,035
1992	239,032	207,032	160,316

* Mazabuka, Livingstone, Siavonga. Choma and Namwala, whose data were unavailable, are the key cattle districts

Table 4 **Sales of livestock, 1991 and 1992**
(Source: Provincial Veterinary Officers)

	Cattle	Goats	Pigs
Southern Province (3 districts)*			
1991	29,459	3,420	3,973
1992	31,549	6,259	3,939
Difference	2,090	2,839	(34)
Eastern Province			
1991	4,572	693	1,422
1992	3,830	1,499	3,342
Difference	(742)	806	1,920

* Mazabuka, Livingstone, Siavonga. Choma and Namwala, whose data were unavailable, are the key cattle districts

Table 5 **Cattle losses in Gwembe valley villages, 1992**
(Source: ARPT, 1992a, Southern Province Report - Drinkwater and Lwaile)

	Owned	Dead	Sold	Stolen
Munyumbwe	161	94	26	4
Nakanjere	342	185	71	0
Sinazeze	468	119	954	13
Sinazongwe	183	364	34	-

Province in March 1993, when the ARPT teams were carrying out a problem-diagnosis exercise (ARPT, 1993b), and by our own interviews with farmers (Annex 2).

There were probably more sales than have been recorded. Generally, farmers first sold off their small stock, protecting their cattle as long as they could. Sales were impelled by the need to buy grain before 'Food For Work' began, and, only secondarily, by difficulty over water sources.

The impact of the drought on livestock numbers may have been rather more than is implied by official statistics but the best evidence is that it was limited and that the major problem, in Southern Province, was disease.

Fisheries

Fisheries position in 1991

There are three main types of fishing in Zambia: lake fishing, especially in Lake Kariba and Lake Itezhi-Tezhi; swamp fishing, in areas such as the Kafue Flats, and fish culture. The latter is as yet small.

In Lake Kariba, there are two types of fishery - the deep-water fishing of *Kapenta* - a small, sardine type fish which is caught by commercial fishermen working on a large scale and bream, caught in-shore by individual fishermen. The numbers of fish are affected mainly by the inflow of nutrients from the Zambezi; when rain in the catchment area and inflows are low, so are nutrient levels and fish numbers. Catches per boat are tending to go down, because of an increase in the number of boats.

In the swampy areas, the numbers of fish depend on the area flooded.

The Fisheries Department has, for a long time, had incomplete control over markets. Fish markets passed from the Department of Fisheries to the local governments in 1976. Fishermen evade registration and payment of licence charges for their boats. Fish traders evade checkpoints and collection of dues. In Southern Province the fisheries officer believed the number of fishermen had trebled between 1976 and 1987 and increased tenfold between 1976 and 1993. While this is only an informed guess, it appears certain that there has been an increase in numbers. The increase in the number of small traders has reduced the number of large traders operating refrigerated lorries, so that more fish now reaches the market in dried form.

Effect of the drought on 1992 catches

Because of the low and fast diminishing water levels in many lakes, ponds and streams, it became easier to catch fish. Further, the number of fishermen increased, as people attempted to compensate for the failure of crops. The resulting increase in recorded production at some

Table 6 **Fish catches at three stations in 1991 and 1992, in tons**
(Source: Provincial Fisheries Development Officer, Choma, Southern Province)

Fishery	Station	Production 1991	Production 1992
Lake Itezhi-Tezhi	Itezhi-Tezhi	220.4	266.1
Kafue floodplain	Mansangu	101.9	114.8
Lake Kariba	Sinazongwe	138.0	146.4

stations is shown in Table 6. It is important to emphasise that only a small fraction of total fish caught pass through the recording stations and pay dues. It is believed there was an increase in fishing by illegal and destructive methods.

Figures of landings for *Kapenta* for the Zambian portion of Lake Kariba show a 6% rise from 6,754 tons in 1991 to 7,158 tons in 1992. However, on the Zimbabwe side, the recorded catch of *Kapenta* declined slightly, being possibly affected by the drop in nutrient supply from the Sanyati River (Figure 1).

Long-term impact

High catches of breeding adults in 1992 in the rivers and swamps may affect fish numbers in 1993 and subsequent years. The early drying of some streams in 1993 also affected fishing in some localities. However, though the breeding stock will have been reduced, juveniles will grow faster due to reduced competition for nutrients. The nutrient supply will have increased due to the good rains of 1992-93 which have partially refilled Lake Kariba and which caused more widespread flooding than usual of the Kafue Flats. The long-term impact of the drought is, therefore, difficult to predict.

Fisheries personnel believe that it is necessary to give greater protection to breeding fish, either by a closed season or by banning fishing in certain areas. At present they do not have the resources to monitor the position.

Fish farming

Due to the severity of the drought, only one out of 16 Government-managed fish farms was functioning in 1992; the others had dried up. However, demand for fish farming is increasing. It is estimated there are 472 active fish farmers in Eastern Province, with an additional 500 interested. Existing farmers are now being traned to produce fingerlings for sale to new fish farmers.

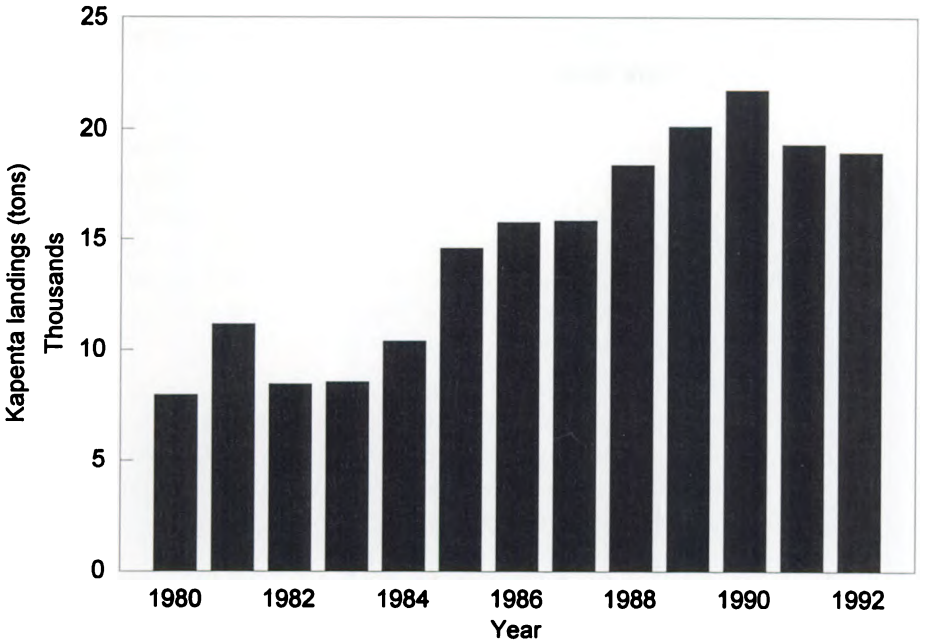

Figure 1 ***Kapenta*** **landings, Zimbabwe side, 1980-92**

Wildlife

Mammals

Immediate effect of the drought

Wildlife reserves in Zambia are of two kinds. There are **National Parks** which are areas where biological and physical resources are protected. Officially no human settlement is permitted. There are also **Game Management Areas**. In these, there are human settlements. Hunting of animals not classified as game is allowed by authorised permit or licence.

Like livestock, wildlife can be affected during a drought by inadequate surface water, and reduced availability of fodder. The effect on vegetation in the worst affected areas of Southern Province has already been described. Consequences can include migration or death. Field staff of the Department of National Parks and Wildlife Service believed some animals suffered from water and forage stress, especially when they had to move long distances. However, deaths amongst herbivores were probably limited. Middleton (1993) observed that, on a game ranch in Southern Province, hartebeest and eland were 'lamentably emaciated', but there were no deaths because the animals travelled long distances

to find water and grazing. Bushbuck and reedbuck, which do not travel so far, were more affected (Mr A. Mwenya, Director of National Parks and Wildlife Services).

The Wild Life Conservation Society of Zambia observed that the problem was more in surface water than in feed material. It reported an incident where fifty buffaloes were poisoned at a water-hole in the Kafue National Park (*Kobus*, November 1992). Hippopotamuses, especially in the South Luangwa National Game Park, were endangered by the reduction of water in the lagoons and in the Luangwa River. The Department of National Parks and Wildlife Service licensed some culling to reduce the stress.

An indirect effect of the drought was an increase in illegal hunting, which was made easier by animals converging on a few water points, including those near human settlements. In Eastern Province, the number of poachers arrested increased from 166 in 1991 to 394 in 1992 (Mr J.A. Phiri, Senior Ranger).

Position in 1993 Middleton (1993) reported from the severely drought-affected Kalomo District in Southern Province:

> Our experience with wildlife has been excellent conception rates in spite of drought and their resultant depressed condition. Further it has been noted that 'compensatory growth' or recovery of the wildlife has been markedly greater than in cattle. By Christmas 1992, the wildlife (all ages and sexes, nursing or otherwise) were in top condition again. The cattle, especially nursing cows, were still showing signs of deprivation.

Conclusion The drought had a limited, temporary effect on wildlife. It led to some deaths, mainly due to water shortage, especially amongst hippopotamuses. Land-based herbivores were stressed, but most survived, and there is evidence of increased breeding since. Poaching may have increased temporarily but Department officials are not conscious of any area where this caused a noticeable reduction in any species, although they are not in a position to produce precise data.

Insect pests It has already been noted that the drought brought about a temporary reduction of the tick population and assisted in bringing Corridor Disease under control. In Southern Province we were told that tsetse flies suffered from the lack of shade from trees (these insects need shelter during the heat of the day), which restricted them from following the game and livestock in their movements to new pastures. However, at the crowded watering points, the transmission of Trypanosomiasis was high, due to the mixing of domestic and game

animals and the increased vulnerability of livestock due to stress. SADC researchers thought the drought had little overall effect on tsetse distribution (Mr Prang, SADC Regional Tsetse Control Project, Chilanga).

In some areas, the early rains of 1992 brought a plague of army worms. Armoured crickets were also damaging crops 1992-93. It is possible that some insects react to losses in droughts by increased breeding as soon as conditions become favourable, but the linkages are not well known to agricultural officials.

Soil fertility and soil erosion

In areas that have been farmed a long time, farmers have noticed a fall in fertility but this is not due to the drought. However, the drought made some farmers much more conscious of the need to conserve soil and water resources, and groups with whom we spoke said they were taking more interest in soil conservation measures and the use of green manure. A Soil Conservation and Agro-Forestry Programme (SCAFE) is already operating in some areas.

Because there were additional areas of bare soil, the heavy rains of 1992-93 caused more than usual gullying. This was reported in parts of Southern Province.

Conclusion

The impact of the drought on the biophysical environment was limited, since the rains started normally, and resumed in March. It had a severe impact on crops, especially late planted hybrid maize and local maize and sorghum types which require a long growing season. While maize is a major element in local diet, and a major cash crop, there were also losses of other nutritionally important crops such as groundnuts. Some local varieties of maize and sorghum may have been permanently lost.

Natural vegetation showed markedly more resilience than crops. Grasses recovered, due to the March 1992 rains. Older trees survived, though providing less browse because of leaf loss and, in some cases, less fruit. Young trees, especially planted ones, suffered. There was a probable increase in wood-cutting and charcoal manufacture, but neither of these activities have major long-term effects on the extent of woodland. The cutting of isolated mature trees for charcoal facilitates young regrowth. Woodland is reduced much more by increases in cropland and human settlement.

Wildlife also showed great resilience, suffering during the drought, but breeding and recovering fast with the return of the rains. A probable temporary increase in illegal hunting does not appear to have had a marked effect on numbers. The long-term impact on the fish population

is more difficult to assess; there would have been losses of breeding stock due to deaths and the activities of fishermen, but the increased inflow of nutrients due to the abundant rains of 1992-93 and the reduced competition for nutrients may promote faster growth of juveniles. Livestock suffered somewhat more than wildlife, but less than crops. Numbers were reduced by disease raging before the drought, by forced sales and by stress from poor access to water, rather than from lack of grazing.

In summary, the natural environment has developed resilience during the long process of adaptation to the variations in rainfall which have probably been experienced in the past. As shown in Chapter 2, the rainfall conditions of 1991-92 were not unprecedented. Human introductions of crops and livestock have not developed resilience to the same degree; this was particularly true of hybrid maize, but it must be noted that local varieties of sorghum and composite maize also failed. The impact of the drought was increased by previous policies which had encouraged farmers to rely on the delivery of hybrid seed and by the failure to control Corridor Disease.

4 Management of the drought

Background to the selection of a management strategy

The Zambian Civil Service had long been accustomed to working under a centralised and bureaucratic system, a situation which the new government was resolved to displace. This created a lack of trust between the two. The Government, therefore, set up a number of Task Forces to decide on policy and implementation issues. These operated independently of the Civil Service, though some civil servants were incorporated into them. It was committed to greater devolution of power to local authorities, but new elections to these were still in the process of organisation. In any case, a new revenue base, which would give these authorities some hope of competence, had not been established and most of them lacked material resources and skilled manpower. The Government, therefore, decided to work through NGOs. The two main requirements were to organise the supply of essential food, particularly maize, to those who needed it and to bring water to communities that lost their normal supply.

The new Government was also committed rapidly to restructure the economy in the direction of liberalisation of marketing and a greater reliance on private enterprise. Many donors were anxious to see it succeed.

Diagnosis of the situation

The 1990-91 maize crop had not been particularly good, and there had been the usual difficulties in moving it to storage. Some food imports were in hand to tide the country over to the next harvest. Zambia, therefore, entered 1992 with little emergency food in store. The management of the drought was successful partly because the seriousness of the rain failure in January 1992 was recognised almost immediately, leading to early arrangements to import maize to substitute for the substantial loss of crops in the 1991-92 season. There is a long lead time for imports due to distance from ports. This recognition did not depend on scientific warning systems.

The SADC Early Warning System based in the meteorological department in Harare sent a report to the Zambian meteorological office in December 1991 indicating there might be much less rain than usual in the first quarter of 1992 (information from Mr Sakala, Meteorological Department). The Meterological Department issued a press release, but it was not much reported. The Minister of Agriculture at the time, Dr

Guy Scott, cannot recollect hearing of it. In any case, long-range meteorological forecasting is not yet soundly enough established to trigger large expenditures on food imports.

The Ministry of Agriculture's Zambia Early Warning Unit (ZEWU) has published since 1989 monthly bulletins on the food security position, in collaboration with the Central Statistical Office, the Department of Meteorology and various other institutions which produce or market crops. This was assisted by funding from FAO and the Government of the Netherlands. The 15 January 1992 issue of the *Food Security Bulletin* reported: "The situation (regarding rainfall) is expected to improve, however, given that rains had started all across the country beginning in the third dekad of December 1991" (p. 2). "Maize production prospects for the 1991/2 season are above average" (p. 3). It estimated current stocks would be sufficient up to the end of May 1992, when imports would be needed to cover a month's shortfall before the new crop was available at the end of June (p. 5).

The next issue, the *Food Security Update* of 15 February 1992, reported rainfall deficits likely to have a severe effect on crops. However, by this time, action had already been taken. As it also reported, Western, Southern, Central and Eastern Provinces had "been declared disaster areas early in February 1992 by the President"; the Minister of Agriculture had been appointed head of a task force to assist the population and the import of 73,000 tons from the USA as food aid had been arranged, to help the country last out to June 1992. On 26 February 1992 the President declared a national disaster, and appealed to the international community for aid.

Dr Guy Scott, the then Minister of Agriculture, said his assessment of the seriousness of the situation by late January relied mainly on reports being brought into his Ministry by various persons, describing the rapidly deteriorating crop situation in their districts. The processing of information in ZEWU was, at the time, too slow to enable a fast response to the failure of the rains.

Organisation of the food programme

Overall organisation for food importation

The Drought Relief Task Force coordinated by the Minister of Agriculture set up inter-ministerial sub-committees to develop action plans for:

- Aid and resource mobilisation;
- Logistics;
- Internal distribution;
- Hunger relief;
- Animal health and water development;
- Credit management.

By 1 July 1992 some 19 donor countries had made food aid pledges of 438,000 tons of maize and the government had arranged to import commercially another 243,000 tons. Eventually, some 800,000 tons of food aid, mainly cereals, of which most was maize, was delivered. The drought in Zambia probably cost donors more than US$60 million. It also diverted Zambian Government resources which could otherwise have been applied to improvements in infrastructure and services for economic development. The cost to individual households was also very high, as will be described in the next Chapter.

The negotiation of aid, the arrangement for purchase and delivery of such quantities from ports already congested and over a long road or rail transport system traversing several countries before reaching Zambia, was an immensely complicated task which involved close collaboration between several Zambian Government Ministries and many donors. Two consulting firms were appointed to oversee the logistics. Within Zambia, distribution had to overcome problems created by the run-down condition of the railway and roads. We were told by several people that the required food importation and distribution was achieved due to the zeal and efforts of various individuals in Ministries and in aid agencies, who worked together to overcome bureaucratic or political impediments and to solve a stream of problems. Within Zambia the major actors were the Ministers of Agriculture, Health and Finance.

By this time the regional aspect of the drought was realised and the UN had launched a Drought Appeal for Southern Africa, co-ordinating the relief efforts of different agencies and different countries. However, bilateral agencies were important in Zambia.

Principles adopted for distribution of free and subsidised food

The Ministry of Agriculture, Food and Fisheries (MAFF), Ministry of Finance and Ministry of Communications and Transport were given responsibility for procuring food and distributing it for sale to the various depots in the country. The Ministry of Health took the immediate responsibility for distribution of free or subsidised food to those affected by the drought, "especially 'poor' pregnant women and malnourished children" while the newer Ministry of Community Development and Social Welfare developed a long-term programme of assistance to vulnerable groups (*Food Security Bulletin*, 15 July, 1992).

It was originally agreed that approximately 90% of the imported maize should be distributed through the normal commercial channel, which was then the Zambia Cooperative Federation (ZCF) and its subsidiary Cooperative Unions. The Government was to use the money from sales to fund internal transport and other necessary elements in the drought relief programme, such as improvements in water supplies. The 10% for free distribution was eventually increased to 25% for 'Food For

Work' and free distribution, which affected the Government's ability to fund the water programme and some other activities.

In previous food shortages, maize had been unevenly distributed. After much discussion by the Cabinet, it was decided to plan for a year of relief and recovery. The Programme to Prevent Malnutrition (PPM) was set up, chaired jointly by the Ministers of Health and Agriculture, with active participation by other concerned Ministers, the Director of Operations of the World Food Programme and other UN agencies. It was also decided to target and deliver food through the NGOs, who should use their own networks and those of the Ministry of Health to identify the most needy groups. Food would be distributed in three ways:

- by sale to those able to pay (most of those in the urban areas, and in the rural areas, those with continuing cash incomes such as salaried workers);
- in return for food for work by the able-bodied who were unable to pay. In general, it was assumed that an average family of five could provide one able-bodied person, whose reward for work would cover the family's maize need; and
- free distribution to households without breadwinners able to work for reasons of age, ill health, etc.

The National PPM committee was the policy-making body. It provided 250,000 tons to an NGO which the Government set up for the purpose, the Programme against Malnutrition (PAM). It has a governing body of prominent Zambians of varied political affiliations. The Chairman is a respected business man, a former Minister of Health under the previous government. It was given a headquarters within the office of the World Food Programme (WFP), which also monitored it.[1] The National PPM and PAM divided the drought-affected areas into 26 areas, corresponding to a hospital catchment area. In each, an Area PPM was formed to set policy and solve problems for the district. It was usually chaired by the District Medical Officer, and had as members the district agricultural extension officer, the district water engineer, and local religious and community leaders.

A lead NGO for implementation was selected by the National PPM/PAM, in consultation with the local area committee. These came from many different backgrounds. Many were missionary bodies, others were engaged in long term development programmes (e.g. OXFAM) or disaster relief (e.g. the local Red Cross). In Southern Province there were large well-established missions and church organ-

1 Information on PAM's activities is taken from PAM (1993), *Programme to Prevent Malnutrition, End of Drought Report, June 1993*, unless otherwise stated.

isations with a network of parish organisations, schools, hospitals and clinics, relatively well-resourced, and with an existing network of people on whom they could call for information and help. Box 1 gives examples. In some other provinces, such as Eastern and Western, some of the organisations concerned were smaller and more localised. In some places, it took time for a PPM to get organised, as an ARPT Team found in a district of Western Province in October 1992.

In Eastern Province, the relief programme was handled by two organisations: the PPM Committee which channelled resources through various churches and NGOs, operating as Area Committees for different areas, and OXFAM, which was the lead organisation in some Districts. Box 2 gives some examples. In both cases, village committees were also established (University of Zambia, Gender Studies Unit, 1993: Appendix 1). OXFAM's experience in facilitating village community development organisations was useful in this regard. In April-May 1992 its Lusaka headquarters staff visited two chiefs' areas in each of the seven districts and facilitated community workshops and the election of local committees. They also held District multi-sectoral workshops attended by Governmental heads, NGOs and churches, to stress the bottom-up approach. OXFAM's experience in, and need for, publicity that would assist its fund raising operations gave it a higher public profile compared with some other organisations. It had a very definite agenda connected with its existing community empowerment programmes. This sometimes led to confusion, with rather different directives coming from the national PPM committee (OXFAM Drought File Programme documents).

A smaller organisation dealt with distribution to the needy in urban areas. In general, urban people still had their usual incomes.

Implementation of food distribution

The first task was to assess total national food needs and then to subdivide this into commercial needs which consumers could continue to buy if food was available in the market (especially in urban areas) and the requirement for food aid for those without resources, mainly in the rural areas.

The first assessment of commercial demand relied on the normal monthly output of maize meal from the mills. However, the maize subsidy was stopped during this period. Demand then dropped sharply, probably because smuggling of subsidised maize into neighbouring countries ceased to be worthwhile.

The first assessment of the need for food aid was made by District Drought Committees established by MAFF with assistance from FAO. This estimated 1.7 million people would need 94,000 tons of food aid during the year. This later proved substantially too low. It was realised there was inadequate knowledge of household maize stocks, and of the

Box 1 NGOs and PPM organisation in Southern Province

At the **Macha Mission**, the coordinator thought that food was distributed reasonably fairly to the people who needed it, though to have been able to monitor everything would have required more staff than they had. They had two tractors and had hired additional trucks. The main constraint because of the necessarily late arrival of food in the country, was that there was not enough time to stockpile food in the more inaccessible villages before the rains made roads impassable. FFW began in June and steadily expanded.

In **Gwembe Valley** the coordinator at Gossner Mission said that it was an arid area, where people are accustomned to being unable to grow enough crops for subsitence. Income for food purposes came from livestock, cotton, fishing, wage earning and some illegal activities. The major problem in the drought was lack of water. Although levels were low, water was still available near the lake. In some places, however, when the wells dried up, people had to move and camp near water. This was the case for approximately 10% of the population in the Mponde area. In other areas, people stayed, but some moved with their animals. Some livestock died because of the drought. FFW was organised through twenty small sub-committees and one area committee. The sub-committees suggested projects which the area committee checked and aproved, discouraging those that needed unavailable materials. Resource limitation was eventually understood by the sub-committees. The area committee discussed giving food in return for work on people's own gardens when rains started, but decided against it. As a compromise they provided free sorghum seed. However, there was not enough to distribute, local seed was particularly scarce. People appreciated the higher yield of the new variety which was distributed. Fifteen or twenty groups asked if they could be helped to build small dams or wiers. They had stared work on five or six, for which they had had technical advice. People now seem much more ready to do work themselves, instead of waiting for the government. This was ascribed to the new political climate and the experience of the drought.

Sister Mary Noel, Catholic Diocese, **Mazabuka**, said that the programme had been able to provide for survival, through carbohyhrates, but did not prevent malnutrition. The FFW programme had worked well and helped people to maintain their dignity. The drought period had encouraged people to start fending for themselves. For this reason she thought that continuation of relief after the drought would be a disaster. However, there were a few people in each village who continue to need relief. Parishes, other churches and village leadership were used to organise village committees. As this area was less badly affected than others, initially the PPM handled maize for sale. By October 1992, half was FFW.

Box 2 Some drought relief arrangements in Eastern Province

Nyimba District Disaster Relief and Development Group was formed in April 1992 with headquarters at Nyimba Secondary School. Local churches were also involved. It had 34 centres, each with a committee of five people. They made arrangements locally and decided priorities for FFW, which started in June 1992 and continued until April 1993. By June 1992 the water situation was serious and many wells were dry. Ten boreholes were equipped and eight rehabilitated. Five shallow wells were deepened, thus improving water availability. Food distribution was impeded by the condition of the roads after the rains began. Maize, sorghum and groundnut seed were distributed in December 1992.

Chipata Disaster Relief Fund established village committees which worked well. FFW was organised, since many families had exhausted their food supplies. FFW included farmers extending their fields for the new season. The relief supplies of maize seed arrived late and the groundnut seed was inadequate. Good work was done on the roads where road officers could supervise it. Bricks were moulded to construct local granaries. The PPM was asked for assistance to continue this after the main relief programme stopped.

In **Mambwe** the Community Development Officer was the secretary of the Drought Relief Committee. FFW included road, school and house building for vulnerable groups. Sorghum seed was distributed in time, but the PPM programme stopped in April 1993 before the sorghum crop had been harvested.

position in regard to sorghum and cassava which are important rural foods in some provinces. The Area PPMs and NGOs were trained in May 1992 to collect data from community leaders to estimate the date by which family food stocks would be depleted, when they would run out of cash to buy food, and which families were in most need. This was supposed to be done by a Family Needs Assessment questionnaire administered in each community. Many Area PPMs found the form far too complex and, in any case, had no resources to duplicate and administer it. They made rough estimates, using, for example, staff of local health clinics who had a good knowledge of their clientele (for example, in Monze - information from Susan Foster, who was involved). There was some under-assessment of need in some districts, and over-assessment in others.

Lead NGOs were given vouchers, authorised by the PAM coordinator, and countersigned by the Permanent Secretary for Food Security in MAFF, to draw out a specified amount of maize from the nearest ZCF depot. The depot returned the voucher to MAFF, which replenished it. NGOs took charge of moving the maize from the depots to their villages, with transport paid by PAM and WFP. From June to October most NGOs sold maize at the depot price, which enabled them to buy more maize, through a revolving fund. By November, rural people were running out of money for food purchases, and Food for Work (FFW) programmes began. They were started earlier in the worst hit areas. NGOs, Area PPM Committees and local community leaders met to decide on the type of project that would be most beneficial. Popular projects were repair of rural roads, dam and well construction or repair, digging of latrines, building or improvement of schools. In general, a worker received 75 kg maize per month, providing approximately 500 grams per person, per day. The identification of the needy who were unable, for various reasons, to participate in food for work was made by the headman, chief, local leaders or a village committee.

Total maize distribution is shown in Figure 1. The PPM system eventually distributed considerably more than the first estimate, supplying some 2.5 million people over a ten month period, and distributing about 250,000 tons of maize. Of this, 76% was FFW, 14% sales and 10% free distribution.[2]

The system was flexible enough to move food to the areas with genuine need but at the national level there was an overestimate. In July 1993 the remaining 110,000 tons of yellow maize in stock, most of which had deteriorated to a stage where it was fit only for non-human uses, was turned over to WFP for sale and disposal. The fact that some cheap yellow maize had remained on the market after mid-May was one of several factors causing marketing difficulties for the 1993 harvest, (*Sunday Times of Zambia*, 29 August 1993; Chabana and Sakufiwa, 1993:51).

A supplementary feeding programme run by the Ministry of Health with aid from the World Food Programme was in place before the drought. This aimed to reduce the high levels of malnutrition amongst children through donations of HEPS (High Energy Protein Supplements), peas, beans, rice and cooking oil. Some additional donations of these foods were received during the drought and were distributed through the health centres to mothers with malnourished children.

2 It appears that the percentage may have varied considerably from District to District, but the relevant information was not carried in later issues (*Food Security, Nutrition and Health Monitoring System*, January 1992, Table 1-6).

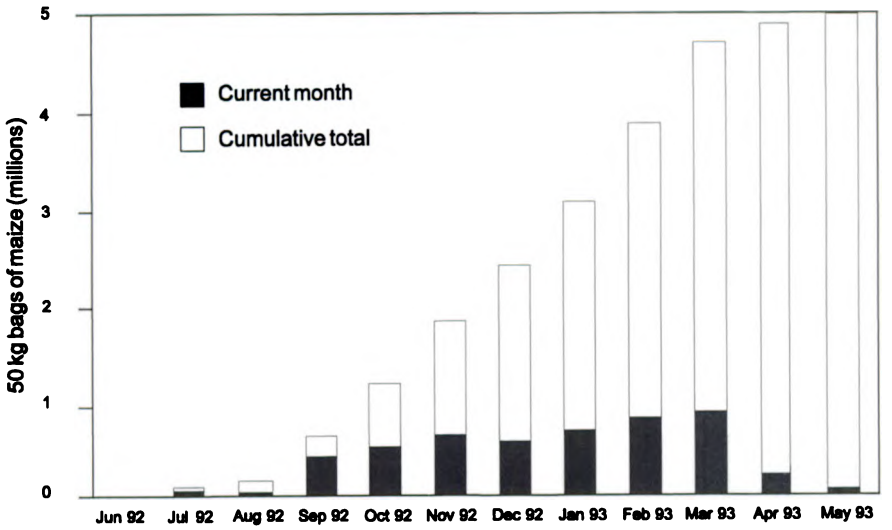

Figure 1 **Maize distribution: programme to prevent malnutrition, June 1992 to May 1993. Figure for May 1993 is preliminary**
(Source: Programme Against Malnutrition, May 1993)

They were given enough to feed their family. However, often the transport systems to the health centres broke down and NGOs had to assist where possible.

Examples we examined included Macha, organised from Macha Mission Hospital, (Brethren in Christ Church), the Gwembe valley area organised by the Gossner Mission, and the Mazabuka and Monze area, both organised through the Catholic Diocese. In the latter there was considerable assistance from the Ministry of Health staff. Details of local organisation in Southern Province are given in Box 1. Box 2 gives details of some NGO arrangements in Eastern Province.

Finance and monitoring

Monitoring for accountability

Most of the money for the operation came from the commercial sale of donated maize, through the Ministry of Finance. There were also some other donations. These included some vehicles and tractors to reach outlying communities and tools, spare parts, tarpaulins, etc. Financing was flexible, so that tyres etc. could be provided to commer-

cial transporters or local Councils providing vehicles to the operation. Where necessary, committees hired transport, which was sometimes expensive, due to road conditions and lack of competition. In a few areas NGOs were assisted with a salary for an additional staff member. PAM also provided engineers to give technical guidance to FFW programmes engaged in dams, latrines, wells, etc. NGOs were often late with their monthly reports on maize distributed, but it does not appear that much misuse took place.

Aid agencies also arranged monitoring to satisfy their particular constituencies and their home public. The larger donors established monitoring systems for their own aid. USAID contracted Price Waterhouse to monitor maize sales and storage systems. The Netherlands and Norway funded a report on the impact on women, carried out by the Gender Studies Unit, University of Zambia. OXFAM carried out a series of visits, questionnaires, workshops and reports under its Drought File Programme.

From these and other sources one can gather than some maize went astray, particularly during transport; that some people who deserved help did not get help; that some volunteers lost commitment as the emergency continued; that some transporters may have overcharged; that in a few cases local committee members abused their position. These problems were relatively minor given the scale of the operation.

Monitoring for programme management

PPM/PAM met every two weeks with all NGOs and area PPMs, usually chaired by the Minister of Agriculture or Health. Other interested parties attended, including the donor organisations. This committee was able to solve problems quickly. PAM staff also visited each area, if possible every month. MPs and newly elected local government representatives contributed to the information base, though in some cases, political interference with distribution was a problem which had to be eliminated.

An *ad hoc* Drought Monitoring Group chaired by the UNICEF representative in Zambia was set up in April 1992 to develop a monitoring and reporting system. It consisted of representatives of both government departments and aid agencies. In May, a consultant was hired from the Food Studies Group in Oxford to advise on a system to monitor the drought's impact. FAO hired a local NGO for a similar purpose. The aim was to be able to target relief, to monitor effectiveness, and to identify where changes of tactics were necessary. Thirteen critical indicators and six less essential indicators were identified and tested in three pilot Districts (CSO and UNICEF, 1992a). This led, in January 1993, to regular monthly publication of data from a Drought Impact Monitoring System (DIMS), which collected data, through the CSO, from five communities and five clinics within each district. It

gave information on the health status of those attending clinics; maize meal price changes; other food prices; food availability; household food stocks and household food sources; food supplementation programmes; water availability and sources; cattle deaths, sales, and status of grazing and livestock water. Much of the information was collected in simple comparative form: better, the same, or worse than last month, in order to identify problem areas quickly. From data collection to publication took only one month. The system was designed not to be burdensome on NGOs who were fully occupied with implementation and rarely had spare staff for elaborate monitoring.

Other improved systems of foreseeing problems and taking appropriate steps were also put in place during the drought. For example, the Zambian Early Warning Unit, Food Security Bulletin of October 1992 carried a long-distance forecast from the Drought Monitoring Centre, Nairobi, predicting, correctly, that prospects for the coming season looked reasonable. The Food Security Bulletin, which had appeared quarterly with brief monthly updates in between issues, became fuller and was issued monthly, carrying the DIMS output. Methods were improved so that information collected by the meterological department and MAFF was processed and published more promptly. MAFF was able to use the information to give appropriate messages for extension staff to deliver. USAID is supporting a Famine Early Warning System based on remote sensing data. In some ways, data collection systems have become overelaborate and overlapping and recommendations will be made on this in the final chapter.

Drought recovery: preparation for the next agricultural season

ZAMSEED conducted a post-harvest survey amongst its contracted maize seed growers (ZEWU, Food Security Update, August 1992) and identified the existence of 3,500 tons of various maize varieties, provided there were funds to purchase it. Arrangements were made to buy another 1,000 tons from Zimbabwe (*Food Security Bulletin*, 20 October, 1992). This was later increased to 2,500 tons, with assistance of funding from WFP and Norway. Improved sorghum seed was multiplied up at the Gwembe Valley Development Company farm under irrigation, but production was lower than hoped, due to pumping difficulties and water shortage.

In October 1992 the ARPT carried out studies in Eastern, Lusaka, Southern and Western Provinces, for MAFF and the IFAD SSRP, with the aim of determining the seed requirements in the most severely affected areas, and to assess the effect of the drought on draft power, as well as to identify medium-term strategies for promoting drought recovery. Despite the commendable speed with which this was carried out, it was in fact too late to do much to influence the seed quantity,

thought it was helpful for local distribution. The ordered seed was already on its way.[3] Its Terms of Reference did not include non-cereals.

By December the *Food Security Bulletin* reported that 7,500 tons of maize seed, estimated to be 88% of the requirement, had been distributed to the provinces and PPM had distributed 1,500 tons of free seed (it is not clear how this relates to the figures quoted earlier). There was surplus seed in the northern half of the country, and shortages in the southern half. As the maize planting season was virtually over, ZAMSEED was concentrating on making sunflower, soyabean and sorghum seed available. These, together with several hundred tons of sorghum, millet and sunflower seed, were distributed to small-scale farmers through the NGOs, on various terms, before the next season. Usually the arrangement was that the farmer was to repay at the end of the harvest, but it has not always been feasible to enforce this. The usual lending agencies carrying out the supply of fertiliser were authorised to forgive or roll over debts from the drought year, but not older debts.

When army worms invaded some areas at the start of the season, MAFF purchased the necessary sprayers and chemicals to combat them and distributed them through the PAM system that was already in place. The information on this need reached MAFF through its own staff.

The water programme

Shortage of water for drinking and livestock was a serious problem, particularly in view of the bad state of facilities before the drought began (Chapter 2). The Department of Water Affairs made a rapid assessment of these in March 1992. Various donors made small grants, totalling US$818,706, and the GoZ allocated Kw 100 million initially and later pledged to double this (Sutton, 1992). UNICEF took the lead as the implementing donor. The action plan of the Department of Water Affairs (Table 2.3) concentrated on rehabilitation, as this was cheaper and quicker than new constructions. Work was held up by the need to identify where facilities were and in what state, as well as where water shortage was greatest, in order to work out logistical requirements and implementation plans. A major problem was that under past programmes the facilities had been regarded as belonging to the government, and there was no community level organisation to maintain them and to organise even small repairs and replacements. District Councils are supposed to be responsible for facilities, but as the facilities do not generate revenue, they do not have means.

3 It was, however, useful to IFAD's project preparation, both in regard to a development programme for Southern Province and a programme to assist local level storage and in the preparation of this report.

Donor money provided a proportion of local costs, such as some employment of casual labour, and purchase of local materials and vehicles (purchased or hired), equipment, training and technical assistance costs. Communities were expected to provide sand and aggregate, and unskilled labour. GoZ was responsible for some other local costs and purchases, for example, allowances for workers travelling out of their station, fuel and other recurrent costs. After a lot of initial activity in 1992, funds ran out, and only began to come through again in the second half of 1993. The problem lies partly in the GoZ budgeting system, with the full budget only approved by parliament in March. Only after that is more money made available by the Ministry of Finance to the different Ministries, who then have to decide how to allocate it to their Provincial offices. In 1993 the process was even more delayed by the Government's cash shortage and determination to keep expenditure within available cash revenue.

Some 30% of the UNICEF funds was used to establish better accounting systems, particularly to budget for the future recurrent costs of new equipment, and to develop systems which would enable recurrent costs to be met in future. It also ran training courses in maintenance of equipment and vehicles. In August 1993 the department established a Community Maintenance and Management Unit. NORAD, via UNICEF, is funding courses for trainers of village mechanics and water committees. It was realised that there needs to be more self-help and community participation in water programmes and two major meetings were held to enable NGOs and government agencies to move towards a common approach. NGOs and local communities have been involved in the rehabilitation of facilities, especially shallow wells and the simpler types of borehole rehabilitation, sometimes with technical assistance from Department of Water Affair's staff, whose costs they have paid.

Borehole drilling has also been impeded by shortage of hydro-geologists. The Department has only four, of whom one is away on training. They are now fully engaged in the implementation of the rehabilitation programme.

The rehabilitation of dams and the construction of new ones is a longer process. In 1993 two consultants were employed to review 27 dams each in Eastern, Central and Southern Provinces and to select 10 for rehabilitation, as funds will only be sufficient for this.

It can be seen that the rehabilitation of existing water facilities, let alone the creation of new ones, has been a slow process. During the drought many people were left dependent on sources that were polluted (for example, because animals also used them) or that were immensely time-consuming to reach, or where water could only be gathered laboriously.

Overall assessment of the management of the drought

Zambia was unique in Southern Africa in deciding to manage drought relief with the full involvement of NGOs. We assessed its efficiency and fairness partly by discussion with those directly involved but also through enquiries to the District Council Secretary. The latter is in good contact with local political leaders, and is therefore likely to have heard of any complaints. All District Secretaries consulted thought the operation had gone smoothly, and that aid had reached the right people. The NGOs generally worked through local committees, and this has strengthened village level institutions (see Chapter 5).

The national level organisation of maize imports, the involvement of donors, the redistribution of maize to the provinces and the assessment of seed requirements for recovery also went well, with only the minor difficulties that are to be expected in a programme of this size. The early ordering of imports meant that the towns felt no acute shortages. The main mistake was an overestimate of needs, leading to a substantial surplus of yellow maize at the end of the programme. It is comprehensible in view of the need to make quick decisions to ensure food is issued on time, and in view of the known inefficiency and disorganisation of the parastatals responsible for grain marketing, storage and handling.

Very few deaths occurred because of the unavailability of staple food. Rural people recognise this to be the result of the programme. As women farmers in Southern Province said, in droughts "On our own we would die. Government must help" (Annex 2). However, despite the title Programme Against Malnutrition, malnutrition did occur and was increasing in 1993, as will be shown in the next chapter. The water programme was hampered by the poor original state of facilities, the lack of any community organisations to manage them and shortages of funds. It has begun to address some of the basic organisational issues, but the number and state, of rural water facilities for humans and livestock, are still grossly inadequate. That had health repercussions, discussed in the next chapter.

Working through the NGOs was a successful emergency strategy. However, it should not detract attention from the need to strengthen the organisation and revenue base of central and local government organisations and community institutions, so that in any future drought, information on food stocks and needs, water facilities and their status, is more accurate. Services unable to operate well in normal circumstances cannot cope with emergencies.

5 Human impact

In general, it can be said that human systems will take longer to recover from the drought than natural systems. The evidence for this was gathered from reports by ARPT, in October 1992 and March 1993 (the latter in Southern Province only), from an OXFAM workshop report in March 1993, the University of Zambia's Gender Studies Unit and our own interviews with farmers. Since the latter were particularly requested in our terms of reference, the notes taken at the meetings are given in Annex 2.

Asset loss

Asset sales during the drought

The major effect of the drought was that many rural families were stripped of their assets. For most, the harvests they had expected to make at the end of the 1991-92 season were a major part of their usual income and expected to end the shortages and hardship that frequently precedes the harvest. Crop income on a farm is taken in two ways, in kind as food reserved for use during the coming year, and as sales which generate the cash to meet the multifarious other needs of families, as well as to make food purchases. Unlike urban families and rural civil servants, they probably lost 30-100% of their income, depending on the variety of income sources which they had. This impact started when they would normally have expected to be able to harvest green maize from their early planted local maize crop in March or April, 1992. Although some were able to earn a little money from other income earning activities, notably charcoal manufacture and fishing, this was more possible for those near roads and urban centres (and hence observable by outsiders) and less feasible for those in more distant communities. Further, as we have seen, the market for these products can only have expanded slightly, so that the expanded supply probably led to a relative drop in price. More people in competition probably led to reduced average earnings.

The consequence, as one group of women farmers told us, was they had to sell whatever they had to buy maize before the yellow maize started arriving in June 1992. They sold the vegetables that still remained in the *dambos*. They sold their chickens, goats, pigs and such cattle as had not died from Corridor Disease. They ended the year, naturally, with no cash saved to buy fertiliser and other inputs (Annex 2). In the drier areas of Zambia, cattle are regarded as a form of saving for just such emergencies, and those who had large herds were

better off than most. Thus, a relatively wealthy farmer we interviewed had had 40 cattle in 1991. He had to sell many in 1992-93 to buy food, and lost 10 in December 1992 from Corridor Disease. He was reduced to 10 animals, but at least, retained 4 oxen. More typically, farmers in Southern Province originally owned 10-20 cattle, and proportionate losses imperilled their ox power.

Asset loss also included seed stocks. Seeds of some crops, especially legumes grown for home consumption, are normally retained. If all the 1990-91 seed had been planted in 1991-92 and the crop had failed, there was no seed. In some cases, small quantities had been harvested, but families had been obliged to eat what they would normally have reserved for the next year's planting. The ARPT surveys in several districts in October 1992 stated that seed retention for maize, sorghum and millet was negligible in Southern Province, the valley area of Lusaka Province and the Sesheke District of Western Province. In other areas covered by the survey in Western, Eastern, and Lusaka Provinces there was limited seed retention (ARPT, 1992a).

Recovery from such asset loss can be hastened by credit. However, many families could not get credit for the 1992-93 season, although the Government had arranged for 1991-92 debts to be forgiven or rolled over. Sometimes they were ineligible, because they owed money from previous years. Credit was also in short supply because lending organisations had financial problems in the inflationary situation, or were disorganised by the new marketing situation. Thus, ARPT reported in Namwala District, Southern Province that LINTCO[1] support in credit and seed had been withdrawn and that farmers were finding it difficult to get soyabean seed (ARPT, 1993b,v). Credit came at a very high nominal cost which may have deterred farmers. Banks have preferred to take up the newly introduced treasury bills, which offer good yields and low risk.[2]

The difference the availability of credit made can be seen from the different outcome of the 1993 harvest for two women farmers in Siakachamatanga village, Southern Province (see Annex 2). Both farmers had received 10 kg of hybrid maize seed from PPM under the recovery programme. The first had obtained a loan for fertiliser, and had been able to buy another 10 kg of seed. As a result, she had harvested some 110 bags of maize, and had put 66 bags in the family store and sold 54. This family would have enough to eat during the

1 The Lint Company of Zambia, a parastatal that deals in cotton, soyabeans and coffee.

2 As noted by Chabala and Sakufiwa (1993). The Zambian press has carried stories of banks which use money given to them to facilitate maize marketing, to purchase short-term treasury bills.

year, and was well on the way to recovery. However, only 6 of the 13 women farmers in the group we interviewed had got loans. The second, a farmer without a loan, was unable to obtain fertiliser and harvested only 6 bags from 10 kg seed. She had a family of eight, for whom this would not be enough and for whom she would need to buy food, somehow, later in the year. Poorer farmers without loans are often also those without oxen, who plant late. Those who had a good harvest would have cash to buy fertiliser next year. The rest would still be struggling.

The same observation was made elsewhere. In an ARPT interview in Mazabuka District (March 1993) a farmer noted that without fertiliser he would remain in patched clothes. Farmers said that agriculture in their area without fertiliser was not possible.

In some of the dryer areas people were given improved sorghum seed instead of hybrid maize; this sorghum does not need fertiliser.

A second problem in recovering from the drought for some families is their lack of draft oxen. This was generally due to Corridor Disease; farmers made great efforts to conserve their oxen; they were not sold except as a very last resort. In areas where many cattle had been lost, the area families had been able to plant had been reduced to between a quarter and a third of normal (ARPT interviews, March 1993 in Monze East).

Long-term social and environmental effect

In the medium term, some families were left with insufficient income and food to carry them through to the harvest of 1993-94, because they lacked draft power or access to credit in 1992-93. Others did well and will have begun to restore their assets. The likely long-term effect of the drought is, therefore, an increase in inequality amongst village families. It is difficult to predict what environmental impact this will have, since we do not know whether it is the richer or the poorer peasants who cause most of the pressure on woodlands and common grazing grounds. It is probably the richer who are able to keep more cattle, or to purchase a lorry to go in for charcoal burning on a commercial scale.

Mortality, health and nutrition

Causes of the increase in malnutrition in 1993

The successful distribution of maize, described in Chapter 4, prevented deaths from famine. However, although high protein foods were distributed to vulnerable families attending health clinics, this does not seem to have been enough to prevent an increase in children under weight for their age, which continued, surprisingly, in 1993. This is an indicator of longer term food insufficiency, in quantity or quality, unlike weight for height. Table 1 gives an illustration from Macha

Hospital catchment in Southern Province, but the increase has also been noted in many other districts, through the monthly information collected through the drought monitoring programme of CSO (Mrs Joyce Kanyanga, CSO). The CSO weight for age statistics are taken from samples of five mother and child welfare clinics per district, and are accompanied by a warning that care must be used in interpreting them. We have preferred to illustrate the situation by the case of the Macha hospital clinic, since this will have used a consistent methodology over time in its measurements and recording.

Poor weight for age has been a problem in Zambia for some time, with levels of around 25% persistently found by national surveys between 1987 and 1991. The Macha clinic records in 1990, 1991 and 1992 are consistent with these, but show a rise in 1993. It is worrying that the CSO data accord with this. For example, in July 1993, 13 out of 27 clinics reported more under weight for age children than the previous month, but 23 reported more under weight compared with the previous year. Clinic attendance was up over the previous month in 17 cases, over the previous year in 22 cases. Low weight for height may be associated with diarrhoea; however, diagnoses of diarrhoea were down by 33% compared with the previous year, having increased in only 4 clinics and declined in 23 (from CSO, 1993, July).

Table 1 **Percentage of children underweight for age at Macha Hospital clinic** (Source: Data provided by Mr Parry, pharmacist, Macha Hospital)

	1990	1991	1992	1993
January	14.77%	23.62%	15.83%	33.25%
February	13.66%	25.82%	14.84%	33.33%
March	26.50%	25.19%	21.13%	33.61%
April	21.39%	24.65%	27.19%	34.51%
May	19.74%	20.86%	24.80%	36.08%
June	17.77%	19.59%	24.17%	
July	12.90%	16.86%	21.78%	
August	34.37%	24.41%	50.56%	
September	18.64%	23.51%	49.59%	
October	13.41%	21.10%	24.37%	
November	22.81%	13.25%	25.15%	
December	22.98%	18.50%	68.14%	

The causes of the increase of low weight children under five are not clear. A possible factor mentioned to us is lack of balance in the diet of pregnant and nursing mothers and children who are being weaned, since many of the relishes accompanying the maize staple have been lacking for a long time. These include legumes and vegetables, good sources of important amino acids, vitamins and minerals. A recent more detailed survey found only 4% of children under 6 months underweight, but with dramatic increases after 7 months, peaking at 13-18 months (Luneta, 1993).

In areas where people have cattle, milk has been lacking. It is normally available in the wet season and short in the dry season. However, when cattle had to be taken early to more distant grazing grounds, it became unavailable to children at home. The losses due to Corridor Disease reduced supply. Currently, people are trying to rebuild their herds and this may involve giving priority to the calves, rather than the family.

Rural families do not, generally, eat much meat and the first effect of the drought, as we have seen, was that they increased their sales of chickens and small stock to urban areas to raise money to buy maize. According to Mrs Kayemba, nutritionist at CSO, it was originally assumed that the drought would cause slaughter of livestock, which would, thus, provide dietary supplements, but this does not seem to have happened on any large scale. Hunting, legal or not, has not been sufficient to compensate. Fishing was undertaken mainly to generate cash. Rural families, when asked, did identify the need for non-maize foods as part of the relief programme. Thus, in an OXFAM report on community meetings in Nyimba District, Eastern Province, in April 1992, food requirements were stated as being

> Maize, beans, *Kapenta*, groundnuts for adults. Sugar, milk, soya beans and HEPS for children and those that are malnourished.

While the PAM programme did distribute some beans and HEPS through the clinics, it does not seems to have met the full requirements for a balanced diet.

Vitamins and minerals, as well as proteins, were probably in short supply during the drought, first because of increased sales of vegetables to buy maize, and later through their unavailability. However, in many places there were plenty of vegetables in 1993. Vitamin A, iron and iodine are the main known deficiencies (Luneta, 1993).

A cultural factor is that men are usually given the first choice of available food, since it is considered they do the heavy work (although in fact, in many areas, women were more involved in FFW), women are next and children last.

Another factor during the drought period was the shortage of water and use of polluted sources, leading to more diarrhoea and other intestinal

infections, leading to less benefit from food taken. However, this would not explain the increase in the first months of 1993 during the rains, compared with the rains of 1991. As already mentioned, the CSO survey showed a drop in diagnoses of diarrhoea in 1993.

AIDS may be a factor in increasing the number of underweight children, both because some children are affected by the disease and because the increase in the number of orphans to be cared for is stressing the resources of the relatives who have to provide for them. However, this is more likely to show up as a gradual increase in malnutrition, rather than the substantial rise in 1993 shown in Table 1.

The people themselves feel conscious of a lack of legumes such as groundnuts, which have been in short supply since the 1991 crop was exhausted. It is noticeable that in both the interviews that we conducted, and those conducted by ARPT in October 1992 and March 1993, in both Southern and Eastern Provinces, there was a strong emphasis by farmers on the need for legume seeds - groundnuts, beans, cowpeas, etc. (see Annex 2).

Use of gathered and hunted foods from the wild

It was reported that some families were making increased use of gathered foods from the wild during the drought, including roots. This seems to have occurred mainly in the early stages, before the yellow maize became available (University of Zambia, Gender Studies Unit, 1993:45). When CSO enquired as to the primary source of staple food in the DIMS exercise which started in January 1993, wild roots were of minor importance. They were mentioned as the third source in order of importance in only five and three out of 27 districts in January and February 1993 respectively (CSO, *Food Security, Nutrition and Health Monitoring System*: January and February, 1993). Food relief and purchases were overwhelmingly the main sources. In the less affected districts, own stocks were mentioned.

Some gathered fruits, vegetables and insects are always used in the diet. Chapter 3 has shown that some wild trees provided less fruit than usual in the drought. Some of the gathered foods were sold to generate cash (University of Zambia, Gender Studies Unit, 1993) and this may also have applied to hunted animals. In both cases sales would have been by the poorest, most desperate families. The illegality of hunting means information is not available. Given the extent of natural woodland in Zambia, it is unlikely that additional gathering of wild roots in the vicinity of villages will have endangered any species of flora or fauna.

It should be noted that gathered and hunted foods form a smaller proportion of the diet as people come to live in permanent settlements. The only way to have a sufficiency of food from a permanent base is by farming. While population density is low and the proportion of

unmanaged land high, as in many parts of Zambia, gathered and hunted foods provide useful supplements of proteins, sugars, minerals and vitamins, but not the main diet staples. In a drought, desperate people will range further afield to find wild foods, but the cost in energy-expenditure will be high in relation to the calorific benefit. The denser the population, the more scarce wild foods will be.

Other health effects

In addition to intestinal diseases, shortage of water led to increases in skin diseases. There were also increases in diseases related to vitamin deficiency and poor diet (University of Zambia, Gender Studies Unit, 1993:iv). These have not been quantified.

Family and community solidarity

Solidarity within the extended family

Some families received assistance from urban relatives during the drought, but this seems to have been exceptional. Gifts were mentioned as a third order source only in nine and five districts, in January and February 1993. They were never in the first or second rank for importance. Indeed, some people commented that family relationships were put under acute strain, when rural families visited urban relatives and were made unwelcome (Sister Mary Noel, at Mazabuka). Urban families were suffering the effects of inflation and, in some cases, from short-time working due to electricity cuts and may have been in genuine difficulty.

The Gender Studies Unit reported that across the country, some people had migrated to seek help from urban relatives, or to find work. However, we were not told of any mass evacuation of villages because of food shortages. This was another success of the relief programme. In a few cases, people had to camp near the lake, because their village water source had dried up.

Differential effects as between men, women and children

The University of Zambia, Gender Studies Unit (1993) found that more women were involved in FFW programmes than men, in all districts except Mongu, Western Province (where the type of work, on canals, was traditionally done by males). In addition, women retained responsibility for water collection, which became more time consuming and tiring during the drought, owing to greater distances to the collection point, and long queues and waits once there. Many of the gathering activities are also regarded as traditionally female activities, but it was noted that in Katete and Luangwa Districts, in Eastern Province, men were also involved and seemed also to be equally involved in all agricultural activities. While some agricultural activities, such as harvesting, would have been reduced during the drought, once the rains

began again, there was a double workload, on the family fields in the morning and on FFW in the afternoons.

One reason for less male participation in FFW was that most of the extra income earning activities such as cattle sales, fishing, charcoal manufacture, basket and mat manufacture, etc. were undertaken by men. Men are also more often able to find casual work. In some cases, as the owners of assets such as draft oxen and carts, their contribution to FFW programmes was in transportation, rather than labouring.

Women's income generating activities such as beer brewing and sale of vegetables were reduced as the drought set in. As a consequence, female headed households were worse hit than households with an income generating male. These households were those most likely to have to reduce the number of meals per day and absenteeism from school was more prevalent amongst their children, due to difficulties with costs and the need to call on them for assistance.

The Gender Studies Unit found that school absenteeism increased. This was often, teachers said, because of hunger. In other cases, children were needed to assist in income generation (mainly boys) or water carrying, etc. (mainly girls). There was no marked difference between the sexes in rates of absenteeism; it varied according to circumstances locally.

It was the intention of PPM, at the national level, that female headed households and pregnant women should be given special attention in the free food issue. However, as explained in Chapter 4, the actual decisions relating to which families should be excused FFW was made by local committees or local leaders. These did not generally regard either pregnancy or female headedness as in themselves sufficient criteria for excusing people from FFW.

Community solidarity and self-help

One beneficial result of the drought has been a strengthening of village institutions, through the formation of drought committees under the PPM programme. These generally assisted in deciding what activity should be undertaken under the FFW programme. The work has not only led to improved community facilities, such as repaired roads, wells, dams, or new latrines and school buildings, but also led to a realisation that local people can organise to get things done for their communities. This is in accordance with the political philosophy of the new government, which wants people to realise that the government cannot do everything and that much must depend on their own efforts, or those of local government. People are proud of what they managed to achieve during the drought and there is at least some hope that the new facilities will be looked after, especially where, as in the case of water, some training effort is being directed to this end. People are also now being consulted, and this should also help in local

institution building. Thus, in one of the southern province villages, people were earnestly debating whether to request a borehole or a dam, knowing that they would not get help for both (see Annex 2).

The involvement of the NGOs, both foreign-aided and those, such as the churches, which are more locally-based, has also been a positive factor, giving them a recognised role as partners in development. There is now better communication between government officers and NGOs, and a greater appreciation on both sides of how they can work together. In both agriculture and water, for example, government has in place experts who can provide technical advice, if NGOs or local communities can provide funding for transport and other needs.

However, there is also a danger that people think free food a necessary element in a community programme. In some cases, programmes begun under FFW have not been completed, and there is a question-mark as to whether they will be completed. The OXFAM workshop considered this and seems to think that people could be encouraged to continue, if funding could be found for materials needed (as is planned under a continuing PAM programme).

While community solidarity in working together for community facilities has probably been stimulated, the extent of peoples' willingness and ability to help the poorer members of their own community should not be exaggerated. A suggestion to women farmers that those who had done well in 1992-93 might be able to help those who had had poor harvests was not well received.

Changed attitudes to cropping and marketing

The drought has changed attitudes to crop diversification. While farmers still appreciate the qualities of hybrid maize, particularly in conjunction with fertiliser, they are also much more conscious of the dangers of over-reliance on this one crop. ARPT, ourselves and government extension officers, have all remarked on the greater interest being shown in having a variety of crops, including the new sorghum varieties, legumes and roots such as cassava and sweet potato. It is illustrated in the interview reports in Annex 2. The problem is access to seed or planting material. This applies particularly to groundnuts and other legumes. Agricultural officers think there is also more interest in fish farming and in planting fruit trees, but it is legumes which farmers seem to mention most.

It is possible that farmers will become interested in storing more maize and other crops on farm, under a liberalised marketing system, in the hope of getting higher prices later. To do this, many of them will need to invest in improved storage structures. However, at the moment, the marketing system is in too much confusion to ascertain if farmers will take this option. The co-operatives have yet to evolve into fully

independent organisations controlled by their memberships rather than by government; private traders are still deterred by uncertainties over export permissions, the cost of credit and inexperience; the millers are suffering from the competition of smaller hammer mills which are being set up to produce meal more cheaply and which can provide local needs without the necessity of transport to and from a distant mill (see Chabala and Sakufiwa, 1993).

Changed attitudes to soil, water and wildlife conservation

Farmers also seem to have become more interested in the soil conservation measures that are being promoted under the SCAFE programme. This is in the context of their greater appreciation of the need to improve yields with less reliance on fertiliser, now that the latter has become more expensive, and given the credit difficulties. This provides an opportunity which extension officers need to take up.

As yet, there seems, by contrast, little interest in new methods of grazing management control of wood collection or planting woodlots. Generally, it is still thought that grazing and fuel wood can and should be obtained by free access to uncultivated land, controlled by nobody. Land control is becoming an issue in some areas, but, rather, in relation to cultivation rights than grazing. This is due to growing population pressure in some areas, not the drought.

It is not to be expected that the drought would have led to more interest in wildlife conservation. Rather to the contrary, it has led to more interest in hunting, legal or otherwise.

Summary

The drought impoverished rural people, causing the sell-off of important assets such as livestock and seed stocks. The seed need was in part met by the PAM programme, but there is still an important shortage of legume seeds. The prolonged shortage of legumes, and other dietary deficiencies, is the most probable cause of the increase in malnutrition. Those farmers who got credit and who retained oxen, have been able to make a good recovery. However, those who had no credit will again be in difficulty before the next harvest: there is an increase in inequality in village society. However, the drought had some good effects; the way that FFW was organised and food distributed has strengthened village level organisation and left communities with some improved facilities. It has also led to a general consciousness of the need to diversify crops and to conserve soil.

6 Issues and recommendations

Mitigating droughts?

We have shown that many of the environmental impacts of the drought proved temporary, due to the adequate rains in the 1992-93 season. However, there has been a longer lasting impact on the assets of farmers and the nutritional status of rural people. The drought also absorbed national economic and manpower resources which could otherwise have been used for development, and affected industry through power generation. However, an economic assessment has not been attempted here. Severe droughts will always necessitate an aid programme.

Droughts cannot be avoided, but they can be mitigated, particularly if the agriculture is geared to making the best use of rainfall, and if water is stored where this is economically and physically feasible. Various programmes are already in hand or being planned, which will assist farmers in this. These include the projected IFAD aided project for Southern Province; various other district programmes supported by bilateral donors, and SCAFE. The recommendations which follow are intended as a supplement to, and comment on, such programmes.

The drought happened against a background of increasing population density in many rural areas, and a shift in macro-economic policy towards more market orientated management. Both these factors, together with a successful experience in many areas in community decision making and the organisation of FFW programmes appear to be encouraging individuals and communities to new attitudes towards the management of both their own and the communities resources of land, water and vegetation. Government policies need to build on the positive aspects of these changes.

Foreseeing drought

We have produced evidence that the drought of 1991-92 may be a cyclic event and rainfall levels may be due to increase. The cost of actions taken to mitigate the effect of drought has to be measured against the frequency, severity and geographic extent of droughts. While a major drought is, on past evidence, a once in sixty-year phenomena and, therefore, not worth guarding against, frequent minor droughts are to be expected in AEZ I. This report, therefore, concentrates on measures to mitigate minor droughts in AEZ I, and on

improving warning systems that will detect the approach of a major, widespread, drought.

It is important to continue and deepen the present studies of climate, using the longest available data records, to obtain further insight into possible cyclical pattern. If necessary, the Zambian Meteorological Department should be given additional resources to carry this out. The two sunspot cycles of around 8-11 years and 16-22 years appear to be the best established cyclical phenomena, although not all climatologists believe in their importance. The latter may be related to the 18-year periodicity which some meteorologists think evident in south east Africa. Zambia is to the north of this region, and its Meteorological Department has produced evidence of different patterns which may affect the start and the finish of the rainy season, which is why it requires its own studies. The longer periodicity may also affect the frequency of mid-season dry spells. Hulme (1993) suggests that there may also be shorter term influences and that el Niño events every three to seven years are in phase with dry years in south east Africa. There are so many influences on rainfall that even if the existence of cycles can be established and described, this will not enable the prediction of rainfall totals in a particular year. Nevertheless, it is worth trying to increase the ability to forecast the probability of having a sequence of years with below average rainfall. Any trend due to global warming would be likely to affect long-run averages gradually, but annual and periodic variation will cause more obvious and immediate disturbance to crop expectations.

The Department should also consider applying the Drought Index described in Chapter 2 to its long-term records, so that it is better able to characterise the severity and frequency of droughts in the different AEZs.

Currently, information from the SADC Early Warning System at Harare and the Drought Monitoring Centre at Nairobi is now being circulated more quickly through the *Food Security Bulletin*. Guidance should, however, be given to staff of the Zambian Meteorological Department as to the type of information coming from these centres which justifies an immediate high level warning to the Ministry of Agriculture and the Office of the President.

Contingency planning and early warning systems on threats to food supplies

The question of a national maize reserve, its size and financing is outside the scope of this report. However, it is worth raising the issue as to whether there are too many new systems for monitoring crop prospects and welfare. New methods should complement, not duplicate, older systems that work, for Zambia does not have governmental

resources to waste. However, some of the older methods may not work in the freer market economy that is now being established.

There is a need to assess national consumption levels of major cereals and legumes, and national production, to be able to quantify shortfalls better. The existing systems operated by MAFF and CSO, which both are seeking to refine, are adequate for production. However, a national household survey may be needed to assess consumption, given the new marketing situation, the removal of subsidies and possible changes in consumption patterns as crops are diversified. It may be better to delay this until the situation has stabilised.

Reports to the Ministry of Agriculture alerted the Minster of crop failure. However, the regular field reporting of Ministry of Agriculture field staff could be improved to make them more alert to danger signals. Ideally, field staff need to report immediately to their supervisors about higher or increased incidence of pests and diseases of economic importance so that emergency control measures can be undertaken with the support of government and other organisations. Similarly, they need to report on their observations of rainfall distribution, credit and input supplies, and availability of livestock drugs. Any serious problem in these areas is likely to affect the performance of crops and livestock. The earlier such problems are identified and reported to the central level the better the arrangement for contingency and emergency measures.

Field staff in Agricultural Extension services can make such quick reports both verbally and in writing to their District Agricultural Officers who in turn must contact the Provincial Agricultural Officers (PAOs) by phone or post depending upon the urgency of the situation being reported. The PAOs also get in touch with the departmental headquarters once they are in receipt of details of emergency requirements in the field. This reporting should not necessarily result in additional heavy financial costs if field staff are more alert and well drilled to report danger signals on the performance of crops and livestock in the areas under their charge. Over and above this, it will be important and necessary to properly equip the offices of the district agricultural and veterinary officers so as to enable them to respond immediately to field emergencies besides merely reporting matters to their respective provincial officers.

CSO's recent methods of quick sampling and analysis of five communities and five clinics on a short list of topics and publicising this widely along with crop-weather reports and other information help many ministries in planning. For example, the Ministry of Agriculture is assisted in devising extension messages appropriate to the season and the circumstances. It has picked up the apparent deterioration in the health of children.

The role of NGOs proved very valuable in the emergency, but they have their own agendas and should not be regarded as a replacement for regular government services, either central or local. Reliance on NGOs for **development** would lead to very uneven coverage of the country. However, an annual meeting at district and national level for information exchange between government, local authorities and NGOs to identify problems, or badly served areas, could be useful.

While the people involved are still available, PAM could ask each district to record its methods in regard to organising the logistics, identifying the needy, involving the community in planning distribution and FFW programmes and the major lessons learnt, so that this stock of knowledge can be easily accessed in the case of any new emergency.

A more privatised marketing system will lead to decentralisation of buying, storage and processing. There will be more on farm storage, and more storage by smaller traders in smaller towns, etc. There will probably be a need for extension through MAFF to farmers, and through appropriate Ministries and NGOs to traders, especially in relation to pesticide use. There may be a role for NGOs in assisting communities who are not well served by traders, because of distance and cost, to develop services to bring in inputs and sell outputs.

Donors and government need to take account of the costs of monitoring and targeting. Money is saved if aid is confined to the really needy, but the costs of different methods of identifying the needy have to be considered. The use of local elected or representative body at village or ward level, identifying the needy, seemed to work reasonably well. The poor are always with us and there needs to be a system by which the local authorities, in conjunction with NGOs and local representative organisations and the Ministry of Community Development and Social Welfare are aware of needs and raise funds for them, in a manner which can be expanded in case of emergency (there has been a workshop on this subject at the Ministry of Community Development and Social Welfare recently). The existing systems of early warning could be reviewed to see if there is unnecessary overlapping and expenditure. As far as possible, use should be made of staff and facilities already in place (as with the extension staff of the Ministry of Agriculture, and health clinic staff).

Population density, agriculture and the management of natural resources

The first requirement of a sound policy is clear thinking about the causes of changes in the natural environment and in human welfare and about what we view as positive and negative.

We have shown that some of the changes ascribed to the drought, such as a possible increase in the reduction of tree cover, have been exaggerated, and that the increase in the size of human settlements and associated agricultural activities has had a greater effect. However, the problem in parts of Zambia is that there are not enough people to make intensive agriculture and careful management of land and water either possible or profitable, partly because low population densities inevitably mean poor marketing facilities and social and transport infrastructure. In Western Province the Dutch supported integrated rural development programme has been struggling with this difficulty for more than a decade. In other parts, population density has increased to a level where it puts stress on traditional extensive agriculture, while not yet getting the full benefits of the better communications, information and market incentives that generally accompany higher population densities. In other areas, scattered pockets of dense population are separated from the stimuli of main roads and towns by large-scale commercial farms and ranches.

We need, therefore, to distinguish between three different types of situation. First, there are the large areas of Zambia which are already National Parks, where wildlife and the maintenance of natural genetic diversity has priority. The main problem here will be ensuring that the wildlife population remains in balance with the resources available. This may necessitate judicious culling from time to time, by the State, since there is no local population.

Second, there are the low population density areas, such as Western Province, but also including many districts in other provinces. At low population densities, there is scope for humans and their livestock to co-habit with wildlife, and the large amounts of uncultivated land will provide supplementary foodstuffs, both animal and vegetal. The appropriate type of agriculture in such areas is one which may give low returns to land (i.e. low yields per hectare), but high returns to the scarce factors of capital and labour. Fallowing will give higher returns than fertiliser, organic or inorganic. People should be encouraged to grow appropriate, local foodstuffs, according to the natural resource base, without use of imported inputs, since transport is costly and difficult. They should be encouraged to rely for cash on livestock, which can be trekked to markets, or on goods with high value in relation to bulk, which might include, for instance, honey or wildlife products such as skins.

Local communities in such areas should, therefore, be encouraged to involve themselves in wildlife management, with some care to see that the benefits go to ordinary people and not simply to chiefs and employees. However, it has also to be recognised that community institutions, like governments, will have difficulty in policing the large areas over which the population is scattered. For both reasons, the

Game Management Areas schemes require monitoring. Wildlife ranching is not an option for small farmers; it requires the ownership or leasing of many hundreds of hectares and capital. It could, theoretically, be done by a co-operative, but co-operative management has many difficulties.

Third, there are the areas with rising population densities where the transition to more intensive forms of agriculture needs to be encouraged. Rural people in Zambia have already shown that they prefer to live in permanent settlements that can provide good schooling and clinics and that, preferably, have good access to roads and markets. It is these areas that must provide food not only for the larger proportion of the rural population, but also for Zambia's sizeable urban and mining communities. Here again, there is a choice between a relatively extensive form of agriculture, with low yields per hectare (as for example, from composite drought-resistant maize that does not need fertiliser) and more intensive methods, that use hybrids and inorganic fertiliser. Villages that choose the former will need to clear more land per person, and cut down more trees, to grow enough to feed the family and meet their cash needs than those who chose the latter. This is not always recognised. If transport, inputs and maize are not given distorting subsidies, most farmers will make the appropriate choice for their locational situation, although in Zambia, where there have been many distortions in the past, their experimental period will not be without difficulty. However, in many areas of land shortage, farmers will become more motivated to conserving and improving the fertility of both cultivated and grazing land. Information on a variety of suitable techniques will help them, but these must be profitable, and provide them with resources and incentives for the extra work. They will also need secure, heritable land rights if long-term investments are to be attractive.

They will want to defend their cropped fields from the depredations of wildlife; profitable farming cannot co-exist with extensive damage by baboons or hippopotamuses. The diminishing, and more distant, areas of uncultivated land will provide a smaller proportion of the diet. In these areas, therefore, good policies can encourage the growth of good, conservation minded farming, and a cared for environment. This will increase human welfare and incomes from the low levels now prevalent in rural Zambia. But it is not compatible with the maintenance of large populations of wildlife and a large range of genetic variety in natural vegetation. This will make the functions of the National Parks more important.

Water conservation in agriculture *versus* irrigation

There is always a temptation to think that investment in irrigation is the best way of insuring against drought. Irrigation certainly proved its usefulness in safeguarding the wheat and tobacco crops. However, it has also to be recognised that large-scale irrigation is costly, not usually justified for staple food crops, particularly in countries where the rural population is dispersed, land is not in short supply, and there is scope for getting more out of rainfall.

There is much scope for improving yields by making better use of rainfall in AEZ I and parts of AEZ II. Early planting is one of these methods; it requires ensuring that hybrid seed is available early (in a private marketing system farmers may prove willing to pay a premium for seed that arrives in their village in November). However, early availability can also be encouraged by developing local multiplication, making more use of improved composite varieties where farmers can retain their own seed, ensuring the availability of drought-resistant crops such as the new sorghums, cassava, short-season legumes, etc.). There are many other techniques which enhance water infiltration and its storage in the soil: contour ploughing, dry ploughing and planting, more use of manure, early weeding, interplanting, spacing, etc. Most of these techniques have the secondary benefits of reducing soil erosion and improving fertility. After the shock of the drought, farmers are very willing to experiment with these methods. It could be worthwhile to take a party of 20-40 farmers to a dry area of Kenya, such as Machakos District, to see the practices of farmers there. Farmers tend to be most easily convinced by the practice of other farmers. Seeing is believing; hearing is not. In some countries, group work, assisted by donations of hand tools, has been found to work. In Zambia, larger farmers may find the use of ox-plough techniques suitable.

In dry areas where land is plentiful, an orientation of agriculture towards livestock is natural. There should be an emphasis on the integration of livestock and arable farming, through the use of ox-drawn implements, and the use of manure. In some areas the use of manure was rejected in the colonial period because it increased the need for weeding; however, may areas will now have reached land:labour ratios which make increased inputs of labour and capital per unit of land worthwhile.

Irrigation is only to be recommended where it can be done cheaply and easily and managed by the farmers concerned. Examples are small stream diversions for vegetable growing, shallow lift methods, etc. The International Rice Research Institute in the Philippines has developed various foot operated pumps, and animal operated lifts are traditional in north Africa. Where the market is such that fuel and spares can be easily accessed, and the resulting products easily sold, small mechani-

cal pumps might be within the reach of a group of farmers. Alternatively, an entrepreneur can see it as worthwhile to invest in a well and pump to sell water to neighbouring farmers. Experimentation with various simple types of lift and pump could be justified, perhaps in conjunction with a government fruit nursery. The nursery we saw in Southern Province depended on pumping from a long intake from a reservoir; it would be better to try irrigation from a shallow well, or in a site downstream of the reservoir, fed by gravity, or some other means within the reach of farmers or small groups. Small-scale, simple irrigation for small holders could be studied in relation to medium-sized reservoirs recommended below, but it is essential to be sure that a high value crop can be marketed. Irrigation demands much more work than rainfed farming, and will only be successfully undertaken if there are commensurate rewards. In Zambian circumstances, it is unlikely to be profitable for maize.

Forests, woodlands, trees and land tenure

Uncontrolled cutting of trees occurs not because of the drought, but because land is open access and populations are growing. The licensing system is a failure, because it is too costly, in terms of staff, in comparison with revenue raised. Where population density is rising, it may be necessary to reform the system of land tenure, so that either individual families or a definite community have full rights over it. These rights should include the right to sell the land, or to sell its products, including trees, or to regulate the terms and conditions under which they give permission to others to cut or harvest, to graze animals, etc. As community institutions and community management, where it is not a living tradition, can be very difficult to set up, there is a presumption in favour of allocating family rights. In order to avoid reinforcing inequality, the existing inhabitants could be given an equal share of the community's grazing areas; those who had not much stock could then sell or rent land to those who wanted additional land. This would provide them with capital to improve their arable farming or a non-farm business.

Land reform is a complex subject. In many parts of Zambia population density is still so low that individual title may not yet be needed. Custom in many countries evolves over time. Experiment with change in one or two districts where the conditions seem ripe might be justified, but the subject needs more study than this report can give. It would be necessary to discuss this with the people concerned, to ascertain their views on present and future landrights and the feasibility and desirability of individual *versus* communal ownership and management. Such experimentation seems all the more necessary given that the present *ad hoc* giving out of leasehold titles with the chief's

consent seems to be leading to tensions, as demonstrated by various recent newspaper reports.

In areas where population density is rising, and rural families are experiencing increasing difficulty in collecting fuel, they need to be encouraged to grow trees, for fruit, for fuel, and for their commercial value in providing building poles. Observation suggests that families begin by planting trees around their house, and any related garden plot, as fencing or for fruit. It is important that government nurseries carry the kind of trees that farmers are really interested in and not merely those which are environmentally fashionable. In AEZ I the nurseries should carry drought-tolerant trees, rather than fruits which need irrigation. Many types of tree can survive a drought, once mature, even if yield drops during the drought. Experience in other African countries tends to show that as population density rises, so people plant, or protect more trees, on their private lands. As government resources are limited, individuals or groups should be encouraged to open private, commercial nurseries. Government nurseries should be for experiments and demonstrations, with sales hived off to the private sector as soon as demand warrants.

If any new medium-sized dams are built, it will be necessary to give attention to the catchment area; it may be necessary to arrange for protective forestry on part of it, or for special conservation measures if it is under arable farming. Such measures should only be undertaken after consultation with the local community to ascertain existing rights to, and use of, the land. In some circumstances neighbouring farmers may be willing to form groups to do the work on each of their farms in turn, particularly if they see a benefit to the community in a more assured water supply. Again, this is more likely to happen if they also see an individual profit, for example, because the tree planted will have a saleable product.

Improving and maintaining rural water sources in the dryer provinces

Given that droughts occur in AEZ I and that water is essential to human and livestock health, continuation of the existing UNICEF aided programme of drilling and repairing boreholes and wells is of great importance. Priority must be given to AEZ I. The programme is developing on the right lines, in seeking to involve the community in planning, siting and organising a system that will produce revenue for operation and maintenance.

Beyond that, the medium-sized reservoir which stores more than a year's supply proved its value in areas such as Chikankata. Such reservoirs would be particularly valuable where there is a concentration of population. They would not only supply water for domestic use,

but also for livestock, for livestock dipping and, perhaps, for irrigation. It is recommended that support be given to the existing programme of investigation into 55 dam sites for repair, since, at the moment, funding is only available for 20 of them. Support could also be given to some of the existing projects, such as the German supported Siavonga District project, which at the moment does not have a water component, although some potential dam sites have been identified.

Smaller livestock dams would be appropriate in the less densely inhabited areas like the Gwembe valley and Siavonga, where these are requested by the community. It should be a condition that the community is willing to elect a management committee to work with the construction team, that they are willing to contribute the site, work and local materials and that they are willing for an elected management committee to enforce, by fines or otherwise, the necessary rules for good maintenance. Communities are now manifesting a greater realisation that the government's resources are limited. The experience and confidence they have gained in local management, through the FFW programmes, needs to be built upon.

It would be worth investigating technologies, such as sub-surface dams and collector wells in sand rivers, in the drier valleys. These are in use in Kenya and Zimbabwe respectively, and have proved to be technologies which villagers can handle.

Recognising the importance of livestock health

The main coping strategy for agricultural emergencies is to store wealth in livestock, which can be sold to raise cash, buy foods, etc. This strategy fails if there is livestock disease.

Preparedness for drought, therefore, also means ensuring that veterinary services work efficiently, and that staff have funds for touring, advising, treating etc. Given the revenue shortage, this means organising a payment system and a revolving fund, at district or community level, to reduce the cost to government of these services. While dipping remains the recommended measure against East Coast Fever, the Veterinary Department needs to work with the Water Affairs Department in ensuring that new water facilities will also cover dipping needs.

While cattle are the main store of wealth and have other important functions in contributing draft power and manure for water saving agriculture, it should not be forgotten that poultry and small livestock were also important elements in people's coping strategies and that their diet could be improved if more use was made of this source of protein. Newcastle Disease was frequently mentioned as a threat to poultry.

Increasing the supply and variety of legumes

Crop diversification is already being planned by farmers and the Government. However, as yet, the Government has put most emphasis on starchy foods. Farmers have shown they also want legumes. Legumes are important not only in balancing the diet, but also for their contribution to the improvement of soil fertility. Their by-products can be important dry season animal fodder - ground nut hay, for example, is very nutritious. At the moment the SCAFE programme is putting emphasis on **inedible** green manures such as Sunn-hemp, as a substitute for fertiliser. A great variety of pulses is grown in different parts of dry Africa and it should be quite possible to obtain and produce seed for farmer experimentation, at small cost. Most can be grown in rotation or in mixtures.

Fisheries

The Fisheries Department needs to be encouraged to continue its monitoring of stocks, since the effect of the drought on the fish in the main fishing grounds is not clear. It should continue to encourage (private) fish farming to reduce pressure on wild stocks. It needs to make a study, to decide if protection of selected breeding areas or enforcement of close season would increase fish stocks in Kariba, or whether these depend mainly on the inflows and levels of nutrients.

Credit

Credit has been identified as the means by which some farmers have already partially recovered from the drought situation. However, credit entails risk; if the rains had again been bad, such farmers would merely have increased their debt. Credit will become a safer option in AEZ I only after farmers have adopted agricultural techniques which make more use of available rainfall. Credit at present is also risky because no-one is quite sure how prices will behave in the marketing situation. Hence, while credit should be available on commercial terms, as a contract between borrowers and lenders who have weighed up the risks, we do not feel that it should be pushed, at least until the new marketing system has had a chance to settle down. It will be better to make inputs such as seed as available as possible, and perhaps for NGOs to set up systems of assistance for the really needy. Once the marketing situation has stabilised, it may be feasible to service group-based credit schemes, in which members, who know each other, guarantee each other, as in the Grameen Bank scheme in Bangladesh.

Well functioning government services and self-help

The drought illustrated harshly the deteriorated efficiency of central and local government, caused by many years over which operation and maintenance budgets had been reduced proportionally more than staffing levels. Services which cannot cope with the normal cannot be expected to function well in an emergency. This is a large and difficult subject, which cannot be covered by a report such as this. However, there are certain issues which the Government needs to consider, in relation to the reform of both local authorities and central services, and the encouragement of the spirit of self-help which is beginning to be manifested by families and communities. These are:

- Improving the budgeting and disbursement process, so that what operational and development funds that exist are available from the beginning of the financial year.
- Planning for a greater contribution to costs by beneficiaries; however, control of revolving funds needs to be kept as local as possible; funds passed over to the central treasury are rarely available for the operation and maintenance of the service which generated them.
- Keeping a balance between personnel costs and the operation and maintenance funds with which staff can perform their tasks.

Above all, it is necessary to build on the two positive legacies of the drought; the increased realisation by farmers that their agricultural systems need adaptation and that this depends on their own choices of techniques and effort, and that communities can manage some of their own welfare and infrastructural needs. Development and improvement in the environment and welfare can only be built through building on the special advantages of respectively, individual effort, community and local government management and central government expertise and resources, trying to avoid overloading any one component of the national system.

Annex 1

People met and schedule of visits

LUSAKA

Ministry of the Environment and Natural Resources

Mr T.J. Ngwane	Acting Permanent Secretary
Dr P. Chipungu	Executive Director, National Environmental Council

Ministry of Agriculture, Food and Fisheries

Mr N. Mukutu	Permanent Secretary
Mrs L. Chisuta	Acting Permanent Secretary, Food Security Division
Ms R.K. Chungu	Acting Director of Agriculture
Mr A.K. Banda	Acting Director of Policy and Planning
Mr L.J. Mwale	Assistant Director of Agriculture (Extension)
Mr G.B. Phiri	Chief Agricultural Officer (Animal Husbandry)
Mr H.G. Mudenda	Director of Fisheries
Mr C. Maguswi	Fish Culturist
Mr J.M.C. Lupikisha	Fisheries Statistician
Dr P.G. Sinyangwe	Acting Director, Veterinary and Tsetse Control Services
Dr D. Mumba	Assistant Director, Tsetse Control

Ministry of Agriculture, Mount Makulu Research Station

Dr K. Munyinda	Assistant Director of Agriculture (Research)
Ms Margaret McEwan	ARPT, Nutritionist
Dr W. Mwale	Chief Agricultural Research Officer (maize breeding)
Mr I. Kaliangile	Chief Agricultural Research Officer (seed specialist)

Ministry of Energy and Water Development

Mr R.B. Khuti	Acting Director of Water Affairs
Mr D.E.M. Kyob	Senior Water Engineer
Mr S. Kangomba	Hydrogeologist
Mr N.B. Mwansa	Hydrogeologist

Minstry of Tourism

Mr A. Mwenya	Director of National Parks and Wildlife Service
Dr L. Saiwana	Acting Chief Wildlife Warden

Ministry of Communications and Transport

Mr S. Mwangala	Deputy Director, Meteorological Department
Mr W.K. Sakala	Hydrometeorologist, in charge of Rainfall Section, Meteorological Department
Mr Z.L. Mumba	Hydrometeorologist

Central Statistical Office

Professor B. Kiregyera	National Commission for Development Planning
Dr Joyce Kanyangwa	Nutritionist

Ministry of Health

Dr John Mbomena	MCH/FP specialist
Mr A.K. Luneta	National Food and Nutrition Commission

National Commission for Development Planning

Mr M.E. Longwe	Acting Permananent Secretary
Dr A. Magan	Projects Officer, UNICEF
Dr Guy Scott	Former Minister of Agriculture, Food and Fisheries
Mr K. Pushpanath	OXFAM Regional Representative
Mrs Freda Luhila	Co-ordinator, Programme against Malnutrition
Mr P. M. Chipulu	Project Co-ordinator, IFAD Small Holder Services Rehabilitation Project
Mr I. Moreithi	Acting Country Representative, World Bank
Dr T. Frankenberger	University of Arizona
Dr Graham Eele	Food Studies Institute, Oxford
Mr B. Thomsen	Programme Officer, Office of the FAO Representative in Zambia
Mr Brendan Rogers	Chargé d'Affaires, Embassy of Ireland
Ms Lucinda Bate	in charge of environmental issues
Mr Bradley J. Flam	FEWS Field Representative, Zambia, USAID Famine Early Warning System Project
Mr John Foster	USAID
Mr Harry Houck	USAID
Mr C.F.G. Mukosa	Chief Engineer, Hydrology, Zambia Electricity Supply Corporation

Mr Mark Henderson	Project Officer (WES), UNICEF
Ms Petra Dauschek	Office Administrator, GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit)
Mr Bernard Chisanga	Chief Executive, Zambia Confederation of Industries and Chambers of Commerce
Professor V. Seshamane	Department of Economics, University of Zambia
Mr E.N. Chidumayo	Lecturer, Biology Department, University of Zambia
Mr Kasonde	Head of Water Resources Department, National Council for Scientific Research
Mr Pieter Gooren	Royal Netherlands Embassy
Ms Monique Calon	Royal Netherlands Embassy
Ms Carolyn Yetman	Junior Economist, Swedish Embassy
Ms Nusrat Hussein	Gender Specialist, Swedish Embassy
Mr Graham Farrell	TA, Food Aid, EEC Delegation
Mr E.M. Siamachoka	Zambezi River Authority
Mr Prang	SADC Regional Tsetse Control Project
Mr S. Mwape	Director, Wildlife Society
Mr M. Hammond	First Secretary, Development/Economic, British High Commission

EASTERN PROVINCE

Chipata

Mr A.B. Mulenga	Permanent Secretary, Office of the Minister for Eastern Province
Lt S.K.D. Mwape	Deputy Permanent Secretary, Office of the Minister for Eastern Province
Mr A.J. Mangisi	Acting Provincial Agricultural Officer
Mr A.M. Phiri	Provincial Natural Resources Officer
Mr E.B. Lungu	Acting Extension Training Officer
Mr L. Kaluba	Acting Animal Husbandry Officer
Mr J.C. Mutale	Provincial Fish Culturist
Mr M.N. Sishekanu	Provincial Co-ordinator Soil Conservation and Agro-Forestry Extension Programme (SCAFEP)
Ms Anna Karlson	Associate Expert, Soil Conservation (SCAFEP)
S.A. Ngoma	Senior Co-operatives Inspector
Ms Margaret Lungu	Chairperson, Chipata Drought and Disaster Relief Development Fund

Chipata District

Mr J.A. Phiri	Senior Ranger, National Parks and Wildlife Service
Mr G. Monta	HQ Ranger, National Parks and Wildlife Service
5 male and 16 female farmers	Luangeni village, Chipata, Chief Mpezeni (soil conservation pilot area)

Petauke District

Mr S.A.Kapunula	District Officer, LWF/Africa Drought Programme
Mr O.A. Moosa	District Water Engineer
Mr G.S. Chirwa	Wildlife Department
Mr D.H.E. Kasaro	District Forestry Officer
Mr C.S. Mundelela	District Natural Resources Officer
Mr M.M. Siwale	District Agricultural Officer
Dr J.C. Lubinga	District Veterinary Officer
Mr L. Luchinde	Council Secretary
8 farmers	Members of the Agro-Forestry Programme, Nyatuwondo village

Nyimba District

Mr N. Mukelabai*	Deputy Head, Nyimba Secondary School
Mr T.A. Mbuzi*	Assistant District Agricultural Officer
Mr T.A. Sakala*	Acting District Secretary, District Council
Mr P. Simukonda*	Clerk, Prisons Department
Mr N. Kokela	Senior Veterinary Assistant
Mrs A.K. Mphande*	Nurse, Nyimba District Hospital
Mr T.M. Nthani	Water Development Officer
Mr B.M.C. Chivubwe	District Agricultural Officer
Mr N. Mbewe	Council Secretary

Katete District

Mr G.S. Ndhlovu	District Agricultural Officer
Mr J. Mkandawire	District Livestock Officer
Mr M.P. Daka	Assistant District Agricultural Offier
Ms Stephania Mpatsihi	Women and Youth Programmes Officer
Mr W. Moyo	Water Development Officer
Mr P.S. Nkoma	Agricultural Information Officer

* Members of the Nyimba District Drought Relief and Development Group.

Mr A. Simwanza	District Agricultural Engineer
Mr C. Siame	Forestry Officer
Mr S.H.K. Chilambu	Zambia News Agency
Mr D.M. Banda	Deputy Council Secretary
Mr H. Banda	Farmer

Chadiza District

Mr F. Chitambala	Soil Conservation Officer, Department of Agriculture

Mambwe Sub-Boma

Mr M. Sakala	Chief Administrative Officer
Mr G.P. Chisi	Community Development Officer
Mr L. Nyendwa	District Agricultural Officer
Mr P. Zulu	Assistant District Agricultural Officer
Mr C. Mbewe	Farmer
Mr K. Kamulewe	Farmer

SOUTHERN PROVINCE

Choma

Mr B. Kalonga	Acting Provincial Agricultural Officer
Mr M. Sendoi	Acting Principal, Land Resettlement
Mr D.N. Nabuyanda	Provincial Fisheries Development Officer
Mr S. Phiri	Irrigation Engineer, Agriculture
Mr D.K. Niamwiza	Provincial Forest Officer
Mr J. Munnkombwe	Provincial Natural Resources Officer
Dr S.M. Minyoi	Provincial Veterinary Officer
Mr W.R. Wakumelo	Fish Culturist
Mr E.M. Nyowama	Agricultural Information Officer, NAIS
Mr D.M. Musonda	Irrigation Engineering Assistant
Mr C. Kalonga	Farm Management Officer
Mr N.S. Tembo	Agricultural Supervisor, Choma District
Mr D.C. Malambo	Agricultural Supervisor
48 male and 13 female farmers	Siakachamatanga village
Mr Dean Parry	Pharmacist, Macha Mission Hospital
Mr P. Green	Commercial farmer

Mazabuka District

Mr M.M. Beene	Acting District Agricultural Officer
Mr F. Sumali	Fisheries Assistant
Mr G.S. Masheka	Natural Resources Officer
Mr L.M. Mulele	Forestry Officer
Mr J. Musho	Livestock Officer
Mr G.S. Mbewe	Officer in charge, Water Affairs
Sister Mary Noel	Catholic Diocese Youth Programme
Mr A. N'handu	Council Secretary

Chikankata, Mazabuka District

Mr Aaron Siaziba	Farmer and restaurant keeper

Sinazongwe District

Mr K. Chiteta	District Agricultural Officer
Mr N.S. Tembo	Agricultural Superivisor
Mr B. Mwenya	Assistant Forestry Ranger, Forest Department
Mr M. Mutumba	Agricultural Information Officer
Mr C.C. Malimawa	Farm Management Officer
Mr V. Bwalinde	Fisheries Assistant
Mrs Z. Ngalande	Acting District Council Secretary
Mr R.F. Bredt	Gossner Mission

Monze District

Mr D.K. Masowe	Acting District Agricultural Officer
Dr B. Chitalu	District Veterinary Officer
Mr H.C. Mutinta	Animal Husbandry Officer
Mr Redson Sialwindi	Agricultural Supervisor (crops)
Ms Milimo M. Chiboola	Women and Youth Extension Officer
Mr B. Sinyangwe	District Forest Officer
Mr H.C. Chiinzila	Water Development Officer
Mr E.H. Michello	Co-ordinator, Monze Diocese Agricultural Programme
Mr E. Maanya	Agricultural Advisor, Monze Diocese
Ms M. Evalisto	Agricultural Advisor, Monze Diocese
Mr A. Chuuka	Farmer
Mr L. Shalala	Agricultural Assistant

Siavonga District

Mr D. Hesselbach	Agricultural Adviser, Siavonga Agricultural Development Project
Mr P.C. Chiyanika	District Agricultural Officer
Mr J. Mungala	Assistant District Agricultural Officer
Mrs P.N. Pandwe	Senior Agricultural Assistant
Mr Y. Muliwana	Senior Agricultural Assistant
Mr J. Cheelo Senio	Agricultural Assistant
Mr D. Mwandila	Agricultural Assistant
M. Kabalata	Agricultural Assistant
Ms J. Manda	Depot Buyer, LINTCO
Mr C.K. Pandwe	Senior Agricultural Assistant
Mr H. Kapoko	Acting Area Manager, Siavonga District Co-operative and Marketing Union

1993 Schedule

9th-13th August	MT and RM*	Meetings in Lusaka
15th-19th August	MT and RM	Field visits to Southern Province, covering Mazabuka, Monze, Choma and Sinazongwe Districts
22nd-27th August	RM	Field visits to Eastern Province, covering Chipata, Katete, Chadiza, Petauke and Nyimbe Districts and Mambwe Sub-Boma
23rd-27th August	MT	Meetings in Lusaka; preliminary drafts
30th August	MT and RM	Meetings with various people in Lusaka; co-ordination of findings
31st August	MT and RM	Siavonga, Presentation of Preliminary Findings to a Workshop on Environmental Impact Assessment
1st September	MT and RM	Meeting with various people in Siavonga
2nd September	MT and RM	Discussion of draft report; debriefing with Mr Ngwane, Acting Permanent Secretary, Ministry of Environment and Natural Resources

* MT = Mary Tiffen; RM = R. Mulele.

Annex 2

Notes on meetings with farmers

Three interviews were held with groups of farmers, as well as some other meetings with individual farmers. In Siakachamatanga village, men and women farmers were interviewed separately. It is interesting to note the close agreement between them, with only some differences of emphasis. The women showed greater care for family food crops and were more concerned with the effects on the health of their children. Interviews were also held in Eastern Province, at a village in a soil conservation pilot area, which had, therefore, rather more help than under normal circumstances. Due to time constraints, we were dependent on local agricultural staff to arrange meetings at short notice. Their help, and that of the farmers, is much appreciated.

Thirteen female farmers, Siakachamatanga village, Choma District, Southern Province (with Mary Tiffen)

The leading speaker said that during the drought they had to sell possessions in order to buy seed before the yellow maize became available. The retained local seeds were eaten. When it came to planting, there was no money to buy seed, no loans, no retained seed. So on the little maize they planted they could not apply fertiliser. They had fed their families by selling vegetables from *dambo*.

Questioned further, she said that she had planted 100 kg hybrid maize seed before the drought and one bucket of local maize seed. This season she had been given 10 kg hybrid by PPM and had purchased 10 kg. She had no local seed left. In 1990-91, before the drought she had obtained a harvest which filled 21 Scotch carts; this year it filled 20 carts. She had put 66 bags in store and 54 were sold. She had got a loan for fertiliser. Follow up showed only six of the 13 women had got loans. A farmer without a loan, and no fertiliser, said she got only one Scotch cart, six bags, from 10 kg seed. She had a family of eight for whom this would not be enough. Those who had a good harvest would have cash to buy fertiliser next year. The rest would need loans.

One woman had retained half a bucket of local seed. One had bought one bucket. Normally, at onset of rains, hybrid maize is not available, so they plant local varieties, which will be germinating when the hybrid maize is delivered. The hybrid variety matures more quickly, and with greater consistency; every plant has a cob. Local varieties taste sweeter, are less subject to weevil attack and are heavier.

The main foods are maize grits for beer, and maize for *nshima*. They would like other foods. Groundnut and bean seed is always a problem. There was no milk because of Corridor Disease; this had caused a lot of mortality since 1987, leading to reduced

farming because of draft problem. They were not accustomed to hoeing. Only two of the 13 had husbands who now owned draft oxen. One had ploughed using a female and male. If the Government cannot continue free dipping, they would pay if they had to.

If Government inputs were more timely, farmers would be able to plough at a more appropriate time. Hiring a plough costs Kw 1,000/day. A bag of maize sold for Kw 5,300.

From June 1992 the *dambo* dried up. In 1991 there had been no such problems. With the onset of rains vegetable planting began again. Indeed, at the time of this interview the market was glutted.

Maize brings a higher income to the family, but vegetables are second and important for their regular cash. Some of the vegetable crop is used at home.

Water was a big problem during the drought. They had to dig in the *dambo* and it took a long time to collect sufficient water. Normally, they get water from the stream.

The yellow maize provided through FFW was enough to feed the family. They had three projects - road maintenance, school latrines and an extra ward at the clinic. They had supervisors who chose the projects, all of which were useful to the community.

Only one had a son who sent money.

The drought caused more weakness and illness amongst children.

The major drought effect was the loss of livestock. They had had to sell their pigs, chickens and goats to buy food. Therefore, poverty had increased. Normally, they retained groundnut seed, but they lost the crop in 1992 and now could not plant.

One lady had owned five pigs. She had problems feeding them during the drought. One died, and she sold the others off individually, until all four were gone.

Four had goats before the drought; five have goats now. Four had pigs before the drought; three have pigs now.

Soil fertility was declining, because of lack of kraal manure and no new land to open up for farming. They were taught to make contour ridges and this has helped retain both soil and water. It had a good effect.

Before the drought, they had been able to gather wild fruits. The drought did not kill trees, but reduced their fruiting. There was also defoliation.

Firewood collection was not a problem. They used more in the drought dry season because there was no maize stover. They did not sell firewood.

Before the drought they could fish in a stream. It has not yet recovered sufficiently for fish. The fish had been used as a relish, rather than for sale.

Mitigating droughts

The farmers said that without help they would die and that the Government must help. They were willing to plant more sorghum but lack of seed was a problem. PPM did not supply it. They would also have liked to plant other crops: beans, groundnuts, *bambara* and cotton, primarily for their own use, with any surplus used for sale. Before the drought only those with seed had planted beans. The main problem in enlarging the vegetable gardens was the cost and availability of fertiliser.

Council or NGO assistance is wanted for improvement of water supplies. It was difficult to prioritise between a dam and a borehole, they really needed both - a dam for livestock and a borehole for safe drinking water.

The drought alleviation measures had helped the community. The problem was that some of them had had bad yields in 1992-93. Therefore, some people would still need help to recover. Some could not last out until the next harvest.

Forty-eight male farmers, Siakachamatanga village (with Mr R. Mulele)

Crops

Less maize was planted in 1992/93 than in 1991/92 because of losses during the drought, and less cash available to purchase seed and fertilisers. However, yields were higher in 1992/93. For other crops, there were problems with seed availability. The sunflower area was also reduced, although seed was available.

Livestock

Corridor Disease was still a problem this year. Only a few span of oxen were available for draft. The farmers were unable to buy replacements because there was no cash and prices were high.

Food availability

Food stocks had been adequate before 1991. The FFW programme had helped in building roads, schools and a clinic. This year's harvest is good or adequate for some people. Cash needs have increased and There is no adequate market in the vicinity for vegetables, which limits the growing of vegetables. Despite delays in payment for produce marketed to the co-operative, the farmers thought that they were better off selling their maize to the co-operative than keeping it for sale at a later date. Normally there is high milk production during the rains (December to March) and a shortage in the dry season.

Sources of cash

There were more vegetable sales in 1991 than at the time of this interview because of water availability. Maize sales generated the most cash. In 1992 some farmers obtained cash from the sale of vegetables, chickens, pigs, goats, etc. In 1993 the farmers hoped to gain income from sales of maize, some vegetables and chickens. Not many have relatives in urban centres and only a few get assistance from relatives in times of drought.

Migration

There was no migration during the drought.

Sickness

Malaria was on the increase. The farmers had not noticed a drought effect.

Schooling

Schooling continued, although some children were delayed, due to lack of uniform.

Poverty

Poverty was increasing. Before the drought they would call 30% of families poor, now it was 70%. This was due to the drought, cattle rustling and Corridor Disease losses.

Environmental impact

Water

In 1992 and 1993, the streams dried early. They are normally dry in September-October. There are no dams nor government wells in this area. Villagers dug a few wells, but these are now drying up.

Soils

Soil fertility is declining. The problem has been in the supply of 'D mixture' with only 10% nitrogen instead of 'R mixture' with 20% nitrogen. The effect of the drought was indirect - inadequate moisture for crop growth. Erosion was a problem; contour ploughing did help and extension advice was useful.

Dambos

Most families have access to *dambo* for vegetable growing. They are being used more this year than during the drought. Other crops were not planted in *dambo* during the drought. Pests, especially aphids, are a problem on vegetables. With the growing use of *dambo* for vegetables, there is less good grass and water available to cattle.

Grazing land

Local grazing was not much affected in 1992. The same is true in 1993, although some areas near *dambos* are fenced off. The farmers did not move animals during the drought. Fires are not used to manage the bush or grazing land - only careless people create fires.

Status of the bush

A variety of fruits are collected from the bush and some were less abundant during the drought. Others fruited twice - November-December 1991 and March 1992. No trees died from drought. There was the normal amount of wood cutting during 1992. However, collecting firewood takes more time than it did five years ago, but this is not because of the drought. There is not much hunting now, but this is not drought-related.

Fishing

There is no fishing

Pests

The crops suffered from termites and cutworms in 1992, but only termites in 1993. Ticks are on the decrease because of stock dipping.

Remedies for drought

There should be dam construction by the Government and local people. Individuals are willing to work on well construction if supported by the Government or local authorities.

Sixteen female and five male farmers, Luangeno village, Chipata, Eastern Province, Chief Npeseni soil conservation pilot area (with Mr R. Mulele)

Crops

More hectares of crops were planted this year, on account of the extra help and services given, increased fertiliser, use of green manuring crops and soil enriching. Seed was available through PPM. Extra guidance resulted in an increase in maize yields. More hybrid maize than usual was planted, as other seed was mainly lost through drought. The 1993 harvest was enough for family food, but financial needs were greater in order to pay back loans. Vegetable availability was better this year.

Livestock

The farmers said that they had fewer cattle, but that they were looking better. The lack of water and grass reduced livestock condition, and they also had to make sales to raise cash. More milk was available this year. During the drought year, they had stopped milking.

Cash

The farmers main source of cash before December 1991 was the sale of crops, vegetables and livestock. In 1992 they depended on piece work and livestock sales. In 1993 they would earn cash from maize and livestock.

Social impact

Some people were assisted by urban relatives who sent money. No families left the village. Sickness and school attendance remained normal. The farmers thought that the number of poor families had increased from 20% to 50% during the drought.

Water was a problem during the drought and the dam was distant, but the situation improved during the rains. At the time of the interview the situation was not too bad, although some places that usually had water were dry. Streams dried up during February or March in 1992. In 1993 there was still water flowing. The area had two dams, both of which were completely dry during the drought. Now they had started to desilt them.

Soil fertility

The farmers noticed that fertility had decreased because of erosion, but there was no additional drought effect. They perceive the remedies as contouring, intercropping, using animal manure and planting vegetable beans and sunhemp, but they do not have any seed.

Other points

There is no fishing in the area. Army worm had been noted in the year after the drought.

Suggested remedies for a drought situation

Themselves

The farmers wish to diversify their crops and plant more sorghum, millet and cassava. To do this they require seeds.

Local authorities and churches

There were no suggestions relating to local authorities or churches, although some farmers thought that the churches favoured their own members.

Government

The Government should make seed available: cassava, sorghum, groundnut, beans, soya beans, sunhemp, peas, potatoes and rice.

Bibliography

ARPT (Adaptive Research Planning Team), Western Province. 1985. *The Commercial-crop based agricultural systems of Western Province (1980-1990 and beyond)*. Mongu, Zambia.

ARPT. 1992a. *Drought recovery assessment: Immediate requirements and medium term strategies (for drought-prone areas in Eastern, Lusaka, Southern and Western Provinces)*. Main Report and Area Reports conducted for IFAD SSRP. Project Co-ordinator P. Chipulu. Lusaka.

ARPT. 1992b. *Survey of selected aspects of land degradation in Katete District, Eastern Province, Zambia, "Nthaka Yatha"*. Lusaka.

ARPT. 1993a. *The economics of crop diversification in Western Province*. Mongu, Zambia.

ARPT. 1993b(i). *Fighting drought in the valley - a report of an informal survey in Gwembe South*. MAFF.

ARPT. 1993b(ii). *Report of an informal diagnostic survey of farming systems in Mapangazhya area, Mazabuka District, Southern Province*.

ARPT. 1993b(iii). *The farming systems of Mapanza block*. Report of an informal survey among small scale farmers of Mapanza in Choma District of Southern Province.

ARPT. 1993b(iv). *A farming systems study of smallholder farmers in Kaumba and Mujika camps of Monze East*.

ARPT. 1993b(v). *Namwala District Informal Survey Report*.

Banda, G. 1990. Adjusting to Adjustment in Zambia: Women's and Young People's responses to a changing economy. OXFAM Research Paper 4. Oxford.

Boserup, E. 1965. *The conditions of agricultural growth: The economics of agrarian change under population pressure*. Allen and Unwin, London. (Republished, Earthscan, 1993).

Chabala, C. and E. Sakufiwa. 1993. *Small-scale maize marketing, handling and storage in Zambia*. Report for IFAD Smallholder Services Rehabilitation Project. Lusaka.

Charman, J.A. 1990. The environment and the Kafue River. Paper presented at the Engineering Institute of Zambia Symposium on Environmental Management and the Engineering Industry. Zambia Consolidated Copper Mines.

Clarke, J.E. 1993. *Relief programme for drought stricken wildlife areas*. SADC wildlife project AAA.6.3.

CSO. 1981. *1980 Census of Population and Housing*. Lusaka.

CSO. 1990. *1990 Census of Population, Housing and Agriculture.* Lusaka.

CSO. 1992a. *Country Profile.* Lusaka.

CSO. 1992b. *1991-1992 Final Crop Forecast.* Lusaka.

CSO. 1992c. *Selected Socio-Economic Indicators, 1992.* Lusaka.

CSO. 1993. *Food security, nutrition and health monitoring system: Monthly report (from January 1993).*

CSO and UNICEF. 1992a. *Drought Impact Monitoring System in Zambia: Report of a pilot survey in Kalomo, Luangwa and Senanga Districts, June 1992.* Lusaka.

CSO and UNICEF. 1992b. *Report of a dissemination workshop on pilot survey on drought impact monitoring system.* Lusaka.

FAO. 1991. *Zambia. Comprehensive Agricultural Development and Food Security Programme.* Rome.

Foster, S.D. 1993. Maize production, drought and AIDS in Monze District, Zambia. *Health Policy and Planning* 8. pp. 342-354.

Gaisie, K., A.R. Cross and G. Nsemukila. 1993. *Demographic and Health Survey, 1992.* University of Zambia, CSO, and Demographic and Health Surveys Inc. Lusaka.

Geisler, G. 1992. Who is losing out? Structural Adjustment, Gender and the Agricultural sector in Zambia. *The Journal of Modern African Studies* Vol. 30, No. 1.

Government of the Republic of Zambia and IUCN. 1985. *The National Conservation Strategy for Zambia.* Gland, Switzerland.

Haggblade, S., P. Hazell and J. Brown. 1989. Farm-nonfarm linkage in rural sub-Saharan Africa. *World Development* Vol. 17, No. 8:1173-1202.

Hulme, M. 1993. A note on the incidence of drought in sub-Saharan Africa. Mimeograph. Paper for the Overseas Development Institute, London.

IFAD (International Fund for Agriculture and Development). 1993a. *General Identification Report.* Vols I - IV. Report 0425-ZA.

IUCN. 1992. *The IUCN Sahel Studies, 1991.* IUCN, Gland, Switzerland and Cambridge, UK.

JICA (Japan International Cooperation Agency). 1992. *The master plan study on hydrological observation systems of the major river systems in Zambia.* For the Republic of Zambia, Ministry of Energy and Water Development.

Jeffery, R.C.V., H.N. Chabwela, G. Howard and P.J. Dugan. 1991. *Managing the Wetlands of Kafue Flats and Bangweulu Basin.* IUCN, Gland, Switzerland.

Kobus. Newsletter of the Wildlife Conservation Society of Zambia, Lusaka. mimeo.

Kydd, J. 1988. Coffee after copper? Structural Adjustment, Liberalisation and Agriculture in Zambia. *The Journal of Modern African Studies* Vol. 26, No. 2.

Lendor International Ltd. 1993a. *Report on Z.C.F. Yellow Maize Management Project.* Week ending 23rd July 1993. Lusaka.

Lendor International Ltd. 1993b. *Report on Z.C.F. Yellow Maize Management Project.* Week ending 13th August 1993. Lusaka.

Lupisha, J.M.C. 1993. *1992 Fisheries Statistics.* Chilanga.

Luneta, A.K. 1993. Overview of the nutrition situation in Zambia. Paper presented at the Nutrition Project Planning Workshop, Barclays Bank Training Centre, Lusaka.

MacPherson, N.M., R. Lilja and M.M. Maimbolwa. 1992. Recommendations on the structure, function and technical requirements of the National Environmental Council, Zambia. Lusaka.

Masi, C. 1991. Simple analysis of rainfall data for assessing rainfall as a constraint to maize production in Choma District, Southern Province, Zambia. *Farming Systems Bulletin, Eastern and Southern Africa* 8. CIMMYT.

Middleton, T. 1993. Drought - Wildlife vs cattle. *Kobus* March 1993. Lusaka.

Ministry of Agriculture, Food and Fisheries (MAFF). 1992. *Final Crop Forecast, 1991/92.* Lusaka.

Ministry of Agriculture, Food and Fisheries (MAFF) and Central Statistical Office (CSO). 1993. *Final Crop Forecasts, 1992/93 season.* Early Warning Unit, Planning Division (MAFF) and Agricultural and Environment Division (CSO). Lusaka.

Ministry of Environment and Natural Resources. 1992. *Zambia's national report to UNCED, 1992.* Lusaka.

Monö, R. 1993. *Environmental Profile Zambia.* A study for SIDA.

Muchinda, M.R. 1992. On climatic change. *Crop Weather Bulletin* 16. Republic of Zambia Department of Meteorology, Lusaka.

Mukosa, C.F.G. 1993. Effect of the drought on the Kafue and Kariba power systems. Paper for the Seminar on Conservation of National Energy, 29 August, Kitwe.

National Commission for Development Planning, Lusaka and Directorate General for International Cooperation, The Hague. 1991. Western Province. Joint Zambia-Netherlands Programming Mission.

National Environmental Council and IUCN. 1992. *Zambia: Natural Resources Data Profile.* Lusaka.

National Environmental Council and IUCN. 1993. *Upper Zambezi Wetlands Resource Planning Project: Project Proposal.* Lusaka.

OXFAM. 1993. Various visits, drought file and tour reports, 1992-3. Lusaka.

PAM NEWS. 1993. *PAM NEWS* Vol. 1, No. 1, July 1993.

Parry, M.L., Carter, T.R. and Konijn, N.T. (Eds). *The impact of climatic variations on agriculture*, Vols 1 & 2. Kluwer Academic Publishers, Dordrecht, The Netherlands.

Programme against Malnutrition. 1993a. *End of Drought Report, June 1993*. Lusaka.

Programme against Malnutrition. 1993b. *Work Plan Post Drought Recovery Programme, 1993-1995*. Lusaka.

Report Formulation Mission. 1992. *Planning and Management of the Rural Development Programme, Western Province, Zambia*. Lusaka.

Ruthenberg, H. 1980. *Farming systems in the tropics*. Clarendon Press, Oxford.

SADCC. 1992. *Drought emergency in southern Africa (DESA)*. Situation Report, August 1992. No. 1.

SADCC Regional Early Warning Unit. 1992. *Food Security Quarterly Bulletin* 31 March 1992.

Sanyanga R.A., P. Jokonya and R. Chimanga. 1993. *1992 Fisheries statistics Lake Kariba - Zimbabwe shore*. Lake Kariba Fisheries Research Institute, Kariba. Project Report No. 73.

Serenje, W., E.N. Chidumayo, J.C. Chipuwa, H. Egneus and A. Ellegard. 1993. *Environmental Impact Assessment of the charcoal production and utilisation system in central Zambia*. Stockholm Environmental Institute. (Draft).

Sutton, S. 1992. *Report on immediate and medium term response to drought*. UNICEF, Lusaka.

Tiffen, M., M. Mortimore and F. Gichuki. 1994. *More people, less erosion: Environmental recovery in Kenya*. Wiley, Chichester, UK.

UNICEF. 1993. *Draft final report for Government of Finland contribution*. Lusaka.

University of Zambia, Gender Studies Unit. 1993. *Coping strategies of women during the 1992 drought and the impact of relief programmes on the position of women*. Gender Studies Unit May 1993. Lusaka.

World Bank. 1992. *Zambia Agricultural Sector Strategy: Issues and Options*. Washington.

Zambezi River Authority. 1992. *Annual Report and Accounts for the year ending June 1991*. Lusaka.

Zambia Early Warning Unit. 1991-1993. *The Food Security Bulletin*, and *Monthly Food Security Update* formerly *Quarterly Food Security Bulletin*. April-June 1991 to 1993.

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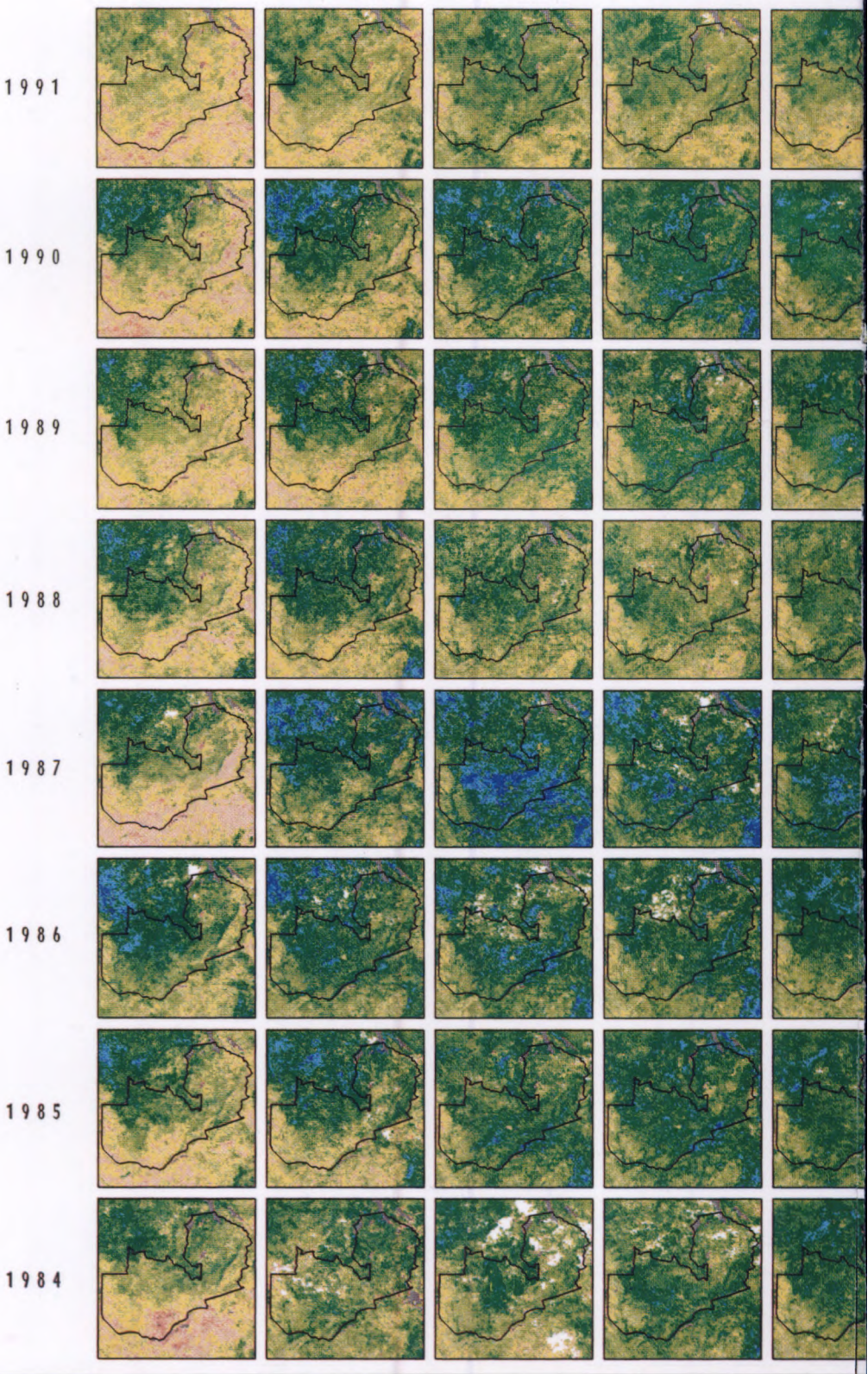

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