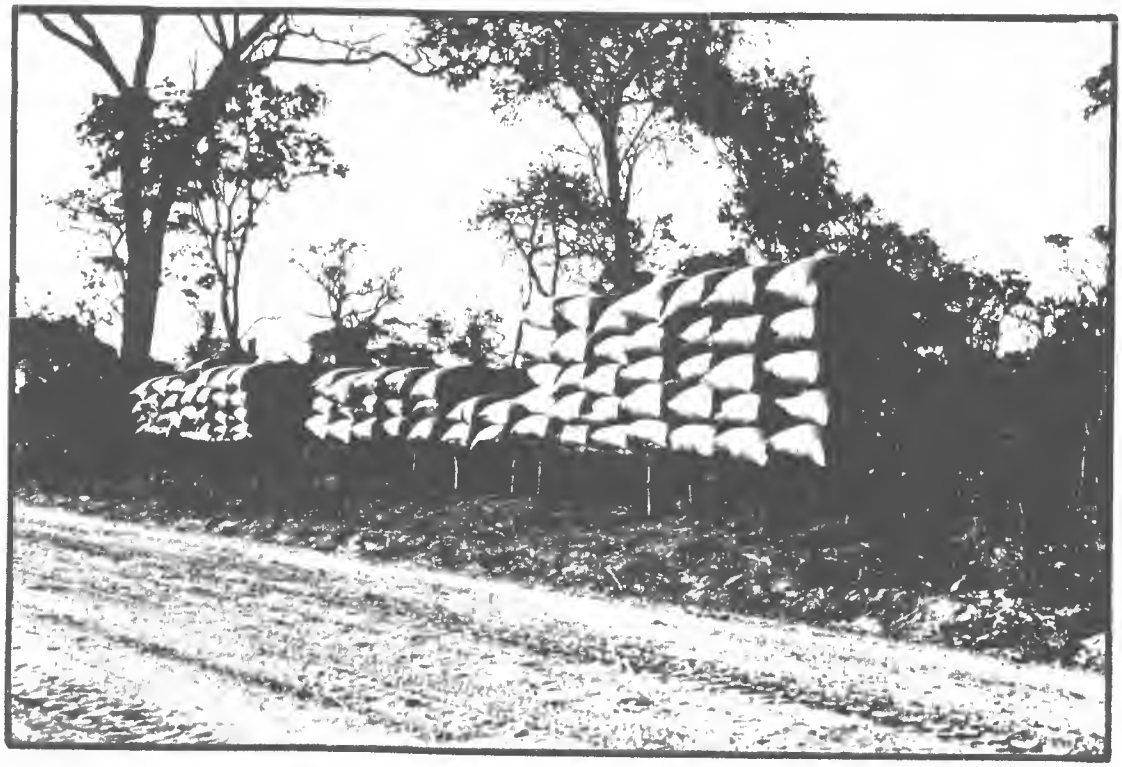
ENVIRONMENTAL EFFECTS OF AGRICULTURAL CHANGE AND DEVELOPMENT IN THE NORTHERN PROVINCE, ZAMBIA



A report prepared for

The Provincial Planning Unit, Northern Province
Government of the Republic of Zambia

and

The Norwegian Agency for International Development
(NORAD)

by

The Norwegian Centre for
International Agricultural Development
(NORAGRIC)

and

The International Union for the
Conservation of Nature and Natural Resources
(IUCN)

December 1989

ACKNOWLEDGEMENTS

This study is a modest contribution to the discussion on sustainable development strategies for the Northern Province of Zambia.

Based on an assessment of environmental effects of current land-use practices, the study presents options for improved resource management. Hopefully, the study will provide useful background information to people involved with environmental planning and management in the Province.

The study team would like to thank the many individuals who gave generously of their time during our interviews and fieldwork in Zambia in September and October 1989. We would like especially to thank the staff of the Provincial Planning Unit (PPU), Mr. Francis S. Lubinda, Chief Regional Planner, Mr. Mark Veitch, Monitoring and Evaluation Officer and Mr. Jacob Chisha, VAP District Coordinator. We are also grateful for the assistance provided by Dr. Thor Larsen, Assistant Resident Representative, NORAD, Lusaka.

The team would like to acknowledge the input made by Ms. Nancy MacPherson in graphic design (front page and chapter dividers), by Mr. George Chileshe, Ms. Nina Sandok and Ms. Liv Finborud in drawing maps, and by C.A.M. Attwell, IUCN for all photos.

The team would also like to acknowledge the comments and contributions to the report by the staff of NORAGRIC, especially those of Dr. Bal Ram Singh.

Finally, special thanks are due to Per Bratterud and Johnny Valen, NORAGRIC in charge of the computers and word processing facilities, and Chris Ennals for language editing, who helped us finish the report.

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ACRONYMS

ADMADE	Administrative Management Design for Game Management Areas
AFC	Agricultural Finance Company
ARPT	Adaptive Research Planning Team
CSO	Central Statisctics Office
DAO	District Agriculture Officer
DCSP	District Council Support Programme
DC	District Council
DDSP	Mpika District Development Support Programme
DES	District Executive Secretary
DNPWS	Department of National Parks and Wildlife Service
EEC	European Economic Community
EFPF	Economic and Financial Policy Framework
EIA	Environmental Impact Assessment
ETP	Extension Training Project
FNDP	Fourth National Develoment Plan
FTC	Farmer Training Centre
GDP	Gross Domestic Product
GMA	Game Management Area
GRZ	Government of the Republic of Zambia
IDZ	Intensive Development Zone
IMF	International Monetary Fund
IRDP	Integrated Rural Development Programme
ISNAR	International Service for National Agricultural Research
IUCN	The International Union for the Conservation of Nature and Natural Resources
LINTCO	Lint Company of Zambia
LIRDP	Luangwa Integrated Resource Development Project
MAWD	Ministry of Agriculture and Water Development
MCC	Member of the Central Committee
MLNR	Ministry of Lands and Natural Resources
NAMBOARD	National Agricultural Marketing Board
NATCO	National Tobacco Company
NCC	National Conservation Committee
NCDP	National Commission for Development Planning
NCS	National Conservation Strategy
NCU	Northern Co-operative Union
NEC	National Environment Council

NERP	New Economic Recovery Programme
NGO	Non Governmental Organization
NORAD	Norwegian Agency for International Development
NORAGRIC	The Norwegian Centre for International Agricultural Development
NP	Northern Province
ODA	Overseas Development Administration (United Kingdom)
PAO	Provincial Agriculture Officer
PPU	Provincial Planning Unit
PS	Permanent Secretary
PSNP	Permanent Secretary Northern Province
RDSB	Rural Development Studies Bureau
SIDA	Swedish International Development Agency
SPRP	Soil Productivity Research Program
UNIP	United National Independence Party
UNZA	University of Zambia
VAP	Village Agricultural Programme
WAP	Ward Agricutural Programme
ZCF/FS	Zambia Cooperative Federation, Finance Services Ltd.
ZAMSEED	Zambian Seed Company

PHOTOS

Cover photo:	Harvested maize awaiting collection in Northern Province, Zambia.
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Photo credits - All photos: Dr. C.A.M. Attwell, IUCN

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Chapter 1:

INTRODUCTION

1. INTRODUCTION

1.1 OBJECTIVES AND TERMS OF REFERENCE

This report was commissioned by the Provincial Planning Unit (PPU) of the Northern Province, Government of the Republic of Zambia and the Norwegian Agency for International Development (NORAD).

The major objective of the study was to investigate the long term environmental effects of expanding agricultural production and other use of natural resources in the Northern Province (NP) of Zambia, and in particular to identify potential problems related to current agricultural development policies and practices.

The study was undertaken by the Norwegian Centre for International Agricultural Development (NORAGRIC) in conjunction with the International Union for the Conservation of Nature and Natural Resources (IUCN) during a three month period from September to November 1989.

The terms of reference for the study required a broadly based environmental assessment to be undertaken (Appendix 7). However, at the outset of fieldwork in the NP in October 1989, the study team, in conjunction with the PPU, redefined the terms of reference of the study so as to focus on the following issues:

* problems related to possible degradation of the natural resource base due to changes in land use and resource utilization;

* problems related to soil deterioration and possible reduction of biological productivity;

* problems related to ability of forest resources to meet present and future requirements for agricultural purposes, construction and/or fuel;

* capacity of the resource base to meet the needs of a growing population, on a sustainable basis;

* actual or potential conflicts in resource utilization;

Based on a survey of the environmental status of the NP the study team was to advise both PPU and NORAD on the following:

* current policies or practices which are likely to have an adverse effect on the environment;

* measures for improved management and conservation of the environment and the resource base including soil, water, wildlife, forestry, fish;

* means of monitoring the long term environmental effects of government policies and programmes;

* the means by which the National Conservation Strategy (NCS) could be decentralized to the NP;

* the development of an Environmental Profile for the NP to assist in long term development planning and sustainable resource use.

It should be noted that the terms of reference excluded any detailed inventory of species of flora and fauna; problems of water-borne diseases; the actual preparation of an environmental profile for the NP; environmental problems of urban and peri-urban areas and the provision of water and sewage services for such areas; and recommendations for raising public awareness of environmental issues.

1.2 METHODS

For this study NORAGRIC and IUCN considered the following elements essential to carrying out the work necessary to meet the terms of reference:

* a multi disciplinary study team, with expertise in soil science, natural resources management, forestry, wildlife and fisheries management, environmental planning and policy, socio-economic; and farming systems;

* library and research support from NORAGRIC;

* close working relationship with members of the PPU, Northern Province.

The study team was composed of the following individuals from NORAGRIC, the International Union for the Conservation of Nature and Natural Resources (IUCN) and the University of Zambia (UNZA):

Trond Vedeld, Natural Resource Planner, Team Leader, NORAGRIC
Emmanuel Chidumayo, Plant Ecologist, University of Zambia
Colin Murphy, Farming Systems Researcher, NORAGRIC
Jon Gisle Vikan, Soil Scientist, NORAGRIC
Charles Attwell, Animal Ecologist, IUCN
Nancy MacPherson, Environmental Planner, IUCN
Jacob Chisha, VAP District Coordinator (team associate), Kaputa

Francis S. Lubinda, Chief Regional Planner and Mike Veitch, Monitoring and Evaluation Officer with the Provincial Planning Unit, NP provided assistance to the study team during the field work in Zambia. Bal Ram Singh, Senior Soil Researcher, Agricultural University of Norway, assisted in reviewing soil related aspects of the study.

The study team undertook the following:

* literature review at NORAGRIC in Aas, Norway for two weeks;

* interviews during October and November, 1989 in Lusaka and the Northern Province with key persons involved in natural resource management and agricultural development in Zambia and the NP (see Appendix 2);

* review of GRZ departmental reports from the Ministries of Agriculture, Lands, Natural Resources and Water, National Parks and Wildlife, Forestry, PPU, NCDP, parastatals and NGOs;

* field visits to research stations and demonstration projects ranging from agricultural production through wildlife, fisheries, forestry and small scale industrial development located in districts throughout the NP;

* informal working sessions with key individuals involved in agricultural and natural resource development in the NP;

* reporting seminar at the conclusion of the mission with key officials in the NP.

The study team was not required to undertake any primary data collection throughout the study, but was restricted to existing data sources.

1.3 DATA RELIABILITY

Throughout the study, the team was constrained by the lack of quantitative data, particularly on various environmental effects of present natural resource utilisation. Hardly any aggregate data at provincial level exist. Information on the status of a particular resource (e.g. fish, game animals) is particularly scanty. Fairly good socio-economic data exist on agriculture, but no data were available on total land under cultivation. Data on other sectors are poor or at best piecemeal. The monitoring, survey and evaluation work carried out by Mpika District Development Support Programme (DDSP; formerly IRDP) and Adaptive Research Planning Team (ARPT) Kasama have provided valuable information on various aspects of agriculture. The Soil Productivity Research Programme (SPRP) Misamfu, has provided essential knowledge on the sustainability of various technological options for improving farming systems in the NP.

The reliability of various data used in this report is hard to assess. Errors might stem from biased sampling procedures, ill-devised questionnaires, incorrect recordings by enumerators or fieldstaff. Inferences about the rural population based on small samples and without supportive research findings are particularly doubtful. The use of unreliable data-sources and lack of research data on environmental issues in the NP must be kept in mind while reading this report.

1.4 AGRICULTURAL DEVELOPMENT AND ENVIRONMENTAL ISSUES IN THE NORTHERN PROVINCE: AN OVERVIEW

Historically the major environmental issue linked to agriculture and resource use in the NP has been accelerating deforestation due to the extensive practice of chitemene, a shifting cultivation practice whereby the products of burnt branches are used to enrich soil fertility. Already under colonial administration, concerns were raised over long term effects of deforestation on land productivity and depletion of wildlife resources.

It is widely accepted that only a transition to more permanent and less extensive cultivation systems would counter this deforestation. Different strategies have been tried in the past to encourage transitions to more permanent farming systems in order to reduce deforestation. These strategies have met little success. Chitemene is still a dominant cultivation system in the province and is practised by about fifty percent of the rural households. If current trends in chitemene cultivation continue, a complete deforestation of the province may occur in a few decades.

Relatively independent of outside initiatives to encourage agricultural change, gradual transitions to more permanent systems of agriculture have taken place in certain areas. Such transitions were first reported in the northeastern areas of the province (Mambwe area), where forest biomass for chitemene became scarce due to increasing population pressures (Allan, 1967; Mansfield et al., 1975-76; Schultz, 1976; Trapnell, 1953; Watson, 1958). More recent studies have identified similar transitions in other areas of the NP (Strømgaard, 1989).

Over the past 10-15 years the government has promoted hybrid-maize cultivation with fertilizer use as a core component of agricultural development in the NP. The production achievements in this regard have been impressive. Maize sales to the Northern Cooperative Union (NCU) have increased from 205 000 bags in 1978 to 1 760 000 in 1988. This represents an increase of more than 850%, compared to the national average for the same period of approximately 50%. The NP now produces about 11% of total marketed maize in Zambia. As many as 50% of farm households may be involved in hybrid-maize production. About 70 000 farmers in the NP delivered maize for sale in 1988.

The effects of this "maize programme" on land-use have been dramatic: most of the production increase is due to expansion in the area under maize cultivation. Total area under maize cultivation is now about 100 000 hectares. The programme has had major implications for food consumption patterns, food security, income and living standards in the rural areas.

The maize programme in the NP has been analyzed and criticised from a variety of perspectives. Underlying the debate are differences in views of what "development" is, as well as what strategies are considered most efficient in stimulating the process of "sustainable development".

The debate has centred around three major issues:

i) Equity and poverty alleviation.

In spite of its small-scale farmer orientation (relative to the large-scale commercial farmers along the "line of rail"), the maize programme has been criticised for not being sufficiently adapted to meet the needs of the poorer farmers in the NP. It is argued that more could be done to reach the majority of people including women and less advantaged rural producers such as women. Some have argued that the increased maize production has increased neither household food stocks nor rural food supplies (Sharpe, 1988). Others (Appelton et.al, 1989) have associated the maize programme with decreased nutritional standards in some households and increased income differences between farmers. Finally, the preoccupation with the maize programme may have resulted less government support for development of other natural resources such as forests, fisheries and wildlife. Overall, the biased focus by the government on the maize programme as its core component for development may have accentuated inequalities in the NP between households as well as districts.

ii) Economic sustainability.

GRZ objectives for the agricultural sector include the achievement of self-sufficiency in the production of major foodstuffs, particularly maize, cassava and sorghum. The maize programme in the Northern Province has, however, been criticised for being too dependent on government subsidies within a costly marketing system. Hence, the financial cost to the government of maize production in the NP is high (ARPT, 1988c).

Moreover, the maize programme has become donor dependent in terms of technical assistance and financial support for investments and running costs. It is argued that the government may not be able to maintain the social and physical infrastructure and sustain the development activities when the donors phase out. In addition, profit margins at farm level have been low, risks of failures high and sustainable increases in income for most farmers have been hard to document (Masdar Ltd, 1989).

iii) Environmental management.

The environmental effects of chitemene cultivation have already been mentioned. A new concern has, however, been raised as a consequence of the expansion in maize cultivation. Due to low inherent soil fertility, continuous maize-cropping with fertilizer use may lead to irreversible soil depletion. It is, furthermore, questionable whether the increase in maize cultivation has had any significant effect on chitemene cultivation and the rate of deforestation (Sano, 1989). In areas where the woodland resource is still adequate, farmers who have adopted maize cultivation appear to continue practising chitemene.

A main focus of this study is to analyse these issues from a perspective of sustainable agricultural development in the NP.

Major attention will, however, also be accorded to the use of natural resources such as forests, wild plants, wildlife, and fish. These resources form an important and integral part of the farming systems in the NP and urgent measures are needed to prevent further degradation of these resources.

The study, furthermore, recognises the importance of off-farm activities in the farming systems. According to one survey, activities such as trading, beer breving, fishing, piecework of some sort, and small-scale manufacturing contribute on average 43% of total household income (ARPT, 1988a).

A basic assumption throughout the study is that the promotion of sustainable agricultural development and resource use in NP is linked to environmental protection and the alleviation of poverty. Policies, programmes and institutional mechanisms in these areas must therefore be mutually supportive.

This study sets out: an overview of the resource base of the NP including a brief description of present land use practices; an assessment of the environmental effects of these land use practices; and recommendations for programme, policy and institutional options for improved resource management which would contribute to both sustainable agricultural development and to the protection of natural resources and ecosystems in the NP.

An important theme of the study is that strategies for sustainable development must be formulated through the active participation of local people and be based on people's needs, knowledge and skills.

Chapter 2:

ENVIRONMENTAL OVERVIEW OF THE NORTHERN PROVINCE

2. ENVIRONMENTAL OVERVIEW OF THE NORTHERN PROVINCE

2.1 THE RESOURCE BASE OF NP

2.1.1 Background: ARPT - zone system

The resource base of the NP is here described with reference to zones identified by ARPT (1986a) for farming system research purposes. The approach taken for delimiting these zones involved identifying the main influences on farming throughout the Province and establishing areas within which these influences and their resultant farming systems are relatively homogeneous. Both agro-ecological and socio-economic parameters were used in this process.

Influences were assessed in two stages. Firstly it was decided which "external" influences (i.e. those outside the control of farmers) give rise to agriculturally significant differences in farming conditions. Among the factors considered were climate, duration of growing season, insolation, soils and other physical factors; socio-economic considerations included important customary factors, e.g. traditional cattle ownership, population density, and market access.

These classification criteria resulted in the following zones:

* Zone 1: The Lakes Depression (Kaputa) - an isolated cassava/fish system covering Kaputa and part of Mbala Districts.

* Zone 2: The Central Plateau (Kasama/Mpika) - traditionally a chitemene based, finger millet/bean cropping system; with increasing land pressure and better market opportunities this has become an important maize producing area.

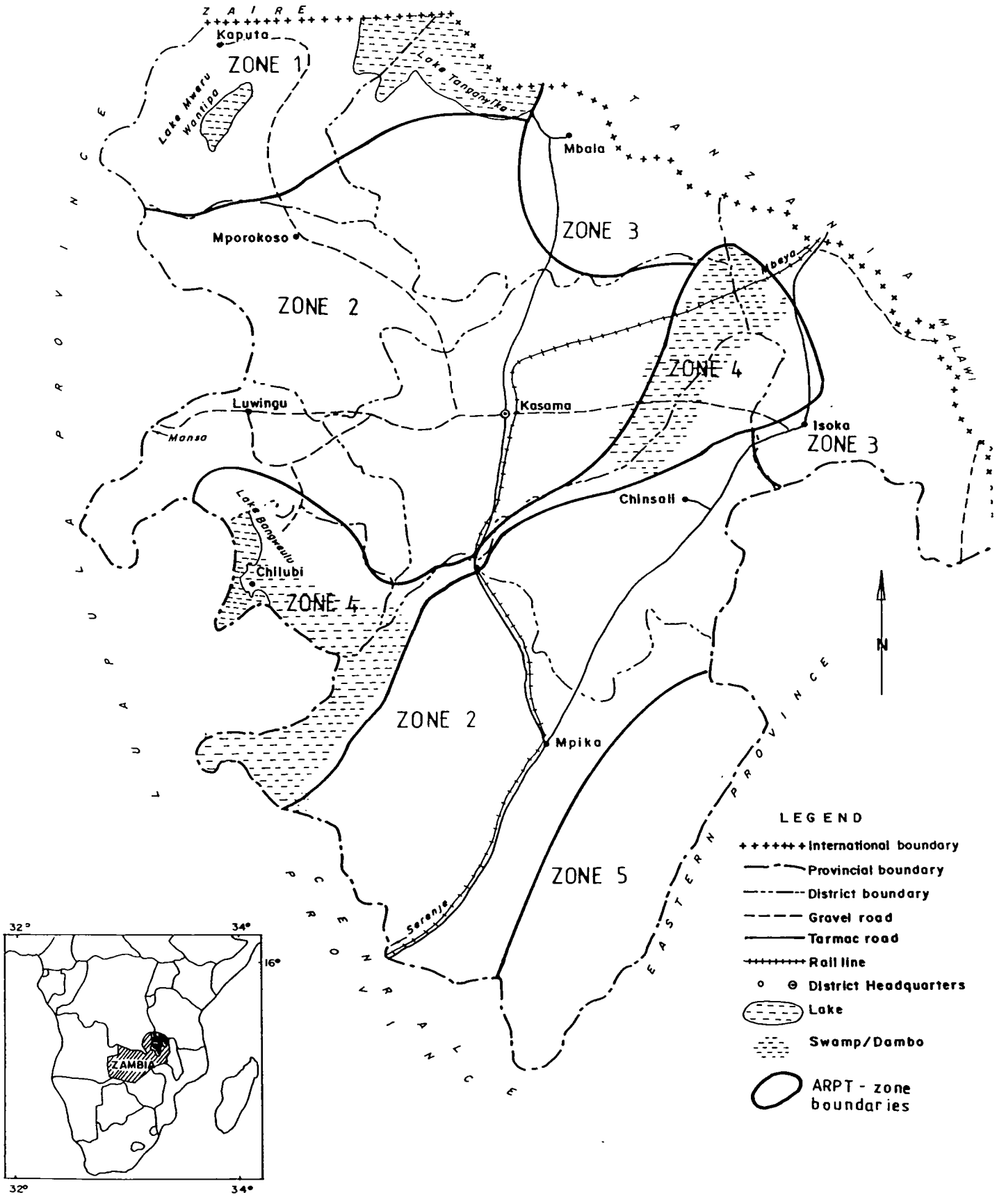
* Zone 3: The North Eastern Plateau (Mbala/Isoka) - a highly productive maize/cassava/finger millet cropping system based on increasingly permanent land-use methods, with a tradition of cattle keeping.

* Zone 4: The Chambeshi Bangweulu Floodplains - a predominantly cassava/fish system, located on the perennially waterlogged areas surrounding the Chambeshi River and Lake Bangweulu; rice is an increasingly important cash crop.

* Zone 5: Luangwa Valley - a largely sorghum based system located in the much drier area found in the descent into the Luangwa Valley.

Secondly, farmers within each of the five zones were divided into commercial hierarchies, as a reflection of their internal circumstances. This was estimated using maize sales to NCU as a proxy measure of commercialization (Section 3.2 'Farmers Profiles' provides further information on socio-economic characteristics for farmers by zone. The delimitation of the zones is presented in Map 2.2.

A R P T - Z O N E S



APPROX. SCALE 1: 3,30,0000

2.1.2 Geographical location and infrastructure

The NP of Zambia is approximately 148 000 km^2. It is the largest province in Zambia, and covers 20% of the country. The province is divided into 10 districts and 300 wards (the smallest administrative units). The location within Zambia and Africa is indicated in Map 2.1. Mwali et al. (1989) recorded 1000 km of tarred roads, 2000 km of all-weather gravel roads, and 5000 km (dirt) feeder roads within the Province. Some of the dirt roads may be difficult to pass during the wet season. The distance by road from Kasama to Lusaka is 880 km, and to the coast from Kasama to Dar-es-Salaam approximately 1100 km.

The Tazara railway running north-south through the Province links Kapiri Mposhi to the coast at Dar-es-Salaam. Other important infrastructural features are regular air connections from Kasama / Kasaba Bay to Lusaka and the Copperbelt. There is also at least one small airstrip in each district.

Settlement patterns are associated with both infrastructure (roads, railways) and social services (schools, health services, shops etc.). In turn, population density is related to various resource use problems (e.g. deforestation, soil deterioration, overfishing) which are discussed in Section 5.

2.1.3 Physical features

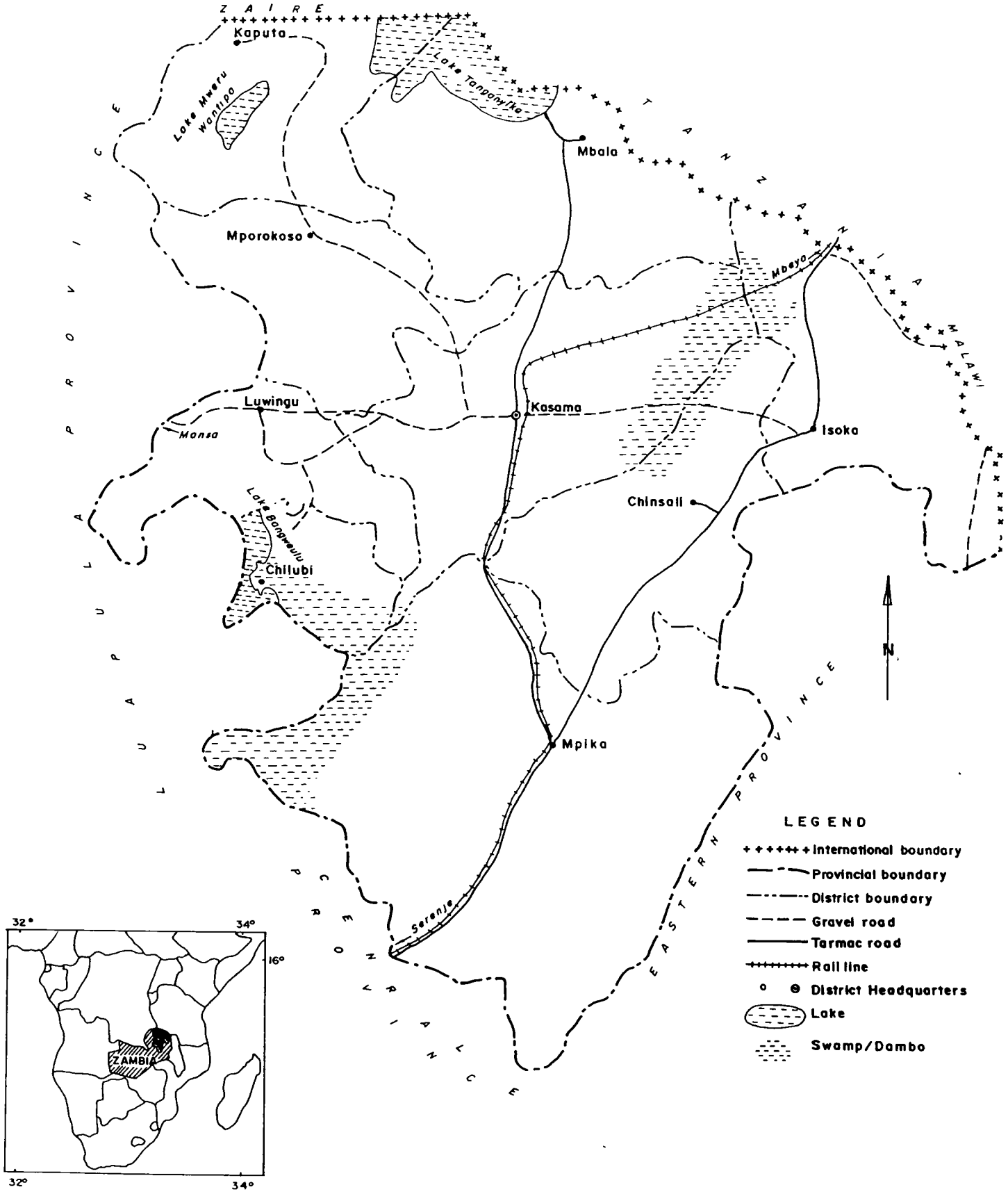
2.1.3.1 Climate

Most of the NP is within a high rainfall zone, receiving on average more than 1000 mm of precipitation per year. The rainy season lasts from November until March/April. The main agro-climatological features are reliability of rainfall, erosivity, drought, frost, length of the growing season and average sunshine hours in the rainy season. Some of these features are summarised in Table 2.1.

TABLE 2.1 Meteorological determinants of ARPT Zones in the Northern Province Data from ARPT (1986).

Zone	Mean Rain fall (mm)	Rain-fall relia-bility	Drought risk (days during rainy season)	No.of rain days	Length of growing season	Frost risk (gr.season)	Sun-shine hours
1 Kaputa	800-1000	low-moderate	moderate 10-20	70-100	150-170	none	700-850
2 Kasama-Mpika	1000-1600	high	none	80-130	140-200	none	below 700-840
3 Mbala-Isoka	900-1200	high	none	80-120	140-170	none	below 700-850
4 Chambeshi-Bangweulu	1000-1300	high	none	90-110	150-160	none	700-more than 850
5 Luangwa	750-1000	low	high 40-50	below 80	90-140	none	more than 850

LOCATION MAP THE NORTHERN PROVINCE, ZAMBIA



APPROX. SCALE 1: 3,30,0000

i) Rainfall

Severe drought may occur at least once every ten years, and severe drought during two consecutive seasons may happen every 30 years (Simango and Das, 1977). This occurred previously in 1953 and 1954. Severe drought in parts of the NP (zone 1 and 3) may occur once every two years. During the period 1940-70, serious drought was experienced only during 9 out of 30 years.

The rainfall distribution generally shows a unimodal pattern in ARPT-Zones 1, 2 and 4. Zones 1 and 3 have a tendency towards a bimodal rainfall distribution, with December and March as the rainfall peaks. This also influences the occurrence of dry spells during the rainy season. Dry spells exceeding ten days in January and February occur twice as often in Mbala as in Mpika (Dept. of Meteorology, 1970).

Generally, rainfall over most of the NP is more reliable than in the southern and central parts of Zambia. The high and reliable rainfall is a major asset for rain-fed agriculture.

Rainfall erosivity for storms is high in Kasama district (Lenvain, 1983), with consequent erosion potential. During the 1978/79 rainy season, there were three storms with an intensity of 50 mm of rain or more within one hour.

ii) Temperature.

The overall temperature range (5-14°C) is relatively limited within the NP (ARPT, 1986). Minimum temperatures are higher in the north-western part of the NP (Zone 1), but frost has not been recorded, and temperatures during the growing season do not seem to be a constraint for agricultural production.

iii) Sunshine hours.

The potential yield of most crops is restricted when the number of sunshine hours during the growing season falls below 700 (Hutchinson, 1974). There is a high rainfall belt covering western Mbala and northwestern Luwingu districts where levels of sunshine are below 700 hours. For the remainder of the NP, agricultural yield potential is not, or is only slightly, restricted by the lack of sunshine during the growing season.

iv) Length of the growing season.

This parameter is defined as the length of the growing period (based on soil moisture availability) that can be expected for seven years out of ten (Veldkamp, 1987a). Most of the NP falls within the range from 140 to 170 days for the growing season, which is sufficient for most rain-fed crops.

2.1.3.2 Topography

The main topographic features are summarised in Table 2.2, which relates them to the ARPT-zones.

Table 2.2 **Topographical Features of the Northern Province. Data from ARPT (1986) and Mansfield et al. (1975-76).**

ARPT-Zone	Dominant topography	Altitude (m)	Slope (modal) (°)	Mean rel. relief (m)	Dambo frequency per km^2
Kaputu-Zone 1	lakes plateau escarpment	900-1200	1-4	20-80	0.2-0.6
Kasama-Mpika Zone 2	gently undulating plateau	1200-1600	1-2	20-40	0.15-0.25
Mbala-Isoka Zone 3	undulating plateau	1000-2000	2-6	20 to more than 100	0.5-1.2
Chambeshi-Bangweulu Zone 4	floodplain, swamps	1000-1200	<1	<20	0.6-1.5
Luangwa Zone 5	valley escarpment	500-1200	1-more than 6	20 to more than 100	0.6-1.5

The NP is part of an ancient planation surface of the Central African Plateau (Mansfield et al., 1975-76). The highest feature (Sunzu, 2067m) is situated near Mbala , while the majority of the province consists of a gently undulating plateau between 1200 and 1700m.

The main physiographic features as described by ARPT (1986) are: The Lakes Depression (Zone 1) which includes Lake Tanganyika and the Lake Mweru Basin in the north. Neither of these lakes has any outlet. The depression is a continuation of the large Central African Rift running through East Africa from north to south. The rift drops almost 1000m down from Mbala at the western part of Mbala-Isoka (Zone 3). The Zone 3 plateau is more dissected than the gently undulating Central Plateau (Zone 2), which covers the largest part of the province. The Chambeshi floodplains and the Bangweulu swamps (Zone 4) are level plains at an altitude of 1000m. The Luangwa valley (Zone 5) is separated from the rest of the NP by the Muchinga Hills and escarpment. The valley floor lies at 500-700m and is fairly level, dissected only by some erosion gullies, created by seasonal streams flowing into the tributaries of the Luangwa River.
Topography is clearly a major factor in arable potential.

2.1.3.3 Water resources and drainage

There are three main river systems draining the Province. The Luangwa River (the catchment area in the NP is 28,400 km^2) drains the eastern part of the Province into the Zambezi River system. This drainage area is divided by a watershed, along which the Great North Road runs, as far as the Chambeshi River system (catchment area in NP is 88,500 km^2). The Chambeshi drains the whole of the central part of the Province into the large Bangweulu Swamps (5,000 km^2), which are themselves drained by the Luapula River. Three smaller catchment areas are found in the north-east, where the Lufulu River (catchment area 15,000 km^2) drains into Lake Tanganyika. This lake has no outlet, neither do Lake Mweru-Wa-Ntipa and the associated swamps which form a

basin (3,500 km^2) towards the Zairian border. The north-western part of the NP drains directly into Lake Mweru via the Kalunwishi River. (Catchment area 12,500 km^2).

The plateau areas are drained through seasonally waterlogged incisions (dambos). The patterns and frequency of these features are described in detail by Mansfield et al. (1975-76). The most common dambo frequency is one every 10-30 km^2 with widths of 200-800 metres. The widest dambos are 5-8 km wide.

Dambos are particularly prevalent in miombo woodland, and are usually associated with bedrock of the Basement Complex, which covers much of the NP. Various types of dambos have been identified (headwater dambos, slope dambos, hanging dambos, river dambos). However, all are found on stable land surfaces of gently undulating plains with convex slopes like the plateau areas of the NP.

Dambos play a major part in the ecology of the NP. They are important in the water balance, acting like sponges for the release of water into perennial rivers/streams during the dry season.

2.1.3.4 Geology and soils

Soils are a product of parent material, relief, time, vegetation, climate and human influence. The most important soil-forming factors are parent material, time and climate. (see Appendix 3)

In the NP the parent material is composed mainly of acidic rocks of Cambrian or pre-Cambrian origin. Excluding the Luangwa Valley (Zone 5), approximately 96% of the soils are underlain by rocks with less than 10% basicity, i.e. more than 90% of the minerals in such rocks are acidic (Mansfield et al., 1975-76). The high degree of leaching and weathering in the high rainfall areas of the NP may have confused the clear distinction between soils derived from acidic sedimentary rocks and those from acidic igneous rocks, thus giving plateau soils that are rather uniform in texture and chemical properties. However, the small areas of moderately leached soils in the NP are derived from basic, rather resistant, igneous rocks.

2.1.4 Biological resources

2.1.4.1 Vegetation

The vegetation in NP consists of four forest types (museshe, chipya, mateshi and riparian), three woodland types (miombo, mopane and munga), grassland and a variety of vegetation types associated with termitaria. These vegetation types have been described by Fanshawe (1970). Grasslands are mainly edaphic and are found in depressions (dambos) on the plateau, on flood plains and in swamps where soils are seasonally or permanently waterlogged. Termitaria vegetation is also associated with these edaphic grasslands. The contact zone between edaphic grasslands and the plateau carries a chipya forest which is characterized by isolated tall trees, e.g. over a sparse woody understorey undergrown by tall grasses. In the Mweru-Wa-Ntipa area the chipya

forest is replaced by a thicket vegetation called mateshi (the itigi of Fanshawe, 1970) in which species of Baphia, Boscia and Bussea are dominant.

Mopane and munga woodlands are largely confined to the Luangwa Valley. Mopane woodland is dominated by Colophospermum mopane, and is often associated with sodium-rich clay soils in arid areas. Miombo woodland is the most extensive vegetation type in NP and covers most of the plateau area. This woodland is dominated by species of the genera Brachystegia, Isoberlinia and Julbernardia. The extent of these different vegetation types is given in Table 2.3.

TABLE 2.3. Extent of vegetation types in the Northern Province. Data from the 1:500 000 vegetation map of Zambia.

Vegetation type	Extent (km^2)	Relative area in NP (%)
Museshe Forest	430	0.30
Chipya Forest	7300	5.04
Mateshi forest	1430	0.99
Riparian forest	30	0.02
Miombo woodland	95 240	65.80
Mopane woodland	10 080	6.94
Munga woodland	810	0.56
Termitaria	6590	4.55
Grassland	22 830	15.77
Land area	144 740	99.99

Forest biomass in the NP in the mid-1980s was estimated at 641 million tonnes (MT), which represented 22% of the total forest biomass in Zambia (SADCC Energy Coordination Unit, 1987). Biomass of miombo woodland has been studied in detail by Strømgaard (1985c) and Chidumayo (1987a, 1988a). Chidumayo (in press) has developed regression models for estimating forest biomass from tree diameter. Based on data for the NP (Chidumayo, 1987b), biomass of miombo woodland is estimated at 89 $t.ha^{-1}$ (made up of 4% leaf, 7% twig wood and 89% cord wood). In addition to the estimated 641 MT of wood biomass in the NP (SADCC Energy Coordination Unit, 1987), woody vegetation types produce about 27 MT leaf litter per annum. In mature natural forest mean annual increment (MAI) in woody biomass is estimated variously at 2.7 $t.ha^{-1}$ (SADCC Energy Coordination Unit, 1987) and at 2.0 $t.ha^{-1}$ (Chidumayo, in press). Mature woodland would, based on these estimates, require about 43 years to regenerate, when cut at breast height or lower. However, MAI varies with age of the stand, composition and site quality. For example, Chidumayo (in press) in the Copperbelt Province found that MAI increased from 0.4 $t.ha^{-1}$ in coppiced woodland aged 3-6 years to 2.9 $t.ha^{-1}$ in woodland aged 7-29 years before decreasing to 1.7 $t.ha^{-1}$

in woodland aged 48-49 years. Forest productivity therefore declines as the woodland matures.

Valuable timber species in the vegetation of Northern Province include Pterocarpus angolensis (mukwa), Afzelia quenzensis (mupapa) and Faurea saligna (saninga). The chipya forest contains a larger stock of timber (2.0 $t.ha^{-1}$) than miombo woodland (0.6 $t.ha^{-1}$), according to the Forest Department Management Book for Chinsali. The natural forest also contains many useful plants. Storrs (1982) lists 41 species of edible fruit and seed, eight of which contribute to relish and side dishes, as well as 43 fodder species. Although the complete list of medicinal plants is not known, Storrs (1982) gives 29 species with reputed medicinal properties.

Herbage production in natural forest, dambos and wetlands of NP is not well known. Hood (1972) found a herbage biomass of 1-2 $t.ha^{-1}$ in the Kasama area but production doubled to 3-4 $t.ha^{-1}$ immediately after woodland clearing. Herbage production in wetland grasslands in the Kafue Flats of Central Zambia was estimated at 5-15 $t.ha^{-1}$ yr^{-1} (Ellenbroek, 1987). Total annual production of herbage in NP is therefore estimated at about 40 MT.

2.1.4.2 The wildlife resource

As background to the present status of the wildlife resource, some comment is needed on the potential of habitat in the NP to support wildlife populations. Miombo has relatively low carrying capacity for large herbivores, as this moist-oligotrophic system tends to support a low biomass of herbivores (Bell, 1984). Of the ungulates adapted to, or commonly found in, miombo woodland, few species attain high densities. Both sable antelope (Hippotragus niger) and hartebeest (Alcelaphus lichstensteini) thrive in miombo, but seldom reach large numbers. Reedbuck (Redunca arundinum) and oribi (Ourebia ourebi) favour the grassland habitats of miombo systems, but neither species forms herds. Other antelope found in miombo frequent densely wooded habitats; such species include kudu (Tragelaphus strepsiceros), bushbuck (T. scriptus) and grey duiker (Sylvicapra grimmia). Again, densities in miombo are low, with resultant sensitivity to hunting pressure. The duiker alone is resilient to hunting pressures, and populations (though dispersed) appear to maintain vigour within zones of human settlement.

Hence, the potential for very high wild herbivore biomass is restricted either to species adapted to utilise specific habitats (eg. lechwe in wetland areas), or to more eutrophic systems eg. Luangwa Valley, with high soil nutrient status. In both cases, the potential exists to exploit species on a sustained yield basis.

Against this background of reduced potential for wildlife resources in miombo woodland, the chitemene system has been an aggravating factor. One effect of this system is that low human population density can have extensive impact in terms of habitat. More "sensitive" herbivores, with very specific habitat requirements, are then displaced.

To maximise returns from the wildlife resource, it is increasingly required that less area-demanding practices be substituted for chitemene. Simultaneously, conservation

and development efforts for wildlife must concentrate on those areas where viable wildlife populations still exist, and must design and implement appropriate strategies to ensure conservation for sustainable utilisation.

The following paragraphs are devoted to a review of wildlife resources within the National Parks and Wildlife estate.

The NP includes all or parts of the National Parks indicated in Table 2.4 and Map 2.3 (see Section 2.2.1). Contiguous with these National Parks are Game Management Areas (GMAs), which were originally delimited to serve as buffer zones for national parks.

TABLE 2.4. National Parks and associated GMAs in the Northern Province, Zambia.

National Park	District Responsible	Associated GMA (in N. Province)	District Responsible
Mweru-Wa-Ntipa (part)	Kaputa	Kaputa	Kaputa
Sumbu	Kaputa; Mbala	Tondwa	Kaputa
Isangano	Kasama; Chilubi	Luwingu; Chambeshi	Chilubi; Luwingu; Kasama Chilubi
Lavushi Manda	Mpika	Bangweulu (part)	Mpika
North Luangwa	Mpika	Munyamadzi	Mpika
South Luangwa (part)	Mpika	Munyamadzi	Mpika
Nyika	Isoka	-	-

Assessing the population status of key wildlife species in the NP is extremely difficult; few reliable recent data are available even for proclaimed areas, apart from material relating to South Luangwa National Park and some data for lechwe from the Bangweulu basin. For example, Chipeta (1988) reports that there are no census figures for any species in Mweru-Wa-Ntipa and Sumbu National Parks, nor in the associated Tondwa GMA. Brief comments on the current status of these are as follows:

Mweru-Wa-Ntipa National Park: Subjective accounts (Chipeta, 1988) indicate a collapse in wildlife populations, including elephants, mostly due to poaching pressure from Zaire. Human pressures on this park are marked, especially from the north along the Kaputa-Nkoshya road. This appears related to salt collection in the region of Kabwe pan.

Kaputa GMA: High human population density in this GMA (with consequent depletion of the fishing resource in Lake Mweru-Wa-Ntipa), has resulted in heavy poaching pressures. Wildlife populations are highly threatened; most larger species are extinct in this area. This GMA was previously identified by Motshwari Game (1981) as having potential for commercial game ranching. Since that assessment, this land-use option has now been closed.

Tondwa GMA: People resident in this GMA increased by over 50% in 1988 (Chipeta, 1988). This GMA is under severe pressure owing to the collapse of the fishing in Lake

Mweru-Wa-Ntipa. Although safari hunting continues to take place in this GMA, the future is bleak for wildlife utilization unless poaching can be controlled and quotas are allocated on basis of reliable census figures.

Sumbu National Park: Apart from the Luangwa Parks, this park appears to have the highest potential for maintaining viable wildlife populations in the NP (Chipeta, 1988.)

The above four areas all fall within Zone 1 (Kaputa).

In Zone 4 (the Chambeshi-Bangweulu floodplains), the National Parks and Wildlife estate consists of Isangano National Park and the Chambeshi and Bangweulu GMAs.

Isangano National Park: This area is in a critical state as a result of poaching pressures. An aerial survey conducted in October 1989 (R.C.V. Jeffery, pers.comm.) confirmed almost total eradication of wildlife populations. Human settlement in the Park is now widespread, with associated agriculture, including chitemene. Isangano National Park was established with the specific objective of providing a sanctuary for black lechwe (no other proclaimed area exists for lechwe over its natural range, which is now effectively confined to Zambia).

The other proclaimed wildlife areas within Zone 4 can be collectively treated as a unit within the Bangweulu Basin. This basin extends over both Luapula and Northern Provinces. Gazetted national parks and GMAs are under pronounced human population pressure, as the basin is densely inhabited, with large settlements on edges of the wetland in the Mpika and Serenje Districts (the latter in Central Province), as well as in the Samfya District of Luapula Province. Indeed, much of the remaining wildlife resource now lies outside proclaimed areas; black lechwe herds are now largely restricted to the Kalasa-Mukoso Flats (Luapula Province), and to the south and south-east floodplains of Lake Bangweulu, extending into the Bangweulu GMA of the Mpika District. A black lechwe aerial census was undertaken in 1988, but results are still under analysis (R.C.V. Jeffery, pers. comm.).

Human lifestyles in the area are inextricably linked with fishing and wildlife, as the potential for arable agriculture is limited mainly to cassava production on sandy soils. Thus, wildlife and fisheries are the overriding resources of the basin (Grimsdell and Bell, 1975). Commercially significant species of wildlife include black lechwe, sitatunga and tsessebe, and some potential may exist to exploit lion, buffalo, elephant and leopard. The status of black lechwe has been the subject of considerable research. (Grimsdell and Bell, 1975; Howard, Jeffery and Grimsdell, 1984). From estimates of around 200 000 animals at the beginning of the century, the lechwe population declined considerably owing to hunting pressures and changes in habitat up to the early 1970's. From 1973 to 1983, an annual rate of increase of about 5% was detected, to give an estimated total of about 37 000. (Howard, Jeffery and Grimsdell, 1984.) As this is well below the potential rate of increase of about 20% per year, it was estimated that around 15% of the population was being removed by hunting over this period. Grimsdell and Bell (1975) estimated that the southern floodplains of Lake Bangweulu could sustain about 160 000 lechwe.

Lavushi-Manda National Park also falls within Zone 2 of the Central Plateau (Kasama/Mpika), as does Luwingu GMA. In both areas, game populations have collapsed to the extent that there is little potential for tourism under present conditions. Small populations of hartebeest and eland survive in Lavushi-Manda, but are highly threatened.

Zone 5 of the ARPT zone system contains the Luangwa valley.

N. Luangwa National Park: This is treated as a wilderness area, and consequently no major research or management has taken place in the Park. The area has enormous potential for wildlife, but elephant and rhino populations are under intense poaching pressure. Owens and Owens (1988) draw attention to habitat degradation as an additional problem for North Luangwa. These problems are complicated by the fact that there is a lack of involvement of local people, who should be benefitting from this resource-rich area. Similar problems for North Luangwa National Park were isolated by MASDAR Ltd (1988), including lack of revenue accruing to the Mpika District Council.

S. Luangwa National Park: Aerial surveys of wildlife (particularly elephant) were undertaken in 1987 (LIRDP Project Document No. 4), giving a figure of about 15 000 elephant. Compared with 35 000 elephant in this park in 1973, these results indicate a population under heavy poaching pressure. The South Luangwa National Park falls within the Luangwa Integrated Resource Development Project (LIRDP), which extends over parts of the Eastern and Central Provinces in addition to the NP.

As the park, together with Lupande GMA, forms part of major experiment in natural resource utilisation (the LIRDP) it is not appropriate at this stage to formulate strategies for South Luangwa outside the LIRDP framework.

2.1.4.3 Fish

The NP is estimated to contribute as much as one third of Zambia's annual fish production. Indeed, market values in good years exceed the value of cash crops in the NP by a factor of two (PPU, 1988). In addition, direct employment is provided to about 7 000 fishermen, with several thousand more employed in related occupations like transport and boat building (Ndonna, 1986).

The fish resources of the NP can be categorised by the nature of the water body: lake system, swamp system, or river system. Lakes Tanganyika and Mweru-Wa-Ntipa are the major lake (open-water) systems in the NP. The Lake Bangweulu system contains both open-water as well as swamp, and the Chambeshi system is the main example of a river-based fisheries.

The fisheries based on Lakes Tanganyika, Bangweulu and Mweru-Wa-Ntipa are gazetted as commercial fishing areas (Fish Conservation Act. Ch.314,1955), and as such are controlled by the Dept. of Fisheries. (Previously, Fisheries was housed within the same Department as Wildlife and National Parks, until acquiring full Departmental status under a separate Ministry - that of Agriculture and Water Development]. Municipal

councils, township councils or rural councils have the right under the Local Government Act to supervise fishing in their areas (Cap. 480).

i) Lake Tanganyika

The fish resources of Lake Tanganyika must meet the needs of Burundi, Tanzania and Zaire, in addition to those of Zambia. Zambian waters comprise about 2000 km^2, representing 6% of the total lake area. Fishing is concentrated around Mpulungu and Nsumbu in Zambia. The Nsumbu fishery operates largely in Cameroon Bay, which is shallower and more extensive than the Mpulungu system, and thus potentially more productive. Lake Tanganyika yields about 12 000 tonnes annually for Zambia, consisting mainly of Kapenta (Limnothrissa miodon and Stolothrissa tanganicae) and Nvolo or Buka-buka (Luciolates stappersii). These species appear linked in a predator-prey cycle, so that biomass returns of Kapenta (for example) are inversely proportional to returns for Buka-buka.

ii) Lake Mweru-Wa-Ntipa

This water body covers approximately 1600 km^2. The potential of this fishery has recently declined dramatically. The reasons are not clear, but are related in part to a change in nutrient status, with a trend towards oligotrophy. During the 1970's, catches of up to 16 000 tonnes per year were recorded (Ndonna, 1986). Such returns attracted heavy fishing pressure, coupled with illegal methods. Together with changes in nutrient status, these pressures have resulted in a partial collapse to about half the yield previously recorded. The important species Sarotherodon macrochir has been largely replaced by a small pelagic species. These changes have stimulated an exodus of fishermen, largely to Lakes Tanganyika and Mweru.

iii) Lake Bangweulu

This complex lake/swamp system covers an area of about 7500 km^2. Of this, most of the open water occurs in Luapula Province, while most swamp is in the NP. Most of the production is derived from the swamps (11 200 tonnes annually); the entire system yields about 14 000 tonnes per annum. The NP production is about 2000 tonnes, from about 1000 fishermen. Catch composition is documented by Evans (1978), but includes Sarotherodon macrochir, the only important true phytoplanktivore in Bangweulu. The characin Alestes macropthalmus and the squeaker Synodontis nigromaculatus are also important commercial species; Alestes is in fact the major contributor (both in terms of frequency and biomass) to catches from the open waters (Evans, 1978).

The Bangweulu system is fairly oligotrophic, and competition consequently occurs between macrophytes and phytoplancton for nutrients (Evans, 1978). In addition, there appears to be no fish species which can take full advantage of macrophytic primary production.

Evans (1978) estimated the sustainable yield from fish stocks in the Bangweulu complex at 17 000 tonnes; this is not viewed as highly productive by most African standards.

Heavy fishing pressures, especially on S. macrochir and Tylochromis bangwelensis, as well as the indiscriminate sandy-beach seining throughout the year, have caused major transformations - the decline in cichlid populations, with a concomitant increase in characids, e.g. Alestes macropthalmus. Characid species are less desirable commercially.

iv) Chambeshi River System

Little is known of the potential of this system. The main artisanal fishery area is situated along the floodplains between Mbesuma and the confluence of the Mufusi River. Ndonna (1986) gives catch estimates as 2000 tonnes annually. The system is under severe fishing pressure (including the use of illegal methods), which is compounded by the proximity to human population centres (Kasama and Chinsali), to which fish products are directed.

2.2 LAND-USE SYSTEMS

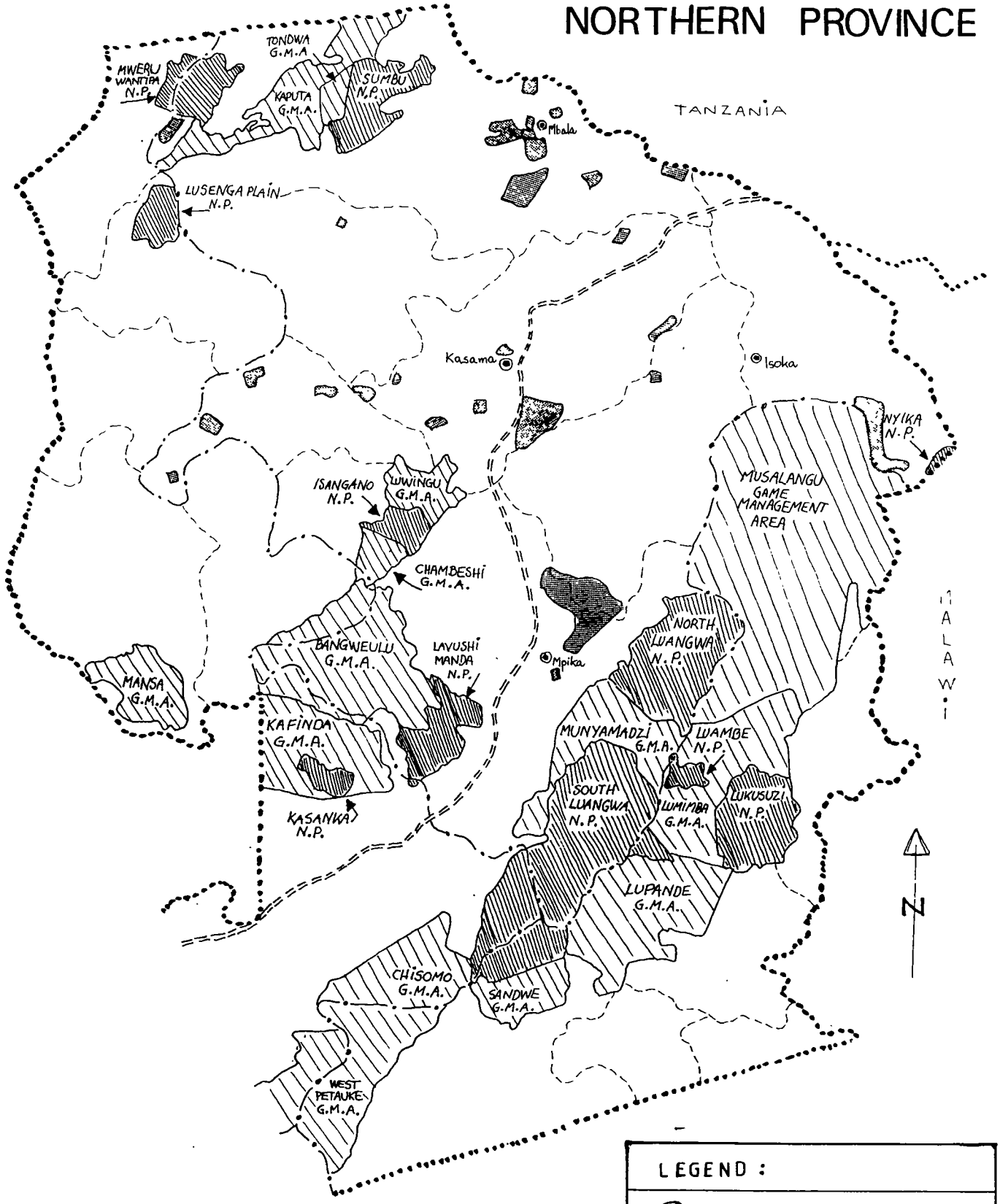
2.2.1 Land classification

The gazetted land classes in NP are forest reserves, National Parks and Game management areas (GMAs). The forest reserves are administered by the Forest Department under the Forest Act. National Parks and GMAs are administered by the National Parks and Wildlife Service under the National Parks and Wildlife Act. Activities such as settlement, cultivation, livestock grazing and harvesting for forest produce and game are prohibited in forest reserves and National Parks unless licensed. However, settlement, cultivation and licensed game hunting are permitted in GMAs. The extent of forest reserves, National Parks and GMAs in NP is shown in Table ... and their distribution is shown in Map 2.3. (NB! Due to incomplete data made available to the team, some Forest Reserves have not been plotted on the map. A few reserves are also too small to appear on a map of this scale)

Table 2.5 Forest reserves (FRs) National Parks (NPs) and Game Management Areas (GMAs) in Northern Province.

Zone	Total area (km^2)	FRs	NPs	GMAs
1. Kaputa	15 790	266	5154	4140
2. Kasama/Mpika	89 360	8411	2340	1090
3. Mbala/Isoka	19 100	2694	0	0
4. Bangweulu/Chambeshi	13 470	0	0	7090
5. Luangwa Valley	10 100	0	6800	3300
Total	147 820	11 371	14 294	15 620

DISTRIBUTION OF WILDLIFE AND FOREST RESERVES IN NORTHERN PROVINCE



SCALE 1 : 3.300.000

LEGEND :

- GAME MANAGEMENT AREAS
- NATIONAL PARKS
- FOREST RESERVE
- Railway
- District boundary
- Provincial boundary
- International boundary

2.2.2 Agricultural potential and soil related constraints

2.2.2.1 General potential

A look at the natural resource base indicates that the province has a fairly large resource potential in terms of soils and water for agricultural purposes.

Lal (1988) estimated that 23% of the world's potential arable land is found in the African woodland savannah region, and that the major soils are acidic and strongly leached (Ferralsols and Acrisols). In the high rainfall areas of Zambia, about 43% of the soils are highly leached and about 37% come under the moderately leached category. These soils are highly acidic, low in CEC and very poor in plant nutrients. For these reasons they have often been called problem soils. It is now generally accepted that provided chemical constraints can be removed, these soils have good agricultural potential, particularly in Northern Zambia because of ample and regular rainfall.

Veldkamp (1987a) estimated approximately 50 000 km^2 of the arable upland land in NP to be good or moderately good accessible land. Of this, 10-20 000 km^2 were regarded as good accessible arable land, suited for permanent agriculture. There are 8500 km^2 of seasonally flooded land, 9800 km^2 of seasonally waterlogged land and 18 000 $km^2$of shallow and/or sloping non arable land (based on estimates by Chileshe and Spaargaren, 1987; Mansfield et al., 1975-76 and Veldkamp, 1987a). With data from these authors a rough land capability map of NP has been drawn (Map 2.4).

2.2.2.2 Irrigation potential

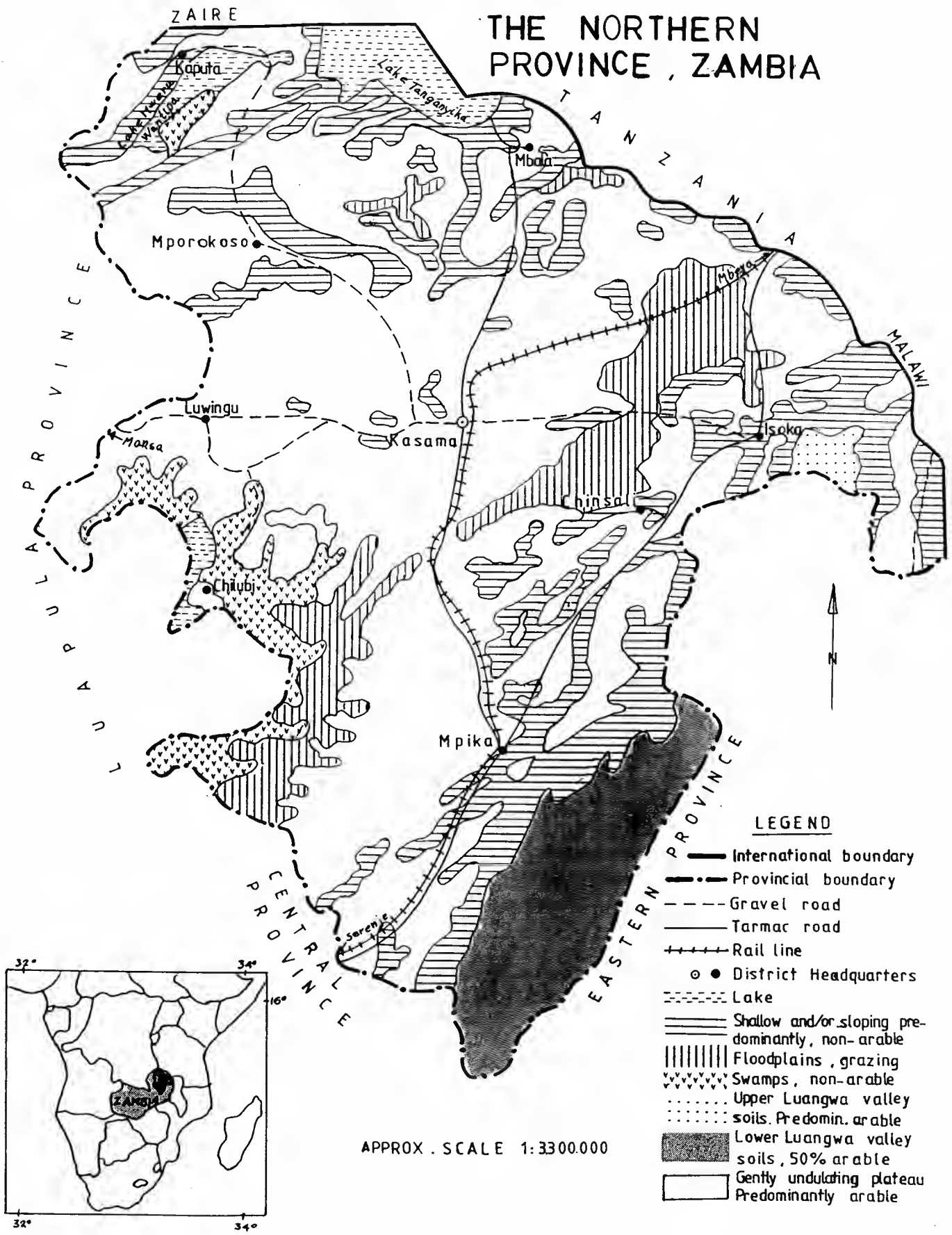
A number of perennial streams and rivers in the Province and a relatively flat topography provide a good low-cost irrigation potential. Mansfield et al. (1975-76) estimated that about 20 000 km^2 (2 million ha) representing 30% of the arable land could be irrigated.

At present, irrigation in the NP is mainly used by large coffee-growing farms or by some small-scale farmers for coffee, fruit-trees, and vegetable cultivation. There are, however, plans for large-scale irrigation schemes (Tazara Irrigation Scheme), aiming at utilizing some of the large irrigation potential within the province.

2.2.2.3 Grazing potential

The dambos and flood plains represent potential dry season grazing land in NP. Likewise, the miombo woodland on the plateau soils offers some potential for both dry and wet season grazing of grasses and browsing of shrubs and trees. More than 70% of total land area is free of Tse-tse (Bingham, 1983). This implies that livestock production may have some potential in the NP. But, because of poor quality of grass and nutrient poor soils the grazing potential can only be realized through improved pasture management.

LAND CAPABILITY MAP - THE NORTHERN PROVINCE, ZAMBIA



2.2.2.4 Soil-related constraints linked to crop production

The major soil constraints linked to the agricultural use of the land are the soil acidity/fertility complex and the soil erodability hazard (Njøs, 1983; Singh, 1983 and 1984). Recent advances in soil research have proved that these constraints can be addressed through appropriate soil management.

i) Soil acidity/fertility complex

The major soils of NP (Oxisols and Ultisols) are characterized by low pH, high Al and Mn, low nutrient retention, low organic matter content, and medium to high P fixation (Singh, 1989). The main constraints to crop production in acid soils are toxicities of aluminum and sometimes of manganese and deficiencies of Ca and Mg (Kamprath 1980). Msunza et al. (1983) showed good correlation between pH ($CaCl_2$) and Al-saturation of some Zambian soils; the pH-levels of 4.7 for subsoils and 4.4 for topsoils were found to be critical levels. The critical level of Al may vary from crop to crop. For maize, for instance, critical level of Al-saturation may be 40-50%. Singh (1987) reported a strong negative correlation between exchangeable Al and wheat yield, suggesting that Al toxicity was the main constraint to wheat growth. Kalima (1983) found most of the soils in the NP have pH below 4.4, although there are large variations. The fairly low pH allows them to become easily acidic during cultivation and the use of fertilizers.

ii) Soil physical status

The productivity of the land is also linked to the physical properties of the soils. The major soils in the NP have low water retention capacity and some (Ultisols) are prone to soil erosion. Lenvain (1983) estimated that the soils in NP have high soil erodability factor which combined with the rainfall erosivity index can result in a soil loss of 330 tons per ha and year on a slope of 5° over a length of 100m. However, there are only a few areas in the province which have such a high slope. Sheet erosion on the topsoil on research plots situated on fairly flat land (slope less than 2°) has been recorded on numerous occasions (SPRP 1987, 88, 89).

Clearing without removing the tree stumps and hand cultivation are the most common practice today and they maintain a satisfactory soil physical status. Mechanized clearing with full stumping without proper soil conservation methods is not to be adviced due to economic risk.

2.2.3 Agriculture

2.2.3.1 Historical perspective on land use.

The evolution of land-use systems in the NP is not well known. Records from the first colonial officials arriving in the early 1890s indicate how the Bemba established hegemony over the surrounding tribes. The Bemba people apparently arrived from the North (Congo) to their present territory around 1700 (Richards, 1939). The Bemba, essentially a warrior people operating from large well-protected villages, continually raided neighbouring tribes for various goods. The Mambwe country was their grain

store, the Namwanga and Iwa tribes brought in livestock, grain and hoes; Bisa provided fish and salt, while the Senga provided tobacco (Meebeelo, 1971; Richards, 1939, Rau, 1978). This raiding may be regarded as an "institutional" activity - an established way of life for a tribe occupying areas relatively marginal for agriculture. These inter-tribal relations were partly a reflection of different agricultural adaptations among the various tribes to different ecological conditions. The other tribes, however, suffered from these contacts - particularly since the Bemba contributed prisoners to the Arab slave trade, in exchange for guns, cloth, beads and other goods (Tindall, 1968). The Arab trade lead to the heavy poaching of elephants, resulting in localised extinction as early as the 1890s (Meebeelo,1971).

With the coming of the colonialists the raiding came to an end. The Bemba now had to rely entirely on chitemene agriculture, and new inter-tribal relations evolved. The colonial influence was significant throughout the province. Labour was demanded from the province in the mines, in constructing the railway, as servants and on white settler farms. The Bemba were deprived of 50-60% of their most able-bodied men in the 1930's (Richards, 1939). This had a particularly negative effect on yields, production and livelihood, since the chitemene system depended on the men, e.g. for chopping branches.

A particular aspect of agriculture in NP was the fairly widespread European commercial agriculture around Abercorn (Mbala) during the 1920s and 1930s. Abercorn was then a major colonial centre for Northern Rhodesia. The European settlers produced food for urban markets, and coffee for export through Mpulungu harbour to Kigoma in Tanzania, and from there by railway to Dar-es-Salaam and to Europe by sea. The European settlers also raised livestock, and when they abandoned their farms in the late 1950s, they sold their cattle mainly to local Mambwe farmers, thus contributing to a livestock tradition for the area.

Against this historical background current land-use systems are reviewed.

2.2.3.2 Present land-use patterns

A striking feature of the NP is the diversity in agro-ecological and socio-economic conditions, leading to complexity in land-use patterns. The chitemene "slash and burn" cultivation has in the past been the dominant land-use system, but more semi-permanent systems are being adopted. Not only can differences in land-use systems be detected between households in the same village, but also among villages of the same region, and among regions.

The study will distinguish between three main land-use systems:

i) Chitemene shifting cultivation;
ii) Semi-permanent systems;
iii) Permanent/semi-permanent hybrid maize cultivation, with applications of fertilizers.

Each system is faced with particular environmental problems, and thus will have a choice of options for improved resource management (see Section 7). Strictly speaking, maize is also cultivated through a semi-permanent system. Farmers tend to shift every 4-5 years. But since maize cultivation entails environmental and socio-economic problems distinct from the two other systems, it is treated separately. Moreover, in many areas, particularly in Zone 3 (Mbala/Isoka) on the more fertile soils, maize is mono-cropped on permanent fields.

One farm household may practise one or more of these systems, but the relative dependence on each for cash and food will vary by household and region.

In addition to returns from cultivation, off-farm activities constitute an important source of cash, as much as 40% of total household income on average in the province (ARPT, 1988a).

Livestock, except in the Mambwe area, is not an important element of agriculture in NP.

Below we present a brief outline of the three land-use systems. For more detailed information on land use in the province reference is made to Allan, 1967; Holden, 1983 and 1988; Mansfield, 1975-1976; Richards, 1939 and 1958; Schultz, 1976; Strømgaard, 1989; Stølen, 1983; Svads, 1983; Trapnell, 1953; Vedeld and Øygard, 1982; Vedeld, 1981; Watson, 1958.

2.2.3.3. Chitemene shifting cultivation systems

The chitemene system practised in the NP is essentially a "slash and burn" cultivation system that utilises the products of burnt trees to improve soil fertility and raise pH.

Chitemene cultivation in the NP has three main sub-systems:

(i) The most extensive of these is practised throughout the miombo woodland of the plateau area of Zones 2 (Kasama/Mpika) and 3 (Mbala/Isoka). This "plateau chitemene" is a woodland fallow cultivation system; trees are lopped by men early in the dry season, gathered and stacked into circular piles by women, and then burnt in about September/October. A single ash garden is made by lopping trees from the surrounding woodland. Cucumbers and marrows together with other vegetables are planted in the ash plot after the first rains. Finger millet seeds are broadcast in the latter half of December and harvested in April/May.Cassava cuttings are widely planted throughout the millet field. Several different crop sequences might follow in subsequent seasons after the finger millet stalks have been burnt following the first year's harvest. The following sequences are common:

	Year 1.	Year 2.	Year 3.	Year 4.
Crop sequence 1:	Millet	Groundnut	Beans	Millet
Crop sequence 2:	Millet	Groundnut	Millet	Beans
Crop sequence 3:	Millet	Millet	Millet	Beans
Crop sequence 4:	Millet	Sorghum	Beans	Millet

A particular crop sequence is not area specific, but is largely a matter of personal choice for the farmer. Cassava is maintained in the ash garden and harvested continually until the third year. In a grain-legume cropping sequence (e.g. finger millet-groundnut) ridged mounds are made in the ash garden in the third or fourth year. Weeds and crop residues are collected and buried in these earth mounds, a practice that improves soil fertility, water infiltration and water retention (Strømgaard, 1989). Where mature woodland is scarce, small trees are cut at breast height or at ground level. The average size of an ash garden is 11 times the size of the cleared woodland area (Strømgaard, 1984; Kakeya and Sugiyama, 1985; Chidumayo, 1986). Currently, about 45% of rural households in the NP make annual chitemene millet gardens. About 7 ha of woodland are required to make an average ash garden. Where woodland is still abundant, almost all households have annual chitemene millet gardens (Kakeya and Sugiyama, 1985; Vedeld and Øygard, 1982), but this proportion may be as low as 15% in areas deficient in woodland. In such areas, households make chitemene millet gardens every second year. In areas with severely depleted woodland, millet gardens are often made up to 6 km from the village. Small grass huts (mitanda) are constructed close to the garden to ward off intruding bushpigs, duikers and monkeys.

The period left for forest regeneration varies with population density and productivity of the miombo woodland. Little critical work has been done on the required length of fallow period for regaining soil fertility or forest biomass in the cleared area. According to Mansfield et. al (1975-76), most figures given by various researchers for "adequate" regeneration periods are based on subjective assessments. Using annual ring counts of samples of fully grown trees in abandoned chitemene fields, Peters (1950) estimated a resting period of 35 years for regeneration of forest biomass. Trapnell (1953) came to an overall estimate of 20-25 years for regeneration of forest biomass. Alder (1958) held that 25 years of fallow was adviseable, although he had no concrete evidence to support this. Several (Trapnell, 1953; Mansfield et al., 1975-76) emphasize shorter fallow periods for regeneration of woody biomass in areas cleared for chitemene if late dry season fires are suitably controlled. Shortening of fallow periods is common where population growth is high (Mansfield, 1975-76; Strømgaard, 1985).

(ii) In the thicket chitemene cultivation subsystem of Zone 1 (Kaputa), the shrub thicket is cut at ground level between April and September and burnt in October. Finger millet is broadcast in December and harvested in April/May. Very few other crops are planted with millet. One or two successive crops of millet are raised before the land is abandoned. Apparently, the thicket once burnt does not regenerate, and this vegetation has now been overexploited (Mansfield, 1975-76). Consequently, the cleared area is now planted with either millet alone or millet incorporated with sorghum. The average area cleared per household for this system is 0.27 ha per year (Forestry Department Management Book for Mporokoso).

(iii) The third chitemene subsystem is based on cassava mound cultivation, practised in Zones 1 (Kaputa)and 4 (Chambeshi Bangweulu Floodplain). Here, Chipya shrub is cut and stacked in piles before burning. A sequence of two successive cassava crops is followed by millet with cassava, before shifting to another plot. In the past an average

of 0.27 ha was cultivated per household per year (Forest Management Book for Luwingu). In Chilubi, plots now may be smaller in the more densely populated areas.

2.2.3.4. Semi-permanent systems.

There are basically two major semi-permanent cultivation systems practised in the Northern Province.

(i) The fundikila system is a semi-permanent bush/grass fallow cultivation system practised in Zone 3 (Mbala/Isoka), especially in the open grassland. Prior to cultivation, grass is cut and stacked around trees or stumps and burnt. The turf is cut late in the rainy season or early in the dry season, turned over and made into either circular mounds or long mounded ridges. The mounds and herbage are left to decompose, and are then spread out in the following rainy season. Sometimes maize and cassava are planted on the mounds before spreading. Finger millet is broadcast among the (maturing) maize and cassava plants, and harvested late in the rainy season. Mounding and spreading alternate until the fifth year, after which the plot is rested for up to 8 years. Maize has been grown as a staple crop on mounded ridges for up to ten years (Watson, 1958). However, continuous cropping is usually done for only 3 - 4 years. Maize is becoming increasingly common in this grass mound system as fertiliser is able to improve crop potential and extend cultivation period (Holden, 1988).

(ii) Cultivation is also practised on a semi-permanent basis around homesteads (ibala). A variety of crops are intercropped in homegardens. Most crops are grown on ridges although these may be flattened for the growing of finger millet, when fertiliser is common. Nearly all households have ibala gardens. Sometimes farmers make gardens on the sides of dambos (mianda), near perennial streams. Vegetables (e.g. tomatoes, rape, cabbage) are grown together with beans and maize (Pottier, 1988). Both homegardens and dambo gardens are assuming greater importance in traditional farming systems in NP due to a decrease in chitemene cultivation in areas with high population pressure (Holden, 1988; ARPT, 1988c; Pottier, 1988) .

2.2.3.5 Permanent systems.

Cash crop permanent cultivation is relatively new in the NP and has emerged in response to the government programme of maize monocropping. It is a high-input cultivation system based on mineral fertilizer application. Abandoned homegardens are increasingly used for hybrid maize production. The proximity to homesteads reduces labour, for transporting the produce from the field. On average 60% of households in Zones 2 (Kasama/Mpika) and 3 (Mbala/Isoka) grow hybrid maize on an average hectarage of 1.2 ha (range 0.30 - 2.0). Apparently hybrid maize plots are cultivated continuously for about 5 years, invariably without liming, before productivity declines due to increasing soil acidity and weed encroachment. This forces the farmer to shift to a new plot (Gibson, pers. comm).

2.2.3.6 Livestock

Livestock husbandry has never been a major part of agriculture in the NP. Development of livestock husbandry among small farmers has been inhibited by the prevalence of trypanosomiasis in large areas of the province. Main fly-infested areas occur in parts of Mpika, Chinsali, Kaputa and western Luwingu. However, non-infested areas occur on large parts of the Northern Plateau, south and west of Mbala and along the western border against Luapula Province. The low amount of livestock is also partly explained by the non-pastoral tradition among many indigenous tribes. Cattle (Zebu type) is mostly confined to the Mbala and Isoka District, in areas with Hyparrhenia grasslands. Lack of dry season grazing limits any increase in cattle numbers in this area. Dry season grazing is often confined to homegardens as many dambos contain unsuitable grass species with high starch content. Small livestock (goats and sheep) are more widely distributed and common in the western part of the province although populations are low. Large fluctuations in animal populations are common in certain districts due to incidence of livestock epidemics (tickborne anaplasmosis) and lack of veterinary services.

Table 2.6 Livestock in Northern Province

	Cattle	Sheep/Goats	Pigs
NP	104 848	20 339	3 400
Zambia	2 415 970	465 269	201 445
% National herd	4.3%	4.4%	1.7%

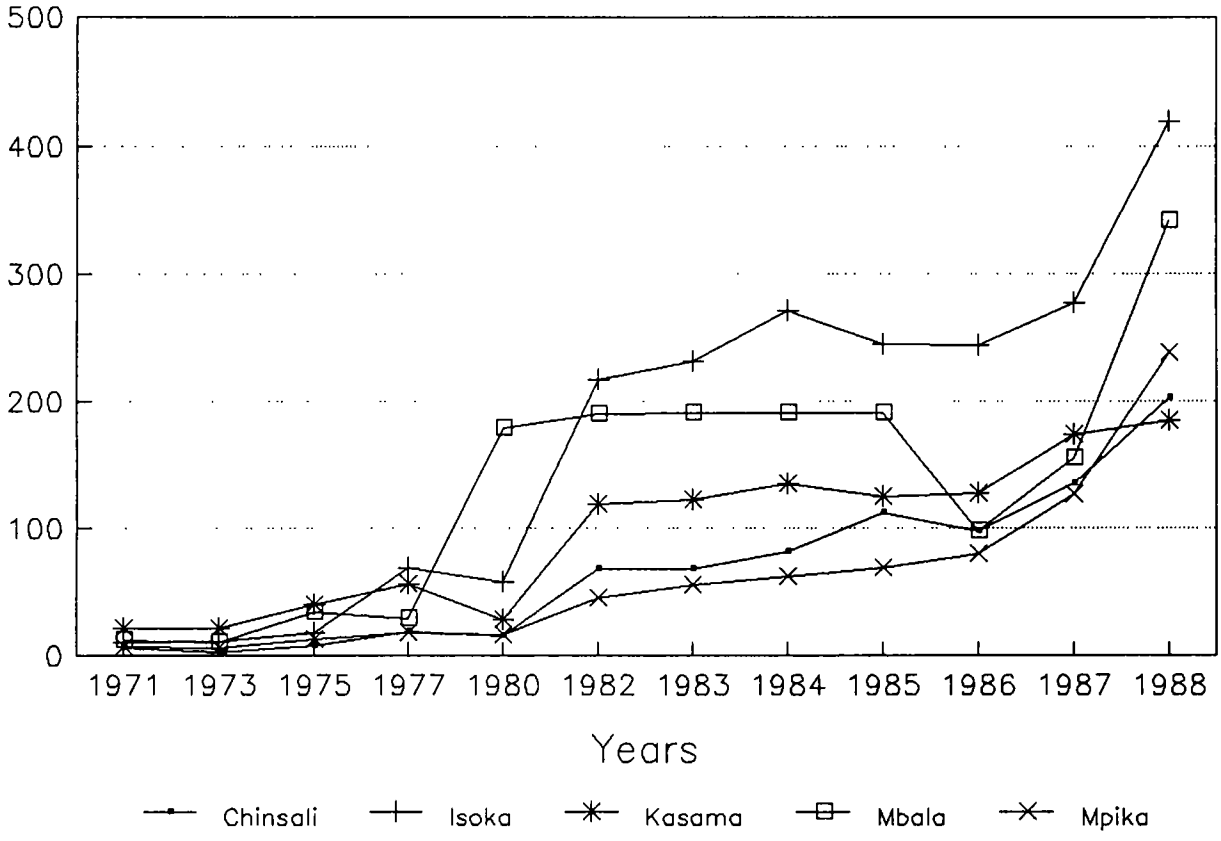
2.2.3.7 Trends in agricultural production in NP

There are no reliable figures for total agricultural production of individual crops in the NP. Present and past trends in crop production can only be indicated by records kept by the Northern Cooperative Union (NCU), Lintco and the Coffee Board. Records are also kept by primary cooperative societies. Although NCU is responsible for all marketing in NP it handles mostly maize and many crops are sold informally to neighbours or kin, in district towns or to private traders. Unofficial marketing of crops accounted for 29% of all crops sold in surveyed villages in Zones 2 (Kasama/Mpika) and 3 (Mbala/Isoka) (ARPT, 1988a). Lack of information on retention rates for maize and other crops in various districts and households makes it difficult to ascertain what is actually produced from one year to another. Retention rates might be influenced by the growing importance of maize as a staple food crop both for rural and urban households, variation in yields due to lack of rainfall or by reliance on use of crops as payment for hired farm labour (Crehan and Oppen, 1988). Analysis of all sample points in areas surveyed by ARPT in NP showed an average retention rate of 44% for all interviewed farmers.

Most impressive has been the dramatic increase in marketing of hybrid maize. From 1971 to 1988 official sales of hybrid maize increased by 2832%. The purchase of maize by Northern Cooperative Union increased tenfold from 1980 to 1988, when it reached 153 000 tons.

Large increases in marketing of hybrid maize occurred during two periods from 1979 to 1981 and from 1985 to 1988.

Fig. 2.1 District trends in marketed output of maize in Northern Province.



As shown in the above Fig. 2.1 Kasama was the main maize producing district from 1971 to 1977. From 1977 eastern districts have experienced a dramatic increase in marketed output of maize unchallenged by other districts. Mpika, Isoka, Mbala have become the largest maize producers. Together with Kasama these districts accounted for 82% of the total maize purchased by NCU in 1988.

Mpika has had the largest increase in the last few years. Other districts like Kaputa and Mporokoso have lagged behind in marketed output of maize. Kaputa has a bimodal rainfall regime with high risks of dryspell during the growing season which makes it

less suited for hybrid maize production. Households rely on fishing in Lake Mweru-Wa-Ntipa and rice production for cash supplemented with basic food crops like cassava, sorghum and local green maize. Ability to generate some cash from fishing together with poor infrastructure and relative remoteness has acted as a disincentive for farmers to venture into hybrid maize production. Mporokoso District lying on the central plateau is disadvantaged by a poor infrastructure essential for timely input delivery and crop collection. Growth in the provincial marketed output of maize has mainly come from an increasing number of farmers involved in hybrid maize production. More farmers have meant more land taken into cultivation. There are very few data on a possible contraction in the area grown with other crops like cassava, beans, fingermillet or vegetables in ibala gardens. According to ARPT expansion in maize production has come through a 69% expansion in area cultivated, partly through clearing virgin land and using abandoned ibala gardens. Survey data also show a drop in area cultivated over time among the more commercialized farmers (> 30 bags sold) and increase in yield per ha. A study of a selected number of commercial maize farmers in Mpika district revealed that the average area planted per farmer decreased over time with large annual variation in yields (IRDP-Mpika, 1987). Moreover total output increased over time indicating higher yields per unit of area planted coinciding with an increase in fertilizer applications.

Coffee and rice are other major cash crops mainly grown in Kasama district. Official marketing of other crops like tobacco, sunflowerbeans, millet and soybeans is small.

2.2.4 Forestry use of tree

Gathering of produce from the natural forest is an important activity for rural households. Produce obtained from the natural forest include honey, insects (caterpillars), fruit and plants (orchid tubers (icikanda), mushrooms and medicines). Popular fruits from the forest include Parinari curatellifolia (mpundu), Uapaca kirkiana (musuku) and Anisophyllea boehmii (mufungo). However, the full range of edible fruit and seed plants is only used during famine. Nevertheless, children generally eat a greater variety of wild fruits than adults.

In the NP the production of edible caterpillars (finkubala) is an important source of nutrition and income to rural households, especially resource-poor households. When abundant, the caterpillars are collected, processed by roasting in hot ashes, bagged and transported to urban areas for sale. Edible caterpillars are larvae of moths, e.g. species of genus Conimbrasia (emperor moth). The moths lay eggs on Julbernardia, Brachystegia and Isoberlinia trees in September / October and young caterpillars emerge in late October and are fully grown and harvested in November and December.

Beekeeping, although currently practised on a small scale, has great potential in NP. Honey may also be gathered from the natural forest. The Forest Department is involved in promoting beekeeping in some parts of the Province e.g. in Mbala district. Honey from natural forests is made from the nectar of miombo woodland trees which flower late in the dry season (October / November).

There are scattered groups of pit-sawyers throughout the NP who exploit valuable indigenous timber trees (mukwa, mupapa and saninga). Although pit-sawyers are required to obtain licenses from the Forest Department, many of them operate without licenses. Currently, felling licenses range from K35 to K40 per mupapa or saninga tree. This appears disproportionate when considering that sawn timber sells at K3,700 per m^3 (K6,200 per tonne).

Fuelwood is the main household energy source in the NP, although charcoal is more important in the main urban centres. According to the 1988/89 GRZ (Department of Energy) / World Bank household energy strategy (HES) study (GRZ/World Bank 1989), consumption of fuelwood in urban Zambia is 797 kg of fuelwood and 983 kg of charcoal per household per annum.

The traditional earth kiln method of charcoal production practised throughout Zambia is 25% efficient (GRZ/World Bank 1989). Thus four tonnes (dry weight) of cord wood produces one tonne of charcoal. Thus, an urban household will therefore use the equivalent of 4.73 tonnes of cord wood per annum. Various rural fuelwood consumption surveys indicate that a rural household uses on average 5.41 tonnes of fuelwood equivalent per annum (Chidumayo, 1989). The number of rural and urban households in NP in 1980 119,180 and 24,030 respectively (Central Statistical Office 1980), which required 644,760 tonnes and 113,660 tonnes of fuelwood equivalent, respectively.
Little is known about fuelwood use for non-household purposes, e.g. it's use for fish drying in the Sumbu area and for salt-manufacture in the Kaputa area (Zone 1).

The Forest Department has established 10 km^2 of eucalyptus and pine plantations in some forest reserves in the Province to supply building and industrial timber. Currently plantations do not contribute to the supply of fuelwood. The Forest Department is also responsible for the promotion of rural tree planting through the distribution of seedlings of exotic timber species (e.g. Eucalyptus spp.), but lack of transport and inputs is hampering the successful implementation of this exercise.

2.2.5 Wildlife utilization systems

The vast majority of wildlife utilization in the NP is consumptive as opposed to non-consumptive (an example of the latter would be returns from photographic safaris). In addition, this consumptive utilization operates at a subsistence level, and is often illegal. This illegality makes it hard to quantify the extent of this utilization, but it is undeniably extensive and non-sustainable, given the severe depletion of wildlife resources in the Province (see 2.1.4.2).

What follows, then is comment on utilisation restricted to the "formal sector"; little data are available on the illegal forms of utilisation which constitute the overwhelming impact on the resource.

2.2.5.1 The ADMADE Programme

The ADMADE programme (Administrative Management Design for Game Management Areas) has been formulated as a new national policy for wildlife management, administered through the Department of National Parks and Wildlife Services. Directed specifically at GMAs, the programme aims to manage wildlife resources on a sustainable basis for the benefit of people within such areas. The underlying philosophy is that this approach will develop a conservation consciousness in people benefiting from the wildlife resource, thus combating poaching.

The design has been tested successfully in the Lower Lupande GMA (Eastern Province), and the intention is to extend ADMADE to other GMAs in Zambia, including the NP. For the scheme to work in GMAs, various conditions must be met (Mwenya, Kaweche and Lewis, 1988).

These conditions include: cooperation between GMA residents and National Parks and Wildlife Service (NPWS) personnel; adequate funding generated from within a GMA through wildlife utilisation to meet conservation costs in that GMA; and a resource data base that reflects current wildlife population trends, as well as rates of off-take (legal and illegal).

In the NP, ADMADE has been instigated in the Tondwa GMA, with a Unit Leader directing the programme.

2.2.5.2 The WWF/Zambia wetlands project

A parallel exercise to ADMADE, the WWF-Zambia wetlands project is currently operating in the Bangweulu Basin (and elsewhere in Zambia), through DNPWS. The project is being implemented in a Core Area (about 7 500 km^2) of the Bangweulu swamps, and involves the Northern, Luapula and Central Provinces. This core area includes the Bangweulu GMA, the Kalasa-Mukoso GMA (NB - not marked on DNPWS map of 1985!), and the Kafinda GMA. In the NP, the project is operating mainly in the Mpika District, in the Chiefdoms of Kopa, Kabinga and Chiundaponde. Note that this excludes Isangano National Park, further highlighting the total collapse of this area in terms of wildlife potential. Ultimately, the intention is to extend the project into Chambeshi and Luwingu GMAs and the Isangano National Park in the Bangweulu Basin, as well as into the Kaputa GMA - Mweru-Wa-Ntipa National Park complex further north.

As with ADMADE, the project aims to involve local communities in management and control of wetland resources, so as to encourage these communities to invest in these resources. In fact, the wetlands project draws on the ADMADE system and facilities, not only for its implementation but as a means of ensuring continuity. The project area boundary follows the Chambeshi river from Kabinga to the Luapula river, taking in the Kalasa-Mukoso flats to Mukuku. From there, the boundary follows the Southern and South-Eastern floodplains of the swamps past Chiundaponde, and back to Kabinga.

Success of this project will depend upon implementation of the legal provisions pertaining to the protected areas within the project area, and upon timely and effective land-use zonation. These concepts are expanded in 7.4 and 8.3.

2.2.6 Fisheries

2.2.6.1 Commercial fisheries - current status

Lake Tanganyika dominates the commercial fisheries in the NP. Five companies (including SOPELAC) operate at Mpulungu, totalling 15 boats at an intensity of about 20 fishing days per month. These companies are responsible for about 8000 tonnes annually (equivalent to about K25 million). The industrial companies together employ about 800 workers.

In addition, three companies are registered at Nsumbu, utilising four boats. Efforts are directed largely at Kapenta and the inshore fishery.

All these commercial operations employ the use of ring nets, while beach seine-netting is the major artisanal method.

With respect to processing, lake fish are either sold fresh, are frozen, or are preserved by sun-drying or smoking. Processing is inefficient, causing considerable loss before marketing (Ndonna, 1986). Marketing is also problematic, owing to major distances between fishing areas and markets. Private traders dominate marketing, and deal almost exclusively in dried or smoked products, whereas registered companies deal in fresh or frozen fish, which are transported mainly by rail to outlets in towns further afield.

2.2.6.2 Artisanal fisheries

On Lake Tanganyika, the artisanal fishery is responsible for over 80% of the total fish production. About 1500 Zambian artisanal fishermen operate on Lake Tanganyika using beach seines; they are responsible for some 12000 tonnes annually (mostly Kapenta).

In the Mpulungu region of Lake Tanganyika, artisanal fishermen are providing protein for an estimated 50000 people; fishing is concentrated over the dry season when Kapenta stocks are high. Some fishing activity also takes place on the Lufuba floodplain south-west of Kasaba Bay, where some farmers exploit Alestes populations when the river is flooded.

In the Nsumbu area, the artisanal catch approximates 3000 tonnes annually. At least 700 fishermen operate in the area; this figure may rise to 1000 between June and November when a special concession (Chisane beach) opens within Nsumba National Park Waters (Ndonna, 1988). Kapenta (Limnothrissa miodon and Stolothrissa tanganicae) constitute the main catch. Dried Kapenta is ferried to Nsumbu for onward transport to market. Transport problems dictate that some spoilage occurs before the product reaches market (Ndonna, 1988).

In Lake Mweru-Wa-Ntipa, about 3000 fishermen operate, primarily using gill nets (Ndonna, 1986). Data for 1979 indicate about 2000 artisanal fishermen operating 1400 fishing crafts (Anon., 1987). The catch was composed largely of cichlids and clariids; catch declines have meant that inshore populations are now exploited using modified "beach seines" (mosquito netting), which are towed onto the beach.

In the Bangweulu system, fishermen operate routinely from boats using gill nets in conjunction with the illegal "Kutumpula" method (driving fish into nets by hitting the water surface). Evans (1978) recorded a fall in the number of fishermen, perhaps related to a continual decline in the catch per effort. On the western side of the Lake (i.e. Luapula Province), approximately 75% of the catch is sold. However, only 25% of the catch is sold on the eastern part of Bangweulu; this is explained by reduced cassava production in this area, where fish assure a more important dietary role at subsistence levels.

2.2.6.3 Fish culture

The NP Fish Culture Development Project is based at Misamfu, with substations at Isoka, Chinsali and Kaombe/Mpika. The aim of the project is to develop and diffuse appropriate fish farming technology to small and medium scale farmers in the province. As this project is still running, no hard data are available on the viability of this form of land-use in the NP. However, there are estimates of about 1500 prospective fish farmers in the Province; the aim is to provide them with fish seed and technical assistance. The Department of Fisheries claims that approximately 3000 fish ponds are in existence in the NP, owned by some 700 farmers. The production is almost entirely for subsistence purposes.

The programme is directed at farmers as opposed to fishermen, primarily as a diversification strategy to utilize areas unsuitable for agriculture, and by integrating fish culture with other activities where possible.

2.2.7 Off-farm activities

Off-farm activites constitute a larger share of total farm household income in NP, on average more than 40% according to one survey in Zone 2 (Kasama/Mpika) and Zone 3 (Mbala/Isoka) (ARPT, 1988a). Rural households supplement their agricultural production by exploiting the natural environment for valuable off-farm produce to meet subsistence and income needs. The produce from activities such as gathering, hunting and fishing constitutes an important component of the overall land-use production system in all traditional farming systems in the NP. The local people have a great knowledge about valuable and diverse products from the natural habitat. Hence the necessity of involvement in natural resource management.

Gathering of produce from the natural environment is an important activity for both men and women. Produce obtained through gathering includes honey, insects (caterpillars), fruit and plants (icikanda tubers, mushroom and medicines). Popular fruits include Perineuria curatellifolia (mpundu) and Uapaca kirkiane (mususku).

Fishing is an important activity, especially during the early dry season when men migrate to fishing locations and establish camps (Strømgaard, 1985). Men use spears,weirs, nets and traps to fish, while women use fish poisons from indigenous plants. Fish is the main source of income in Zones 1 (Kaputa) and 4 (Chambeshi Bangweulu Floodplain). Thus fish is not only a source of protein but also a source of income for rural households. Even in other Zones, river fishing occurs and a programme to promote fish farming in these Zones has just started in the NP.

Hunting is another activity that is dependent on resources of the natural habitat. However, because game hunting without a government licence is illegal, data on the importance of hunting to the economy of rural households are difficult to obtain. But ARPT (1986) indicates that game hunting is an important source of income in Zone 5 (Luangwa Valley) and possibly in Zone 1 (Kaputa) also. Most hunting occurs during the dry season, especially in September - October, when the grass is burnt off. Hunting is exclusively done by men and because few people own guns, hunting is mainly by spears, nets and a variety of traps (Strømgaard, 1985b).

Few studies except for the ARPT study have been able to quantify the dependence of rural households on off-farm produce from the natural environment (Ogle, 1989). However, it is generally accepted that such produce enhances food security and promotes nutrition, especially among resource-poor households. Holden (1988) found that off-farm produce from the natural environment played a significant role in the economy of rural households in Kasama District. In one village trade in charcoal had become an important source of income for some households. Another study in three villages around Kasama revealed that cash from sales of fish, beer, caterpillar, handicrafts, livestock, honey, icikanda (wild orchids) accounted for a significant part of the mean income of households (Vedeld and Øygard, 1982).

Other off-farm activities of major importance for cash income in many households are trading, small-scale food processing and manufacturing. While it is beyond the scope of this report to discuss the potentials of these sectors, we would hold that a further encourragement of these activities could relieve pressure on natural resources and contribute significantly to sustainable development in NP.

Chapter 3:

SOCIO-ECONOMIC CONTEXT

3. SOCIO-ECONOMIC CONTEXT

3.1 POPULATION

3.1.1 Population distribution

Population distribution in the NP has a decisive influence on options given to people for sustainable use of local natural resources. The size, pattern and density of human settlements influence the rate and extent of natural resource use.

The present population distribution of the rural population in NP reflects reliance on public services and the growing importance of roads, railway and service centres for choice of residence. Access to co-operative depots, urban markets, health clinics, primary schools and hammermills are becoming more important for people's settlement decisions.

Particularly important in recent years (1960-70) were the completion of the Tazara railroad, improvement of the Great North Road and growth of rural districts which have brought new employment opportunities to formerly minor rural towns like Mpika, Mbala and Kasama and led to the build up of rural settlements along the Isoka-Nakonde and Kasama-Mbala roads. The formerly more even distribution of settlements disappeared between 1963 and 1969 and major population concentrations appeared along roads and around minor service centres and rural towns. Large areas with poor infrastructure remained largely uninhabited. Western districts with low population densities like Luwingu and Mporokoso have a more scattered population than eastern districts. The combined influence of restriction on the customary movement of villages which was implemented in the late sixties and people's need for social services has led to more permanent settlements.

3.1.2 Population growth

The NP experienced negative population growth (-0.6% per.annum) between 1963 and 1969, mainly due to high male labour migration to Lusaka and the Copperbelt. In the seventies (1969-80) natural population growth exceeded net migration causing a halt to a declining population trend in the NP. From 1969 to 1980 the population of NP increased from 545 096 to 677 894 which makes it the second most populated province in Zambia. Population density is, however, low compared to other provinces and well below the national average. The positive population growth (2.0% per.annum) can be attributed to two main factors: 1. Decreasing out-migration and perhaps 2. Increase in-migration of former labour migrants.

The positive population change is also reflected on district level as shown in table 3.1.

Table 3.1 Annual population growth by district (%) 1963-69 and 1969-80. Data from Central Statistical Office (1980).

District	1963-69	1969-80
Chilubi [1]	- 0.3	0.7
Chinsali	- 3.4	1.2
Isoka	- 0.9	1.8
Kaputa [2]	- 0.6	2.2
Kasama	- 0.9	2.9
Luwingu	- 0.3	0.7
Mbala	0.8	1.6
Mpika	- 0.2	2.9
Mporokoso	- 0.6	2.2
Average	- 0.6	2.0

1.Chilubi was part of Luwinga during the 1963 and 1969 censuses
2.Kaputa was part of Mporokoso during the 1963 and 1969 censuses

The decrease in migration from the province has apparently coincided with a change in migration within NP (Pottier, 1988). District towns have become increasingly important as new centres for rural migration putting more pressure on land, water and forest resources in peri-urban areas.

3.1.3 Household characteristics

NP has also been characterized by a high proportion of female-headed households. In 1980 36 % of all households in the province were female-headed. Highest figures have been in districts with high occurrence of labour migration. Between 1969 and 1980 all provinces except NP experienced an increase in the proportion of female headed households. Assuming equal divorce rates and male mortality throughout Zambia a reduced number of female headed households might be an additional proof of reduced out-migration of males combined with a larger number of returning migrants.

The slowdown in labour migration from NP has probably also contributed to an increase in average household size:

Table 3.2 Change in household size

Sector	Mean h.h size		Change	Projected mean h.h size	
	1969	1980	(%)	1985	1990
Urban	4.5	4.9	8.9	5.1	5.3
Rural	4.5	4.7	4.4	4.8	4.9
Total	4.5	4.8	6.0	4.9	5.1

Assuming the same rate of linear increase in average household size during 1980-1990 the projected average household sizes for urban and rural populations are as given above. The projected mean household size in 1985 is lower than recent studies have shown. For example rural surveys by IRDP-Mpika, ARPT-Kasama and NORAGRIC/AUN researchers in NP indicate that the average rural household size in 1984/85 was 5.2. Given the fact that households form the basic consumption and production unit in both rural and urban areas and a positive population growth rate, increase in mean size of households will put more pressure on demand for arable land and other natural resources.

3.2 FARMER PROFILES

The rural households of the NP constitute a diverse group. There are large differences in size of farms, availability of resources (land, labour, capital, access to inputs and markets), as well as in income and nutritional levels.

Differences in availability of resources have contributed to the wide spectrum of land-use strategies and farming systems in the province. We distinguish between three categories: 1) chitemene shifting cultivation, 2) semi-permanent, and 3) permanent systems (see Section 2.2.3).

Within each of these land-use farming systems two categories of farmers with differential access to resources emerge: "resource rich " and "resource poor" farmers. Each category appears to have different goals and different production strategies. Consequently, the different land use systems associated with each will have different environmental implications.

Rural households and farmers in Zambia are often grouped according to their marketed production. In the NP we distinguish three types of farmers based on the number of bags of maize sold to the NCU (ARPT, 1986): 1) subsistence farmers with no bags sold; 2) emergent farmers with 1-30 bags sold; 3) commercial farmers, compricing a) small-scale commercial farmers with 31-250 bags sold, and b) medium to large-scale commercial farmers with more than 250 bags sold. In this latter group are included institutional farms such as parastatals and Rural Reconstruction Centres.

The subsistence farmer will typically be resource poor relative to the resource rich commercial farmer.

ARPT (1986) estimated the percentage of farmers in each category by zone, based on NCU depot records and population data estimates, as in Table 3.3.

Table 3.3 Percentage of farmers within farming categories by ARPT-Zone in Northern Province. Data from ARPT (1986a).

Farmer category	ZONE (% of farmers)					
	1 (Kaputa)	2 (Kasama/Mpika)	3 (Mbala/Isoka)	4L*	4R*	5 (Luangwa Valley)
Subsistence	>95	75	50	>95	60	>95
Emergent	<5	20	40	<5	35	<5
Commercial large-scale	0	5	10	<5	5	0
	100	100	100	100	100	100

4L: Lake Bangweulu area
4R: Chambeshi River Valley area

The striking feature is the variation from one Zone to another, with a much higher frequency of emergent farmers in Isoka/Mbala (Zone 3) in the Mbala region of Zone 4, and in Kasama/Mpika (Zone 2). Due to the sharp increase in maize production after 1986 when this table was produced, the relative numbers of emergent farmers in each Zone would be much higher today.

3.2.1 Subsistence farmers

The number of subsistence farmers in NP is not known, but they constitute the largest group of farmers. There is considerable variation in degree of market integration and land use systems within this group, but typically they produce mainly for subsistence needs. A primary goal is to secure the household requirements for preferred foodcrops (millet, cassava, local maize, hybrid maize, beans, groundnuts); a secondary requirement is to obtain cash for essential consumer goods (cooking oil,sugar, salt, school uniforms and medicines). Risk of crop failure will be spread over diverse cropping and farming patterns. The dependence on chitemene cultivation and off-farm activities will be high. The size of the cultivated area (chitemene and semi-permanent fields) depends primarily on the subsistence needs of the household and on the availability of family labour. Various surveys have indicated average size of the area under cultivation to be 1-2 hectares. The agricultural production for sale among the subsistence farmers is more incidental than planned. The expansion of maize cultivation in the NP has shown that, given appropriate incentives and access to input supply and marketing services, the more resource-rich subsistence farmers may mobilize extra labour resources (both from within the household and from outside the family) to produce maize on semi-permanent fields.

The main cash crops were formerly beans and groundnuts, but hybrid maize is taking over in many areas. Millet and cassava are also important as cash crops, and are sold

locally. Beans are sold mainly through private merchants that offer better prices and marketing services than does the NCU.

3.2.2 Emergent farmers

About 70,000 farmers delivered maize for sale in 1988. But the stable core of emergent farmers is probably less. They are basically subsistence producers, but with a larger and more planned production of maize for sale. Typically they will have a favourable producer:consumer ratio in the household equivalent to a larger household labour capacity. Access to input supply and marketing services will be better than for subsistence farmers. The farm size may vary from 2 to 5 hectares, depending on the degree of mechanization and on the ability to raise cash for extra household labour. The majority still rely on manual cultivation, but oxen are becoming important in some areas around e.g. Mbala, Isoka and Mpika. Only very few will hire a tractor for ploughing.

The main cash crop grown will be maize, but many farmers may also grow beans, soybeans, cotton, sunflower, rice (particularly on the Chambeshi plains), and vegetables. Returning migrants are found more frequently in this group of farmers than in the subsistence group. An increasing number of the more resource-rich emergent farmers are obtaining leasehold titles to their land, which give them legal security for long term investments in, for example, soil conservation.

3.2.3 Commercial farmers

No specific data could be obtained on the numbers of small-scale and large-scale commercial farmers in NP. While the small-scale commercial farmer will typically cultivate 5-10 hectares, the large-scale commercial farmers may cultivate from 10-20 hectares up to several hundreds. Large-scale commercial farmers cultivating more than about 100 hectares, may according to our information, number less than fifty. Commercial farmers typically cultivate on large open fields, sometimes through mono-cropping. They produce a variety of crops for the market - including maize, coffee, cotton, sunflower, wheat. Fertilizers and pesticides levels are high, with some application of lime. Tractors are often used for land preparation and ploughing, and permanent labour employment is common. Commercial farmers will have good access to input supply and marketing services, and will typically seek to maximize net income to a greater degree than subsistence and emergent farmers manage to do.

Commercial farmers will mostly have lease-holding titles to land, and, hence, greater land security than land held under customary law.

Chapter 4:

POLICY AND PLANNING IN THE NORTHERN PROVINCE

4. POLICY AND PLANNING IN THE NORTHERN PROVINCE

In assessing the environmental effects of agricultural change and development in NP it is essential to understand the GRZ policies that determine directly or indirectly the type and scale of land use and resource development in Zambia. Also of importance in this discussion are the planning mechanisms through which policies are translated into programmes.

This chapter sets out the various policies, planning mechanisms and legislation relevant to agricultural development and resource use in NP. It is not intended to be comprehensive but rather to highlight policies and economic factors that have had a profound effect on Zambian agriculture. Readers with a thorough knowledge of the policies and economic factors influencing Zambian agricultural development may wish to proceed to subsequent chapters.

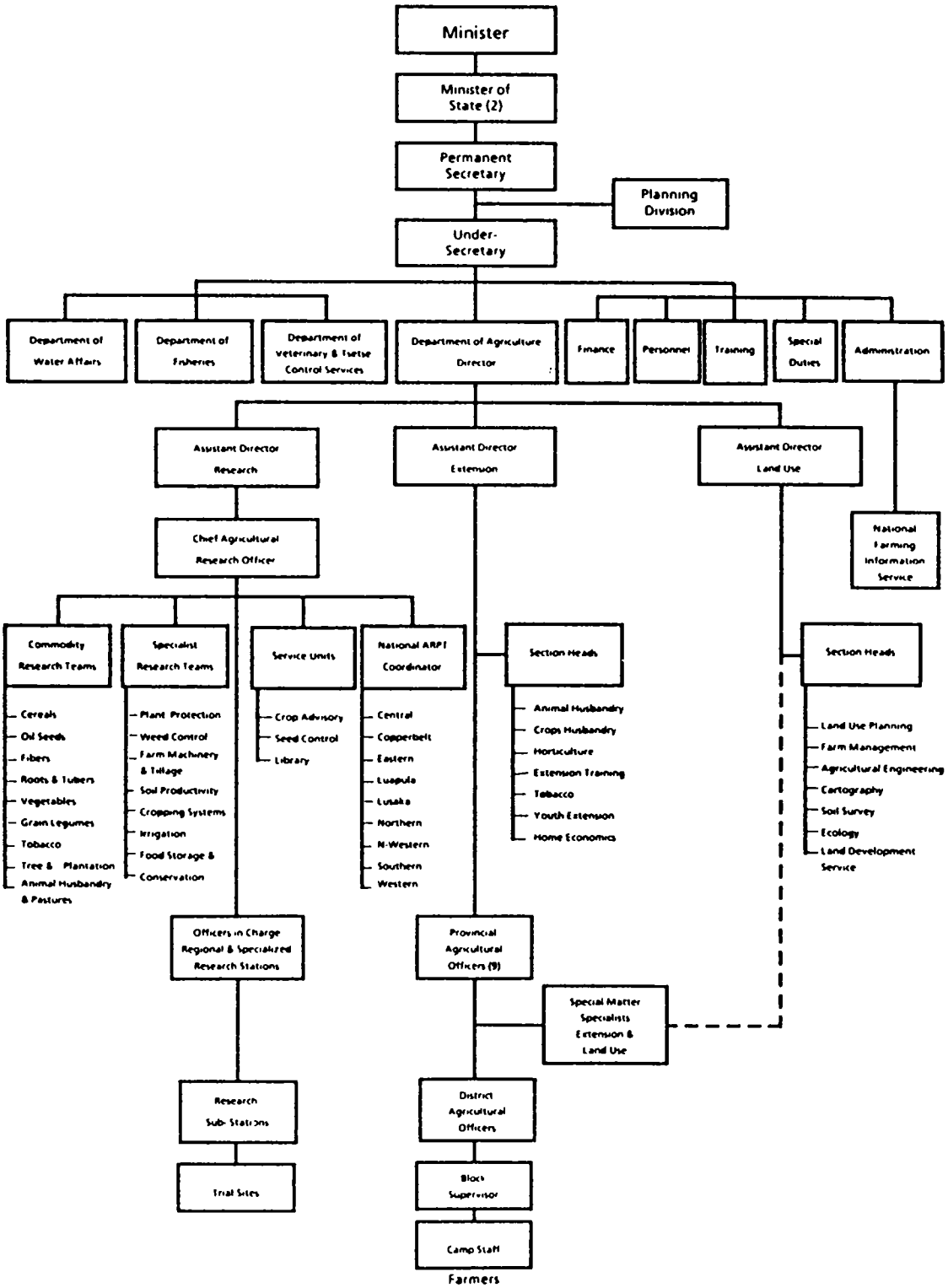
In setting out the policy framework we recognize that external economic factors have had a major influence on resource use and development policy in Zambia. Extreme economic hardships along with an overwhelming debt burden have forced Zambia to adopt resource-use policies directed almost exclusively at generating revenue and achieving food security.

Furthermore, although in many cases GRZ policies as outlined in the national development plans provide considerable insight into the strategies that must be taken in various sectors to achieve sustainable resource use, few of these policies and strategies are actually translated into successful programmes due to a variety of economic, human resource and infrastructure problems.

We have considered policies relating to agriculture, fish, forests, wildlife and environmental conservation of vital importance to achieving a sustainable development future for NP. Beyond the scope of this study, but also viewed as critical to long-term sustainability are appropriate population and human resource development policies and programs.

All GRZ policies and plans discussed in this chapter are generated within a five-year national planning cycle in which national policies are drafted by individual GRZ ministries, assembled into a five-year planning document by the National Commission for Development Planning, recommended to the cabinet by ministers and permanent secretaries and finally approved as official national policy by the Party Central Committee. The strategies and programmes necessary to implement these policies are then carried out by line ministries at the national, provincial and district level.Acting within the national policy framework set by the Party Central Committee, provinces and districts set their own policy priorities through provincial and district development councils. Provincial and local policy priorities of the NP are outlined in Section 4.2.

Fig. 4.2 **Present Structure of the Department of Agriculture Ministry of Agriculture and Water Development**



Source: Kean and Singogo, 1988.

4.1 AGRICULTURAL POLICY CONTEXT

The agriculture sector in Zambia plays a crucial role in effecting structural transformation of the economy by contributing to the GDP and to exports and employment. Current agricultural policies focus on efficiency gains from regional comparative advantages and the production of export crops. As a result of recent policy changes maize production will be increased in the smallholder sector which is considered to have production cost advantages, and commercial farmers will be encouraged to produce mostly export crops. Zambia's agricultural strategy during the Economic and Financial Poling Framework (EFPF) plan period (1989-93) will focus on promoting smallholder production by redirecting and augmenting research and extension services, strengthening agricultural credit, and improving the administration of services by the Ministry of Agriculture and Cooperatives.

The GRZ institutional mechanisms to implement agricultural policies include the Department of Agriculture (DAO), the Department of Veterinary and Tsetse Control Services, Agricultural Extension Services, the Land-Use Branch and the Research Branch. Agricultural marketing is carried out by a mixture of parastatals, co-operatives and private marketing bodies. The main organizations involved in the marketing of agricultural produce and supply of inputs such as seeds, fertilizers, chemicals and farm equipment are the National Agricultural Marketing Board (NAMBOARD) and the Provincial Co-operative Unions (Northern Co-operative Union in NP). The Zambian Seed Company (ZAMSEED) has overall responsibility for seed production and marketing. Other parastatal companies with responsibilities for specific crops are the Lint Company of Zambia (LINTCO) and the National Tobacco Company (NATCO).

4.1.1 Economic policies

Agricultural policies in Zambia are tied inextricably to the country's economic policies. In the past GRZ policy has depressed agricultural prices relative to world market prices by overvaluing exchange rates and providing high levels of protection to the industrial sector (Dodge, 1977; Kydd, 1986). Government expenditure for agricultural development has been low in the past and official farm prices fixed by government during the 1970's did not keep pace with overall price levels, except for a few crops like maize. The share of total direct national budget allocations to agriculture was less than 5% up to the mid-1980's (SUAS, 1987).

In the past policies have tended to favour emergent and commercial farmers along the "line of rail" rather than subsistence farmers. Until changes in policies were introduced in the early 1980's, few incentives and little support were accorded the small-scale farmers of NP. With the trade collapse in 1982 and with the lowest copper prices since World War II, a process of reorientation in economic policies in Zambia was initiated. Through structural adjustment programmes more attention was given to the agricultural sector, with positive implications for agricultural production in NP.

On May 1 1987 the IMF-supported programme of economic adjustment was discontinued by the Zambian government. The government maintained that the programme - comprising a reduction in government spending, foreign exchange auctioning, decontrol

of prices, a wage freeze, decontrol and upward adjustment of interest rates - had not achieved its intended objectives, and had led to a decline in social and economic well-being of the people. The government embarked upon a New Economic Recovery Programme (NERP). The objectives of NERP coincided in many ways with those of previous reform programmes by putting emphasis on growth through diversification, reducing dependency on imports, and stabilizing the economy through the control of inflation (EFPF, 1989).

The main development objectives for the agricultural sector in the NERP were:

* to achieve self-sufficiency in staple food crops;

* to expand the production of agricultural exports;

* to increase the import substitution of agricultural products and inputs;

* to improve rural employment and incomes among peasants and emergent farmers.

A wide range of government support programmes and policies were launched in pursuit of agricultural development:

* remunerative farm producer prices;

* reducing flat rate of tax on agricultural income to 15% (as compared to normal rates of 40-45%);

* a foreign exchange incentive to producers of maize, wheat and soyabeans in the form of a bonus of foreign exchange remittance of USD 0.20 per bag for production in excess of 5000 bags and USD 0.50 per bag over 1000bags;

* a bonus for early delivery of maize;

* a retention of 50% of foreign exchange earnings from the export of non-traditional produce;

* exemption from customs duty when importing agricultural machinery;

* permission for farmers to export 25% of harvested wheat, soyabeans and groundnuts;

* a two year write-off period for farm machinery and equipment;

* preferential allocation of foreign exchange.

Economic performance improved in certain respects in 1988. An impressive growth rate of 6.7% was recorded compared with 2.2% in 1987. Agricultural output increased by 21 %. While agriculture received relatively low foreign exchange allocations compared to the manufacturing sector, the agriculture sector was stimulated through increased producer prices (EFPF, 1989; Lumbwe, 1989).

In August 1989 the Economic and Financial Policy Framework (1989-1993) was announced as part of the New Economic Recovery Programme. The following measures were of particular relevance to agricultural development in NP:

* the commitment to increased emphasis on the agricultural sector;

* to reduce the budgetary burden of subsidies; removal of consumer subsidies on maize - except for a coupon subsidy of maize for the needy in urban areas; phasing out the handling subsidies for maize and fertilizers, as well as the price differential subsidy for fertilizer.

* NAMBOARD would be abolished and fertilizer importation and marketing would be taken over by Nitrogen Chemicals of Zambia;

* the provincial cooperatives would take over the responsibilities for maintenance of the maize reserve and maize marketing;

* the cooperatives would be supervised through budgetary control measures;

* adequate funding would be provided to key sectors of agriculture (particularly extension and other support services) roads, health and education;

* civil service salaries would be increased, especially at the upper levels;

* prices for all products except maize were decontrolled in June 1989;

* the private sector should receive an equitable share of the foreign exchange allocations to the agricultural sector

* inflation would be brought down to 40% by 1991;

* private traders to be allowed and encouraged to participate in the marketing of maize by 1993;

* regionally differentiated floor producer prices that approximate border price equivalents would be introduced;

* fertilizer marketing would be made more efficient by restructuring the distribution system and introducing private trading beginning in the 1990/91 crop season;

* fertilizer subsidy would be eliminated by 1993.

4.1.2 Marketing policies

Neither the distribution of inputs such as seed, fertiliser and lime nor the marketing of produce have been very successful in the past due to inefficiencies in the transportation system and poor management. Despite the relative strength of parastatals, the retail trade in NP is still dominated by the private sector with the

exception of maize. No private trading of maize has been allowed by GRZ. Although NCU has a mandate to collect all crops, it concentrates almost exclusively on maize. This is also a result of the low floor prices of other traditional cash crops such as beans and groundnuts. These floor prices are set too low to compete with the private traders.

4.1.3 Credit policies

Policies of credit institutions are directed towards the provision of credit to all farmers, but in practice commercial farmers receive priority over subsistence and emergent farmers. There is some indication recently that allocations of credit to subsistence farmers have gradually increased over the last few years.

ZCF-FS (also termed LIMA Bank Limited) disbursed Kw 5,578.000 to NP in 1986/87 and Kw 7,555.000 in 1987/88. An announcement this year by GRZ indicated that the credit schemes for NP would receive an increased financial allocation for 1989/90 to match the increase in input prices. Both AFC and ZCF-FS provide seasonal, medium and long-term credit. Current interest rates are 35% with credit extended to cooperatives, farmers groups and to individuals. Recovery rates have increased to between 95% and 98% in AFC over the last few years; the LIMA Bank has a lower recovery rate.

4.1.4 Agricultural research and extension

Most agricultural research in Zambia is conducted by the Research Branch. Research in NP is conducted at Misamfu Regional Research Station, particularly through the Soil Productivity Research Programme (SPRP). On-farm client-oriented research has been introduced as a national programme through semi-autonomous provincial operational units known as Adaptive Research Planning Teams (ARPT). ARPT in NP has been under operation for about three years.

Extension activities are the responsibility of the Extension Branch. In 1978 Zambia initiated an extension approach along the lines of the Training and Visit (T & V) system. The classical T & V system involves a programmed and disciplined approach to extension, based on regular farm visits by trained staff, delivering key messages to carefully selected contact farmers. These are coupled with a rapid feedback of problems from farmers to researchers. Due to lack of funding the system has only partially been introduced. A modified T & V system is planned introduced in NP (VAP/ETP, 1989).

4.2 NATURAL RESOURCE USE POLICIES

Although this study focuses primarily on agricultural policy and development in NP, policies pertaining to lands, natural resources, water, forests, fish and wildlife are also critical factors in achieving sustainable development in NP. These policies are outlined briefly here to highlight current objectives and general policy directions.

4.2.1 Lands, natural resources and water development

Land-use policies are implemented through the Ministry of Lands, Natural Resources and Water Development, as well as the Land-Use Planning section of the Ministry of Agriculture.

The major focus of MAWD is on land-use and land tenure activities as well as water development for local and industrial use. Land tenure and land use activities include the identification and survey of land, the allocation of land rights through title deeds and the collection and dissemination of information pertaining to land. Current strategies for carrying out policy objectives for land tenure and land use under the FNDP are to:

(a) improve the planning and land delivery system by updating existing laws; streamlining land acquisition procedures; providing basic infrastructure for underdeveloped land; and strengthening land, survey and planning services for aquiring title to land, giving priority to rural areas.

(b) providing up-to-date topographic maps for the purpose of rural and urban development, planning, agriculture, forestry, tourism and utilisation of natural resources.

(c) providing national survey information for the benefit of all users.

(d) increasing revenue from land.

Objectives of the water development sub-sector include ensuring acceptable quality and quantity of water to users, providing for effective conservation and pollution control measures, enacting legislation to establish regional water authorities, and maintaining proper hydrological and hydrogeological data pertaining to the country's water resources.

The Land-Use Planning Section of the Land-Use Branch in the Ministry of Agriculture is responsible for land-use planning for farm settlements including catchment planning, farm planning, soil conservation, settlement schemes, project planning (such as tobacco schemes) and surveys and feasibility studies.

Realization of land-use and water development goals have been slow due to lack of resources and skilled manpower.

4.2.2 Forestry

Closely linked to sustainable agricultural development is sound forestry management. The Forest Department is responsible for the management of gazetted forest reserves (approximately 9% of Zambia) as well as controlling the harvest of forest produce such as poles, timber, mushrooms, caterpillars, firewood, charcoal, fruits and honey. This is done through the sale of licences for operations in all natural forest areas in Zambia.

The Forest Department is also responsible for the establishment of local supply forest plantations and promotion of tree planting and beekeeping in rural areas.

The Ministry of Agriculture is responsible for agroforestry and tree planting schemes on farms. The Ministry of Natural Resources is responsible for forests outside of national parks and gazetted forest areas. The Forest Extension and Publicity Section is responsible for advising the public in sound forestry practices. Forestry objectives under the FNDP are to:

(a) protect and manage indigenous forests and forest plantations;

(b) promote forest-based industries; and

(c) ensure adequate supply of fuelwood.

Targets include increasing forest estates, planting more trees, increasing honey production and establishing additional regional and local plantations and increasing the technical and professional staff of the department.

Strategies to achieve these objectives include:

(a) assessing and compiling the quantity and quality of the available forest resources in the country;

(b) strengthening silvaculture and utilisation research with particular emphasis on indigenous species;

(c) co-ordinating and offering technical advice to wood based industries;

(d) expanding and strengthening the training programmes at all levels; and

(e) increasing wood resources for timber products and fuelwood supplies.

4.2.3 Wildlife

Despite the fact that the Department of Wildlife is one of the largest and oldest government departments in Zambia the FNDP contains very little mention of wildlife goals and objectives other then those activities directly related to the improvement of tourism in Zambia.

Several years ago the Department of Wildlife was transferred from the Ministry of Lands and Natural Resources to the Ministry of Tourism and National Parks. This transfer appears to have separated the management of wildlife from other natural resource interests, thus resulting in a lower profile for wildlife interests in national development planning.

Along with objectives for the tourism sector the FNDP identifies the following priority for the Ministry of National Parks and Wildlife:

* to serve the dual needs of conservation and development, mobilising the income generating potential of wildlife and ensuring that earnings from tourism offset a growing amount of public expenditure on wildlife conservation.

The FNDP states that Game Management Areas support programmes for the exploitation of wildlife reserves, primarily in providing communities with houses and employment, and also utilize wildlife for food, as most rural populations are deficient in protein. It is the policy of the Party and its Governemnt to expand wildlife with full involvement and participation of the local people. (NCDP, 1989b p. 207)

Strategies for meeting objectives in the field of wildife include:

* impressing on local authorities the need for them to play an active role in the preservation of the cultural heritage, natural resources and wildlife;

* extending the integrated approach to other Game Management Areas based on the Luangwa Resource Development Programme; and

* conducting Wetland programmes at Kafue Flats and Bangweulu Swamps with a view to providing demonstration of how wetland should be conserved, and in particular to provide the local inhabitants with methods of conserving wetland resources for their sustainable development.

* the Wildlife Conservation Society will consolidate efforts and promote on a small scale, socially acceptable and culturally appropriate conservation clubs within their communities including a Natural Resources Centre in the Lusaka Showgrounds and ongoing education and training programmes mainly for the Chongololo and Radio Clubs. (NCDP, 1987)

4.2.4 Fisheries

Under MAWD, the Department of Fisheries is responsible for the management of national fisheries, control of fishing, control of water pollution and the promotion of fish culture. Although Zambia has one of the largest inland fisheries on the African continent, policies and programs related to fisheries have received little support on the national development agenda relative to other sectors.

Current objectives for the fisheries sub-sector are to:

(a) increase fish production with a view to self-sufficiency;
(b) improve marketing, handling and processing of fish;
(c) encourage the production of exotic fish; and
(d) promote the export of acquarium fish.

The following strategies are to be employed to meet these objectives:

(a) setting up of a fisheries industry co-ordination committee;
(b) improving the supply of fishing gear and fish seed;
(c) strengthening of research, extension and monitoring activities;
(d) improving accessibility to credit facilities; and
(e) improving processing and marketing.

4.2.5 Environmental protection and conservation

The adoption by cabinet of GRZ in 1985 of a National Conservation Strategy for Zambia has provided a forum for the development of policies and programmes focusing on environmental protection and conservation. Developed under the auspices of the Ministry of Lands, Natural Resources and Water Development, with the assistance of IUCN, the NCS was officially adopted as policy by Cabinet in 1985. The NCS seeks to define and establish policies, plans, organisations and action to ensure that the sustainability of natural resource use is fully integrated with every aspect of Zambia's social and economic development (IUCN, 1985).

The NCS outlines requirements for action in the areas of agricultural resources, human settlements, wildlife resources, tourism, fisheries, energy, mining and industry, population and health and water.

Strategies to implement these action requirements are proposed through:

* the establishment of cross-sectoral guidelines for the assessment of sector policies in relation to other sectors;

* sustainable financial policies pertaining to development planning and resource allocation incorporating as a general principle the valuing of natural resources realistically reflecting the real costs of resource use;

* a new conservation co-ordinating body which has taken the form of the National Conservation Committee soon to become the Environment Council under the new Environment Act;

* the enactment of a new Environment Act which is expected to pass through parliament during 1989;

* increased environmental education for the public, politicians, planners, developers, teachers and school children and extension workers;

* a more integrated conservation oriented extension service;

* increased community participation in conservation through such programmes as self-help housing, gardening and employment generation, community fuelwood plantations, resource co-operatives in Game Management Areas, and public participation in the town and country planning process.

* increased training of field staff, teachers and professionals in sustainable development of natural resources;

* increased inventory of land capability information identifying areas of worst soil erosion, deforestation and overgrazing together with the type and severity of each problem, ecological conditions of different protected areas and inventory of fish stocks and water resources.

* research on community forestry and agroforestry, soil erosion, soil conservation, sustained yield management techniques, livestock carrying capacities, water conservation, fisheries, effects of pesticides, life cycles of important pests and their predators and more effective pollution control.

The National Conservation Committee through the Ministry of Lands, Natural Resources and Water Development proposes to decentralize the National Conservation Strategy to the provinces with initial priority to Northern, North-Western, Western and Southern Provinces. To date nothing has been done in the Northern Province to begin the decentralization process, but it is envisaged that a Provincial Conservation Committee or Council would be established under the Permanent Secretary. Provision for such a Council exists under the Natural Resources Conservation Act and the new Environment Council Act described in Section 4.6.

A Provincial Conservation Council would be comprised of representatives from key government departments, chiefs and representatives of the district and ward councils and NGOs in the Northern Province. The key role that this Council could play in environmental management in the Northern Province is discussed in Section 7.

4.3 PRIORITIES FOR THE NP

Within the framework of the foregoing national policies, provincial priorities have been set by the Provincial Development Council of NP. Current resource use and development-planning priorities for the Northern Province are outlined in the FNDP (1989):

(a) expansion of the integrated rural development programme (IRDP) to other areas of agricultural potential;

(b) development and expansion of agricultural services and supporting facilities;

(c) expansion of the medium sized coffee plantation schemes;

(d) expansion and development of crop production schemes;

(e) expansion of the Ward Agricultural Program (WAP);

(f) expansion of the existing wood based small scale industries and bee-keeping;

(g) development and improvement of feeder roads network.

These objectives are to be met through the following strategies:

(a) provincial self-reliance in food through accelerated agricultural production;

(b) providing more infrastructure support in agricultural productive areas;

(c) promoting viable small-scale agro-based industries for both domestic consumption and export;

(d) expanding wood resource-based industries and establishment of appropriate wood processing unit;

(e) promoting the bee-keeping industry;

(f) expanding the fishing industry;

(g) redressing imbalances between Eastern and Western Districts of the Province; and

(h) aligning all IRDPs and converting the VAP into a Ward Agricultural Programme.

Within agriculture and water development the following activities are to be given priority:

(a) extension and training - rehabilitation of existing Farmers Training Centres and establishing new ones in Kuwingu, Chilubi and Kaputa;

(b) research - improving research facilities - particularly for the coffee industry;

(c) crop and fruit production - strengthen research and extension on crop production, expand mango production in Mbala, encourage palm oil in Kaputa, Mpulungu and Mbala, and develop pineapples in Mporokoso.

(d) livestock production - establish more cattle ranches in the Province, constructing quarantine facilties to allow free movement of cattle within the Province, producing high quality stockfeed, and setting up milk collection centres in Mbala and Isoka.

In the land-use sector six settlement schemes are to be rehabilitated, farm blocks established, bulldozers purchased and land use equipment rehabilitated.

In the fisheries sector development priorities include the provision of credit to fishermen, expansion of fish ponds, and bringing a halt to the sharp decline of fish stock in Lakes Mweru-Wa-Ntipa and Bangweulu.

In the forestry sector sawmilling activities in Kasama are to be expanded, and community forestry programmes will be implemented through the establishment of pine and eucalyptus plantations at the ward level.

Within the natural resources programmes, activities will be concentrated on the establishment of an efficient monitoring and control system to prevent further decline of the natural resources base of NP.

4.4 INSTITUTIONAL PLANNING MECHANISMS

Equally important for consideration in this study as the policies themselves are the GRZ organizational mechanisms that act as vehicles for policy development and the formulation of plans or options to address increasing resource use demands. For it is in these forums that the principles of sound resource use can be integrated into development planning by donor agencies and GRZ alike.

Of particular interest to this study are committees, commissions or departments dealing with agriculture and resource use, and in particular those with potential for increased environmental planning and managment in a cross-sectoral context.

Figure 4.1 outlines selected GRZ departments, councils or commissions at the national, provincial, district and ward level and their relationship within the GRZ. The diagram is not intended to be comprehensive, but rather to assist in identifying potential areas (sectoral and cross sectoral) within government for improved environmental management in resource development.

The following councils, commissions, departments are considered to have potential as planning mechanisms for sustainable development in Zambia generally and specifically in the NP:

* The National Commission for Development Planning (NCDP) - established by Presidental directive, reporting directly to the Office of the President - is responsible for co-ordinating sectoral and regional planning priorities for national development planning. Although potentially an excellent vehicle for cross-sectoral planning, assisting sectoral departments in sound resource-use planning, environmental assessment and project appraisal, NCDP currently lacks staff who are trained in natural resources management and environmental assessment.

* The Planning Unit within the Ministry of Agriculture could provide a focus for sustainable agricultural development through strategies for a more conservation oriented agriculture programme. It could also provide critical linkages to other resource use sectors. It should be noted that such a planning unit exists only within agriculture; there is no such unit within the Ministry of Lands, Natural Resources and Water Development or the Department of Fisheries or Forests.

* The Interministerial Planning Committee for agriculture, fisheries, natural resources, land and water - an ad hoc committee for the purpose of reviewing

national development plan priorities within these sectors. It is one of the few cross sectoral planning committees within GRZ. It reports to the P.S. for each ministry as well as the Sectoral Planning Branch of NCDP. Individuals from organizations external to government (such as the University of Zambia) may be invited to sit as committee members. This committee can play an important role in scrutinizing sectoral plans, reinforcing sustainable development goals and principles, and offering recommendations to mitigate the effects of unsound resource use policies and practices. It should be noted that this committee does not include wildlife interests.

* The National Conservation Committee (NCC) (soon to be called the Environment Council) is appointed by the President's Office with a secretariat in the Ministry of Lands and Natural Resources. The objectives of the NCC are to implement the NCS, advise on environmental aspects of major projects, monitor environmental trends, set environmental standards for use in regulations, carry out educational programmes and provide coordination for conservation interests in Zambia.
  The NCC is the only ongoing cross-sectoral committee within GRZ (the Interministerial Committee described above meets on an ad hoc basis). The NCC provides a sound cross-sectoral forum for the asssesment of resource use policies and promotion of sustainable development principles.

* The National Council for Scientific Research carries out a range of research activities and recently has expressed considerable interest in research projects identified by the NCC.

* The Provincial Planning Unit for NP is an advisory body to the Provincial Development Council and the District Development Councils. It is currently funded by and responsible to NCDP, but it is to be transferred to the jurisdiction of the Province during the 1990 budget year. PPU is responsible for:
  1) Preparation of long-term, medium and annual work programmes and budgets for the Province; 2) Project development and appraisal; 3) Rural development monitoring and evaluation of key socio-economic indicators; 4) Project evaluation; 5) Co-ordination of all development activities in the Province; 6) Act as a Secretariat to the Provincial Development Council.

With this mandate PPU has the potential to be a focus for improved environmental planning and management in NP. The placement of PPU within government at the intersection of sectoral ministries is seen as an advantage in offering environmental planning and assessment expertise to a number of sectoral departments such as agriculture, forestry, fisheries, lands and natural resources, as well as to district and ward councils. In addition PPU is the logical focus for increased communication and co-ordination with donor agencies in development planning in the NP.

* The Provincial Development Council and the District Development Councils decide the priorities for development within districts and the Province. They recommend priorities for the NP to the Provincial Party Conference, which in turn makes representation to the National Party Council.

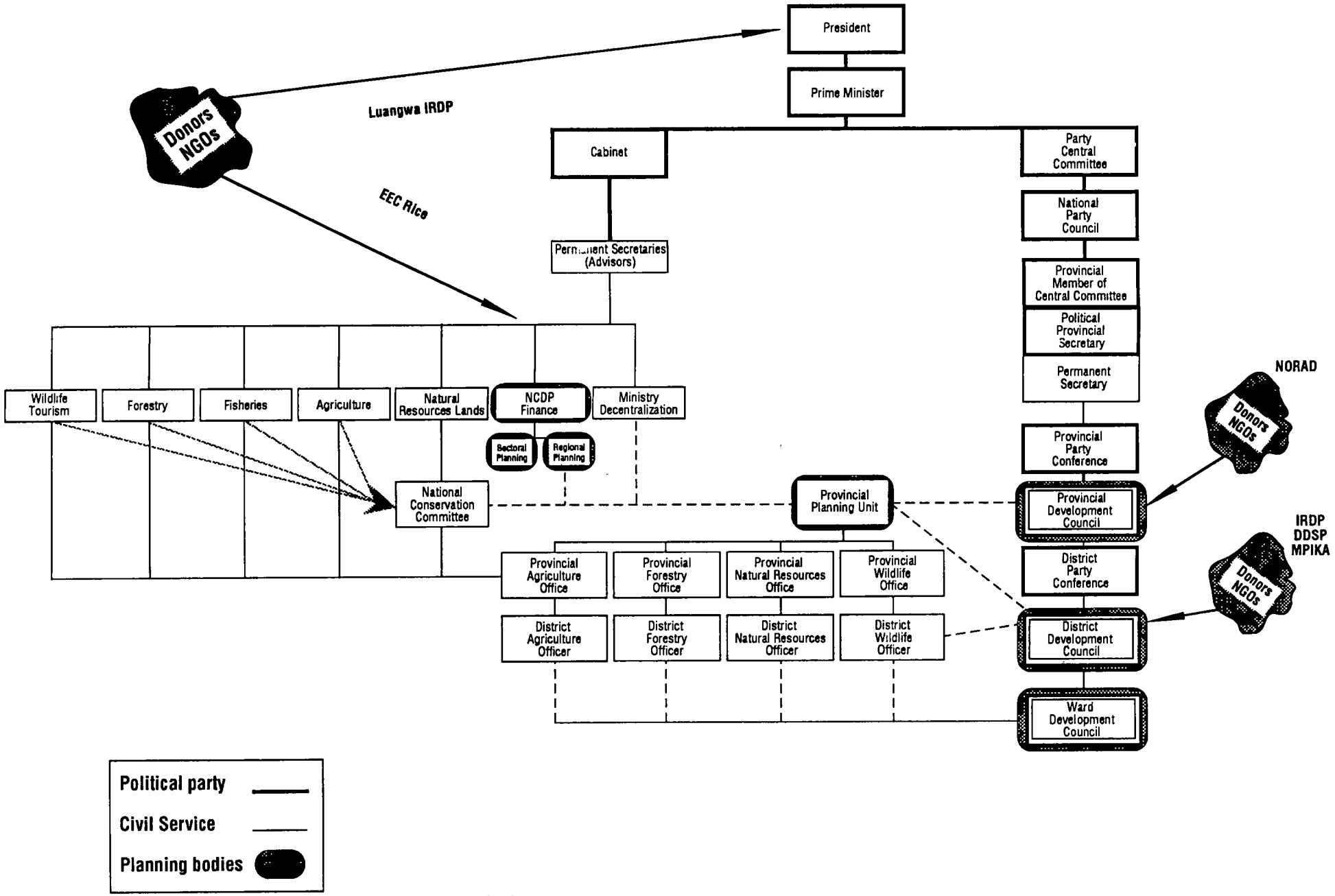


Figure 4.1 Organization of selected policy and planning bodies within GRZ

Provincial and District Councils combine political membership and representatives from GRZ. Although these councils approve annual priorities for the NP, the actual budget allocation for these priorities is done at the national level. Therefore the list of priorities as they appear in the national development plans may not reflect the resources that are actually budgeted for the implementation of these plans. Until financial resources are decentralized to the Provincial and District Councils, their ability to carry out plans will continue to be limited.

With respect to international and transboundary resource issues there are several bodies/ organisations with potential to play a key role in resource development policy and planning:

* Joint Permanent Commissions of Co-operation act as a useful platform for bilateral agreements on exchange of information, exchange of experts, as well as cooperation in transport and communications, industry, agriculture, banking and finance, energy and environmental issues. A deliberate effort is to be made during the Fourth National Development Planning period to use third party funding where necessary to finance some of these bilateral programmes and projects. (FNDP p.48) A Joint Commission exists between Zambia and Zimbabwe and it has met in the past to discuss issues such as the designation of Victoria Falls as a World Heritage Site. Potential exists for Joint Commissions between Zambia and other border countries such as Tanzania, Zaire, Malawi to deal with fisheries issues, watershed management, markets for agricultural produce. Through these Commissions and with the assistance of SADCC (described below) regional efforts towards sustainable development could be planned and implemented.

* The Southern African Development Co-ordination (SADCC) acts as a development planning co-ordination body for the front line states for the purpose of strengthening the institutional capabilities of the member countries (Zimbabwe, Zambia, Malawi, Tanzania, Mozambique, Lesotho, Swaziland, Botswana). To date SADCC has focused on the development of integrated strategies for strengthening the region, such as transportation and energy corridors within the region. However SADCC has also established offices within the region specialising in different environmental aspects of development planning such as soils, water, energy. In addition SADCC is planning to undertake a major Environmental Impact Assessment training project for the Southern African region. Such an EIA project could be of great benefit to GRZ and NP in providing EA and project assessment training, site specific EAs, and transboundary EAs between SADCC countries.

4.5 DEVELOPMENT PLANNING

Development planning offers a major opportunity to influence the shape of resource development in the NP. GRZ agencies involved in co-ordinating and implementing development interests of donor agencies have an important role to fulfill in this respect.

At present there seems to be little co-ordination of donor development interests in the NP; the result is the initiation of projects from a number of different levels of government. For example, DDSP Mpika was initiated at the district level, Luangwa LIRDP was initiated at the presidential level, NORAD funded projects are initiated at the provincial level and the EEC Rice Scheme was initiated at the national level. This is not to criticize any of these projects; the point is to illustrate the fact that development planning is currently taking place at many different levels. In Sections 7 and 8 we discuss advantages of increased co-ordination of donor interests in working towards sustainable resource development.

Criteria for the selection of externally aided projects in Zambia are developed by NCDP. Agreements between donor countries and GRZ take place primarily within NCDP and the Ministry of Finance. Although the concept of evaluating projects according to a set of criteria is commendable, the criteria used by NCDP (FNDP, p 49) in the case of externally funded projects for evaluating projects do not specifically include principles of ecological or resource base sustainability. Rather the criteria are heavily weighed towards economic values such as job creation and income generation which we agree are vital factors, but should not be chosen at the expense of the long term viability of the resource base.

At the Provincial level development planning is co-ordinated by the Provincial Planning Unit after receiving programme plans and priorities from the District Councils. The Provincial Development Council approves priorities for the Province and recommends them to the National Committee for allocation of funds by the Party Central Committee and Cabinet. Although the Provincial and District Councils do set priorities, their ability to implement these priorities is entirely dependent on the budget allocation process at the national level. Funds to carry out the stated priorities are usually extremely limited.

We have identified several other GRZ bodies having the potential to play a key role in development planning:

* The Joint Permanent Commissions of Co-operation act as a platform for bilateral agreements on a range of topics listed above in Section 4.4. They could play a key role in regional and transboundary resource-use issues.

* SADCC as described above currently plays an important role in development planning for the region.

4.6 RELEVANT LEGISLATION

Both statutory law and customary law play an important role in developing resources of the NP. Table 4.1 sets out the statutory legislation most relevant to resource use and agricultural development in Zambia. Customary law is discussed below with respect to land tenure:

Table 4.1 Statutory legislation relevant to agricultural development and environmental conservation in Zambia.

* Land Tenure Act (1970)
* Land Acquisition Act (1960)
* Land Reform Act (1970)
* Township and Country Planning Act (1979)
* National Parks and Wildlife Act (1971)
* Forest Act (1974)
* Fish Act (1967)
* Natural Resource Conservation Act (1970)
* Water Act (1971)
* Local Administration Act (1980)
* Environment Act (to be passed during 1989 sitting of parliament)

A review of legislation pertaining to the management of natural resources carried out by the National Conservation Committee concluded that with the addition of the proposed Environment Act the legislative framework in Zambia is adequate for the promotion of sustainable resource use with several notable exceptions. (NCC, 1989)

One exception is the need to make the Township and Country Planning Act binding for Trust and Reserve Land, mine townships and government operations including requirements for more conservation oriented, ecologically based planning. For example settlement planning should include an ecologically based assessment of the capacity of the surrounding area to provide necessary resources such as fuel.

It is of interest to note that some legislation currently provides for district councils to control certain activities related to resource use such as fishing and water pollution under the Fish Act, solid waste disposal under the Local Administration Act 1980 and forest protection under the Forest Act (1974). The new Environment Act also provides for major provincial or district initiatives to be taken in the environmental protection field. Details of the Act are outlined in 4.6.2 and Appendix 3.

4.6.1 Land tenure

Of particular importance when considering resource development is the system of customary and statutory law pertaining to land tenure. In most parts of Zambia and more specifically in the NP the distribution of land is still the responsiblity of the chiefs, as is the holding of courts for certain civil disputes within the area governed

by chiefs, known as chiefdoms. Chiefdoms vary in size and population, however the NP has some of the largest chiefdoms in Zambia approximating 4,500 sq. km. (Waern, 1984)

State land is mainly devoted to urban and industrial use and large scale commercial farming. Trust land and Reserves are areas where subsistence and emergent farming systems prevail. Statutory land rights (i.e. leaseholds) under the Land Tenure Act (1970) apply to State land only, while customary tenure rules still predominate in traditional farming areas.

In NP by far the largest portion of the land is held under customary law by jurisdiction of the Chiefs. Chiefs are also represented on District Councils. Chiefdoms are traditionally divided into village headman areas. Each farmer has a right to land which will be allocated to him/her by the Chief. Cultivated land belongs to the cultivator as long as the land is utilized. No title deed is accorded the cultivator and security of tenure is at the pleasure of the Chief in question. Local people are well aware of the boundaries of chiefdoms which usually follow hills and streams, unlike government administrative boundaries which often follow roads and tracks (Waern, 1984).

In recent years an increasing number of farmers have applied for registered title deeds, particularly in areas near markets such as Kasama, Mpika, Isoka and Mbala. In some cases however, this has taken the form of land grabbing, resulting in a disproportionate allocation of land. For example, in the area near Kasama, deeds of up to 5000 hectares have been granted, while a survey of 500 large scale farms by the DAO in the same district showed the average farm size to be 1000 ha. A later inspection of these farms indicated that only a small percentage of this land had actually been developed. Under the present law alienation of land for farming purposes is limited to a maximum of 250 ha, and land development should take place within 2 years.

It is important to note that rights over land under customary law have mainly been restricted to arable land. Chiefs have powers to set aside certain land for common use such as grazing, burial grounds and other cultural uses. Rent of an annual fee of K6.80 per hectare under State law is collected from commercial farmers and more recently from the emergent farmers. The lease contract period for land rental may be up to a maximum of 99 years.

4.6.2 Environment Act

Mention should be made of the new Environment Act which is expected to be passed in parliament during the 1989/90 sitting of parliament. The Act will provide for the establishment of an Environment Council to carry out activities related to the protection of the environment and the control of pollution. The overall functions of the Council will be to:

* control pollution;
* promote and encourage the protection of the general and working environment;
* ensure proper natural resource utilization for national development; and
* satisfy environmental and aesthetic values for better human welfare.

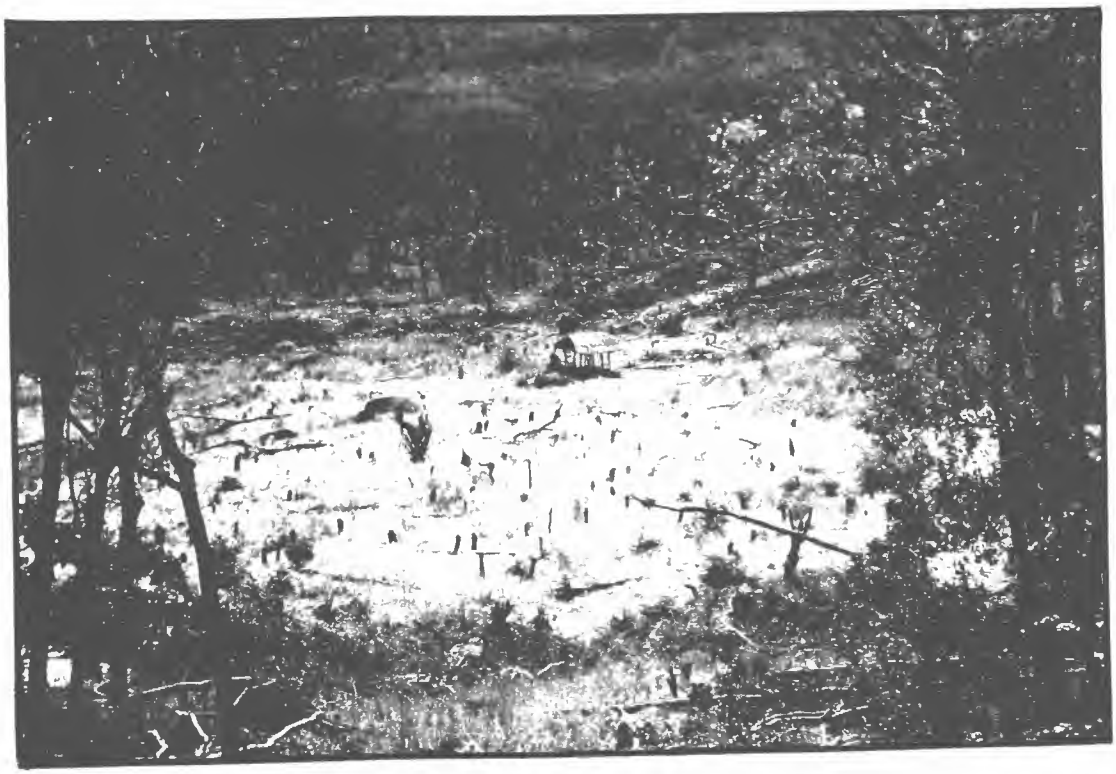
The Act sets out a broad range of activities in which the Council may engage itself. The list is impressive and comprehensive including co-ordinating the activities of all Ministries and other bodies concerned with the environment, advising on any aspect of conservation, carrying out surveys and studies, monitoring trends and providing financial support for programs.

The Council will be composed of a multi-sectoral membership chaired by the Prime Minister, with an Executive Director, Secretariat and Standing Technical Advisory Committee. Seven Inspectorates dealing with water, air, solid waste, pesticides, noise, ionising radiation and natural resources will eventually be created under the Act within appropriate ministries. Of particular importance to the agricultural sector will be the Pesticides Inspectorate which will control all aspects of pesticide use in Zambia.

This new Environment Act will provide Zambia with a very progressive piece of environment legislation and every effort should be made to use the wide reaching powers under the Act. More detailed work beyond the scope of this study needs to be done to highlight the potential for applying this Act to the resource development issues in the NP. A detailed list of powers under the Act and membership of the Council is set out in Appendix 4.

Chapter 5:

ENVIRONMENTAL EFFECTS OF LAND USE PRACTICES IN THE NORTHERN PROVINCE



5. ENVIRONMENTAL EFFECTS OF LAND-USE PRACTICES IN NP

5.1 ENVIRONMENTAL EFFECTS OF CURRENT LAND-USE PRACTICES

5.1.1 Agriculture

We have distinguished between three main agricultural land-use systems in NP:

i) Chitemene shifting cultivation;
ii) semi-permanent systems (Fundikila);
iii) permanent/semi-permanent systems, mainly associated with hybrid maize cultivation and fertilizer

A fourth land-use system of perennial crops such as cultivation of coffee and fruit trees exists, but this system is very poorly developed in NP. The most important crop of this system is coffee, which seems suitable to the area and compatible with small-scale farmer production. However, coffee is a relatively new crop in the NP and has not yet reached the small farmer, and hence will only be briefly described under intensive arable land use practices.

There are no accurate statistical data on the extensiveness (hectares) of these land-use systems. Assuming an average yield of 20-25 bags of hybrid maize per hectare and a total production of more than 2 mill bags, the total area under maize in 1988/89 may be about 100 000 hectares. These 100 000 hectares represent about 5-10% of the 10-20 000 km of good accessible arable land in the province (see Section 2.2.2.1) and perhaps about 40% of the total land under some form of cultivation. The size and possible expansion of area under hybrid maize cultivation underlines the importance of farmers using ecologically sound management practices. The area under chitemene and fundikila is more difficult to estimate, since no production data on average yield exist for traditional crops.

No studies have been carried out in the NP which systematically assess the environmental effects of current land use practices. However, some information from the province and experiences from similar ecological zones in the tropics will provide the basis for assessing the environmental effects of different land-use practices and for making some recommendations in this report. A separate Section (5.2) assesses the potential long-term environmental effects.

5.1.1.1 Chitemene shifting cultivation

The period required for soil fertility restoration by natural regeneration in chitemene depends on (a) composition of vegetation, (b) soil type, (c) climate, and (d) the frequency of bush fire. The time needed depends also on the relative duration of the cultivation and fallow periods (see Section 2.2.3.3). Under low population density chitemene is practised by lopping trees. The technique removes about 40% of the forest biomass and the lopped trees regenerate faster than in areas with high population

v) Soil erosion

Despite alterations in soil water balance, surface runoff losses are generally low in the chitemene system during the cultivation period (3-4 years). There is no evidence of any measurable soil erosion losses from chitemene fields in the province when it was practised by lopping of trees. In Nigeria, Lal(1981) also found that water runoff and soil erosion were negligible in plots cleared by traditional farming methods.

5.1.1.2 Semi-permanent systems (Fundikila)

Possible ecological effects in semi-permanent land-use systems are:

i) Soil degradation and/or depletion

On highly leached, infertile, and acidic soils, soil degradation is possible if the input/output balance of nutrients is not maintained due to shorter fallow periods.

In deforested areas (e.g. Chilubi Island), where nutrient conservation and recycling capacity in the Miombo ecosystem are broken, there is no tree canopy to lessen the impact of raindrops on the soil surface nor is there a network of roots to absorb nutrients. The nutrients released during decomposition are easily leached out and are not available for succeeding crops (Strømgaard,1989). Soil degradation is the consequence of these processes.

Consequently soil nutrients are depleted, and the fallow becomes primarily dominated by nutrient poor Hyparrhenia grass spp. An experiment conducted by SPRP (1987) showed a very low bean yield on mounds made from Hyparrhenia grass, and the yield differed little from the control plots.

In such cases farmers either abandon the plot or use crops which require low fertility and that can tolerate developing soil acidity, e.g. cassava.

ii) Weed infestation

Trapnell(1953) postulates that often weed, rather than soil exhaustion, is the cause for cessation of cultivation in the grass mound system.

iii) Soil productivity

Yield levels are generally low. A substantial decline in yield with continuous cultivation on the same land has been observed. This is attributed to a depletion of plant nutrients and build up of pests. In a study by SPRP(1988) it was found that the residual effect of grass mounds, made in the previous season on finger millet yield, was negligible. This indicates that the nutrients released from the decomposition of grass were either taken up by the first crop or were lost from the soil before the second crop was planted (results not reported).

of lime and fertilizer, maize yield was maintained or increased over a period of 6-8 years.

These observations suggest that mono-crop maize on acid Oxisols and Ultisols is not a feasible and sustainable system, while high yields might be sustained over a longer period on the high base soils of e.g. Mpika region.

Maize is known to deteriorate soil structure and cause soil compaction giving rise to soil erosion under mechanized or partially mechanized cultivation practices. Such effects have been observed in research fields in the province (IRDP, 1982; Woode, 1983; SPRP, 1987).

ii) Perennial crops

Among perennial, crops coffee is the dominant crop and grows over a sizeable area in the province. Coffee growing is mostly confined to medium or large mechanized commercial farms. Some soil erosion and water runoff losses during land clearing and the early establishment stage have been observed at Kateshi farm. Use of pesticides both for weed and pest control is widespread. Contamination of surrounding areas due to runoff or leaching might occur.

Pesticides are also used in vegetable production on a limited scale. Some of the pesticides having long biodegradation and residual time are still in use in Zambia and may create local and site specific problems for the farmer and consumer. There are, however, no scientific data from the area on negative effects of pesticide use.

5.1.1.4 Livestock

Livestock may occur as part of farming systems, often on farms with permanent fields, or on (state) ranches using the floodplain grazing potential. The number of livestock in NP is small compared to other provinces (Bingham, 1983). The cattle are concentrated to certain areas, with approx 1/3 confined to Isoka District. Mbala-Isoka (Zone 3) has about fifty percent of the cattle population in the NP. The smaller animals (sheep, goats, pigs) are more evenly distributed throughout the province (PAO 1987/88). Generally speaking overgrazing is not a problem in N.P. However, due to concentration of livestock in certain areas, local overgrazing problems may arise. Overgrazing mostly takes place in dambos. The overgrazing in dambos is caused by removing of vegetation and trampling by animals. This reduces infiltration rates and soil moisture retention of the soils. The problem occurs in some areas of Mbala and Isoka Districts, mainly at the end of the dry season. Signs of serious soil erosion due to overgrazing is rarely found even in these areas. However, if cattle production is to become more widespread, the problem will have to be addressed. Over-utilization of dambos combined with deforestation may create increased runoff and erosion problems in streams and rivers.

5.1.3 Wildlife

With other approaches to land-use discussed above (agriculture and forestry), environmental impact can be measured directly in terms of habitat alteration, together with associated factors like soil loss and exhaustion. However, in the case of wildlife and fisheries, these resources may themselves be over-exploited and mismanaged, but this may take place in absence of the direct habitat impacts referred to earlier. Thus in this section (and in 7.4), we consider loss of the resource itself as an "environmental problem".

It is acknowledged by most authorities in Zambia that wildlife resources have been seriously undermined (see Section 2.1.4.2), primarily due to the incapacity of relevant authorities to take effective anti-poaching measures. Such incapacity is caused not so much by lack of expertise or commitment on the part of Zambian authorities, as by budgetary and manpower constraints. A secondary factor contributing to the erosion of the wildlife resource appears related to peoples' perceptions of the resource; previous wildlife legislation and management had tended to channel benefits to sectors other than those actively interacting with the resource.

This latter factor is being partly addressed by the ADMADE programme. To comment on the potential for ADMADE's success, it is necessary to briefly review the GMA concept itself. GMAs were established in colonial days, primarily to serve as a buffer for national parks and to provide an area where controlled hunting could take place. Hunting is in theory regulated by a quota system and the issuing of permits, which are issued for a nominal fee to GMA residents, and for a weekly fee (three weeks maximum per person per year) to non-residents. Clearly the efficiency of this system depends on (a) the potential for its enforcement, and (b) the reliability of the data on which the quotas are based.

A critical issue in GMAs relates to human residency. People have always been allowed to live in GMAs; however, the control over the rate of subsistence settlement is tenuous. In theory, an intending "settler" must receive clearance through local leadership (usually through the Chief of that area); once approved by the Chief, further clearance should take place through the District Council, and ultimately through the Department of National Parks and Wildlife Services. Even when these channels are maintained, lack of clear definition of, for example, the role of DNPWS in this aspect of GMA planning means that settlement in GMAs has in effect been subject to little control.

5.1.4 Fisheries

5.1.4.1 Adverse effects of current commercial fisheries practices

On lake Tanganyika, commercial fish production dropped considerably after 1985, as indicated by Table 5.1. Declines have coincided with a fall in the relative contribution of Kapenta (compare first two columns of Table 5.1 for 1985 and 1986).

populations in open waters of Lake Bangweulu, with a concomitant increase in characids. This he attributes to fishing pressures.

5.1.4.2 Adverse effects of current artisanal fisheries practices

The reduction in catches by artisanal fishermen (Table 5.1) is cause for considerable concern. With beach seine gear, artisanal fishermen concentrate on kapenta, and then only the one genus Limnothrissa; the life history of this genus is such that susceptibility to beach seine fishing is high. Limnothrissa currently shows definite signs of over-exploitation (Pearce, pers. comm.). The crucial factor in beach seine fishing is that it fails to catch Buka-buka as well as adult kapenta. Thus, not only does it fail to utilize the full potential of the resource, but it limits productivity of the kapenta by concentrating on juveniles. Change to alternative fishing practices on Lake Tanganyika now seems imperative.
Artisanal pressures are equally severe on Lake Mweru-Wa-Ntipa. About 3000 fishermen operate in this area, mainly by gill-netting (Ndonna, 1986). As the resource base is eroded, fishermen respond by using progressively smaller mesh sizes. Again, control measures are critical if this fishery is to retain its former status.
In the Bangweulu system, most fish occur in the narrow channels of the swamps and floodplains. Apart from gill-netting, there is a variety of traditional fishing techniques, including basket trapping across channels or in the open floodplain (Grimsdell and Bell, 1975). Most fishing is done from temporary fishing camps scattered across the wetlands. During the rains, fishing takes place from permanent villages; dry season conditions allow penetration of fishing camps towards the permanent swamp. The point is that seasonal changes in water levels, navigational constraints in water channels, the topography and drainage of the swamp system, coupled with a variety of fishing techniques all combine to ensure that pressures on the fish resource are discontinuous in both time and space. Thus, for the Bangweulu swamp fishery system at least, a degree of resilience operates. However, as with most fisheries in the Northern Province, the data base is too poor to quantify the resilience of the system.

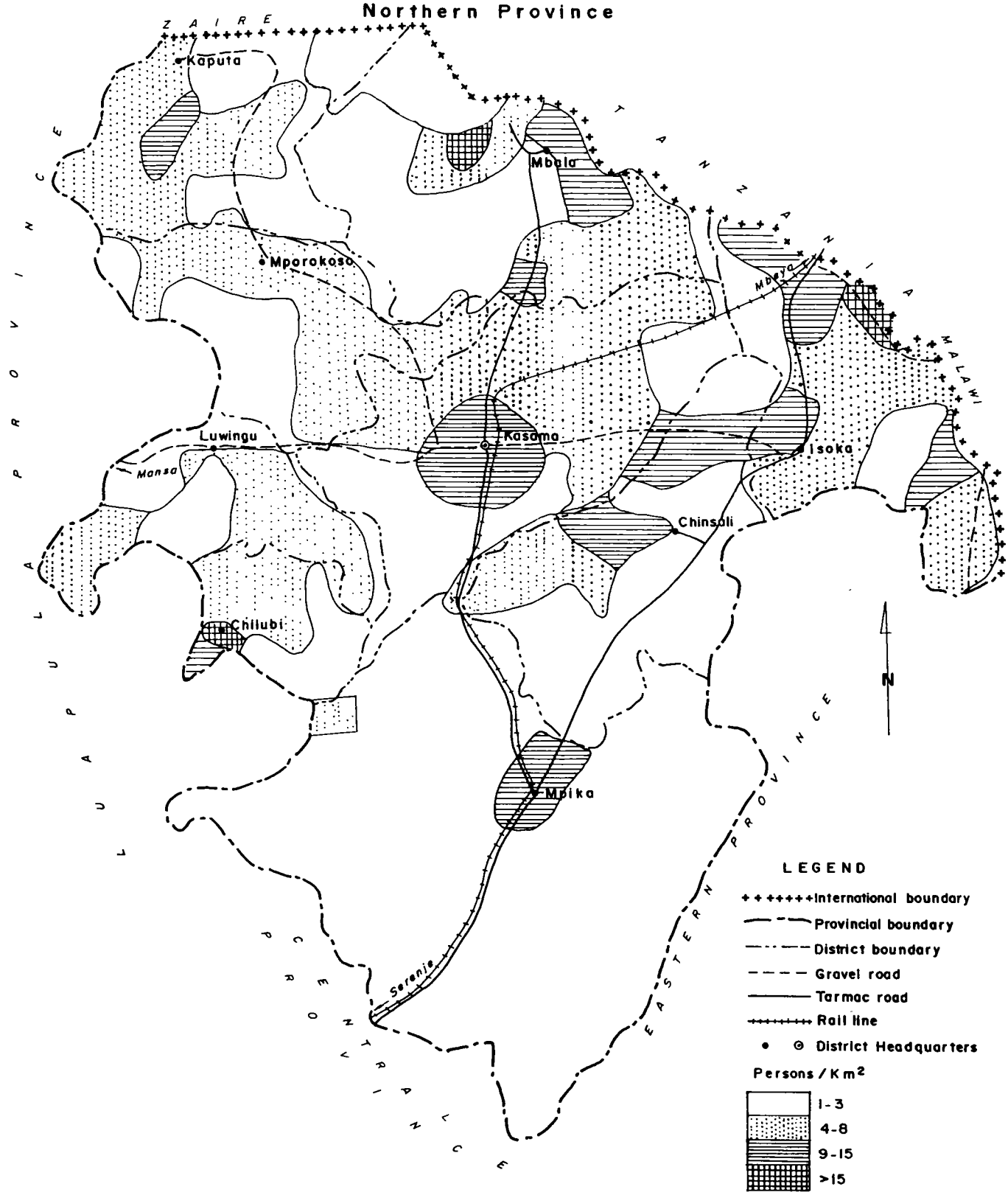
The open waters of the Bangweulu system do not have this resilience; the pelagic fishery, based previously on cichlids, is now dominated by characids. Over the last three decades, pelagic catch rates have declined (e.g 22 kg per net in 1955 to 2 kg per net in 1972). Declines are due to the use of illegal mesh sizes, coupled with improved net technology and increased demand. Oreochromis macrochir (a desirable cichlid) made up 18% of the catch in 1958, in the period 1972-84 it made up only 2%, being largely replaced by species like (Hydrocynus vittatus and Alestes macrophalnus. In general, yield from pelagic catches may now be as low as one third of that from the swamp/floodplain area.

5.2 POTENTIAL LONG TERM IMPLICATIONS OF CURRENT LAND-USE PRACTICES

5.2.1 Population projections and population density

Population growth is probably the single most important factor endangering sustainable use of natural resources in the Northern Province. High population growth puts increasing pressure on natural resources to ensure the livelihood of rural and urban

ESTIMATED RURAL POPULATION DENSITY IN 1990 IN Northern Province



APPROX. SCALE 1: 3,30,0000

Mansfield et al. (1975-76) estimated critical population densities for different cultivation systems practised in NP. Chitemene cultivation was considered unsustainable in areas with more than 4 persons per square km assuming adequate land availability. Chidumayo (1987) has estimated the carrying capacity of chitemene to be even lower; 2.4 persons per square km. Other more permanent cultivation systems, not dependent on miombo woodland, was found to be able to sustain a far higher rural population in areas with ample land for cultivation. The Northern grassmound system practised in Zone 3 was estimated to have a critical population density of 52 persons per square km (Mansfield, et al. 1975-76).

Today parts of Zone 2 on the northwest and western plateau and some parts of Mpika district have low population densities where chitemene might still be practised without serious degradation of forest biomass in the short term. The trend towards increasing population concentration around district rural towns, minor service centres, and roads may entail that these areas will remain largely uninhabited.

Areas with 4-8 persons per square km cover large parts of the Zone 2, Zone 3 and Zone 4. Here chitemene is still widely practised by subsistence orientated farmers, but chitemene fields are often openened up far from the homestead. The thicket chitemene system in Zone 1 has almost disappeared and been replaced by cassava/mound cultivation. Partly due to increasing land pressure and continued forest deterioration, farmers are relying more on semi-permanent (fundikila) gardens for crop cultivation.

Areas with over 9 persons per square km are mostly confined to land surrounding major lakes (e.g. Lake Bangweulu, the southernmost part of Lake Tanganyika in Mbala district and Lake Mweru-Wa-Ntipa) where high population densities are maintained through a combination of fishing and permanent cassava mound cultivation. The northern eastern plateau area of Zone 3 (north-western Mbala and part of Isoka district) also have high population densities where semi-permanent grassmound cultivation predominate.

High population densities are also found around major urban areas (e.g. Kasama and Mpika) where chitemene has almost totally disappeared. Here farmers rely almost exclusively on permanent and semi-permanent cultivation based on grassmounding and use of fertiliser. Separate permanent cassava gardens are also common in peri-urban areas, especially among resource-poor households (Holden, 1988). High population densities around major towns have also serious implications for use of other resources (e.g. fuelwood, building poles).

Increasing population densities on the central plateau and introduction of hybrid maize has led to less reliance of chitemene cultivation and a transition to more permanent cultivation systems (ARPT, 1988a). Cassava gardens are becoming more important in areas with high population pressure, and grass mound cultivation systems are spreading southwards from Zone 2.

Against this background we will indicate how farmers respond to resource depletion, and thereafter, assess potential long-term implications of current land-use practices.

sometimes made on the side of termite mounds because mounds are often less acidic and contain more nutrients (Tveitnes,1983)

iii) Permanent systems

The traditional way of maintaining soil fertility in permanent agriculture is by addition of chemical fertilizers. When the fertility starts declining as a result of continuous cultivation, farmers respond to this either by leaving the area for some years or by adopting a crop rotation of cereal/legume, which may prolong the cropping period.

Continuous use of fertilizer on leached soils and especially in mono-crops may result in reduced soil fertility and increased soil acidity. Mono-cropping may also lead to increased infestation of weeds and pests. We have noted that farmers respond to such soil deterioration, by either leaving the area fallow or clearing new land. Very few use lime to ameliorate soil acidity.

5.2.2.2 Long-term implications

i) Chitemene shifting cultivation

a) Deforestation of miombo woodland

The forest cleared under the chitemene system of agriculture will be restored if the land is soon made fallow again and left undisturbed sufficiently long to restore soil fertility. However, with increased population growth farmers are compelled to reduce the fallow period; this has undesirable ecological consequences in the long run.

The current rural population density exceeds the carrying capacity of 2-4 per km^2 under a sustainable chitemene cultivation system in most of the province. The current requirement for forest biomass to fertilize ash gardens is estimated at 8.7 MT. SADCC Energy Coordination Unit (1987) has given data on forest biomass per km^2 for different vegetation classes in Zambia. When these data are applied to vegetation classes in NP the potential forest biomass is estimated at 991 MT. The SADCC study estimated that the NP had 641 MT of forest biomass around 1985. Based on these figures, the Province has lost 350 MT or 35% of its forest biomass. This represents 43.000 km^2 of forest land in the Province. Assuming forest biomass regeneration takes 43 years, the observed forest degradation has occurred over the past 40 years or so. Chitemene cultivation has been the major cause of this forest degradation. Given the positive population growth in NP (Table ...) forest degradation is likely to continue until alternative agricultural production systems are adopted.

Continued deforestation may have other severe ecological consequences of the following nature:

* Biological diversity - Fire influences vegetation succession. Some of the species susceptible to extreme fire are not able to regenerate and thus disappear in the subsequent cycles of growth cleared chitemene areas. Slow but steady

* The grass-mound system dominated by Hyparrhenia grass spp. may also immobilize the nutrients added through fertilizers, thereby reducing the utilization efficiency of the nutrients added.

iii) Permanent systems

a) Annual crops

The main long term effects of continuous maize cultivation with application of fertilizer may be:

* Decline in Soil Fertility - Due to low inherent soil fertility, low nutrient retaining capacity and acidic soils (predominant in the province) soil fertility decreases rapidly if:

  a) fields are cleared mechanically by scraping of surface soil;
  b) if application of nutrients does not balance the loss by removal of crops or through leaching.

After continuous cultivation of mono-crop maize for many years, deficiency of micronutrients (Zn, B and Cu) is likely to arise and seriously affects yields. Banda and Singh (1989) found that nearly 90% of soil samples investigated from the high rainfall area of Zambia were deficient in Zn.

* Acidity development - Due to low buffering capacity of the soils, acidity problems intensify with the use of fertilizers. For sustained production, soil acidity needs to be ameliorated. Moderate rates of lime (600-1200 kg/ha) in these soils have been found to ameliorate soil acidity up to 4-5 years after application (SPRP,1987,1988).

* Soil structure deterioration and soil compaction - Loss of organic matter in soils under maize mono-cropping will result in structural breakdown and consequent soil compaction. Such changes are, however, more apparent in mechanized cultivation than in manual hoe cultivation. Some mechanized farms (Katito in Mabla) provide a good example of such problems. Information on the impact of such changes on crop production is, however, lacking from other parts of the Province.

* Reduced moisture retention - Alteration in soil surface structure affects soil moisture retention. The exposed canopy of maize is known to decrease the soil moisture retention capacity.

* Reduced activity of soil fauna - Mono-cropping of maize has been shown to decrease biomass carbon and the population of microorganisms. Mono-cropping of maize without crop rotation and fallow period may imply the use of pesticides. Faunal activity declines rapidly with the heavy use of pesticides. Whether the use of chemicals in the province will reach the levels associated

continue to contribute significantly to deforestation around urban centres in NP in the future.

5.2.4 Wildlife

Most wildlife in the NP is found on areas which are marginal for agricultural potential. Elsewhere in Africa (e.g. Zimbabwe), it has been demonstrated that in marginal agroecosystems, a more intensive sustainable production system is possible if "unconventional" components (e.g. wildlife utilisation) are included in production systems (Martin, 1986; Muir, 1988).

The implication is clear: if the wildlife resource continues to be eroded at its present rate, then the option to apply perhaps the most productive system of land-use for marginal areas will be effectively foreclosed. This option has now been lost for many of the GMAs in the Northern Province.

In practice, GMAs have largely failed to serve the role of buffers for National Parks (see Section 2.1.4.2), and ADMADE can now only be introduced into those GMAs which have adequate wildlife populations. It appears that currently only Tondwa, Bangweulu and Munyamadzi GMAs meet these requirements. Clearly, a reciprocal arrangement exists between wildlife conservation and potential benefits to people: conservation may only be realised if benefits are forthcoming, and benefits themselves depend upon adequate conservation of the wildlife resource. If rural peoples are to benefit from the sustainable utilisation of wildlife resources, it is critical that further erosion of the buffering capacity of GMAs be interrupted.

5.2.5 Fisheries

It is clear that, in most waters of the NP, sustained yield harvesting if the fish resource cannot be maintained at current levels without either affecting total production, or radically transforming fish population dynamics and community structure. In most cases, conservation measures are not implemented and regulations are resented. On occasion, the undermining of fisheries regulations has even been used as political tool (Ndonna, 1986).

It is difficult to comment on long-term implications for the fish resources, given the unprecedented changes in fish community composition which are taking place under fishing pressures. What levels of exploitation, for example, can Buka-buka tolerate, given its migratory habits?

In the Bangweulu system, fishermen tend to prefer cichlids to characids, selecting specific habits to ensure this (Evans, 1978). Without reliable monitoring, long-term estimations are meaningless. What conservation measures are needed during critical periods in such systems, for example when low-water levels lead to intense exploitation?

Recently, concern has been raised from researchers (Sharpe, 1988) that the growing importance of hybrid maize cultivation has led to a decline in nutritional status in rural households. Early surveys (IRDP, 1985c) indicate more severe malnutrition among children (0-5 years) in households selling more than 30 bags of maize and households that have just started to take up hybrid maize production.

The correlation was first attributed to the displacement of millet cultivation, especially in densely populated areas. Here, cultivation in grass mound permanent millet gardens became increasingly difficult owing to weed encroachment (e.g. Eleusine indica). Under these conditions, hybrid maize cultivation offered an opportunity to alleviate the seasonal labour burden of weeding and clearing new fields (Pottier, 1988).

However, households with high maize production levels were also found to have considerable areas of millet, and retained more grain crops for consumption. Therefore, displacement of millet for hybrid maize as the main staple crop could not explain malnutrition in households with large production of hybrid maize. Another explanation for the high prevalence of malnutrition in these households was related to an increased workload required from women. These women work longer hours in the fields, compared to women in less commercialized households (ARPT, 1988c). Again, labour input competed with essential domestic chores (e.g. preparation of meals for young children). Later studies, however, have not been able to confirm these findings (Appleton et al., 1989).

Increase in hybrid maize growing has not led to increased food availability for many rural households (Sharpe, 1988). Although a high percentage of the hybrid maize is retained for home consumption among hybrid maize growers, the displacement of local open pollinated varieties of maize can contribute to a higher risk of seasonal food shortages. Hybrid maize has poorer storage properties compared to the local maize and can be harvested earlier. Hybrid maize has been found to be more difficult to grind and requires access to hammermills. Lack of attention to high crop management requirements for hybrid maize (e.g. correct planting date and plant spacing, correct timing of fertiliser application and appropriate weeding),together with late delivery of fertiliser, may lead to low yields. Increased reliance on hybrid maize cultivation may therefore under certain conditions contribute to lower food security among some households.

5.3.3 Influence of maize programme on farmer participation, farm income and income distribution NP.

The following factors have influenced farmer participation in the maize programme:

* ability to acquire cash for expensive inputs
* eagerness to venture into market production
* previous labour employment

A case study of thirteen commercial farmers from Mpika showed that most had previous wage labour experience (Masdar Ltd., 1989). These farmers had been at school longer and showed the entrepreneurial attitude necessary for taking up hybrid maize

years and between areas (ARPT, 1988a). The difference in crop sales between resource-rich and resource-poor households may exceed 2,000%. Although agricultural income was small in the poorer households, hybrid maize (together with beans) still amounts for a considerable part of their income. Various surveys (ARPT, 1988a; Sano, 1989) indicate that maize cultivation is regarded by all farmers as economically worthwhile, although profitability is low. Hybrid maize production is not only a strategy for increasing cash incomes and provision of maize for home consumption, but also for increasing production of other subsistence crops. Sano (1989) found that subsistence crop production as well as secondary cash crops (e.g. rice and beans) increase with growing maize production, indicating that farmers through the maize programme also strive for higher levels of food security.

In view of the national policy to improve living standards in rural areas and to redress provincial imbalances in agricultural production, concern has been raised that the maize programme has been biased against resource-poor farmers (ARPT, 1988a). Because of a superior resource status resource-rich farmers are better able to obtain costly inputs, as well as being in a better position to mobilize additional labour when required. Hybrid maize cultivation has been shown to require extra-labour during critical periods in the growing cycle (ARPT, 1987). Sharpe (1988) holds that the cost of hiring extra household-labour has been met by reducing their economic return to household labour and foregoing consumption. As payment of extra household labour are both given in the form of cash and grain.

The differential access to labour is a factor creating income differences between households (Sano, 1989). Resource-poor households are not able to mobilize labour for extensive hybrid maize cultivation. Due to lack of cash, many resource-poor farmers hire themselves out as farm labourers thereby limiting development of their own farms.

In conclusion, profitability of hybrid maize cultivation has decreased in the last decade, rural-urban terms of trade have deteriorated and input supply and crop collection have become increasingly unreliable. Despite this, farmers continue to grow maize. Even resource-poor households are eager to grow maize. The major reason for the wide adoption of maize cultivation is its ability to provide more cash income than any other cash crop. Despite some evidence of growing income disparities between households and adverse nutritional effects, maize cultivation enhances food security by providing a surplus both for sale and consumption.

Chapter 6:

POLICY AND INSTITUTIONAL CONSTRAINTS

6. POLICY AND INSTITUTIONAL CONSTRAINTS

Theoretically, the process of formulating National Development Plans for Zambia is generally commendable. The planning process provides a framework within which ministries through NCDP can align their objectives with those of the Party. If given adequate finances, implementation of the Plans as outlined in the FNDP would elevate the status of resource management and conservation above its current position. The FNDP identifies many of the resource utilization problems in Zambia and moreover includes mitigative measures to address these problems. The failure to implement these objectives is due to a lack of resources, skilled manpower and infrastructure. Professionals in relevant sectors are fully aware of the nature and extent of resource problems but few are adequately equipped to undertake remedial measures.

Moreover, the legislative base including the new Environment Act appears generally adequate for radically improved environmental management in Zambia with a few exceptions noted in the following discussion. Again, resources to enforce legislation are seriously lacking.

6.1 Policy and planning constraints

GRZ has recognized fundamental problems related to policy and planning mechanisms within the government of Zambia. These are identified by NCDP in the Fourth National Development Plan:

* inadequate institutional framework for planning and plan implementation;
* inadequate mechanisms for project implementation and monitoring;
* absence of planning units at corporate, ministerial and provincial levels;
* inadequate professional and skilled manpower;
* weak linkages between parastatals, the private sector and the national planning machinery (NCDP, 1989b p. 551).

While we agree with the above weaknesses outlined by NCDP, we highlight the following areas as particularly significant constraints to achieving sustainable development in the Northern Province:

6.1.1 Lack of cross-sectoral planning

There are few opportunities within GRZ for cross sectoral policy development and/or review of departmental programmes and plans from an integrated perspective. Projects and programmes are often conceived in isolation by line ministries, parastatals and donors and seldom benefit from cross-sectoral analysis in the early stages of formulation. At present, the National Conservation Committee is the only permanent cross-sectoral mechanism within government. An ad hoc Interministerial Committee is convened for the purpose of reviewing annual national development plans for the

agriculture, fisheries and forestry subsectors, but the committee does not have an ongoing function within government nor does it include wildlife interests.

6.1.2 Project planning and appraisal

Project planning and appraisal are rarely approached from the perspective of sustainable resource use. Models currently used in project appraisal at the national level in NCDP are heavily weighted towards conventional economic values. Projects are proposed and implemented without adequate assessment of the resource base, with disregard for land capability and in isolation from the effects of the project on human populations and ecosystems. This applies equally to the many small projects initiated at the district level throughout the Northern Province (e.g. roads and bridges) as it does to the large major projects proposed through NCDP and donor agencies such as the Tazara Resettlement Scheme or the EEC Rice Project.

6.1.3 Environmental management tools

Environmental management tools include guidelines, standards and resource capability information and assessment procedures. Decision-makers within government, the private sector and donor agencies require such tools for routine administration, but they are noticeably absent. For example, at the national level, environmental checklists and acceptable guidelines for standards could be used by NCDP staff in their programme planning with donors agencies, line ministries and parastatals. The same guidelines could be adapted to assist District Councils and the Provincial Development Council in making decisions related to small but incrementally significant projects. In section 7 we suggest how such tools may be developed and used.

6.1.4 Research and monitoring

There is a lack of research projects that meet sustainable development goals, i.e. just, economically viable and ecologically resilient. Moreover there is a lack of monitoring to determine whether existing projects meet any or all of the above criteria. The National Council for Scientific Research has identified a variety of conservation oriented projects such as pollution monitoring, but few projects have a multidisciplinary cross-sectoral application. The exception to this in NP is the ARPT project, which has strived to adapt research to the needs of local people from an ecological and socio-economic perspective.

6.1.5 Lack of planning units within line ministries

Planning units have not been set up within the departments responsible for fisheries, land, natural resources and water.

6.1.6 Wildlife management

Responsibility for wildlife management was transferred several years ago from the Ministry of Natural Resources to the Department of National Parks and Wildlife, in the Ministry of Tourism. This move effectively separated it from those resource issues

(e.g. land management) critical for wildlife habitats. The recognition of wildlife as a resource with immense potential to benefit rural Zambians has all but disappeared from the profile of GRZ's National Development Plans. Although the Department of Wildlife is one of the oldest and largest government departments in Zambia, it receives little mention in the FNDP, and then only in relation to tourism. This weakness is again exhibited in development planning in the composition of the Interministerial Committee reviewing priorities for the National Development Plans. Representatives from agriculture, fisheries, lands, natural resources and water are represented on the Committee, yet wildlife professionals are absent. This omission represents a serious weakness in working towards an integrated approach to resource management.

6.1.7 Lack of co-ordination of donors

Although agreements between GRZ and donor agencies take place within the NCDP, in practice donors operate at different levels within GRZ. These levels extend from the President and Cabinet level to the Provincial and District level. This can result in a lack of co-ordination in development planning and implementation with subsequent uneven distribution of resources within an area. In turn this can create tensions between districts, as well as weakening the mandate of provincial and district development planning agencies. Thus a favoured project may be promoted by a donor or a local politican, but it need not reflect a balanced or co-ordinated approach to development planning for the region. For example, the Luangwa Valley has two major development projects, the LIRDP and a project funded by the Frankfurt Zoological Society (Owens and Owens, 1986). There is no co-ordination between projects, nor have the staff of the projects even met to discuss common goals and objectives. Other major projects such as the EEC Rice project have been implemented in the NP with little consultation and planning with provincial and district officials. This is not to question the value of these projects but to call for a more co-ordinated approach which will strengthen the capacity of development planning agencies in the NP.

6.1.8 Lack of legislative authority

Neither NCDP nor the Provincial Planning Units have legislative authority. As a result the lines of authority for implementing and enforcing plans are not always clear.

6.1.9 Decentralization

Since the enactment of the Local Administration Act, district councils have encountered major problems in their operations. With the decentralized system there is currently no clear definition of working relationships between councils and central ministries and between provincial authorities. The absence of legislation aimed at integrating various government departments and parastatal organisations at district level has created problems in the effective supervision, co-ordination and implementation of development programs. The prevailing situation is that district heads of departments are still controlled by, and owe allegiance to, their provincial and ministerial heads. In most cases, they receive counter instructions which defeat the policy of decentralization (NCDP p 575) While the directive for decentralization

is in place within GRZ the resources to carry out decentralized programs and enforcement are seriously lacking.

6.1.10 Perception of "environment"

Throughout this study, we have been struck by the perceptions of many project and line ministry staff (Zambian and ex-patriate alike) that "environment" work is something done outside of sectoral resource development programmes, and it is irrelevant to the day-to-day operations of projects or departmental programs. Environmental work is also perceived as a luxury that only developed countries can afford. These perceptions indicate a fundamental lack of understanding of the nature of sustainable development - in fact the very principles upon which all line ministries, development agencies and parastatals should base planning and decision-making. Thus, environment and sustainable development must be suitably "packaged" to be perceived as relevant by all involved in resource use from decision makers and politicans to project workers and consumers.

6.2 WEAKNESSES IN AGRICULTURAL POLICY AND STRATEGIES

Resource depletion within the agricultural land-use systems of NP persists mainly because the large majority of farmers lack options and resources (labour, capital, market access) for changing practices and adopting more permanent sustainable practices. The rapid and widespread adoption of hybrid maize cultivation in NP proves that given external support and incentives, farmers are able to adopt more permanent systems and increase crop production. In this respect the new priority accorded to agriculture in general and to small-scale farmers in particular from the early 1980's has proved successful.

Within the framework of national policies (see Section 4.1), the small-scale farmer focus of the provincial policy should provide a sound basis for sustainable agricultural development in NP.

But in the formulation of agricultural strategies, environmental sustainability, economic viability and equity aspects should be more firmly integrated. In the FNDP there is little reference to such issues, while the maize programme, which is a core component of agricultural development in NP, raises exactly these issues.

The potential adverse ecological effects of continuous maize cultivation was dealt with in Section 5. In the long term, hybrid-maize cultivation in NP will depend on application of both fertilizer and lime to be sustainable. In the following sections we will argue that the introduction of lime will add to already high production costs, and lower profit margins in maize cultivation. This will particularly affect the marginal and often resource-poor maize growers, and maize farmers in areas with less favourable market access. Since the markets are generally better developed in Eastern than Western Districts, a narrow focus on maize cultivation as a strategy for agricultural development will accentuate income differences and district imbalances.

We will, furthermore, show that there are large capacity deficiencies in the supply and marketing system serving the maize growers. The system does not have capacity to handle present production levels, involving close to 2 mill. bags of maize.

We will therefore hold that a more diversified strategy for agricultural development is needed. Encouraging initiatives in this direction have recently been taken in agricultural research (ARPT/SPRP) and in the extension services. More attention seem to be accorded low-input biological technologies based on traditional food and cash crops (with high-value-to-bulk), and measures for preserving long term soil productivity.

In order to illustrate particular economic and institutional problems in promoting a high-input agricultural strategy for NP based on a low-value-to-bulk-crop, a review of the maize programme is presented below.

The maize programme has depended on a high level of support to infrastructural development (roads, depots, storage, milling), extension services, large input subsidies, and marketing and credit support.

The improvement of road infrastructure, the introduction of hybrid seeds, the introduction of subsidized producer and fertilizer prices from mid-1970's laid the foundation for the expansion in maize production. The first boom in production of maize for sale occured from 1979/80 to 1981/82. The boom was triggered by enlarged extension service, provision of fertilizers, seeds, credit and improved marketing (e.g. increase in number of depots, collection of produce at farm gate). This increase in maize production took place first of all in Kasama, Isoka and Mbala Districts, which received the highest amounts of fertilizers in NP (Sano, 1989).

Increase in input supply explains also the second production boom from 1985/86 to 1988/89 (ARPT/PPU 1988). This boom involved Mpika District in addition to Kasama, Isoka and Mbala, and only to lesser extent the other districts. The expansion in marketed maize production was triggered by factors on the supply side. There is a clear correlation between provision of inputs, notably fertilizers, and marketed maize delivered to NCU (Sano, 1989).

At provincial level there is, however, a significant increase in the ratio between marketed maize and sales of fertilizers through NCU from 1980 to 1988. The ratio in Table 6.1 expresses the number of tons of maize produced and sold to NCU per ton of fertilizers sold.

Table 6.1. Ratio between marketed maize and sales of fertilizer through NCU (1976-1988) (tons). Data from PPU (1989).

Year	Maize	Fertilizers	Maize/Fertilizers
1976	16,400	8,300	2.0
1980	14,300	8,000	1.8
1984	70,000	19,100	3.6
1988	153,000	34,300	4.5

The maize/fertilizer ratio increased from 1.8 in 1980 to 3.6 in 1984 and to 4.5 in 1988. This could be an indication that farmers improved managerial skills, efficiency in use of fertilizers and, thereby increased yield levels after a few years of maize growing. But it may also be explained by e.g. improved input supply, lower retention rates of maize, less smuggling, less fertilizer diverted to other crops and less fertilizer sent out of the province. (This would be an important topic to investigate for further research.)

6.2.1 Input subsidies

Maize production in NP has depended on three major government input subsidies; 1) the fertilizer subsidy, 2) the consumer subsidy on maize meal, and 3) the transport subsidy through a system of equity pricing (as opposed to efficiency pricing).

This subsidy policy has been enormously costly to Zambia, and partly for this reason, the subsidies are now being scaled down. For example, in 1986 subsidies distributed to the Cooperatives and NAMBOARD for maize and fertilizer price differential and for maize and fertilizer handling totalled K 485,5 mill. This compared with K 54.1 mill. in 1976 and Kw 103.7 in 1981 (ARPT , 1988b).

Appendix 5 provides a brief review of economic and environmental aspects of the government subsidy policy.

The most crucial subsidy for maintaining the maize production in NP has been the fertilizer subsidy. The likely effects of a complete removal of the fertilizer subsidy would be a loss of marginal maize growers, return to subsistence production based on chitemene, initial food shortages until production of traditional food-crops would pick up again, and a general contraction in the cash economy (ARPT, 1988a).

In order to avoid such adverse effects a certain level of fertilizersubsidy may be necessary to maintain on a transitional basis, combined with a similar subsidy on lime. The effects on land-use and farm household economy of phasing out the subsidies should be monitored closely in the next few years.

6.2.2 Output pricing

The rationale for keeping producer and retail prices low by large government subsidies has been to provide cheap food for the urban population. In particular over the last five years, the GRZ has taken steps to ensure better output price incentives, and also to reduce subsidies. Producer and consumer prices of all agricultural commodities and inputs have been increased periodically and significantly. This has enabled subsidies to be reduced. Maize prices have gradually been adjusted to keep them more in line with world market prices. The official price of maize has been kept relatively higher than for other cash crops produced by subsistence and emergent farmers of NP. Official prices for beans, groundnuts, millet and cassava, for example, are kept below the unofficial market prices. Farmers producing these crops therefore do not benefit from the official price-policy or marketing services.

A particular problem facing the farmers in NP is the frequent changes in producer prices and the late announcement of changes in producer prices. This year, for example, the announcement of increase in the price of maize by 160% and increase in fertilizer prices by 300% was done after the farmers would normally have cleared fields, i.e. too late for them to respond effectively.

6.2.3 Marketing and credit policies

In a setting of scattered farmers, a strategy based on a low-value-to-bulk-crop will be faced with particular problems in marketing. In NP, marketing problems have been compounded by large deficiencies in the institutions responsible for infrastructural development, input supply and marketing services for agricultural development.

The marketing of maize has been particularly weak. By end-November this year about 800 000 90 kg bags of maize remained uncollected, well into the rainy season. In 1988 ARPT estimated the direct financial cost to the government of every 100 000 bags destroyed by rains of paid for but uncollected maize to be K 8 000 000 in crop payment, K 1 300 000 in wasted fertilizer subsidies, USD 353 000 in wasted foreign exchange for fertilizer importation (ARPT, 1988b).

Appendix 5 provides a brief outline of some of the weaknesses in marketing and credit services in NP. These weaknesses may be summarized as follows:

* priority as regards input supply (seeds, fertilizers) and marketing accorded to high producing maize farmers and districts/zones.

* no granting of credit for inputs to cultivation of traditional crops such as beans, groundnuts, millet, cassava

* uneven distribution of credit between various categories of farmers, with priority accorded to resource richer maize growers

* high subsidisation of fertilizers has discouraged traditional ways of maintaining soil fertility.

* lack of lime with Northern Cooperative Union (NCU)

* late forecast of input requirements at provincial level

* insufficient and/or late delivery of inputs to the province and to the farmers

* late payment to farmers for their harvest

* insufficient supply of credit

* lack of co-ordination in planning and development of infrastructure (roads, depots, storage, mills)

Overall, there is an urgent need to strengthen the planning and implementation capacity of various agricultural marketing and credit institutions, particularly NCU. To alleviate present marketing constraints, private traders are envisaged to participate in maize marketing from 1993 (EFPF, 1989).

Major investments would be needed in transport and infrastructure (road maintenance, depot establishment, storage and milling), if the maize programme is to continue at present production levels without great economic losses to the government (see Appendix 6).

6.2.4 Agricultural research and extension

Policy and institutional issues limited to agricultural extension and research are treated under Sections 6.3.1, 8.1.5 and 8.1.6.

6.3 INSTITUTIONAL AND MANPOWER REQUIREMENTS

The FNDP makes the observation that effective implementation of policies and co-ordination of human resource development at the national and sectoral level greatly depend on an effective institutional set-up (NCDP, 1989b). As a general observation most of the departments involved with resource use and development in the NP seem poorly equipped from an institutional and manpower perspective to carry out their mandates. The agriculture sector receives most of the support in this area with little institutional support going to other resource uses such as forestry, fisheries and wildlife.

In NP there is a Provincial Manpower Committee under the Chairmanship of the P.S. However this committee sits only to consider promotions, awards, scholarships and does not undertake actual training programmes. An increasing number of donor-supported projects such as VAP, SPRP, IRDP (SIDA) and IRDP (ODA) are undertaking their own manpower training programmes (Collinson, 1988). Such programmes are aimed at improving the technical and managerial skills of their personnel. However most of the donor-funded projects in NP seem to be biased towards agricultural development, and as such most of the staff-sponsored training is in areas related to agricultural research

and extension. Staff are rarely trained in fields such as forestry, fisheries and wildlife. Moreover, there is lack of coordination between the donor funded projects regarding human resources development.

6.3.1 Agriculture

At present there are approximately 360 staff members of various categories under Department of Agriculture in NP. About 230 of these are field staff working at provincial, district and ward levels (VAP/ETP,1989). The ratio of households to extension workers for the extension system in Zambia is about 800. Due to the low population density and widely dispersed farm households, a lower ratio would be more appropriate for the extension system in NP. Based on an estimated number of households of 160,000, the average household/extension ratio is 700 (VAP/ETP, 1989). This may be an appropriate level of staff. We will stress, however, that a stronger emphasis on low-input biological methods of agriculture, as recommended in this report, will require a strengthening of the extension service. It should be recognised that the yields obtained by such technologies, and hence the demonstration effects, are less than for hybrid maize/fertilizers, and that the adoption by farmers therefore depends on more active and convincing extension efforts. Staff training of extension workers would be needed in soil and water conservation, as well as in principles of low-input agricultural systems. Training in environmental planning should also be introduced. The extension work is severly constrained by lack of transport.

6.3.2 Forestry

Both the Forest Department and the Natural Resources Department are grossly understaffed, poorly equipped and lack transport to effectively carry out their responsibilities with respect to management of forests. The Natural Resources Department is represented in only four of the nine districts in the NP and the existing staff are inadequately trained in natural forest management and forestry extension. Consequently rural tree planting and natural forest management programmes have not been successful, and collection of revenue has been low. New plantations have not been initiated due to lack of trained staff, while older plantations cannot be harvested because of lack of equipment, transport and staff. Both the Department of Forests and the Department of Natural Resources need considerably more financial support, trained staff, equipment and transportation to effectively carry out their responsibilties.

6.3.3 Wildlife

Although the Department of National Parks and Wildlife is responsible for the conservation of wildlife, 19 National Parks, three bird sanctuaries and 31 Game Management Areas, covering an area of 23 million hectares, the Department has not grown since the late sixties to support these growing responsibilities. It now has only 591 wildlife scouts, strategic camps have been abandoned, a number of protected areas have been neglected, and infrastructure has nearly collapsed. Consequently wildlife, particularly trophy species, has become vulnerable to the increasing poaching pressure.

6.3.4 Fisheries

Any approach to sustainable development must be based on knowledge of the dynamics of the system. This is particularly true when dealing with the fish resource of the NP: the review in the previous chapter gives ample evidence of the rapid changes taking place in fish population dynamics. Unless such changes are properly monitored, there is no sound basis for management strategies for fisheries. Likewise, without procedures for implementation of such strategies (assuming that the latter are soundly based on reliable data), sustainable development of the fishing industry will not be possible. Clearly, these notions may be simplistic to those working in the fisheries field in Zambia, but no assessment would be complete without reinforcing these basic requirements.

Thus, institutional and manpower needs must centre around the objectives: the collection of adequate data on which to base management plans, and the capacity to implement these plans with the active participation of local fishermen communities or fish industry. An obvious first requirement is the strengthening of the Department of Fisheries. Of the four divisions within this Department (Training, Research, Extension and Development and Fish Culture), only Fish Culture is currently receiving adequate support from donor agencies. The research branch is quite inadequately staffed, with the result that, apart from Lake Tanganyika, management decisions must be based on inadequate data. Even with routine monitoring, the reliability of the data is questionable. The Department must have the capacity to develop separate management plans for each water body within the NP.

Chapter 7:

OPTIONS FOR SUSTAINABLE RESOURCE UTILIZATION IN THE NORTHERN PROVINCE

7. OPTIONS FOR SUSTAINABLE RESOURCE UTILIZATION IN THE NORTHERN PROVINCE

7.1 CONCEPTS FOR SUSTAINABLE DEVELOPMENT

The World Commission on Environment and Development (1987) defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". After hearing delegates from many developing countries at the Conference on the World Conservation Strategy (1986), Jacobs, Gardner and Munro (1986) suggested that strategies and tools to achieve sustainable development should respond to the following five requirements:

* integration of conservation and development;
* satisfaction of basic human needs;
* achievement of equity and social justice;
* provision for social self determination and cultural diversity; and
* maintenance of ecological integrity.

The challenge is now to translate these concepts into action so as to ensure the ecological soundness of development activities. Jacobs, Gardener and Munro (1986) suggest that actions towards sustainable development must be:

* pro-active, initiating, value-oriented and alternativegenerating;

* adaptive, incorporating feedback and self-reflection, experimental and responsive learning, stressing process as much as product;

* integrated in the sense that actions must be interactive, holistic, recognizing the complex web of larger and smaller levels of interaction.

Faby (1984) identifies four pre-requisites which have to be fulfilled for such actions to be implemented:

(i) Appropriate methodological frameworks within which alternatives can be evaluated. The tools to achieve sustainable development are available to us, i.e. information, data, technology and methods such as EIAs, but we must develop a framework for integrating and assessing information and values. The limitations of conventional economic theory are increasingly obvious when attempting to calculate the marginal opportunity costs that resource users must bear. A multi-disciplinary, cross sectoral approach must be taken in problem solving and the formulation of development options.

(ii) Appropriate institutional frameworks for decision making and action. Such institutional machinery provides the foundation for all measures implemented. The tools for sustainability of development cannot be applied without structures and organisations within the private and public sector, education systems and processes and environmental legislation.

(iii)Formulation of concrete alternatives. Sustainable development rhetoric has often been criticised for being short on alternative actions to meet the criteria put forward above. The role of scientific institutions in the formulation of alternatives is implicit in (ii). Professionals involved in "design" should take a leading role in the development of alternative practices of resource use and management that are both participatory and based on appropriate value systems. Some sustainable alternative practices have been apparent for many years, but prevailing political or economic value systems have failed to recognize them.

(iv) Attitudes and perceptions of people themselves. People must perceive that actions towards sustainable development are in their best interests. Arguably this is one of the most difficult prerequisites to achieve. Influential politicians, business leaders and decision makers should play a key role in setting development agendas that demonstrate to the public the short and long term benefits of sustainable development. NGOs, citizens groups and networks of common interests can also promote a new way of thinking and acting. National Conservation Strategies in many countries have provided an effective forum towards this end.

It is against this background that we suggest the following options for sustainable resource development in NP of Zambia.

7.2 AGRICULTURE

7.2.1 Options for improvements in agricultural land-use systems

The development of sustainable semi-permanent or permanent land-use systems in NP must build on improvements of the existing farming systems. Such improvements could be linked to both farming and off-farming activities. Our focus here will be on agricultural technologies for more sustainable agricultural land-use systems. We will stress, however, that important options for sustainable development also consist in encouraging off-farm activities in combination with agriculture.

Dissemination of new technologies should start with methods for improved soil fertility maintenance and water conservation, based on available local resources, knowledge and skills. We may distinguish three options at different technological levels:

i) Transformation of chitemene to semi-permanent systems at low-input levels by increasing the cropping period or decreasing the fallow period. Some promising technological packages to this end include: planting of fallow vegetation with eg. shrub legumes like pigeon peas; introduction of hedgerows with fast growing nitrogen-fixing trees (Holden,1988).

ii) Improvement of the fundikila grassmound system at low to medium-input levels by maintaining fertility levels without or with very low levels of fertilizers. This could be achieved by introduction of fast growing leguminous trees, planted fallows,

maintenance of natural vegetation, green and animal manure, improved mulching and use of crop residues and composts.

iii) Improvement of maize cultivation at high-input levels by application of appropriate amounts of fertilizers and introduction of lime. By introducing crop rotation with lime applied to legumes, several benefits could be achieved; lime and fertilizer requirements would be less, pest and weed problems would decrease, and yield levels increase in the long term.

a) Low and medium-input technologies

An obvious advantage with the low and medium-input technological options is that yields may be improved and sustained at a lower cash input level, because of reduced need of nitrogen fertilizers and lime. Crop rotation with legumes would further reduce nitrogen fertilizer requirements. Soil structure can also be improved through increased supply of organic matter, maintaince of micro-nutrient status and soil microbial activity. A key constraint to introduction of these technologies is the relatively high labour requirements for various operations, especially in mounding or pruning of hedgerows of trees. Further research is needed to identify technologies that are appropriate for the various farming systems zones, ie. they should involve minimum costs and risks, limit labour input in peak periods, while maximising benefits in terms of food and cash.

Appropriate low and medium-input technological packages would provide options for the resource-poor subsistence farmers to sustain higher yields. Such technologies may have the greatest potential among cash-poor households with a relatively favourable family labour situation.

Furthermore, they would have particular potentials in areas where access to agricultural inputs and reliable marketing services are low, and dependence on chitemene , fundikila and/or off-farm activities (particularly fishing) is high. Such areas would be located to parts of zone 1 (Kaputa) where chitemene is disappearing and is replaced by more permanent cassava/mound cultivation; in the western parts of zone 2 (Mporokoso District) where chitemene is still widely practised; in zone 4 (Chambeshi-Bangweulu) in the lowlands where population densities are high and particular pressures on land exist (eg. Chilubi Island); and in zone 5 (Luangwa Valley).

Low and medium-input technologies should through farming systems research be further adapted to the cultivation of local crops such as beans, groundnuts, millet, sorghum, cassava, local maize and vegetables.

b) High-input technologies

We have argued that maize-monocropping on permanent fields cannot be sustained without application of lime, while hardly any lime is presently being used in NP. The introduction of lime in NP faces particular problems at farm level. If cultivation results in depletion of soil nutrients or acid soils, the farmer will shift to a new plot when yields fall below a certain level rather than applying lime or in other ways

ameliorating the soil fertility. Land is still easily obtainable and free of charge in most areas. The cost to the farmer in this regard would be for clearing of new land; such costs are relatively low to subsistence and emergent farmers since the work is mostly done by hand and hoe, and full stumping is not required. The willingness to adopt liming is likely to be higher among commercial farmers and institutional farms practising tractor or ox-ploughing, since full stumping is required and costs of land clearing much higher. For subsistence and emergent farmers lime will be profitable mainly for use on particular acidity-susceptible, high-value crops such as beans/ soyabeans and groundnuts (Øygard, 1987). Various options exist for stimulating the use of lime;

* maintain on a transitional basis a subsidy on lime similar to that for fertilizers;

* improve extension of the use of lime, including surveys to monitor the profitability of applying lime for various categories of farmers (subsistence, emergent,commercial) and cropping systems.

* continue research on yield responses to lime for various crops, crop rotation and farming systems, and compare with other alternatives to lime for checking soil acidity;

* make lime available on credit e.g. through LINTCO

* reduce farm gate prices of lime by making distribution systems more efficient (eg. transport by rail, bulk transport rather than bagged lime, improved efficiency in NCU);

* investigate further the feasability of establishing a crushing plant based on local lime resources, when lime demands in the Province reach a higher level than today.

High-input technologies may be accompanied by credit schemes for oxen, ox-ploughs, carts and other equipment to address labour and transport constraints. These technologies would be appropriate for resource-rich emergent and commercial farmers. They require higher incomes or access to credit, and a competent supply and marketing system.

The highest potential for these technologies would be in zone 3 (Mbala-Isoka), where most farmers are already growing maize, marketing systems are well developed, and soils are relatively fertile; and in central and south eastern areas of zone 2 (Kasama-Mpika) which are fairly well serviced by official markets.

7.2.2 Options for livestock development

Outside fly-infected areas in restricted parts of the NP, livestock have traditionally been grazed in the miombo woodland during the rainy season and on dambo margins or floodplains during the dry season. Although supplementary feeds and improved pastures are necessary in order to maintain animal condition, these measures are often too

costly for the ordinary farmer. The promotion livestock husbandry among farmers is largely a function of to availability and quality of natural grazing areas. This quality is dependent on by annual rainfall and nutrient status of the soil.

In miombo woodland, the grass cover varies in inverse proportion to tree density, with cover reduced where the tree canopy is well developed. Perennial grass species dominate, particularly Hyparrhenia spp.; perennial grasses are generally less palatable than annuals, owing to translocation of nutrients to root reserves at critical periods during the dry season, and growth form (generally tall caespitose grasses) requiring a high proportion of structural cellulytic material.

The implications for cattle are considerable. Although biomass is not limiting, the quality of grasses is poor. As the dry season progresses, grass palatability falls; cattle will tend to lose condition during the dry season as their non-selective feeding habits will not permit adequate protein levels to be maintained. Under such conditions, cattle require supplementary feeds during the dry season to maintain condition, and even to ensure survival when stocking rates are high. When "seasonal bottlenecks" in nutrient availability are apparent, such cattle rely heavily on " key resources" over their range (Cousins, Jackson and Scoones, 1988). Such resources include dambo systems, river banks and drainage sinks. In the northwestern part of the province prevalence of "acid" dambos restrict dry season utilization by cattle due to poor grass palatability and an abundance of sedges. In other parts these land units are extensively cultivated. Given extensive cultivation of such areas in NP, a potential conflict between arable and grazing needs might occur. Certainly, any oxenization programme must take into account the very low carrying capacity for most of the Province, and should ensure that stocking rates are highly conservative.

Promoting of livestock keeping in NP is not only aimed at enhancing provision of animal protein for the rural population, but also draught animals for agriculture. Reliance on hand cultivation and seasonal labour peaks restrict expansion of agricultural production. Labour shortages are often critical during land preparation, weeding and harvesting of planted crops. Introduction of draught animals can alleviate present reliance on extra-household labour among more commercialized farmers and provide on and off-farm transport.

The socio-economic effects and responses to oxenization programmes are complex, as experienced by IRDP-Mpika (Marks, undated). Mortality among purchased animals has been high due to lack of disease control and a number of accidents. Poor training in livestock husbandry has further led to inefficient use of animals and lack of supplementary feeding during the dry season. Often kin have demanded use of oxen, thus reducing economic returns to the owner. Although cultivated areas of maize have increased substantially by use of oxen, yields per unit area have often declined, probably due to lack of weeding which is still done by hand. Because of declining yields, net income is not increasing as fast as gross income.

7.3 FORESTRY

7.3.1 Household based options

Household-based options are those that can be readily implemented by individual households or institutions (e.g. in schools) possibly with technical assistance from government or other specialised organizations. Such options include agro-forestry and tree planting.

7.3.1.1 Agro-forestry

The aim of agro-forestry in the NP is to increase the cropping periods, while at the same time decreasing fallow periods of the various shifting and semi-permanent cultivation systems. Agro-forestry research has therefore concentrated on:

* The pruning of fast-growing leguminous trees grown in hedgerows for maize crop production;

* The use of planted fallows for rapid regeneration of soil fertility (SPRP, 1987).

Trials at Misamfu/SPRP have shown the potential of these types of agroforestry to increase crop production and to enhance sustainable agricultural production in the Northern Province can only be assessed after adequate on-farm trials have been conducted. Nevertheless, the success of alley cropping with agroforestry species is dependent on selection of plant species that are easy to manage, that are fire tolerant and that are productive. Furthermore, agroforestry technology is likely to be more labour intensive than the traditional cultivation systems it is supposed to replace, because alley cropping involves pruning and mulching. Agroforestry systems must be properly assessed to determine the best way of promoting their acceptability to farmers, especially to small-scale farmers.

7.3.1.2 Tree planting

The shortage of building poles is probably more critical and more obvious in rural areas than the shortage of fuelwood, except in areas deficient in wood resources. Planting suitable fast growing species for timber by households has a better chance of succeeding. The trees can then be harvested as poles and the residual wood used as firewood. In this way, even firewood deficient areas (such as Nakonde, Chilubi, the Chambeshi floodplain, and the swamps) may benefit from timber tree planting.
However, the tree planting programme in the NP has several problems, which must be resolved if tree planting is to succeed:

* the supply of seeds is inadequate;

* pesticides for seedling protection are rarely available;

* there is a lack of transport and extension staff to supervise decentralised nurseries and distribute seedlings.

Fruits are cherished throughout the Province, as evidenced by the existence of indigenous fruit trees in cultivated areas, and by the planting of exotic fruit trees around homesteads and on farms (Holden, 1988). Another important element in the promotion of timber trees should therefore be the inclusion of fruit trees within the tree planting programme.
Generally, rural households give priority to food issues and the integration of fruit trees in the rural tree planting programme might enhance its success. For example, in addition to timber and fruit management, forest extension should also include beekeeping.

7.3.2 Community-based options

The major problems affecting natural forests in the Northern Province are degradation by late burning and deforestation due to chitemene and commercial fuelwood harvesting. The options for minimizing chitimene have been discussed in section 7.2. Deforestation through fuelwood production is associated with urban demand. Current charcoal production is occurring outside gazetted forest areas where natural forest is regarded as common property. No management is practised in deforested areas to enhance forest regeneration. Currently, both the Departments of Forest and Natural Resources are inadequately staffed, poorly equipped and lack transport to effectively organise local communities, especially through chiefs, to manage natural forests properly. However, because natural forest management does not generate income in the short term, local communities are unlikely to participate actively in natural forest management. In order to promote and sustain community participation in natural forest management the government, through the Forest Department, should provide incentives to local communities for their participation in forest management. These incentives could take the form of investments in community projects, such as roads, bridges, clinics, schools, water wells etc.

In order to invest in community projects the Forest Department must generate enough revenue. Stumpage fees for urban fuelwood in the NP would amount to several million Kwacha, while only a small percentage of the fees is collected (less than 2%). New investment in the Forest Department is therefore necessary to boost revenue collection, a proportion of which can be invested in community projects to sustain community participation in natural forest management.

The two main objectives of natural forest management in the Northern Province are:

* to enhance the production and supply of woody biomass for chitemene, fuel, wild foods and timber;

* to maintain ecological services, such as, catchment and biodiversity conservation.

This can be done through the control of late burning and regulation of exploitation of forest resources. Priority areas requiring management include headwaters of the major

rivers, recently deforested areas and fragile catchment areas, such as escarpments and hilly areas.

7.3.3 Government-based options

Forestry programmes that require high level management, large investments and special professional skills can best be implemented by government, parastatal and private organizations. Such programmes have been classified as government-based options.

7.3.3.1. Local supply plantations

The government through the Forest Department has already established about 1000 ha of eucalyptus and pine local supply plantations in the Province. These plantations supply pole and sawn timber for building and furniture. The demand for plantation timber is high and growing. With declining hardwood timber supplies from natural forests, the programme of establishing and expanding local supply plantations in each district should be continued through improved investment. However, a phased programme of installing saw mills to process plantation timber should be developed and implemented in each of the district plantations when ready for exploitation. Saw mills should be run on a revolving fund basis to ensure efficiency and timely generation of revenue. The NORAD supported Kasama saw mill project is an excellent example of what can be achieved by a project managed on a revolving fund basis.

7.3.3.2 Natural forest management in forest reserves

The government through the Forest Department should continue with the management of natural forests in gazetted forest areas. Areas outside forest reserves which require special management to conserve their ecology should urgently be surveyed and proposed for gazetting as forest reserves. This is in line with the objective of increasing the area of forest reserves in the country.

7.3.3.3 Natural forest reserves

In order to implement forestry options at the different levels, it is necessary to determine the natural forestry potentials, as well as the appropriate management and exploitation techniques. The Forest Department and other institutions should therefore be given more research support, especially applied research.

7.4 WILDLIFE

7.4.1 Existing directions

Current efforts to sustain utilisation of wildlife are in their infancy in the NP, and as such should still be seen as options for sustainable wildlife utilisation. In addition to those directions already outlined, consideration should be given to other options which have not yet been implemented, as follows.

7.4.2 Revenue-generating projects in Mpika district

Initiatives for the introduction of a Tourist Development Project are taking place in the Mpika District. This district is particularly well-endowed with wildlife resources, as it contains both the North Luangwa National Park, as well as the larger portion of South Luangwa National Park.

Staff of the Integrated Rural Development Project (IRDP), based at Mpika, are exploring possibilities of developing the wildlife resource in Mpika District as a foreign exchange earner. Early initiatives have included holding a wildlife workshop at IRDP Mpika in 1988, and the location of an IRDP officer in the Munyamadzi Corridor (GMA). The terms of reference for this officer are to identify means of developing the Corridor to improve the welfare of the local population, and to assist with the implementation of development programmes. Work to date has related both to sustainable agriculture, as well as to wildlife conservation.

Concurrently, the Frankfurt Zoological Society has initiated a project in North Luangwa National Park (Owens and Owens, 1988). This project has drawn attention to the immense potential for North Luangwa National Park to provide benefits to local people.

In addition to the IRDP directions and the proposal for North Luangwa National Park by Owens and Owens, application has been made for creation of a new GMA along the western boundary of North Luangwa National Park, centred in the Katibunga area.

All these developments have great potential for one important reason namely that the Muchinga escarpment provides a natural barrier to access to the Luangwa Valley from the West; thus the potential for Munyamadzi GMA (as well as for the proposed new GMA) to maintain a wildlife resource base will not readily be undermined by human population pressures.

7.4.3 The role of the private sector

Elsewhere in Zambia, there are moves to involve private enterprise in developing tourist potential in wildlife estates. Such proposals have been made for Kasanka National Park in the Central Province (R.C.V. Jeffery, pers. comm.). A management concession could be offered to private enterprise, say, for the development of a tourist industry in Lavushi Manda National Park. All legislation and control would remain in the hands of DNPWLS, but the Department would have the added support of private sector resources. As it is close to the main Lusaka-Mpika road, Lavushi Manda would be well-suited to this development option.

7.4.4 Game Ranching

This form of land-use is topical elsewhere in Africa. In commercial game ranching, game is maintained as the sole or major crop on the land, and harvesting takes place on a sustained yield basis for financial gain (products are marketed as meat or as live

animals, or sold to safari hunters). Guidelines for appropriate changes in restrictive legislation have been proposed by Motshwari Game (1981). (see Section 8.)

7.5 FISHERIES

As evidenced from Section 5, options for sustainable utilization of the fisheries resources are intimately linked with the need for a sound data base and ability to implement conservation strategies.

A primary concern is the maintenance of the Tanganyika system. Here, measures for improving yield must be balanced by policies which ensure sustainability. A first measure, largely independent of levels of exploitation, is to improve approaches to fish processing. Ndonna (1988) estimates that as much as 25% of the catch does not reach market, as a result of spoilage due to inadequate processing.

A second measure which will improve both yields for artisanal fishermen as well as strengthening fish conservation practices is the proposed conversion from beach seine gear to lift nets. This strategy will enable artisanal fishermen to increase yields by exploiting a broader spectrum of the fish resource, including Buka-buka, and will remove pressure from those species presently breeding inshore, especially Limnothrissa. This change in gear must be accompanied by increased mobility, to allow artisanal fishermen to exploit open waters; catamaran type craft are one option to replace existing canoes. These proposals are currently being pursued by the Department of Fisheries in conjunction with the World Bank Development Project (Ndonna, 1988). On the basis of the rapid recent changes in fish population dynamics in Lake Tanganyika, it is likely that failure to speedily implement this conversion in fishing gear will threaten the sustainability of both commercial and artisanal fisheries in this system. In other water bodies where beach-seining is still practised, and where gear conversion is impractical, it is imperative that closed seasons are observed. For example, Evans (1978) recommends a closed season for beach seines on Lake Bangweulu, extending from October to December, ensure the sustainability of cichlid stocks.

Fish farming is not seen as a means of reducing pressures on naturally occurring fish populations, as this practice is aimed at farmers (as a supplementary protein source and as a diversification exercise), and not at artisanal fishermen in the Northern Province. As such, the problems of fish farming do not immediately relate to issues of sustainable resource utilization, but rather to understanding those factors which are presently impeding the spread and acceptance of this form of land use in the Northern Province. Ndonna (1988) has drawn attention to some limiting factors in the fish culture programme, of which the most important is the inability to properly provide farmers with fish seed and extension services.

7.6 INSTITUTION BUILDING AS AN APPROACH FOR SUSTAINABLE DEVELOPMENT

Recent evaluations of IRDP/SIDA, DDSP/ODA and VAP/NORAD and recommendations for future directions in their work (PPU, 1986) are of interest to this study. Particularly in assessing potential mechanisms for increased environmental management at the provincial, district and ward level. The measures we suggest for increased

environmental management fit well with the recent donor decision to move away from project specific funding towards strengthening the performance and capacity of District Councils (referred to as "institutional building"). Most of the environmental measures recommended in this report such as project assessment, regional planning, EIAs and assessment of growth strategies are consistent with the institutional building approach, and indeed, these measures should be an integral part of the district and provincial decision making process with respect to resource use.

Much of the environmental degradation currently occurring in NP results from many small scale agricultural operations. One approach to this problem is to improve local administration with respect to land-use planning and resource use. An increased understanding of the causes of environmental degradation along with increased options for land and resource management may prompt better decisions in the future as well as the implementation of mitigative measures for current problems. This can be accomplished through a range of methods at the local level, including workshops and on the job training. Such a workshop was held recently for chiefs and local councillors by DDSP Mpika on the wildlife resources of the Mpika District. The Masdar Ltd (1988) objectives of the workshop were: to raise awareness of the value of the wildlife resources of the areas; understand the need for conserving and developing the resources for the long term benefit of people; discussing strategies for consideration by the Mpika District Council; and agreeing on an initial plan of action for the future. In attendance were local councillors and chiefs, government officials and project staff. Similar workshops could be offered at the district level focusing on forest, fish and water resources. With the assistance of an environmental planner at PPU, this type of training assistance could be extended to districts throughout NP. The causes of environmental degradation occur at many levels in the system from the national policy level down to the cumulative actions of many people at the local level. Obviously improvements at the local level cannot address all of these problems, but the organisations and institutions closest to the actions of the people can influence local actions to a large extent.

We are therefore supportive of the move to strengthen institutions at the district level and encourage the use of such a model to increase local environmental management skills. Section 7.7, 7.8 and 7.9 offer suggestions for ways in which the NP and district councils can work towards more sustainable resource development.

7.7 A PROVINCIAL CONSERVATION STRATEGY FOR NP

The concept of National Conservation Strategies grew out of the World Conservation Strategy prepared by IUCN with the assistance of UNEP and WWF in 1980. The WCS provides a model based on fundamental principles of sustainability to lead developed and developing countries towards more sustainable use of resources. The World Conservation Strategy model has rapidly become endorsed throughout the world. Many international organizations, governments and non government organizations have adopted the principles of the WCS in their own development practices and guidelines. (IUCN, 1987)

In October 1980, His Excellency The President Dr. K.D. Kaunda met with the Director General of IUCN to discuss ways of bringing about sustainable development in Zambia. It was decided to begin with the development of a National Conservation Strategy for Zambia which was subsequently produced in 1985.

The National Conservation Strategy for Zambia is described in some detail in Section 4 of this report. Of significance for this chapter on options for sustainable development in the NP is the recommendation of the NCS that conservation oriented development planning be decentralised to the provincial and ultimately to the district levels of government. This would entail the establishment of a Provincial Conservation Committee and ultimately District Conservation Committees in NP to guide the development of a Provincial Conservation Strategy.

Such a committee has already been established at the provincial level in the Eastern Province comprising representatives of the Forest Department, Natural Resources Department and Agriculture Department. The Committee meets to review project proposals and current activities prior to the meeting of the Provincial Development Council.

Although it would be the role of the Northern Province Provincial Conservation Committee to determine more specifically what a PCS would contain, we would offer the following suggestions for consideration by the Committee:

* a PCS for Northern Province could be developed as a sub component of the Regional Plan for NP, thus linking it closely with development goals and objectives for the Province. Section 7.8.1 outlines how a PCS could contribute to the Regional Plan.

* it could provide an Environmental Action Plan for the implementation of conservation objectives for resource use in the NP. Such objectives would be formulated by the PCC; to a large degree the objectives would be determined by the status of the current resource base, and the measures deemed necessary to ensure future sustainability. This report indicates the status of forests, soil, fisheries, wildlife and water; an Action Plan might want to include a broader set of categories similar to those of the NCS.

* it could include the development of an Environmental Profile of the NP - a document which could be used by line ministries, PPU and development agencies as base line data on resources of the NP. The Environmental Overview chapter of this report offers an outline of what might be included in such a profile.

* in conjunction with the Environmental Profile, the PCS could include a Land Use and Resource Map of the NP which would identify the resource base of the NP as well as the limitations and potential for development of natural resources. This could act as a guide for development planning by PPU/GRZ and investment by the private sector and donor agencies. The NCS makes some suggestions with respect to documentation of basic land capability incorporating LANDSAT information to indicate areas of worst soil erosion, worst deforestation.

* mirroring the Zambia NCS, it could provide cross sectoral guidelines specific to the NP in the areas of agriculture, forestry, fisheries and wildlife for the development of resources. This could assist in bringing wildlife management back into the planning nucleus with other natural resources.

* it could develop and implement a series of training seminars and workshops on project planning, appraisal and environmental assessment for PPU, line ministries, parastatals and development agencies in NP as well as on-the-job training of District officials involved in development planning through the District Development Councils in the preparation of their Annual Plans.

* it could assist PPU in designing a monitoring system that includes environmental indicators.

* it could assist in augementing the efforts of conservation education programmes in NP such as the Wildlife Conservation Society of Zambia's Chongololo Clubs for primary schools and the Conservation Clubs for secondary schools.

We see the application of the NCS model as timely and appropriate for development planning in the Northern Province. There are several factors which favourably predispose Northern Province to the development of a Provincial Conservation Strategy at this time:

* the role of the Provincial Planning Unit in NP is growing with respect to development planning and co-ordination in the Province, and as such it is timely to include increased environmental management capability in the formative stages of an enhanced role for PPU.

* in addition there is a nucleus of skilled and motivated professionals within the PPU and the line ministries in the NP who see the need for increased environmental management.

* the development of a Regional Plan for the Province provides an excellent opportunity to place a Provincial Conservation Strategy in the broader context of development planning for the region.

* the system for project monitoring and primary data collection in the NP is curently being refined by the PPU, DDSP, ARDP and SPRP. It is timely to build environmental monitoring into this model.

* evaluations and reviews of NP projects such as VAP and IRDP have recently taken place with a view to assessing the long term sustainability of these projects. It was concluded that in order to provide optimum long term sustainability these projects should be realized through the institutional building approach of IRDP Mpika (DDSP). Donors have accepted such an approach as a major focus for funding, together with an increased emphasis on environmental management at the institutional level in NP.

* IRDP Mpika (DDSP) have developed an improved level of management at the District levels, and as such this momentum can act as a catalyst for environmental management training at the district level. The need for increased environmental management has been identified by DDSP and district councils in such areas as deforestation and the need for fuelwood.

* donor agencies involved with the NP have a good track record of interest and motivation with respect to environmental management and this is likely to continue.

The limitations in developing a Provincial Conservation Committee and Strategy at this time do not differ greatly from programme implementation constraints currently found throughout Zambia, that is, lack of resources, trained personnel, transport. It is felt that the positive and timely aspects of development planning in the NP far exceed the disadvantages, and that a Provincial Conservation Strategy should proceed as soon as possible as a priority for a Regional Development Planning exercise.

7.8 REGIONAL PLANNING AS A TOOL FOR SUSTAINABLE DEVELOPMENT

7.8.1 A regional development plan for NP

The Provincial Planning Unit of Northern Province will undertake the development of a regional plan for Northern Province in 1990. We see a regional plan providing a valuable and timely opportunity to ensure that the principles of sustainable development are built into plans for future development and resource use in the NP. In addition, the process of developing a Regional Plan offers an extended forum for training, raising awareness and building an increased level of environmental management at the provincial and district levels for the future.

Typically, regional plans set out development goals and strategies of the region by sector including commerce and industry, agriculture and water development, forestry and natural resources, public works, education and social development, health and nutrition.

Based on a sound assessment of the limitations and potential of the resource base of the region, a regional plan could set out guidelines and priorities for resource use that are sustainable over the long term, that maximize the potential of the resource base and that meet the needs of local people. Such a plan could act as a guide for donors and GRZ in their negotiations over future investment in the NP. For local district and ward councils a regional plan could provide a framework to guide decision making with respect to options for development of their local area. Ultimately it could provide district councils and the PPU and Provincial Council with the information and analysis needed to attract and interest donors and private sector investors in resource developments appropriate to the region, thereby avoiding the dilemma of accepting projects which may not be in the long term interests of the region, but which do provide much needed financial resources and jobs in the short term.

From the perspective of planning for sustainable development a Provincial Conservation Strategy as a sub-component to a regional plan for the NP provides an opportunity to:

* identify the resource base potential of the province, including underutilized resources, as well as the limitations of the resource base. We hope that this study will contribute to such an information base;

* identify the mitigative measures that must be taken to remedy problems of resource depletion and environmental degradation;

* identify enhancement measures necessary to replace resources which have been depleted beyond regenerative capacity;

* set priorities in an action plan for the phased development of resources in the Northern Province, including the shifting of current priorities to a more sustainable agenda. For example we suggest in this study that maize mono-cropping and chitemene may not be sustainable practices for the NP in the long term. A regional development plan offers an opportunity to shift priorities to alternative resource developments and thus a more sustainable development path.

* identify the training and manpower needs associated with implementation of the above measures.

A regional plan involves a planning process as well as the Plan itself. We suggest that in the long run the process of developing the plan is as significant, if not more so, than the Plan itself and that adequate time and skills be accorded the process of plan development. Plans can be produced and changed at pleasure, while the strengthening of skills at local and regional levels is a long term investment in the sustainability of the region. We would suggest that a participatory method be adopted for the preparation of the Regional Plan whereby in addition to a full consultation process the Planning Team incorporates members of District Councils to work with the Team on a training basis.

In order to undertake the development of a Regional Plan according to principles of sustainable development the Planning Team should have access to the following tools:

* an environmental/resource base profile and data base of the NP which clearly sets out the location and extent of the resources of the NP.

* an assessment of the limitations and potential of the resource base. We have attempted to provide an overview of such limitations and potential, but more detailed work is required in certain areas. We have identified such areas for further study in our recommendations (Section 8).

* a process for raising awareness at the provincial, district and ward level concerning the limitations and potential of the resource base of the NP through regular workshops, seminars, training with key government officials in all

relevant resource sectors as well as PPU, parastatals, NGOs and political organizations.

* a sound assessment of the range of options for resource use in terms of long term sustainability of the resource base, capacity for income generation, diversification of agricultural production, enhancement of underutilized resources and mitigation of depleted resources.

In order to implement the Plan the following institutional elements must be present:

* increased expertise in environmental management and project appraisal at the Provincial, District and Ward level through the addition of an environmental planning position within PPU.

* understanding and acceptance by political leaders, policy makers, key government officials and chiefs in the Province of the need to apply sustainable development principles in decision making with respect to resource use in the NP.

* financial resources and manpower allocated to carry out the above tasks.

* a legislative framework through which to enforce sustainable policies and practices;

It is our view that all of the institutional prerequisites can be met in NP through a combination of the continued support of donor agencies in sustainable development and the commitment of GRZ officials to the manpower resources necessary for decentralisation. With the enactment of the new Environment Act for Zambia the legislative framework is adequate to pursue the objectives of sustainable development.

7.8.2 An assessment of regional growth strategies

We anticipate that a regional plan for the NP would consider issues such as the implications of population growth in the NP along with related questions of present and future land uses. In this study we have pointed out significant limitations as regards present land-use practices and strategies in the NP. We suggest that it would be beneficial to the development of a Regional Plan to assess national growth settlement stategies in light of the ability of the resource base to meet these demands. These "Growth Poles Strategies" are cited in the FNDP (NCDP, 1989b):

Centre of Development: Kasama, Mbala and Mpika. Sub-centres of Development: Isoka, Mporokoso, Mpulungu, Mungwi Ward Development Centres: Chilubi, Chinsali, Kaputa, Luwingu, Nakonde.

It is envisaged that additional resources and priority will be given to these areas for increased growth in the near future with specific strategies to include: promoting regional specialisation in staple food production and processing, expanding extension

services, identifying resource potential, developing the capacity of district and provincial planning units. (NCDP, 1988 p576)

From the perspective of sustainable (agricultural) development for the NP it would be wise to assess these growth strategies in terms of the ability of the resource base of the area to sustain increased growth and consequent resource utilization.

7.8.3 Small-scale renewable resource industries

A regional plan for NP could also examine strategies to encourage the development of small scale renewable resource industries which could contribute to a more sustainable future for NP through diversification of development from the heavily focused agricultural sector. By placing more emphasis on development of off-farm activities in the areas of forestry, fisheries and wildlife areas, the NP could develop alternatives to agricultural development that could provide income, food, skills and an enhanced resource base. We have made some suggestions for sustainable small scale industrial development in the areas of forestry, fisheries, wildlife and agriculture.

While such enterprises are likely to be small in scale, cumulatively they can contribute to a substantial shift in emphasis on the part of donors and development agencies to development activities that are sustainable in the long term, regardless of the scale. The following list of ideas is by no means comprehensive; rather it is intended to indicate how small scale industries may help in promoting sustainable development in NP.

* forestry: increased support for small scale enterprises dealing with forest products such as poles, timber, mushrooms, caterpillars, fruits, honey, medicinal plants.

* fisheries: increased support to fisheries development, improved management and processing, including fish farming.

* wildlife: encouragement of commercial game ranching; game management schemes; or private enterprise involvement in developing tourist potential in wildlife estates.

* incentives for resource enhancement could be built into financial loans so that individuals or small business who borrowed money to engage in some type of renewable resource harvesting (wood, fish, animals) would be expected to contribute in some way to an enhancement programme such as tree planting, maintenance of a woodlot or fish hatchery, repair of equipment, etc.

A working group could be established to further develop ideas for small scale renewable resource industries that meet the criteria for sustainable development as outlined in Section 7.1. The group should consist of representatives from the VIS small scale industries, Departments of Forests, Fisheries, National Parks and Wildlife and other groups with an interest in small scale enterprises such as financial institutions.

The list of renewable resource small scale enterprises could be discussed and revisd at the annual donors/GRZ conference on sustainable futures for NP.

7.9 INCREASED CAPACITY FOR ENVIRONMENTAL MANAGEMENT

The solutions to the environmental problems of Zambia lie in a range of measures from appropriate national policies and economic incentives to adequate enforcement of current legislation and institutional mechanisms through which to deliver programmes. The PPU in NP will obviously not be able to address all of these levels. Nevertheless, the PPU is in a good position to exert a positive influence over the future shape of development activities in NP.

Based on our assessment of present and potential problems of environmental degradation in NP it is apparent that the Province requires increased capacity for environmental management. We suggest the following areas would provide a good starting point:

7.9.1 Project planning, appraisal and environmental impact assessment

We suggest that opportunities exist for increased environmental management at the national, provincial, district and ward levels in the areas of project planning, project appraisal and environmental impact assessment (EIA).

At the national level:

* project assessment, appraisal and environmental assessment (EIAs) within the Project Preparation and Evaluation Unit of NCDP and within line ministries. This should be practically oriented work using existing project plans and staff involved in their development. This work has begun within NCDP through seminars in natural resource economics sponsored by IUCN through the NCS Secretariat. In addition the same type of training can be carried out within line ministries.

* consideration of environmental matters through the National Environment Council in the form of case study examples to accentuate projects that are successfully achieving sustainable development goals.

* increased consideration of environmental matters through Joint Permanent Commissions for transboundary environmental matters such as fisheries, pollution, wildlife, transport of hazardous chemicals.

* improved briefings for political leaders, permanent secretaries and key decision makers on the environmental implications of resource developments pointing out opportunities for sustainable development policies.

At the provincial level:

* the addition of an environmental planner to the PPU with responsibilities for cross sectoral environmental planning, training and co-ordination of the PCS, and contribution to the Regional Plan;

* offering seminars and courses to line ministries in project planning, assessment and EIA;

* working with the PPU to improve the co-ordination of development planning with donors and GRZ;

* preparing environmental checklists for use at the district level in development planning (see Appendix 7 for examples on environmental checklists);

* improved briefings for the Provincial Development Council on environmental implications of N.P. resource development.

At the district and ward level:

* implementing the use of environmental checklists for use by district councillors involved in development planning;

* interpretation of information from the Land Use and Resource Map of N.P. indicating resource limitations and potential;

* development of enhancement/incentive schemes for natural resource development at the local community level;

* public education in local languages on the proper use and handling of pesticides and other hazardous chemicals, as well as enforcement of the sections of the new Environment Act pertaining to the control and regulation of pesticides.

For donors:

* encouraging the establishment of EIA guidelines to be used by all donor agencies in assessing their own projects;

* increased co-ordination of donors focusing on sustainable development for the NP.

In the private sector:

* establishment of guidelines for industrial projects in the Northern Province based on enforceable standards and regulations.

* establishment of an investment fund for rehabilitation, enhancement of land and resources degraded or lost by industrial development.

Ideally, exerting influence over resource use decisions before they become fully fledged project plans is a more cost-effective approach to sound sustainable development planning. The earlier the review of resource development ideas, concepts and projects, the less costs and delays are involved and the more potential benefits can result. Environmental assessments (EIAs) can play a useful role in assessing the potential impact of large scale projects. However, we would suggest that EIAs be limited to larger scale projects at the national level through NCDP. The emphasis at the provincial and district level should be in bringing about increased skills and knowledge about environmental factors, problems and solutions, and integrating this knowledge into day-to-day local decision making processes.

7.9.2 Environmental monitoring

Many of the measures suggested in this report focus on options to diversify the development of the resource base in the NP away from hybrid maize cultivation to other cash crops and revenue generating natural resource based activities. These measures are based on the assumption that information exists or can be collected on the present capacity and changing status of the resource base, and that this information can be interpreted clearly to determine a range of sustainable resource use options. The establishment of a data base and a system of monitoring are two essential ingredients in determining which options are sustainable over time. Our comments on monitoring focus on a broader environmental / ecological assessment of the resource base of NP rather than the monitoring of specific agricultural projects. ARPT, SPRP and DDSP have already developed indicators that can be used in monitoring change in the agricultural sector.

The PPU in NP along with DDSP, SPRP and ARPT are working towards a system of primary data collection in the NP, and all PPUs will be preparing a provincial statistical handbook. With this momentum already underway it should be possible to build into the data collection system a series of environmental/natural resource base indicators.

While a comprehensive list of environmental indicators could be prepared by the Provincial Conservation Council with the assistance of the PPU environmental planner, we suggest that the following list might be a useful starting point for discussion. These points are adapted from discussion papers on evaluation and monitoring from the World Conservation Strategy Conference in 1986 and are directed towards monitoring the environmental status of the resource base of the NP:

(i) Land Quantity:

* the extent (quantity) of existing suitable agricultural land;

* the extent of chitemene (from satellite imagery interpretation);

* the rate of loss of agricultural land;

* areas and rates of conversion to incompatible uses of land;

(ii) Land Quality:

* areas where soil loss and degradation are occurring due to soil depletion or erosion, deforestation and other causes;

(iii) Areas of wetlands and water bodies that remain able to support fisheries, waterfowl and other wildlife resources:

* rates of loss of such areas, or conversely rates of protection;

(iv) Maintenance of Biological Diversity:

* ecosystem diversity: unique ecosystems given long term protection;

* proportion of representative ecosystems present or lost;

(v) Species diversity:

* recovery rates or rates of loss of endangered species;

(vi) Genetic diversity:

* extent to which traditional and advanced breeds and genetic stocks are given long term protection or are lost;

* extent to which wild resource species are given long term protection primarily in parks, reserves, botanical gardens, seedstores, etc, or rates at which they are lost;

(vii) Maintenance of harvested resources at sustainable levels:

* the capacity for recruitment of the species or ecosystem especially with respect to fisheries, forestry and wildlife compared to the extent to which harvesting of species and ecosystems takes place.

(viii) Socio-economic factors:

* responses to change in resource policies (subsidies, incentives, fines);

* nutrition levels;

* changes in labour patterns;

* changes in settlement patterns.

All of the above categories can be broken down further into exact information to be collected. The above categories are listed simply to indicate the various areas of

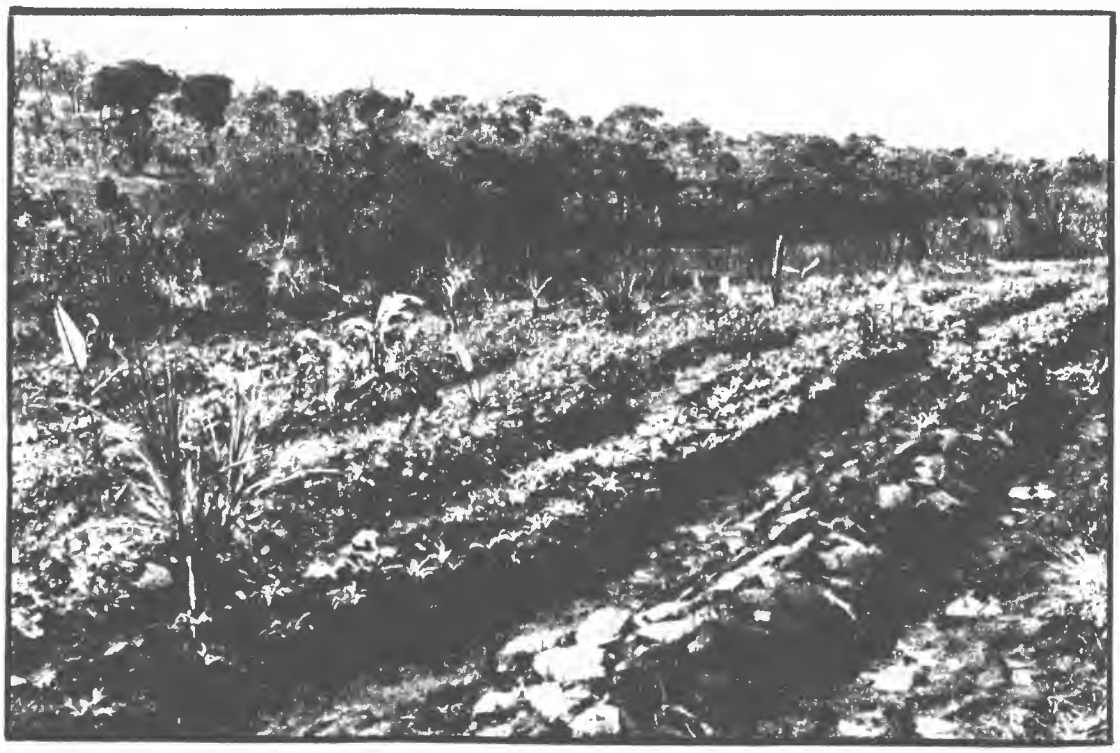
environmental and ecological data that would be useful in assessing the capacity of the resource base and changes over time.

It should be noted that some of this information is already collected in one form or another in NP through ARPT, SPRP, DDSP or other projects. Some of these data must be obtained from sectoral departments responsible for fisheries, forestry and wildlife; they may not, however, have data collection systems in place.

We recognize that the design and collection of such data are costly and time consuming, requiring trained staff to collate and interpret data. We suggest that beginning with case studies is one way of limiting the monitoring, yet still obtaining useful data. If a set of environmental indicators could be developed for PPU and NP, then donors could be requested to build these into their present and future projects with the assistance of the environmental planner from PPU. We suggest that in undertaking the design and impementation of an environmental monitoring that PPU request assistance from the IUCN/UNEP Monitoring Centre.

Chapter 8:

RECOMMENDATIONS



8. RECOMMENDATIONS

8.1 AGRICULTURE

The study distinguished between three major environmental problems associated with agriculture in the NP: 1) deforestation mainly due to chitemene shifting cultivation, but increasingly also due to expansion in semi-permanent/permanent cultivation, 2) soil depletion due to the acidifying effects of maize cultivation with use of fertilizers, and 3) soil erosion arising particularly from mono-cropping on permanent fields under mechanized farming. The most significant environmental problem is linked to accelerating deforestation, but concern is also expressed about the risk of decline in soil productivity due to reduced soil fertility and acidity development on the approximately 100,000 hectares under hybrid-maize cultivation. Soil erosion, at present mostly confined to areas under mechanized farming, may likely become a more widespread problem in the future.

Faced with low income levels and food security problems, the farmers of NP are by necessity more concerned about day-to-day survival than protection of the environment. Undernutrition and malnutrition are still prevalent in the province. When the full effect of the economic recession reaches NP, poverty is likely to increase, and thus also the number of farm households vulnerable to malnutrition. Strategies for promoting permanent agricultural land-use should therefore not be limited to more commercial production, resulting in a subtraction of labour force, time and resources from subsistence production.

Despite its commercial character, however, the maize programme (which to date has been the main government programme in the province) have contributed positively to food security and income for many farmers. Nevertheless, farm households at the early stages of commercialisation seem vulnerable to malnutrition (Sharpe, 1988, Appelton et al., 1989).

The financial cost to the government of every bag of maize produced in the NP has been high. The programme has depended on input subsidies and donor support in the form of technical assistance, capital expenditure, and recurrent costs. Realizing the fiscal burdens, GRZ is now phasing out the subsidies. NORAD , one of the major donors in the agricultural sector, cut budgets by 10-12% this year for its development programme in NP. While it is difficult to predict what policies donors will follow in the future, a strategy for sustainable development in NP cannot be based on a high level of donor support in the long term. This does not mean that donors should scale down their involvement in the province. On the contrary, a high level of support will be needed to maintain what has been developed, both regarding physical and social infrastructure. But the form of assistance should change and match the strategy recommendations given below.

It is important to realize that if complete deforestation of NP is to be prevented, cutting for chitemene must be controlled in the future. But a ban on chitemene cannot be justified and will be difficult to enforce - until more attractive production alternatives are developed for the majority of chitemene cultivators. Hybrid maize

cultivation will continue to be an alternative for many emergent farmers. Maize production is, however, dependent on fertilizer and lime applications to ensure its long term sustainability. Application of lime will increase production costs and lower profit margins to farmers. With the present deregulation of prices and subsidies, many marginal maize growers are thus likely to fall out of this production. Maize cultivation may therefore not be a viable alternative for the majority of the subsistence and emergent farmers of NP in the years to come. If this is the case, we stress that lower-input biological alternatives must be developed further and offered to the farmers. We also stress that crops other than hybrid maize continue to play a crucial and often dominant role for food security and cash income in rural households. Crops such as beans, groundnuts, millet, sorghum, cassava, local maize and vegetables demand less external inputs, and thus deserve a higher priority in agricultural development efforts. The legumes have three particular advantages in this regard: they enhance soil fertility; they are less costly to market, being high-value-to-bulk crops; and they are protein rich.

The major challenge for long-term agricultural development in NP lies in capacity building and strengthening of institutional mechanisms for agricultural planning and implementation. In this regard, the marketing system of maize is particularly weak. Late November this year, for example, about 800 000 x 90 kg bags of maize had not been collected, even though the rains had started (Mikkelsen pers. comm., 1989). This shows an extreme weakness in the marketing system that cannot be tolerated. Major inefficiencies in the marketing system of maize cause great losses to society and farmers. Likewise, production and income losses to farmers due to inefficient input supplies are also very significant. The risks involved in maize cultivation, decrease farmers willingness to adopt technologies based on external inputs.

Generally speaking a sustainable agricultural development in NP depends on the following factors:

* An economic environment based on provision of infrastructure, economic incentives, input supply and marketing services, that may enable farmers to adopt more permanent sustainable land-use systems.

* A firm commitment by GRZ to continue an appropriate level of investment and support to agricultural research and development efforts in NP.

* A firm integration of environmental concerns in agricultural policy, planning and implementation.

* A focus on proper land-use planning and land evaluation.

* A shift in policy towards a more diversified approach to agricultural development, and a recognition of the importance of off-farm activities in the different farming systems.

* A consolidation of development efforts through the maize programme, rather than further expansion - both for improving efficiency in planning, investments and operations, and to investigate further its environmental implications.

* A prime focus on provincial food security in agricultural development programmes, and to a lesser extent on national food security. A higher priority accorded to traditional food and cash crops, in particularly legumes that may enhance soil fertility.

* A stronger emphasis on poverty alleviation, i.e. targeting development efforts towards resource poor farmers dependent on chitemene, by improving their access to productive assets.

* Continued research and development efforts on low-input biological methods of agriculture.

* A strengthening of institutional capabilities in policy analysis, planning, economic management and programme implementation.

* A planned approach to human resource development and training in agricultural and environmental planning, research and extension.

* A gradual reform of land tenure systems to enable title to be registered by farmers, thereby increasing security and encouraging long-term investments, for example, in enhancing soil fertility.

* A strengthening of rural institutions - such as cooperatives, farmers' and women's groups.

More specifically the following recommendations are given:

8.1.1 Agricultural planning and infrastructural development

* A strategy for long-term development of the agricultural sector should be prepared by the provincial agricultural authorities in collaboration with PPU. The plan would in particular need to consider:

  - environmental concerns raised by this study concerning further expansion of maize cultivation;

  - costs of maize production in NP to society and the need to consolidate and rationalise the maize programme;

  - more diversified crop and agricultural strategies based on comparative advantages of districts and farming systems;

  - institutional strengthening and capacity-building needs;

- infrastructural maintenance, rehabilitation and development;

- assessment of the role of donors within the context of creating sustainable agricultural development; reduce dependance; improve coordination;

- reappraisal of technical assistance within the agricultural sector; greater use of Zambian consultants, more attention to transfer of skills, better coordination.

* Environmental considerations should be included in road planning, construction and maintenance, since roads are crucial for locating settlements and agricultural expansion into new land. New settlements may, for example, increase pressure on GMAs or other areas in need of protection, e.g. headwaters of the main rivers.

8.1.2 Economic policies

* Relative changes in producer prices should be considered so as to favour higher-value-to-bulk cash crops that may also enhance soil fertility. Introduction of floor prices for legumes that can compete with prices in unofficial markets may be one such incentive. Another incentive would be to maintain differential rates for delivery of inputs and collection of crops based on km/weight, i.e. pricing according to cost and thereby favouring high-value-to-bulk crops.

* A subsidy on lime should be maintained on a transitional basis to promote lime use among farmers and to increase local demand. A pilot programme for introduction of lime to emergent and commercial farmers in high-producing maize areas with particular acidity problems should also be considered. The recent increase in transport prices may be an argument for undertaking a new feasibility study on development of local lime deposits, based on the findings by Øygard (1987).

8.1.3 Marketing policies

* NCU should consider:

  - covering all crops as mandated, including legumes, millet and possibly cassava in the longer term;

  - making lime available to farmers;

  - stimulating improved storage at farm level and district levels - of all crops;

  - introducing carts (hand drawn, bicycle drawn or ox-drawn) on credit.

* Provincial authorities should establish a system for forecasting input requirements two years in advance.

* The supply of fertilizer and lime should be increased to meet demand, but decisions to increase support to fertilizer-based agriculture must be based on assessments of soil acidity development (see Sections 8.1.5 and 8.1.6).

* Payment to farmers for harvest must be made available in time for them to purchase inputs for the following season.

* New investments in transport equipment (trucks) by GRZ and NCU should be planned based on expected increases in marketed maize production, capacity of the railway to transport maize produce, and the contribution of potential private traders towards maize marketing by 1993.

8.1.4 Credit policies

* Credit allocations should be increased to at least match increasing input prices.

* Seasonal credit schemes should be re-directed to bring new producers into commercial and more permanent farming. Currently, large established maize producers are favoured to compensate for late payment by NCU for their maize harvest.

* Credit should be provided also for inputs to other crops than maize in the future. Credit for fertilizers to millet would encourage millet cultivation on permanent fields rather than on chitemene. Credit for fertilizers to legumes cultivated in rotation with other crops could result in improved soil fertility.

* The LINTCO credit-package of soyabeans, fertilizers and lime should be further encouraged.

* Savings and credit possibilities for subsistence and emergent farmers, should be further expanded and encouraged. Particular efforts should be done to reach the women.

8.1.5 Agricultural extension

The study has identified a need for a more integrated, conservation-oriented extension service based on principles of local participation. The farmers need better advice on how to allocate time and resources between various often conflicting practices, both in farming and off-farm activities. The advice should be based on local resources, knowledge and skills. With increasing pressure on land and other resources, it is essential that farmers are given a balanced view concerning the best use of the total resources (land, forest, fish, game) under their control, together with knowledge of better resource management. This will require a wider base of training for the extension officers. The Department of Agriculture controls the majority of extension workers in NP. It should therefore take a lead role in developing an integrated extension service involving a much closer collaboration with the Forest Department, Natural Resources Department and Department of Fisheries. Closer links should also

be established with government or private entities involved in off-farm activities such as trading, small-scale food processing and manufacturing.

Our recommendations are related to extension programme objectives and to institutional capacity building.

8.1.5.1 Extension programme objectives

* The extension service should diversify extension advice according to the comparative advantages of farming system zones and districts. This would imply a stronger emphasis on traditional food and cash crops (beans, groundnuts, millet, cassava, sorghum), particularly in areas less favourable to hybrid maize cultivation.

* This would include recognition of the importance of off-farm activities in the different farming systems and how farmers could be best advised to allocate resources (time, labour, capital) between various farming and non-farming activities, such as trading, fishing, handicraft, charcoal burning etc. The extension officers should therefore work more closely with fisheries, forestry and natural resources management officers. The PAO should take the initiative to develop a co-ordinated programme for an integrated, conservation-oriented extension service involving the Department of Fisheries, Forest Department and Natural Resources Department.

* A stronger emphasis should be put on low input biological methods for improving soil fertility (green or animal manure, crop rotation with legumes, intercropping, agroforestry, composting). Biological methods should be emphasised, particularly in areas which have lower potential for hybrid maize cultivation, due to poorly developed infrastructure and marketing. But available organic matter of the topsoil should be preserved and increased also under maize cultivation, especially since lime is not being used. Low input technologies should be tried out on farm trials.

* Extension officers should be encouraged to increase the number of farmers visited. Today less than half the farmers are in touch with the extension service, and priority is too often accorded the resource richer maize growers (VAP/ETP, 1989).

* More efforts should be put on food crop storage and preservation at farm level to counter crop harvest losses.

* The nutrition aspect of extension should be strengthened, both in training of extension workers and farmers.

* Since women often play a central role in the production of food crops, the extension service should focus on reaching women with improved low-input technologies.

* Soil testing and advisory services should be established in the province, particularly for pH and P determination.

* A soil conservation programme should be developed by the Provincial Agricultural Officer (PAO), with particular attention accorded to Mbala/Isoka (Zone 3).

* The introduction of lime in hybrid-maize cultivation should be tested on a pilot basis to emergent and commercial farmers in high producing maize areas.

* More emphasis should be put on the problem of weed infestation in the extension message.

8.1.5.2 Institutional capacity building

* Emphasis should be on institutional strengthening and capacity building, rather than on increasing the number of staff. Any increase should be in the recruitment of women into the extension service.

* A plan for capacity strengthening and human resources development should be developed. This should include a consideration of incentives for extension staff, e.g. improved working conditions, training and scholarships, to improve efficiency through the extension system.

* A post should be created with the PAO for co-ordinating a more integrated extension service.

* Particular training efforts should be introduced in: i) low-input biological technologies and soil conservation, and ii) soil testing and soil fertility monitoring and evaluation programmes. ARPT/SPRP could undertake short-term in-house training courses on such topics. Extension workers involved in oxenisation programmes should have priority regarding soil conservation training.

* A sufficient funding of the extension service by GRZ to cover transport and recurrent costs is a prerequisite for efficient utilization of existing staff. Unless such funding can be provided at the present staff levels, a lower staff level, but better equipped, should be considered.

* Extension workers should participate more actively in strengthening primary cooperatives, which now number about 130, involving 30-40,000 members (NCU manager, pers.comm.).

* Farmers' training must be tailored to farmers resource levels (labour, capital, market access) and farming system practices.

8.1.6 Agricultural research

Agricultural research in established institutions (SPRP and ARPT) in the NP have come a long way in addressing the real problems faced by farmers. This has been achieved by basing research priorities on farmers' resource constraints rather than on single commodity research. The agricultural research recommendations in this report largely coincide with research priorities set by these institutions. Efforts should, however, be made for closer collaboration between existing institutions in setting agricultural research priorities. Furthermore, research and extension staff should meet more frequently to improve on problem identification and information flows.

The following findings have important implications for agricultural research:

* A trend towards increased population concentration in and around district towns, smaller service centres and close to roads has led to more semi-permanent cultivation. Increasing dependence on semi-permanent agriculture (e.g. grass mound systems and cassava gardens) requires increased research priority on extending cultivation periods and decreasing fallow periods in these semi-permanent systems. Emphasis should be on low-cost and labour-saving technologies for maintaining soil fertility.

* Decreasing forest biomass for chitemene cultivation will require development of technology to increase crop output over time in semi-permanent systems without jeopardizing soil productivity.

* The wide differences in resource availability (land, labour, capital) among subsistence, emergent and commercial farmers require development of agricultural technology appropriate to their resource situation.

* Decreasing profitability of maize production and unreliability of input supply require promotion of locally adapted cash crops and strengthening of research on subsistence crops.

* Dependence on hand hoe cultivation requires introduction of labour-saving technology.

* Poor nutrition in rural areas requires crop diversification for providing a more balanced diet in rural households.

The following recommendations are based on these findings:

* Farmers should be involved early in the research process and on-farm trials of recommended low-input technology should be encouraged among farmers.

* Socio-economic dimensions of resource management in agricultural development should receive higher priority, including gender issues.

* Research on technological improvements in semi-permanent systems should be based on low-input cultivation systems;

  - * agroforestry e.g. alley cropping, planted fallows to improve regeneration of soil fertility
  - * animal and green manure
  - * legume-cereal crop rotations
  - * mulching
  - * use of crop residues and composting
  - * selection of crop species and varities that tolerate high soil acidity levels and low levels of fertility

* Research on low-input technology for improvement of semi-permanent cultivation should emphasize maintenance of soil chemical, physical and micro-biological properties.

* Research efforts should be directed at monitoring farm management of soil acidity in permanent fields with continuous use of fertilisers without the use of lime. It is necessary to determine the soil acidity of recently abandoned permanently cultivated fields. There is also a need to assess the effect of excessive application of fertilizer on soil acidity and the potential irreversible effects on soil productivity. Research should be undertaken on the efficiency on fertilizer use by farmers.

* Research should continue on methods for acidity control at different levels of acidity development with both lime and/or organic material as ameliorants.

* Technological recommendations for improving semi-permanent systems should be closely analyzed with respect to changes in use of labour, land, capital and economic benefits to the farmer.

* Promotion of diversification of both cash and subsistence crop production should centre on locally adapted acid tolerant species that are economically and socially acceptable. Efforts should also be made to identify and test new species suited to local conditions with better potential than local crops.

* The relative importance of increasing weed encroachment, pest problems and declining soil fertility on permanently cultivated fields should be analysed at farm level. Research on effective weed control should be given high priority.

* The effects of differences in resource availability and changes in market opportunities for land-use strategies should be analyzed in order to assess how farmers allocate labour, land and capital to various cultivation systems (e.g. chitemene, semi-and permanent cultivation).

* One should analyze in more detail the type, annual distribution and extent of involvement in off-farm activities among farmers and in various farming systems in the NP.

* More research should be directed towards the effects of agricultural commercialisation on nutrition.

* More research should be carried out on potential and actual soil erosion in areas with high population pressure (e.g. Mbala/Isoka), and assess possible conservation measures.

* More research should be directed at improving farm storage facilities to reduce post-harvest losses.

* Research should also continue on technological options for improving chitemene cultivation.

8.2 FORESTRY

The two main problems affecting forest resources in NP are: 1) deforestation caused mainly by chitemene and expansion in agriculture, partly also by urban fuelwood consumption, and 2) late burning of forest areas which depletes surface organic matter and has a negative impact on forest biomass and production. A third problem is the over-exploitation of valuable indigenous hardwoods, such as mukwa, mupapa and saninga, around towns where the demand for hardwood timber is high. Recommendations for addressing deforestation due to agricultural land-use have been presented in the previous chapters. The other problems are linked particularly to the lack of natural forest management at various levels.

No initiatives have yet been taken to actively involve local people and their leaders and chiefs in collective management of natural forest, while this is a pre-requisite for achieving appropriate management of the vast areas involved. People's participation in forest management could be encouraged and sustained if they derive benefits from the resources they manage. Improved revenue collection by the Forest Department could form the basis for investing in community development projects for natural forest management.

The Forest Department is responsible for management of gazetted forest areas and controlling the harvesting of forest produce (poles, timber, mushroom, caterpillars, firewood, charcoal , fruits, honey) for sale through a licensing system in all natural forest areas in the country. The Forest Department is also responsible for the establishment of local supply forest plantations and the promotion of tree planting and beekeeping in rural areas. The Natural Resources Department is responsible for the management of land resources (including forest) outside gazetted forest areas and national parks. Good progress has been made in the establishment of local supply plantations. The exploitation of these plantations is now a major revenue source for the Forest Department of NP. The rehabilitation of the Kasama Sawmill and the establishment of a revolving fund have increased revenue generation and demonstrate the great potential that the plantation forestry has in the province.

The two departments are currently grossly understaffed. The Natural Resources Department is represented in only four of the nine districts in the Province. The existing staff are also inadequately trained in natural forest management and forestry extension. The Departments lack transport and equipment to effectively implement

forestry and conservation laws and policies. Consequently, rural tree planting and natural forest management programmes have not been successful. This has resulted in poor collection of government revenue. For example, less than 2% of the revenue in the form of stumpage fees for cord wood for firewood and charcoal in 1988 was collected by the Forest Department in NP. These fees could amount to several million Kwacha annually. If collected, the revenue could be reinvested in natural forest management.

Lack of title to land contributes to poor management of natural forest which under traditional land tenure is regarded and utilized as a common property. Promotion of land holding by title and training of landholders through extension education in resource management are necessary prerequisites for improved management of land resources.

The following specific recommendations have been made to address problems of forestry management:

8.2.1 Community participation in natural forest management

Mechanisms should be worked out to involve local people and their political leaders and traditional rulers in natural forest management, especially in the control of over-exploitation and encouragement of early burning. Such mechanisms should include the transfer of benefits from forest produce to participating communities through investment in community development projects.

8.2.2 Forest extension

Natural Forest Management Departments of Forest and Natural Resources should be strengthened through appropriate training in forest extension and natural forest management, adequate staffing and provision and maintenance of transport equipment.

8.2.3 Revenue collection

Priority should be given to improving revenue collection which can generate the necessary funds to support natural forest management and tree planting.

8.2.4 Title to land

Acquisition of title to land should be encouraged as an initial step in fostering individual responsibility towards land resources.

8.2.5 Tree planting

Tree planting should be integrated with the production of fruit (exotic and indigenous), mulch and fodder, and bee-keeping at household level. Regarding production of fuelwood, priority should be accorded to improved natural forest management rather than planting of trees.

8.2.6 District forest surveys

District forest surveys should be urgently undertaken to assess stock of forest produce and identify priority areas, especially critical headwaters and areas with high potential for hardwood timber production, for forest reservation.

8.3 WILDLIFE

8.3.1 The role of wildlife in development planning

The depletion of wildlife resources in NP is associated with increasing hunting pressure within zones of human settlements. Hunting pressure increases when the miombo habitat deteriorates. To improve wildlife management it is required that less area-demanding agricultural systems be adapted. Wildlife management must become an integrated concern in development plans and programmes at provincial level, particularly regarding programmes for new settlements.

8.3.2 Game Management Areas

As erosion of wildlife resources has been so pronounced in GMAs of the NP, it is recommended that a commission be established to review legislation related to GMAs, and particularly relating to the settlement of people in these areas. Motswari Game (1981) has already proposed, for example, the classification of GMAs into those for safari hunting only, and those for non-safari hunting. It is abundantly clear that ADMADE-type programmes can only operate where development of GMAs is controlled, and a primary requirement relates then to settlement.

Where adequate safeguards available for land-use planning in GMAs exist (at both legislative and enforcement levels), consideration could be given to de-gazetting those GMAs which have no potential to meet the original objectives - that they should act as buffers to national parks and provide sustainable returns to residents, either directly or indirectly through safari hunting. Such degazetting must be conditional on a committed implementation of conservation and utilisation strategies in those GMAs which still retain the potential to maintain a wildlife resource.

Such a policy might not only meet political aspirations for population resettlement, but would allow an over-extended Wildlife Department to concentrate its efforts on those areas with remaining potential. In addition, any development in GMAs must be conditional on meeting requirements related to proper zonation of resource use, coupled with a clear resource use strategy. Here, it is recommended that firm links be established with the Provincial Conservation Strategy (PCS).

An integrated land-use plan should be worked out, which would have the legislative backing of the National Environmental Council (NEC). Chabwela (In: Jeffery. (ed) 1988) for example, points out that any cropping programme needs to be clearly associated with government policies and regulations for it to be successful. Firm links with both the PCS and the NEC would achieve this prerequisite.

The ADMADE programme in GMAs depends upon the development of a custodial awareness; pressures from outside GMAs which detract from this should be discouraged. For example, settlement close to GMAs may place severe pressure on GMAs from chitemene practices; such pressures lead not only to habitat destruction but to increased poaching. One strategy to counter this would be to encourage game farming ventures adjacent to GMAs. One such experiment has taken place in Noshinga Swamp, west of Chinsali, using black lechwe translocated from Bangweulu. Here, the District Council oversees the herd, on behalf of the President.

It is further recommended that full support be given to the development of the "Katibunga GMA" on the W. boundary of NLNP, given the justification above. The relevant legislation (CAP. 316) states "... the President may by statutory order declare any area of land to be a GMA provided that if any land within any such declared or extended game management area is held in private ownership, the said land shall not, except with written consent of the owner thereof, be affected by the said declaration or extension and shall be deemed to be excluded therefrom".

Attention should also be drawn to the wholly unacceptable manner in which National Parks estate has been illegally settled, e.g. Isangano National Park. As this is of national concern, as opposed to provincial, it falls outside the immediate terms of reference of this review. Nevertheless, there is a considerable onus on provincial authorities to initiate national steps to redress this disturbing trend.

8.3.3 National wildlife programmes and co-ordination

As far as possible, developments in the NP should be linked with national programmes, e.g. the wetlands programme, and the ADMADE approach. Where several initiatives have similar objectives, it is essential that a co-ordinating body provides an integrated approach. For example, ADMADE, IRDP, Frankfurt Zoological Society, and LIRDP are all active in the Luangwa Valley. These efforts can be integrated through the Provincial Conservation Strategy for NP.

8.4 FISHERIES

Each body of water in the NP that have high potentials for development of fish resources (Lake Tanganyika, Lake Mweru-Wa-Ntipa, Lake Bangweulu, the Chambeshi River System) requires its own management plan, but these plans are meaningless unless coupled with three essential requirements:

8.4.1 Data base: monitoring

A sound data-base on which to formulate management plans should be developed, as well as continued monitoring for purposes of of making fisheries management adaptive. Continued investment in exploitative schemes for fisheries is unjustified until data-collection and research capacities are strengthened on a long-term basis. For example, the figure for the fisheries potential of Lake Tanganyika (Zambian waters only) of 12000 tonnes per year (Pearce, pers. comm.) is based on an FAO estimate arrived at

when the fish community structure in the Lake was radically different from the present one. Management plans must be based on reliable data which reflect the dramatic recent changes in fish populations which are taking place not only in Lake Tanganyika, but elsewhere in the NP.

8.4.2 Extension and law enforcement

Extension and law-enforcement back-up is needed to implement management policies, and involve local communities in improved management efforts.

8.4.3 Community participation in fisheries management

The management activities required for the fish resources will cover vast lakes and rivers, and involve considerable investments. To reduce the burden on fisheries authorities, their role in resource management should primarily be to initiate forms of community management at local level. A further recommendation therefore relates to the need for sociological feedback in the NP, particularly on those issues concerned with conservation legislation and implementation. What regulatory measures are regarded by people as unacceptable, and why? What are the most desirable channels for the implementation of conservation regulations? How can regulations be made more palatable? How can household resources best be allocated between fishing, agriculture and other off-farm activities. Above all, what approaches need to be taken to ensure that fishermen and communities begin to see themselves as guardians of their own resource, for their own benefit?

8.5 POLICY AND PLANNING RECOMMENDATIONS

In this report we have indicated that the environmental problems resulting from land-use practices and resource development in the Northern Province are significant. Immediate action is required to reverse current trends leading to depletion. Development of policies based on principles of sustainability are therefore urgently required, as well as the planning mechanisms and institutional framework necessary for implementation.

Some of the resource management activities required in NP, such as natural forest management, watershed management and management of fish resources, will cover vast areas and involve considerable human and financial resources. These activities may not generate income in the short term. Moreover, such undertakings will normally be outside the control of individual farmers.

The provincial authorities should in this regard take on a catalytic role and initiate forms of community resource management. This may reduce the burden on the GRZ, and engender the necessary collective responsibility for conservation. The involvement of local people would also help them to ensure that the activities serve the peoples needs.

We recommend the following measures to be taken in the area of policy and planning in the NP:

8.5.1 The development of a Provincial Conservation Strategy (PCS)

We recommend that the PPU and the NCC proceed as soon as possible with the development of a PCS for the Northern Province. This Strategy should be developed as a sub-component of the Regional Development Plan and should contain an Environmental Action Plan for the NP. Section 7.7 and 7.8 expand on roles that a PCS could play in the NP and in regional planning.

8.5.2 An environmental planner for the PPU

To enhance capacity for environmental planning and management at the provincial level, we recommend the placement of an environmental planner within the PPU. The incumbent would co-ordinate the development of a the PCS and contribute to the work of PPU and line ministries in the areas of environmental planning and assessment, project review, cross-sectoral analysis and training at the provincial, district and ward levels.

In addition we suggest that the environmental planner be a member of the Study Team responsible for the development of the Regional Plan for the NP.

8.5.3 An environmental profile for NP

A comprehensive environmental profile should be developed for the NP including:

* documentation of the natural resources of the NP
* identification of specific areas under pressure
* sustainable land-use options for each district
* rural development strategies consistent with such options
* operational guidelines for donor agencies seeking to operate in the NP
* a resource use and land use map for the NP showing the natural resources of the NP, and areas under pressure (e.g. eroded and/or deforested areas).

We suggest that this map would be a useful tool for work with District Councils, donors agencies and NCDP in making decisions concerning resource development in NP. The preparations of such a map also enables natural resource sectors such as fisheries, forestry and wildlife to clearly illustrate areas in which urgent work must be done, and areas such as watersheds and transboundary regions where management plans must be undertaken.

We recommend that the Environmental Profile and Resource Use Map form part of the Provincial Conservation Strategy and that it should be used with educational materials

in schools and within government, and as a management tool for decision makers and resource managers.

8.5.4 Environmental assessment tools for the NP

We recommend that a range of environmental management tools be developed for use in the NP including:

* an environmental checklist to be used by District and Provincial Development Councils. Suggestions for such a checklist appear in Appendix 7.

* inclusion of environmental data in monitoring models used by PPU, DDSP, VAP, IRDP.

* the development of materials for training seminars on project planning and assessment including scoping techniques, EIA methods, monitoring and evaluation.

8.5.5 The convening of an annual workshop on sustainable futures for NP for donors and private sector interests.

We recommend that the NP could benefit from increased co-ordination of donors in development planning. One way that PPU might facilitate this is to invite all donors agencies and development interests to an annual workshop to discuss sustainable resource development futures for the NP, and to review the progress of current initiatives. Such a workshop could provide a venue for innovative sustainable project ideas, an education focus for new information and analysis on the resource base of the province, and at the very least an informal level of co-operation and co-ordination between donors and projects.

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PERSONAL COMMUNICATIONS

Gibson, D., Mpika District Co-ordinator

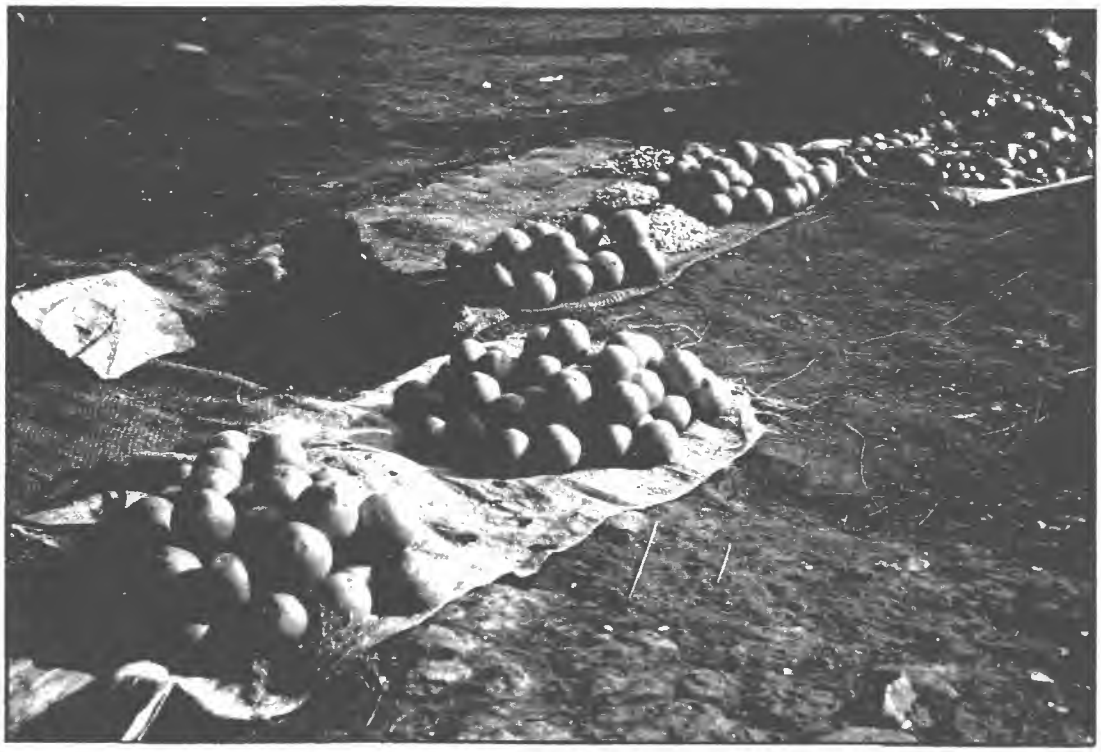
Jeffery, R.C.V., Project Manager, IUCN, Lusaka

Mikkelsen, K.H., Project Co-ordinator, Soil Productivity Research Programme (SPRP)

Pearce, Fisheries Research Officer, Mpulungu

Yaloma, P.C., General Manager, NCU, Kasama

Appendices



TERMS OF REFERENCE

FOR A CONSULTANCY TO INVESTIGATE THE LONG TERM ENVIRONMENTAL EFFECTS OF EXPANDING AGRICULTURAL PRODUCTION AND OTHER USE OF NATURAL RESOURCES IN THE NORTHERN PROVINCE OF ZAMBIA

1. INTRODUCTION

Traditonally the agricultural production in the Northern Province of Zambia has been low and subsistence-oriented. The majority of the farmers has been and still is shifting cultivators. This production system, called chitemene, requires, due to the heavily leached soil, from 1/4 to 1 square km per individual to be sustainable, and is thus adapted to a population of low density. A growing population will cause an increased pressure on the land and forest resources.

A prosess of commercial agricultural production has started in the province, and the total production has increased considerably during the eighties. The estimate for maize for 1988 reached 2 million sacks.

ZAMBIA has for several years subsidized maize production and fertilizer consumption, and NORWAY has also for several years supported agricultural development in the province. During the Fifth Annual Meeting of the Agriculture and Rural Development Programme ZAM 020, held in Kasama in October 1988, it was noted a concern of potential detrimental effects of continued emphasis on increasing the production. To get more knowledge the meeting agreed on a consultancy to investigate the long term environmental effects of expanding agricultural production and other use of natural resources.

2. OBJECTIVE

Since the principal emphasis in Northern Province is on agricultural development, the overall purpose of the consultancy is to examine the long term potential impact of this development on the environment and resource base of the province.

Since the province's resource base needs to be maintained in order to secure an adequate development for future generations, the consultancy should in particular identify potential problems related to current agricultural and rural policies and practices.

3. SCOPE OF WORK

The consultancy shall comprise, but not necessarily be limited to the following tasks:

Appendix 1

3.1 The team shall consider and discuss:

a) problems related to possible degradation of the natural resource base, including the effects on the natural flora and fauna, due to changes in the land use and resource utilization

b) problems related to soil erosion

c) possible decline in soil fertility and the biological productivity in general

d) problems related to pollution of soil and water, increase in waterborne diseases, etc.

e) effects on the sustainability of the resource base from current population size and growth within the province

f) actual or potential conflicts between different ways of resource utilization within the province (wildlife conservation/utilization versus agricultural development, different forestry practices, etc.)

3.2 From its survey of the environmental status of the Northern Province, including problems identified, the consultancy should prepare an Environmental Profile of the province for the purpose of assisting in long term development planning and sustainable resource use.

3.3 Identification of problems should lead to recommendations, of two kinds. First where current policies and/or practices (whether national or local) are found to have adverse effects on the environment or resource base, amendments to such policies or practices should be recommended. Secondly measures for better management and conservation of the environment and the resource base should be recommended, on the assumption that certain policies and/or practices, which have an actual or practical negative impact, may continue to change only slowly.

3.4 Recommend ways of monitoring long term environmental effects of government policies and programmes, spesific projects, and current and future agricultural practices; any recommendations on methods of monitoring should take account of the likely ability of the Government administration in Northern Province to continue and utilize the system(s) recommended.

3.5 If possible identify specific geographical areas where environmental degradation or resource base depletion is already advanced, and recommend remedies. In addition the consultancy should make recommendations for more detailed analysis to be made in two districts of the Province, in line with the National Conservation Strategy.

3.6 Formulate recommendations related to the conservation of natural resources within the Province, including wildlife, forestry, and fish, in light of their potential as resource bases for future generations as well as pressures or conflicts to which they may be subject. Particular attention may be devoted to the management of National Parks and Game Management areas in the Province.

3.7 Furthermore examine environmental problems of urban or peri-urban areas in view of likely increases in population and the problems of providing adequate services such as water and sewage, and also the supply of natural ressources for construction and for fuel within the Province.

3.8 Present recommendations on how to increase a more general environmental awareness among both policy makers and the general public. Such recommendations should refer to the National Conservation Strategy and the implementation of its decentralisation by the National Conservation Committee and its provincial counterparts within the framework of the Government's overall policy on decentralisation and environmental protection.

4. PARTICIPANTS, MODE OF WORK

4.1 The consultancy shall consist of four persons with experience in following disciplines:

- environmental sciences
- agriculture
- forestry
- ecology
- soil science (with erosion control)
- resource economics
- sociology/anthropology

At least one of the team members shall be a woman and at least one shall be a Zambian national.

4.2 The work shall be carried out in close cooperation with the appropriate Zambian authorities and MDC in Lusaka and Oslo.

4.3 The work will include review of relevant documents, field visists and discussions with relevant persons and institutions.

4.4 The consultancy will require ten weeks of work to be spent on preparations, field work and report writing, all in Zambia. A draft report, in English, shall be prepared to Zambian authorities and MDC in Lusaka before the team leaves Zambia.

20.2.89

INTERVIEWS CONDUCTED BY THE NORAGRIC/IUCN STUDY TEAM

LUSAKA:

* Ministry of Lands Water and Natural Resources

  Mr. India Musokatwane, Director of Natural Resources

* National Conservation Committee

  Dr. Derrick Medford, IUCN Senior Consultant

* National Commission for Development Planning

  Mr. Sikubansi, Director
  Ms. Patricia Munbe, Economist
  Mr. Frank Muller, Environmental Economist IUCN
  Mr. Benson Marah, ILO Population Expert
  Ms. Dorothy Muntemba, Senior Economist.

* Ministry of Agriculture

* Department of Agriculture, Soil Conservation Unit

  Mr. Steve Gossage, Senior Soil Conservation Officer
  Mr. Roy Chiti, Planning Officer
  Mr. Herbert Mwanza, Senior Land Use Planning Officer

* Department of Agriculture, Planning Division

  Mr. M. Soko, Assistant Director
  Miss Chikumbi, Economic Planner

* Department of Agriculture, Research Branch

  Mr. Peter Aagaard, ZAREP Co-ordinator

* Mt. Makulu Research Station

  Mr. Ken Phillips, Resource Management Co-ordinator

* NORAD

  Mr. G. Klem, Division Chief, Natural Resources Management
  Mr. T. Larsen, Assistant Representative, Lusaka

Appendix 2

* Ministry of Lands, Natural Resources and Water, Forest Department, Ndola

  Mr. S.J. Akapelwa, Chief Conservation Officer, Forestry

* University of Zambia. School of Agricultural Sciences

  Dr. Vernon Chinene, Dean
  Dr. Obed I. Lungu, Lecturer, Soil Science
  Mr. Willie Mulonga, Lecturer, Soil Science.

* Commercial Farmers Bureau

  Mr. John Hudson, Executive Director
  Mr. Willard N. Nang'amba, Assistant Executive Director

NORTHERN PROVINCE:

* Permanent Secretary: Mr. James Ntonga

  Mr. F.S.Ng'ambi, Provincial Development Officer

* Provincial Planning Unit, Kasama

  Mr. Francis S. Lubinda, Chief Regional Planner
  Mr. Mike Veitch, Monitoring Officer
  Mrs. M.Mooto, Women's Coordinator

* Department of Agriculture

  Mr. Thomas Mwape, Monitoring Officer, Extension and Training Programme
  Mr. Edward Chamolonga, Region Extention Training Officer
  Mr. Hakon Faste, Project Co-ordinator
  Mrs. Mulenga, Women's Program Coordinator

* Department of Veterinary Services, Tetse Control Program

  Mr. M.K.D. Mwansa, Provincial Tse-tse Control Officer
  Mr. Nyangwe, Mbala District Tse-tse Control Officer

* Ministry of Lands Water and Natural Resources, Department of National Parks and Wildlife

  Mr. W.K. Sinkamba, Senior Wildlife Ranger, Kasama

* Ministry of Lands Water and Natural Resources, Department of Fisheries, Kasama

  Allan Brooks, NORAD, Fish Culture, Misamfu Research Station

* Provincial Fisheries Development Office

  Mr. Charles Ndonna, Fisheries Officer
  Mr. Pearce, Fisheries Research Officer, Mpulungu

* Provincial Agriculture Engineer, Kasama

  Mr. Bror Karlson

* Village Agriculture Program (VAP), Kasama

  Mr. Egil Nestande, Program Co-ordinator

* Integrated Rural Development Program (IRDP) Kasama

  Mr. Axel Johannessen, IRDP Co-ordinator
  Mr. Torben Lindquist, District Representative
  Mr. Werner Heuberer, District Representative

* Soil Productivity Research Program (SPRP), Misamfu

  Mr. Robin Matthews, Agroforester
  Mr. Smart Lungu, Agronomist
  Mr. Timothy Mwambazi, Agronomist
  Mr. Masauso K. Sakala, Soil Microbiologist
  Mr. Joseph Mwanamwenge, Agronomist
  Mr. Samuel Phiri, Soil Scientist
  Mr. Alfred Mapiri, Soil Scientist
  Mr. Masule Kamwi, Lab Technician
  Mr. Bonaventure Suza, Senior Agricultural Assistant
  Mr. Bright Mwakalombe, Microbiologist
  Mr. Pumulu P. Mubiana, Senior Agricultural Assistant
  Mr. Bwembya Shadreck, Agricultural Supervisor

* Adaptive Research Planning Team (ARPT), Misamfu

  Mr. Trevor Pritchard, Research Extension Officer
  Mr. Peter Reid, Agronomist, Co-ordinator
  Mrs. Mary Silavwe Mulenga, Economist
  Mr. John A. Siame, Agronomist
  Mr. Fred Kakondo, Data Manager

Appendix 2

* E.E.C. Rice Development Project

  Mr. Richard Gillett, Co-ordinator

* Zambia Coffee Company Ltd.

  Mr. J. Graham Pollok, General Manager

* Luangwa Valley, IRDP Nabwalya Camp, Munyamadzi Corridor, Mpika District

  Mr. George Allison, Graduate Assistant

* Chitoshi Agriculture Camp, Mporokoso District, Tandabube Farm

  Mr. S. Kabwe

* Mpika District Development Support Program (DDSP)

  Mr. Dave Warrick, Director
  Mr. Simon Berry, Chinsala District Co-ordinator
  Mrs. Barbara Conland, Chinsala District Co-ordinator
  Mr. Dutch Gibson, Mpika District Co-ordinator
  Mr. Ed Mwale, Monitoring Officer
  Ms. Charlotte Harland, Monitoring Officer

* Northern Co-operative Union

  Mr. P.C. Yaloma, General Manager

* Agriculture Finance Company

  Mr. Koposa, Financial Manager

* LINTCO, Kasama

  Mr. Peter Kumwenda, Soyabeans Development Officer

* Mungwi Settlement Scheme Farmers:

  Mr. J.F. Sikazwe, Farm No. Z6
  Mr. C Kabwe, Farm No. Y8
  Mr. P.P. Mwansa, Farm No. A1
  Mr. T. Mwila, Farm No. B2
  Mr. A. Chishiraba

* Pitsawyer Operation, Indigenous Timber, Nkolemfumu area, Kasama

  Mr. J. Chanda

DISTRICT VISITS:

* Luwingu District Council

  Mr. D.H. Simusokwe, Social Secretary
  Mr. J.D. Nsama, Administrative Secretary
  Mr. E. Nsama, District Forestry Officer
  Mr. B. Kosamu, District Agriculture Officer
  Mr. L. Chileshe, District Social Development Officer
  Mr. E.L. Chasowya, Luwingu District Council
  Mr. S.C. Changa, Luwingu District Council

* Chilubi District Council

  Mr. Kalunga, Postmaster
  Mr. P. Nganga, Manager ZCBC
  Mr. Chikwese, O.O.P.
  Mr. F. Walanga, District Registrar
  Mr. Mushibwe, Officer in Charge P.W.D.
  Mr. Mubanga, Social Secretary
  Mr. Lungu, District Health Inspector
  Mr. Chipuku, District Justice Officer
  Mr. Chileshe, District education Officer
  Mr. Nuleka, Zambian Police
  Mr. L. Muchuishi, Ward Chairman (Headman)
  Mr. A. Muchuishi, Administrative Officer
  Mr. Kabaso, District Executive Secretary
  Mr. Fuleki, Financial Secretary
  Mr. Siame, District Governor
  Mr. Derek Manda, District Administrative Officer

* Mpika District Officials

  Mr. A.Z. Sichamba, District Agriculture Officer
  Mr. V. Mulenga, District Forestry Officer
  Mr. K.P. Lungu, District Natural Resources Officer

* Isoka District

  Mr. L.K. Sikwewa, District Agriculture Officer
  Mr. A. Muzyamba, District Forestry Officer
  Mr. D. Mwanza, District Natural Resources Officer
  Mr. Kolyokolyo, Kapumbu Agriculture Camp Officer

Appendix 2

* Kasama East District Officials

Mr. B.W. Sinyangwe, Provincial Natural Resources Officer
Mr. C.A. Mutambo, District Coffee Officer
Mr. R.L. Chewe, District Planning Officer
Mr. K. Mulenga, District Agricultural Officer, Crop Husbandry Officer
Mr. M.S. Hankende, Camp Officer

SEMINAR WITH ZAMBIAN OFFICIALS

Chaired by Francis S. Lubinda, Chief Regional Planner, PPU

Ms. Mary Silavwe Mulenga, Economist, ARPT
Mr. John Andrew Siame, Agronomist, ARPT
Mr. C.J. Mwnthali, Provincial Forest Officer,
Mr. L.G. Nyondo, Agriculture Officer
Mr. Gabriel Kaunda, Land Use Planning Officer
Mr. B.W. Sinyangwe, Provincial Natural Resources Officer
Mr. Mulima Mooto Women's Co-ordinator, PPU
Mr. L. Zimba, Co-op Inspector, PMCO
Mr. C.T. Chanda, Ext. Training Officer, Department of Agriculture
Mr. M.V. Veitch, Senior Monitoring and Evaluation Officer, PPU

THE MAIN SOIL TYPES IN THE NORTHERN PROVINCE

The following outline describes main soil types in the NP, and is based on Veldkamp (1987), Chileshe (1988) and Kalima (1983).

I Soils developed on escarpments, and piedmonts

A Soils developed on acidic rocks

A1 Moderately deep to shallow, well to excessively drained, reddish to brownish medium textured, strongly acid soils. Inherent fertility very low.

B Soils developed on basic rocks

B1 Essentially similar to soils in A, but with a moderate inherent fertility and moderate acidity. Generally, the soils are very erodible. Some of these soils are used for chitemene cultivation, especially in the Isoka district (Zone 3).

II Soils on the gently undulating plateau

C Soils developed on acidic rocks

C1 Very deep, well drained, reddish to brownish, medium to fine textured, strongly and very strongly acidic soils. Mainly loamy topsoil with a distinct clay increase by depth (10-100cm). Weak to massive soil macrostructure. Strong micro-aggregation, often binding clay particles together with the fine sand or silt fraction. Inherent fertility is low. Nutrient holding capacity is low, while nutrient reserves are generally very low. Permeability is high on virgin land under forest cover, but may decrease to very low under mechanized cultivation. The soil may, even on very level slope, be prone to erosion. The soils are mainly used for chitemene cultivation of millet, cassava, beans etc., but are increasingly being taken into permanent cultivation of maize and semi-permanent grass-mound cultivation. These soils are by far the most extensive ones on the arable land in the NP, represented in Zones 1 and 2.

C2 Very deep, well to excessively drained, mainly brownish to yellowish, coarse textured, strongly and very strongly acidic soils. Mainly sandy topsoil, often with a clay increase with depth (10-100cm). Massive structure. Weak micro-aggregation. Inherent fertility is very low as well as nutrient holding capacity. Permeability is rapid. These soils are mainly used for chitemene cultivation. They are most extensive in the Mpika district, on the plateau towards the Bangweulu floodplain.

C3 Very deep, well drained, reddish, fine textured, strongly acid soils. Mainly clay topsoils with no or diffuse clay increase by depth (10-100cm). Weak to moderate structure, often with (very) strong micro-aggregation. Inherent fertility is low. Nutrient holding capacity is moderate, as is permeability.

The soils are used for chitemene and semi-permanent cultivation. They occur in close association with the C1 soils, but are most extensive on the plateau between Kasama and Mbala, and near Mporokoso.

D Soils developed on basic rocks

D1 Deep, well drained, yellowish brown to red, medium and fine textured, moderately acidic soil. Mainly loamy or clayey topsoil, often with a distinct clay increase with depth. Moderate structure and strong micro-aggregation. Inherent fertility is moderate. Nutrient holding capacity is usually moderate to high, while the nutrient reserves are moderate. Permeability is moderate to high, and soil structure is more stable compared to the A1 soils. They are therefore less erodible. These soils are used mainly for semi-permanent (fundikila) cultivation and permanent (mainly maize monocropping) cultivation. They occur in patches in ARPT-Zone 3, from Mbala to Isoka along the Tanzanian border. They are common in the northeastern part (Tendere-Muyombe area), and they also occur in patches near Mpika and close to the Central Province boundary. Their extent is not large, but they are potentially the best arable soils in the NP.

D2 Deep, well to excessively drained, brownish to reddish coarse textured, moderately acidic soils. Mainly sandy or loamy topsoil, rarely with a distinct clay increase by depth (10-100cm). Weak structure. Inherent fertility is low to moderate and nutrient holding capacity is low. Permeability is rapid. The soils occur mainly between the ridges on the Luangwa/Chambeshi watershed, from Mpika to Isoka, and are used both for chitemene and permanent cultivation. They are not very extensive.

E Soils developed on acidic colluvium/alluvium on plateau dambos

E1 Deep, poorly drained, greyish, very strongly acidic soils with varying textures. Inherent fertility is low, while nutrient holding capacity may vary according to texture and depth of the organic topsoil layer. The soils occur in dambos on the plateau and are mainly used for dry season grazing or rice growing. They are also quite extensively used for vegetable growing in the dry season (on residual moisture), especially near towns.

F Soils developed on basic colluvium/alluvium on plateau dambos

F1 These soils are essentially similar to E1, but with moderate acidity and inherent fertility. They occur mainly in association with the more basic plateau soils and are quite extensively used for dry season grazing.

III Soils on floodplains and swamps

G Soils developed on (mainly) acidic alluvium/colluvium

G1 Deep, very poorly drained, seasonally flooded, greyish, strongly acidic soils with varying textures. Inherent fertility is generally low as well as nutrient holding capacity. The soils occur on the Chambeshi and Bangweulu floodplains, and are mainly (if at all) used for dry season grazing and rice growing.

G2 Deep, very poorly drained, constantly flooded or waterlogged soils with varying textures and mainly a thick organic topsoil layer. The soils occur in swamp areas, being most extensive in the Bangweulu swamps.

iv) Luangwa Valley

H Soils developed on basic rocks or basic alluvial terraces

H1 Deep, moderately to well drained, yellowish to brownish, fine textured, slightly acidic to neutral soil. Mainly clayey topsoil with no clay increase by depth. Moderate to strong structure. Inherent fertility is high as well as nutrient holding capacity. Permeability is moderate to low. The soils occur within the Luangwa National Park or associated GMA, and are used for some chitemene.

I Soils developed on basic alluvium

I1 Deep, imperfectly to poorly drained, dark greyish brown, fine textured, neutral to mildly alkaline soils. A cracking clay topsoil having high organic carbon content. Strong structure. High inherent fertility and nutrient holding capacity. These soils are under the same land-use as H1.

v) Distribution of the soils

A few types of soils dominate in the NP. Table 2.X estimates the extent of the various soil types.

Table 2.A.1. Summary of soil types and their extent in the NP (After Chileshe (1988) and Vikan (1983)).

Topography	Associated soil types: Major	Minor	Arable potential	Extent (km^2)	Relative (area %)	Associated ARPT-zones
Escarpments, hills, ridges	A1,B1	C2,D2	Low	20,000	13.5	1, 3, 5
Plateau	C1, C2 D1, D2	E1, C3 C1, C2	Moderate Moderate to high	85,000 4,000	57.8 2.7	1, 2 3
Plateau dambos	E1	F1	Low	10,000	6.7	1, 2, 3
Floodplain	G1	C2	Low	9,000	6.1	4
Swamps	G2	G1	None	3,000	2.0	4
Luangwa Valley	H1, I1		Low	12,000	8.1	5
(Lakes)	-	-	-	(4,600)	(3.1)	(1, 4)

EXERPTS FROM THE NEW ENVIRONMENT ACT FOR ZAMBIA
(to be passed in Parliament during 1989/90).

Membership of the Environment Council:

Representatives from:

Ministry of Lands Natural Resources
Ministry of Agriculture and Water Development
Ministry of Mines
Ministry of Health
Ministry of Power, Transport and Communications
Ministry of Labour, Social Development and Culture
Ministry of General Education, Youth and Sport
Ministry of Higher Education
Ministry of Information
Ministry of Local Administration
NCDP
National Council for Scientific Research
Copperbelt University
Industrial Development Company Ltd.
Zambia Consolidated Copper Mines Ltd.
Commercial Farmers' Bureau
Chamber of Commerce
Zambia Bureau of Standards
NGO nature conservation organization
Two other persons appointed by the Prime Minister

Functions of the Council:

(a) control pollution
(b) promote and encouage the protection of the general and working environment;
(c) ensure proper natural resource utilisation for national development;
(d) satisfy environmental and aesthetic values for better human welfare;

The Council may:

(a) recommend measures aimed at controlling pollution resulting from industrial processes or otherwise;
(b) advise on any aspect of conservation;

(c) advise on the need to conduct and promote research, analysis, surveys, studies, investigations and training of personnel in the field of personnel, in the field of environmental protection and pollution control;

(d) receive and review reports and make recommendations to the Government on environmental matters;

(e) make studies and recommendations on standards relating to the improvement of the environment and the maintenance of a sound ecological system;

(f) co-ordinate the activities of all Ministries and other bodies concerned with environmental matters and serve as a channel of communication between Ministries and between those other bodies and Government;

(g) advise on co-operation between and liaison with, national and international organizations on environmental matters;

(h) advise on the need for and embark upon, general educational programmes for the purpose of creating an enlightened public opinion regarding the environment and an awareness of the individual and collective role of the public in its protection and improvement;

(i) consider and advise, but without prejudice to economic and social advancement, on all major development projects at an initial stage; for that purpose the Council may request information on the major development projects with a view to making recommmendations based on environmental impact assessment;

(j) monitor trends in the use of natural resources relating to the health of the environment and advise the Government on priorities for relevant research, surveys, studies, the training of personnel and conservation activity;

(k) identify, promote and advise on projects which further or which are likely to further conservation for sustainable development and environmental protection and improvement;

(l) hold seminars, symposia, prepare studies and make recommendations on standards relating to environmental and natural resource use and protection;

(m) identify projects, plans and policies for which environmental impact assessments appear desirable, and undertake or request others to undertake such assessments for consideration by the Council;

(n) advise the Government on policies governing the management of natural resources and the environment;

(o) call for information on project proposed, planned or in progress by any person anywhere in Zambia;

(p) call for information on natural resource quantities, qualities and management methods and environmental conditions from anywhere in Zambia;

(q) provide support for environmental conservation, protection and improvement by way of grants or loans, by the provision of accommodation or equipment, by arranging the common use of equipment or helping in any other way the Council considers desirable;

(r) advise the Minister responsible for any aspect of the environment on all environmental protection and pollution control matters relating to the socio-economic development of the country;

(s) publicise all regulations, statutory instruments and rulings made by the Minister responsible for any aspect of the environment under this Act; and

(t) carry out any other activities relating to the protection of the environment and the control of pollution which are necessary or conducive to the better performance of its functions under the Act.

The Council shall establish a Standing Technical Advisory Committee whose members shall be experts in field relevant to the environment, pollution, pesticides and toxic substances, ionising radiation, hazardous wastes and solid waste management.

The functions of the Advisory Committee shall be to advise the Council and any Minister responsible for the protection of some aspect of the environment on:

(a) the formulation and periodic revision of standards and regulations for pollution control relating to water, air, slid wastes, hazardous wastes, pesticides and toxic substances, noise emmission and ionising radiation;
(b) the methods and equipment to be used for the monitoring and control of pollution in the environment.
(c) sound natural resources conservation, including the creation of natural resources preserves for the propagation and maintenance of all indigenous species and their germ plasm;
(d) proper land use practices;
(e) methods and procedures of rehabilitation of derelict land; and
(f) any other matter referred to it by the Council.

The Environment Act also allows for the creation of Inspectorates within ministries responsible for the following areas:

* Water Inspectorate - The Inspectorate will in consultation with the Council establish water pollution standards, including rules for the preservation of fishing districts, aquatic areas and drinking sources; identify and carry out research on the effects of water pollution on the environment, human beings, flora and fauna, initiate and encourage international co-operation in matters of water pollution.

* Air Inspectorate - The Inspectorate in consultation with the Council shall set ambient air quality and emission standards and guidelines, identify and/or sponsor research on the effects of air pollutants on the environment, flora and fauna, initiate and encourage international co-operation in matters of air pollution.

* Solid Waste Inspectorate - the Minister shall give specific or general directions to District Councils with respect to the collection and disposal of solid waste operations under the Local Administration Act, 1980, set standards with respect to solid waste, monitor the contamination and degradation of the environment arising from the operation of any disposal site, provide for members of the public to make representation to the Council on matters affecting the health or aesthetic value of their surroundings.

Appendix 4

Applications for waste disposal shall be subject to prior endorsement by the town and country planning authority before a disposal licence is granted by the Inspectorate.

* Pesticides Inspectorate - the Minister in consultation with the Council shall control the importation, manufacture, storage, distribution, sale, disposal and advertisement of pesticides and toxic substances; provide for the monitoring in the environment of pesticides, toxic substances, hazardous wastes and their residues; collect data from industry on the production, use and health effects of pesticides, toxic substances and hazardous wastes.

* Noise Inspectorate - The Inspectorate shall set standards procedures for noise measurement, set noise level emission standards, establish noise level standards for zones and areas defined under the Town and Country Planning Act including noise abatement zones.

* Ionising Radiation Inspectorate - the Minister in conjunction with the Council shall establish standards for the proper regulation of radioactive contamination; inspect any site containing radioactive material, provide information to the public in cases of actual or potential public exposure to radioactive material or ionising radiation within the environment, call upon any outside authority to offer assistance in carrying out the duties of the Inspectorate.

* Natural Resource Conservation Inspectorate - the Minister in consultation with the Council shall conduct or sponsor research on land use practices and their impact on natural resources, and other such studies as the basis for better conservation and protection of natural resources; establish and review land use guidelines; make regulations for the conservation and protection of natural resources; assess the nature of rehabilitation necessary for derelict land; monitor land contamination; increase public awareness about natural resources conservation; take stock of the nation's natural resources and their utilisation.

SOME ECONOMIC AND ENVIRONMENTAL IMPLICATIONS OF MAINTAINING INPUT SUBSIDIES

i) Fertilizer subsidies in NP

An important rationale behind the introduction of fertilizer subsidies in Zambia has been to encourage agricultural production. In NP the subsidy has helped farmers to overcome perception of risk in adopting a new and costly technological package, and established the province as a major contributor to national self-sufficiency. The fertilizer subsidy has also been important for maintaining a certain profitability in maize cultivation and sustaining a high adoption rate of farmers as regards fertilizer-based agriculture. A total removal of fertilizer subsidy in the 1987/88 season would have meant a 15% drop in gross margins to maize farmers. Subsidies were then 40% of actual cost of fertilizers (ARPT, 1988b).

But the high level of subsidies has financial implications for the government. If the subsidy for fertilizers delivered to NP had been removed in 1987/88 it would have saved the GRZ Kw 23.0 mill (based on 1987/88 prices, i.e. before this year's devaluation) (ARPT, 1988b).

Furthermore, the subsidised fertilizer contributes to less efficient utilization at farm level, since the cost to the farmer of maintaining and restoring fertility is kept artificially low. It has been observed that when supply is ample, farmers apply fertilizer rates in excess of LIMA recommendations (400kg per hectare). Soil productivity is then reduced, both due to increased soil acidity and weed infestation. The latter problem is aggravated by farmers tending to clear maize fields of a larger size than they are able to weed properly (ARPT, 1988b). The subsidisation of fertilizers may also have discouraged traditional ways of maintaining fertility on the NP soils, such as: 1) inclusion of organic manure and composting which lower the exchangeable aluminum level; 2) selection of crops that tolerate high acidity levels (e.g. cassava); 3) crop rotation with legumes with a positive effect on soil fertility (e.g. beans and groundnuts); or 4) intercropping.

On the other hand, major environmental arguments for maintaining a subsidy is that fertilizer-based agriculture seems to discourage chitemene cutting (particularly in areas with degraded miombo wood-land). Two observations may support this: 1) Millet which is traditionally produced on chitemene fields, is increasingly planted on fundikila with application of fertilizers; 2) Maize is to some degree replacing millet as a staple food crop implying that the local production of millet is decreasing.

We therefore hold that sustainable agricultural development in NP depends on maintaining a subsidy on fertilizers on a transitional basis. The effects of phasing out the subsidy completely by 1993, as proposed by GRZ, should be monitored carefully (EFPF, 1989).

Appendix 5

ii) Equity pricing and transport subsidies

From 1973 GRZ introduced a system of equity pricing (as opposed to efficiency pricing) for maize and most other important crops. The intention was to eliminate regional differences in producer prices, and to promote inter-regional equity (Kydd, 1986 and 1988a).

A system of equity pricing implies a direct transport subsidy to the co-operative unions, and cross-subsidies of better located producers in other provinces. In the context of NP these subsidies will be particularly large since: 1) farmers are scattered and often reside in very remote areas; 2) there are few large producers, 3) NCU practises a policy of collecting the crops (maize) at farm gate, and, 4) maize, the main crop collected, is a low-value-to-bulk crop.

The system of equity pricing has been important for encouraging market production among the farmers of NP. But the financial costs to the government of maintaining the system are large. If measures are taken to introduce regionally differentiated producer prices, parallell efforts would be needed to: 1) provide credit to farmers for transport equipment (hand-drawn, bicycle- or ox-drawn carts), and 2) encourage private traders in agricultural marketing. Only such efforts could compensate for a reduced official marketing service.

iii) Consumer subsidies

The motivation for subsidising maize meal has been to secure supply to the whole population - including low income groups.

Maize subsidies accounted for 12% and 14% of total government expenditure in 1987 and 1988 respectively (Mwaanza et. al 1989). In order to ease the burden on government budgets, the general subsidy was removed in 1989, while a targeted subsidy was introduced to provide urban dwellers with an income less than Kw 20 000 per year with subsidised mealie meal through a coupon system. Rural households, on the other hand, are expected to produce their own maize.

MARKETING CONSTRAINTS ON MAIZE PRODUCTION

There are large deficiencies in the marketing and supply services of the maize programme:

* If NCU is to cope with the marketing at present level of production some three 20 tons trucks may be required for each district (Mwanza et al 1989), alternatively tariffs, to private transporters must be increased.

* The provincial forecast of input requirements is produced too late to be used by national authorities when ordering inputs. The forecasts done by the Provincial Statistics Office and the Department of Agriculture are not available for NCU to be able to estimate input requirements.

* Provincial fertilizer supplies are generally insufficient to meet needs, arrive too late at the Provincial depots and are again delayed before being delivered to the farmers. Furthermore, inequalities arise in distribution to individual Districts. A sample of farmers interviewed across the province in 1987/88 had received only 70% of fertilizer quantities ordered on credit. Fertilizers tend to arrive late. ARPT in one survey found that one third of the farmers had not received basal dressing by recommended planting date in 87/88 season, while more than 80% received top dressing after the beginning of January.

* Lime is hardly obtainable with NCU in the province. This is partly due to lime not being available in amounts adequate to meet national demands, partly due to the high transport cost from lime deposits (Lusaka/Ndola) to the province. From 1988/89 season to 1989/90 the lime price per 50kg bag in N.P. was increased from K42 to K170. Based on present rates (K2.60 per km on trips above 200km) and distance a truckload of lime (30 tons) would cost: K 2.60x852x30= K 66,456 to transport from Lusaka to Kasama. This implies K110 per 50 kg bag , which is 65% of the local price.

* The supply of hybrid-maize seeds faces similar problems as for fertilizers. In 1987/88 supplies of both longer and shorter maturing varieties fell short of targets by a wide margin. Only 61% of targets for longer maturing varieties (MM 751/612) and 70% of the targets for short maturing varieties (MM 603/604) were met (ARPT/PPU 1988). In the same season more than half the farmers in a survey received their seeds one month after the recommended planting date - mid November (ARPT, 1988b). Agronomic trials show that yields drop by 30% if planting is delayed by a six weeks. Seed supply has, however, improved over the last couple of years.

Appendix 6

* Bags for the maize also arrive late. This year the late delivery of bags seriously delayed bagging, and as such delayed the collection of maize bags.

* Late payment to farmers for their harvest compounds problems of late input delivery. ARPT found that payment from sale of previous year's crop is crucial for financing new inputs. Through an analysis of cash flows in farm households, ARPT estimated that farmers in Mpika and Kasama West re-invested 40% of previous season's crop income, on average, while in Mbala as much as 80% was re-invested (ARPT, 1988b). The degree to which payment is given late varies from one year to the next; this year was particularly bad. Farmers need payment by the beginning of November to be able to buy inputs or pay for labour to prepare their fields. By beginning of November 1988/89 season only 57% of all maize purchased by NCU had been paid for.

* Delayed payment by NCU to farmers for the previous season's harvest increase the farmers dependency on credit. Credit is crucial both for entering agricultural commercialization, for maintaining a certain level of marketed maize production, and for expanding agricultural production (eg. through purchasing of oxen and equipment). A sample of farmers surveyed in 1986/87 suggests that 80% of farmers growing hybrid maize had applied for credit at some time, while 54% actually received credit that year (ARPT/PPU, 1989). Credit is not available in amounts sufficient to meet total demands, or provincial targets. Credit is granted only to maize and other cash crops such as soybeans and sunflower. Credit will not be granted to beans, groundnuts, millet, cassava, while credit to fertilizers for these crops would, in the case of the two former, stimulate better crop husbandry (rotation with legumes), and for the two latter discourage chitemene, since these crops could then be grown on permanent fields. Credit is distributed unevenly between social groups, villages and areas. ARPT found significant differences in credit levels between Mpika, Mbala and Kasama West. While credit was used to finance the major portion of inputs for all categories of farmers in Mpika and for cash richer farm categories in Mbala, very little credit was used in Kasama West. Moreover, the size of the loans issued in Mbala was much larger than in other areas. Furthermore, cash-poorer households received no credit in Mbala. These households financed, in general, a higher proportion of farmers inputs from own cash sources. This was also found in a credit study by Biseth (1987).

Overall, priority in granting credit is given to resource-richer households, who would have been able to finance a larger portion of their inputs through sale of crops. Previous clients have priority and get loan every year (Biseth, 1987). This allows fewer farmers a possibility of moving away from chitemene to more permanent farming.

Female farmers are less likely to get credit than men. In the period 1970-1985 only 8.6% of all loans in NP were given to female farmers. This situation has improved, however, and AFC now reports 30% of the loans given to women (AFC Manager, Pers. Comm. 1989).

* The dispersed location of farmers in NP makes the access to depots and collection points crucial for farmers' involvement in the maize programme or any programme for agricultural development. Sano (1989) found that the increase in number of depots significantly contributed to the first boom in maize marketing. In Isoka, Mbala and Kasama Districts the numbers increased by 71%, 56% and 37% respectively. Distance to depots often decides the level of involvement in maize marketing from one village to another. This is particularly so since the farmers normally have no other means of transport than to carry bags on their head. Only very few possess a bicycle, and even fewer ox-carts, of which only a few hundred, maybe less, are found in the province. From 1986-1988 NCU distributed only 38 ox-carts and 224 wheel-barrows (Mwanza et. al 1989). With the abolition of harvest collection at farm gate (NCU policy announced every year over the last few years, but not followed), carts for farmers must be made available on credit.

* Infrastructure development (feeder roads, bridges) and maintenance are crucial for sustaining any agricultural development in NP. The planning of new roads is not based on a proper development plan for the resources in the Province, while road construction is crucial for settlement and development of new land and introduction of more permanent farming.

* The storage capacity for the maize harvest is a problem at farm, depot, district and provincial levels. Total storage capacity in NP is about 700 000 x 90kg bags. Kasama has 42% of this capacity. In 1988 only about 55% of the maize purchase could have been provided safe storage in the province. The rest would need to be transported to other provinces (Mwali et al, 1989). Safe storage at farm level is another major problem. Since NCU takes economic responsibility for the harvest once it has been placed by the road side, few farmers bother to make attempts to protect the crops from rains or pests. Post harvest losses of maize for sale are therefore great.

* The milling capacity in NP is another problem that needs to be addressed if present level of maize production shall be maintained. Total capacity in NP today is about 350 000 x 90kg, while local demand for mealie meal at the beginning of 1988 was about 830 000 x 90kg (Mwanza et al, 1989). The provincial demand may, however, have dropped markedly with the price increase this year on mealie meal. Based on 1988 figures Mwanza (et al, 1989) estimated the total cost of transporting maize produce from Kasama to Copperbelt for milling and back, subsequently sold as mealie meal, to be Kw 18 mill.

EXAMPLES OF ENVIRONMENTAL CHECKLISTS

Major resource use decisions are made by GRZ bodies at the national, provincial and district level with respect to the type, siting, scale and phasing of projects such as roads, agriculture and irrigation schemes, and settlement planning. These decisions can have a major effect on the resource base of the NP. These decisions are made in day to day administration and in the course of annual GRZ development plans. They are often made by departments or bodies with little background in environmental planning or natural resources management. While it would be ideal for key development planning agencies and bodies within GRZ to have thorough training in these areas, it is probably not a realistic goal in the near future. Rather we would suggest that there are a number of environmental managements tools that can assist in the formative stages of development planning to identify areas requiring further detailed environmental assessment and planning.

Environmental checklists and matrices are tools that can be used by project planners, economists, development workers, village councillors, NGOs and others involved in resource use decision making. These are obviously no substitute for sound resource management training and EIAs, however checklists do ensure that a prescribed set of impacts are at least considered in decision making processes, thus serving the important function of alerting both village and project planners to potential problems areas. This can often prompt requests for more thorough and specialized assistance at an early stage when design plans can be changed or modified.

Checklists and matrices can be developed for use at a technical level (such as NCDP, development agencies, senior trained staff) as well as for use at the district and provincial level. Simplified checklists may be designed (or obtained from international agencies or bilateral donors) to serve village and NGO staff in the project planning process.

With some modifications to Zambia the following type of technical checklists and matrices would be suitable for use by agencies, project planners and technical staff. The categories in the lists and matrices can be adapted to any specific type of development.

Typical Project Checklist by Impact Area

POTENTIAL IMPACT AREA	CONSTRUCTION PHASE			OPERATING PHASE		
	Adverse effect	No effect	Beneficial effect	Adverse effect	No effect	Beneficial effect
A. LAND TRANSFORMATION AND CONSTRUCTION						
a. Compaction and settling						
b. Erosion						
c. Ground cover						
d. Deposition (sedimentation, precipitation)						
e. Stability (slides)						
f. Stress-strain (earthquake)						
g. Floods						
h. Waste control						
i. Drilling and blasting						
j. Operational failure						
B. LAND USE						
a. Open space						
~~b. Recreational~~						
c. Agricultural						
d. Residential						
e. Commercial						
f. Industrial						
C. WATER RESOURCES						
a. Quality						
b. Irrigation						
c. Drainage						
d. Ground water						
D. AIR QUALITY						
a. Oxides (sulfur, carbon, nitrogen)						
b. Particulate matter						
c. Chemicals						
d. Odors						
e. Gases						
E. SERVICE SYSTEM						
a. Schools						
b. Police						
~~c. Fire protection~~						
d. Water and power systems						
e. Sewerage systems						
f. Refuse disposal						
F. BIOLOGICAL CONDITIONS						
a. Wildlife						
b. Trees, shrubs						
c. Grass						
G. TRANSPORTATION SYSTEMS						
a. Automobile						
b. Trucking						
c. Safety						
d. Movement						
H. NOISE AND VIBRATION						
a. On-site						
b. Off-site						
I. AESTHETICS						
a. Scenery						
b. Structures						
J. COMMUNITY STRUCTURE						
a. Relocation						
b. Mobility						
c. Services						
~~d. Recreation~~						
e. Employment						
f. Housing quality						
K. OTHER (List as appropriate)						

Examples of an Environmental Factors/Project Action Matrix

Environmental Factors	Project actions: Noise	Release of smoke	Runoff	Removal of vegetation	Grading the site	Construction phase	Operation phase	Possible impacts
Physical:								
Air	X					X	X	Noise pollution
Water			X					Water pollution
Soil				X				Erosion
Landform			X					Contour, alteration
Biological:								
Vegetation				X				Loss of native vegetation
Key Plants				X				Loss of key plants
Rare or endangered plants								None present
Animals				X	X			Loss of habitat
Key animals				X	X			Loss of key animals
Rare or endangered animals								None present

Illustrative Ad Hoc Approach to Environmental Impact Versus Environmental Area

Environmental Area \ Environmental Impact	No Effect	Positive Effect	Negative Effect	Beneficial	Adverse	Problematic	Short-term	Long-term	Reversible	Irreversible
Wildlife			X			X	X			
Endangered Species	X									
Natural Vegetation			X			X			X	
Exotic Vegetation	X									
Grading			X			X		X		X
Soil Characteristics	X									
Natural Drainage	X									
Groundwater		X		X						
Noise			X				X			
Surface Paving						X				
Recreation	X									
Air Quality			X		X			X		X
Visual Disruption	X									
Open Space			X		X			X		X
Health and Safety	X									
Economic Values		X		X				X		
Public Facilities (includes schools)						X	X	X		
Public Services	X									
Conformity to Regional Plans		X		X				X		