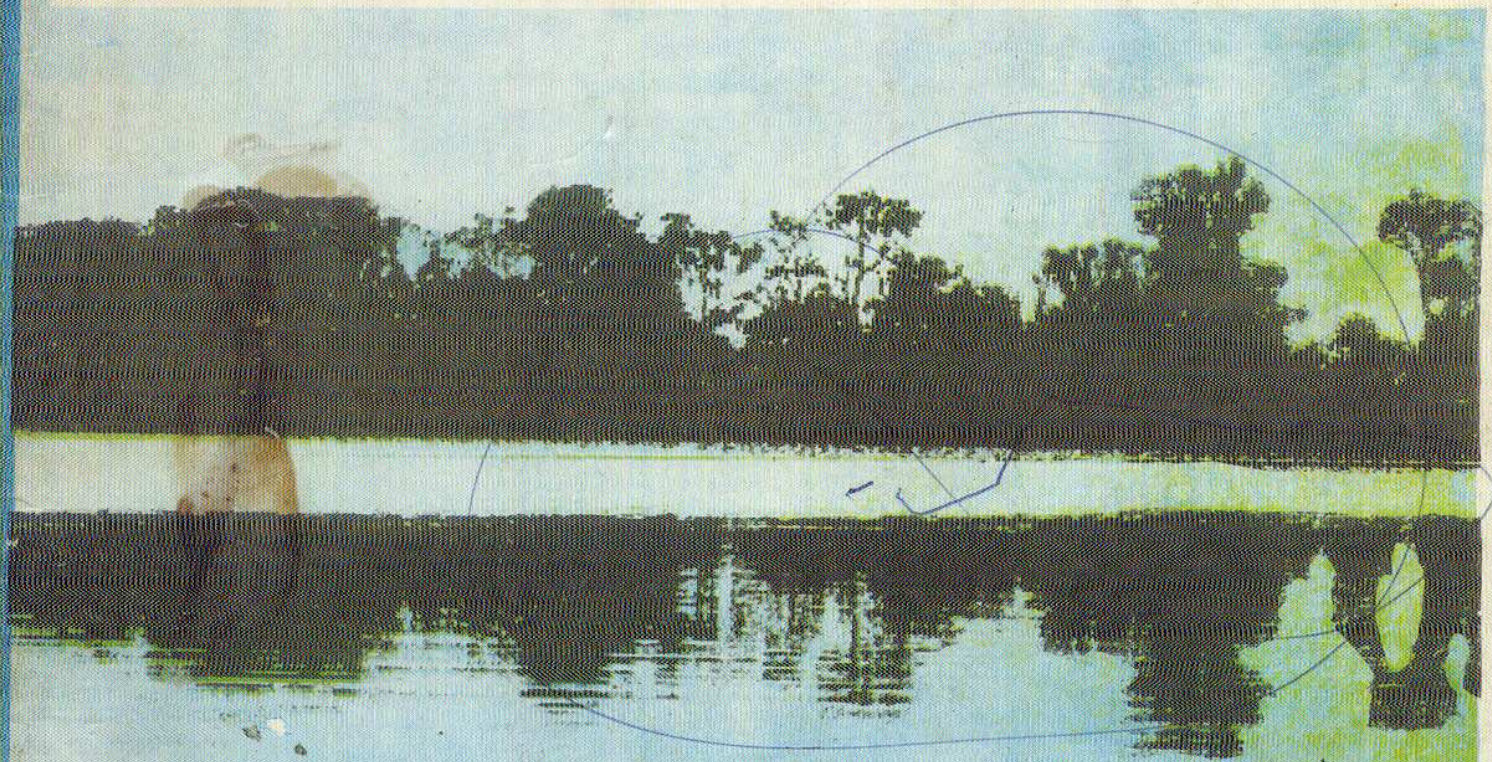
REPUBLIC OF ZAMBIA

MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES

THE NATIONAL ENVIRONMENTAL ACTION PLAN



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DEFINITIONS

ON-GOING	Implementation in progress
IMMEDIATE	Implementation to start as soon as conditions permit
SHORT TERM	Implementation to be completed in 1 - 2 years
MEDIUM TERM	Implementation to be completed in 3 - 5 years
LONG TERM	Implementation to be completed in over 5 years

ACRONYMS

BPM	Best Practicable Means
CBO	Community Based Organisations
CSO	Central Statistical Office
DOE	Department of Energy
DOF	Department of Fisheries
DOR	Department of Resettlement
ECZ	Environmental Council of Zambia
EIA	Environmental Impact Assessment
EPPCA	Environmental Protection and Pollution Control Act
FAO	Food and Agriculture Organization
FD	Forest Department
GRZ	Government of Zambia
IUCN	International Union for Conservation & Nature
JICA	Japanese International Cooperation Agency
LA	Local Authorities
MAFF	Ministry of Agriculture, Food and Fisheries
MCDSS	Ministry of Community Development and Social Services
MCI	Ministry of Commerce, Trade & Industry
MEC	Ministry of Education
MENR	Ministry of Environment and Natural Resources
MEWD	Ministry of Energy & Water Development
MLA	Ministry of Legal Affairs
MLGH	Ministry of Local Government and Housing
MMMD	Ministry of Mines & Mineral Development
MOF	Ministry of Finance
MOL	Ministry of Lands
MOT	Ministry of Tourism
MTC	Ministry Transport & Communication
MOH	Ministry of Health
MST	Ministry of Science and Technology
NCS	National Conservation Strategy
NCSR	National Council for Scientific Research
NCZ	Nitrogen Chemicals of Zambia
NEAP	National Environmental Action Plan
NGO	Non Governmental Organization
NORAD	Norwegian Agency for Development
NSCU	National Soil Conservation Unit, MAFF

PFP	Policy Framework Paper
PHC	Primary Health Care
PPAZ	Planned Parenthood Association of Zambia
PTC	Planning and Technical Committee
SIDO	Small Scale Development Organization
TCPD	Town and Country Planning Department
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
WAD	Water Affairs Department
ZCCM	Zambia Consolidated Copper Mines
ZEEP	Zambia Environmental Education Program
ZESCO	Zambia Electricity Supply Corporation Limited
ZFAP	Zambia Forestry Action Plan
ZNFU	Zambia National Farmers Union

EXECUTIVE SUMMARY

The National Conservation Strategy, adopted by the Government of Zambia in 1985, has been the main policy document on the environment. It led to the establishment of environmental legislation and institutions. The NCS was developed to manage natural resources and the environment in the context of a centrally planned and controlled economy. A decision was made by Government to update the NCS through the National Environmental Action Plan process in 1992 because:

1. The economy was undergoing a period of liberalisation.

2. The main NCS recommendations had been implemented.

3. The technical information in the NCS needed updating.

4. There was a requirement by World Bank for a NEAP as a prerequisite for International Development Association (IDA) loan funding.

The NEAP is founded on three fundamental principles:

1. The right of citizens to a clean and healthy environment.

2. Local community and private sector participation in natural resources management.

3. Obligatory Environmental Impact Assessments (EIAs) of major development projects in all sectors.

Institutional arrangements and legal reforms are recognized as being key towards successful implementation of the recommendations made. The NEAP identifies the Ministry of Environment and Natural Resources as being responsible for co-ordination and monitoring of the implementation of the NEAP. Designation of Environment Officers in line Ministries and Local Authorities is recommended so as to ensure that environmental issues are considered during project planning and implementation. Several legal proposals are made amongst which are the harmonizing of the fragmented pieces of legislation and the inclusion of the right to a clean and healthy environment in the Republican Constitution. Capacity building through training and environmental education and awareness is recommended.

The overall objective of the NEAP is to integrate environmental concerns into the social and economic development planning process of the country. The market economy, therefore offers new opportunities and challenges for economic development and environmental management. EIAs should be integrated at all levels of the development process. Government should have an increased role in regulation, monitoring and enforcement of appropriate resource use practices. Use of economic instruments, where possible, such as incentives should be considered and used for proper environmental management. Government should also facilitate the evolution of a new property rights regime while ensuring equitable distribution of resources during the transition from one property rights system to another. A preliminary attempt is made in the NEAP to identify major issues with the greatest social costs. Further elaboration of environmental costing is necessary to guide decision making concerning investment priorities in the environmental sector. The NEAP recommends comprehensive studies for this as there is a general lack of reliable data.

The main thrust of the NEAP is to identify environmental problems and issues, analyse their causes and recommend actions required to resolve those issues. In the NEAP, this is done for the major sectors. Some recommendations, inevitably, cut across several sectors. Form the recommended actions, an Implementation Strategy is drawn for each sector and it proposes the Action, a Priority Ranking, a Time Frame for its implementation and finally the Responsible Agency for the implementation of the recommendation. These proposed actions will therefore form a bias for a detailed action plan which will support the implementation of the NEAP through the Environmental Investment Programme (EIP).

1: THE NATIONAL ENVIRONMENTAL ACTION PLAN (NEAP)

1.1: Why the NEAP?

Zambia is endowed with a rich natural resources base and an environment that is relatively unspoiled. However, rapid demographic changes, caused by a population growth rate of 3.5 percent, urbanization, industrialization, increasing agricultural demands and a general economic decline, pose a threat to sustainable use of the natural resources which, in turn, threatens economic, social, and environmental sustainability over the long run.

The government recognises the need to promote and maintain the welfare of the people by adopting sustainable policies. These must aim to maintain ecosystems, essential ecological processes and the biological diversity of the country. Natural resource use must be sustainable, for the benefit of both the present and future populations.

An implementation program to achieve these goals requires appropriate policies, incentives, guidelines and public awareness at local, provincial and national levels. Government accepted the need to review the existing economic framework and policy measures, and identify the relationship between the environment and the economy. This review was carried out through the preparation of the National Environmental Action Plan (NEAP).

1.2: The NEAP Process

The NEAP process was managed by the Ministry of Environment and Natural Resources (MENR). The MENR established a Planning and Technical Committee (PTC) with a membership of 28, to ensure a wide participation of people and organisations in the environmental sector in the development of NEAP. MENR appointed a full time National Coordinator, who was guided by the PTC.

The PTC established a number of Task Forces to coordinate the preparation of key sector-based papers by Zambian experts. The PTC held a workshop in December 1993 to prepare for provincial NEAP workshops. The regional workshops proceedings and sectoral papers were used as background documents for preparing the draft NEAP by a Core Group appointed by the PTC and approved by the MENR.

The PTC held nine meetings from October 1993 to May 1994 to plan, review documents and progress of the NEAP process before presenting the draft NEAP at a national workshop for discussion by a wider public. After incorporating comments from this workshop, the final draft was presented on 24 June 1994.

At each stage of the NEAP development, wide participation and consultation was sought.

1.3: The NEAP

The NEAP provides an overview of Zambia's environmental problems, existing legislation and institutions, and strategy options for improving environmental quality. The plan is based on a review of relevant studies and reports, local knowledge at Provincial level, and a process of consultation and discussion involving central and provincial governments, private sector, academic institutions, civic representatives, NGOs and international organisations and the donor community.

The NEAP provides updated environmental policies and actions. It forms the basis for the future development of detailed Environmental Investment Plan (EIP), which will support the implementation of the NEAP recommendations. The successful implementation of the NEAP therefore depends on the mobilisation of adequate local and donor financial resources for the EIP.

2: ZAMBIA

2.1: The Biophysical Environment

Zambia is a landlocked country in southern Africa, and covers about 752,600 sq.km located between latitudes 8 and 18 degrees south and longitudes 22 and 33 degrees east. Its neighbours are Tanzania, Malawi, Mozambique, Zimbabwe, Angola, Botswana, Zaire and Namibia (Figure 2.1).

A large part of Zambia is on the central African plateau between 1000 and 1600 m above sea level. The plateau is incised by large rivers (Figure 2.1) and the alluvial plains of the Kafue, Zambezi and Chambeshi form expansive wetlands.

Although Zambia is tropical, temperatures are modified by altitude. There are three seasons: the cool dry (April-August), hot dry (August-November) and hot wet (November-April). Average temperatures range from a mean monthly minimum of about 10 degrees C in June and July to a mean monthly maximum of 30 degrees C in October and November. Most of the rainfall is concentrated over the period November-March. However, rainfall varies from 700 mm in the south to 1500 mm in the north.

The natural vegetation is savanna woodland dominated by miombo woodlands which cover about 50% of the country. Mopane and munga woodlands cover much of the hot and dry southern valleys of the Zambezi and Luangwa. The country has abundant wildlife.

2.2: Human Population

The Zambian population is characterized by a high growth rate and high urbanization. The 1969, 1980, and 1990 national censuses reported total populations of 4.0 million, 5.7 million, and 7.8 million, respectively (Central Statistical Office 1990). This implies population growth rates of 3.1 per annum between 1969 and 1980, and 3.2 percent per annum between 1980 and 1990, amongst the highest in Africa.

Urbanization has been very rapid since independence in 1964, when about 20 percent of the people lived in urban areas. The proportion of the population living in urban areas has increased steadily from 29 percent in 1969 to 42 percent in 1990, making Zambia the most urbanized African country south of the Sahara.

High population concentrations in urban centres have put increased pressure on meagre urban resources. Most urban municipalities have fail to provide services such as clean water, adequate sanitation and waste disposal. Migration into urban centres has led to the sprouting of unplanned settlement areas (shanty towns and compounds). Inadequate sanitation and the lack of a clean water supply pose great health dangers. Outbreaks of diseases formerly rare in Zambia (such as cholera) have now become endemic problems.

2.3: The Economy

Copper mining has been the backbone of Zambia's economy since independence. Although copper prices dropped in the mid-1970s and have remained relatively low, the copper industry still provides about half of the Government revenue and 85 percent of the country's export earnings.

Zambia's industrial sector is small but fairly diversified with food, beverages and tobacco forming the largest sub sector in terms of employment, investments and output. Other important industries are textiles, saw milling, cement products and pharmaceuticals. Recently metals, paper products and chemical industries have been established.

Although agriculture accounts for only 13 percent of Gross Domestic Product, it provides livelihood for about half of Zambia's population. Small-scale farm families, cultivating land with oxen or hand hoes make up over 90 percent of the farming population.

A further 7-9% are classified as medium scale farmers, with only 1-3% in the large-scale farming sector. The main crops are maize, sorghum and cassava. Other cash crops are irrigated wheat, cotton, oilseeds, coffee, tobacco, and horticultural crops.

Zambia's economic performance deteriorated during the 1980s, as reflected by negative economic growth rates and a breakdown in social services delivery systems. Social indicators show increased hardships that parallel the general decline in the economy. By late 1991, approximately 40 percent of all young children suffered from chronic malnutrition and households spent an average of 70 percent of their income on food. Zambia is one of the few countries not at war that has seen an increase in infant mortality rates: from about 95 per thousand in 1980 to about 106 in 1991. In response to the declining economic situation, the new government has continued to implement an ambitious economic reform program based on a 1990 Policy Framework Paper (PFP). The reform programme is planned with the World Bank and the International Monetary Fund as the first step towards achieving macroeconomic stability, through controlling inflation and adopting economic adjustment policies. In the midst of such reforms, harmonising necessary economic measures with development processes requiring expenditure(including environmental concerns) can pose problems. Environmental strategies must complement macroeconomic measures, aiming to provide the right incentive structure for sustainable economic growth and development. Indeed, one of the main reasons for developing a NEAP is to propose changes, where needed, that would make environmental strategies compatible with the economic programme.

2.4: Property Rights

Property rights in Zambia are a blend of the traditional systems of the area, the British colonial system, and post independence Government policies. Since the beginning of the British colonial rule, the trend has been firmly towards central government control of natural resources.

Mineral rights were separated from other property rights early in the Colonial period. Mining rights in the copper mining areas were initially acquired by the British South Africa Company and later transferred to the Government of Zambia.

Property rights for water, air, fish, wildlife, and forests are all closely tied to systems of land tenure. They all became increasingly under central government control during colonial rule, and even more so following independence with the nationalization of most large companies controlling natural resources and the expropriation of most freehold land. In some cases traditional systems were not as effective as central control in preserving natural resources (eg in the wildlife sector), and this trend has been beneficial. However, in many cases, the transfer of property rights from local resource users to the central government, combined with a subsequent lack of law enforcement, has resulted in *de facto* open access, overuse and misuse of these resources.

2.4.1 Land

During the colonial period, the government assigned land into three categories: Crown Land, Trust Land, and Reserve Land. Crown Land was identified in large blocks mainly along the rail line between Livingstone and the predominate on former Reserve and Trust Lands. Although other distinctions previously existed, the only difference today between Trust and Reserve Land is that use of Reserve Lands is restricted to members of a specific tribe, while Trust land is not.

up to 99 years.

Traditional land, which covers about 96.5 percent of the land, is administered by traditional chiefs and their village headmen who control land allocation. Generally, once an individual has been allocated a parcel of land, ownership is perpetuated through cultivation (including fallow periods) and may be inherited upon the death of the owner. Land and its forest and wildlife resources in uncultivated areas are communally utilized. Resources in cultivated areas may temporarily be communally utilized between periods of cultivation, especially through grazing. These tenurial arrangements have been an obstacle to investment in fixed land resources, including land conservation structures or tree planting activities. However, it is now becoming possible to obtain leasehold titles to land in traditional areas.

Disputes in all areas are ultimately subject to the authority of a magistrate, but rarely get this far in traditional areas. A headman's area of control is generally understood in the local community. The village may occasionally walk the boundary to affirm its exact area. Disputes between headmen will be adjudicated by chiefs, although the exact formula varies between tribes. Circumventing tradition by appeal to the magistrate is legal but not effective since local authority is stronger in traditional areas. The magistrates, however, are handling an increasing number of cases involving boundaries between chieftainships.

The government has set aside about 7.9 percent and 8.6 percent of the country respectively as National Parks and Forest Reserves. The utilization of these is controlled through the Departments of National Parks and Wildlife Services and of Forestry.

2.4.2 Water

Use of water is regulated through the Water Act (Cap 312). The Act distinguishes between public and private water. Private water would not naturally flow off the holding of the user (eg a swamp, spring or well contained on a single parcel of land), and is generally not controlled by the government. However, shared or 'public' water is controlled. Diverting a flow requires a permit, and although this is commonly ignored by individuals, industrial users usually conform. Water rights are granted following investigation, advertisement and (where necessary), permission from the Chief. They are often conditional on use of erosion controls, maintenance of water structure, and other conditions. Partial rights are also assigned for abutment (to anchor a dam on the border of another's land), storage (by way of flooding), and passage (to move water across another's land).

2.4.3 Trees and Wildlife

Wild mammals were state property until 1982 which allowed private ownership and ranching of game animals. Hunting regulations vary by location, and the cost of licenses is higher for commercial or tourist hunters, and lower for residents of the game management area. Fishing licenses are required for commercial fishing only. All uses of trees is limited in forest reserves to permit holders, although in practice enforcement is limited only to commercial exploitation.

3: INSTITUTIONS AND ENVIRONMENTAL LEGISLATION

3.1: Recommended Actions

Twenty-three Ministries have a bearing on the environment and there are twenty eight different relevant pieces of legislation. The lack of co-ordination between Ministries which are in any case weak means that in practice the laws are generally not implemented. This is a major problem which the NEAP must address. The following are therefore recommended.

(i) The MENR must formulate environmental policies, and co-ordinate and monitor the implementation of the NEAP by other Ministries. A Planning Unit should be established to assist in monitoring the NEAP.

(ii) Environmental Impact Assessments (EIAs) must be demanded from investors and developers, and evaluated independently. The Environmental Council of Zambia (ECZ) should perform this task, as provided for in the Environmental Protection and Pollution Control Act (EPPCA) of 1990. However, further capacity building will be required for the ECZ to perform this role effectively.

(iii) The ECZ should designate environmental officers in line ministries and local authorities to ensure that environmental issues are considered during project development and implementation.

(iv) The lack of land use planning to coordinate land use and resolve conflicts causes environmental problems. An authority must be established either in the Ministry of Lands or in the Town and Country Department.

(v) Environmental awareness is crucial for the successful implementation of NEAP. The Ministry of Education integrates environmental education in schools, but there is no mechanism to promote awareness in business or the informal sector. A national coordinating body, comprising all major stakeholders, should be established in the education unit of the ECZ, to promote appropriate education in these sectors. NGOs and CBOs can play a prominent role, and where necessary capacity building programmes can be introduced.

(vi) The EPPCA is the principal environmental law, which establishes environmental quality standards for water and air, municipal, hazardous and industrial wastes, pesticides and toxic substances, noise and ionizing radiation. Since other environmental laws are fragmented, sector biased and sometimes contradictory, and should be reviewed and subsequently harmonized with the EPPCA.

(vii) The right to a clean and healthy environment should be included in the constitution. This may increase the involvement of the public in environmental management.

(viii) Traditional land tenure systems lower the value of land, distort the rural and agricultural economy, and provide little incentive for sound environmental practices. The power of Chiefs over traditional land should therefore be rationalised. The existing system of converting traditional land to leasehold only with the permission of the Chief and the District Council should be maintained for the time being in the interests of a smooth transition. In the long term, Chiefs can play an important role in providing leadership for community based natural resource management. The MENR should establish a framework to promote the role of traditional institutions in environment management.

3.1.1 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Establish a planning unit at MENR	1	Immediate	MENR
Enforce EIAs	1	Medium to long term	ECZ
Designate environmental officers in Ministries, Provincial Planning Units & LAs	2	Long term	ECZ
Merge Regional Planning (NCDP) & Regional Planning Authorities in TCPD to establish Land Use Planning Authority	2	Short term	NCDP, MENR, MLGH
Create Environmental Co-ordinating Committee under ECZ	3	Immediate	ECZ
Review of Acts on environment & harmonization with EPPCA	1	Short term	MENR, ECZ
Incorporate the right to a clean environment in the Republican Constitution	1	Immediate	
Review & reform of traditional land tenure systems	2	Long term	MENR, MLA, MLGH, MOL, MAFF, NGOs

3.2: Review of Institutions and Legal Reforms

3.2.1 Ministry of Agriculture, Food and Fisheries

The MAFF has four departments: Agriculture (comprising Research, Extension, Irrigation and Land Husbandry branches); the National Agricultural Information Service (responsible for broadcasting through radio and television agricultural and extension message); Fisheries; and Veterinary and Tsetse Control. There are a number of parastatal organisations under the Ministry.

The legal basis of agricultural management is established by *Agricultural Lands Act of 1960, Cap 296.* This act is weak in some areas and should be revised as follows:

(i) The Act should be harmonised with the *Town and Country Planning Act Cap 475* and the *Land (Conversion of Titles) Act 289*;

(ii) Natural resource management and conservation should be included and sections 13 and 17 should be reconciled to promote land use management.

The *Agriculture (Fertilisers and Feed) Act, Cap 351* of 1990 regulates and controls the manufacture, processing and importation and sale of agricultural fertilisers and feed, and establishes minimum standards and purity. It is prohibited under this act to sell farm requisites without prescribed statement of analysis. However, the liberalisation of the market may make it increasingly difficult to regulate trade in such inputs. Harmonisation with Trade Licensing legislation could help to ease enforcement.

The Department of Fisheries is divided into four Units and a Training Branch. The Management Unit licenses fishermen, enforces fishing regulations, and collects data. The unit also implements fishery development projects. The Fisheries Research Unit conducts research in lakes and rivers, including estimating potential catches, whilst the Aquaculture Research Unit develops techniques of culturing fish, including appropriate methods for introducing and maintaining exotic species. The Aquacultural Extension and Development Unit transfers knowledge from research to fish farmers, and coordinates aquacultural development projects. The Training Branch is largely an extension of the Extension and Development Units.

The Surveyor of Vessels in the Ministry of Transport and Communication determines the suitability of large commercial fishing vessels. Boats used by artisanal fishermen (who contribute a large percentage of the national catch) are not subject to regulation.

The *Fisheries Act (Cap 314)* of 1974 provides for commercial fishing and the registration of fishermen and their boats. To increase its effectiveness, some institutional and legal aspects should be reviewed. These include:

(i) The Act regulates commercial fishing only. Non-commercial fishing areas are not regulated although they clearly affect fisheries management. A provision for this should be included in the Act.

(ii) The Act does not cover private fish farming. Provision for this should be made, and appropriate regulations established.

(iii) Penalty for illegal fishing should include forfeiture of fishing vessel, as a deterrent to potential offenders.

The Department of Veterinary and Tsetse Control is responsible for livestock disease control, research and tsetse fly control. The Department also regulates internal and transborder movements of livestock under the Stock Diseases Act CAP 387.

3.2.2 Ministry of Environment and Natural Resources

The MENR is responsible for pollution control and natural resource conservation. Environmental quality control is facilitated by the Environmental Council of Zambia, and natural resource conservation falls under the Departments of Natural Resources and Forestry. In addition, Zambia Forestry and Forest Products Industries Company Limited (ZAFICO) is a parastatal which maintains most large plantations in the country and processes timber on commercial basis. ZAFICO is on tranche 5 of the privatisation schedule, and therefore will remain a parastatal for some time to come (the 134th company in the planned sequence of divestiture). The Environmental Council of Zambia (ECZ) falls under the MENR and is responsible for the enforcement of the *Environmental Protection and Pollution Control Act* (EPPCA). Under the *Town and Country Planning Act Cap 475*, the ECZ considers and recommends applications to subdivide agricultural land to the Planning Authority.

The Forest Department is organized into five divisions and the headquarters is responsible for the control of expenditures and revenue, price setting, licenses, concessions, training, public relations, and personnel. Forest

Management Division is responsible for reservation of new forest area, forest inventory and mapping, plantation sites, and management working plans. Research is split between the Forest Research Division, which researches basic silviculture, mensuration, tree improvement, and forest protection, and the Forest Products Research Division, which researches timber utilization, saw milling, seasoning, preservation, conversion and development, wood composites, and minor forest products. The Beekeeping Division deals with extension of techniques, promotion of production, and, until recently, acted as a marketing board. This function is now in the private sector. The Extension Division deals with extension of forestry to communities, training of local people in management techniques, community forestry programmes, and public education.

The *Forestry Act (Cap 314)* provides for forest management, conservation and protection of forests and trees, and licensing and sale of forestry produce. It has been subject to resistance from the public, primarily due to the lack of provision for community participation in forestry management. The Act should be amended to remove those elements that marginalise the public. The Act should also make provisions for the following.

(i) Afforestation should be an obligation for persons holding title to land. The Chief Conservator of Forests should determine the approach to afforestation,according to the nature and size of land;

(ii) Public participation should be promoted through local forest development committees, similar to those for wildlife. Revenues from the exploitation of the forests should reach local communities;

(iii) Some element of retribution or compensatory penalties should be prescribed so that persons found felling trees unlawfully or tempering with trees should be required to plant replacement trees.

The Natural Resources Department is charged with conservation functions across all sectors. Its principal functions are to monitor and control the management and use of natural resources outside forest reserves and national parks as determined by the *Natural Resources Conservation Act (CAP 315)* of 1970.

3.2.3 The Ministry of Energy and Water Development

The MEWD consists of the Departments of Energy and of Water Affairs. In addition, the MEWD consults with the Ministry of Environment and Natural Resources on issues related to water pollution control. The ministry overseas development and administration of energy policy, the provision, control and administration of electricity, and petroleum policy, including petroleum storage, pricing and oil pipeline supervision. The Ministry has a number of parastatal bodies including Lublend Limited, which recycles used engine oil, Tazama Pipelines Limited, Indeni Petroleum Refinery Company Limited, Zambia Electricity Supply Corporation Limited (ZESCO), and statutory bodies such as the Water Board, National Energy Council and the Zambezi River Authority.

The Department of Water Affairs is responsible for the management of water resources. This includes development and maintenance of drinking water supplies and delivery systems in forty seven townships throughout the country, and establishment of rural water supplies. The latter usually involves sinking wells and drilling boreholes prior to handing over to the MLGH for operation and maintenance, although transfer of responsibilities has been slow.

The *Water Act (Cap 312)* came into force in 1949 and provides for control, ownership and use of water excluding water that is part of international boundaries. The Act also established the *Water Board* which is administered by a Water Officer. Ownership of water is vested in the President and therefore all use of water is made in accordance with the Act. The Water Board regulates the use of public water other than that for domestic use and has a specific section dealing with industrial water uses. The Act further establishes polluting public water as an offence. The Act is in many respects outdated and needs review. The following amendments are therefore suggested:

(i) Defining private and public water so that ground water resources can be regulated;

(ii) Elaborating water pollution standards:

(iii) Establishing rationing procedures in case of emergencies such as drought and flooding;

(iv) Emphasising community participation in water management in rural areas.

The Department of Energy is responsible for the management of national energy policy, regulation of electricity generation, production and processing of fossil fuels and the development of renewable energy resources.

3.2.4 Ministry of Tourism

The MOT consists of the department of National Parks and Wildlife and statutory boards such as the National Parks Board, the Zambia National Tourist Board, and the Hotels Board, the National Museums Board and the National Heritage Conservation Commission.

The tourism industry is primarily wildlife based and therefore directly affects wildlife areas through its safari operations. Further, natural resources are affected through the MOT efforts to promote traditional crafts.

The *Tourism Act* does not explicitly address the issue of conservation or natural resource management. It also makes the Minister the final authority to hear appeals, thereby ignoring the courts. It is therefore suggested that the Act be amended as follows:

(i) Harmonise the Tourist Act with National Parks and Wildlife Act since tourism in Zambia is wildlife resource based;

(ii) Include responsibility for conservation in licensing regulations;

(iii) The Tourist Board should stipulate conservation guidelines to tour operators to ensure the conservation of resources.

The National Parks and Wildlife Services (NPWS) has overall mandate to manage all National Parks and Wildlife resources.

The National Parks and Wildlife Act of 1991 repealed the *National Parks and Wildlife Act (Cap 316)* and provides for establishment, control and management of National Parks and Wildlife and objects of interests in National Parks; Game Management areas; licensing of hunting; control of possession of trophies and the control of bush fires.

The Act establishes Integrated Resource Development Committees to manage both game management areas and national parks. The inclusion of local communities in natural resource management has promoted conservation.

The granting of mining rights to national parks should be carefully studied and measures to ensure that the holder of mining rights takes remedial conservation measures.

The placement of NPWS under the MOT is inappropriate. It should go back to the MENR to separate regulation from the client Ministry.

Secondly, tourist operators should be given more responsibility in national park management in areas in which the have leases. The department can then monitor the management of concession areas, and strengthen its regulatory capacity. Distinguishing the policing and management functions may strengthen NPWS and promote better management in areas outside national parks where strategies such as community participation in natural resource management are appropriate. Separation of functions can result in improved resource in flow to this sector, and promote accountability of stakeholders by enhancing private sector and household level involvement in resource management.

3.2.5 Ministry of Mines and Mineral Development

The MMMD has jurisdiction over various facets of mining, including development of small mines, minerals and materials research and testing, geological surveys, petroleum exploration, mineral production and processing, and seismic monitoring.

The Chief Inspector of Mines is responsible for matters concerning the safety and health of all persons employed in prospecting, exploration and mining operations. The Ministry oversees monitoring and treatment of pneumoconiosis, a lung disease caused by long-continued inhalation of mineral or metallic dusts, through the Pneumoconiosis Compensation Board and the Pneumoconiosis Medical Board (both in consultation with the Ministry of Health), and the Pneumoconiosis Appeal board. In 1986 a new comprehensive code of practice and training manual were published by ZCCM and approved by the Chief Inspector of Mines in an effort to improve mines rescue.

Discharges from ZCCM operations are monitored and controlled by the company itself. ZCCM checks specified drainage locations for acidity, hardness, sulphates, dissolved metals (copper and cobalt), and suspended solids. The MMMD Mine Safety Department is responsible for monitoring mine effluent, but in fact relies on ZCCM data due to lack of equipment and operating funds.

The *Mines and Minerals Act* 32 of 1976 regulates the law relating to mines and minerals. In its present form, the Act has no provision for public participation. This should be reviewed because;

(i) There are a number of high value mineral occurrences that are only suitable for small scale exploitation particularly diamonds and other gemstones, such as emeralds and aquamarine. Present legislation marginalises the public as possession of these stones without authority is unlawful. In spite of this, the Act in its present form has failed to eradicate illegal trade in gemstones.

(ii) The Act is silent on water, noise and air pollution arising from underground and surface mining.

(iii) The problem of waste dumps is not adequately addressed and is left to regulations.

There is a separate *Petroleum (Exploration and Production) Act* number 13 of 1985 specifically enacted to promote petroleum exploration in Zambia. Even though the Act contains some environmental obligations, it is silent on natural gas exploration. Moreover, it does not make provision for EIAs prior to application for licensing of petroleum exploration and production activities.

3.2.6 Ministry of Lands

The Ministry of Lands affects natural resource use through its control of land use planning, and through the formulation and administration of land policy. The Ministry also oversees the administration of lands and deeds registration and land acquisition. The ministry consists of the of the Lands and Survey Departments. The Lands Commissioner administers Land laws on behalf of the President. Issues of land tenure have been discussed in Chapter 2 (section 2.4).

3.2.7 Ministry of Home Affairs

The Ministry of Home Affairs is responsible for a variety of legal issues, such as drug enforcement, immigration, citizenship and refugee issues, civil defense, and corruption, and endangered species protection. The Ministry affects natural resource use and conservation through its jurisdiction over protected places and areas.

3.2.8 Ministry of Local Government and Housing

The MLGH is responsible for local government policy. The two institutions under the Ministry are Local Authorities and the Town & Country Planning Department The LAs in the ten largest municipalities are responsible for the provision of drinking water and sewage disposal. Many of theses have fallen into disrepair, and disruptions in service and poor quality of drinking water are major environmental issues. Sewage treatment is generally ineffective or nonexistent, with obvious negative effects.

The Local Government administration is established by the *Local Government Act number 22 of 1991* which provides for their functions and *inter alia*, their environmental obligations. These regulations are comprehensive and cover most of the aspects of environmental management. The *Local Administration (Trade Effluent) Regulations number 161 of 1986* which were passed under section 64 of the Local Government Act of 1980 are still valid. However, these regulations as they relate to effluent into water courses duplicate the water pollution control (effluent and waste water) regulations of 1993 under the Environmental Protection and Pollution Control Act. This duplication should be removed to provide local councils with powers relating to effluent discharged into their sewers and ponds so that effluent into public water courses would then be responsibility of the ECZ.

The Town and Country Planning Act Cap 475 provides for the appointment of planning authorities, the preparation approval and revocation of development plans, and the control of development and subdivision of land. Although most of the Act does not apply to trust and reserve lands and mining areas, part VIII which deals with regional plans does. However, the Act needs to be amended to provide for environmental impact assessment in the process of making development plans and also explain the role of the Environmental Council in this area.

4: ECONOMIC DEVELOPMENT AND THE ENVIRONMENT

4.1: Recommended Actions

(i) Environmental planning should be integrated into the development process through EIAs and this principle should be incorporated at all levels, including development co-operation protocols. The placement of environmental officers by ECZ at the Ministry of Finance and NCDP should be implemented immediately to facilitate the implementation of this recommendation.

(ii) The market economy will give government an increased role in regulation, monitoring and enforcement of sound resource use practices than was the case in the past. Government should therefore strengthen its regulatory capacity through economic instruments, such as incentives and disincentives that promote utilization of resources at socially optimal levels and sound environmental management and by manpower development and attractive conditions of service to retain trained staff. Where both direct and indirect taxes or subsidies currently exist, it is recommended that their maintenance should be continuously evaluated with respect to their contribution to the promotion of environmental quality and sustainable natural resources use within the context of a market economy.

(iii) In situations where property rights are not well defined, uncertain or allow open access in situations of resource scarcity, individuals or communities may be caused to use a shorter planning horizon in determining their own resources use patterns than is socially optimal. Government must facilitate the evolution of a new property rights regime but should ensure that there is equitable distribution of resources in the transition from one property rights system to another.

(iv) The economic units that allocate natural resources uses in Zambia are at the grassroots level and their actions can be influenced by empowerment and appropriate incentives to enhance efficient and sustainable resource management. Inadequate resources in rural areas, including a lack of budgetary resources for local authorities, precludes genuine local control.

The NEAP recommends that the right to tax must be assigned to local authorities or centrally collected tax revenue should be redistributed to local authorities. The redistribution should be based on the needs of the recipient authority, level of development in the area and the natural resource endowment.

(v) The NEAP process has identified five major issues with the greatest social costs to Zambia. These are

a water pollution and inadequate sanitation;

b soil degradation;

c air pollution in the Copperbelt towns;

d wildlife depletion (fish and game); and

e deforestation.

This was based on a very preliminary analysis due to a lack of reliable data. The GDP values do not reflect the cost to the nation of environmental degradation. The NEAP recommends that a comprehensive study be made to determine costs of environmental degradation and criteria to be sued in prioritising environmental problems as soon as possible. For the long term, the MENR and ECZ should co-operate with the CSO to strengthen their capacities so that environmental and natural resources accounting is carried out on a regular basis.

4.1.1 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Integrate EIAs in development planning	2	Short to medium term	ECZ, MOF, NCDP
Strengthen environmental regulatory capacity of government	2	Long term	All Ministries
Review & reform of property rights	2	Long term	MOL, MENR, MLA, NGOs, LAS
Build capacity for environmental & natural resources accounting	2	Long term	MENR, ECZ, NCDP
Valuation of environmental degradation	1	Short to medium term	MENR, NCDP, ECZ
Review of impact of economic incentives on environment	2	Short term	MENR, NCDP, MAFF

4.2: Review of Economic Policies and the Environment

4.2.1 General Policies

During the 1980s Zambia`s annual economic growth was less than 1.0%, while economic development stagnated, despite relatively high levels of investment compared with most of Africa. Inflexibility and institutional rigidity undermined national development efforts and protective tariffs encouraged investment in consumer rather than capital goods. This was largely responsible for the decline in investment efficiency and inadequate generation of wealth.

It is now recognized that central planning and direct State control of the economy were among the major constraints that impeded the economic development. Consequently, Government funded poorly evaluated projects and plan implementation became costly to society. The reduced efficiency of the public sector management and falling quality of government had a negative effect in the state and use of natural resources.

Inappropriate economic policies reduced the return on investment and encouraged production techniques which used capital rather than the abundant available labour resources. State control of the economy concentrated the roles of natural resources regulation and exploitation in the government. This made exploitation of natural resources difficult and resulted in failure of government to regulate natural resources use at socially optimal levels. In turn, this resulted in inappropriate policies and reduction of economic return of natural resources use, unsustainable resources use practices and even resource abuse.

Policies such as those which emphasised maize monocropping encouraged reduction of the economic return of land because it increases the risks of disease, weed infestation and nutrient loss due to soil structure deterioration. Minerals and mining development policies ignored conservation and neglected maintenance of appropriate exploration and mine development expenditure levels. As a result, the mining industry now faces the risk of premature depletion of resources, in spite of the existence of enormous mineral resources potential. Similar concerns relate to inadequate biological resources development and management which have resulted in the premature degradation of biological diversity. The lack of enforcement of regulations about water resources and waste disposal has caused unnecessary risk to human health and loss of lives, both in urban and rural areas.

Government efforts to redress this decline in the economy and environment started in 1989 through the economic structural adjustment programme. The programme advocates the removal of subsidies, economic liberalisation, privatisation of public enterprises and monetary and fiscal reforms to improve economic discipline of government. As a result of these efforts, the country achieved a positive real growth rate of 4% in 1993. This performance has to be maintained and a minimum GDP annual growth rate of 6% achieved by 2010 to restore better human welfare and environmental quality.

4.2.2 Subsidies

In the past, the government intervened heavily in the market through taxes and subsidies of various activities. While these taxes and subsidies contribute to efficiency where they offset market failure, they also created distortions and inefficiencies in natural resource use. For example, pan-territorial prices for maize resulted in significantly higher levels of resource use, increased costs of maize production and transportation than would otherwise have been the case. In addition, Government has failed to tax resource users through realistic user fees or fines. Examples of this are rents charged on government owned land, fees on timber concessions, hunting and fishing licenses, water use fees and fines for polluting which are considerably lower than is socially acceptable.

In the past, the motivation behind subsidies was to increase employment levels and provide low cost food to urban areas. While this may have had the desired short term effect, subsidies also drained budgetary resources, and created a highly distorted pattern of natural resources use, degradation, and steadily declining standard of living.

Therefore, wherever direct and indirect taxes or subsidies exist, it is important to evaluate whether their removal will improve environmental standards and sustainable natural resources use in the context of a market economy.

In addition to having a high degree of centralized management control over most natural resources, the Government is a major shareholder in large natural resource use enterprises. Experience indicates that there is temptation to sacrifice conservation for short term benefits because of economic difficulties. Incentive structures for parastatal management have led to poor resource management decisions. Resources required to monitor and control these organizations have not been available to GRZ, and outcome is large budget deficits and an over-extended civil service.

4.2.3 Property Rights

Achievement of sustainable development is closely tied to property rights that ensure growth with equity and the ability of future generations to meet their needs. Poorly defined property rights, poverty, and unequal access to physical and natural resources are at the heart of the country's incapacity to transform its rich natural resources potential and abundant land into wealth. Income distribution is skewed, and poverty and the behaviour it causes is significant in most man made environmental degradation in Zambia.

There are also negative environmental effects of actions of parties which benefit from unequal appropriation of natural resources, reinforcing poverty and degradation.

The colonial land tenure system and its minor changes in 1975 placed the majority of Zambians in native reserves and trust land in an unequal position relative to their counterparts on state land. This inequality of land tenure systems has given rise to direct entitlement failures which should be removed.

Property rights in Zambia, especially land rights were established by procedures that were not always acceptable to the local population. African rights to natural resource use were denied and in some cases banned. This created conflict between government and the local population in natural resource management. People were inclined to suspect government measures of dishonesty as greater protection was ostensibly being granted to wildlife than to themselves. Independence provided opportunities to resolve issues of access to natural resources by the majority of the population, but they have largely not been taken.

State land largely consists of the best agricultural lands in terms of soil quality and access to communications and also includes protected forests and national parks. Native reserve land is often less economically preferred and distant from agricultural markets. This places small scale agricultural activities predominant in native reserve land in an unequal position to state land dominated by large scale farms. This arrangement was not based on rules of economic efficiency but political expediency of colonial government and has no compensatory arrangements. There is need to unify land tenure system wherever practicable because unequal distribution of land is accompanied by unequal valuation of land as an asset.

This means that properties on state or private land are associated with higher productivity and lower costs of production which on the basis of freehold and leasehold tenure systems enable their owners with reliable collateral and have easy access to financial credit. On the other hand properties in traditional systems of land tenure have an indeterminate economic value in terms of financial collateral (Mbulo, P. 1990). This kind of land tenure gives impetus to a distorted sector, which should be eliminated (Gore, 1992:89).

The dual land tenure has a number of environmental implications, among them imperfections of land markets, the existence of unutilized and under utilised land, distorted factor utilisation patterns and comparative returns.

The market mechanism is unable to perform the redistributive function owing to fragmentation of land markets. Furthermore, the existence of under utilised land on some large scale farms (especially those owned by parastatals or with absentee landlords) contrasts sharply with pressure for land in traditional areas, especially in Southern Province. This means that the market mechanism has failed to allocate land efficiently which reflects inefficient resource use and exchange entitlement failure. On the other hand free availability of land under traditional land

tenure means that pressure on land is due to extensive farming systems rather than actual shortage of land. This suggests that farmers are encouraged to cultivate as much land as possible including marginal land. This behaviour can lead to premature land degradation. Similarly, given low population densities in Zambia's rural areas, inability of the small scale farmers to intensify production encourages clearance of virgin land once soils are believed to be exhausted. This can also contribute to rapid land clearing and unnecessary loss of woodland.

Associated with economic land deprivation of most of rural Zambia is devaluation of labour power entitlements which aggravates poverty and environmental degradation. Again the structural determinants of this situation are to be found in the colonial legacy and the land tenure nexus. Labour power entitlements failure refers to socio-economic circumstances that prevent labour power from realising adequate real incomes when deployed in terms of production or wage employment (Gore, 1992).

This is demonstrated by extreme income differentials between rural and urban areas and the preponderance of poverty in rural areas. Up to 83% of rural households are poor as opposed to 42% of urban households. Inflation and economic stagnation is associated with a rise in formal sector unemployment and inability for labour to realise it`s exchange entitlement. In rural areas, poverty is associated with female headed households, critical labour shortages during peak labour seasons and dependence on female labour due to absence of men. Traditional land offers a reservoir of cheap labour since it cannot realise it's labour entitlement. In turn, failure in labour exchange entitlements encourages environmental degradation and natural resources encroachments.

4.3: Action Plan for Sustainable Development

4.3.1 Economic Liberalisation

In the move to a market economy, government will have to rely on sound economic and legal instruments to achieve sustainable development and environmental management. The focus of these instruments should be to influence patterns of resource use by providing resource users and managers, such as households, entrepreneurs, government agencies and NGOs with incentive structures encourage utilisation of resources at socially optimal levels. Strategic actions to this end include sound financing of activities, the involvement of communities (including women) in management activities, and supporting business development in the informal sector. A balance must be struck between short term growth and long term efforts to restore the integrity of the of the environment.

A market economy still requires economic planning and Government still plays a significant role. Government is a major participant in the market, and also needs to ensure a strong and efficient system is in place. The need to remove past deficiencies and administrative controls that introduced distortions in the economy requires changes in the role of planning.

The case for planning is due to a large number of abandoned projects and the sheer scale of investments required to remove the country's state of economic backwardness and under development. Carefully planned programmes and effective policies using well defined economic incentives and inducements are essential for full employment of currently under employed economic resources. This means that economic and social overhead capital should be used to establish physical conditions for existence of a market and support interdependence of markets.

4.3.2 Economic and Environmental Planning

Environmental planning should be integrated into the development process through Environmental Impact Assessment (EIA) which is a tool for both planning and decision making. EIA is concerned with identifying, predicting and evaluating the expected environmental effects, both beneficial and adverse, of public and private development activities. The EIA is a process and not merely an activity and should be fully integrated into the project preparation cycle.

As a matter of policy, EIA screening should apply to all projects and development programmes whose budgets exceed $ 250 000 expenditure per year, and individual small projects or aggregates of small projects with potential

for environmental degradation. Infrastructure projects, industrial projects such as, metallurgical, chemicals, agro-industries and extractive industries, urban and land development, waste management disposal, tourism and allied activities whether new or up for rehabilitation should invariably go through an environmental assessment. Environmental concerns should become a regular component of commercial bank project financing.

Given the economic situation, development cooperation will remain a necessity for a considerable time to come. Whilst there may be shifts of emphasis, project financing will continue to be a significant component of development cooperation. GRZ should support the adoption environmental assessment at all levels of development cooperation protocols, establish procedures for environmental assessment of all development cooperation projects, establish responsibility for supervising and guiding the environmental assessment of all projects including those under NGOs, and mobilise resources to improve the capacity of appropriate bodies for conducting EIAs.

The strategy for implementing a system of standards and enforcing them should be accompanied by an economic incentive and or sanctions. Firms or individuals will be explicitly or implicitly licensed to pollute at a minimum level beyond which a penalty or fee will be appropriated in proportion to their level of damage. The onus will be on firms to reduce their wastes using the most efficient means available.

The advantage of such a system is that it is consistent with national economic policies, has a sound economic basis, is consistent with the polluter pays principle, creates no drain on public funds and is readily targeted to priority industries and areas.

4.3.3 Property Rights Reform

Much of the poverty in Zambia can be explained by entitlements failures which are demonstrated by the inability of the majority of the population to gain command of physical and monetary resources, especially in the traditional land tenure areas where the majority of the population lives. Exchange entitlements failures are also common and are generally due to low exchange value of tradeable ownership entitlements such as land, labour or capital or the goods and services produced by the majority of the population.

Uncertain or ill defined property rights, or those allowing open access at times, cause individuals or communities to use a shorter planning horizon in determining their own resource use patterns than is socially optimal. Systems of property rights evolve in societies in response to recognizable resource use problems but these systems can take generations to develop. One of the major problems facing Zambia today is that many of the existing systems of property rights have not been able to evolve fast enough to cope with the rapid demographic and political changes in the country, resulting in socially sub optimal levels of resource use. The government has a role to play in facilitating the evolution of new property rights regimes, and ensuring that there is an equitable distribution of resources in the transition from one property rights system to another.

Resource use rights in Zambia are closely tied to the dual systems of land tenure. Under the system of leasehold tenure found in state land, rights to the use of natural resources on the land are allocated to the holder of the leasehold title, while under the traditional systems of land tenure resource use rights to different resources on the same area of land are often disbursed amongst multiple users.

For example, the cropping rights may be granted to an individual, while access rights, hunting rights and winter grazing rights may be granted to another individual or the community as a whole. As a result, any reform of the traditional resource use rights will have to be tied to changes in the system of land tenure and involve significant changes in social behaviour, and vice versa. Changes in the systems of allocating resource use rights are inevitable as population pressure causes increased competition for scarce resources and there is increased political pressure to grant exclusive resource use rights to individuals. There is already evidence of this occurring along the line of rail and in peri urban areas where there is a high demand to convert traditional land to leasehold.

While there are legitimate economic and environmental reasons for moving to a more formalized and exclusive system of individual use rights as resource scarcity increases, in the process of evolving from one system to another

there is always the danger of alienating some of the existing resource users. This is particularly true when moving directly from a traditional system to a private property system, because the use rights that are disbursed among a large number of users under the traditional system tend to be concentrated in the hands of a single individual under the private property system. In most cases this would be the individual that has agricultural use rights to the land under the traditional system, which in most cases would be the male head of household, alienating the wood collection, access, gathering and grazing rights of other members of the community, particularly women. There is need to develop institutional mechanisms that will protect the rights of existing resource users.

The existing system of converting traditional land to leasehold, which requires the permission of the chief or chieftainess, the District Council, and the Commissioner of Lands, provides reasonable protection to traditional rights holders against non-consensual removal of rights. There are two elements of the system that need strengthening. Improved documentation and awareness of use rights at the local level, providing individuals with a basis for legal recourse in instances where the system fails. This would include the education of traditional leaders and the improvement of record keeping systems at the local level. Removing the backlog of applications for conversion of title since this situation lends itself to a system of selective titling which favours the influential and the wealthy and will lead to an inequitable distribution of resources and resultant social and poverty related environmental problems. By strengthening the existing traditional systems and allowing them to evolve as resource scarcity increases, individuals will have a vested interest in managing their resources on a longer term basis. Without strengthening them, these systems are likely to break down under the pressure of increased resource scarcity, providing open access to the resource, leading to suboptimal levels of use.

4.3.4 Privatisation

The privatisation programme will reduce role of government in the management of natural resources, freeing budgetary and management resources to focus on more relevant activities. By privatizing ownership, the government intends to bring incentives facing resource users more closely tied to returns from the resource, ensuring greater efficient resource use in a well functioning market.

Privatisation will give the government an increased role in regulation, monitoring and enforcement of sound resource use practices.

As government moves away from direct ownership and management of natural resources, it will need to develop its regulatory capacity through a complete set of regulations and standards
relating to the environment and natural resource use. Unless carefully monitored and enforced, regulations and standards are useless and can be subject to abuse. They only make sense when the institutional capacity to monitor and enforce them exists. Where possible, regulations on new facilities could be based on *Best Practicable Means (BPM) or Best Available Technology (BAT)* requirements, with approval of such facilities contingent on licensing.

4.3.5 Decentralization and Community Participation

The economic units that actually allocate natural resource uses in Zambia are typically small, most often households in rural areas. The effective managers are not government officials, but the small farmers, beekeepers, hunters, and their villages. The Government can influence these users, and success lies in the level and direction of that influence. An effective strategy to improve resource use operates through rural households and villages by providing a logical framework of cooperation. It is structured on the incentives facing rural communities and various groups within those communities where most of the impact of resource use occurs. For example, if fishing families see the benefit from reduced off take during the breeding season, the off take is more likely to be controlled. Thus the empowerment of local communities, each gender, occupational and other groups is an appropriate approach to sustainable resource management.

In the past, GRZ relied on government ownership and the centralized management of natural resources. This system was unable to ensure equitable and efficient use of these resources because it failed to provide incentives to individual resource users to participate in management. The result was increased enforcement costs, beyond what

Government could afford, even with donor assistance. There is need to redefine the role of the central government in natural resources management, and address the issue of individual incentives for resource users in order to promote efficient and sustainable resource use.

Practical steps that could be taken include institutional and policy reforms, such as the following. Reduction of central government role in the direct ownership and management of natural resources could be achieved by increased divulsion of responsibility for natural resource management to local authorities and communities and privatization of public enterprises involved in natural resource use. However, provision of incentives to induce individual users to engage in sustainable resource use and allowing the market to regulate the use of these resources will enhance this process.

Lack of resources in rural areas, including a lack of budgetary resources for local governments, precludes genuine local control. For this reason, the right to tax must be assigned to local governments or there should be a redistribution to local governments of centrally collected tax revenue. This redistribution would be based on formulae that take into account both the needs of the recipient government, the level of development in an area, and the natural resource endowment.

5: AGRICULTURE

5.1: Recommended Actions

The major environmental impacts of the agricultural sector occur at the production level and these impacts vary according to agroecological region and the level of agricultural development. In order to ensure sustainable agricultural production and food security at household and national levels while minimizing land degradation, the NEAP recommends the following

(i) The role of incentives, such as input subsidies, should be evaluated and where these promote fixed and intensive sustainable agricultural production, these should be maintained at appropriate levels that take into account the burden on the national economy and their usefulness in promoting better land husbandry and environmental quality.

(ii) In areas where land degradation is a consequence of ill-defined or uncertain property rights, these should be replaced by secure property rights which improve access to credit facilities and promote long term investment in agricultural development and land husbandry.

(iii) The majority of small-scale farmers are women and their capacity to care for agricultural land and sustainably produce food depends on access to capital and agricultural extension services. The MAFF in co-operation with the private sector and NGOs should establish a framework that ensures easy access to credit facilities and extension services by women and other resource-poor farmers.

(iv) The past overemphasis on the promotion of hybrid high yielding crop varieties, especially maize and exotic animal breed, through research and commodity extension service has increased the vulnerability of these crops and livestock to natural disasters, such as disease, drought and pest outbreaks and has contributed to the erosion of the genetic diversity, through lack of promotion of local breed and crop varieties. The MAFF should reverse this trend by strengthening research and capacity to conserve crop genetic diversity, including wild relatives of cultivated crops.

(v) Agrochemicals are widely used in Zambia to ensure high production of crops and livestock through the control of weeds, pests and diseases. These chemicals often pollute the environment and are dangerous to man and wildlife.

Whereas legal provisions exist for the registration of imported and locally manufactured agro-chemicals under the EPPC, the MENR, ECZ and MAFF should establish a framework for the disposal of agro-chemicals and their residues, and should promote research and use of natural pesticides.

(vi) Land husbandry is the responsibility of local communities and individual farmers. The success of land conservation therefore depends on community participation and the promotion of useful indigenous and agroforestry technologies. Agricultural programmes should involve active community participation, especially of women and other marginalised groups. NGOs and CBOs can play an important role in promoting community participation and environmental awareness among small-scale farmers and should be strengthened through capacity building to perform this role effectively.

(vii) Large scale agricultural development schemes, including settlement schemes, can have profound adverse environmental impacts. The NEAP recommends that such schemes, as well as large scale pest control operations, should be preceded by an EIA that is acceptable to ECZ.

(viii) MAFF should strengthen research in rangeland management to enhance biodiversity conservation by controlling bush fires and overgrazing.

(ix) Baseline data on land degradation process in the agricultural sector is extremely scarce. This impairs decision making and rationalization of investment to combat land degradation. At present, it is not easy to quantify and cost land degradation due to agricultural activities. The government, especially through the MAFF, should strengthen research capacity in research institutions, including the University and National Council for Scientific Research, to implement and sustain long term monitoring of land degradation processes, especially soil degradation due to erosion and acidification.

5.1.1 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Assess impact of incentives on land husbandry & sustainable production	1	Immediate to short term	MAFF, MENR
Property rights evaluation & reform	2	On-going & long term	MAFF, MENR, MLA
Provision of credit facilities & extension series to small-scale farmers and women	1	Immediate to long term	Private sector, MAFF
Strengthen research & conservation of local animal breeds & crop varieties & their wild relatives	2	Long term	MAFF, UNZA, NCSR
Research & promotion of natural pesticides	3	Long term	NCSR, MAFF, UNZA
Establish framework for disposal of agrochemicals & residues	3	Immediate to short term	MAFF, ECZ, NCSR, ZNFU
Community participation in agricultural programmes & environmental education	2	Long term	MAFF, NGOs, CBOs
Enforcement of EIAs for large scale agricultural & settlement schemes	2	Long term	MAFF, ECZ, TCPD
Develop technologies for rangeland management	2	On-going & long term	MAFF, UNZA
Monitor land degradation & costing	1	Long term	MAFF, UNZA, NCSR

5.2: Review of Agricultural Policy

The rising production costs and falling copper prices since the 1970s have left the economy have made it imperative to shift development emphasis from mining to agriculture. However, successive national development plans have failed to achieve this shift. For example, the agriculture sector during 1980-1990 grew at 2.5% per year compared to a population growth rate of 3.2%. Consequently, per capita food production declined while the contribution of the agricultural sector to GNP has remained at 15%. The value of agricultural food exports as a proportion of food imports has remained at about 2%. But there have been significant increases in the production of maize (65%), wheat (176%), mixed beans (113%) and oilseeds (42%) during the 1981-1991 period. A large proportion of these increases is due to expansion of land under cultivation rather than intensification of production per unit area.

Excessive government intervention and control of markets and inadequate provision of essential public services, such as, extension , roads and market information, have contributed to the poor performance of the agriculture sector.

The sector has depended too heavily on subsidized hybrid maize crop even in areas where this crop has no competitive advantage. And although livestock forms an important part of the rural economy, productivity of the predominantly traditional cattle is low and off take is less than 10% of the estimated 2.2 million herd. The agriculture sector is therefore dominated by crop production.

For rural households, which make up 58% of the population, agriculture is the main source of livelihood. But low incomes, overemphasis on cash non-food crops, shortage of labour and poor food storage and processing have all contributed to poor nutrition of rural populations, especially women and children. The levels of malnutrition in Zambia are highest among rural women and children (Gaisie, et al., 1993).

The development objectives of the agriculture sector are therefore to:

(i) ensure household and national food security through dependable annual production of adequate basic foodstuffs at competitive costs;

(ii) generate income and employment to improve human welfare and the standard of living by using local resources and the realisation of both domestic and export market potential;

(iii) ensure that the existing agricultural resource base (land, water and soil) is maintained and improved upon;

(iv) contribute to sustainable industrial development;

(v) significantly expand the sector's contribution to national balance of payments by expanding agricultural exports.

The emphasis on annual production of adequate basic foodstuffs at competitive costs as a basis for ensuring household food security fails to address the importance of local food crop varieties and small livestock. There is great need to promote local food crops through breeding research and better marketing to enhance production. there are 0.5 million goats, 0.07 million sheep, 0.3 million pigs and over 20 million poultry. Households are probably more willing to dispose of such small livestock through sale and/or own-consumption than of cattle. Small livestock can therefore be a better source of income and nutrition for rural households than cattle. Agricultural development should therefore also aim at improving small livestock husbandry.

5.3: Environmental Issues in the Agricultural Sector

Zambia is divided into three Agro-ecological Regions based on annual rainfall (Figure 5.1). Region I, with 600-800 mm annual rainfall, covers the Zambezi and Luangwa valleys. Region II, with 800-1000mm annual rainfall, covers the central zone of the country. Region III, with 1000-1500mm annual rainfall, covers the northern and northwestern parts of the country.

The predominant soils in the three Regions have low nutrient reserves and retention capacity and are acid to strongly acid.The soils in Region I also have a high sodium and salt content, while those in Region III have high amounts of iron and aluminium oxides which reduce phosphorus availability to plants. The common physical limitation of all these soils is the low water holding capacity and in Region I, a high erosion hazard, and limited soil depth in both Regions I and II. In spite of these constraints, there is great diversity of locally adapted crops that are suited to and produced in the different Regions.

The extent of potential arable land in Zambia is estimated at 42 million ha with only 2.5 million ha (6% of arable land) under cultivation. However, this potential arable land includes land in national parks and forest reserves and low potential arable land. Given a population growth rate of 3.2% per year, the need to manage cropland will continue to grow in the future, especially that current increase in food production is largely based on bringing new land under cultivation.

5.3.1 Cropland Issues

Environmental problems caused by crop production include soil degradation through acidification, nutrient loss, deterioration of structure, erosion, salinization, pesticide and fertiliser pollution and deforestation.

Clearing land for agriculture is a major contributor to deforestation in Zambia. Under the traditional slash and burn chitemene shifting cultivation in Region III, about 0.5 million ha of woodland were cleared in 1990 alone. However, soil fertility declines by 80% in three years and fallowing is used to regenerate soil fertility (Stromgaard 1991). This farming system is therefore only sustainable at low population densities of under 4 per square km. At higher densities severe deforestation due to reduced fallow periods occurs (Chidumayo 1989). This has occurred within 50 km of the major roads in Luapula and Northern Provinces. Even in Region II, about 20% of the forest land has been converted to semi-permanent and permanent agriculture (World Bank 1990).

In Zambia soil acidity is naturally associated with excessive leaching, especially in Region III. As a result, acidity levels are higher in Region III. But pedogenic acidity due to the nature of the parent material and soil texture also contributes to soil acidity.

The problem of soil acidification has been worsened by the use of nitrogenous fertiliser. The use of mineral fertiliser started in the 1950s when hybrid maize, a N-demanding crop, was introduced in the country. Fertiliser sales increased from 35000 t in 1964 to 250000 t in 1984 (McPhillips & Wood 1990), but due to foreign exchange and importation problems, declined to 97000 t during the 1991/92 season.

In Region III, continuous maize monocropping with N-fertiliser without lime reduces the soil pH further and yields decline by 20% per year. Continuous maize monocropping in Mpika, Serenje and Chinsali districts reduced yields from 3500 kg per ha in 1981 to 2400 kg in 1986 while fertiliser use increased from 250 kg per ha to 350 kg during the same period.

Hence, 4-5 years of maize monocropping has to be followed by fallowing, just like under the traditional chitemene shifting cultivation.

It is estimated that acidification due to fertiliser may result in the loss of 15% of arable land in 20 years in the Northern Province (Blackwell et al., 1991). Although the use of N-fertiliser increases biomass production which should potentially increase soil organic matter, there are cases even in Region II, where continuous use of N-fertiliser destabilizes the clay and enhances pan formation which impairs plant root growth while loses in organic matter of up to 80% may occur (Robinson 1978). High soil organic matter content is important for the maintenance of nutrient exchanges between the soil and plants.

In the past the subsidized low fertiliser prices tended to encourage excessive use of fertiliser as yields under a continuous hybrid maize monocropping declined. Such monocropping was pursued at the expense of crop rotation, intercropping and the use of organic manure. This reduced areas under local crop varieties and this had negative effects on household food security and nutrition, and also eroded crop genetic diversity (Sharpe 1990). Eutrophication of aquatic systems caused by nutrient-rich runoff from over-fertilised farmlands, although not widespread, also reduces biodiversity while promoting the productivity of noxious weeds. For example, drainage waters from the Nakambala irrigated sugar estate contain 72% more nitrate-N and 229% more orthophosphates than the pre-irrigation water pumped from the Kafue river upstream (Salter 1978-79).

Agrochemicals are widely used in Zambia to ensure high production of crops through the control of weeds, pests and diseases. The country spends more than three billion Kwacha on the importation of these chemicals, without which production of maize ,cotton, horticultural and vegetable crops would fall below economic levels. The outbreak of army worms during the 1992/93 season and that of locusts in the 1993/94 season underline the importance of pesticide use for crop protection.

However, some chemicals are harmful to human and animal health and the environment. Some of these chemicals, such as, DDT and Dieldrin, have now been banned for agricultural use in the country. However, banning the use of a pesticide does not necessarily resolve the issue of disposal of the unsold stock of the banned chemicals. For example, there is a dump of 50 t of banned toxic pesticides in Lusaka west which poses a threat to the environment, especially the underground aquifer. In addition, the use of broad-spectrum, although non-persistent chemicals, such as, Endosulfan, is still a source of environmental concern.

Soil erosion has thus far constrained agricultural potential only in isolated areas of Zambia. Only 10% of the land surface has a high soil erosion hazard (Chiti 1991). However, cases of severe soil erosion and degradation occur in the low hazard areas. Soil loss on red clay soils on land with 2.5% slope is estimated at 12.5 t per ha per year (Lenvain et al 1989). Although this loss represents 0.4% of the cultivated land, soil erosion has accelerated in many areas due to poor cropping practices. Given that in most Zambian soils, the highest nutrient concentration is in the top 0-10 cm, soil erosion can result in considerable loses of plant nutrients. In Malawi, loses of 0.30 kg N, 0.15 kg P and 0.18 kg K per ha per year from cropland without soil conservation works compared to 0.17 kg N, 0.06 kg P and 0.04 kg K losses from cropland with physical soil conservation works has been observed (Amphlett 1986). Thus nutrient losses from cropland without soil conservation works are 2-5 times more than where soil conservation works exist. In Nigeria loses of 5800 kg per hectare of maize on Alfisol soils has been observed (Food and Agriculture Organisation 1984). Soil erosion does not only destroy agricultural lands but also results in the siltation and sedimentation of rivers, streams and water reservoirs and blocking of irrigation canals.

Soil salinization is not a major environmental concern in Zambia. This is partly due to the small hectarage of land under irrigation. Only 2 % of land under cultivation is currently irrigated. But given the 0.15 - 0.45 million hectare of potential irrigated land in the country, the expansion of irrigation can be an environmental menace on wetland soils of moderate to fine texture unless specific preventative measures are taken. Already 70 hectare of the irrigated 20,000 hectare in Mazabuka have become saline.

5.3.2 Rangeland Issues

Almost the entire traditional herd of 2.2 million depends on the natural grassland and browse for feed while the commercial herd is given supplementary feed. The rangeland available for the traditional livestock sector is estimated at 10 million ha, which gives a stocking rate of 5 ha per animal compared to the carrying capacity of 10-15 ha per unit. About 90% of the traditional herd is concentrated in Central, Lusaka, Eastern, Southern and Western Provinces. Pressure on rangeland resources is therefore greatest in these Provinces. Except for the Barotse and Kafue wetland grazing areas, rangeland degradation is widespread in Regions I and II.

There is currently little grazing management designed to assure sustainability of rangeland in Zambia. This has resulted in low livestock productivity and localized over consumption of better range and grassland. Overgrazing is particularly conspicuous in the Gwembe valley, east of Monze and Katete, with attendant soil erosion.

Overgrazing is not only caused by overstocking, but also by poor grazing management. In part, this is a consequence of decreased power of local chiefs who in the past were effective managers of land and in part, because of the concentration of livestock around a few permanent water sources during the dry season. Even an off take of up to 10 % from the traditional sector would not necessarily lead to reduced stocking levels. Income stability and the need to preserve wealth in form of livestock have contributed to the reluctance by traditional herders to cull herds to match the carrying capacity of the rangeland.

5.3.3 Animal Health Issues

Animal health activities also pose environmental danger, especially the uncontrolled disposal of wastes from chemical solutions used in cattle dips to control ticks. Very little is known about this problem in Zambia.

Tsetse control is another of these activities. During the 1960s and 1970s, tsetse control was based on bush clearing and ground spraying. Bush clearing is now discouraged but both ground and aerial spraying are still used because they have comparable costs. However, the most common method is the use of baited traps and targets impregnated with an insecticide which are laid down in bushes.
Tsetse control has shifted from the use of persistent insecticides to non-persistent but still broad-spectrum chemicals, such as, pyrethroids. There is need therefore to continue the search for safer, more target-specific pesticides to replace the current broad-spectrum ones. Large scale tsetse control activities in Zambia are now sanctioned by a coordinating committee of government. The committee ensures that adequate and proper consideration is given to human health and the environment.

5.4: Action Plan for the Agricultural Sector

The strategy for dealing with environmental issues in the agriculture sector include the following.

(i) Improvement of the incentive structure for all farmers and increasing smallholder`s access to public and private support services and encouraging increased use of land.

(ii) Reorganisation of the management and delivery of key support services, especially research, extension and farm credit.

(iii) Periodic review of the role of incentives in environmental and land management in the agricultural sector.

(iv) Review and updating of laws relating to Cooperatives, Agricultural marketing, Agricultural credit, Seeds, Fertiliser and Feeds.

Specific activities include the following:

(i) Liberalization of markets

(ii) Diversification of crop production and promotion of mixed farming

(iii) Provision of extension services to smallholders

(iv) Promotion of sustainable agriculture through low-cost environmentally friendly production technologies, such as, soil conservation, agroforestry, crop rotation, green manuring, intercropping and use of animal manure

(v) Encouragement of full use of land available for agriculture

(vi) Development of the livestock sector

(vii) Expansion of opportunities in rural areas

(viii) Improvement of the economic status of women

(ix) Assisting farmers to deal with natural disasters

(x) Improving use of available water resources

Current activities in the agriculture sector include agricultural research, agricultural extension and veterinary and tsetse control.

5.4.1 Agricultural Research

Agricultural research generates appropriate technology for improving and sustaining the agricultural sector in the country. In crops the research activities emphasize the improvement and development of food crops, such as, cereals, roots and tubers, vegetables, and legumes, and export crops, such as, cotton and cashew. The frequent droughts in Regions I and II have shifted attention from maize to sorghum and millet which are more drought tolerant. In Region III, research has concentrated on improving the productivity of the farming systems which are traditionally based on finger millet, cassava and sweet potatoes. The following is a summary of these activities.

(i) Development of mixed cropping systems and maximising livestock-crop interactions where possible

(ii) Research on sustainable cropping systems using adapted crop varieties and low levels of purchased inputs, such as, fertilisers

(iii) Development of alternative strategies to counteract soil acidity and soil infertility, including liming and application of chemical fertilisers

(iv) Agroforestry research to enhance soil fertility, land rejuvenation and fuel wood production

(v) Integrated pest management to control the major insect pests and diseases of crops

(vi) Maize improvement and development.

In the livestock field some research has been carried out to assess the performance of native cattle breeds under alternative husbandry and feed supply regimes. In addition indigenous cattle have been crossed with exotic breeds to improve their productivity of milk and meat.

5.4.2 Agricultural Extension

Agricultural extension is the mechanism through which technical, economic and policy information is passed on to farmers. It is through agricultural extension that farmers problems are identified and communicated to researchers for attention. The main activities in extension are summarized below.

(i) Providing farmers with available information on farming techniques, such as, appropriate crop rotations, soil erosion control and soil fertility improvement, activities methods, crops to be grown in a given location and recommendation packages

(ii) Linkages between farmers and researchers to feed the latter with the main constraints facing farmers so that appropriate technologies can be developed

(iii) Identification of major pests and diseases of crops and control methods, as well as, indigenous soil conservation and fertility improvement practices

(iv) Encouraging labour saving techniques, especially those affecting women

(v) Encouraging the use of improved methods of food storage and processing at the household and village levels

(vi) Promotion of crop-livestock interactions and animal disease control

5.4.3 Veterinary and Tsetse Control

The Department of Veterinary and Tsetse Control carries out important activities directed at improving the productivity of the national livestock herd. The main activities are as follows.

(i) Disease monitoring and control. The main disease include foot and mouth disease, rabies, African swine fever, anthrax, brucellosis, black quarter, tick borne diseases and trypanosomiasis.

(ii) Improvement of livestock productivity through artificial insemination.

(iii) Provision of diagnostic services for major diseases affecting livestock.

(iv) Eradication of tsetse flies from infested areas and experimentation of new methods of fly control.

(v) Research on animal health and tsetse control.

(vi) Maintenance of the Angola-Zambia cordon line to control contagious bovine pleuro-pneumonia.

5.4.4 National Council for Scientific Research (NCSR)

The Livestock and Pest Research Unit of the NCSR carries out research in livestock production which complements the work of the Veterinary and Tsetse Control Department. The research is targeted at ticks, tick-borne diseases, tsetse and trypanosomiasis and livestock nutrition and reproduction.

5.4.5 University of Zambia (UNZA)

The Departments of Animal Science and Crop Science at the UNZA carry out research in livestock improvement and nutrition and agronomy, respectively.

6: RENEWABLE NATURAL RESOURCES

6.1: Water Sector

6.1.1 Recommended Actions

Water is an important resource to life and socio-economic development. In order to ensure adequate supply of quality water, and its conservation as a resource, the NEAP recommends the following:

(i) The Water Affairs Department in conjunction with the Town and Country Planning Department, develop and enforce integrated river basin management plans to rationalise utilisation, conservation and management of water and other natural resources;

(ii) To strengthen local authorities and Water Affairs Department to improve drinking water supply;

(iii) Require EIAs prior to the construction of dams and other hydroschemes to be evaluated by the Water Affairs Department and ECZ;

(iv) To strengthen capacity at ECZ and Water Affairs Department to enforce environmental quality standards in respect of water resources;

(v) To develop and implement a strategic plan to minimise the impacts of drought and floods at national and community level;

(vi) To strengthen the capacity of the Water Affairs Department and NCSR to carry out water resource inventories and to immediately carry out a comprehensive inventory of water resources of the Kafue basin for the purpose of developing and implementing programmes to increase water availability and quality to all sectors;

(vii) To negotiate and implement international treaties for the conservation and management of shared water bodies and river basins

6.1.2 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Develop river basin management plans	2	Long term	WAD, TCPD
Improve drinking water supply	1	On-going & long term	WAD, LA, ECZ
Enforcement of EIAs	2	Long term	ECZ, WAD
Enforcement of water quality standards	1	On-going and long term	ECZ, WAD
Develop strategic plan on drought & flood management	1	Long term	MAFF, WAD
Assess water resources in river basins	3	Long term	WAD, NCSR, UNZA
Implement international treaties on shared water resources	3	On-going and long term	ECZ, DOF, MCT, MEWD

6.1.3 Review of the Water Sector

Zambia is considered a fortunate country in Southern Africa, receiving relatively substantial rainfall, and endowed with major perennial rivers, lakes, swamps and flood areas. However, this does not mean that water is always easily accessible. There is a variation in rainfall and water resources across the country, and demand is high - Zambia consumes an average of 225 liters per person per day, and will have a daily requirement of 1.2 million cubic metres by the year 2000.

6.1.4: Sources of Water

The principal source of water is rainfall, which recharges both surface and ground water reservoirs. Zambia has distinct dry and wet seasons and about 95% of the annual rainfall occurs from November to April. Average rainfall ranges from 600 mm in the south to 1500 mm in the north. The minimum for effective crop production is around 600mm, although the distribution throughout the season is also highly significant in determining yields.

The high temperatures create high levels of evaporation and evapotranspiration, leaving less than 15% to run off. This is an average of 20 % in the headwater regions and 10% in the tailwater regions. The runoff enters the Zambezi, Kafue, Luangwa, Chambeshi, Luapula and Lake Tanganyika basins, and it is estimated at 90 billion cubic m,with 60 billion cubic metres is in storage in lakes and swamps (Sharma 1985).

6.1.5: Water Storage

Assessments indicate that there is enough water in the major basins to meet present and medium term water demands. Surface water covers 45,000 km^2 or 6% of the country.

The Luangwa basin (147,472 sq.km) has a rainfall input of 147 billion m^3 while ground water storage exceeds 200 billion m^3. In the Chambeshi (38,820 sq.km) and Kafue (150,000 sq.km) basins rainfall input is 34 and 150 billion m^3, respectively. Ground water occurs almost all over the country within 100 m depth. Total ground water storage is in excess of 1000 billion m^3.

Groundwater is stored efficiently, in the sense that loss through evaporation is eliminated. However, access can be a constraint to the utilisation of groundwater resources.

Wetlands are ecosystems classified as either riverine (rivers & floodplains), lacustrine (lakes) or palustrine (swamps, lagoons, springs & ponds). These are widely distributed in Zambia in the major river basins, and are particularly common in Luapula, Northern, Western and Central Provinces. Such wetlands not only store water , but also contribute to water purification, and control of floods. Wetlands are the main source of recharge for ground water.

6.1.6 Management and Utilisation of Water Resources

The Department of Water Affairs is responsible for the management of water resources, which includes planning, utilisation and conservation. The Water Board authorizes, on behalf of the President, the use, diversion and apportionment of all water, and regulates the use of public water, other than that for domestic use. The Water Affairs Department and the Water Resources Unit of the NCSR undertake water resources inventories and assess and monitor the quality of both surface and ground water. The Water Act also provides for the offence of polluting public water, so as to render it harmful to man, plants and animals.

The major uses of water are as follows:

(i) Public water supply: The total domestic water supply is between 200-400 l. per person in urban areas, and 15 l in rural areas. Only 33% of rural people have access to clean drinking water. Around 3.5 million people received piped water, of which 75% is surface. It is estimated that 427 million m^3 will be required by the year 2000, of which 412 million m^3 is for urban consumption. It is unclear whether this can be met at the present rate of development.

(ii) Industry and mining: The exact water consumption by industry is not known. Much of that used is from the Kafue river. Water abstraction from the Kafue river in the Copperbelt area is estimated at 4.22 m^3 per second, which represents 65% of the total of 6.45 m^3 per second. The latter includes 3.74 cubic m per second which is pumped back into the river from the mines.

(iii) Agriculture: Agriculture is dominated by rainfed production. Irrigation can be used to bridge dry spells and minimise risk of total crop failure, although summer production of staple crops using irrigation is sub-economic. Approximately 50,000 ha is irrigated, using 0.5 million m^3 per year, or 1% of national water resources. Although 400,000 ha are in theory potentially irrigable for agriculture, the economics makes this impractical, as the crops which can profitably be grown in this manner are limited.

(iv) Hydropower generation: Electricity has become a major form of energy in Zambia following the construction of hydrostations at Kariba (1200mw), Kafue (900mw), Victoria Falls (108mw), Lusiwasi, Musonda Falls, Lunzua River, Mulungushi and Lunsemfwa. These mainly generate power on river flows. The water use for hydropower generation is in the order of 6 billion cubic m per year. There are controversial plans for a hydrostations to be constructed at Batoka Gorge (1400mw), which may destroy a World Heritage Site, and for a further dam at Kafue (400mw).

(v) Transportation: Communities living in wetlands generally depend on water as the major means of transportation. Main water ways are in Bangweulu, Luapula, Mweru, Mweru-Wantipa, Lake Tanganyika and the Zambezi flood plain.

(vi) Tourism: Recreation uses of water resources have often been ignored, but there is potential for developing sustainable and profitable boating and fishing tourism facilities, particularly on Lake Kariba and Lake Tanganyika.

6.1.7 Environmental Issues in the Water Sector

(i) Domestic water supply: Low levels of water are available to most urban dwellers, as described above, creating predictable health and welfare problems. Since the country has sufficient water resources, this problem is caused by inadequate abstraction, treatment and distribution.

(ii) Urbanisation: Many cities have grown on river catchments or banks, a location which compounds the many environmental water resource problems caused by large, unplanned and poor urban settlements. The rapid increase in urban population means that settlements have spilled over to flood plains and swamps. Water draining from hard surfaces in the cities are rapidly conducted to the adjacent areas, producing local floods, and problems in sub-surface biological systems. Increased pollution from domestic waste and inadequate sewerage can cause runoff into the water system.

The water system is further stressed by excess extraction, which can destroy the underlying aquatic system.

(iii) Mining and Industry: Water pollution from the leaching of heavy metals and other forms of industrial waste have a severe effect in the Copperbelt and Kabwe. Further, industrial effluent has been identified as a severe problem in the Kafue river by Kafue township. Procedures such as sand extraction and open cast mining may also contribute to siltation.

(iv) Deforestation: Loss of trees (through agriculture, charcoal burning and urban expansion) causes an increase in water run off and soil erosion. This increases flooding, reduces streams to annual status, and increases siltation. Runoff is increased by 10- 20% by deforestation (Mumeka 1986). In the Copperbelt area runoff is 50% higher than normal due to deforestation.

(v) Wetland destruction: Wetlands are destroyed by siltation, sedimentation and dam construction, the causes of which are discussed above.

(vi) Agriculture: Agriculture can cause harm to water resources where soil conservation measures are not adopted, through erosion and siltation. Further, improper use of agrochemicals can lead to toxification through run off and leaching.

These areas of concern in reality combine to form integrated problems, which are not tackled through pursuit through any one of the sectors mentioned above. For example, conflicts over water use are emerging in the Kafue basin, due to high demand for hydropower, agriculture development, and increasing urban domestic and industrial demand. The conflicts are greatest in the Copperbelt.

The water supply situation is critical during the dry season, more so following successive drought years. The minimum river flow during the dry season in Kafue in the Copperbelt is 6.45 m^3 per second, of which 58% is pumped from underground mines. Abstraction is 4.22 cubic m per second while 0.32 cubic m per second is lost through evaporation. If underground water pumping was reduced, there would be a deficit in availability with serious consequences for industry and urban domestic sectors. There are also consequences for water quality, as dilution for effluent discharges is greatly reduced.

6.1.8 Action Plan for the Water Sector

The environmental action plan for the water resources sector includes the following activities.

There are two strategies which must be followed in order to improve and develop the water resources of Zambia. Firstly, integrated river basin management will allow the adoption of an watershed area as a unit of management, which optimises water utilisation, conservation and management. Secondly, emphasis must be placed on water resource development, which will allow future needs to be met, and potential realised, whilst ensuring the sustainable use of this significant resource.

Specifically, the following actions are recommended:

(i) Improvement of drinking water supply in both urban and rural areas.

(ii) Building national and local community capacity to minimize the effects of drought and manage water resources

(iii) Carrying out a comprehensive inventory of water resources of the Kafue basin and developing and implementing programs to increase water availability and quality to all sectors.

(iv) Establishment and maintenance of a network for monitoring runoff, evapotranspiration and ground water levels in all the major basins.

(v) Training of manpower at both technical and professional levels.

(vi) Improvement of water transport in wetland areas.

(vii) Resolution of problems of transboundary rivers and lakes.

(viii) Review and amendment of legislation relating to shared water resources, water quality, extraction and conservation.

6.2: Forests

6.2.1 Recommended Actions

Recognising the importance of the forestry sector to socio-economic development and in view of the dangers of forest depletion, the NEAP recommends the following:

(i) To carry out immediately an inventory of forest resources, including an assessment of deforestation and its associated environmental costs, with the results used as the basis for developing a forest and natural resources management plan;

(ii) To review immediately forest produce fees (including stumpage, charcoal and concession fees) to reflect real and environmental costs, and to improve forest revenue collection so as to generate income for forest management and community development;

(iii) To improve forest research, extension and management through strengthening the capacity of the Forest and Natural Resources Departments;

(iv) To incorporate into forest policy and legislation the principle of private and community participation in forest management, including the sharing of revenue with local people;

(v) To develop a forest protection strategy through ZFAP that incorporates ecosystem representation, biodiversity conservation, and river basin management;

(vi) To support technical and professional forestry training at Mwekera Forest College and both Universities;

(vii) To promote tree planting and agro-forestry in conjunction with other organisations including NGOs and CBOs;

(viii) To merge the departments of Forestry and of Natural Resources, amending the legislation as necessary, to streamline operations.

6.2.2 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Assess forest resources & costs of depletion	1	Immediate & medium term	FD
Review of forest products fees & revenue collection system	1	On-going & short term	FD, DOE
Merge & strengthen departments of Forest & Natural Resources	2	Medium to long term	MENR
Develop framework for community & private sector participation in forest management	1	Short to long term	MENR
Human resource development	1	On-going and long term	MENR
Promote tree planting & agroforestry	1	On-going and long term	MENR, MAFF, NGOs, CBOS
Develop forestry protection strategy for biodiversity & ecosystem conservation	3	Medium to long term	FD, CBU, UNZA

6.2.3 Review of the Forest Sector

The forest sector is potentially very important to national development and human welfare. For example, wood fuel (firewood and charcoal) is the main cooking energy source for over 90% of the households in the country. The charcoal industry in 1991 was worth 5 billion Kwacha or 2.3% of GDP, while the rest of the forest sector contributes about 3%? to GDP.

It is estimated that charcoal production provides full-time employment for about 41000 people in rural areas and another 4500 are employed in charcoal transportation, marketing and distribution (Hibajene & Chidumayo 1993). Forests are sources of construction wood. In 1992 timber and pole production from industrial plantations was 67500 cubic metre (Central Statistical Office 1992). Forest food resources, such as, fruits, vegetables, mushrooms, roots and tubers, which provide essential micronutrients are harvested from indigenous forests for subsistence needs and sale. Edible insects, such as, caterpillars and termites, and secondary products, such as, honey and beeswax, are all prized forest products in high demand in the country. Forests regulate the flow of water to provide for industry, agriculture and households; they protect catchments from soil erosion and regulate global climate through maintenance of the balance of atmospheric chemistry.

However, the potential of the forest sector has not been realized because forestry and natural resources institutions have little capacity to carry out research, develop and manage the country's forest resources. Forest policy must aim at economic efficiency, equity, growth, welfare, sustainability and food security.

6.2.4 The Forest Resource Base

About 80 % of the country is potential forest and woodland but 20 % has been converted to agriculture. The remaining 60 % contains about 3000 million t (dry weight) of wood, with an annual increment of 30 million tonnes (Chidumayo 1993a).

Indigenous forests are rich in biodiversity: they contain about 5500 species of flowering plants, 88 species of mosses and 146 species of ferns (Chisumpa 1990; Phiri & Ochyra 1988; Kornas 1979). The forests range from evergreen forests (3 million ha), deciduous forests (1 million ha), deciduous savanna woodlands (53.5 million ha) and scrub (2.8 million ha). Grassland covers 13 million ha. Of these vegetation types, the miombo (Brachystegia-Julbernardia) woodland is the most extensive and covers 35.3 million ha.

With the exception of a few hard woods, such as, mkusi (Baikiaea plurijuga) teak and mukwa (Pterocarpus angolensis), indigenous forests in Zambia are poor in commercial timber species. The stocking rate of these valuable hard woods ranges from 0.5-2.0 t per ha and there are only five main commercial timber areas in the country (Figure 6.2). Indigenous forests have potential for small-scale commercial beekeeping in many parts of the country, especially in Northwestern and Western Provinces, where there are already traditional beekeeping activities.

Government-owned forest plantations of tropical pines and eucalyptus have been established to meet the industrial timber needs of the country, although timber imports have continued. In 1990 the country imported 51000 cubic metres of coniferous and non-coniferous sawn and rough timber. These plantation cover about 59000 hectare throughout the country but 90 % of this is in the Copperbelt Province.

6.2.5 Forest Management

For management purposes, the forest resources are divided into three zones: forest reserves, unreserved forests and industrial plantations.

The Forest Act of 1974 established local and national forest reserves in which logging and collection of forest produce is regulated by the Forest Department.

No settlements are allowed in forest reserves which cover about 10 % of the country (Figure 6.2). These are intended for conserving and developing forest resources to ensure secure supplies of timber and other forest produce. National forest reserves have the additional function of protecting watersheds.

The Forest Department is also responsible for licensing the harvesting of forest produce for sale in unreserved forests, while management is the responsibility of the Natural Resources Department. Industrial plantations in the Copperbelt Province are managed by the Zambia Forest and Forest Industries Corporation (ZAFICO).

The current forest policy (which is under review) places too much responsibility on the Forest Department. The following are the main elements of the forest policy.

(i) Placing under government control and managing forest areas needed to protect land against floods, erosion and desiccation and to maintain and protect the flow of rivers.

(ii) Carrying out in each district forest surveys and determining the forest resources for each district and the forest areas needed to be managed for land protection and for local and industrial supplies of forest produce.

(iii) Carrying out all necessary research work on ecology, protection, management and restocking of indigenous forest areas.

(iv) Placing under government control land for forest plantations needed to provide forest produce for people's homes, farms and local industries.

(v) Spreading amongst the people of Zambia an understanding and value of forests and to provide training opportunities for people engaged in forest work.

(vi) Advising and encouraging local authorities and private enterprises in the practice of sound forestry.

(vii) Integrating the country's forests in a wise system of land use and in the development of the nation's other natural resources.

The goal of the forest policy has been to increase the area under forest reserves from 10 % to 15 % of the country. This goal will probably never be achieved because additions to and excisions from the existing area have maintained the forest reserves at about 7.44 million ha during the 1981-1991 period and there is a growing pressure, both political and public, to reduce the area under forest reserves. Current failure to properly manage the existing forest reserves is also working against the campaign to increase the area under forest reserves. Improving indigenous forest management is therefore a necessary precondition for meeting the forest policy objectives.

6.2.6 Environmental Issues in the Forest Sector

The environmental issues in the forest sector are associated with the way in which forest resources are managed and exploited.

Commercial exploitation of indigenous hard woods started during the third decade of the 20th century. Mkusi teak forests in southwest Zambia have been exploited for railway sleepers, mining timber and furniture since the 1920s and in the 1970s the rate of exploitation was estimated at 12000 tonnes per year (van Gils 1988). In the Copperbelt area, miombo woodlands have been exploited for mining timber and poles since the 1930s (Lees 1962). This selective felling resulted in the over exploitation of some species.

For example, mukwa has largely been overexploited in the central region of the country, although some stocks exist in the western, northwestern, northern and eastern regions of the country. In most cases, natural regeneration is poor in the exploited areas and no artificial regeneration is taking place. Such type of exploitation, without adequate management, is clearly unsustainable.

Little is known about the impact of harvesting other forest products, such as, medicines and wood for crafts making. There are currently eight species in Zambia on the world list of endangered species (World Conservation Monitoring Centre 1993).

The major commercial forest produce from indigenous forests in Zambia is charcoal used for cooking in 83% of the urban households (Hibajene & Chidumayo 1993). The charcoal used by urban households represents 87% of total national consumption. And total charcoal consumption increased from 510000 t in 1980 to 588000 t in 1990 (Chidumayo 1993a). This represents a 1.5% annual increase in consumption compared to the population growth rate of 3.2%.

Charcoal is produced in traditional earth kilns which have a wood to charcoal conversion rate of 23% (Chidumayo 1991). This implies that 2.5 million t of cord wood was used in 1990 to produce 588000 t of charcoal. Given a cord wood stocking rate of 65 t per ha in miombo woodland, the main source of raw wood, charcoal production in 1990 represented a deforestation rate of 39000 ha or 8% of the annual production. Some of the charcoal is made from wood on land being cleared for agriculture. This would reduce the hectarage of deforestation caused primarily by charcoal production.

It is apparent therefore that at national level, deforestation caused by charcoal production is not as significant as is generally made to be. However, the problem assumes greater significance in Copperbelt, Central and Lusaka Provinces, where 76% of the urban population lives. During carbonization the earth kilns emit large amounts of carbon monoxide, carbon dioxide and volatile elements, contributing to the build up of green house gasses. Charcoal producers may be exposed to as much as 13 ppm of carbon monoxide although few exceed the occupational hygiene limit of 35 ppm monoxide during an 8-hour shift (Hibajene & Chidumayo 1993).

The deforestation occurs in both forest reserves and unreserved forests and deforested areas are not managed properly to enhanced natural regeneration. Furthermore, less than 10% of the stumpage and charcoal removal fees is collected by the Forest Department. Total government revenue from charcoal production, if collected, was estimated at K120 million in 1990.

Annual productivity of regenerating woodland is estimated at 2.5 t per ha of which 40% is cord wood suitable for charcoal production (Chidumayo 1993b) With better management, this production can be doubled. Deforestation caused by charcoal production is therefore as much a problem of management failure as it is of over exploitation, especially in the Provinces with large urban populations.

The main factor reducing the productivity of indigenous forests is uncontrolled bush burning. In regenerating miombo woodland,late dry season bush fires reduce wood annual increment by 50% (Chidumayo 1993c). Bush fires also destroy industrial plantations. A total of 36000 ha were affected and timber on 3200 ha destroyed by fires in the Copperbelt Province during 1975-1993. Since bush fires are man-made, their control will have to involve local communities. Bush fires also generate large amounts of green-house and other reactive gases which may upset atmospheric chemistry and contribute to global warming. The characteristic hazy atmosphere during the late dry season is largely caused by particles generated by widespread bush fires. Little is known about the ecology, silviculture and responses to harvesting of indigenous forests. Research needs in these fields are clearly obvious.

Current activities in the sector include:

(i) The national tree planting programme, which aims to plant 20 million seedlings per year, between 15 December and 15 January. In fact, only 10 million trees have been planted since 1985;

(ii) The soil conservation and agro-forestry programme, which works with farmers in collaboration with MAFF and through the regular extension system;

(iii) Fuel wood plantations have been established around urban areas (80 ha since 1980)

6.2.7 Action Plan for the Forest Sector

Strategies for dealing with environmental problems in the forest sector address three issues: law and institutional reform, research and training and indigenous forest management.

The Forest Act of 1974 should be reviewed in order to:

(i) Facilitate the involvement of local people and the private sector in forest management and the provision of incentives;

(ii) Amalgamate the Forest Department and the Natural Resources Department

Training and retraining manpower in indigenous forest management and strengthening capacity to carry out inventories and monitoring activities. Mechanisms for involving the private sector in these activities should be worked out and implemented. The two universities should be supported to develop and mount appropriate undergraduate and graduate courses in forestry and natural resources.

Forest management should be improved through the following.

(i) Involving local communities and the private sector in sustainable utilisation, development and management of forest resources by the provision of incentives and transfer of ownership of forest resources.

(ii) Integrating agriculture, tree planting and natural forest management, especially in areas where deforestation has occurred due to agricultural activities.

(iii) Reviewing forest produce fees (including stumpage, charcoal and concession fees) to reflect real and environmental costs, and to improve forest revenue collection so as to generate income for forest management and community development;

(iv) Strengthening the forest extension service;

(v) Strengthening forest product and market research.

Current activities in the forest sector include the following.

(i) The national tree planting programme. This programme aims at planting 20 million tree seedlings per year during the tree planting month, from 15 December to 15 January. But since the programme started in 1985 less than 10 million seedlings have been planted.

(ii) The soil conservation and activities programme. This is a collaborative programme between the Departments of Agriculture, Forest and Natural Resources to encourage farmers and communities to practice soil conservation and activities. The programme is implemented through the agriculture extension service.

(iii) Establishment of fuel wood plantations. This project aims at establishing fuelwood plantations to supply woodfuel to urban areas, such as, Lusaka. Since 1980 only 80 ha have been planted.

(iv) The Zambia Forest Action Plan. Following the development of the Zambia Forest Action Plan, the Department of Forest is involved in the implementation of the Plan.

6.3: Wildlife Resources

6.3.1 Recommended Actions

The wildlife sector has much to contribute to economic development, and towards this end, the following recommendations are made:

(i) To develop separate management policies for National Parks and GMAs, including local community involvement (including revenue sharing) and private sector participation (through granting of management concessions with appropriate user rights and obligations), under the administration of NPWS;

(ii) To develop management plans for National Parks and GMAs and to implement them immediately where there is threat from human encroachment;

(iii) To restructure NPWS and increase community based wildlife initiatives;

(iv) To improve law enforcement by increasing manpower and resources, and strengthening the law with greater deterrents;

(v) To support technical and professional training of wildlife officers at wildlife schools and both Universities;

(vi) To carry out EIAs prior to granting permits for mining, fishing tourism and logging in National Parks and GMAs, and to charge deposits against inadequate rehabilitation of sites to holders of mineral rights;

(vii) To introduce environmental standards for tourism development in National Parks, GMAs, and game ranches;

(viii) To assess wildlife resources and depletion costs for future policy development and investment.

6.3.2 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Develop separate wildlife policies for national parks & GMAs	2	Medium to long term	NPWS
Transfer of NPWS from Tourism to MENR	1	Immediate	MOT, MENR
Develop & implement management plans for national parks and GMAs	1	On-going and long term	NPWS
Reorganise & restructure NPWS	2	On-going and medium term	NPWS, MOT, MENR
Improve law enforcement	1	On-going and long term	NPWS
Human resource development	1	On-going and long term	NPWS, UNZA
Assess wildlife resources & costs of depletion	1	On-going and long term	NPWS
Enforcement of EIAs	2	Long term	NPWS, ECZ

6.3.3 Review of the Wildlife Sector

Zambia is rich in fauna resources. For example, vertebrate species in the country are estimated at 1,330: 65 amphibians, 156 fishes, 145 reptiles, 731 birds and 233 mammals. No comprehensive list of invertebrates exists, although it is common scientific knowledge that these make up the majority of fauna in Zambia. This fauna diversity and its ecosystems are given legal protection in 19 national parks and four bird sanctuaries. National parks cover 8.4% (6.4 million ha) while game management areas (GMAs), in which regulated game hunting is permitted, cover 22% (16.6 million ha) of the country (Figure 6.3). In addition there are 19 game ranches and seven crocodile farms under private sector management. National parks and GMAs are managed by the Department of National Parks and Wildlife Service whose main functions include the following.

(i) Managing national parks for the protection of ecosystems and biodiversity and objects of scientific, prehistoric or historical and aesthetic interest including the repopulation of depleted parks.

(ii) Management of Game Management Areas for control and utilization of wildlife and plant species.

(iii) Planning and development of tourist infrastructure in National parks in conjunction with the private sector;

(iv) Promotion of wildlife utilisation, as an alternative form of economic land use outside national parks.

(v) Encourage the development of appropriate economic activities to mitigate pressure on wildlife resources

Wildlife resources are important to national heritage, economy and local communities. The values of wildlife include the following.

(i) Wildlife ecosystems in national parks represent a rich natural heritage of biological diversity for cultural, educational, aesthetic, ethical and scientific values

(ii) Rural populations rely heavily on bush meat as a source of protein and a variety of mammals are so utilised

(iii) Safari hunting and non-consumptive wildlife-based tourism generate employment for local people and revenue for government. In 1993 government revenue from these activities was estimated at over K500 million

(iv) Wildlife provides materials for a range of industries.

6.3.4 Environmental Issues in the Wildlife Sector

The main objectives of the wildlife sector are to

(i) optimise the productivity of wildlife species

(ii) promote sustainable utilisation of wildlife to improve human welfare

(iii) preserve biodiversity.

These objectives have not been realized due to a number of problems.

(i) Illegal hunting and over exploitation. Illegal hunting, often for commercial purposes, is one of the most important causes of wildlife decline in Zambia. Factors such as poverty, foreign exchange restrictions and easy availability of military weapons have promoted illegal game hunting and over exploitation. For example, elephants which in 1980 were estimated at 100,000, were less than 22,000 in 1993. The population of rhino has declined from 15,000 in 1980 to less than 100.

(ii) Land use pressure. Human encroachment in areas around national parks, and unplanned settlements in GMAs, pose a threat to wildlife conservation. Human settlements are associated with agriculture, livestock, grazing, fishing, deforestation and illegal hunting. These activities are not always compatible with wildlife conservation. Settlements in GMAs are expanding and therefore more land is being converted to agriculture. Already, seven national parks (25%) and 20 GMAs (48%) are degraded as a result of land use pressure. Apart from degrading wildlife habitats, human settlements obstruct wildlife migratory routes for feeding or breeding.

(iii) Dam development. Dams are known to have serious ecological consequences where ever they have been constructed (Scudder, 1989). There are four large dams in Zambia. Large scale dam developments as experienced at Kariba (1958) and Itezhi tezhi (1976) resulted in wide displacement of animals and loss of habitat. However, the full impact of these dams has not been fully documented due to lack of systematic monitoring.

(iii) Road construction. The Kafue and Mweru Wantipa national parks are among the national parks that have been adversely affected by road construction. Although knowledge is limited on the impact of road construction in the country, habitat alteration and loss of micro wetlands habitats have been observed. Furthermore, access roads are associated with increased human traffic and influx of people including fishermen, timber loggers, honey collectors and poachers, and they attract human settlements.

(iv) Large roads tend to obstruct animal migratory routes which might be important for breeding and feeding purposes. These potential effects could be minimized if roads developments were proceeded by Environmental Impact Assessment.

(v) Mining and prospecting. Possible impacts of mining operations on wildlife includes vegetation destruction, disturbance of breeding and feeding patterns, loss of habitat and poaching. Mining in protected areas has occurred in Lukusuzi national park for the precious stones, Lochinvar national park for gypsum and Mweru Wantipa national park for salt. While these operations may have social and economic justification, they nevertheless cause problems to wildlife management and require careful planning before implementation.

(vi) Logging activities. Much of logging is carried out in Lunga, Luswishi, Mumbwa, Mbala, Mulobezi and Lupande GMAs. The impact of logging varies with the system of cutting and levels of operations. Much of the logging in Zambia is selective cutting for species such as Pterocarpus angolensis (Mukwa). Potential effects of logging on wildlife include loss of habitat (mainly nesters), habitat alteration for woodland species, and disturbance.

(vii) Tsetse control. Large parts of Zambia are infested with tsetse fly, and nearly all protected areas are affected by its distribution. In the past tsetse control used a variety of methods such as wildlife elimination, clear cutting of trees, construction of fences and holding lines, chemical application, and trapping (Stevenson 1988). While the effects of these methods have not been fully evaluated, eradication of the fly may mean exposure of protected areas to other land uses particularly human settlements agriculture and live stock grazing. This would lead to more land use pressure and resource degradation.

(viii) Fishing activities. Conflicting activities in Lakes Tanganyika, Mweru Wantipa, Luapula, Busanga, Luangwa, Lukanga and Kafue Flats have posed serious problems to conservation of wildlife resources. Fishing usually antagonize crocodiles (Crocodylus niloticus, C. cataphractus), Hippopotamus, while species such as Sitatunga, Lechwe and those of the Water fowl are largely threatened by such activities. Nesting sites of birds, mostly the Shoe Bill Stork (Balaeniceps rex) in Bangweulu, and Spurwing Goose (Plectopterus gambensis), in Kafue Flats have been severely disturbed, and to a large extent destroyed through fishing activities.

(ix) Tourism development. The conflict arising from tourism development in national parks is a consequence of uncoordinated and bad planning that have caused overcrowding and bad tourist behaviour. Bad planning relates to infrastructure development and the channelling of tourists inside the park, which causes overcrowding. While there has been no real concern of the effect of tourism development in Zambia, its potential negative effects should not be ignored. We cannot rule out the potential for this problem. Infrastructural developments in Musi-oa-tunya, Lochinvar, Kafue and Luangwa South national parks are indications of poor planning which should be avoided in the future.

(x) Bush fires. Uncontrolled bush fires pollute the atmosphere and damage wildlife habitats. They are largely man-made, and should be controlled to avoid these consequences.

(xi) Management plans. The absence of management plans for both national parks and GMAs has contributed to failure to resolve land use conflicts and establish acceptable zoning for wildlife management.

(xii) Institutional and manpower capacity. Inadequate and/or absence of skilled manpower in the National Parks and Wildlife Service, both in law enforcement and wildlife research, has also contributed to the low success in wildlife conservation.

6.3.5 Community Participation in Wildlife Management

The creation of national parks and GMAs did not always had the support and/or approval of local communities. This has caused resentment among local communities and this has been the root cause of conflicts with the National

Parks and Wildlife Service in wildlife areas. Until mid-1980s local communities were not involved in wildlife management and this contributed to resource over exploitation, as local communities saw no benefit from wildlife utilisation.

With the initiation of community-based wildlife management programs, the situation has improved. These programs of joint wildlife management with local communities in GMAs are based on two principles established by the Administrative Management Design (ADMADE) programme:

(i) Revenues derived from the use of natural resources in the protected area should be returned to the area for reinvestment in the local economy.

(ii) Establishing a system of user rights with defined rights of access to wildlife resources for communities inhabiting GMAs or living around the National Parks.

ADMADE, whose main activities are carried out in GMAs, started in 1985 (Mwenya and Lewis 1989). In many of the ADMADE GMAs game populations have increased and local attitudes towards wildlife conservation have substantially improved in favour of conservation.

Two other programmes have adopted the ADMADE approach. The Luangwa Integrated Resource Development Programme (LIRDP) started in 1985 and is located in South Luangwa national park and the Lupande GMA. Results have shown drastic reduction of illegal hunting in the areas while local communities have benefitted through improvements in infrastructure and provision of social services. The WWF-Zambia Wetlands Project is located in Kafue Flats and Bangweulu swamps. The project started in 1986 and has promoted the participation of local inhabitants in conservation of wetlands and development.

Although the ADMADE style programmes are showing positive benefits of involving local communities in wildlife management through revenue sharing mechanisms, there is still inadequate capacity to ensure efficient financial management and accountability, both at the departmental and local community levels. The programmes thereby fail to meet community needs, and their is threatened.

6.3.6 Action Plan for the Wildlife Sector

The Action Plan Strategy in the wildlife sector aims at the realization of wildlife resources potential in Zambia through the following activities.

(i) Review of the current protected area system;

(ii) Involvement of the private sector in national park management through joint management concessions;.

(iii) Development and implementation of management plans for national parks and GMAs.

(iv) Carrying out comprehensive inventories of wildlife resources in order to optimize long term utilisation.

(v) Carrying out regular reviews of the current safari hunting system, and considering periodic evaluations of both the hunting blocks as well as the companies so as to minimize risks of over exploitation.

(vi) Reviewing the suspended trade of elephant ivory, taking long term views of both economic considerations and the implications for the elephant population;

(vii) Encouraging the establishment of more game ranches and other similar category of farming such as the crocodile and ostrich farming.

(viii) Permitting land holders access to user rights for wildlife on their land.

(ix) Adoption of appropriate methods to facilitate community participation in wildlife planning and management;

(x) Supporting training of skilled manpower in wildlife management at the University of Zambia and at the wildlife training schools in the country.

(xi) Development of an effective strategic policy framework which should give clear objectives for the wildlife sector and improving legislation to ensure support for the institutional structure and sustainable conservation of wildlife resources.

6.4: Fisheries Resources

6.4.1 Recommended Actions

The following actions are recommended:

(i) To strengthen law enforcement to prevent illegal fishing methods and control the introduction of fish species from outside and among fisheries;

(ii) To improve fisheries management as part of an integrated river basin strategy

(iii) To review fish levies in order to contribute to management costs and encourage community participation in sustainable resource management through revenue sharing

(iv) To control illegal waste disposal from fishing and tourist vessels and other forms of water pollution, in conjunction with the Ministry of Transport and the ECZ.

(v) To develop and promote fish processing techniques with minimum negative environmental impact, in conjunction with Ministry of Energy, NGOs and CBOs. This may include planting fuelwood lots where appropriate

(vi) To strengthen fisheries research through development of manpower and facilities to provide reliable data on fish productivity and stock depletion.

(vii) To propagate and replenish stocks of endangered and depleted species ;

(viii) To negotiate and implement international treaties for the conservation and management of shared water bodies.

6.4.2 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Improve law enforcement	1	On-going and long term	DOF
Develop strategy for fisheries management	2	On-going and long term	DOF
Develop framework for community & private sector participation in fisheries management	2	Long term	DOF, LA
Control of water pollution in fisheries	2	Long term	DOF, ECZ, MCT
Develop & promote environmentally friendly fish processing techniques	1	Long term	DOF, FD, DOE, NGOs
Develop human resources & data bank	1	On-going and long term	DOF, ECZ
Implement international treaties on shared fisheries	3	On-going and long term	MAFF, ECZ, MCT, MEWD

6.4.3 Review of Fisheries Sector

Fisheries of Zambia cover approximately 45,000 sq.km or 6% of the country. These consist of lakes, wetlands, rivers and palustrine systems. Among the major fisheries are Lakes Tanganyika, Kariba, Itezhi tezhi, Mweru, Mweru Wantipa, Bangweulu and Lukanga, Upper Zambezi, Kafue, Luapula, Chambeshi and Luangwa Rivers (Figure 6.4). The Department of Fisheries was created with the primary responsibility of:

(i) Increasing fish production as well as increasing per capita consumption and creating opportunities for employment and incomes of fishermen and fish farmers.

(ii) Improving the quality of fishing equipment, promoting sustainable methods, fish processing and providing credit and other incentives to fishermen and fish farmers so that they can expand their operations.

(iii) Conducting ecological studies of various water systems, with emphasis on limnological investigations, fish stock assessment, productivity and distribution.

The department has also been responsible for assisting farmers in developing the fish culture industry, and to day there are 7407 fish ponds in the country, of which the highest numbers occur in Northern (2538), North Western (2390) and Luapula (1957) Provinces.

Fish resources play a significant role in the national economy and human welfare. Fish is a major source of animal protein in the diet of Zambians. Zambia currently produces over 70,000 tonnes of fish annually (Table 6.1), with most of it coming from Lake Tanganyika, Bangweulu, Lake Kariba, Upper Zambezi, Mweru Wantipa, Mweru/Luapula and Kafue.

Table 6.1 Estimates of Total Fish Catches in Major Fisheries Areas (in tonnes) during 1985 to 1991

YEAR	BANG-WEULU	KAFUE	KARIBA	MWERU LUAPULA	MWERU WANTIPA	LAKE TANGANYIKA
1985	12533	5008	1938	10785	9220	1490
1986	8125	4264	2223	6284	7000	12978
1987	11993	5955	3136	7707	9497	12452
1988	10059	4440	2888	6996	8249	10629
1989	9019	8569	2651	7190	7039	14386
1990	9101	7335	2237	7522	8490	15411
1991	11539	5972	1974	6987	7220	14133
TOTAL	72369	41543	17047	53444	56715	94889

The fishing industry offers significant levels of employment. Estimates show that nearly 300,000 households either directly or indirectly earn income or part of their income from fishery related activities, such as fishing, fish processing, transporting and trading. Fishing in some fisheries is an important sport and recreation for tourists. Fish is also used for ornamental purposes and some fishes are exported for the pet industry.

6.4.4 Environmental Issues in the Fisheries Sector

The primary goal of the Department of Fisheries is to double the current catch of 70,000 t by the year 2010. However, to achieve this a number of issues need to be resolved. Many of these issues contribute to poor management of fisheries and/or the depletion of the resource base.

Over fishing is the major threat to sustainable fisheries production in Zambia. Over fishing is caused by both the overgrowing number of fishermen that is exerting intolerable fishing pressure on many fisheries and the use of bad fishing methods, such as the use of destructive fishing gear, fish poisoning and dynamites. The effects of over fishing are most severe on fish populations during breeding migrations. Fisheries with signs of depletion, such as species disappearance and reduction in fish size and catches, are Mweru Wantipa, Luapula, Mweru, Bangweulu, Kafue Flats and Lukanga swamps.

There is inadequate management of fisheries as a result of low capacity to properly supervise and control fishing activities, lack of good data and monitoring of fish stocks and lack of management guidelines for small fisheries. The unregulated introduction of exotic species into natural fisheries is a potential threat to indigenous fish resources. Pollution arising from effluent and waste disposal from industries, large settlements, mining and agrochemicals in runoff from agricultural lands, although not widespread, poses a threat to fish productivity, especially in small rivers and lakes.

Fishermen communities and fish processing by smoking depend on firewood from catchment areas adjacent to fisheries. Fishing activities therefore have contributed to deforestation. Deforestation has adverse effects not only on the welfare of fishermen communities due to wood scarcity and high cost of obtaining wood, but can also result in increased soil erosion in the catchment areas and the silting of fisheries.

6.4.5 Action Plan for the Fisheries Sector

Since problems associated with fisheries conservation emanate from various uses of land and water within the river basins and the detrimental effects of these uses on water ecosystems are well recognized, the fisheries management strategy should be based on a fully integrated approach to water ecosystem management with the river basin as the basic unit of management. This will ensure minimal impact of land and water uses on fish communities. In particular the strategy should focus on the:

(i) control of soil erosion, run off and sedimentation in the riverine and lacustrine systems,

(ii) maintenance of water quality,

(iii) maintenance of water flow to all fisheries and

(iv) identification of sites and fish habitats that may have high productivity or that are fragile for special protection or improvement.

The management of both major and minor fisheries requires the following activities:

(i) Reviewing of the current restrictions on fishing gear and strengthening of capacity to effectively supervise and control fishing activities, including fishing effort

(ii) Establishment of community based fisheries management in order to promote local participation in fish management.

(iii) Carrying out fish inventories and monitoring the status and productivity of each major fishery to determine and enforce yield standards to forestall fish depletion.

(iv) Supporting training of skilled manpower at both technical and professional levels within the country and strengthening extension services to further expand fish farming throughout the country.

(v) Development of a strong and comprehensive fish policy and an appropriate legislation to support fisheries development and management.

7: TOURISM

7.1: Recommended Actions

Without proper planning tourism could have serious negative effects on the environment. To promote this, the following actions are recommended:

(i) To ensure coordination and regulation, the NPWS should be transferred to MENR;

(ii) To carry out EIAs prior to significant tourist development in protected areas, to be approved by ECZ, and all major tourism sites to be approved by institutions managing the area and ECZ.

7.1.1 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Transfer of NPWS from MOT to MENR	1	Immediate	MOT, MENR
Enforcement of EIAs	2	Long term	MOT, MENR, ECZ, NPWS

7.2: Review of the Tourism Sector

The tourism industry in Zambia when fully developed could form one of the major sources of foreign exchange earnings.

At present the contribution of tourism to GDP is probably very small. In 1983 earnings from tourism were estimated at K147 million of which K70 million and K77 million were foreign exchange and domestic earnings, respectively (Central Statistical Office 1992). But the number of tourist arrivals increased from 108000 in 1988 to 159000 in 1992, after reaching a peak of 172000 in 1991. Of these arrivals, 56% were visiting friends and relatives, 24% came on holiday and business and 21% were in transit. Bed capacity to accommodate tourists has also increased from 4270 in 1979 to 7000 in 1992.

Great potential exists for further development in the tourism industry. The current policy of the tourism industry is to make a meaningful and expanding contribution to the national economy through privatisation and the provision of investment incentives. The role of government is to put up and maintain the basic infrastructure while the private sector concentrates on the development of tourist facilities.

There are a number of institutions involved in the tourism industry under the Ministry of Tourism. The Zambia National Tourist Board facilitates tourist operations, ensures high standards in the tourism product and markets tourism within and outside the country. The National Parks and Wildlife Service manages 19 national parks for the conservation and protection of wildlife and sites of authentic prehistoric, historical and scientific interest occurring within national parks. The National Museums Board establishes, controls, manages and develops national museums in the country. The National Heritage and Conservation Commission conserves Zambia`s heritage, both natural and cultural. The Commission looks after 1600 archaeological, historical and natural sites. The Hotels Board of Zambia establishes and enforces standards of cleanliness, sanitation and services in accommodation establishments.

7.3: Environmental Issues in the Tourism Sector

The potential of the tourism industry in Zambia lies in the uniqueness of certain resources, such as, wildlife and landscapes, buildings and cultural artifacts. Since the natural and cultural resources are unique, fixed in location and often irreplaceable, it is important to control the degree and manner in which they are exploited and to anticipate the effect on the sustainability of tourism of different methods of exploitation. Tourism in Zambia is primarily wildlife based ; other attractions where naturalness needs to be preserved are lakes and waterfalls, cultural monuments and relics which are found throughout the country (Figure 7.1).

Investment in tourism during the early 1990s was phenomenon (Figure 7.2). This type of investment must be supported by proper tourism development planning to minimize and prevent undesirable effects on tourist attractions and the environment.

Tourism activities which have a bearing on the environment include development of accommodation establishments, infrastructural developments, such as, access roads to national parks, aerodromes and airstrips, and the production of carvings and sculpture for sale to tourists. Unfortunately, current tourism research tends to emphasize economic impacts at the expense of social and environmental impacts.

Infrastructural developments, such as, hotel complexes in resort centres has contributed to architectural pollution. Examples include the Modi-oa-Tunya Intercontinental hotel in Modi-oa-Tunya national park and Chichele Lodge in South Luangwa national park.

When tourist attractions are either surrounded by people or found amongst people, population pressures intensify competition between tourist development and other land uses, such as, agriculture, fishing and industry. This type of pressure now threatens the integrity of Modi-oa-Tunya national park in Livingstone. Land is being excised from the park by urban development projects. The Victoria Falls hydro-power scheme has diverted the water on the Zambian side of the Zambezi river for power generation. Consequently, the falls, which is a world heritage site, is turned into a mere cliff during the dry season when riverflow is low.

In other cases, development of tourist facilities does not consider the interests of local communities. The proposed plan to shift the local people from the Lake Kariba area to gave way for further tourism development is insensitive and will disrupt the welfare and livelihood of the local people. These valley people have already suffered enough from the first movement when the Kariba dam was constructed. Furthermore, the uncoordinated developments at the lake has already reduced access to the lake and its resources for the local people. In the meantime, traffic congestion, especially during weekends and public holidays, causes overcrowding, automobile air and water pollution.

In South Luangwa national park, inadequate infrastructure, especially access roads and game viewing loops, has resulted in over utilisation of the limited facilities and soil erosion. Animal trails have been disturbed and walking safaris have caused vegetation trampling.

The collection of objects for tourist purposes from areas where they were originally found results in both cultural and environmental degradation. This has increased the danger of complete loss of some of the moveable objects and deprivation of local communities of their heritage without adequate compensation.

Wood carvings and sculpture is the predominant trade aimed at tourists in the Modi-oa-Tunya national park and the nearby Mukuni village in Livingstone. This trade started in 1905 and has now overexploited the preferred trees of *Diospyros mesipilliformis, Combretum imberbe, Colophospermum mopane, Ricinodendron rautanenii, Afzelia quanzensis* and the palm tree, *Phoenix reclinata*. These trees are now locally very scarce and can only be obtained from very distant places.

7.4: Action Plan for the Tourism Sector

The implementation of the following strategies will minimize and ultimately prevent unnecessary negative effects of tourism development on the environment.

(i) All major tourist development activities should be subjected to environmental impact assessments;

(ii) Tourism development in protected areas must conform to management plans for the area, and emphasise experiencing the rural nature of national parks, using simple aesthetic designs maximising the use of local materials;

(iii) The structure of the Museums Board should be reviewed in order to enable the Board to regulate the setting up of private museums;

(iv) The surveying and inventorying of Zambia`s heritage and the listing and registering of Zambia`s immovable relics outside museums should be supported.

(v) Development of a tourism data bank through the collection and compilation of accurate statistics. The data bank should also be used for formulating tourism development plans.

(vi) Formulate and adopt medium and long term tourism development plans

Current activities involve the rehabilitation of the Victoria Falls by establishing permanent footpaths to various viewing points of the waterfalls in order to minimize destruction of vegetation through uncontrolled movements and the provision of public facilities, such as, toilets, eating shelters and resting benches.

8: MINING

8.1: Recommended Actions

By its nature, mining has great effects on the environment. To minimise degradation, the following are recommended:

(i) To carry out EIAs prior to issuing mining and prospecting licenses, and require the production of annual environmental audits for subsequent extension;

(ii) To study the environmental impact of small scale mining, with a view to formulating environmental policy for this subsector;

(iii) For the ECZ to compile environmental audits on existing mines, and develop a database on pollutants and degradation resulting from mining

(iv) To repeal the Smoke Damage Act, and effect mining mineral resources instructions

(v) To strengthen the capacity of ECZ, UNZA and NCSR to monitor mining pollution and enforce environmental standards specified in the EPPC Act

(vi) For Ministry of Mines to identify disused mines and develop a strategy for making them safe;

(vii) To establish a revolving fund under ECZ and financed by mining companies to repair emergency environmental damage caused by mining;

(viii) To develop incentives for the adoption of clean technologies (eg tax rebates, subsidies, exemptions);

(ix) To strengthen the Radiation Protection Service in the Ministry of Health.

8.1.1 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Enforcement of EIAs	2	Long term	MMMD, ECZ
Assess environmental impacts of small scale mining	1	Short term	MMMD, ECZ, UNZA, LA
Develop data base on mining pollution	1	On-going and long term	ECZ, MMMD, Private Sector
Repeal of Smoke Damage Act and enforce mining mineral resources instructions	1	Immediate	MMMD, ECZ
Enforce environmental quality standards	2	Long term	ECZ, Private Sector, NGOs
Develop strategy to make disused mines safe	1	Long term	MMMD, Private Sector, UNZA
Establish fund to finance emergency environmental damages in mining	1	Short term	MMMD, Private Sector, ECZ
Promote clean technologies in mining	2	Long term	Private Sector, MMMD, MOF, UNZA, ECZ

8.2: The Mining Sector

Zambia's economy still depends heavily on copper mining, although production has been declining since the 1980s (Table 8.1). The contribution of the copper industry to GDP has also declined from about 16% in 1980 to 8% in 1990 (Central Statistical Office 1992). This decline is due to many factors. The cost of copper production has increased because of mining ore of lower grade than before and the overvaluing of the local currency against hard currencies that prevailed during the 1970s and 1980s. The world demand for copper has also declined due to the introduction of copper substitutes, such as, aluminium and plastics. Recently optical fibres have started to substitute for copper in the telecommunication industry. In addition, the London Metal Exchange price of copper is subject to extreme fluctuations which have adverse effects on the copper dependent Zambian economy.

Table 8.1: Production of Major Minerals (in metric tonnes) in Zambia during 1983-1992. (based on Central Statistical Office 1992 and Muyunda 1993 for the 1992 data)

YEAR	METAL PRODUCTION (TONNES)				
	COPPER	ZINC	LEAD	COBALT	COAL
1983	576100	37800	14600	2410	453000
1984	523300	29800	8800	3470	511000
1985	479900	22800	8800	4360	511000
1986	459700	22500	6600	4340	557000
1987	483100	21000	8000	4480	463000
1988	422200	20200	6100	5060	524000
1989	450800	12900	3800	4490	395000
1990	426200	10600	3900	4620	330000
1991	398400	7400	3000	4630	345000
1992	441500	7300	2400	4700	-

The production of lead, zinc and coal also declined during the 1980s (Table 8.1); only cobalt production remained stable. However, revenue from the production of other minerals, such as,limestone, emeralds, silver and gold, increased from K41 million in 1980 to K2475 million in 1991 (Central Statistical Office 1992).

The mining industry accounted for 90% of the foreign exchange earnings and contributed 20% to GDP in 1992. The industry is dominated by a state owned conglomerate, the Zambia Consolidated Copper Mines (ZCCM) Ltd which employs about 55000 people. The small scale mining sector is dominated by open pit gemstone mining which is carried out throughout the country with concentrations in Ndola Rural, Lundazi, Chipata, Mumbwa, Kalomo, Nyimba and Mkushi.

In 1993 355 mining licenses were issued: 230 for metals and gemstones and 125 for building and industrial minerals. A total of 2000 permits were issued for sand, clays and aggregate quarrying. The valid licenses and permits represented a total area of one million hectares or 1.3% of the country. In addition, 85 and 985 exploration and prospecting licenses, respectively, were issued in 1993.

8.3: Environmental Issues in the Mining Sector

Large scale mining of lead and zinc started at Kabwe in 1906 and that of copper at Kanshashi and Luanshya in 1908 and 1931, respectively. The industry has grown since then by opening many copper mines in the Copperbelt area and a coal mine at Maamba,Southern Province, in 1968/69. By 1992 the country had produced over 26 million tonnes of copper and 3.5 million tonnes of lead and zinc. Mineral production of this magnitude implies considerable impacts on the environment.

Copper mining has involved both open-pit and underground digging. Lead and zinc mining consists solely of underground operations while coal extraction at Maamba is by open-pit quarrying. Both the copper ore in the Copperbelt and the coal-bearing rocks at Maamba have high concentrations of sulphur. The quality of the copper ore body has declined from an average of 3.4 % before the 1980s to 2.3 % in the 1980s and continues to decline at many operating mines. The production of copper therefore involves the displacement of large quantities of ore material, although production technologies have improved. In 1982 a total of 32 million tonnes of ore was mined to produce 586000 t of copper while in 1990 about 23 million tonnes of ore were mined to produce 426000 tonnes of copper. The mining of both copper and coal involves the pumping and disposal of large volumes of water from both underground and open-pit operations. This and the high sulphur content in the copper ore and coal-bearing rock and the large quantities of ore body mined imply potential environmental problems. These problems are of three types: land dereliction, water and air pollution.

8.3.1 Land Dereliction

Land dereliction in Zambia is mainly caused by subsidence of the overlying ground and is a feature of most underground mining areas. It is caused by both ore extraction and geological characteristics and can have disastrous consequences. For example, the subsidence of a tailings dam into a mine at Mufulira in 1970 killed 89 miners.

Mining dumps are caused by the disposal of very large quantities of waste rock, tailings and slag. Waste rock and tailings were estimated to occupy 10000 ha in the Copperbelt in 1992. Obtrusive paddock dams cause visual pollution and disfigure the natural landscape. These dumps have a high sand content of about 99% and are therefore subject to erosion by water and wind (Perera 1979).

Copper mining dumps have a high pH of about 8. This is caused by the high calcium content (6 %) which originates from lime additions during ore processing and is intended to control the oxidation of residual pyritic material in the dumps.

Mining dumps in the Copperbelt and Kabwe areas are now covered with top soil or organic waste to facilitate stabilization and rehabilitation, including revegetation. No such treatment is carried out on coal mining dumps at Maamba.

In an effort to reduce visual pollution by obtrusive paddock dumps, the copper mining company now uses valley dams which are easier to rehabilitate. However, since these obstruct natural drainage, headwater streams are diverted away from valley dam disposal areas. Large stilling ponds on the surface of valley dams allow for the complete settling of solids and natural oxidation and decomposition of potential pollutants before water is decanted into natural waterways.

Little attention has been paid to the problem of land dereliction caused by small scale mining of gemstones and quarrying for building materials, such as, sand, clay, laterite and stone. Quarrying leaves scarred landscapes, with consequential pounding, and soil erosion and siltation have been observed on small gemstone mines. Quarry ponds are favourable sites for the breeding of disease-causing animals, such as, malaria mosquitoes.

8.3.2 Water Pollution

Water pollution arises from run-off water from mining dumps, seepage from tailings dams and discharge of untreated wastewater.

The water pumped from underground and open-pit operations in the Copperbelt is not very acid, although it contains more suspended solids than natural surface water. This water is either used in the mining operations or is discharged directly into natural waterways. However, at Maamba coal mine, the open-pit water is very acid (pH 2 - 4) compared to acceptable water quality requirements of pH 6.5 - 9 for potable water. During the rainy season the quantity of water pumped from the pit varies from 3-7 million cubic metres and to neutralize this water requires 10000 t of hydrated lime which the company cannot afford.

Thus the water pumped from the pit and discharges from the slurry ponds and run-off water from stockpiles at Maamba cause acid pollution in natural streams. There is also a high concentration of suspended solids ranging from 100-1500 mg per litre compared to maximum permissible levels of 100 mg per litre. Unfortunately no studies have been done to assess the impacts of such pollution.

In the dry season pit effluents are impounded temporarily to facilitate the deposition of suspended solids.

Tailings dams in the Copperbelt area more risky to the environment than waste rock dams. Sometimes raw untreated wastewater from tailings dams enters natural water courses as a result of design faults and maintenance failures. Heavy rainfall during the wet season may also cause tailings dams to overflow and thereby polluting natural watercourses with heavy metals. During such occurrences copper content in natural waterways may be 23-120 times more than normal (Times of Zambia of 8 September and 17 November 1983). Such levels of heavy metal pollution are obviously harmful to humans and aquatic life.

In spite of such occurrences, the general quality of Kafue water in the Copperbelt area has remained satisfactory and meets the World Health Organisation drinking water standards (Table 8.2).There has also been a decrease in levels of pollutants since the 1970s. For example, from 1971 to 1978 the concentration of dissolved solids in Chingola stream after the discharge of effluents decreased from 1760 to 901 ppm while that of dissolved copper decreased from 11.2 to 3.8 ppm and that of cobalt from 2.7 to 0.6 ppm.

Table 8.2 Water Quality in Kafue River Downstream to the Discharge of Mining Effluents in the Copperbelt Area in 1987 (based on Muyunda 1993)

PARAMETER	CONCENTRATION (MG PER LITRE, EXCEPT FOR PH)		
	MEAN	PERMISSIBLE LIMITS	
		DESIRABLE	MAXIMUM
PH	7.7	7.0-8.5	6.5-9.0
TOTAL SUSPENDED SOLIDS	14	40	100
SULPHATE	29	250.0	400.0
DISSOLVED COBALT	<0.01	0.3	1.0
DISSOLVED COPPER	<0.01	1.0	1.5

8.3.3 Air Pollution

Sulphur dioxide emissions from roasting and smelting operations and the burning of sulphur-containing fuels are the main sources of air pollution in the Copperbelt area. Concentrations of sulphur dioxide occasionally exceed recommended levels of 600 micrograms per cubic metre per hour or 200 micrograms per cubic metre per day. However, because of favourable meteorological conditions, there is rapid dispersal of stack emissions and thermal inversions rarely persist for more than a few hours. As a result the sulphur oxides discharged by the copper industry rarely build up to hazardous levels. In 1977 the mean ground-level concentration of sulphur dioxide within 7 km of smelters at Rokana in Kitwe was 15-40 micrograms per cubic metre of air. At Luanshya and Mufulira concentrations of sulphur dioxide within 2 km of smelters were 100 and 78 micrograms per cubic metre of air, respectively.

Emissions are reduced by converting sulphur oxides to industrial sulphuric acid, some of which is used in leaching processes to recover copper from low grade oxide ores. In fact sulphur dioxide emissions have declined from 450000 tonnes per year in 1971 to 270000 tonnes in the 1990s (Perera 1979; Kaoma & Salter 1979; Muyunda 1993). Gaseous emissions and airborne dust particulates are deposited as acid rain and/or dust, respectively, around Maamba coal mine. Acid rain results from airborne particles and sulphur oxides from spontaneous combustion of the coaly mudstone in the spoil heaps. Combustion is reduced but not eliminated by covering the dumps with soil and compacting the waste rock by bulldozers. But both undercapitalisation and unprofitability have hampered the implementation of pollution control measures at Maamba.

Dust pollution is the main problem at the lead and zinc mine at Kabwe. During 1975-1978 lead concentration in the area within 2 km northwest of the smelter was 11 micrograms per cubic metre. Wind-blown dust is also responsible for the spread of pollution to other areas with consequential lead poisoning of humans and plants. Lead and zinc smelters are also sources of the poisonous thallium (Kaoma & Salter 1979). To control wind-blown dust pollution, ore dumps are wet paddocked or overlaid by non-dusting material coupled with grassing where possible.

Quarrying operations are often associated with dust and noise pollution, particularly when situated in or near residential areas. Dust pollution is the main pollution problem at Chilanga Cement, south of Lusaka. This pollution has adversely affected agricultural experiments at Mt Makulu Agricultural Research Station. The station has had to relocate its experiments to Chisamba area, north of Lusaka, at considerable cost because of limestone dust pollution by the cement company.

8.4: Action Plan for the Mining Sector

The Mines and Minerals Act of 1976 outlines regulations that govern the operations and abandonment procedures for the mining industry. The Mines Safety Department is responsible for enforcing safety regulations in the operations of the mining industry. The Mining (Dumps) Regulations were promulgated in the early 1970s to ensure that the status of existing and future dumps is assessed and monitored and that dumping did not pose a danger to mining operations and humans. Provisions also exist for the revegetation of dumps. The Smoke Damage Act indemnifies mine operators from actions brought against them for nuisances affecting the enjoyment of or damage to land in a smoke area. This Act is a deterrent to the protection of the environment and encourages inefficient operations and should therefore be repealed.

There is currently no environmental assessment requirement at project inception, licensing and implementation stages. This may have contributed to the negative environmental effects caused by the mining industry. The Ministry of Mines and Minerals Development should therefore create and incorporate an environmental assessment capacity at the licensing stage so that projects without sound environmental packages can be detected at an early stage. Provisions should also be incorporated in the Mines and Minerals Act for environmental protection during prospecting, mining and closure.

In addition, a clear environmental impact assessment policy should be put in place to ensure that all projects and programmes being implemented in the mining sector have been screened as a standard procedure.

The current efforts by the Ministry of Mines and Minerals Development to establish Mining (Pollution Abatement) Regulations is therefore commended and should be implemented. It is also necessary for mining companies to be obliged to have environmental protection capacity in their management and supervisory structures.

As the state divests itself from the mining industry, private entrepreneurs should be encouraged through the provision of incentives to invest adequate resources for environmental protection. Along with complying with the laws, standards and criteria that relate to health, safety and environmental matters, companies should establish their own environmental management systems to protect workers' health, the community and natural ecosystems. Mining companies should participate in environmental research and studies to develop new and more effective methods for environmental protection. Special attention should be given to research in the areas of resource recovery, mined land reclamation and air and water quality control. ZCCM Ltd is already recycling discarded tailings and at Nchanga

Division this process has been producing about 50000 tonnes of finished copper per year since 1981.

Large scale mining enterprises should be subject to EIAs before any licenses are issued, and should be required to produce annual environmental audits.

The small scale mining sector is extremely difficult to monitor for compliance with environmental protection measures. LAs should have a measure of environmental protection capacity and should enforce the necessary regulations on mining right holders in their respective areas. This seems the only feasible way of enforcing mining regulations in remote parts of the country where the MMMD and ECZ do not exist.

9: INDUSTRY

9.1: Recommended Actions

In order to reduce the environmental damage caused by industrial waste, the following actions are recommended:

(i) To introduce incentives for industries to adopt clean technologies, including the redesign of existing technologies, devised by MENR and ECZ in conjunction with MCTI and the Ministry of Finance.

(ii) For ECZ to survey industrial emissions, waste water and solid waste generation, in order to develop a database and disposal strategy;

(iii) To levy importations and production of non-recyclable packages, and provide incentives to companies engaged in recycling;

(iv) For local authorities to provide landfills and incineration facilities, levying companies producing large amounts of solid waste;

(v) For new companies to be obliged to produce an EIA as part of the licensing procedure and existing industries to produce annual environmental audits;

(vi) To establish a revolving fund under ECZ and financed by industry to repair emergency environmental damage, and research pollution reducing technologies and recycling

(vii) To strengthen the capacity of ECZ to monitor industrial pollution and enforce the environmental standards of the EPPC Act.

9.1.1 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Promote clean technologies in industry	1	Long term	MCI, UNZA, MOF, ECZ, Private Sector
Develop data bank on industrial pollution	1	On-going and long term	ECZ, MCI, Private Sector
Control of importation of polluting goods & packaging by disincentives	1	Long term	MCI, MOF, ECZ
Improve solid waste disposal	1	On-going and long term	LA, ECZ,UNZA
Enforcement of EIAs	2	Long term	ECZ, Private Sector
Enforce environmental quality standards	2	Long term	ECZ, Private Sector
Establish of fund to finance emergency environmental damages in industry	1	Short term	ECZ, MCI, Private Sector

9.2: Review of the Industrial Sector

The industrial manufacturing sector accounts for a quarter of GDP and 12 % of formal sector employment. However, there have been fluctuations in the growth of the manufacturing industry. Between 1975 and 1980 manufacturing production declined by 15 % in real terms but grew nominally during 1981-1985 while its contribution to GDP stagnated at about 29 %. Capacity utilization has continued to decline since the mid-1970s and was around 42 % by mid-1980s (World Bank 1992).

In spite of its relative significance to the economy, the sector is characterized by the production of consumer goods, with very few enterprises producing capital goods. Furthermore, the production of intermediate goods is weak and consequently there is little vertical integration of manufacturing activities to the country's resource base, such as, agriculture, minerals and forestry. This implies that the sector is dependent on imports for material inputs and production equipment.

Zambia's industrialization strategy since independence revolved around (i) state ownership and direction of important industrial enterprises, (ii) major public investments in intermediate sectors (chemicals, fertilisers, cement and consumer durable), (iii) restriction of foreign competition through import licensing and tariffs and (iv) promotion of import substitution industrialization through high levels of protection, investment controls, restrictive licensing and other regulatory devices. The resources for the strategy were expected to come from the mining industry's foreign exchange earnings and tax revenues.

One major flaw of this strategy was its non-integration of agricultural and industrial production to ensure mutually supportive development (World Bank 1992).

The leading role in industrial development was played by the parastatal sector, which in the mid-1980s accounted for 69% of manufacturing assets, 66 % of value added, and 54 % of total formal employment. The poor performance of the parastatal sector took various forms and was caused by many factors including deterioration in capacity utilization and efficiency, large financial losses due to Government price controls, intrusive political intervention, general economic decline, overemployment, shortage of skilled manpower and unavailability of imported inputs.

In order to boost industrial development , the Government introduced a number of measures, such as, the Industrial Development Act of 19977. The major objective of the Act was to promote private investment but this objective was not fulfilled. The Act was repealed and replaced by the Investment Act of 1986, which although more supportive of the private sector and with better targeted and more streamlined incentives, still failed to stimulate private sector development largely because of Government tight controls on manufacturing registration. The Act was revised in 1991 to minimize Government controls and attract foreign investment. In addition, the Act provides guarantees against nationalization of foreign owned enterprises and attractive incentives. The Act also established the Investment Centre to promote investment in the country.

9.3: Environmental Issues in Industry

The current indications suggest that there is more interest in investing in the manufacturing sector. During 1993 about 25 % of the approved new investment licenses were for manufacturing. The anticipated growth in manufacturing activities implies more generation of industrial wastes, such as, gases, wastewater and solid wastes. Noise pollution is probably more important as an in-factory occupational health hazard. The liberalisation of the economy has also promoted the importation of finished consumer goods, especially foods and beverages, whose packaging has worsened the solid waste disposal problems.

Currently the trade effluents into public sewers and water ways from many industries exceed the recommended standards. A typical example is the situation at Kafue Township where concentrations of pollutants in industrial wastewater are above acceptable levels (Table 9.1). In public water ways such discharges can have negative impacts on human health, wildlife and the environment.

Table 9.1 Quality of Industrial Wastewater Effluents Discharged in the Municipal Sewer at Kafue Township (based on Simuunza 1992). Concentration above the standard is shown by a star

INDUSTRY	QUALITY CHARACTERISTICS (MG PER LITRE)				
	BIOLOGICAL OXYGEN DEMAND	PH UNITS	NITRATE	CHLORIDE	TOTAL CHROMIUM
NITROGEN CHEMICALS		7.3	110*	73	0.04
LEE YEAST		8.2	0.3	1239*	0.03
KAFUE TEXTILES	1765*	11.1*	0.2	71.4	0.09
BATA TANNERY	1035	8.3	0.4	10516*	6.45*
NATIONAL BREWERIES		5.2*	14.9	265	0.38
TRADE EFFLUENT STANDARD	1200	6-10	80	1000	5

The main problem with solid waste relates to disposal of packaging material, especially plastic, glass and tin containers, of consumer and industrial goods which are not recycled. Some waste paper is already being recycled by Zambezi Paper Mills and this conservation activity should be promoted in industry.

Air pollution occurs in the form of gases, vapours and particulates. The most common industrial air pollutants in Zambia are sulphur dioxide, ammonia, nitric acid and ammonium nitrate gases. The Nitrogen Chemicals of Zambia discharges about 21000 t of nitrogen dioxide into the atmosphere per year (Salter 1978-79). Some of this enters the Kafue river through precipitation and direct absorption. Such industrial emissions accumulate during thermal invasions to form a low brown haze over Kafue Township and undoubtedly contributes to human ill-health and environmental pollution. The transport industry also contributes to air pollution through engine emission.

Since radio active materials are used in the country, there is clearly need to enforce the Ionising Radiation Act, and Statutory Instrument No 171 of 1992 to regulate the importation, use and disposal of radioactive materials and waste.

Legal instruments in Zambia are silent on the discharge of radioactive waste. Since radioactive materials are used in the country, there is an urgent need to regulate the disposal of radioactive waste. Instruments are also required to control the importation of radioactive waste for use or disposal in the country.

9.4: Action Plan for Industry

One of the factors contributing to environmental pollution by the manufacturing sector are lack of effective waste treatment due to lack of appropriate technology, maintenance and inadequate capacity.

An incentive framework should be worked out and implemented to encourage manufacturing industries to acquire the right technology and/or redesign current production technologies to reduce environmental pollution.

Very little is known about quantities of emissions, wastewater and solid waste generated by the manufacturing and trading sector, especially in large urban areas. Surveys should be undertaken to determine the size of the pollution problem in the country and how it can be resolved. The National Council for Scientific Research, Zambia Environmental Council and the Universities of Zambia and Copperbelt should be supported to carry out and continue a coordinated programme of monitoring pollution, its impacts on the environment and developing appropriate technologies to control pollution.

District Councils should establish landfills and incineration facilities for the disposal of solid waste. Enterprises importing and/or packaging goods in non-recyclable containers should be levied by either the Ministry responsible for Commerce or the District Council and a proportion of the revenue invested in solid waste disposal and management.

A law should be established to regulate the importation, use and disposal of radioactive materials and waste. Current pollution regulation is weak, although standards may exist. This weakness should be resolved.

10: HUMAN POPULATION

10.1: Recommended Actions

The current population growth rate is high at 3.2% pa, which may result in overexploitation of natural resources. The following actions are recommended:

(i) To review national population policy and population/environmental interactions;

(ii) To reduce urban population growth through family planning and public health programmes and population redistribution;

(iii) To promote rural development to retain and attract people to rural areas.

10.1.1 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Review of population policy	2	Short to medium term	NCDP, CSO, NGOs
Promote family planning & education	1	On-going and long term	MOH, NGOs
Redistribution of population through settlement	1	On-going and long term	DOR, MAFF, MOL
Promotion of rural development	1	On-going and long term	All Ministries, NGOs, Private Sector

10.2: Demographic Characteristics

The population in Zambia increased from 3.5 million in 1963 to 5.88 million in 1980 and 7.82 million in 1990. At an average annual growth rate of 3.2%, Zambia has one of the highest population growth rates in the world. The high fertility and declining mortality are responsible for this high population growth rate.

Total fertility rate (average number of live births during the reproductive period per woman) was 7.2 in 1980 and has decreased only to 6.5 in 1992 (Central Statistical Office 1992; Gaisie et. al., 1993). This high fertility is due to early marriage, although the median age at marriage has increased from 17 years to 18 years; women with secondary education marry at 20 years compared to 17 years among women without education. The crude death rate dropped from 19.7 per 1000 population in 1969 to 14.8 per 1000 in 1980. However, although the crude birth rate has increased from 47.7 to 51.0 from 1969 to 1980, child mortality has increased. Currently, nearly one in five Zambian children dies before the age of five years. Under-five mortality rose by 15% from 1977/81 to 1987/91. Furthermore, child development is retarded by undernutrition: 40% of children under five years are stunted, 25% are underweight and 5% are wasted for their age (Gaisie et al.,1993).

In 1990 the national population density was 10.4 persons per square km compared to 7.5 in 1980. Forty two percent of the population was urban in 1990 and 70% of the urban population is found in Copperbelt and Lusaka Provinces. This has created marked differences in regional population distribution. The density is 53 persons per square km in Copperbelt and Lusaka Provinces and 8 in the other Provinces. The uneven population distribution creates serious problems in the provision of social services, especially in rural areas.

The size of the Zambian population will continue to increase for many decades to come even if fertility levels were to decline considerably until the 60% of the population made up of young people (< 20 years) moves out of the reproductive age span. Given this demographic pattern, Zambia will have to treble her present infrastructure for food production, health services, water supply, sanitation, housing, energy supply and other services in the next two decades in order to maintain the present standard of living for its people. Furthermore, the very high dependency ratio is a serious burden on progress. The standard of living of most Zambians, especially those in the low income groups, has been declining since 1975.Consequently, there are insufficient resources for investment in environmental management.

Under subsistence agriculture, which is characteristic of Zambia's rural population, about 50-70 % of farm products are consumed at home by the family. There is however an increasing temptation for families to sell an increasing proportion of farm output to raise money for other basic needs. This is not only undermining food security at the household level, but is also increasing the number of children with malnutrition. In urban areas, the majority of families live in squalid environmental conditions in unplanned settlements. These families are largely poor, unemployed or underemployed and have inadequate access to urban social services. The introduction of fees for social services will further marginalize these families. The majority of such households in urban areas cook with charcoal. With more households entering the low income group due to economic structural adjustment programmes, the demand for charcoal will increase above the current level of 1.5 % per year. This will in turn accelerate deforestation.

The Zambian population is dominated by females, who in 1990 made up 51% of the population. And although rural to urban migration has declined since 1980, the high rate of rural-urban migration by the youthful and productive population is causing labour shortages in the agriculture sector and an increase in female-headed households. The labour shortage, coupled with the rudimentary technology employed by subsistence farmers means that the amount of land cultivated is limited and the ability to conserve land is greatly reduced.

10.3: National Population Policy

The Zambia national population policy was adopted in 1989 with the goal of improving the standard of living and quality of life of all Zambians. The objectives of the policy are to:

(i) initiate, improve and sustain measures aimed at slowing down the nation's high population growth rate;

(ii) enhance the people's health and welfare and prevent premature death and illness, especially among the high health risk groups of mothers and children;

(iii) systematically integrate population factors into the nation`s development planning and plan implementation processes;

(iv) ensure that all couples and individuals have the basic right to decide freely and responsibly the number and spacing of their children and to have the information, education and means to do so;

(v) achieve a more even distribution of the population between urban and rural areas and to regulate international migration;

(vi) expand and maintain the nation`s population data base.

The targets of the population policy are to:

(i) reduce the rate of population growth from the current 3.2% per year to 2.5% by the year 2015;

(ii) reduce the total fertility rate from 7.2 to 6 and 4 by the years 2000 and 2015, respectively;

(iii) reduce the infant mortality rate from 97 per 1000 live births to 65 and 50 by the years 2000 and 2015, respectively;

(iv) make family planning services available, accessible and affordable by at least 30% of all adults in need of such services by the year 2000.

10.4: Population and Environment

From the environmental perspective, the Zambian population policy fails to distinguish between population issues in the urban and rural sectors. In the urban sector, population size and natural increase have greatly outstripped the supply of basic services, such as, water, sanitation, energy, health, housing and other infrastructures. Slowing population growth in urban areas is therefore necessary and will ultimately contribute to the improvement of environmental quality. In rural areas, agricultural development is partly depressed by labour shortage, especially among female-headed households. Average household size in rural areas was 4.7 in 1980 compared to 5.5 in urban areas. The low population density and dispersion in rural areas are also constraining the provision of services, such as, education, health, transport and marketing infrastructure. Slowing population growth in rural areas will therefore perpetuate the marginalization of rural areas with adverse consequences for natural resources and the environment. It is therefore necessary to revise the population policy to take into account not only the present socio-political situation in the country but also the needs of the people and the environment.

This is in line with the recommendation made by the July 1992 seminar on the population policy for members of Parliament (Planning and Development Co-operation 1992).

11: ENERGY RESOURCES

11.1: Recommended Actions

To promote clean energy resources and minimise negative effects on the environment, the following actions are recommended:

(i) To carry out EIAs prior to issuance of licenses for hydropower dams and fossil fuel operations, to be evaluated by ECZ and the Department of Energy

(ii) To assess rural and urban woodfuel consumption, and the environmental impact of its use;

(iii) To introduce economic incentives for the adoption of non-polluting energy sources;

(iv) To expand urban and rural electrification to reduce use of wood and fossil fuels

(v) To research and develop renewable sources of energy such as solar, wind and biogas.

11.1.1 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Enforcement of EIAs	2	Long term	DOE, ECZ, Private Sector
Assess woodfuel consumption & environmental impacts	1	On-going and long term	DOE, FD, UNZA
Promotion of energy conservation	1	On-going and long term	DOE, UNZA, MENR, Private Sector
Expand household & rural electrification	1	On-going and long term	MEWD, Private Sector
Promote new & renewable sources of energy	2	On-going and long term	DOE, UNZA, NCSR, Private Sector

11.2: Review of the Energy Sector

Out of Zambia's total primary energy supply of about 5.85 million tons of oil equivalent in 1990, firewood accounted for 43 %, charcoal 33 %, electricity 10 %, petroleum 10 % and coal 4 %. Other energy sources, such as, wind, geothermal and solar, are insignificant. After correcting for conversion losses, firewood accounts for 58%, electricity 12%, charcoal 11 % and coal 6 % of the final energy consumption. Coal, electricity and petroleum are the main forms of energy consumed in the commercial sector.

Table 11.1 Energy Consumption by Sector in 1990. Total consumption is shown in brackets

SECTOR	ENERGY CONSUMPTION (% OF TOTAL)			
	COAL 374920 MT	ELECTRICITY 6350 GWh	PETROLEUM 597250 MT	WOODFUEL
Agriculture & Forestry	0	2.8	1.7	2.8
Commerce & Industry	36.7	9.8	9.7	9.0
Mining	53.9	70.8	27.4	0.1
Transport	0	0.2	52.0	19.0
Households	0	9.1	5.5	68.7
Government & Services	9.3	7.3	3.7	0
TOTAL	100	100	100	100

Since the introduction of the Department of Energy in 1984, it has been implementing a well defined sectoral programme, primarily aimed at provision of energy supplies. Energy supply and distribution infrastructure for coal, electricity and petroleum has deteriorated, and rehabilitation has been required.

11.3: Woodfuel

Woodfuel consists of firewood and charcoal. Firewood is normally burnt in open three-stone stoves while charcoal is burnt in tin stoves with perforated walls. Firewood is the dominant fuel in rural areas while charcoal is predominantly an urban energy source.

The biomass used in woodfuel burning takes many decades to produce through carbon fixation by photosynthesis in trees. Woodfuel burning therefore releases stored carbon to the atmosphere and this contributes to the build-up of green houses gases, such as, carbon dioxide, which cause global warming. For example, the nearly 8 million t of woodfuel burnt in 1990 generated about 16 million t of carbon dioxide. The burning of charcoal alone is estimated to have emitted 200 t of sulphur dioxide, 1200 t of oxides of nitrogen and 2 million t of carbon dioxide. These represented about 5% of total emissions from charcoal burning in sub-Saharan Africa (Chidumayo 1993b).

During woodfuel burning the users are exposed to smoke and gases. Firewood users are exposed to 890 microgrammes respirable solid particles per cubic metre compared to 380 for charcoal users. And because of this, 65 % of firewood users have tearing eyes when cooking compared to 30% among charcoal users (Ellegard & Egneus 1992). However, people who cook with charcoal are exposed to more carbon monoxide (13 ppm) than those who cook with firewood (8.5ppm). Carbon monoxide exposure among 31% of charcoal users exceeds the WHO Europe recommended maximum levels compared to 17% among firewood users. These observations suggest that firewood users are most affected by respiratory ill-health while charcoal users have more symptoms related to carbon monoxide exposure, such as, headaches and dizziness. Carbon monoxide exposure can be fatal when charcoal is burnt in poorly ventilated rooms.

The strategy for woodfuel is to reduce and ultimately replace its use. This is necessary if the standard of living of the people has to be improved. However, since this is likely to take a long time, public awareness about the health and environmental effects of woodfuel burning should be increased.

The strategy also seeks to support efforts to identify alternatives to woodfuel in order to achieve higher standards of living by promoting viable options like electricity and new and renewable sources of energy (NRSE).

11.3.1 Action Plan for Fuelwood

(i) Research into improvement and utilisation of woodfuel

(ii) Assessment of rural and urban woodfuel consumption, and its environmental implications

(iii) Revision of levies to reflect material and environmental costs, with establishment of efficient revenue collection system

(iv) Improvement of woodfuel use in small and medium scale enterprises

(v) Establishment of fuelwood lots in fishing areas and other deficit areas

(vi) Expansion of household electrification in urban areas, with subsidised electric stoves to encourage change in domestic fuel use pattern

11.4: Hydroelectric Power

Zambia has a total installed electricity generation capacity of 1778 MW and nearly 94% of this is derived from hydropower resources. The main inter-connected system is made up of three large hydropower stations at Kafue Gorge (900MW), Kariba North Bank (600 MW) and Victoria Falls power station (108 MW) which have an installed capacity of 1608 MW (Department of Energy 1988). In addition, there are several smaller hydropower plants in Central, Luapula and Northern Provinces with a total installed capacity of 23 MW and Zambia Consolidated Copper Mines owns and operates two small hydropower plants. It has been estimated that

Zambia has an additional potential of 6000 MW hydropower. This potential is largely concentrated in the Zambezi river basin which includes the Zambezi river and its tributaries, the Kafue and Luangwa, and Luapula river. A series of preliminary studies have been carried out at several potential sites while detailed studies have been carried out at a few sites, including the Batoka gorge which has an estimated potential of over 1600 mW.

The mainstay of the power transmission system is made up of 1900 km of 330 kV lines connecting the main load centres in the Copperbelt Province to the power stations in the Southern province. Additional 512 km of 220 kV supply other main loads of significant magnitudes. The remaining loads are supplied by 514km of 88 kV and 3103 km of 66 kV sub-transmission lines. Distribution to final consumption points is at 33 kV and 11 kV while end-user three phase supply is at 400 V and single phase is at 230 V.

11.4.1 Hydropower Environmental Issues

There are three major hydropower dams in Zambia: Kariba (5400 sq.km), Kafue gorge (3100 sq.km) and Itezhi-tezhi (370 sq.km). Apart from hydropower generation these lakes have become important fisheries, tourist attractions and sources of water for irrigation. But they have also been associated with negative environmental effects, such as, forced resettlement of people, loss of wildlife habitat, eutrophication and the associated proliferation of noxious weeds and increases in environmental diseases.

The construction of Kariba dam had the greatest negative social impacts on the Gwembe Tonga. A total of 57000 Tonga were forcibly resettled, with little or no compensation, from their homeland as a result of the flooding of 5400 sq.km in the Gwembe valley (Colson 1971). The people lost their fertile agricultural land which produced two crops per year and had to adjust to living on the infertile drier upland that produces only one crop per year. This has resulted in permanent malnutrition among the resettled populations. Overcrowding in resettlement areas, such as Lusitu, has also resulted in spectacular land degradation in the form of overgrazing and soil erosion.

Both Kariba and Itezhi-tezhi lakes were important wildlife areas before flooding. In the Gwembe valley there were 65 species of mammals before flooding. Many animals were caught up in the rising waters of Kariba. Although more than 6000 animals were rescued during " Operation Noah", many others died. Since the creation of Lake Itezhi-tezhi and the Kafue Gorge dam, the hydrological pattern of the intervening Kafue Flats, an important wildlife area, has changed considerably. Flooding has been reduced and the dry season minimum water level has increased.These changes have reduced the productivity of the floodplain and the extent of the range. Although the population of lechwe (*Kobus leche*) in the Kafue Flats increased in the late 1980s and early 1990s perhaps due to reduced poaching, the Kafue hydropower schemes have adversely affected the breeding and feeding patterns of fish and wildlife in the floodplain.

During the early development of Lake Kariba, there was an expansion of the kariba water weed (*Salvinia molesta*). The productivity of the weed was promoted by the release of nutrients into the water body from the decaying drowned vegetation. In 1961 the weed covered up to 400 sq.km of the lake. Physical weeding and spraying with herbicides failed to control the weed which only started to disappear after a decline in nutrient status of the lake. The weed now covers less than 6% of the lake. The weed not only presents danger to power generation, but also interferes with the proper functioning of the aquatic ecosystem and hinders fishing and recreation.

The most important diseases that are promoted by hydropower dams in Zambia are malaria and bilharzia. The irregular shoreline of the lakes presents favourable habitats for the breeding of malaria mosquitoes and bilharzia snails which are hosts of the parasites that cause malaria and bilharzia, respectively, in man. Since the creation of Kariba dam, the prevalence of *Schistosoma mansoni bilharzia* in Siavonga has increased from 16% around 1960 to 56% in 1991 (Mungomba et al., 1993). The creation of the lake therefore appears to have promoted the transmission of schistosomiasis in the area. It is important to control such environmental diseases because they not only reduce the quality of life of the people but in conjunction with other diseases can be fatal.

11.4.2 Action Plan for Hydropower

Even though the country has abundant hydro-electric power generating potential, only about 23% of the existing resources have been developed. Unlike fossil fuels, hydroelectricity is a clean energy source and its development and use should be promoted. However, hydropower generation may create enormous environmental and social negative effects. These can be minimised through the following:

(i) Carrying out EIAs prior to future hydropower development programmes, to study environmental effects of dam and other water impoundment structures at the feasibility and design stage. In the case of resettlement, adequate compensation should paid to the affected population and adequate access to the water resources must be guaranteed to the local people bordering the hydropower scheme.

(ii) Developing small scale hydro scheme, with minimal negative impact for the environment or the community

(iii) Review electricity tariffs to economic rates enabling reinvestment in infrastructure

(iv) Involvement of private sector in distribution of electricity to improve efficiency.

11.5: Fossil Fuels

About 91% of coal is used for industrial and commercial purposes while 80% of petroleum is used in transport and mining (Table 11.1). Coal and petroleum represent fixed carbon that has been out of global circulation for millions of years. Burning fossil fuels therefore releases surplus oxides of carbon and other reactive gases which accumulate in the atmosphere where they cause global warming. Emissions such as sulphur dioxide and oxides of nitrogen from fossil fuel burning cause air pollution. However, these emissions have not yet caused widespread environmental problems in Zambia, except at and in the vicinity of specific emission sources, such as, industrial furnaces, refineries and boilers.

In 1987 traffic emissions of oxides of nitrogen from petroleum fuels was estimated at 6530 t (Anonymous 1990). The rate of emission of most of these pollutants depends largely on the type of fuel, state and speed of the automobile (Table 11.3). although carbon dioxide is emitted at a constant rate of 168-192 g per km.

Diesel engines have a fuel-to-air ratio of about 1:30 and because of this high ratio the rate of emissions is less than in petrol engines. For example, emissions of carbon monoxide/dioxide and hydrocarbons in a diesel engine is 190 g per km compared to 245 g per km in a petrol engine. The petrol made in Zambia also contains a high lead concentration of about 1.0 g per litre. This implies lead emissions by petrol engines that are unacceptably high for man and plants.

The coal briquettes produced for household use at the National Council for Scientific Research has less fixed carbon (57%) and more volatile matter (23%) and ash (19%) than charcoal. Coal briquettes, which consist of 78% coal fines, 20% molasses and saw dust and 2% lime, also generate more sulphur dioxide than charcoal (Kaoma & Kasali 1993).

11.5.1 Action Plan for Fossil Fuels

Zambia spends up to 10% of its foreign exchange earnings on petroleum imports. Thus petroleum supply and consumption must be as efficient as possible both for economic reasons and to minimize environmental pollution caused by the use of petroleum fuels. Efforts should also be made to reduce the concentration of lead in petrol.

There is sufficient scope for the promotion of use of coal in the economy, especially as a substitute for the imported petroleum in industry and commerce. However, increased use of coal will result in the spread and intensification of negative environmental effects which must be addressed. The promotion of coal use must therefore be accompanied by adequate environmental impact assessments.

The promotion of efficient energy conservation through

(i) Efficient energy use practices;

(ii) Appropriate energy prices and taxation to reduce demand for polluting energy sources;

(iii) Technologies reducing emissions from fossil fuels

11.6: New and Renewable Sources of Energy

Zambia is endowed with a variety of renewable energy sources - solar, wind, geothermal and biogas. They are largely untapped at present, although have great potential. Solar energy is used for a variety of purposes, such as telecommunications, pumps, domestic water heating, refrigeration and lighting.

11.6.1 Action Plan for Renewable Sources of Energy

(i) Promote renewable energy sources through research and development

(ii) Remove or reduce import duties on technologies required for harvesting renewable sources of energy

(iii) Disseminate information about such sources using Government, NGOs and CBOs as vehicles.

12: ENVIRONMENTAL EDUCATION

12.1: Recommended Actions

The following actions are recommended to increase and improve environmental awareness and education:

(i) To form a body to support and coordinate environmental education, with a secretariat at the ECZ, with a membership of all relevant Ministries and NGOs;

(ii) To incorporate environmental education into existing school curricula and technical and University teacher training programmes;

(iii) To produce appropriate education materials for area and problem specific community based non-formal education programmes by establishing a publishing facility at ECZ;

(iv) To strengthen science teaching in secondary schools through the improvement of facilities;

(v) To establish an Institute of Environment at UNZA to carry out research and training in line with the NEAP. and promote collaboration between UNZA and industry;

(vi) To establish a science and technology research fund to support topical research;

(vii) To strengthen NGOs and CBOs as effective vehicles for environmental programmes;

(viii) To strengthen existing training and research institutions to incorporate environmental issues in all programmes

12.1.1 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Creation of Environmental Co-ordinating Committee under ECZ	1	Immediate	ECZ
Incorporate environmental education in existing education curricula & teacher training	1	On-going and long term	MEC, MST, NGOs
Establish desktop publishing of environmental education materials at ECZ	2	Short term	ECZ
Strengthen science teaching	2	Long term	MEC, MST
Establish Institute of Environment	2	Short to medium term	MENR, ECZ
Capacity building in NGOs & CBOs	2	Short to long term	MENR, ECZ
Establish Environmental Research Fund	3	Short to medium term	MENR, ECZ

12.2: Review of Environmental Education

A comprehensive conservation education programme is a major requirement for a successful National Environmental Action Plan; Unless people are aware of their own environment, efforts to conserve the environment may be worthless.

Education enhances and speeds up the process of culture. Perception and understanding of the environment vary considerably from community to community and such factors as culture and beliefs have a major influence on man's relationship with the environment. While former education is preoccupied with the acquisition of knowledge, parents and senior citizens should teach the young their responsibility in caring for the environment.

Various environmental issues in Zambia have already been highlighted in this document. Environmental education should therefore centre on these issues and should be directed at all sectors of society, as ignorance contributes to these problems. Education is also essential as a means for translating environmental knowledge into practice.

Zambia has made considerable progress in the field of education since independence in 1964. School enrollments in

the 1970s increased by 44% in primary schools, 75% in secondary schools and 46% at technical training levels (CSO 1992). In 1989 these levels of enrolment represented at total of 1.5 million in primary schools, 161,350 in secondary schools and 8,220 in teacher training and technical education. The enrolment at university was 6,250. However, these figures are too low to meet national demand.

12.3: Issues in the Education Sector

The main education problems in Zambia are:

(i) Absence of local knowledge input. Much of the education in Zambia puts too much emphasis on formal education at the expense of traditional knowledge system. The education system curricula and teaching materials focus on the European System (mainly the British), and young Zambians tend to grow up with knowledge from outside. This difficulty extends to the two universities where much of the teaching materials are sourced from outside.

(ii) Education output is generally too low. The number of pupils successfully completing school education is far less than the dropouts.

(iii) The number of students at college and university level is too low, and does not reflect a true picture of those leaving secondary school who have successfully completed. This restriction is artificial and should be discouraged.

(iv) Rural areas are severely deprived of education primarily because of poor population dispersion pattern, under developed infrastructure and limited social services.

(v) Non-formal education is not well developed. The role of institutions such as zoos, NGOs and extension work through the Department of Agriculture and the Department of National Parks and Wildlife Services has drastically declined. Activities by the Wildlife Conservation Society are largely limited by poor funding and lack of trained manpower.

There are also serious constraints in the formal education. In primary schools the pupil to teacher ratio is 44:1 due to lack of trained teachers, and the limited number of classrooms, especially in urban areas, causes overcrowding. Lack of teaching materials and teaching aids also contribute to the large number of dropouts. In secondary schools there is a lack of education materials while laboratories and workshops are poorly equipped, and in some cases absent altogether. At higher education levels and training, the infrastructure is dilapidated while education materials are insufficient.

12.4: Action Plan for Environmental Education

The action plan proposes a number of recommendations for the education sector.

(i) Formal education should integrate traditional and modern knowledge systems and values into school curricula. There is need for indigenous knowledge to be passed on to young generations as this is a true reflection of mans interaction with his environment.

(ii) During primary education children should be exposed to knowledge about the environment, including the physical, cultural, aesthetic, manmade environments, public health and resources within their surroundings. It is necessary at this level that concern is developed among young Zambians about their environment as well as creating a sense of responsibility of looking after their surroundings.

(iii) There is need to expand the environmental sciences programme in secondary education to include a strong component of ecology, from which students will acquire deeper understanding of the environment and man's relationship with it. At this level pupils should also appreciate the relationship between

environmental sciences and other sciences such as biological, physical and social sciences. Contents of the syllabus should include resources and issues related to their development, ecological principles about ecosystems, structures and their functions and how these are related to other sciences.

(iv) An Environmental Institute in the school of Natural Sciences at the University of Zambia should be established and the School of Environmental Studies at the Copperbelt University should include aspects of ecology and natural resources management .

(v) Informal education should aim at making Zambians aware of their own environment, acquire basic knowledge about their environment and its associated problems and skills for solving environmental problems.

In trying to achieve these objectives, the strategy should focus on:

(i) Strengthening institutions, such as the zoos, zoological parks, botanic gardens and museums, and to see to it that such institutions develop conservation education units.

(ii) Intensify the literacy education programmes particularly for rural communities based on environmental themes.

(iii) Concentrating conservation education specifically at leaders of Government, politicians, chiefs and local leaders, planners, administrators and resource users.

(iv) Encouraging District Councils, municipalities and Provincial administration to establish environmental conservation units within their administrative structure.

(v) Strengthening the existing education conservation units among institutions such as Agriculture Extension service, National Parks wildlife service education unit.

(vi) Promoting the participation of NGOs in conservation education by strengthening the existing NGOs such as the Wildlife Conservation Society of Zambia, Zambia Environmental Education Programme, and the creation of more NGOs to supplement efforts currently being made.

(vii) Supporting the training of teachers, extension workers, technical and professional staff and administrators for effective dissemination of environmental education.

(viii) Rehabilitating and improving infrastructure at all levels of education and increasing the availability of education materials through local production of text books, magazines, documentaries, newspapers and films.

13: HUMAN SETTLEMENT.

13.1: Recommended Actions

In order to minimise the negative impact of human settlements and infrastructure on the environment, the following measure are recommended:

(i) To establish a land use authority to formulate and enforce river basin development for all major river systems, at the Town and Country Planning Department;

(ii) To strengthen the Town and Country Planning Department in rural land use zoning and enforcement;

(iii) To review and develop an urban land use policy to designate areas for specific uses, and implement environmental standards;

(iv) To carry out EIAs on proposed resettlement areas, to be evaluated by ECZ and Town and Country Planning Department;

(v) To strengthen capacity at ECZ to monitor pollution from human settlements and enforce the EPPC Act

13.1.1 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Establish land use planning authority	1	Immediate	NCDP, TCPD
Review & develop clear urban land use policy & enforcement	1	Medium term	TCPD, LA
Enforcement of EIAs	2	Immediate and long term	TCPD, ECZ, LA
Enforce environmental quality standards	1	Immediate and long term	ECZ, LA, TCPD, Private Sector

13.2: Review of Human Settlements

Human settlement is an issue which should be examined quite critically in any development of a country as this affects nearly every sector of the economy, environment, political and social welfare. Unfortunately, the question of human settlement has not been adequately addressed in Zambia despite the increasing problem associated with it, and this is perhaps one of the obvious failures of government in the country's development process.

Zambia is the third most urbanized country in Africa (CSO 1992). Of the estimated 7.8 million inhabitants, 3.28 million people live in urban areas, and this accounts for 42.0% of the total population. While the degree of urbanization varies considerably with the provinces, Copperbelt (90.4%) and Lusaka (86.2%) are most urbanized provinces. There are a total number of 85 urban centres in the country (CSO 1992), of which 10 are large urban settlements with a population of over 50,000. Largest populations occur in Lusaka (982,362), Ndola (376,311) and Kitwe (336,207), and details are given in table 10.1.1. Provincial population distribution shows highest number of inhabitants to occur in Eastern (888,104), Southern (755,869) and Northern (744,338) provinces. However, lowest population densities are recorded in North Western (3.0), Central (5.4) and northern (5.9) provinces.

13.2.1 Settlement Patterns

Zambia has five types of human settlements: three large cities, municipalities, district centres, rural centres and the villages which are scattered throughout the country. While structural and functional factors have a profound effect on the pattern of settlements, there are underlying causal factors for the emerged pattern of settlements in this country, and these range from natural, social, historical, cultural to economic factors.

(i) The distribution of settlements is largely affected by resource occurrence in most parts of the country. Main determining factors are availability of food, water and land for agriculture. Rural settlements are therefore distributed along major rivers, lakes, flood plains and dambos, as these are environments where fish, wildlife and grazing potential are high.

(ii) Mining, industry, railway and road developments have been a major contributing factor in the rapid urbanization of cities in Zambia. The copper, lead and zinc mining developments have led to the rapid growth of urbanization in Copperbelt and Kabwe areas. The construction of the railway line between Livingstone and Copperbelt, Tazara railway and trunk roads have attracted a large number of settlements, some of which have grown into towns.
Obviously these developments are important because they provide opportunities for employment and community access to social services.

(iii) Disease and pests. Large settlements in Zambia have been influenced by the occurrence of livestock diseases and tsetse flies. Most cattle rearing tribes of Southern, Central and Eastern provinces are settled in areas free of tsetse flies. It is important to mention that human health has also been a major concern in establishing settlements. Large areas inhabited by wild animals have been avoided for settlements.

(iv) Land use and land tenure. Zambia is divided into Native Reserves, State Land and Trust Land tenure systems. These have had a profound effect on settlement patterns in the country. In addition, human and animal health considerations have been important in the location of settlements.

(v) Natural features. Relief, slope, swamps and mountains have affected settlement patterns. While some settlements may be located in remote and quite inaccessible areas such as Bangweulu, Luangwa and Zambezi valleys, a large portion of the population is distributed on the plateau area.

Apart from poor funding and lack of manpower, there are a number of issues which frustrate all efforts to deal with settlements more effectively. These are:

(i) Settlements in rural areas are generally scattered and unstable, and therefore provision of meaningful supportive infrastructure and social services is impossible. Consequently, the ability of rural communities to benefit from any form of national development is limited.

(ii) The current planning Act has not been reviewed since 1974, but the planning concepts for which it was formulated have become obsolete and have since been abandoned. As a result, human settlements in Zambia have no approved up to date plans to guide their development.

(iii) Just after independence in 1964, rural-urban migration accelerated, although this may appear to have stabilized. Migration into town is for seeking better opportunities such as employment, health facilities, schools, social amenities and transport which are lacking in rural areas. This drift has generated unemployment, congestion, slums, and crime in the face of ineffective and inadequate policies to address and direct the development of settlements.

13.3: Environmental Issues of Human Settlements.

The government is currently promoting the resettlement schemes in various parts of the country, and at the same time, urban areas are being expanded to allow for the rapidly growing populations. Furthermore, there is a growing pressure to change land tenure so as to promote new settlements for agriculture purposes. However, while such settlement initiatives may be of importance for national development, their implementations would have serious environmental implications.

13.3.1 Urbanisation Issues

(i) Urban sprawl. Nearly every city and town in Zambia is affected by un planned settlements. The growth of squatter townships has become a major issue particularly in Lusaka, Kitwe, and Ndola. Unplanned shelters and private buildings have taken over land reserved for either zoning or for future urban expansion. Unfortunately, because these compounds are not part of the planning process, they are largely deprived of a number of facilities such as infrastructure good sanitation and sewerage and social services. This leads to problems of health excessive uncollected solid waste and poorly drained surfaces.

(ii) Degradation of infrastructure. Development of infrastructure in urban areas has almost ceased, while the existing is not only inadequate but severely run down; for example, roads and streets narrow surfaces eroded and poorly drained. Equally , housing is not only limited but most houses have not been maintained for a long time. Until 1990, only 57% of the people in urban areas had direct access to piped water, while 34% were using communal piped water supply. Nevertheless much of the piping is small, old and has not been replaced ever since.

(iii) Pollution. Urban pollution is generally caused by

a. industrial operations through mining, factories such as textiles, tanning, fertilizers, petroleum, metals and food.

b. Municipal operations through sewerage systems, domestic waste disposal and water systems

c. Transportation system

d. Health control.

Unfortunately, very little is known about the effect of various pollutants in this country particularly how human health is threatened. Nevertheless, the obvious effects of urban pollution are:

- Decline in water quality of both surface and ground water. Problems arise because cities and towns are located either in river catchment, river banks or near lakes. Water draining from urban hard surfaces into channelized streams passing through the city will rapidly be conducted to adjacent aquatic systems, consequently affected aquatic systems. Most of the river water passing through Lusaka, Kitwe, Ndola, Kabwe and Livingstone is not accessible to people because it is extremely contaminated.

- Increase in eutrophication from domestic waste and inadequate sewerage collection and treatment can cause water to be overloaded by organic material, bacteria and nutrients from municipal sewerage outlet and factory effluent outlets. While eutrophication promotes growth of aquatic weeds such as *Azolla sp.*, *Salvinia molesta and Eichhornia crassipes*, it reduces accessibility to water and both domestic and industrial uses.

- Increase in infectious diseases resulting from domestic and industrial waste and poor sanitary conditions.

- Solid waste and smelling gases from sewage and the effluent reduces the aesthetic values of some areas of as a city

(iv) Deforestation. This occurs in all settlements in Zambia although to a varying degree. It is caused by cutting of trees for wood fuel, charcoal production, building material, clearing for agriculture, construction of houses, roads, and other structures.

Most urban centres are severely deforested. While in general, deforestation causes soil erosion, siltation and may kill a river or reduce life of a reservoir, deforested urban areas lose ground potential, and exposes the city to strong winds and dust.

(v) Overcrowding. Nearly every urban area is overcrowded in Zambia. This is a result of rapid population and unplanned settlements. Overcrowding increases potential for poor sanitary conditions, decreased water quality, spread of diseases, unemployment, crime, increased mortality, and social instability.

(vi) Land pressure of hinterland populations. Most cities and towns are expanding, thereby forcing inhabitants out of their traditional villages. For example, chiefs around Lusaka have lost substantial land previously occupied by their residents due to urban growth.

13.3.2 Rural Settlement Issues

(i) Deforestation. This is caused by poor agriculture practices and woodfuel. Much of rural Zambia is affected by the shifting cultivation which includes the *Chitemene* farming system, and semi-axe and hoe cultivation (Schultz, 1976). Large areas are equally cleared for commercial agriculture. Excessive, vegetation removal causes soil erosion, siltation of rivers and sedimentation which subsequently affects aquatic systems down stream. Most rivers in southern and Eastern provinces have been severely affected by siltation.

(ii) Degradation of resources. This is caused by increasing population, shifting settlements, poor methods of exploitation and over commercialization. of resources. Resources that have been mostly degraded are the forests, wildlife and fisheries.

(iii) Soil erosion. A number of factors such as removal of vegetation cover, poor agricultural methods, overgrazing, and poor construction of roads are responsible for soil erosion. While the impact of settlements on soil depends of type of soil, rainfall, relief and rate of disturbance, destruction of waterbeds and river banks can accelerate the erosion process. Soil erosion affects water quality, life span of water reservoir, soil fertility and food production.

13.4: Environmental Action Plan Strategies for Human Settlements

The Action Plan strategy on human settlements is a direct response to the country's need to improve the quality of life of Zambians while minimizing risks to human life and property. The strategy therefore focuses on three issues;

(i) Urban land use category. The current urban land use system fails to effectively support the functions for which settlements are established. This is evidenced by the increasing number of unplanned settlements. For the purpose of correcting this situation, the strategy should be to formulate a clear land use policy which will designate distinct land distribution for residential, industrial, commercial, institutional, tourism and recreation, transportation, waste disposal and open areas. The strategy should further discourage the upgrading of squatter compounds but to be replaced by well planned housing schemes that would be supported by elaborate infrastructure.

(ii) Rural land use category. Poor dispersion, remoteness, inaccessibility and temporary nature of rural settlements are factors that constrain an attempt to provide suitable infrastructure and other social services to rural communities. Unless settlement units are coherent and coordinated, their productivity will remain low, and community access to national wealth severely hindered. As a matter of rectifying this deficiency, and the country being desirous to mobilize all resources for productive purposes and to discourage rural urban migration, the strategy should be to:

a. make provision for transport when necessary for products such as timber, meat, fish, maize, rice, fruits etc.

b. create light industries in rural areas to generate employment.

c. improve education facilities, health, amenities and other social services.

d. promote progressive farming economy by giving access to loans, technical services, and adequate facilities for marketing of produce.

e. Encourage construction of permanent houses which in turn would have a prohibiting effect on shifting of villages.

(iii) Settlements and environmentally protected areas. The strategy should be to cause settlement limitations in :

a. Watershed areas. Settlements should be limited to lower altitudes as might be prescribed so as to avoid vegetation destruction in the uplands.

b. Hazard areas.Settlements should avoid areas of steep slope, river banks, flood plains or lands sensitive to erosion.

c. Conservation or sensitive area. Settlements should not be located immediately adjacent to protected areas such as forest resources, National Parks or major fisheries breeding areas, where developments would adversely affect habitats or population of unique species or endangered species, or block migratory routes.

d. Special environments. Settlements should not be permitted in areas such as wetlands where such developments may require draining or dredging of a wetland, thereby causing destruction or alteration of physical, chemical or biological characteristic of fish breeding and feeding areas.

e. Unique areas. Settlements should be discouraged in areas of archaeological significance, historical and cultural importance, where such developments could threaten the aesthetic and ethical values of such features.

(iv) Resettlement. Resettlement has political, economic, social and psychological implications, To minimise these, the following are recommended:

a. Areas should be provided with basic infrastructure prior moving people

b. People being moved forcibly must be educated on the reasons necessitating this

c. People should be warned against settling in prescribed areas

d. Political protection should not be used for people flouting regulations in restricted areas

e. Compensation should be paid where appropriate

f. Resettlement programmes should as far as possible avoid disrupting the way of life of those affected

These strategies in turn call for improvement and fulfillment of supporting tasks:

(i) Provision of a good planning policy to support the current strategy as being proposed;

(ii) Improving legislation to allow for effective implementation of the strategy;

(iii) Providing institutional reforms mainly to decentralize power, create local frame work within which the strategy should operate;

(iv) Training of manpower so as to support effective implementation of the strategy.

Table 13.1 Growth Rates of Population in Large Urban Areas

DISTRICT	POPULATION 1969	POPULATION 1980	GROWTH RATES 1969-80	POPULATION 1990	GROWTH RATES 1980-90
C/ BOMBWE	44862	54737	1.8	76848	3.4
CHIN GOLA	103292	130875	2.1	167954	2.5
KABWE	65974	136875	6.3	166519	2.0
KALU-LUSHI	32272	52146	4.3	75197	3.6
KITWE	199798	266286	2.6	338207	2.4
L/STONE	45243	63275	3.0	82218	2.6
LUAN-SHYA	96282	110907	1.3	146275	2.8
LUSAKA	262425	535830	6.2	982362	5.9
MUFULIRA	107802	135535	2.1	152944	1.2
NDOLA	159782	250502	4.0	376311	4.0
TOTAL URBAN (INC SMALL URBAN)	1192116	2258500	5.6	3285766	3.7

Table 13.2 Population Distribution by Rural/Urban in Provinces 1990

PROVINCE	RURAL	URBAN	% URBAN 1990	DENSITY 1990
CENTRAL	509588	216023	29.8	5.4
COPPERBELT	150845	1428697	90.5	50.4
EASTERN	888104	85714	8.8	14.1
LUAPULA	443669	83036	15.8	10.4
LUSAKA	166507	1041473	86.2	55.4
NORTHERN	744338	123457	14.2	5.9
NORTH-WESTERN	337547	45599	11.9	3.0
SOUTHERN	755969	190384	20.1	11.1
WESTERN	536114	71383	11.8	4.8
TOTAL ZAMBIA	4532681	3285766	42.0	

14: ENVIRONMENTAL ISSUES IN THE PROVINCES

14.1: Recommended Actions

Zambia is divided into nine political provinces: Central, Copperbelt, Eastern, Luapula, Lusaka, Northern, Northwestern, Southern and Western. Each of these provinces has its own decentralized administrative structure. The provinces differ in size, culture, history, geography, natural resources endowment and levels of development. Consequently, resources use and environmental issues vary from province to province. Achieving sustainable resource utilisation and environmental management in the provinces will therefore require strategies appropriate to each province. In order to enhance environmental management in the Provinces, the NEAP recommends the following:

(i) To strengthen local authorities to enforce land use development plans and provide adequate water supply and sanitation

(ii) To integrate economic and physical considerations into regional planning;

(iii) For the ECZ to designate an environmental officer to Regional Planning Units;

(iv) To empower local communities, traditional institutions, NGOs and CBOs to participate in the development of local land use plans and natural resource management, including revenue sharing;

(v) To promote rural development to make rural areas more attractive;

(vi) To promote environmental awareness.

14.1.1 Implementation Strategy

ACTION	PRIORITY	TIME FRAME	RESPONSIBLE AGENCY
Capacity strengthening in Las	1	Long term	LAs, ECZ, TCPD, WAD
Implement regional planning	2	Long term	LAs, TCPD, ECZ
Promote traditional institutions and community participation in regional planning & natural resources management	1	Long term	LAs, TCPD, NGOs, CBOs, MENR
Promote rural development	1	On-going and long term	All Ministries, NGOs, CBOs, Private Sector
Promote environmental awareness	1	On-going and long term	NGOs, CBOs, ECZ, MENR, MCSD

14.2: Environmental Problems

14.2.1 Central Province

The main environmental issues in Central province are: deforestation, soil erosion, shifting cultivation, bush fires, overgrazing, overexploitation of fish and game, agro-chemical pollution, poor urban sanitation, solid waste dumping from Lusaka Urban, land dereliction caused by sand quarrying, mining pollution and water pollution by inadequate sewage treatment in Lusaka Urban. Current environmental activities in the province include the involvement of local communities in wildlife management through the ADMADE Wildlife Programme and the Soil Conservation and Agroforestry Extension Programme

14.2.2 Copperbelt Province

The main environmental issues in the Copperbelt province are deforestation, soil acidity, pollution, land dereliction, poor urban sanitation, unplanned urban development and noxious weeds arising from eutrophication of waterways by sewage effluents. These environmental problems are complex and a detailed assessment is required in order to develop appropriate environmental strategy actions for the province.

14.2.3 Eastern Province

The main environmental issues in Eastern province are deforestation, overexploitation of game, soil erosion, bush fires, water pollution and poor sanitation. Current environmental activities include the Luangwa Integrated Resources Development project, ADMADE Wildlife project and Soil Conservation and Agroforestry Extension programme.

14.2.4 Luapula Province

The main environmental issues in Luapula province include deforestation, soil acidity and infertility, wildlife and fish overexploitation and confined land and water pollution around Mansa town. Current environmental activities include the WWF/DANIDA Wetlands Development project which focusses on local community participation in resource development, utilisation and management.

14.2.5 Lusaka Province

The main environmental issues in Lusaka province include deforestation, poor sanitation, unplanned urban settlements, industrial pollution, soil erosion, drought, overgrazing and overexploitation of game and fish.

14.2.6 Northern Province

The main environmental issues in Northern province are soil acidity and infertility, deforestation and overexploitation of wildlife and fish. Current environmental activities include the Soil Productivity Research Programme which aims at resolving the problem of low soil fertility due to acidity.

14.2.7 North Western Province

The main environmental issues in Northwestern province are soil infertility, deforestation, wildlife depletion, bush fires, soil erosion and poor sanitation. Current environmental activities include the GTZ supported Beekeeping and Forestry project.

14.2.8 Southern Province

The main environmental issues in Southern province are deforestation, soil erosion, wildlife depletion, pollution and salinization. Current environmental activities in the province include the Soil Conservation and Agroforestry Extension Programme.

14.2.9 Western Province

The main environmental issues in Western province include deforestation, soil erosion, bush fires, water pollution, poaching, poor sanitation, famine, floods and drought. Some environmental activities in the province include the Upper Zambezi Wetlands Resources project, Masese Agricultural project, and Liangati Integrated Development Area project.

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