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Zambia Natural Resources Management Strategy Assessment

Submitted to:
United States Agency for International Development/Zambia
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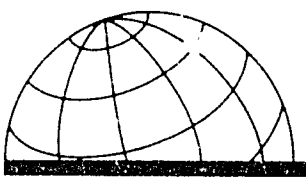

Submitted by:
Tropical Research & Development, Inc.

Oct. 16, 1992

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Cover Letter

During the course of this Natural Resources Management Strategy Assessment, it was learned that the World Bank expects to fund a Natural Resources project for Zambia. World Bank staff reported that a funding level of as much as $60 million might be involved. A World Bank team is expected to arrive in Zambia in September or October 1992 to conduct the technical design of the project. Following the World Bank sponsored Workshop on Natural Resource Use and Conservation in Zambia, World Bank personnel demonstrated a particular interest in the potential of the forestry sector.

A large World Bank project is likely to exceed the absorptive capacity of most Zambian institutions. This is particularly true of the Forestry Department. USAID would be well advised to wait for the outcome of the World Bank project design before making any decisions concerning the aspect of Natural Resources Management it might wish to support.

Acknowledgements

The contributors to this report acknowledge the splendid cooperation of many individuals. A few of these people deserve special recognition here. These include Mike Bingham, who made many of the arrangements for the rest of the team and Dr. Emmanuel Chidumayo who contributed a written report which is the basis for much of the information in the chapter on Forest Resources Management Issues. The assessment team would particularly like to acknowledge the cooperation and collaboration of Mr. Willie Kalunga, Mr. Ken Mwansa and Mr. Robbie Mwiinga of the Natural Resources Department. A substantial debt is owed to all the persons who were contacted during the course of this assessment, not only from the members of the team, but from Zambians who may benefit in the future from their efforts in the environmental field.

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List of acronyms

ADMADE	Administrative Management Design for Game Management
AFDB	African Development Bank
ARPT	Agricultural Research Planning Team
BOD	Biochemical Oxygen Demand
CIDA	Canadian International Development Agency
CPSP	Country Program Strategy Plan
CSO	Central Statistics Office
DDSP	District Development Support Program
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency (US)
EPPCA	Environmental Protection and Pollution Control Act (1990)
FAO	United Nations Food and Agriculture Organization
FINNIDA	Finnish International Development Agency
FNDP	Fourth National Development Plan
GDM	Gross Domestic Product
GMA	Game Management Area
GRZ	Government of the Republic of Zambia
GTZ	German Technical Assistance Agency
ha	Hectare
IBRD	International Bank for Reconstruction and Development: also World Bank
IMF	International Monetary Fund
IUCN	International Union for the Conservation of Nature and Natural Resources
JICA	Japan International Cooperation Agency
K	Kwacha, the currency of Zambia; as of July 1992 200K = $1
kg	Kilogram
km	Kilometer
km^2	Square kilometers
Lintco	Lint Company
LIRDP	Luangwa Integrated Resource Development Project
MAWD	Ministry of Agriculture and Water Development: now Ministry of Agriculture, Food and Fisheries
MENR	Ministry of Environment and Natural Resources
mm	Millimeter
MMD	Movement for Multiparty Democracy
MPDC	Ministry of Planning and Development Cooperation
mt	Metric ton
MW	Megawatt
Namboard	National Agricultural Marketing Board
NCDP	National Commission for Development Planning: now Ministry of Planning and Development Cooperation
NCSR	National Council for Scientific Research
NCZ	Nitrogen Chemicals of Zambia

NEC	National Environmental Council
NGO	Non-Government Organization
NHCC	National Heritage Conservation Commission
NORAD	Norwegian Agency for Development
NORAGRIC	Norwegian Center for International Agricultural Development
NP	Northern Province
NPS	U.S. National Park Service
NPWS	National Parks and Wildlife Services
PACs	Processed Agricultural Commodities
PCAs	Pest Control Applicators
PHI	Pre-harvest Interval
PTA	Preferential Trade Area
RACs	Raw Agricultural Commodities
SADCC	Southern Africa Development Coordination Conference
SCAFE	Soil Conservation and Agroforestry Extension
SIDA	Swedish International Development Authority
SPRP	Soil Productivity Research Program
TDP	Trade and Development Program, U.S. Department of Commerce
TFAP	Tropical Forestry Action Plan
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Program
UNICEF	United Nations Children and Education Fund
UNIP	United National Independence Party
UNZA	University of Zambia
USAID	United States Agency for International Development
US$	US Dollar
USIS	United States Information Service
WB	World Bank
WMO	World Meteorological Organization
WPRDP	Women's Participation in Rural Development Program
WWF	World Wide Fund for Nature: ex-World Wildlife Fund
ZAA	Zambian Agrochemicals Association
ZAFFICO	Zambian Forestry and Forests Industries Corporation
ZAMS	Zambia Agribusiness and Management Support Project (USAID)
ZATPID	Zambia Agricultural Training, Planning and Institutional Development Project (USAID)
ZCCM	Zambian Consolidated Copper Mines
ZCF	Zambian Cooperative Federation
ZESCO	Zambian Electricity Supply Corporation

Executive summary

The purpose of this report is to provide the United States Agency for International Development/Zambia (USAID/Zambia) with an assessment of priority problems that need to be addressed with regard to natural resource management and the environment in Zambia and to recommend alternative program interventions for consideration by USAID/Zambia. The assessment team suggested several alternatives given potential interest of other donors in several of these possibilities.

Chapter 1 of the assessment provides a country profile and an overview of major issues of natural resource management and environment in Zambia. Chapters two through four provide details of the development of important natural resource management and environmental issues in the forestry, agricultural and water sectors, respectively. Chapter five provides a brief analysis of some key institutions involved in natural resource management.

This executive summary addresses some of the key issues and alternatives that USAID/Zambia might consider as potential opportunities for program intervention.

Water-resources management

Water quality is the most urgent problem. Many urban areas have neither adequate control and treatment of sewage nor adequate treatment of the water supply. Water and sewage treatment facilities in many of these areas are in a state of disrepair and deterioration because of a lack of investment and fiscal management. In some cases, sewage is being recycled as drinking water. Epidemics of cholera, typhoid and dysentery have become endemic. Yet, water systems that generate significant revenue streams cannot obtain funding to purchase chlorine to disinfect the water supply. A move to privatize these water departments is underway. Privatization would improve the departments' cash flows and improve fiscal management. USAID/Zambia should consider providing support for this privatization effort.

A less obvious, but equally critical issue is contamination of the Lusaka groundwater aquifer from hazardous and toxic chemicals in industrial and commercial pollution. The aquifer under Lusaka is relatively close to the surface, the intervening material is porus and there is no control of industrial and commercial pollution which contains hazardous and toxic chemicals. If the groundwater becomes contaminated, the aquifer can not be cleansed and Lusaka will lose access to the 50 percent of its water supply which is relatively clean and inexpensive. But with pollution on the surface uncontrolled, contamination is only a matter of time. The NEC is clearly the agency responsible for addressing this type of problem, but it will likely be several years before it is fully functional, has written specific regulations to deal with this problem and receives authority to prosecute polluters. In the meantime there is an urgent need to inventory the sources of hazardous and toxic chemicals in Lusaka and the surrounding townships, and to provide companies with practical ideas for controlling these chemicals voluntarily. A second step would be to do a regional study in the area surrounding Lusaka, of groundwater occurrence and movement, which identifies recharge areas and inventories groundwater use, and investigates the risk of pollution from agricultural chemicals used on local farms.

The Kafue River is the most important water system in Zambia. Zambia's major urban centers, mining operations, irrigated agriculture and commercial farms, industrial plants, and hydro-electric generating facilities, the largest national park and important wildlife reserves are all located in the Kafue River Basin. The Kafue Flats wetlands are important resource for wildlife, dry season cattle grazing and fisheries. The Kafue River is the primary outlet for sewage and effluent from towns, mines and industries, and for agricultural run-off, while at the same time being a source of drinking water for at least one third of Zambia's population.

No system of planning now exists which integrates the needs of the many sectors which use the Kafue and regulates or the competing interests of the many stakeholders who use the Kafue River and Basin. Something like a Kafue River and Basin Authority is needed to provide cross-sectorial planning to and mediate the different needs and interests so that this important resource can be conserved. If support for establishing such an Authority is not provided by another donor, USAID should consider an intervention in this area. UNDP is sponsoring a study of the Basin and may develop a project.

Waste management

An issue closely related to water quality which urgently needs to be addressed is the lack of any appropriate system of waste management and disposal for either ordinary solid wastes or hazardous and toxic wastes. Zambia needs to develop a waste disposal system. Waste dumps need to be developed at sites which will minimize their impact on the environment and technology identified which requires a minimum of maintenance. Regulations need to be written, a licensing system designed, and private enterprise encouraged to develop waste disposal services. A second system needs to be developed for Zambia or the SADCC region, which provides safe disposal for hazardous and toxic wastes. There is no dump or incinerator in either Zambia or the region where industries can send hazardous or toxic waste, or where 60 mt of unwanted toxic chemicals exposed to the weather can be sent for safe disposal to prevent them from contaminating the Lusaka aquifer. US experience in waste disposal could be a tremendous help in designing a safe and efficient system.

Forest-resources management

Zambia's forests and woodlands have immense productive potential
which is neither being conserved nor developed to benefit Zambia on a sustainable basis. An attitude exists on the part of many Zambian officials that any land which is unplowed is unused and unproductive. But the forest sector has significant potential to produce exports and foreign exchange generation, in addition to supplying most of Zambia's fuel needs, numerous wood products and habitat for wildlife. While the woodlands are not in danger of disappearing anytime soon, the benefits which the forests and woodlands could potentially produce are being squandered through poor management and lack of husbandry.

Alone, the Forest Department does not (now, nor will it ever) have the means to adequately manage or even protect the 7 million ha of gazetted forest estate, without even considering the more than 40 million ha of other forests and woodlands in Zambia. If the productive potential of Zambia's forests are to be developed, it will have to be done by individuals and local communities. The present forest code discourages sustainable and regulated exploitation of forest resources by claiming that all forest products belong to the state. On lands under traditional tenure, individuals or local communities can

not legally restrict access, cut trees, or charge others a cutting fee, even if they have protected and managed a forest area. Thus with no incentive, no open tenure forest areas are protected or managed. Without local protection, clandestine cutting to avoid government fees has become the norm. The laws and incentive structure must change so that individuals and local communities can benefit from their actions to protect and manage forests, and have an incentive to do so.

Charcoal production, like agricultural production, provides a commodity which is essential to Zambian society. Eliminating charcoal use is neither feasible or desirable, if it implies switching to the use of non-renewable energy resources. Charcoal production, like agricultural production, is not bad. It is charcoal production in a wasteful and unsustainable manner, and which has a negative impact on the natural resource base, which is undesirable. Efforts are needed to make charcoal production sustainable.

Tree plantations on private farms around Lusaka, seems to be the most likely solution to its growing energy crisis. Private farmers have the potential for developing the sustainable production of charcoal and other forest products and have other sources of livelihood to sustain them during the 8 or more years necessary for trees to grow to an exploitable size. Private farmers primarily need an incentive to grow trees on part of their land, and supporting extension services to provide the means to do so. The best incentive would be increased charcoal prices brought about because a new forest code allowed local communities to restrict access to their forests and charge a fee for any trees cut. Private farmers may have trouble competing with charcoal burners who get their trees at no cost. If obtaining wood for charcoal production has a cost, private farmers in advantageous locations should become competitive. A land tax which taxes cleared land more heavily than forested land would provide an additional incentive.

In addition to private farmers, residents of the GMAs which benefit from the ADMADE program provide a unique opportunity to increase the production of forest products and by-products. People in the GMAs need to find additional sources of income if the wildlife is to be preserved in the long-run, and the wildlife program provides revenue in the short term, which will help sustain people until forest production is developed. The development of forest production (woodfuel, poles, hardwood timber, honey, mushrooms, eatable caterpillars, etc.) on a sustainable basis should not be incompatible with wildlife conservation. The additional revenues produced should help sustain wildlife conservation in the long term.

Community forestry will have significant potential once the forest code is changed to allow individuals and communities to benefit from efforts made to protect and manage a forest area. (Pilot projects can work if the Forest Department agrees not to apply the code in the specific pilot project area.) Either communities of charcoal burners or normal villages might provide a base for community forestry. Agricultural villages have the advantage of other sources of income, charcoal burners will perhaps have the most need. The design of an intervention would depend on whether it was based on natural forest regeneration or plantations. This in turn would depend on whether the area in question was sufficiently large, relative to the population in question, to allow sustainable production using a 25 to 30 year cutting rotation. Plantation development would only be feasible near high demand urban areas. Changing the forest code, convincing villagers that they will benefit from forest related efforts and developing practical forest management would make community forestry a

long-term project. Food-for-work might provide much of the incentive necessary to convince communities to work on forestry management.

Agricultural-resources management

The impact of agricultural development policies on land use, seems to be the most important natural resource management issue in the agricultural sector. USAID is already heavily involved in agricultural policy. In addition to these existing interventions, it would be useful for USAID to support policies which specifically promote sustainable production and land use. Some policies which seem particularly appropriate are: the intensification of agriculture in those areas with transport infrastructure and good market access, particularly on land which has already been permanently cleared (destumped); incentives for lime application; and incentives for the use of soil and water conservation practices. One particular strategy for accomplishing these policy objectives would be the introduction of a land tax system. Taxing cleared land more heavily than woodland or forest plantation would provide incentives to intensify cultivation of cleared land, and promote the production of forest products or the return of land to woodland. A system of tax credits or deductions might also be used to provide incentives to farmers to apply lime and use improved soil and water husbandry practices.

Another GRZ program objective which has major implications for land use is the Tazara Corridor development scheme. The Tazara Corridor is an area where the development of intensive agricultural production is appropriate, because it does have access to transportation and markets, and lime and other inputs could be provided. The priority areas already demarcated are approximately equal to the total area now cultivated annually, and they are in a higher rainfall zone. Development of the Tazara Corridor would produce the major increase in agricultural production which is desired for national economic development. It would also promote production which has the potential to be sustainable and in a manner which intensifies land use. This alone implies better management of the land resource, but in addition, it would reduce pressure to clear woodlands and wildlife habitat in the hinterland.

Commercial lime production is one element which appears necessary for intensive agriculture production to be sustainable in Zambia, which has not been developed. Promotion of lime production by small enterprise would be another valuable contribution to the intensification and sustainability of agricultural production.

There is a serious need to increase the use of soil and water conservation practices to improve land use systems and the sustainability of agricultural production. Many of the basic concepts are known but there is need for more adaptive research to integrate these and agroforestry practices into specific farming systems. These concerns also need to be integrated into normal husbandry concepts of extension programs.

In addition to the pollution issues mentioned above, there is a need for the regulation and control of agricultural pesticides. This is another area where USAID could provide valuable expertise to the NEC.

1. Background and context

USAID/Zambia is in the process of preparing a Country Program Strategy Plan (CPSP) to guide its interventions in Zambia over the next five years. This Natural Resources Management Assessment provides information to help in the preparation of the CPSP. The assessment has two basic objectives: 1) To inform USAID/Zambia on the state of natural resource management and environmental issues in Zambia; and 2) To identify and evaluate priority problems and specific opportunities for USAID program intervention in the area of the environment and natural resource management.

Priority is given to the second of these two objectives. The assessment team found considerable literature assessing the environment and natural resource base of Zambia already exists. The country profile, development context and brief overview of the natural resources in Zambia are largely based on this literature. Since much has already been done in the way of a general assessment, it seems appropriate to focus the efforts of the team on identifying and evaluating priority problems and specific opportunities for USAID program intervention.

The work of this team overlapped activities by the World Bank to also prepare a natural resources project for Zambia. The team leader had the benefit of attending a World Bank sponsored workshop on Natural Resource Use and Conservation in Zambia, June 29-30, 1992. A World Bank project design team is scheduled to visit Zambia in September 1992. There is very strong donor interest in the natural resource sector and the situation with regard to other donor projects is changing very rapidly. For example, this team expected to recommend that USAID consider supporting a project to improve resource management in the Kafue Flats. But UNDP has already undertaken a major study of the area and expects that it will lead to the development of a resource management program financed by UNDP. USAID should coordinate with the World Bank and other donors to insure that there is no unnecessary duplication of effort.

1.1. Previous environmental and natural-resources assessments

The National Conservation Strategy, prepared by the Government of the Republic of Zambia (GRZ) with assistance from the International Union for the Conservation of Nature and Natural Resources (IUCN) in 1985, provides a very comprehensive and detailed assessment of Zambia's environment and natural resources. Following an assessment of resources and problems in the various development sectors, this document proposes a strategy and actions which should be taken to achieve balanced conservation and development in Zambia. Among other proposals is one to establish a National Environmental Council (NEC) to serve a regulatory and planning function and to coordinate all environment and development issues. This proposal was accepted by the government and the Council was officially created by the Environmental Protection and Pollution Control Act of 1990. The NEC met for the first time in July 1992. The NEC secretariat began acquiring staff in early 1992 and is beginning to function.

An older document, the 1982 Zambia Environmental Profile was commissioned by the US Man and the Biosphere Project in conjunction with USAID. This document was based entirely on information available in the US about Zambia. Although becoming somewhat dated, this document compiled much information about natural resources and the environment in Zambia.

In 1988-89, several environmental profiles or assessments were written for individual Provinces in Zambia with the help of donors. These profiles assess the resources and issues at the provincial level much more thoroughly than a team working at the national level could take the time to do. These assessments include: the Environmental Profile of the Western Province and the Environmental Effects of Agricultural Change and Development in the Northern Province.

In 1990, The State of Environment Report of Zambia, prepared by the GRZ's Natural Resources Department updated the previous assessments. In addition, the Tropical Forestry Action Plan (TFAP) Draft Issues Paper was prepared by FAO and provides extensive detail on the forestry sector. The Urban Household Energy Strategy of 1990, prepared by the World Bank and UNDP, provides an assessment of charcoal production and use.

Zambia's National Report to the United Nations Conference on Environment and Development (UNCED) in 1992, updates the State of Environment Report and addresses policies and programs as well as recommendations for action and development strategies. In June 1992 the World Bank held a workshop on Natural Resource Use and Conservation as part of the preparation leading to the design of a natural resources project. The discussion paper for the workshop, "Inventory and Prioritization of Natural Resource Problems in Zambia", prepared for the Bank by USDA consultants also provides a very useful assessment.

1.2. Zambia: Country profile

1.2.1. Physical features

Zambia is a land-locked country in Southern Africa, lying between 8° and 18° south of the equator and 22° and 34° East Longitude. It is bordered by Zaire, Tanzania, Malawi, Mozambique, Zimbabwe, Botswana, Namibia and Angola. Zambia covers a surface area of 752,972 km^2.

Much of the country lies on the Central African Plateau, lying between 1,000 and 1,600 meters elevation. The topography is generally undulating, broken occasionally by isolated hills and hill ranges. In the east and southeast of the country, the continuity of the plateau is interrupted by a series of relatively deep rift troughs (below 600 meters) flanked by a faulted escarpment zone. In general this plateau complex is also interrupted by swamps, lakes, floodplains, terraces, temporarily water logged dambos and valleys.

1.2.2. Ecology

1.2.2.1. Climate and hydrology

Located in the tropical highlands, Zambia has a sub-tropical climate. The rainfall pattern is unimodal and precipitation occurs during the warm season, November to March. Rainfall varies from 700 mm in the south to 1200 mm in the north, and temperatures range from 27°C to 38°C. The dry season corresponds to the cooler months from May to August, when temperatures average 16°C to 27°C. During September and October, the weather becomes hot and windy before the onset of the rains. Recent years have been characterized by erratic and lower than average rainfall.

The country's main drainage systems are the Zambezi River system whose major tributaries are the Kabompo, Kafue, and Luangwa rivers, and the Chambeshi-Luapula watershed in the northeast. The Zambezi River system with its tributaries drains the western, southern and southeastern portions of the country. Near Livingstone, the Zambezi River passes over the famous Victoria Falls. Zambia also has substantial lake and wetland resources. Lake Tanganyika, Lake Mweru and man-made Lake Kariba are all shared with neighboring countries, while Lake Bangweulu and Lake Mweru Wantipa lie entirely within Zambia. The Bangweulu swamp is one of the largest inland wetland areas in Africa. The Kafue Flats and the Lukanga Swamp on the Kafue River, the Buelu Swamp on the upper-Chambeshi River and the Barotse/Bulozi Flood Plain on the upper-Zambezi also constitute substantial wetland resources.

1.2.2.2 Vegetation

Over 4,200 species of plants have been found in Zambia of which 211 have been found only in Zambia. Zambia's vegetation is predominantly open miombo woodland (species of *Brachystegia*, *Julbernardia* and *Isoberlinia*). It is estimated that forest and woodland originally covered 80 percent of the country, of which about 60 percent was open miombo woodland. The other 40 percent consisted of a variety of forest/woodland types, depending on rainfall and altitude. Estimates of remaining forest cover range from 45 percent to 55 percent.

1.2.2.3 Fish and wildlife

Zambia has a variety of habitats which support many types of wildlife and Zambia's extensive wetlands are renowned for their biological richness. There are over 1,500 species of vertebrate animals in Zambia, of which 42 are protected. Reports indicate the number of indigenous mammal species is over 200, including several large mammals which are unique to Zambia.[1] Other animal species include 732 birds, 152 reptiles and 83 amphibians. Zambia's lakes, rivers and swamps support 156 known fish species. Zambia makes an important contribution to global biodiversity.

1.2.3. Population and human settlement

The population of Zambia was 7.8 million people in 1990 (the 1991 estimate is 8.02 million) with a growth rate of 3.2 percent, according to the 1990 census. Zambia has the highest rate of urbanization in sub-Saharan Africa with 3.29 million people, or 42 percent of the population now living in urban areas.[2] Outside these areas of high population density, vast areas have population densities below the national average of 10 persons per km^2.

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[1] These include the Kafue Flats lechwe, black lechwe, Cookson's wildebeest and Thornicroft's giraffe.

[2] Based on the 1990 census, Central Statistical Office, 1991. Note that previous estimates based on the 1980 census had projected the urban population in 1990 to be 4 million or 51.3 percent of the total population. The rural population in 1990 was .74 million (19.5 percent) larger than predicted.

Zambia's population is heavily concentrated in the Copperbelt mining area and along the north-south "line of rail" between Livingstone and the mining area.[3] This area developed because of employment opportunities, the demand for goods and services to support the mines, and the availability of transportation. Other much smaller settlements with a high population density include an area in the southeast along the Mozambique and Malawi borders, the Bangweulu Swamp-Luapula River complex, islands of the northern region and the Zambezi River flood plain in Western Province.

In Lusaka, the rate of urbanization has greatly outstripped the development of physical infrastructure and social services. Approximately 45 percent of the 1 million people living in greater Lusaka reside in squatter settlements with very limited access to clean drinking water, sewerage, solid waste disposal, or other social services.

Population growth is the primary cause of the pressure presently experienced by forest, land, water, energy, fish and wildlife resources in Zambia. As long as the natural resource base and the human population remain in balance in a given technological setting, relatively little environmental degradation occurs. Rapid population growth over the last several decades has upset this balance in Zambia. Population control is an important component of an effective natural resource management strategy.

1.2.4. Agro-ecological zones

Zambia has been divided into four major agro-ecological zones based on average altitude, rainfall range, climate, soils and suitability for crops:

1.2.4.1. The northern high-rainfall zone

This zone is found in the high rainfall areas of Northern, Luapula, Copperbelt and North Western provinces, covering about 350,000 km^2. Average altitude is 1,200 meters and rainfall is between 1,000 and 1,300 mm. The main vegetation type is wet miombo woodland. The soils are highly leached sand loam soils and have low base saturation, resulting in acid conditions with a Ph range of 4 to 5. The main crops grown are cassava, sorghum, millet and rice, but perennial crops like tea and coffee are also present. Various forms of slash and burn cultivation, known as *chitemene*, are practiced throughout the region. Under *chitemene*, tree branches are cut and burned to add nutrients to the soil, but only about one tenth of the area cleared is actually cultivated.

1.2.4.2. The western semiarid plains

This area includes Western Province and parts of Southern and Central Provinces, covering an estimated area of 208,000 km^2. The average altitude is 850 meters and rainfall ranges from 1,000 mm in the north to 600 mm in the south. The climate is characterized by extremes of hot and cold,

[3] The railroad provides transportation between the copper mines and ports in South Africa, via Zimbabwe and Botswana. Internally, the railway cuts north-south through the middle of the country, linking the Copperbelt in the north with Lusaka and with Livingstone in the south.

with danger of frost in the cool season. This region consists of an extensive sand-covered plain that is cut from north to southeast by the wide flood plain of the Zambezi drainage system. This plain is covered by a deep mantle of Kalahari Sands, which are deep, loose and structureless in character. They provide little soil moisture for crops but support deep rooted evergreen trees species, and are particularly suited to the growth of *Baikiaea plurijuga* (Zambian Teak). The main vegetation types are the Kalahari and miombo woodlands, and grasslands covering the seasonally flooded central and western plains. The main crops are cassava, millet and sweet potato. Cattle raising and fishing are also important economic activities. Most of the population lives along the Zambezi (often called the Barotse or Bulozi) flood plain.

1.2.4.3. Central, southern and eastern plateaus

This region consists of the plateau areas of Southern, Central and Eastern Province, covering about 94,000 km^2. The average altitude is 1,000 meters and rainfall is 800 to 1,200 mm. The climate is more moderate and the main vegetation types are dry miombo and acacia woodland. The Central Plateau soils are moderately leached sandvelds which blend into the red loams of the Southern and Eastern Plateaus. These are the most fertile soils in Zambia and this region includes most of the areas alienated for expatriate settlement and commercial farming by the colonial government. The main crops are maize, groundnut, tobacco, sunflower and cotton. Cattle ranching is an important activity.

1.2.4.4. The Luangwa-Zambezi Rift Valley

This zone is formed by the rift system along the Luangwa and Zambezi Valleys and occupies an area of 108,000 km^2. The average altitude is 600 meters and rainfall is 800 to 1,200 mm. The rift escarpment creates a rain shadow such that the climate is hot and dry throughout much of the area. Vegetation is primarily mopane or miombo woodland. The soils are shallow sands, prone to drought and of marginal agricultural value. The main crops are sorghum and millet.

1.2.5. Land use

Zambia has a land area of over 75 million hectares, of which 38 to 41 million are classified as having potential for agricultural use. However, much of this is presently woodlands and a substantial portion is in game management areas. Nine million hectares are classified as having fairly good cropping potential, of which about 1.4 million ha are estimated to be cropped annually. An additional 10 million hectares of seasonally flooded areas and swamps are classified as available for grazing, although this also includes most of the wetland wildlife habitat.
The heavy focus on mining and the high rate of urbanization have had an important influence on land use. Like the population, agricultural development has been strongly concentrated along the line of rail. Zambian development plans call for the development of a second line of rail in what is called the Tazara Corridor, along the rail line from Kapiri Mposhi to the Tanzanian border.

1.2.5.1. Agriculture

Farming in Zambia is predominantly rain-fed; only about 2 percent to 3 percent of the land area cultivated annually is irrigated. Maize is the main food and cash crop. It accounts for 50 percent to

70 percent of cultivated area, and as much as 85 percent of crop production. Other staple food crops include cassava, sorghum, millet and sweet potato. Cash crops include wheat, soybeans, sunflower, groundnut, tobacco, vegetable crops, coffee and tea.

In the past, Zambia's agriculture has been characterized by a distinct contrast between commercial and subsistence farming. Commercial farming was concentrated along the central line of rail, subsistence farming was distributed throughout the country. In the commercial sector, production was characterized by a high level of inputs while the subsistence sector depended largely on family labor. Recent analyses show less of a dichotomy. A significant percentage of small-scale traditional farmers do sell a portion of their produce and purchase some inputs and consumer goods. Programs like the extension of the "Lima" technical packages for smallholder farmers have strongly encouraged traditional farmers to become more commercially oriented. Overall, the level of mechanization remains low and the use of animal draft power is just beginning to develop. Agriculture provides employment for 67 percent of the labor force and remains by far the major opportunity for employment of rural women. An estimated 36 percent of rural households are headed by women.

Agricultural production from smallholder households is estimated to have grown at 1.2 percent per annum during 1983-88, while commercial production increased 11 percent per annum for the same period. Most of the growth in the production of individual commodities from 1974-89 can be attributed to increases in area cultivated, rather than increases in yield. While agriculture accounts for about 15 percent of GDP (1990), agricultural exports remain very limited, providing less than 2 percent of total export earnings. Food imports account for at least 10 percent of the total value of imports. The storage, processing and distribution of food products are also important constraints to developing food security.

The 1991-92 crop season was predicted to be a banner year for agricultural production with large surpluses of maize available for export to food scarce neighboring countries. Drought is estimated to have reduced maize production to between 10 and 30 percent of what would be expected in a normal year, requiring food relief on a major scale for the first time.

1.2.5.2. Livestock

Livestock production is dominated by cattle raising with cattle accounting for almost 80 percent of the total number of livestock (excluding poultry). Approximately 80 percent of the livestock are raised in the traditional sector, while commercial ranching accounts for 20 percent. Estimates of livestock populations vary significantly from year to year. For example, the number of cattle was estimated at 2.2 million in 1988 and 2.7 million in 1989. Disease epidemics, particularly of corridor disease (Theileriosis) and/or East Coast Fever are a constant problem. Traditional herders reportedly resist paying the 5 K (2.5 cents) per head fee for dipping cattle against ticks in the communal dip tanks. Reports indicate that many herders in Southern Province have lost as much as 50 percent of their livestock over the last 2 years. Although the use of animal traction is not wide spread, this cattle mortality seriously affects the availability of oxen for animal traction purposes and the ability of the affected families to withstand the effects of the drought.

Livestock numbers traditionally have been concentrated in the southern, dryer regions of the country where there is less tsetse fly pressure, and focused tsetse fly control. Statistics for 1989 show the

livestock population distribution as: Southern Province, 42 percent; Western Province, 19 percent; Central and Eastern Province, 18 percent each. Locally severe soil erosion and the encroachment by aggressive woody species on grasslands are attributed to over grazing in these areas. Kafue Flats is estimated to provide dry season grazing for as much as 40 percent of the national herd. In areas where tsetse fly control is successful, cattle tend to replace wildlife, even in parks and areas officially protected as wildlife reserves.

In 1992, a sell-off of livestock is apparently under way as a result of the drought. Beef prices have reportedly dropped by 60 percent, corroborating this trend. The combined stress of drought and disease has also increased animal mortality. Some migration of livestock herds to areas with higher rainfall and better grazing is likely.

1.2.5.3. Fisheries

The major fisheries are distributed across a variety of lake, river and wetland habitats including: Lake Tanganyika, Lake Kariba, Lake Bangweulu, Lake Mweru, Lake Mweru-Wantipa, the Luapula River, the Kafue River, the Lukanga Swamps, and the Zambezi River and Barotse Flood Plains. Fish production has averaged around 65,000 mt per year in recent years or about 8 kg per capita. This is over 55 percent of the animal protein production in Zambia. Fish farming is estimated to add an additional 2,000 mt, an amount which has almost doubled over the last 3 years. Fish represent an important and relatively cheap source of protein in the national diet.

Artisanal fishermen are responsible for most of the fish production (79 percent). About 25,000[4] people are involved in the fishing industry as primary producers, and an additional 30,000 are involved indirectly, predominantly in fish marketing.
The potential of the major fisheries is currently fully exploited, and reductions in catch weight per net indicate over exploitation in some cases. Restrictions on fishing methods, size of nets, fishing season, and the permanent closure of areas considered to be breeding grounds seems to have helped stabilize fish production. Restrictions applied to water bodies shared with neighboring countries may not be effective, unless enforced by all parties. The production of Zimbabwe fishermen from Lake Kariba is about twice that of Zambian fishermen, and the production of Zairian fishermen from Lake Mweru is almost three times that of Zambian fishermen. Regulation on these lakes must be negotiated with the neighboring countries to be effective.

1.2.5.4. Wildlife

Zambia has significant populations of large mammals, but populations have come under severe pressure from poaching and habitat destruction. The number of elephants has declined from 100,000 in 1973 to 22,000 in 1992. Similarly, the number of black rhino has dropped from 4,000 to near extinction in the same period. Other endangered species include the African dog (*Lycon pictus*), leopard (*Panthera pardus*), cheetah (*Acinonyx jubatus*), lechwe (*Kobus leche*), the Nile crocodile (*Crocodylus niloticus*), and the African slender-snouted crocodile (*Crocodylus cataphractus*).

[4] Several sources report 250,000 primary producers, but regional reports do not appear to support this higher figure.

The official statistics indicate that the harvest of game animals total approximately 10,000 individuals per year, predominantly buffalo, wildebeest and hippopotamus. Safari hunting is a very important attraction and source of revenue. Controlled hunting provides a sustainable yield of animal protein in areas where few alternatives are readily available. Hunting is officially prohibited in National Parks and restricted in Game Management Areas. Although these restrictions have not been effective in the past, significant progress against poaching is reportedly being made with the help of the ADMADE program.

1.2.5.5. National parks and game management areas

Zambia's 19 National Parks cover 63,585 km^2 or over 8 percent of Zambia's territory. An additional 162,521 km^2 or 21 percent of the land area is devoted to 33 game management areas (GMAs). Hunting is officially prohibited in the parks and licensed and restricted in the GMAs. In most cases these GMAs serve as buffer zones around the national parks. Fourteen of the 33 GMAs are classified as satisfactory with regard to wildlife density and species diversity. The other 19 GMAs are classified as depleted. ADMADE is helping maintain the GMAs with satisfactory wildlife populations and hopes to rehabilitate others. The ADMADE program uses revenues generated through tourism and licensed hunting to protect the park and wildlife resources and provide an incentive for local communities to help in this conservation effort.

1.2.5.6. Tourism

The tourist industry in Zambia is little developed except in Livingstone and the Luangwa Valley. In Livingstone, tourism has developed because of the world famous Victoria Falls, now designated a World Heritage Site. Whitewater rafting and game viewing are also popular attractions in the area. Tourist infrastructure is still much less developed in Livingstone than in (the town of) Victoria Falls, on the Zimbabwe side of the river.

Tourism was intentionally developed in the Luangwa Valley, at least in part to help save the elephant population from poaching. A number of companies have concessions to provide game viewing in the Luangwa South and North National Parks. Operating from lodges and camps in and around the parks, these safari companies offer walking safaris, as well as day and night game viewing from vehicles. Although Kafue National Park is much larger, and reportedly has adequate game to attract tourists, it is much less developed. Lochinvar National Park has developed a reputation for bird viewing, but the lodge needs renovation to make it attractive for most tourists.

Tourism is already an important source of foreign exchange for Zambia and has the potential to provide employment and promote the development of infrastructure and services in remote areas, like the Kafue National Park. Zambia boasts a number of waterfalls and other scenic lands which should be maintained and tourist concessions could help provide the means to do so. Zambia may have trouble attracting the type of tourist who wants to stay in large hotels and have daily flight service to locations of choice. However, Zambia has a number of resources which could interest the booming eco-tourism sector of the tourist market.

1.2.5.7. Forests

Estimates of the area of Zambia covered by forests and woodlands range from about 45 percent to 60 percent. Included in this total is the gazetted forest estate, which covers 9.9 percent of the land area. Most of the forested area is open woodland; closed canopy forests cover only 4 percent to 6 percent of the surface area. Miombo woodland is the dominant vegetation type, covering 35 percent to 45 percent of Zambia's land area. Miombo woodland is dominated by species of *Brachystegia*, *Julbernardia* and *Isoberlinia*.

Zambia's vast forests produce benefits which are undervalued, often overlooked and important to the development of the country. Wood provides the major materials for house construction, fencing, furniture, and utility poles. The railway lines are laid on wooden sleepers (rail ties) and the underground mines are literally supported by wooden beams. Artisans use wood to produce a wide range of craft products for every day use and decoration.

Charcoal and fuelwood provide 58 percent of the nation's energy needs, serving as the major source of energy used by households, primarily for cooking. They are also important in activities like smoking fish and curing tobacco. In addition, the woodlands provide a range of by-products including honey, mushrooms, edible caterpillars, leaves, medicines, fruit, fodder and fiber. Women play a primary role in the collection and use of many of these forest products.

Perhaps less obvious, the forests and woodlands protect the land resource under them by helping absorb rain water, reducing runoff and avoiding soil loss due to erosion. The forest and ground litter protect the soil from wind erosion and enrich the soil over time. The absorption of rain water which reduces runoff, helps stabilize and maintain river flow throughout the year, and provides a source of clean and safe water. The forests and woodlands are home for wildlife which provide animal protein and a very important source of employment and revenue in some areas. In fact the forests and woodlands provide habitat for many of the 4,200 species of plants and 1500 species of animals found in Zambia. These in turn constitute a 'gene bank' which may be the source of important wood, food, fruit, fiber, fodder and medicine products in the future.

1.2.5.8. Forest estate

Officially gazetted national forests cover 51,386 km^2 or 6.8 percent of Zambia. Gazetted local forests cover an additional 22,975 km^2 or 3.1 percent for a total of 9.9 percent of the land area. Plantations of pine and eucalyptus have been developed, primarily on the Copperbelt. These plantations total about 56,000 ha or 560 km^2, of which 50,000 ha are found on the Copperbelt. Other protected forest areas include the 8.4 percent of Zambia devoted to national parks, and to a lesser degree, the 21 percent of Zambia in game management areas. Forest protection has not been effective in recent years and several of the forest reserves have been severely deforested.

1.2.5.9. Mining

None of the available reports indicate the area influenced by mining activities. However, mining is a large scale activity in this country, the Nchanga open pit mine is reported to be the second largest open pit mine in the world. Copper ore extracted by the various ZCCM mines was on the order of 17 million mt in 1991. Of this, almost 98 percent ends up on tailings dumps. The Nkana tailings

dump fills much of a substantial valley. Mining effluent is the major source of suspended solids and heavy metals in the Kafue River.

1.2.6. Water

Endowed with a relative abundance of lakes, rivers, wetlands and groundwater, Zambia is estimated to possess nearly 45 percent of all the water resources in Southern Africa. The major development of the water resources has been for hydroelectric power production and domestic water supply. The fishing industry is also very important, supplying over 50 percent of Zambia's animal protein production. Irrigated agriculture has received only limited development.

1.2.6.1. Water quantity

The Zambezi River which drains about 75 percent of Zambia as well as parts of neighboring countries, is the third or fourth (depending on criteria used) largest river system in Africa. With little demand on this resource during the era of Independence, the right to use as much as 95 percent of the flow was allocated to the production of hydropower. With increases in development and a rapidly increasing population, there is now much more demand for water. In some areas competition for water rights has become quite intense. Sectoral development plans call for large increases in agricultural irrigation, hydroelectric generation, and urban water supply, as well as for the maintenance of the wetlands eco-systems. These plans have apparently been made without consideration of the needs of other sectors and their effect on the total water supply.

As this mission was ending, reports began to surface concerning a large number of wells which were going dry due to drought conditions. The availability of, and competition for water may temporarily become much more of a problem than it has been in the past.

1.2.6.2. Water quality

Access to quality drinking water has become a critical issue accentuated by annual epidemics of cholera. Water systems in urban areas are often deteriorating from lack of maintenance and under intense pressure from the rapid increases in population. Chemicals for water treatment are often unavailable or beyond the budget of local district water departments. Sewage frequently flows into the source of drinking water, and often greatly exceeds the capacity of sewage treatment facilities. Solid and hazardous waste disposal is inadequate and largely non-existent. Hazardous and toxic waste pose an acute, but largely unrecognized threat to the quality of surface water and groundwater.

1.2.6.3. The Kafue Basin and Kafue Flats

The Kafue River, while a tributary of the much larger Zambezi River, is arguably Zambia's most important water system. Zambia's major urban centers, mining operations, commercial farms, industrial plants, and hydro-electric generating facilities all are located in the Kafue River basin. The Kafue system is the primary outlet for effluent from these towns, mines, and industries, and for agricultural run-off, while at the same time being a source of drinking water for at least one third of Zambia's population. Much of Zambia's irrigated agriculture is located in the basin as is its largest national park and wildlife reserve complex. The Kafue Flats is a sensitive and important wetlands

eco-system that is under extreme pressure because of intense competition for access to land and water in the area.

1.2.7. Air

Although air-quality problems are not widespread, air pollution is a localized problem near the mines, some industries and population centers. The most affected areas include Kitwe and Chingola (mining and smelting), Ndola (oil refining), Kabwe (lead and zinc refining), Kafue (fertilizer production), Chilanga (cement) and Maamba (coal mining). About 200,000 tons of sulphur dioxide are emitted annually. The smelter at Kitwe is particularly offensive and frequently exceeds World Health Organization (WHO) hourly and daily standards for concentrations of sulphur dioxide (Mabbs-Zeno, 1992). Kitwe residents complain of a high incidence of respiratory ailments. However, food contamination due to excessive levels of lead and cadmium in vegetables near Kabwe's lead and zinc smelter may be an even greater danger to human health in the long run.

Traffic emissions are unpleasant, but the relatively small number of vehicles in Zambia prevents them from being a serious problem. Carbon dioxide production in Zambia is estimated at 30 million tons annually. Excluding bushfires, the primary source of CO_2 is clearing land for agriculture (56.7 percent), compared to 34.9 percent from fuelwood, 5.1 percent from coal, 2.4 percent from traffic and .9 percent from oil. Bushfires are an important source of CO_2 and certainly the situation with regard to CO_2 would improve if the incidence of bushfires could be reduced. However, the growth of annual plants fixes approximately the same amount of CO^2 as is produced when they are burned. Some ecologists prefer to argue that since this cycle by itself produces a rough balance in CO^2 levels, that the contributions from other sources are responsible for the build up of CO^2 in the atmosphere (Chidumayo, personal communication).

1.2.8. Minerals

Zambia's most important mineral resource is copper. The country has about 6 percent of the world's proven reserves of copper ore, and contrary to recent speculation, ZCCM reports it will be able to maintain a substantial level of copper production for many years to come. Zambia is the world's third largest producer of cobalt and is estimated to have 15 percent of global cobalt reserves. Zambia is a minor exporter of lead and zinc and produces coal to meet part of its energy needs. Iron ore and uranium deposits have been located. Both 1985 and 1992 reports indicate that extraction of iron and uranium will soon be implemented. Zambia is also an important source of precious stones including amethyst, tourmaline and emerald. Limestone and dolomite are quarried on a small scale for local building needs, but have not been developed to help counter problems of soil acidity in the agricultural sector.

1.2.9. Energy[5]

Woodfuel (fuelwood and charcoal) is the principal form of energy used in the domestic and small industry sectors, providing 80 percent of the energy used in urban areas and nearly 100 percent in rural areas. In 1988, woodfuel accounted for 64 percent of total primary energy, while electricity contributed 12 percent and coal and petroleum add 7 percent and 11 percent respectively. Other minor sources contribute 6 percent of the supply.

Households account for 58 percent of energy consumption in Zambia, primarily in the form of fuelwood and charcoal. Woodfuel met about 84 percent of household energy needs, while electricity and kerosene each contributed 2 percent.

The mining industry dominates the consumption of the so-called commercial energy, namely electricity, coal and petroleum. The mining industry accounts for 72 percent, 54 percent and 28 percent, respectively, of these fuels and has been the single most important factor in the use of electricity and coal. Before hydro-electric power was available in the 1950s, the mining industry reportedly used over 1 million cords (900,000 tons) of fuelwood per year to fire thermal power stations. This use of fuelwood was eliminated by the investment in hydro-electric power.

1.2.10. Industry

As of 1990, Zambian industrial contribution to GDP was dominated by 1) Food, beverages and tobacco, 2) Fabricated metal products, 3) Mining and quarrying, 4) Non-metallic mineral products, 5) Paper and paper products, 6) Textile and leather industries, and 7) Chemicals, rubber and plastic products.[6] Much of the non-mining industrial sector is oriented towards import substitution of consumer goods. Much of this production is import-dependent and vulnerable to foreign exchange shortages. Many operate at much less than full capacity.

The non-mining industries are concentrated in Ndola, Lusaka and Kafue. Like the mines, most of these non-mining industries are discharging effluent into the Kafue River and its tributaries. Few if any have adequate water and air pollution control or measures to prevent and control toxic or hazardous waste spills. Planned and appropriate disposal of toxic or hazardous waste appears to be practically unknown. No dump or incinerator for the disposal of toxic or hazardous waste exists in Zambia nor is there any known to be available in the Southern Africa Region, which Zambia could use.

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[5] Based on the Urban Household Energy Strategy, 1990, World Bank and UNDP.

[6] NCDP: Economic Report 1991, based on current prices. Note the ranking changes in some cases when 1977 constant prices are used.

1.3 The development context

1.3.1. Historical background

At independence Zambia had substantial foreign exchange reserves and per capita income was among the highest in Africa. Copper accounted for over 90 percent of the country's foreign exchange earnings and provided more than 50 percent of government revenues. The economic activity and foreign exchange generated by the copper mining industry fueled Zambia's economic development. Massive investments were made in physical and social infrastructure. In addition to the normal health and education facilities, the government made enormous investments in urban housing and several large hydro-electric facilities. Following Southern Rhodesia's unilateral declaration of independence, huge investments were made in rail and road infrastructure to replace those systems passing through Southern Rhodesia. In 1969, Zambia nationalized the copper mining industry and many companies in the secondary industrial and commercial sectors, converting them all into parastatal enterprises.

From independence to the mid-1970s, Zambia's economy experienced high rates of growth produced by increasing copper output and rising prices on the world copper market. In the mid-1970s copper prices crashed, causing an almost 50 percent decline in GRZ revenues between 1974 and 1976. Government expenditures were aggravated by the international oil crisis. The slow growth of industrialized economies following the rise in oil prices severely reduced demand for Zambian copper. Changes in technology which substituted other products for copper in the electronics and communications industries also reduced demand. It took a number of years to reduce government spending in line with diminished revenues. In 1983, government expenditures were double government revenues. Foreign debt expanded, reaching US$4 billion in 1983 and US$7.0 billion by 1989. Foreign exchange shortages make it difficult to import spare parts and other materials needed by the manufacturing sector. Industry was constrained to operate well below capacity, averaging 30 percent of capacity through the early 1980s according to some sources.

Food subsidies were introduced soon after independence to make food available to all at affordable prices. The World Bank (WB) estimates that maize subsidies to (urban) consumers exceeded 50 percent of the maize price for 1975-1989. During this period farmers earned only 25 percent of the income that they would have earned for each unit of output under free trade.[7] These conditions, in addition to the lure of government housing and free medical care, provided very strong incentives for rural-urban migration.

Zambian economic growth stagnated, real GDP in 1990 being only 8.6 percent higher than in 1975. With high rates of population increase, real per capita GDP in 1990 has fallen to about 65 percent of what it was in 1975. Many of the economic problems are due to Zambia's economic dependency on copper, one of the highest rates of dependency on a single commodity of any country in the world.

The mining sectors share of the economy has declined from 41 percent in 1965 to about 9 percent in 1990, yet in 1990 Zambia was still dependent on copper exports for 86 percent of its exports and

[7] Zambia Agriculture Sector Strategy: Issues and Options, 1992.

foreign-exchange generation. With this declining share of the national economy, copper revenues alone are no longer sufficient to provide the foreign exchange requirements of the rest of the economy, nor are taxes on the mining sector sufficient to fund the government.

Recognizing that copper would no longer serve as the engine of growth for the Zambian economy, the government changed the emphasis in development from mining to agriculture and other natural resources. With only 1.2 to 1.5 million hectares cultivated annually, there is enormous potential to increase agricultural output. Much of Southern Africa has chronic food deficits and share Zambia's dependence on maize as the staple food. Southern Africa also has a growing demand for forest products which can be produced in Zambia. The challenge is to develop these renewable resources in a manner which is sustainable and avoid environmental degradation.

1.3.2. Recent policy changes

The development context and policy environment have changed significantly with the election of a new government in October 1991. The new government recognizes that:

> "Agricultural development in the past has been inhibited by excessive government intervention in pricing and marketing, especially with respect to maize. Price controls and subsidies on maize and fertiliser (sic), the system of uniform national pricing, and the cooperatives monopoly in maize marketing have operated as disincentives to efficient production and optimal land utilisation (sic), while encouraging consumption, stimulating smuggling, and nurturing a bloated and inefficient structure of agricultural cooperatives.
>
> The Government intends to promote efficient production, ensure food security, and augment exports. Major steps have been taken recently toward elimination of subsidies and liberalisation (sic) of pricing policies.
>
> The liberalisation (sic) of maize and fertiliser (sic) prices is important not only to reduce the burden of subsidies on the budget but also to improve the structure of incentives to farmers and consumers. The improved geographical patten of production and the increased efficiency in the growing, transporting, and processing of agricultural crops that will accompany the liberalisation (sic) of maize and fertiliser (sic) markets should help offset the impact on consumers of the phasing out of subsidies." (Source: GRZ Economic and Financial Policy Framework 1992-1994, 1992).

Fertilizer and transport subsidies have been eliminated and the marketing of agricultural inputs and products has been opened to private enterprise. Preparations for the privatization of many of the parastatals which dominate the economy are in progress. Implementation of these policies should provide incentives for the diversification of the agricultural sector and improved land use with increasing intensification in areas of high potential for agricultural production.

The GRZ began to liberalize and then attempted to re-control maize meal[8] prices after they approximately tripled in reaction to inflation, foreign exchange devaluation and drought. Farmers complain that the 2000 K per bag price they received was only about 70 percent of the price which the government had promised. The announced maize price to farmers for the 1992-93 season is 3000 K per bag, but if inflation continues at the rate of 100 percent per year, this is not likely to be viewed as an improvement. Many commercial farmers say that they will not plant maize as long as the profitability of maize production is uncertain.

Under the influence of drought, production for the 1991-92 crop year is estimated to be between 10 to 30 percent of the harvest expected in a normal year, rather than the bumper crop which was originally expected. The drought and consequent shortage of maize places the government in a delicate situation. Urban riots over the lack of maize or high maize prices destabilized the previous government's structural adjustment efforts on two occasions.

1.3.3. Inflation

Other aspects of the macroeconomic environment have not yet changed significantly. Inflation has increased at the rate of about 100 percent a year for the last four years, and it is unlikely that inflation will decrease during the present drought. Inflation and structural adjustment policies have led to several devaluations of the Zambian currency (Kwacha) over the last few months. The combination of high inflation rates and devaluations causes a great deal of economic uncertainty. Entrepreneurs in general, and farmers in particular will likely be very hesitant to make new investments under such conditions.

Interest rates charged by banks are presently in the range of 50 to 60 percent. But if inflation is continuing at the rate of 100 percent per year, real interest rates are in fact negative. This implies that banks will lose money providing loans at these rates, and will be very hesitant to provide credit, if they have other more inflation resistant investment options. This problem was recently underlined by a newspaper article which indicated that banks would only be able to supply about one tenth of the credit normally needed by farmers to plant the annual maize crop.[9] The low rate of repayment of agricultural loans during this drought year was blamed for the shortage of credit. Unfortunately, even donors are unlikely to be willing to help resolve this lack of credit, since a revolving fund would lose something approaching 25 percent of its capital per year given the existing combination of inflation and interest rates. Until the GRZ manages to reduce inflation or raises interest rates, it is unlikely that much credit will be available for food production, privatization or other aspects of economic revitalization which produce relatively short-term returns. Ventures which require a long period before achieving economic payoff, as is the case with most natural resource and environmental activities, stand little chance of competing for scarce credit resources.

This situation also has implications for the debt swap mechanism which has sometimes been used to finance the investment in natural resource and environmental programs. Zambia has significant

[8] Maize meal is often called "mealie meal" in Zambia.

[9] Times of Zambia, August 3, 1992.

privately and publicly held foreign debt, and the debt swap mechanism has been used in years past by organizations like WWF. But experience indicates that negotiating and arranging a debt swap is often a fairly lengthy process. It typically involves a relatively large lump sum which would be spent over a several year period in support of a project or activity. Conditions of high inflation and negative real interest rates reduce the value of what can be procured with the resources released by the debt swap. Debt swap will not be an attractive funding alternative under conditions of high inflation unless the money can be used for a large capital expense like buying land or financing a long-term lease.

1.3.4. Privatization

One of the new government's major policy orientations is for the privatization of many of the parastatals which dominate the Zambian economy. Privatization is looked to as a part of structural adjustment which will generate private investment to revitalize the Zambian economy. There is a very important environmental factor which may have a significant impact on the privatization process, which has net yet been addressed. Many private, and particularly foreign, investors will be very concerned about the environmental liability facing companies available for privatization. The lack of any clearly stated government policy with regard to the environmental liability of investors for the companies which they might purchase, is likely to discourage many desirable (scrupulous) investors or significantly reduce the price which shrewd investors are willing to pay. Investors need a clear statement of what environmental standards companies will have to meet and what liability investors will have for the past environmental sins of the companies.

2. Issues of forest-resource management

Zambia's forests and woodlands have an immense productive potential which is not now husbanded (managed and conserved) to provide the very significant economic benefits which could accrue from exploiting that potential in a sustainable manner. Colin Heygate[10], has a vision of the future in which forest products replace copper as the major exports of Zambia, and in which processing forest products provides a major source of employment. [illegible] of Southern Africa has an ever increasing demand for such products, and is constrained by climate in its ability to produce them. Certainly if the forests and woodlands are husbanded, Zambia has the potential to produce enormous quantities of timber and wood products.

At present Zambia's laws and incentive structure conspire to cause the forests and woodlands to be treated as a free good, i.e. having no value. As in many frontier societies, forests are perceived as being an obstacle to productive agriculture. A recent newspaper article carried the headline "Zambian land untilled" and the text states that 34 percent of Zambia is still unused, and more specifically that it is "unused woodland".[11] This phrase creates the impression that the existing woodlands have no

[10] Chairman of the Environmental Conservation Association of Zambia and a farmer who grows trees for commercial use.

[11] Underlined for emphasis.

value to people or the nation. Furthermore, the land use classifications in the article include no category for game management areas. The GMAs cover about 21 percent of Zambia, and must be largely subsumed under "unused woodland" in this classification. The failure to include a classification for the GMAs implies that game and other wildlife are not important and strengthens the impression that the woodlands which provide their habitat are unimportant and unused. Perceptions like this must change if the forest and woodlands are to be husbanded to realize the vast potential which they possess.

Zambia's development strategy has officially changed from dependence on mining to the exploitation of renewable resources, specifically agriculture. Lip service is given to other renewable resources, but it seems clear that the prevailing attitude is that Zambia will literally plow its way to economic prosperity. Agricultural production should and will be expanded. Increased food production will increase the food security and well-being of Zambia and the ever increasing population of Southern Africa. But there is a danger that Zambia will not recognize the value of the forests and woodlands until value is imposed by extreme scarcity. In addition, if Zambia does not conserve and manage its forest resources, Zambia will not reap the economic benefits that will accrue from developing forest products concurrently with agricultural production.

Unless Zambia's forests and woodlands are developed to provide employment and increased income, they will not be perceived as having value and they will likely be cleared for agricultural production. The challenge is to develop the forest resources to provide employment and increased income in a sustainable manner which does not degrade the environment.

2.1. Forest resources

The estimates of the area covered by forests and woodlands in Zambia range from 44 percent to 60 percent. Such estimates are seldom, if ever, accompanied by data. Those estimates which do present specific data are based on vegetation type (also called biomass classes). But the data on vegetation type do not have any classification for cultivated land. Such estimates obviously exaggerate the extent of forest cover, but at least provide data which can be evaluated. As vegetation types, closed canopy forests and savanna woodlands cover 48,530 km^2 and 535,926 km^2, respectively, or 6.4 percent and 71.2 percent of the country, respectively. Estimates that miombo woodland covers 353,267 km^2 or 47 percent of the country are made on the same basis. The Commissioner of Town and Country Planning recently presented a report which indicates that 22 percent of Zambia's surface is crop land and another 1 percent is urban area. Other sources indicate that over 20 percent of the land has been cleared for agriculture in Eastern, Luapula, Southern and Northern provinces.

Estimates of Zambia's growing stock of forest biomass vary from 3,000 million mt to 4,300 million mt, and estimates of average annual growth from 83 million mt to 130 million mt. Chidumayo believes the lower estimates are based on more appropriate samples and extrapolation procedures, and are more accurate (Chidumayo, personal communication).

Energy Consumption Estimates
(in petajoules)

Sector	Woodfuel Use	Energy Use from Other Sources	Total Energy Use	% of Total HH* Woodfuel Use	% of Total Woodfuel Use
Rural Households	64.3	12.3	76.6	73.6	61.0
Urban Households	23.1	4.2	27.3	26.4	21.9
Subtotal All Households	(87.4)	(16.5)	(103.9)	(100)	(82.9)
Other Sectors	18.0		59.0	77.0	17.1
Total	105.4	75.5	180.9	100	

* HH = Households

Sources: WB Urban Household Energy Strategy, 1990

A rough calculation based on data in the Urban Household Energy Strategy, 1990, indicates that combined fuelwood and charcoal use is about 13 million mt. Different sources imply wildly different estimates of wood used in poles, sawnwood and other wood products, varying from about 200,000 mt to about 9 million mt. Even if the higher estimate is used, the 22 million mt total for wood resource use is well below the average annual growth of the existing biomass. However, this estimate of wood resource use does not include wood burned in *chitemene* agriculture or destroyed in land clearing. No estimates are available for the amounts of wood consumed by these activities, but it is certainly possible that they exceed the quantities of wood actually used.

Woodfuel use estimates

Sector	% of Total Woodfuel Use	Calculated Woodfuel Use[12] in million tons
Rural Households	61.0	2.85[13]
Urban Households	21.9	7.95
Subtotal All Households		(82.9) (10.80)
Other Sectors		17.1 2.20
Total	100	13.0

* HH = Households

Sources: WB Urban Household Energy Strategy, 1990; and Central Statistical Office, 1990 census data.

2.2. Deforestation

Deforestation is obviously an important issue with regard to the conservation and sustainable use of the forest resource. The issues of charcoal production[14] and *chitemene* slash and burn agriculture, are important primarily as they relate to the larger issues of deforestation and sustainable forest resource use. The same is true of problems of burning and overgrazing as related to forestry.

Most sources agree that clearing land for agricultural production is the most important cause of deforestation. But the amount of land deforested and the rate of deforestation is much less clear. No

[12] Extrapolated from per capita energy use estimates and 1990 census data: urban population of 3.29 million and rural population of 4.53 million.

[13] The WB Urban Household Energy Strategy estimates that total urban firewood and charcoal consumption was .37 million and .57 million tons respectively. Charcoal conversion rates average about 23 percent. .37 + 2.48 = 2.85.

[14] Much of the literature in Zambia refers to charcoal production as "charcoal burning".

systematic forest inventories have been effected, nor is there any other systematic monitoring of the forest resources.

Calculations concerning deforestation have largely been based on the mapping of the vegetation types mentioned above, which include no classification for cleared land or crop land. The entire surface area is attributed to grassland, or one of the various forest/woodland categories. On this basis de Backer (1986) calculated the average annual rate of deforestation from 1975 to 1985 varied by Province from 0.2 percent to 2 percent, and averaged 0.5 percent nation wide. Most other recent estimates of annual land clearing range from 3,000 km^2 to 10,000 km^2, or from 0.5 percent to about 2 percent per year. Even within these estimates it is uncertain how much of this land is stumped and cleared permanently, and how much is cut for fuelwood and *chitemene*, which will coppice and grow back. With an estimated 45 percent to 60 percent of land area in forest and woodlands, these estimated rates of deforestation do not imply an immediate crisis, but neither do they confirm the view that there is nothing to worry about.[15]

A study of the Copperbelt/Lusaka urban catchment area using aerial photos taken in 1982 and 1987, indicates that in this area supporting about 37 percent of Zambia's population, 50 percent of the total land area is still classified as unused forest/woodland. An additional 14 percent was degraded woodland or woodland recently cleared for woodfuel. Only 12 percent was permanently cleared for agriculture and a mere 0.7 percent was classified as urban. However, no rate of annual land clearing is provided in the study. (World Bank, 1990)

In the rural areas, there is a threat of an increasing rate of deforestation in the 1990s, primarily due to increasing population. The rate of population increase in the rural areas was estimated at only 0.5 percent in the 1970s. It was kept low by outmigration to urban areas. With increasing economic problems and difficulties in the cities, this appears to be changing. The 1990 rural population was almost 20 percent higher than predicted. The rate of rural population growth is expected to increases to an estimated 2 percent per annum for the 1990s. This will likely increase the present low rates of permanent deforestation in rural areas as more people clear land to farm. If the rate of permanent deforestation in rural areas approaches the expected 2 percent rate of rural population increase, it would be a significant rise from the estimates of present levels.

2.2.1. Chitemene

Chitemene is often perceived as causing the indiscriminate destruction of forest resources on a large scale, and being wasteful in the sense that a much larger area is cut than is cultivated. Another equally valid perception is that *chitemene* is a traditional agro-forestry system, which when used according to the "large circle *chitemene*" practice, is a remarkably effective cultivation technique and also minimizes the length of time necessary for the forest to recover.

[15] The World Bank, 1992 report states that the expansion in land cultivation was 15 % a year between 1974 and 1988. If not an error, this is much more alarming.

Chitemene is a form of slash and burn agriculture traditionally practiced in Northeastern Zambia in an area covering Northern and Luapula Provinces and parts of Central Province. Allan (1965) estimates that the system will support 3.9 persons per km^2. More recent estimates by Chidumayo indicate a carrying capacity of only 2.4 persons per km^2. Indications are that *chitemene* will be adapted or disappear as population pressure increases. In the Kasama area, the more intensive *fundikila* grassmound system seems to be replacing *chitemene* as population density increases (Blackwell, et al., 1991, quoted from Mabbs-Zeno et al., 1992).

Under *chitemene*, branches are lopped and some trees are cut from a large area (the outfield). These branches are piled and burned in a relatively small part of the total area (infield) to concentrate the nutrients from the ash. The outfield ranges from 1.4 to 2.0 ha per household and is usually about ten times larger than the infield actually cultivated. The fire helps destroy weed seeds and reportedly regulates soil nutrient dynamics in favor of crop production (Chidumayo, 1987).[16] The practice of lopping branches rather than cutting trees, helps the forest to regenerate more quickly than would be possible if the trees were cut.

Data on the area affected or the number of farmers using *chitemene* are not available. A very rough estimate is that about 72,300 ha per year are cleared for *chitemene* agriculture in the Northern Province.[17] This implies that about 0.5 percent of the surface area of Northern Province is cleared each year for *chitemene*. If one assumes that a 25 year period is necessary to obtain substantial regeneration of the woodland, about 14 percent of the Province's land area would be affected by *chitemene* during this period.[18] This guesstimate would indicate that nationally an important but much smaller area is cleared annually for *chitemene* than the 1,000,000 ha suggested in the National Conservation Strategy (1985). That figure would indicate that almost the entire land area of the three Provinces where *chitemene* is traditionally practiced is cut over in a 25 year period necessary for substantial forest regrowth.

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[16] The destruction of soil organic matter by fire which mineralizes nutrients and makes them available to plants is also viewed as a form of soil degradation by soil scientists.

[17] This is based on: estimates that Northern Province has 126,000 farmers, of which 45 percent use *chitemene* and have an average outfield size of 1.4 to 2.0 ha. New gardens were traditionally prepared every year, but reports identify a trend towards preparing new gardens only every other year. The estimate assumes that 50 percent prepare yearly and 50 percent only every other year.

[18] 25 years is an average figure for the time estimated necessary for miombo forest to regenerate after being cut. To the extent that branches are lopped and the trees are not cut, outfields will regenerate in less than 25 years. Infields can substantially regenerate in 25 years if the miombo species' root systems survive the burning of the field.

With the termination of fertilizer subsidies and uncertainty over maize prices, the use of *chitemene* is likely to increase as farmers return to traditional crops and practices which do not require fertilizer. Although this may create a crisis with regard to agricultural production and food security, it still is not evident that it creates a crisis with regard to deforestation.

2.2.2. Woodfuel deforestation[19]

Rural households in Zambia depend largely on fuelwood to meet their household energy needs. Urban households rely mostly on charcoal because its smaller volume is easier and cheaper to transport. Rural households collect fuelwood from local woodlands. Urban households in most cases must buy charcoal which is produced at some distance from the city and transported to urban markets. Rural households use approximately three times as much woodfuel as urban households, and almost twice the woodfuel per person as do urban households. The higher use per person is primarily due to the lower cost of procuring fuelwood. Rural households typically collect branches and deadwood. Thus the high woodfuel use per person of rural households contributes less to deforestation than does the woodfuel use of urban households.

Both urban and rural households are dependent on woodfuel for about 84 percent of their energy needs. Like agricultural production, charcoal production provides a commodity which is essential to Zambian society. Eliminating charcoal use is not in the realm of possibility nor is it desirable if the alternative is the use of non-renewable resources. Like agricultural production, it is not charcoal burning which is undesirable, but rather charcoal production in a manner which is unsustainable and which has a negative impact on the natural resource base.

It is evident that charcoal production contributes to deforestation. Forest resources are increasingly scarce near urban centers where they are needed to provide energy for the ever increasing urban population. However, there are no large-scale efforts to develop tree plantations or manage natural forests to supply these urban centers with fuelwood and forest products. Around small towns forest resources within walking distance are under severe pressure. Around Lusaka, most of the woodlands within 50 to 75 km have been cut for woodfuel (and/or agriculture) and accessible forest areas up to 150 km away are under pressure. Charcoal production needs to be done in a manner which is sustainable and which allows the forest resource to be renewed.

Some sources propose that changes in technology could make a huge contribution to forest conservation. In reality, the solutions are not likely to be this simple. Recent studies (Urban Household Energy Strategy, 1990) show that properly maintained traditional mud charcoal kilns are nearly as efficient as the expensive steel models, as measured by the conversion rate. Many earlier sources estimate the conversion rate of mud kilns at 10 percent. The new studies show conversion rates from 18 percent to 33 percent, averaging 23 percent, or nearly the same rate as the expensive steel models.

2.2.3. The free-good problem

[19] Based on the convention that woodfuel denotes both fuelwood and charcoal.

One of the important underlying problems contributing to the deforestation, scarcity in urban areas, and lack of investment in growing trees or managing natural forests is the whole institution of treating forest resources as a free good. Certainly it is possible to grow trees and manage natural forests so that they are more productive, but there is no incentive to do so. According to the Forest Act and Forest Policy, the forest resources belong to the state, so the local communities do not protect them and the Forest Department has no means to do so. Since the resources of the woodlands are free for the taking, charcoal burners have a strong incentive to move from place to place harvesting free trees, and no incentive to invest in growing trees. Many farmers produce some poles and fuelwood for their own use and would be interested in producing trees on a larger scale if it were profitable. But no one wants to pay them for a commodity which can be appropriated elsewhere at no cost. Some farmers wonder if they can produce poles and charcoal profitably for the Lusaka market, but it is very difficult to cover production costs and still compete with others harvesting a free good.

2.3. Decline of forestry institutions

In the past, what trees were produced or managed were largely exotic trees grown on plantations established by the Forest Department (often with donor funding). Most of these plantations were ceded to the parastatal company, ZAFFICO. This company controls about 50,000 ha of eucalyptus and pine plantations in the Copperbelt. But like the charcoal burners, ZAFFICO primarily just harvests trees. It neither plants any significant quantity of trees, nor adequately manages the plantations which it inherited. Much of the area under their control is in need of thinning, pruning, fire breaks, etc. However, the presence of a parastatal which dominates plantation forestry makes it difficult for private enterprise to get started in this sector.

The Forest Department has also fallen on hard times. It may plant a hectare or two in various local forests or community woodlots each year, but it makes no substantial contribution to the supply of forest resources available. Neither does it have the means to protect the gazetted forest estate. Many of the forest reserves near the urban areas and even the hydrologically important headwaters of the Kafue River have suffered severe deforestation. In defense of the Forest Department, it should be said that politicians often sided with the exploiters of forest resources, and prevented the Forest Department from taking any action.

The situation with regard to protecting the forest estate or the enforcement of any forest policy is seriously in question. To expect any degree of protection or enforcement will require a stronger Forest Department than exists at present. There is serious encroachment on many of the forest reserves, and the Forest service seems unable to prevent it. This is particularly serious where the forest protects an important resource like the headwaters of the Kafue River or a rare ecology. The lack of protection and enforcement is in part a question of means, but more importantly a question of political will. As long as politicians support people who break the forest law, it is unlikely that any policy can be enforced or protection maintained.

The forestry department does maintain depots for the sale of poles and sawnwood, and operates several sawing operations. These in fact provide some revenue for the department. These probably have a tendency to discourage private investment in similar activities.

Management of forest resources outside the gazetted forest estate now resides with the Department of Natural Resources. In particular the Department of Natural Resources is responsible for establishing fire control and the extension of forestry/agro-forestry techniques in the areas of traditional land tenure. Like the Forestry Department, the Department of Natural Resources has practically no capacity to carry out its assigned responsibilities.

The Forest, Agricultural and Natural Resources Departments have had little success in involving individuals or local communities in tree planting activities. Promotion of ecologically unsuitable species, lack of extension services, open access and tenure systems, inadequate tree seedling husbandry and seedling distribution problems have all contributed to failure of the state-directed community tree planting program.

2.4. Indigenous hardwoods

High-value hardwoods such as *Afzelia quanzensis* (pod mahogany), *Baikiaea plurijuga* (mukusi or Zambian teak), *Faurea saligna* (saninga), *Guibourtia coleosperma* (muzauli), and *Pterocarpus angolensis* (mukwa) make up only a tiny portion of the growing stock in most of Zambia's natural forests. Stocking rates for such commercial timber species are estimated to be in the range of 0.5 to 2.0 mt per hectare, or about 0.3 percent to 2 percent of the standing woodland. Since there is no systematic inventory of forest resources, there is little information about the remaining stock of indigenous hardwoods of sufficient size to produce commercial logs. Chidumayo suggests that there is little commercial quality timber remaining in areas which are reasonably accessible to trucks and equipment (personal communication). This of course includes most areas where one might reasonably implement a forestry project.

Little is know about seeding techniques required to reproduce these species or their potential to produce in a plantation environment. The expectation that most hardwood species will require 30 to 50 years to produce commercial logs is a strong disincentive to such investments. The inability to control access to natural forests further discourages investment in enriching woodland areas with these species.

2.5. Forest research

Forest Department activities have primarily focused on plantation production of exotic species. Relatively little is known about most indigenous species, either with regard to their plantation potential, or to improving their productivity in the natural forest setting. The Forest Department has a Forest Products Research Division, but like the rest of the department, it has little capacity to meet its research objectives.

2.6. Policy issues

At present there are no incentives for individuals to value the forests and woodlands. The practical reality is that trees are available virtually free to anyone who wants to cut them down. Therefore, there is no incentive to grow trees or make any investment in natural forest management. Under such a system, a resource will have no value until a value is imposed by extreme scarcity. Zambia's vast woodlands will not disappear any time soon, but commercially exploitable hardwoods in accessible

locations have already largely disappeared. Poles, fuelwood and charcoal may be reaching a level of scarcity around Lusaka which will allow products from plantations or managed forests to compete with products appropriated from gratis wood resources, but transported long distances. Policy changes which will modify this incentive structure are perhaps the most important issue in the forestry sector.

Changing these incentives boils down to implementing an effective fee system for cutting trees. The GRZ does in fact levy a stumpage fee on trees cut on public lands. The fee varies according to end use. Woodfuel is charged the lowest fee and hardwood saw logs are charged the highest. Practically speaking however, few people other than large commercial operations bother to pay this fee. Reports and anecdotal information indicate that even these large commercial operations typically extract several times more wood than the amount for which they were licensed and paid fees. The GRZ also levies various taxes on forest products, particularly a "removal" tax on charcoal which is supposed to be paid by the transporter or trader.

The official fees are often inconsequential. The fees must be approved by the cabinet. In 1988, a new fee schedule was approved which had been drawn up 8 years earlier. In an economy where inflations approaches 100 percent per year, the relative value of the new fees was perhaps one eighth of what was intended.

However, even the existing fees are not effectively implemented. Estimates indicate that the Forest Department collects between 2 and 10 percent of the prescribed forestry fees. Checkpoints collecting the removal tax are not staffed at night, so most of the charcoal transported enters the cities at night.[20] There is no effective means of checking valid tax payments and the same removal license may be used repeatedly.

The Forest Department does not have the power or the means to control cutting trees in the gazetted forest estate, and has even less control over forests under traditional tenure. They don't have the staff or the means to adequately patrol the forest reserves nor can they impose meaningful sanctions on those who are caught breaking the forest code. Fines for lacking the appropriate removal license are reported to be 100 K (50 cents), whether for 1 bag of charcoal, or for a truckload. Certainly tax experts could develop a more effective system for levying fees on forest products. But given the present woes of the government and the economy, the Forest Department is unlikely to have the means to implement the present system any time in the foreseeable future.

Since the Forest Department does not and will not have the means to protect the forest resources from indiscriminate cutting, Zambia needs to explore returning control of the forests to local communities. Since colonial times the government has claimed, and in the past has exerted, control over the forests and woodlands. Individuals or communities have no incentive to protect or use the forest in a sustainable manner. Any stumpage fee collected goes into the national treasury, and is not shared with local governments. A means needs to be found by which the local communities or leaseholders

[20] A second reason is that the dilapidated trucks typically used to haul charcoal do not meet official safety standards and may be stopped by police during the day.

can collect fees and retain a significant proportion of the revenues collected. District councils are in need of revenues and are in a better position to collect such fees, especially in areas outside the forest estate, than is the Forest Department. In agricultural areas, some provision would have to be worked out for land cleared for cultivation.

Similarly, communities and/or individuals must be secure in their right to exploit forest resources, before any significant community forestry program is possible. Communities or individuals have no incentive to invest the time and effort to grow trees or manage a natural forest, if they perceive that the Forest Department (government) will reap the benefits. To explore the feasibility of this approach, it should be possible for the government to mandate that such rights will be granted in specific pilot project areas. Several pilot projects could examine whether this works and how best to proceed, before the government takes the step of ceding all or most forest rights back to local communities. Practically speaking, this is not such a drastic step given that the government does not and can not exercise the rights and responsibilities which it claims.

Implementing a land tax is another policy option which would have important consequences for both forestry and agriculture. Such a tax should target land held under freehold/leasehold tenure, much of which is found along the line of rails and in other areas of high agricultural production potential. Large tracts of arable land which have been cleared for cultivation are presently not cultivated, even on the line of rails. The primary purpose of the land tax would be to encourage farmers with cleared land to use it, at least to pay the tax. Land along the line of rails can be cultivated more intensely than comparable land in isolated areas, because the transportation infrastructure allows inputs to be delivered and products to be marketed. To the extent that such land can be farmed intensively, food security and development goals will require the clearing of less land in the hinterland. Forest or woodland could be taxed at a lower rate to encourage ground cover, soil protection and the production of fuelwood and other wood products for urban areas. A significant tax break might be enough to convince farmers that they can grow plantations or manage natural forests for a profit.

2.7. Potential projects activities

2.7.1. Policy interventions

One simple way to promote changes in the Forest Policy would be to support FAO's TFAP program. The program has been on hold for several years for reasons that are not entirely clear. But the intent of the program is to focus on changing forest policy to provide incentives for private investment in forestry activities and to allow local communities to control and benefit from their local forest resources. It will also involve institution building.

A second alternative might be to help the GRZ and the Forest Department improve its fee system with regard to forest and wood products. To be effective, this activity would have to focus on how to collect such taxes, at least as much as on the tax policy itself.

A third alternative, support for a land tax, would primarily improve agricultural land use. But it would also provide an incentive to produce trees on less fertile lands or in situations in which the farmer does not have the means to cultivate all of his/her land.

2.7.2. Support for private enterprise forest activity

At present there is relatively little involvement of private enterprise in commercial forestry production. Private enterprise is involved in charcoal burning, pit sawing, and some commercial logging activity, but not in growing trees. This is explained in part by laws which reserve for the government the right to exploit forest resources, but which in practice make forest products a free good to anyone who appropriates them. The parastatal, ZAFFICO, dominates the production of poles, sawnwood and other processed forest products. But it neither plants significant areas as new plantations nor manages the existing plantations effectively. Support for the privatization of ZAFFICO would improve resource use and management, and clear the way for other entrepreneurs to invest in the commercial forestry sector.

Once the laws and incentive structure are changed, individual farmers will need information, access to nursery stock and extension services to expand tree production. Just as the Tobacco Growers Association is moving towards providing extension services to tobacco growers (because little is forthcoming from the Agricultural Department), a Forest Growers Association might support the start-up of private nurseries and help provide extension services to groups or individual farmers.

Forest enterprise, whether conducted by commercial entities or by individual farmers, could greatly benefit from an active forest/forest products research program. There is serious question whether the Research Division in the Forest Department can meet these research needs at this time. Support for forest research through a Forest Growers Association, would provide valuable research and perhaps avoid many of the perceived weaknesses of the Forest Department. The Forest Department staff should be encouraged to work with this private enterprise research activity. Research should look at economic production issues and not just physical production. For example the performance of exotic trees in large blocks has often been limited by access to moisture and soil nutrients. Some experts say that most species would perform better planted in wind-break like avenues if fire can be controlled. This approach would also allow tree growing to be compatible with cattle grazing and possibly crop production. On a different note, research on property rights (land tenure, tree tenure, and water rights) would be valuable for the various sectors involved in natural resources management.

If the laws and incentive structure change, the structure and mode of producing poles and charcoal will also likely change. It is not evident whether the trees will be produced by farmers who hire or grant concessions to charcoal burners to exploit the resource, or whether charcoal burners will find it advantageous to settle down and grow trees on a sustainable harvest basis; or both. A definitive answer will probably be found only after experimentation with both systems. Charcoal burners would need extensive help establishing plantations or managing natural forests to produce charcoal (and other forest products) on a sustainable basis. They would also provide a labor resource for re-establishing forest resources in the vicinity of Lusaka and other urban areas. The situation at Kamaila might provide a base for developing this type of activity. It is not clear whether community or private activity, or some combination would be most successful in this type of situation. It would be important however, to encourage the production of forest products for the Lusaka market, and not just end up with more cleared farm land.

It is clear that it will generally be more practical to work with groups that have other sources of income and can survive the 8 to 15 years necessary to establish exploitable trees without subsidies. In

this respect, working with farmers is likely to be easier than working with groups like charcoal burners for whom this period of transition is likely to be difficult. However, sedentarizing charcoal burners might help meet some very important social objectives.

2.7.3. Community forestry

Community forestry also appears to be a logical response to the need for improved natural forest management. Even in the past when the Forest Department was considered effective, it was largely content to manage the 7 million ha of forest estate and did little to manage the 30 to 50 million ha of forest under traditional tenure. The Forest Department does not now, and will not have in the foreseeable future, the capacity to have any significant impact on management in this huge expanse of natural forest. If protection and management of natural forests is to be improved, it will have to be done by local communities and individuals. But for them to invest any effort in these natural forests, they must be allowed to benefit from that effort. Changes in the laws and incentives are a necessary precondition for communities to be willing to make that investment.

Perhaps one advantage of a pilot project in community forestry is that the government can mandate a change in laws and incentives specific to the pilot project area. In this manner the project serves as an experiment to determine what results might be expected, and to explore the important aspects of the process of such a change.

What is not clear is what group or what local institution should be targeted for community forestry development: villages, chiefdoms, rural districts, farmers, charcoal burners, GMA sub-authorities, or joint ventures between institutions which represent both rural districts and traditional local authorities and commercial forestry operations.[21] Although this list may be refined, it seems unlikely that anyone can definitively identify which groups or institutions will be most appropriate until responses of the different groups can be observed. This also seems to imply a need to conduct small pilot projects with several groups and institutional structures.

One other consideration should be the integration and/or specific targeting of women in forest activities. Women outnumber men in the rural communities and an estimated 36 percent of rural households are headed by women. Women are the primary gatherers of many of the forest products and by-products. They are also active in many areas thought to be traditionally dominated by men such as charcoal production and honey hunting. Several projects have identified women as the best bee keepers (a recent video on beekeeping techniques made with German Assistance features women beekeepers) and the best tree nursery technicians. Women are knowledgeable about the characteristics and uses of different species and forest products, and are more involved than men in the feeding and health of rural families.

Another question will be whether community forestry can develop natural forest management alone, or whether it will need to incorporate some form of plantation forestry. In part this will depend on

[21] This type of joint venture would likely require a stronger Forestry Department to insure appropriate regulation of the commercial operators.

the condition and the location of the natural forest selected. Forests within easy access to urban areas and favorable conditions for marketing their produce are likely to be degraded and have few remaining hardwoods of commercial size. People will need a source of income during the 15 or more years necessary to rejuvenate the miombo woodland. Establishing plantations of fast growing species (like eucalyptus, pine or *Jacaranda* but also indigenous species like *Acacia polyacantha* or *Albizia antunesiana*) would reduce this wait to 8 to 10 years. There is little information about the revenues which can be generated from honey, mushrooms, caterpillars, fruits, leaves and medicinal products, but is unlikely to be sufficient to get people through the establishment period.

If a more distant or isolated forest area is chosen, it may have mature woodland which would allow some immediate harvesting for poles and fuel, and very limited selective harvesting of hardwoods. But logistical problems and marketing costs might prevent the project from being successful in the long run.

Several Anthropologists argue that in Zambia efforts to have people produce trees communally will fail. They suggest that plantation production activities must be done on the basis of private or family endeavor. This contradicts the experience of several projects in West Africa that have developed community forestry projects which include communal production activities. Typically those countries do not recognize any freehold or leasehold tenure arrangements, and the taste of private tenure in Zambia, may change the environment. Managing numerous family size plots in a communal forest would seem to be more difficult than managing a much smaller number of large tracts. The human dimension is crucial in such activities and research on such issues is as important as research on technical problems.

Overall, it will likely be most practical to work with groups which have other sources of income, but for whom forestry income will provide a better and more secure future. In this respect, USAID has a unique opportunity to work with ADMADE to enhance the production of forest products and by-products in the GMAs, and increase the revenues of people living in those areas. In the long run, the GMAs can only be preserved if the people have sufficient income from the forest and wildlife resources, that there is an incentive not to clear the land for agriculture.

3. Issues of agricultural-resource management

Despite the need to feed the population, produce raw materials for industrial development, provide employment and the foreign exchange which agricultural exports could contribute, agricultural production is often viewed rather negatively in the context of natural resource management. Agricultural production may have a destructive effect on the soil resource, if only because once cleared, the soil is no longer protected from erosion. Clearing on a large scale may also have a negative impact on water retention in the soil, the seasonal availability of water resources and water quality. Farmers in countries like Zambia with vast land resources relative to population, tend to ignore these negative long-term impacts of cultivation and focus on maximum production with a minimum of labor and cost. Where population densities are low, they can simple move their fields or their settlement, when soil fertility declines. Many forms of traditional agriculture are of questionable sustainability in the long-run, under conditions of rapid population increase. High input agriculture is also of questionable sustainability under conditions of limited physical infrastructure and agricultural

services, limited foreign exchange, and limited financial resources on the part of farmers. Livestock production often leads to overgrazing where access to pasture land is not restricted. For these reasons, there is a general presumption that agriculture will often be destructive of the natural resource base. Also the need for food and income is often so great that farmers do not always act in the best long-term interest of society to conserve those resources which they manage.

Like charcoal production, agricultural production is essential to the development of Zambia, and to meeting the needs of Zambia's people. Agricultural production is necessary in meeting Zambia's needs for food, food security, and income for rural families. It also has the potential to provide agricultural exports and help meet Zambia's requirements for foreign exchange. Like charcoal production, the undesirable aspect of agricultural production is the negative impact which it often has on the preservation of the natural resource base. Because it is essential, agricultural production is often promoted, whatever the cost. It is important that agricultural production expand in a manner which is sustainable and which does not unnecessarily compromise the benefits received from the present land use. While issues of erosion, agricultural policy and the risk of pollution from agricultural chemicals are important, the key issue for the agricultural sector appears to be competition for land resources, or land use.

3.1. Land resources

Zambia has vast areas of land in which the soils have agricultural potential and which receive adequate rainfall and sunlight to produce a variety of crops and grazing for livestock. These rural areas have population densities of less than the national average of about 10 persons per km^2 and so are not presently used intensively for agricultural production. Given this rich resource base, Zambia has immense potential to increase agricultural production. However, it must be remembered that this resource base is not uniquely an agricultural resource base. This same resource base must support the forest and woodlands which provide fuel, wood products and forest by-products as well as the habitat which supports wildlife and attracts tourism.

A recent report (Maimbolwa, 1992) estimates that 22 percent or about 16.7 million hectares is crop land, although Central Statistical Office data show only 1.2 to 1.5 million ha being cultivated each year (NCDP, Economic Report 1990 and 1991). In normal years, Zambia has had sufficient rainfall to produce maize, the food staple, throughout most of the nation territory. Even in drought years like 1991-92, the northern half of the country continues to have adequate rainfall for the production of maize and most other crops. Although the soils are not considered very fertile by international standards, there are 7 to 9 million hectares which are classified as having fairly good cropping potential. In addition, some of the poorer soils seem to respond quite well to the use of inputs. The better soils are found primarily in the lower rainfall zones of the south, and thus are found in those areas most vulnerable to drought. Expansion of agriculture into the higher rainfall zones will probably become a higher priority following the 1991-92 drought which caused severely reduced harvests. Unlike its southern neighbors, Zambia has rarely been afflicted by droughts which reduced agricultural production by a similar magnitude.

3.2. Structure of agricultural production

Zambia had an estimated 650,000 to 700,000 farm households according to the 1980 census, of which 90 percent were classified as traditional smallholders, cultivating an average of 1.8 ha using family labor and simple hand tools, and producing primarily for subsistence with occasional marketable surplus. The fact that they were not necessarily located in areas where infrastructure had been developed limited their access to inputs and marketing facilities, and their lack of cash income restricted their ability to purchase inputs. There were an estimated 60,000 smallholder emergent farmers, (9 percent of farm households) each cultivating an average of 5.3 ha and producing a substantial surplus above subsistence needs which is marketed. The approximately 6,500 commercial farmers constituted about 1 percent of farm households and accounted for 22 percent of the land cropped. The 9 percent of farmers in the smallholder emergent category cultivated about 17 percent of the cropped area. The 90 percent of farmers in the traditional smallholders category, accounted for about 61 percent of all cropped land.

Characteristics of Farm Units

	Commercial	Smallholder Emergent	Traditional Smallholder
	(Above 20 ha)	(5 - 20 ha)	(less than 5 ha)
percent of total units	1	9	90
percent of land cropped	22	17	61
Average area cultivated per unit (ha)	35.7*	5.3	1.8

* Excluding grazing land

Source: Mumba, 1991, based on 1980 census and definitions

Commercial farmers were heavily concentrated in provinces along the line of rail where the infrastructure allowed better access to purchased inputs and marketing. They frequently used significant amounts of hired labor, oxen or tractors, improved livestock breeds, and irrigation. In addition to purchased inputs, emergent farmers often used oxen plowing.

The World Bank's Zambian Agricultural Sector Strategy (1992) states that Zambian agricultural production has undergone a structural change over the last 25 years, largely due to an increase in the number of medium-scale (emergent) farmers. It estimates the contribution of commercial farming (including commercial and emergent farms from the table above) to GDP has gone from 19 percent in 1965 to 49 percent in 1988 while the

contribution of traditional small-scale production has declined from 81 percent in 1965 to 51 percent in 1988.[22]

The World Bank report estimates that the expansion in area cultivated by commercial farmers, particularly as smallholder farmers made the transition from subsistence production to commercial farming, accounts for most of the increases in agricultural production between 1974 and 1988. It also indicates that except for wheat, most commodities experienced little or no growth in yields during this period. Production increases are almost entirely attributed to increases in the area cultivated.

The 1990 agricultural census has changed the names of the categories of agricultural households, but continues to use a similar definition based on the number of hectares under cultivation. The category of farmers with over 20 ha is called large-scale, rather than commercial; the category of 5 to 20 ha is called medium-scale, rather than smallholder emergent, and the less than 5 ha category is called small-scale, rather than traditional smallholder. The 1990 census preliminary results show many fewer large-scale and medium-scale farmers, than there were commercial and emergent farmers in the 1980 census, although the total number of farmers has remained substantially unchanged. Further analysis of the census data will hopefully determine whether there continues to be a trend towards farming which is larger-scale and more commercial in nature, or whether conditions have upset that trend.

[22] Note that the World Bank (1992) estimates of the number of farmers by farm size category differ significantly from prior Ministry of Agriculture sources and the 1990 census. This may affect the accuracy of the statistics cited.

Estimated Number of Agricultural Households by Size[23]

Province	Large-Scale (Over 20 ha)	Medium-Scale (5 - 20 ha)	Small-Scale (Under 5 ha)	Total	
Central	610	7,300	58,200	66,110	
Copperbelt	310	310	19,400	20,020	
Eastern	100	6,475	125,800	132,375	
Luapula	50	2,160	87,700	89,910	
Lusaka	240	1,460	23,530	25,230	
Northern	60	5,910	119,800	125,770	
Northwestern	8	6,050	55,440	61,498	
Southern	271	15,290	66,400	81,961	
Western	40	1,050	80,700	81,790	
Zambia	1,689	46,005	636,970	684,664	
	0.2 %	6.7 %	93.0 %	100 %	

Source: CSO, Preliminary 1990 census figures.

3.3. Women's role and constraints in agriculture

Another very important aspect concerning the structure of agricultural production is the important role of women. An estimated 36 percent of rural households are headed by women. Some estimates indicate that with many men absent in search of urban employment, women constitute 65 percent of the effective rural population and 50 to 75 percent of the subsistence labor force. Women have primary responsibility for subsistence or food crop production, and are increasingly involved in cash crop production as well. Traditionally, men were responsible for land clearing and soil tillage and helped women with planting and harvesting. Women were responsible for soil preparation, planting, weeding, protecting the crop from birds or animals, harvesting, transporting the harvest and crop storage and preservation. Trends towards permanent or longer periods of cultivation and a reduction in the use or frequency of preparation of *chitemene* fields has reduced mens' workload, but not that of women.

[23] The 1990 agricultural census uses categories of farmers which are different than those used in the 1980 census cited above. New definitions avoid the commercial farmer vs. traditional smallholder dichotomy and the term "emergent", but the hectarage used to define each category has not changed.

Village studies show that women spend more time per day than men working in the fields, 6.6 hours and 5.7 hours respectively. In addition they spend much more time than men on household activities, 4.1 hours per day compared to only 0.4 hours.

Female-headed households tend to have fewer laborers, more dependents, smaller landholdings and less income than households headed by men. Although female-headed households express an interest in commercial agricultural production, they have less access to land, purchased and labor inputs, technology and productive services. The highest levels of food insecurity and malnutrition in Zambia occur in female-headed households.

Both traditional land tenure practices and formal laws of inheritance, ownership and control of land discriminate against women. A similar situation exists with regard to access to credit. Women have applied for credit and cooperative membership under the Women's Participation in Rural Development Program (WPRDP). Women apply for credit, primarily for agricultural inputs such as fertilizer as individuals, but collateral is provided through membership in a women's group.

Extension services have focused on commercial farming and cash crops, thus effectively ignoring the traditional subsistence crop domain of women. Efforts to recruit women resulted in 8.4 percent of camp officers and 16 percent of block supervisors being women in 1989. Many of these have little training and many more are not in direct contact with farmers. Efforts to improve extension services to women have focused on female participation in farmer's field days and mobile training courses. Women have constituted 40 percent of the participants of these programs in recent years. It is much more difficult for women to participate in programs with residential requirements like Farmer Training Centers and Farm Institutes.

Over the last decade, agricultural research efforts have shifted to provide more support for small-scale commercial and traditional smallholder producers. This has resulted in more resources being devoted to food crops, which women are more likely to produce. The ARPT approach is devoted to serving the needs of small-scale farmers, which include most women farmers. Particular attention has been devoted by the ARPT teams to gender roles in farming systems and constraints facing female farmers.

3.4. Land use

The key issue of natural-resource management with regard to the Agricultural Sector appears to be the issue of land resources management or land use. Having recognized the problems of dependency on a single commodity and sector, the focus of Zambia's economic development has shifted to develop renewable resources and particularly agricultural production. This shift is expected to meet the food requirements of Zambia's increasing population and to diversify Zambia's exports. However successful this policy might be, agricultural land use in Zambia will undoubtedly increase due to the rapidly increasing population and the deterioration of the national economy and conditions in urban areas. With the expansion of agricultural land use a virtual certainty, the question is: can incentives be provided which will help guide the expansion of agricultural land use to increase the benefits obtained, and to minimize the losses with regard to potential alternative land uses.

3.4.1. Deforestation

Only if the land cleared to increase agricultural production is truly unused, can we assume that whatever is produced by increasing agricultural production is a net benefit to Zambia. Although there

are vast areas of Zambia which at present are not intensively exploited, these areas include most of the forest, woodland and wildlife patrimony of the nation, which can be exploited more intensively to complement the benefits of agriculture. As this patrimony decreases, Zambia loses the potential benefits of the forest products and by-products which could be produced, and will increasingly threaten the wildlife habitats which are important to the tourist trade.[24] To the extent that agricultural production can be intensified in those areas of high agricultural potential, Zambia can benefit from both its remaining woodland/wildlife resources, and from increased agricultural production.

3.4.2. Intensification

Casual observation indicates that even along the "line of rail" there are large expanses of farm land which are either not being used or which are used primarily for extensive cattle production. This observation would seem to be confirmed by the statistics that of 16.7 million ha classified as crop land, only 1.2 to 1.5 million are cultivated each year. With less than one tenth of this crop land cultivated annually, it would certainly seem that agricultural production could potentially expand several fold without necessarily clearing any additional land, if the appropriate incentives and means were provided to cultivate the area presently classified as crop land.

World Bank estimates (World Bank, 1992) indicate that most commodities except wheat experienced very little if any yield increase between 1974 and 1989. Production increases for the different commodities are attributed almost entirely to an expansion of the area cultivated. The removal of subsidies on the transportation of agricultural inputs and products is one step towards providing more incentive to intensify production in these areas where the infrastructure exists to provide inputs and marketing access.

The intensification of agricultural production in those areas with high production potential is an appropriate strategy to achieve both sustainable production and reduce the pressure on non-agricultural lands. Access to inputs will favor sustainable production on good soils in areas with access to transportation. High production in a limited area will leave more area available for non-agricultural uses.

3.4.3. The Tazara Corridor

At present, the area of commercial farming is concentrated along the north-south "line of rails". This area has the transportation infrastructure which allows rapid access to markets and the delivery of inputs necessary for commercial farming. The Tazara Corridor is an area with access to transportation and only limited agricultural development, which has the potential to develop into an region of intensive agricultural production. Development of the Tazara Corridor is particularly attractive following the 1991-92 drought, because it falls largely in the northern high rainfall zone (800 - 1200 mm). Agricultural development of this area could help ensure food security, contribute

[24] Nearly half of the so called "unused woodlands" which are supposed available for cultivation are presently in Game Management Areas.

to crop diversification and provide a substantial increase in the area with sustainable commercial farming potential. The concentration of population under intensive agricultural development would allow more efficient development of infrastructure and other services, and potentially reduce pressure to clear woodlands and wildlife habitat in the hinterland.

The Tazara Corridor is a strip of land extending 30 to 40 km on either side of the Tanzania/Zambia railroad from Mkushi to the border of Tanzania. The Great North Road parallels the railroad along most of its route. The Corridor has an estimated 4.5 million ha of land which can potentially be used for agriculture, of which blocks totaling 1.4 million ha have been designated for priority development. Given that estimates indicate that only 1.4 million ha are presently cultivated each year, development of the Tazara Corridor provides an opportunity to double or triple the total area under cultivation, and the area with commercial farming potential. Development of the Tazara Corridor appears to be a major objective of the GRZ. It appears to be an important opportunity, which if managed appropriately could have a positive impact on woodland and wildlife conservation, as well as making a substantial contribution to agricultural development.

3.4.4. Irrigation

Reports of present land under irrigation in Zambia range from 25,000 to 50,000 ha (GRZ/NORAD, 1991). Some sources estimate that irrigated areas can be expanded to incorporate 150,000 to 450,000 ha (Mbumwae, et al., 1991). Two major problems seem to stand in the way of such a development: lack of water and competition for land in areas with irrigation potential.

In a drought year like 1992, it is not evident that there is water for any significant expansion of irrigation. Much of the potential for expanding irrigation is supposed to lie in the Kafue and Chambeshi Flats. Based on the observation of the assessment team (June 1992), the Kafue Flats is very dry and the river flow is just a trickle. What water is available is largely reserved for generating electricity, water for the cities of Lusaka and Kafue, and existing irrigation schemes like the Nakambala Sugar Estates. It is hard to imagine any significant expansion of irrigation in the area, without building dams and reservoirs to hold water. The flood plain characteristics of the Kafue Flats make it seem like an unlikely place to build such structures or expect them to be effective. The situation may well be entirely different in normal years, but the economics of an irrigation scheme which has to stop operating in drought years seems highly questionable.

The other problem with irrigation in an area like the Kafue Flats is competition for land. The Kafue Flats is one of Zambia's rich wetland habitats for numerous bird and wildlife species, but particularly the Kafue Flats lechwe, which is found no where else in the world. Part of the Kafue Flats has been allocated to 3 National Parks and several GMAs. The area is also the dry season grazing reserve of nearly half of Zambia's national cattle herd. There are several large-scale irrigation schemes at the edge of the flats, and numerous commercial farms using borehole wells for irrigation as one approaches Lusaka and Kafue. Traditional farmers and fishermen also have interests and traditional land rights throughout the flats region. It seems unlikely that major irrigation schemes could be developed without disinheriting some group which presently has rights to use the flats. An Italian irrigation scheme on the flats was reportedly scuttled recently because there was simply too much demand for the land in question to allow its alienation and use for the project.

3.4.5. Wetlands

The wetlands of Zambia are a unique resource and are extremely important as habitat for birds and wildlife. They also are at the crux of both land use and water use conflicts. At the moment it is not evident that there is any global plan for the conservation and development of areas like the Kafue Flats, Chambeshi Flats, Lukanga Swamp, etc or any organization to help resolve the conflicts which do develop. The Kafue basin is the most pressing problem given the importance of the Kafue drainage system, the water quality problems originating in the mining areas and cities along the river, and the many conflicting demands on water and land use within the basin. A Kafue Basin Authority or some institution which can help avoid and resolve conflict appears to be much needed. The UNDP is about to begin a study of the Kafue Basin, which may possibly develop into a project to help manage and conserve this unique resource.

3.4.6. Dambos

A dambo is a an area of seasonal water flow or a seasonally waterlogged depression which is part of a drainage system. Their soils are often somewhat more fertile and they frequently have sub-surface water drainage into the dry season, making them valuable for dry season gardening, orchards, etc. According to McFarlane and Whitlow (1990), mechanized farming of dambos had a very negative impact which caused dambo cultivation to be discouraged or even forbidden by colonial authorities. However, the authors believe that dambos were an important focus of cultivation in traditional agriculture, apparently without causing serious erosion or degradation. They suggest that it might be better to cultivate the dambos (non-mechanized) and leave the interfluves forested to absorb rainfall and maintain the hydrology important to the dambo system. The dambos do appear to have an important agricultural potential which is not now exploited. Whether this potential can be exploited without causing ecological damage is at present only a hypothesis. The most interest in cultivating the dambos will probably be in those areas under population pressure, where reducing the amount of the interfluves being cultivated is unlikely. The ecological risks of cultivating both the dambos and the interfluves needs to be explored.

3.4.7. Scenic lands

Zambia's topography and water resources provide some marvelous scenery in the form of waterfalls, river gorges, and wild rivers. Several of these waterfalls, in addition to Victoria Falls, are listed in the Almanac as being among the world's most spectacular. Such resources are unique, particularly in Southern Africa, where such sites are not common. These scenic sites would be ideal as a focus for local parks, which with camps or low cost lodges might prove attractive to eco-tourists and a source of revenue for local communities. The National Heritage Conservation Commission is responsible for the preservation of such sites, but has little means to develop the park structure which they would like to protect these scenic areas.

3.4.8. Problems of planning and land-use planning

Although land-use planning would seem to be the answer to many of Zambia's land use problems, donor projects have supported planning and land use planning for many years, and positive results are not evident. Apparently, many plans have been made, but very few are ever implemented. In this

respect the problems of land use planning can be compared to the problems of NCDP (now the Ministry of Planning and Development Cooperation) with regard to the larger National Development Plans. If adequately financed, the National Development Plans (particularly as outlined in the FNDP) would improve the situation in many sectors of the economy, including resource management and conservation. The FNDP identifies many of the resource utilization problems in Zambia and indicates mitigative measures to address these problems. But frequently, the financial resources, skilled manpower and infrastructure necessary to implement the Plans, simply are not available. Professionals in relevant sectors are fully aware of the nature and extent of resource problems, but few are adequately equipped to undertake remedial measures (NORAGRIC/IUCN, 1989).

The GRZ has not had an implementation mechanism to realize land use plans directly, or policies and effective regulation of land development such that the activities of individuals lead to the fulfillment of the land use plans. This is evident in the development of shanty towns around major cities as well as in rural development.

Land use planning evolved out of the colonial era activities of attracting white settlers/commercial farmers and concern for controlling soil erosion. (This history is described in section 3.5.1).

Land use planning responsibilities are divided among many departments and ministries, with little evidence of coordination. The Department (ex-Commission) of Town and Country Planning is responsible for planning settlements in Zambia, although the Ministry of Local Government and Housing, the resettlement section of the Ministry of Lands and/or a resettlement office within the Cabinet Offices may also be involved. The major rural land use planning capability is in the Ministry of Agriculture, Food and Fisheries, but the Ministry of Lands is responsible for titles and surveys, while the Ministry of Planning and Development Cooperation is involved in general regional and sectoral planning, and the Ministry of Environment and Natural Resources is responsible for environmental assessments and planning. The Ministry of Water and Energy, Ministry of Mines and Mineral Development or Ministry of Tourism may also become involved if planned activities fall within their respective jurisdiction. A recent paper by the Commissioner of Town and Country Planning called for key departments involved in land use planning to be brought together in a single ministry (Maimbolwa, 1992).

Much of the responsibility for implementation of land use plans is falls on the District or Urban Councils, which have limited resources and expertise. The rights and responsibilities of District or Urban Councils verses traditional authorities are often not well established. Collaboration between local councils and traditional authorities is only beginning to become common practice and no specific institutional structure has been developed as a base for such cooperation. Local institutions often have little involvement in the planning process and may or may not have any interest in implementing the land use plans designed by central Ministries.

3.4.9. Land tenure

The following summary of the land tenure situation in Zambia is taken from Maimbolwa, 1992:

> During the colonial period, land in Zambia was divided into Native Reserves, Trust and Crown Lands. The Crown lands were reserved for white settlement on freehold basis. In the

Reserve lands, a non-native person could be granted a lease not to exceed 5 years, whereas in the Trustlands, a person could be granted a 99 year lease after cadastral survey of the plot or area in question, according to specifications stipulated in the land Survey Act. After Independence all land in Zambia became leasehold and vested in the President with the granting of lease title being the responsibility of the Commissioner of Lands. However, in practice, the country's land tenure system is still characterized by dualism i.e. customary and state land with general land uses being commercial in Stateland areas and subsistence in Trust and Reserve lands.

Although the original colonial purpose of these land divisions is no longer valid, the stated Government goal of changing all Reserve and Trust lands into Statelands to enable the granting of leases in all land areas cannot at present be realized because such a policy has serious implications on the current traditional farming, land usage and allocation systems.

At present land is given a 99 year lease title after a cadastral survey of the land in question. To avoid delays in granting leases, 14 year lease titles (now being extended to up to 30 years) are initially issued which do not require prior cadastral survey to specifications stipulated in the Land Survey Act. In practice, the traditional farming, land usage and allocation systems are still in place in the Reserve and Trust lands creating real disincentives for investment in those areas due to the lack of the security of tenure.

At present, most of the laws governing land use planning are not fully applicable to traditional lands in Reserve and Trust areas. In such traditional land areas, land use planning and development are carried out following traditional ways which in most cases are not based on sustainable use of the available resources, and often lead to their over exploitation to meet the demands of a rapidly increasing population.

Stateland covers only about 6.3 percent of Zambia's land area or 4,745,300 ha. National Parks cover 8 percent. Reserve and Trust lands make up the remaining 86 percent of the country. For example only 13 percent of the gazetted forest estate is on Stateland, the remaining 87 percent is on Reserve and Trust lands. Since much of the forest estate has never been gazetted as Stateland, it is little wonder that local chiefs continue to tell people that they can cut the trees and clear the land for farming, in what the Forest Department thinks are forest reserves.

This same situation also appears to be a major obstacle to the development of the Tazara Corridor. Most of the land along the Corridor is not Stateland, so the government is trying to alienate traditional lands without alienating the chiefs and local inhabitants. Since this land has not been gazetted as Stateland, it is not evident whether farmers will have clear lease title and effective control of the land, even after the required cadastral survey is performed.

Regulations require a cadastral survey with a very high standard of accuracy (based on British standards) as a prerequisite for receiving a 99 year lease title. This requirement has led to a backlog of over 10,000 plots waiting to be surveyed (Maimbolwa, 1992). To avoid delays in granting leases, 14 year lease titles are issued which do not require the cadastral survey. Neither do they assure an

investor that an investment in land in Zambia, like in the Tazara Corridor, is a secure investment. These several uncertainties with regard to the ability to obtain clear tenure rights, and whether the cadastral survey can be completed to gain a 99 year lease title, seem to be severe obstacles to the development of the Tazara Corridor. The GRZ would like to attract foreign investment (from Zimbabwean and South African settlers looking for opportunities to farm) to help develop the Tazara Corridor. Numerous foreign investors have made inquiries, and many say they are very interested, but as yet few if any have made investments because of the climate of uncertainty.

3.5. Soil erosion and soil degradation

Soil erosion is a critical natural resource management issue because it leads to the destruction of a natural resource which is impossible to replace within the human time frame and which is exceedingly costly to rehabilitate. The only cost effective means of dealing with the problem is prevention. Zambia has relatively flat topography over much of the country and vast areas of uncultivated land. Serious soil erosion problems seem to be less wide spread and/or less immediate than problems like: deforestation, water availability and water quality, waste disposal, or loss of wildlife and its habitat. The soil related problem appears somewhat more important if the definition is broadened to address soil degradation as well as soil loss. The contribution of human activity to the acceleration of physical, chemical and biological soil degradation is a problem throughout the country.

Most Zambian soils are classified as having relatively low vulnerability to erosion as measured by an erodibility index consisting of slope, rainfall pattern, vegetative cover and soil characteristics. Eighty percent of Zambian soils have an erodibility index rating of 4 or above which is considered relatively resistant to erosion. Eighty percent of the country has an average slope of less than 5 percent, and 75 percent of the land surface has sufficient vegetative cover to effectively reduce the impact of raindrops on the soil (Grunder, 1992).

Acute soil erosion appears to be a local phenomenon primarily present in the Eastern, Southern and Central Provinces. But these are precisely the areas with the most productive soils and on which the country is dependent for its agricultural production. These are also the areas of Zambia with lower rainfall, so the interaction between and contribution of soil and water conservation to agricultural production is extremely important. Soil erosion is highly correlated with high rural population densities, high livestock populations and a high percentage of land under cultivation. Soil erosion and soil degradation are also closely linked to deforestation: deforestation is a major cause of soil erosion and soil degradation, and clearing new land for agriculture when old fields lose their fertility is a major source of deforestation.

3.5.1 History of soil-conservation activities in Zambia

Soil erosion and other forms of land degradation have been recognized as problems in Zambia since the early thirties and forties when much of the indigenous population was squeezed into the relatively small Reserves, and European settler farmers began to open up larger, more commercially oriented farms. Considerable effort was put into developing physical soil conservation measures on farms, supported by conservation-based infrastructural development (roads, dams, grazing plans, etc) through "Regional Planning" and later, "Catchment Conservation Planning". Much emphasis was placed on

physical soil conservation works which, before Independence, were voluntary and supported by subsidies on the European settler farms, but which were enforced elsewhere.

The years following Independence saw a decline in on-farm soil conservation and in the general conservation-based infrastructural development. "Soil conservation" was no longer obligatory and many farmers neglected what they had, while some even ploughed out their "contours". Commercial farmers lost their favoured status which made it difficult to pay for the high cost of physical soil conservation. Funds for Catchment Conservation were gradually reduced.

More and more emphasis was placed on improving production, particularly through the use of improved seed and chemical fertilizers. Soil conservation became identified with physical soil conservation which was regarded almost as a separate activity carried out largely by specialists. Physical conservation was felt to be expensive or labour demanding, and therefore became unpopular. Recommendations on soil conservation for small-scale farmers were generally the same as for the large scale mechanized commercial farmers and were mostly inappropriate. The results of all this were the tendency for soil conservation and production to be separated, emphasis on production, and neglect of conservation.

From the early eighties, influenced by thinking elsewhere in the world, things began to change. Attention was focused more and more on small-scale farmers, including almost the whole rural population, to help them realize their productive capacity and improve their standard of living. Both research and extension became much broader in perspective and more farming systems oriented. A "new approach" to "soil and water conservation" also began to emerge. This was broader in perspective, regarding productivity and sustainability of all agricultural enterprises as the main objectives, rather than just the conservation or preservation of the soil; and more integrated, with soil and water conservation being an integral part of all farming and extension activities. These ideas on soil and water conservation were developed first in Eastern Province from 1984 and later in Southern, Central and other Provinces. Emphasis was put on making full use of biological techniques, supported where necessary by physical measures appropriate to the socio-economic situation of farmers in the various farming systems. Tree planting and agroforestry were also integrated into farming and extension as normal activities. Soil and water conservation was promoted as an integral part of everyday farming and extension activities. (Source: Department of Agriculture, 1990. Soil and Water Conservation: A manual for extension workers with emphasis on small-scale farmers in Zambia.)

3.5.2. Other causes of soil degradation and soil erosion

The primary cause of soil degradation and soil erosion is the loss or disturbance of natural vegetative cover. In addition to deforestation and land clearing for agriculture, the primary sources are bush fires and overgrazing by livestock.

3.5.2.1. Bush fires

Bush fires leave the soil bare over much of the country each year, exposing it to the effects of wind and water erosion. Fire plays an important role in maintaining and managing grassland and certain woodland vegetation types. While fire may harm certain perennial grass species, it does inhibit the

encroachment of shrubs and other aggressive woody species in grassland areas and under mature and/or fire resistant tree species. But following the loss or disturbance of natural vegetative cover, fire also inhibits the natural regeneration of many perennial grasses and tree species. Although protection for several years may allow seedlings to make a start, a buildup of ground litter may produce a hotter fire and do more damage to existing trees than annual fires. Burning the bush is a strong cultural tradition and has important benefits for hunters, herders, and other rural groups. Few rural groups have the means to establish fire lanes on a meaningful scale, even if they were convinced that an area should be protected from fire. Extension efforts attempt to persuade people to set bush fires early in the dry season, before the grass and particularly the trees are too dry, so that the fire will be less hot and damaging.

3.5.2.2. Overgrazing

Overgrazing is another important but more localized source of decreasing natural vegetative cover, which contributes to soil degradation and soil erosion. Heavy concentrations of livestock not only remove the vegetative cover, but also disturb the soil such that it is more conducive to erosion. Large livestock populations in the Southern, Eastern and Central Provinces exacerbate conditions caused by slope, sandy soils, and a relatively high percentage of area under cultivation. Areas with particularly high concentrations of livestock like the Gwembe valley appear to be seriously damaged by overgrazing.

Although livestock are the major cause of overgrazing, they are not necessarily the only source. The concentration of an estimated 160,000 elephants in the Luangwa Valley during the 1970s led to the destruction of large areas of *mopane* woodland, and little regeneration of the *mopane* is evident to date.

3.5.2.3. Non-sustainable cultivation practices

Many cultivation practices accelerate soil erosion and soil degradation. The mere fact of clearing the land of natural vegetative cover creates a serious potential for accelerated erosion. Cultivation of row crops or other crops which leave much of the soil bare during and after the cropping season will accelerate erosion unless carefully managed. Cultivation or rows which run parallel to a slope automatically concentrate water flow to produce rill erosion. The longer the area of slope exposed, the more water, water velocity and erosion which will be produced. Small plot studies indicate erosion losses of 8 to 12 tons of soil per hectare per year compared with soil formation rates of 1 to 2 tons per hectare per year. Expert opinion indicates that where rill erosion is evident, soil losses are likely in the range of 80 to 100 tons per hectare per year (Grunder, 1992). Such losses can not be sustained without damaging the productive capability of the soil resource.

Soil nutrients used by crops and removed from the fields must be replaced to sustain production and productivity. Traditional cultivation systems like *chitemene*, require 25 to 50 years of fallow under natural vegetation to reestablish soil nutrients and soil characteristics to pre-cultivation conditions. Without the addition of fertilizer, manure, green manure and other soil amendments or sources of plant nutrients, most soils in Zambia will only produce yields acceptable to smallholder households for 3 to 6 years before they become exhausted and are abandoned. Yet clearing new fields is costly for the household, as well as for the environment. Most smallholder households in Zambia do not

have access to the means or the technical knowledge to sustain agricultural over the long-term, nor economic incentives to do so. In fact, land tenure and economic incentives promote mining the land as the resource most readily available to smallholder households.

Soil acidity and related phenomena are an important problem, particularly in the heavily leached soils of the higher rainfall zones of northern Zambia. Phosphate becomes insoluble and unavailable to the plants even when present in the soil under conditions of high acidity. Aluminum and manganese toxicity and degradation of soil structure may also be associated with levels of high soil acidity. This potentially critical problem can be managed relatively easily through the application of lime. Although Zambia has lime deposits, lime production has not been developed and few areas outside of the line of rails and Tazara Corridor have the infrastructure to supply lime (or fertilizer) to farmers at a reasonable cost.

3.5.3. Soil-conservation efforts

The primary program addressing management of soil resources is the Soil Conservation and Agroforestry Extension (SCAFE) program financed by SIDA and administered by the National Soil Conservation Unit of the Ministry of Agriculture. This program began in the Eastern Province where it has had some success in involving local communities in soil conservation, and is now expanding in the Southern and Central Provinces. Since soil conservation was considered a colonial imposition and the domain of engineers, it has taken considerable effort to convince extension personnel and farmers that soil and water conservation is an integral part of agricultural production. The program advocates a broad range of agronomic and agroforestry practices and physical measures aimed at improving soil and water husbandry. The Natural Resources Department has found that planting vetiver grass across the slope is particularly effective in reducing rill and gully erosion, and seems to be more acceptable to farmers than building physical structures. Much work is still needed to develop soil and water conservation practices which fit specific farming systems.

Soil and water conservation should be viewed as only one component of agricultural sustainability. Such efforts are expensive and may not appear to be economical to farmers except where they make a contribution to productivity in a relatively short period. Conditions of high inflation will make delayed benefits even less valuable than under more stable economic conditions. Since much of the farming area is relatively flat, improved husbandry should be the major focus. Simple, practical measures like the use of a legume crop in rotations and planting across slopes should be encouraged. More extensive soil and water conservation efforts are probably appropriate only for farmers with freehold/leasehold tenure, practicing intensive agriculture. It is relatively expensive to obtain a new leasehold and a serious decrease in productivity would have an important economic impact. With Zambia's abundance of uncultivated land, many farmers with traditional tenure may prefer to move their farm rather than invest additional capital or labor in their present site.

3.6. Agricultural research

3.6.1. Crop research

Industrial crops have traditionally been the major focus of colonial agricultural research and extension. While agricultural development in Zambia emphasized white settler commercial farming

and largely ignored traditional smallholder farmers, the industrial crop orientation was in part offset by the need to produce food for the copper mine workers. In recent years, industrial crops like sunflower, soybean, tobacco, cotton, coffee and tea have continued to receive strong attention from commodity research, but maize and wheat have become the centerpieces of the agricultural research program.

Commodity research in Zambia is considered to be relatively successful, primarily on the strength of its success with hybrid maize and wheat and sunflower development. Rainfed wheat varieties have been developed which compare favorably with varieties available from international sources. Commodity research has also produced sunflower varieties which achieve oil extraction rates of 40 percent.

The success of the hybrid maize program is evident in the 10 mt/ha yields achieved by commercial farmers and the approximate doubling of area devoted to hybrid maize from 276,000 ha in 1984/85 to 544,000 ha in 1988/89. With the help of strong government subsidized incentives, the share of maize area planted to hybrid seed grew from 47 percent to 60 percent during this period (World Bank, 1992). One of the major successes of the maize program has been the development of the "Lima" technical packages for smallholder farmers. These packages, particularly successful in hybrid maize production, are based on recommendations for 1/4 ha parcels. As a consequence, in years of good weather, the country is now self-sufficient in maize and about 70 percent of the commercial crop is now grown by small-scale farmers.

Maize production has depended on three major government input subsidies; 1) the fertilizer subsidy, 2) the consumer subsidy on maize meal, and 3) the transport subsidy through a system of equity pricing (as opposed to efficiency pricing). The most crucial subsidy for maintaining the maize production in NP has been the fertilizer subsidy. In the long-term, hybrid-maize cultivation will depend on the application of both fertilizer and lime to be sustainable. The likely effects of a complete removal of the fertilizer subsidy would be a loss of marginal maize growers, return to subsistence production based on *chitemene*, initial food shortages until farmers increase production of traditional food-crops, and a general contraction in the cash economy. Higher production costs due to lime use and higher fertilizer prices will particularly affect the marginal and often resource-poor maize growers, and maize farmers in areas with less favorable market access (ARPT, 1988a; NORAGRIC/IUCN, 1989).

Maize dependence now raises some of the same problems which the Zambian economy faces with regard to dependence on copper. In 1988, maize accounted for 70 percent of the land cultivated and 85 percent of all crop production.

The heavy emphasis on maize research made sense given that it is the primary staple of the country and given the previous government's pricing policy and subsidies which strongly favored maize. But this emphasis meant that relatively little effort was devoted to other important food crops like sorghum, millet or cassava, even though these crops are more tolerant of drought, low fertility and the acidic soil conditions which dominate much of the country. Improving crop production on acidic soils is particularly important given that most of the soils in the higher rainfall areas which have not been seriously affected by the drought, as well as many of the sandy soils in drier areas, are highly

acidic.[25] There appears to be good potential to export maize to neighboring countries (Angola, Zaire, Malawi and Mozambique), so there is good reason to continue expanding maize production. But Zambia would have a more stable food security situation during this drought if more emphasis had been placed on the diversification of food crop production.

Wheat production continues to expand rapidly, although starting from a very small base. The area planted to wheat is still only about 1/100th of the area cultivated in maize. According to World Bank (1992) estimates, wheat is also the only crop which has made really strong yield increases. Sunflower production has fallen somewhat in recent years, in part due to an unfavorable government pricing policy. As an oilseed, sunflower is also facing stiff competition from the very rapid increase in soybean production. Commercial farmers using irrigation seem to be particularly impressed with the results of a wheat-soybean rotation.

Another important aspect of Zambian agricultural research is the increasing attention to the needs and constraints of emergent and traditional smallholder farmers, made possible by the development of the Adaptive Research Planning Team (ARPT) or farming systems approach. ARPT efforts have focused primarily on the neglected traditional crops and integrated systems for small-scale farmers. The availability of seeds, marketing and extension for alternative crops continues to be a constraint.

The Northern Province environmental assessment credits the ARPT program with striving to adapt research to the needs of local people from an ecological and socio-economic perspective and being the only multidisciplinary cross-sectoral research program functioning in the Northern Province. However, much work still needs to be done to improve agricultural technologies of more sustainable agricultural land-use systems. More attention needs to be accorded to low-input technologies based on traditional food and cash crops (with high-value-to-bulk), and to measures of preserving long-term soil productivity (NORAGRIC/IUCN, 1989). More attention also need to be focused on the human resource and the decisions, perceptions and activities of the people who both make production possible and exploit the natural resource base.

3.6.2. Sustainable agriculture land-use systems

In the past, smallholder farmers have employed a maize production strategy which has been characterized as being high-input, low-output.[26] They have used large amounts of cheap, subsidized fertilizer but otherwise have farmed extensively, using fertilizer and land to substitute for scarce labor. With the ending of fertilizer, transport and mealie meal subsidies, this strategy will have to change in areas distant from the line of rails and consumption centers. Several sources indicate that systems using low-input methods to sustain production are potential solutions. Adaptive research

[25] The maize breeder at Golden Valley Farms claims that research will soon make available a productive maize variety which is tolerant of acid soil conditions (Dr. Ristanovic, personal communication).

[26] Although the maize/fertilizer ratio improved some between 1974 and 1989, the World Bank (1992) suggests that maize yields were stagnant, and may have actually declined slightly.

results on such systems are quite limited and practical soil and water husbandry receive little attention from extension. So far, the results from agroforestry research are disappointing. Alley cropping and other forms of agroforestry may be key to a potential solution, but so far this potential has not translated well into practical methods for on-farm use.

A return to *chitemene* is one likely result of these changes in policies. It is a low cash-cost method, even if it does not sustain production on a given field. *Chitemene* requires a heavy labor input to clear new fields and traditionally uses male labor for lopping branches or cutting trees. This activity can be spread throughout the year, but may still pose a labor constraint for many households. Many households used the high-input, low-output strategy precisely because they lack labor, particularly male labor. The 36 percent of households headed by women are only the most obvious cases of households which have a shortage of labor and may find it difficult to employ *chitemene*. In addition, many households will be reticent to leave established communities, yet *chitemene* will require moving to areas of standing woodland or working very distant fields.

A range of low to medium-input alternatives, which extend the productive lives and/or reduce the fallow periods of *chitemene* and *fundikila* grassmound systems, are also needed. These alternatives need to focus on traditional food crops which often are more tolerant of drought, soil acidity and poor fertility than is hybrid-maize. Although fertilizer use should be minimized to keep cash cost low, it should not be excluded if it can economically contribute to productivity and the maintenance of soil fertility. Various combinations of improved fallow, alley cropping, use of legumes in crop rotations, green and animal manure, and the improved use of mulching, crop residues and composts need to be explored. Such combinations need to be adapted to the cultivation of local crops like beans, groundnut, millet, sorghum, cassava, sweet potatoes, local maize and vegetables.

High-input maize cultivation needs to be improved through the use of legumes in a crop rotation, improved weed control and the use of lime to control acidity and to improve the efficiency of fertilizer use. These measures would improve both short-term productivity and long-term sustainability. Regular maize cropping can not be sustained on permanent fields with acid soils without lime applications. ARPT studies indicate that poor weed control reduces yields by almost 50 percent, and that in extensive farming systems the use of herbicides to improve weed control are more profitable than fertilizer use.[27] The main alternative is improved animal powered weeding, which has higher labor requirements and takes longer to develop, particularly among ethnic groups who do not have a cattle herding tradition. Use of forage legumes in a crop rotation would reduce nitrogen fertilizer requirements, improve soil physical characteristics and reduce the risk of buildup of certain disease, pest and weed problems. Systems which better integrate industrial and alternative food crops need to be explored.

[27] Similar results have been found throughout West Africa: herbicides are typically the most advantageous purchased input if one is willing to accept the risk that some deaths may result from improper handling or misuse before farmers learn to use pesticides appropriately.

3.6.3. Livestock research[28]

Livestock research has focused on cross-breeding with exotic breeds. Research on animal nutrition and improving the productivity of native breed has been neglected. Animal nutrition research should explore the integration of: improvements in the use and quality of crop residues and agricultural by-products, production of on-farm forage and feeds, and improvements in the quality of commercial feeds. In addition to improved animal nutrition, research on native livestock breeds should explore genetic improvements and improved herd management. Productivity gains of as much as 30 percent are possible with native breeds in smallholder livestock production, without the risk of losing expensive, fragile, exotic animals.

Most livestock breeding activities in Zambia have been limited to purebred and crossbred cattle and carried out on large state or private commercial farms. The results constitute an important resource, but no system or incentives have been established to facilitate the sharing of this breeding material with smallholder farmers. Government programs have tended to use imported bred heifers and bulls, and subsidized interventions have discouraged sales between private commercial farmers and smallholders. Such interactions need to be encouraged for both beef and dairy cattle, along with breeding associations and cooperatives. Genetic improvement of dairy cattle has focused almost exclusively on the introduction of crossbred heifers. Use of improved bulls would allow for a more rapid improvement of smallholder dairy herds.

The use of grass or forage legumes in crop rotations is one of the best techniques for improving the sustainability of farming practices at relatively low cost. But forage production is unlikely to be economic unless it is an integral part of a livestock production system. The improved integration of crop and livestock production systems needs to be explored.

3.7. Pollution in the agricultural sector

The primary source of pollution from the agricultural sector in Zambia is from agricultural chemicals. Most of these agricultural chemicals fall into the category of chemical fertilizers or pesticides. Although chemical fertilizers can have negative impacts on the environment, the perceived risk and known incidence of pesticide pollution is much greater than for fertilizers.

3.7.1. Chemical fertilizers

The principal problem with chemical fertilizers is that these chemicals may find their way into and contaminate surface water or underground water sources. Although seldom a direct threat to animals or humans, chemical fertilizers cause eutrophication of surface water bodies, which may kill fish and hamper human use. Fertilizer used in irrigation projects is probably the most likely source of contamination for rivers and streams, although chemicals carried in runoff from upland fields may also affect surface water. There is some evidence of nitrogen contamination from a 13,000 ha irrigated sugarcane plantation along the Kafue River.

[28] The following section borrows extensively from the World Bank, 1992.

Where high levels of chemical fertilizers are used over an extended period of time, these chemicals, particularly nitrates, can also leach into underground aquifers. This is certainly a potential problem for the Lusaka aquifer, but there are no reported incidents of groundwater contamination at this time.

3.7.2. Pesticides

Approximately 1700 mt of pesticides, with a retail value of about $16 million were used in Zambia in 1989. Most of this material was imported. Only one pesticide, copper-oxychloride, is manufactured in Zambia, accounting for 250 mt of the total. An additional 250 mt of the total involves pesticides which are formulated and packaged in Zambia. Lack of foreign exchange has in practice served as the major limitation on importation rather than legal constraints. The Environmental Protection and Pollution Control Act, 1990, gives the National Environmental Council (NEC) the responsibility to control, register, monitor and regulate the importation, manufacture, storage and use of pesticides and other toxic substances. The NEC is only beginning to function as of July 1992, and no specific regulations on pesticide importation and use have not yet been established. The government recently began objecting to the importation of DDT, dieldrin and other organochlorine based pesticides and major agrochemical companies have largely stopped importing these compounds.

Commercial farmers are estimated to use 60 percent of the agricultural chemicals employed in Zambia, while smallholder households use 30 percent and specific projects account for approximately 10 percent. Insecticides are estimated to account for 40 percent of use and herbicides 30 percent, although herbicide use is expected to increase more rapidly than that of insecticides. Cotton production uses more chemicals than other crops, followed by maize, coffee, tobacco and sugar cane. Cattle dipping and tsetse fly control are other important uses of related chemicals.

While the use of toxic chemicals always poses a certain danger, the risk of misuse or abuse is even greater in situations where many users do not understand the potential effects and may not be able to read the label. It seems unlikely that poachers, who recently poisoned 50 buffalo with the intention of selling the dried meat, understood that the meat might also poison consumers. The same is true of recent incidents of fish poisoning and using pesticides in preserving dried fish. Persons applying pesticides often do not take appropriate precautions to prevent contact with or breathing the chemicals which they apply. The risk of inappropriate dosage, inappropriate timing, and the use of chemicals for inappropriate purposes are a continuing problem.

Chemical use by programs like tsetse fly control can also be a problem. Aerial spraying of endosulphan for tsetse fly control was reported to have a serious negative impact on birdlife. In 1989, the technique employed for tsetse control changed to the use of baited traps, and now aerial spraying is rarely used.

The greatest danger from agricultural chemicals is the potential contamination of groundwater aquifers. This danger is particularly acute in the Lusaka area, where Lusaka's population of 1 million people is dependent on groundwater to supply 40 percent of their consumption. The aquifer is close to the surface and is covered by relatively porous material. There is little to prevent chemicals used on the surface from eventually contaminating the aquifer.

There is also an acute danger from the inadequate storage of agricultural chemicals. When the Zambia Cooperative Federation (ZCF) took over the National Agricultural Marketing Board (Namboard) offices and warehouse in 1988 ?, workers cleared out the warehouse by dumping 60 mt of unlabeled and obsolete pesticides on the ground outside the warehouse. Situations like this certainly pose a danger to the Lusaka aquifer. There is speculation that these chemicals may have played a role in the incident of accidental poisoning which caused the loss of lives at another company located next door to the Namboard location.

As of July 1992, these chemicals are still on the ground outside the ZCF warehouse and exposed to the weather. Zambia has no toxic waste dump and no access to a toxic waste incinerator. Zambia does not even have a controlled or managed solid waste dump. To the limited extent that industrial waste is managed, it is simply buried in a convenient spot. Most urban and industrial waste is simply hauled out of town and dumped along a road somewhere. A proposal to ship the chemicals to Europe for incineration was rejected because of cost and the logistical problems of shipping toxic substances. Authorities are looking for other disposal alternatives.

3.8. Agricultural sector policy issues

Many important policy changes affecting the agricultural sector have recently been made by the GRZ in relation to the structural adjustment program. These include the elimination of subsidies on fertilizer, maize meal and transportation; allowing private sector traders to become involved in the commercialization of agricultural inputs and outputs; movement towards the privatization of parastatals which have dominated the commerce of agricultural products; etc. Some of these policies like the elimination of the fertilizer subsidy may have some negative short-term effects on the environment and natural resource use by encouraging a return to *chitemene* agriculture. If a wholesale return to *chitemene* and other forms of slash and burn agriculture can be avoided, the longer-term effects should be towards a concentration and intensification of agriculture in areas with good soils and good market access. Such a concentration would leave more of the hinterland in natural forest and available to produce forest products and as wildlife habitat.

What is less clear is whether existing support and incentives are sufficient to ensure that the farming and land-use systems which develop are sustainable in the long-run.

Relatively high input smallholder and commercial agriculture require access to lime and fertilizer at reasonable cost to be profitable and sustainable. Lime appears to be increasingly important to the success and sustainability of high-output commercial agriculture. Yet there is no substantial effort to encourage and ensure the availability of lime for agricultural use, nor any incentives to promote lime application among farmers. Access to lime, fertilizer and output marketing at a reasonable cost is only possible in areas with good transportation infrastructure, like the line of rails and potentially the Tazara Corridor. Yet large tracts of land remain uncultivated in the line of rail, and the Tazara Corridor remains largely undeveloped. As the GRZ moves towards the development of increased food production capabilities in higher rainfall areas to help avoid the consequences of drought, the commercial farming potential of the Tazara Corridor will be increasingly important.
Lime and fertilizer use need to be complemented and perhaps partially replaced by good soil and water husbandry practices. This would include increased use of crop rotations, planting cover crops which produce mulch or green manure, use of legume crops in the rotation, improved use of crop

residues, composts and animal manure, and the integration of agroforestry activities. With only slight modification, these are also the practices necessary to improve sustainability through soil and water conservation. But there seems to be only limited support to develop practical soil and water conservation technologies for on-farm use, and no incentives to farmers to use them. These aspects of soil and water husbandry need to be better integrated into agricultural research and extension activities. Specific incentives are needed to promote farmer adoption.

Introduction of a land tax is a policy which is under discussion and which has great potential to provide some of the incentives which are now missing. It is undoubtedly more cost effective to encourage intensive agriculture production in those areas which have access to transportation infrastructure, rather than building new infrastructure in areas which are not yet served. Yet large tracts of land in the line of rail are not cultivated, or are used primarily for extensive cattle production. It is also better environmentally, if this land which has been cleared and destumped is used for cultivation, rather than clearing new land. A land tax which taxed cleared land more heavily than woodland or forest, would be a strong incentive to encourage the cultivation of land which has been cleared, and to encourage tree growing or the return of uncultivated land to woodland. This would promote both agricultural and forest product production near the population centers along the line of rail. A land tax should target land under freehold/leasehold tenure. This would automatically target land in areas with a high potential for intensive agriculture. There is no clear basis for applying such a tax to lands under traditional tenure, and an efficient system of collection from traditional farmers would be difficult to establish.

With such a land tax, incentives might also be provided to farmers for the application of lime and improved soil and water conservation activities. A deduction or tax credit might provide the necessary incentive to increase adoption of lime application and other soil and water conservation practices.

Promotion of lime production, the development of the Tazara Corridor and protection of scenic lands are also policy issues which merit close attention.

3.9. Potential project activities

3.9.1. Policy interventions

USAID is already heavily involved in Agricultural Sector policy interventions as lead donor on maize market liberalization and support for privatization and economic diversification among other aspects of the GRZ's economic reform program. These reforms should make an important contribution to the economic sustainability of agricultural sector development and should be continued. In addition to these existing interventions, it would be useful for USAID to support policies which specifically promote sustainable production and land use. Some policies which seem particularly appropriate are: the intensification of agriculture in those areas with transport infrastructure and good market access, particularly on land which has already been permanently cleared (destumped); incentives for lime application; and incentives for the use of soil and water conservation practices. One particular strategy for accomplishing these policy objectives would be the introduction of a land tax targeting freehold/leasehold land. Taxing cleared land more heavily than woodland or forest plantation would provide incentives to intensify cultivation of cleared land, and promote the production of forest

products or the return of land to woodland. A system of tax credits or deductions might also be used to provide incentives to farmers to apply lime and use improved soil and water husbandry practices.

Land tenure and property rights is another area where USAID might provide policy support. Land tenure arrangements in Zambia are complicated by state ownership of all land, individual title or freehold lease for about 6 percent of the country, and traditional land use rights on the rest of the national territory. Although the government claims that about 8 percent of the country is devoted to forest estate and another 21 percent to Game Management Areas, most of this is in traditional land tenure areas. The GRZ would like to promote the development of commercial farming in the Tazara Corridor, but the land in question has never been gazetted as state land. Providing clear title is a problem, because it is not yet the state's land to give. An intervention in this area should use a broad definition of property rights so that water rights, tree tenure, and access rights to wildlife are also considered.

3.9.2. Improved agricultural land-use systems

There is a serious need to improve land use systems, the sustainability of agricultural production and increase the use of soil and water husbandry practices. It is less clear how one might address these problems in a practical and efficient manner. Elements of numerous functions are involved including planning, land-use planning, soil and water conservation and agricultural research and extension. Given the negative history of soil conservation activities the focus should be less on soil conservation per se, and more on the integration of improved soil and water husbandry into everyday farmer and extension recommended practices. SIDA is already involved in support to the Soil and Water Conservation Section of the Ministry of Agriculture and with the Soil Conservation and Agroforestry Extension (SCAFE) program which covers Eastern and Southern Provinces and one district in Central Province.

Agricultural research also need more help in addressing many of these same issues. Technologies which can be used by resource-rich farmers are relatively well known. Much less is known about how to help resource-poor farmers adopt individual techniques or technologies in a piece-meal manner, which will have a cumulative effect resulting in a more productive and sustainable farming system. More research is needed on lime use, practices which will improve soil and water husbandry, and traditional alternative food crops (beans, cassava, sorghum, millet, sweet potatoes, etc.). Although SCAFE has agroforestry recommendations, the research done by the agroforestry institutions appeared to be particularly disappointing in terms of producing any practical results. Many donors are involved in various aspects of agricultural research (see the annexes of Jack King's report).

3.9.3. Small-enterprise lime production

One potential project intervention which would improve land-use and sustainable agricultural production would be to provide support for the development of crushed lime production for agricultural application. Lime deposits are reportedly scattered throughout the country, but have been exploited primarily to produce construction materials, whitewash, etc. Small-scale crushing equipment suitable for crushing limestone is reportedly available from South Africa. The feasibility of establishing small-scale private enterprise operations to provide crushed limestone needs to be

studied. Such a study should evaluate equipment and labor intensive production alternatives, transportation and logistics, costs, and the effectiveness of different products. ARPT teams may already have some of the information, and are well placed to help determine costs and feasibility. Zambia certainly has an abundance of mining expertise, some of which might be applicable to this project. (Someone like David Littleford, the ZATPID NCZ advisor, or one of the numerous engineering firms in Zambia might be helpful in assessing the situation, or identifying someone who could.) If project feasibility is confirmed, implementation could use a fairly straight forward small-scale enterprise development approach.

3.9.4. The Tazara Corridor

A second project alternative would be to become involved in the development and implementation of the Tazara Corridor. Development of the Tazara Corridor will: expand agricultural production in the northern high rainfall zone to reduce drought risk and improve food security; increase opportunities for relatively intensive commercial farming; attract foreign capital to help develop and improve the Zambian Agricultural Sector; make better use of existing physical infrastructure; concentrate a portion of the rural population to allow more cost effective development of social infrastructure; promote increased agricultural diversification; help improve and intensify land-use in high potential areas; and permit the conservation of more woodlands in the hinterland which can be developed to produce forest products and as wildlife habit.

The GRZ began land-use planning activities for the Tazara Corridor in 1985. Priority blocks totaling 1.4 of the 4.5 million ha have been identified, some farms have been demarcated, and extensive planning has been done. But very little has happened in terms of implementation. South African and Zimbabwean farmers, as well as Zambians, have shown interest in obtaining land in the Tazara Corridor, but have so far returned home unsatisfied. The legal requirement of a formal, highly accurate cadastral survey for each farm is a problem given the small number of qualified surveyors in Zambia. But it is also not clear whether the GRZ can grant title to land which has not been gazetted as state land.

It appears that the previous government always hoped that some donor would finance the Tazara Corridor development as a classic resettlement project in which the government cleared land, built farmsteads, dug wells, developed villages and provided everything to the settlers. Settlers have rarely appreciated such projects and they have almost always been financial disasters for the governments involved. Zambia needs help establishing a model of free enterprise development and the means to get the job done. The Tazara Corridor development needs a body of rules and procedures which facilitate and regulate the establishment of free enterprise agriculture by commercial and smallholder farmers. This is an area where American experience could be helpful and a project in which USAID could make a major contribution to Zambian economic development.

3.9.5. Pesticide regulation

Pesticide regulation is just one of the many responsibilities placed on the National Environmental Council (NEC) by the Environmental Protection and Pollution Control Act of 1990. The NEC was mad responsible for designing environmental regulations and procedures, monitoring pollution or degradation of national resources, enforcing pollution control, supervising natural resource

conservation, planning improved environmental and natural resource management, maintaining a natural resource data bank and providing environmental educational programs and information. The role of the NEC might be compared to that of the US Environmental Protection Agency (EPA). It will be an immense job, and the NEC will need lots of help.

The NEC is expected to become the key institution for environmental and natural resource activities in Zambia. It will be very interesting to monitor how it develops and performs. Although a director was named in December 1991, the Council which the director is to serve (and was legally responsible for naming the director) did not meet until July/August 1992. The NEC is only beginning to function and there is no history to indicate how viable an institution it might be.

CIDA has agreed to provide some funding and technical assistance to the NEC. It seems that they are committed to providing only a small part of the resources which the NEC will undoubtedly need. Other donors have been contacted, but commitments are uncertain except for a small contribution from NORAD to help continue the Natural Resource Data Bank. USAID should monitor this situation. The US has an immense amount of experience in environmental planning and regulation, and could provide expertise in any of the technical areas.

A project in this area of environmental protection and pollution control might be as small as providing technical expertise to establish pesticide regulations and procedures. It might be expanded to establish a much larger range of regulations and procedures, or expanded in the direction of helping implement regulations and procedures for pesticide and toxic chemicals control. Depending on the areas in which the NEC receives help from other donors, USAID could design a project with the NEC as small or as large as it might wish, or a series of more specific interventions. A project might provide advice on designing regulations and procedures or environmental assessments or become involved with the implementation of environmental protection activities.

3.9.6. Toxic and solid-waste disposal

Zambia has no appropriate facility to dispose of solid waste or toxic waste. The situation with pesticides exposed to the rain, contaminating surface water and leaching into the groundwater aquifer is alarming. But Zambia has no toxic waste dump nor access to an incinerator in which such chemicals might be safely disposed. Zambia needs access to some facility for the safe disposal of toxic waste. A feasibility study is probably necessary to determine what type of facility is appropriate. Does Zambia need its own facility, or is it technically, economically and politically feasible to establish a regional SADCC facility? Given that Zambia has no experience with either technology, does a toxic waste dump or an incinerator provide the safer and more robust solution under conditions of poor funding and low maintenance?

While toxic waste disposal is an acute need, there is a much more widespread need for adequate and appropriate solid waste disposal. There are no formal solid waste facilities in Zambia. There is no environmental impact assessment of waste dumping sites, and no regulation or control of what gets dumped. If it is moved off premises, it is simply loaded in a truck and dumped along a road somewhere outside of town. Zambia needs robust, low maintenance, solid waste disposal facilities located at sites selected to minimize their environmental impact.

The US has the experience and technology to help Zambia develop systems for the safe disposal of solid and/or toxic wastes. USAID could render a tremendous service in helping Zambia develop this aspect of environmental protection.

3.9.8. Licensed pest-control applicators

Another small, but potentially important project intervention alternative would be to help Zambia develop a licensing system for the possession and use of the more dangerous pesticides. Licensees would be required to attend training workshops and renew their licenses regularly. Regulations would be developed to make it illegal to sell specific pesticides to anyone without a license. The Zambian Agrochemicals Association has provided training to retailers and wholesalers and trainers on the proper handling of pesticides. Local sales representatives, cooperative staff and extension personnel would be the most likely trainers for farmers who seek licenses. The licensing of pesticide handling might make the use of some pesticides more costly for farmers, but it also might avoid some mishandling accidents. Obtaining a license to handle pesticides might provide some men/women with an entrepreneurial spirit, an employment opportunity.

4. Water-resource management

4.1. Water resources

Zambia is endowed with an abundance of lakes, rivers, swamps and groundwater resources estimated to include nearly 45 percent of all water resources in Southern Africa. The principle river systems are the Zambezi, Kafue, Luangwa, Chambeshi and Luapula. Natural lakes include Lake Tanganyika, Lake Mweru, Lake Bangweulu, and Lake Mweru-Wantipa. Lake Kariba and Lake Itezhi-tezhi are man-made. The Bangweulu Swamps, Kafue Flats and Zambezi flood plain are important wetlands areas.

Hydropower production and the fishing industry are the major users of Zambia's water resources, in addition to domestic consumption. Huge hydroelectric dams have been built on the Kafue and Zambezi Rivers. One such dam is the source of the man-made Lake Kariba. Irrigated agriculture has not been developed on a large scale. The area under irrigation is estimated at 25,000 to 50,000 ha or approximately 1 to 3 percent of the area cultivated annually (GRZ/NORAD, 1991; cited in Mabbs-Zeno, 1992). Urban areas depend on surface water for about 75 percent of their water consumption.

Zambia enjoys better groundwater conditions than most of the countries of Southern Africa with regard to depth, storage capacity, available yields and exploitation potential. Groundwater constitutes an estimated 25 percent of the drinking water supply for major urban areas and rural water supplies are predominantly taken from either shallow dug wells or boreholes.

4.2. Water quantity

The Zambezi River is the largest water resource in Zambia, but one of its tributaries, the Kafue River, is arguably the most important. Other important river systems include the Luangwa, Chambeshi and the Luapula.

River flows vary greatly from season to season, and from year to year. Most of the surplus water which generates runoff is located in the northern high rainfall areas of the country, as are the sources of most of Zambia's river systems. The average rainfall in the south of the country (700 mm) is approximately half of that in the north (1400), and yet the north produces about five times as much runoff as the south. Runoff rates, which average a mere 9 percent of rainfall, are strongly influenced by evaporative losses from wetlands areas such as the Kafue Flats, Bangweulu Swamp and the Zambezi flood plains. By one estimate, evaporation losses in the Kafue Flats average about one third of the total inflow (Mbumwae, 1992).

Major Rivers in Zambia

River	Basin Area Within Zambia (km^2)	Mean Annual Flow (m^3/sec)	Runoff (mm)
Zambezi	261,000[29]	1,900[30]	135
Kafue	165,000	350	70
Luangwa	152,000	500	95
Chambeshi	34,000	230	210
Luapula	124,000	690	165

Source: Mbumwae, 1992

The volume of water available in Zambia is generally sufficient to meet present critical needs, but temporary shortages are apparent in the dry season of a drought year like 1992. Long-term development plans call for large increases in agricultural irrigation and hydroelectric generation and urban water supply, as well as for the conservation of the wetlands eco-systems.
It is not evident that the volume of water available, particularly in dry seasons and drought years, is sufficient to meet all of these additional demands. A cross-sectorial planning process which takes into account the water demands of all sectors is needed as is some institutional process for improving management and dealing with competing demands for water allocation.

4.2.1. Hydropower

Hydropower has been the major objective of water development in Zambia. The major hydroelectric sites are Victoria Falls and the Kariba dam, both on the Zambezi, and the Kafue Gorge on the Kafue

[29] The total catchment area of the Zambezi River above Victoria Falls is 507,200 km^2.

[30] This includes runoff from Angola and excludes evaporation from Lake Kariba.

River. These sites have a capacity of 108 megawatts (MW), 600 MW[31] and 900 MW respectively. This capacity has exceeded national demand and has allowed Zambia to sell electricity to neighboring countries to generate foreign exchange. But in 1992, water reserves are so low that ZESCO is warning they may not have water to generate much electricity late in the dry season. The generating capacity at Kafue Gorge could be increased by 50 percent without additional changes to the river.

It is difficult to disrupt river systems and eco-systems as is done by large hydropower facilities, without incurring negative environmental consequences. Little was done in the way of environmental impact assessment before most of Zambia's facilities were developed. Lake Kariba, one of the largest man-made lakes in Africa, has become an important fishing and recreational resource in addition to providing electricity. It did displace some 30,000 people and cover a large area of important wildlife habitat. The Victoria Falls facility diverts an important portion of the water from the Zambian side of the falls in the dry season. The Itezhi-tezhi dam was built to stabilize seasonal water availability to Kafue Gorge, and control flooding in the Kafue Flats. Management of water for the flats has been complex, since the eco-system needs flooding to be maintained. In most years ZESCO allows enough water over Itezhi-tezhi at some time during the rainy season to imitate natural flooding. There was not enough water available in 1992 to release this "freshet".

Zimbabwe is very eager to build another dam on the Zambezi River in the Batoka Gorge. The proposed dam would have more capacity than either Kariba dam or the Kafue Gorge, 1200 to 1600 MW (to be divided between the two countries). It would also flood nearly to the foot of Victoria Falls and cover the rapids which have been developed into an important whitewater rapids tourist attraction. The GRZ seems less interested than Zimbabwe to build the Batoka Gorge dam, but is under considerable pressure from Zimbabwe to cooperate. An initial environmental impact assessment of the Batoka Gorge site has been completed, but the results are very controversial.

ZESCO, the electric power company which operates the dams, largely controls the flow of the Zambezi and Kafue Rivers with decisions based largely on considerations related to generating electricity. ZESCO has been allocated the right to use 95 percent of the water flow in the Kafue River, with total flow and ZESCO use estimated at 184 m^3/sec and 178 m^3/sec, respectively. As of June 25, 1992, 120 m^3/sec was being released from Itezhi-tezhi dam, leaving 105 m^3/sec for the operation of the Kafue Gorge power station, which is operating well below capacity. The Itezhi-tezhi dam is below its normal minimum level and Lake Kariba is within 3 meters of the minimum level at which the power station can operate. ZESCO has started running advertisements on TV and in the paper asking people to conserve electricity or there may be no water to produce electricity in October. ZESCO has stopped selling electricity to Zimbabwe and has reportedly negotiated to buy electricity from Zaire if necessary.

[31] Capacity of Kariba North, Zambia's part of the combined Zambia-Zimbabwe venture.

4.2.2. Irrigation

The amount of land presently irrigated in Zambia is estimated at about 26,000[32] ha or about 2 percent of the land area cultivated annually. One half of this total (13,000 ha) is devoted to the Nakambala Sugar Plantation. Most of the rest is used to produce wheat, banana, fruit, vegetables, coffee, tea and irrigated pasture and hay for dairy cattle. The change in policy to make agriculture the engine of growth for Zambian economic development has created pressure to expand irrigated agriculture. Current policy is to expand irrigation with the target of achieving self-sufficiency in wheat and rice and increasing the production of coffee and other high value crops for export. The 1987 Euroconsult Study, places the potential for irrigation from surface water at 363,000 ha of which 165,000 ha is in the Kafue Basin. It also estimates that an additional 60,000 ha can be irrigated from groundwater (World Bank, 1992). The Ministry of Agriculture, Food and Fisheries has identified some 187,000 ha in specific schemes, based on surface water resources (Mbumwae, 1992). The Fourth National Development Plan calls for the development of 6,000 ha per year.

Irrigated agriculture could improve food security and potentially make an important contribution to the foreign exchange balance by producing export crops or through import substitution. But in a drought year like 1992, it simply is not evident that water resources are available for the developments envisioned, particularly in the Kafue Basin. It also seems unlikely that water is available even in normal years, without a reallocation of water rights which would reduce electrical power generation.

Neither the literature nor existing institutions seem to address the question of what would be a reasonable allocation of water rights between electrical power generation, irrigated agriculture, fishing, urban and industrial use, etc.

4.2.3. Municipal Water Supply

Water consumption data is scanty except in major cities. Average daily consumption per capita is estimated at 200 to 400 liters in large urban areas, 100 to 200 liters in small urban townships and as low as 15 liters in rural areas.

In the central city of Lusaka, 80 to 90 percent of the residents have access to treated drinking water and sewage disposal. But the 50 percent of Greater Lusaka's population which lives in squatter townships is much less likely to have access. All urban centers and small urban townships are served at least in part by piped water systems. But many of these systems suffer from a lack of maintenance and are in poor operating condition. Many are also plagued by low river flow and dry wells in this year of drought. The Kitwe City Council announced on August 13, 1992 that due to the critically low levels of the Kafue and Mwambashi Rivers watering lawns, washing cars, watering gardens and

[32] This figure may not include recent developments. Although the author (Mbumwae, 1992), states that irrigated agriculture has only expanded in recent years, and that irrigated area has more than doubled in the past ten years, the figure cited is only 1,000 ha larger the figure for irrigated area used in the 1987 Euroconsult Study.

filling swimming pools would not be allowed. In addition water would be available only for 7 hours in the morning and 2 hours in the evening.

Leakage from broken pipes is so serious that many municipalities regularly turn off water over night. In Mongu, losses in the water delivery system are reported to be as high as 50 percent of intake. There is also a lack of conservation ethic among users. Water engineers report finding faucets which appear to have run for several days without anyone turning them off.

Zambia certainly has the water resources necessary to meet the needs of domestic and industrial use. But Zambia does not have the infrastructure to provide clean drinking water in many urban and rural areas. The infrastructural problems become more severe in drought years when many wells run dry and surface water sources suffer significantly reduced flows. The limited water supply and distribution infrastructure and its deteriorating condition do limit the quantity of water which can be delivered and constrain consumption in many areas.

4.3. Water quality

Although the volume of water available in Zambia is sufficient to meet the needs of domestic water consumption, a large portion of Zambians do not have access to clean drinking water. Deteriorating and inoperative water treatment and distribution systems are under pressure from increasing demand. This situation combined with inadequate sewage and waste disposal has created a crisis in the water and sanitation sector.

The limited data on access to quality drinking water is controversial. According to one study, 70 percent of the urban population and 33 percent of the rural population have access to quality drinking water (GRZ/NORAD, 1991; cited in Mabbs-Zeno, 1992). However, there are many indications that these figures grossly exaggerate access to adequate drinking water supplies. Almost one-half of the population of greater Lusaka live in shanty towns with limited access to treated drinking water and sewage disposal.

Many cities have a serious problem with leaks in both the water distribution and sewage systems. Leaks in the water distribution system often cause low pressure, and many cities only pump water during certain hours of the day. Low pressure or lack of pressure allows water or sewage near the leak to seep into the water distribution pipe. This type of cross contamination is an important cause of poor water quality.

Many urban areas have poorly maintained sewage treatment facilities which have only a fraction of the capacity needed for the present population. Frequently sewage and industrial effluent enters the river system raw or poorly treated. In many cases the water supply intake is downstream from the discharge of sewage and industrial effluent from the same city. Since they are not very far apart, only limited dilution may take place before reaching the intake. Many of the urban water departments do not have the money to purchase chlorine to treat the water supply and/or can not get the chemicals when they are needed. The water departments for both Kitwe and Ndolo, the country's second and third largest cities, recommend that water be boiled before being used for drinking or cooking. Cholera, typhoid and dysentery outbreaks have become endemic.

The threat of contamination of groundwater from sources of industrial pollution is much less obvious, but equally serious, particularly for Lusaka. These hazardous materials and wastes do not degrade rapidly and once they migrate into the aquifer it becomes nearly impossible to clean. At present, groundwater typically requires much less treatment than surface water. Being forced to rely on surface water would significantly increase the cost of urban water supply, and decrease the likelihood that areas like the shanty towns can be adequately served.

The Ministry of Local Government and Housing has commissioned a study to assess the integrity of existing water supplies and sewerage systems for 21 district councils as part of its campaign to protect public health from water-borne diseases, particularly cholera. Lusaka Water and Sewerage Company is providing facilitating services. The study is being conducted in three phases. Phase 1 (already completed) was to determine emergency procedures and measures to reduce the risk of water contamination and thereby assist in reducing the spread of the epidemic. Phase 2 will determine measures to be taken in the short term (by the next rainy season) to sustain an acceptably low health risk. Phase 3 is to determine longer term issues which may be beneficial to communities with regard to improving water quality and reducing costs of water supply. Phase 2 of this study should be completed in September 1992, and will provide a technical assessment by water engineers, for a broader range of urban areas than was visited by this assessment team.

This team looked primarily at water quality in the Kafue Basin and at Lusaka. Much of the population and industry of Zambia is located in the Kafue Basin, which includes both the Copperbelt and Lusaka. Because of this situation, the Kafue is both the river with the most pollution problems and the river most used as a source of water supply.

4.3.1. Water quality in the Kafue Basin

Water quality in the Kafue Basin is very dependent on location. The river is heavily impacted by mining activities as it enters and traverses the Copperbelt. This impact affects the quality of water supplied to Copperbelt urban areas, which further pollute the river by adding sewage and industrial effluent. The swamps and wetlands in the middle section of the river seem to act as filters and cleansing agents since much of the contamination seems to be removed. Water extracted at Kafue (town) for use in Lusaka and Kafue shows little sign of this Copperbelt contamination. But at Kafue, the river is once again subject to serious contamination from urban and industrial effluent.

4.3.1.1. Zambia Consolidated Copper Mines (ZCCM)

In 1991, only 2.26 percent of the 23 million tons ore mined by ZCCM was extracted as copper. The other 97 or 98 percent of this mountain of material was dumped back on the ground, usually along the banks of the Kafue River or its tributaries. Much of the material is combined with water and piped to a convenient valley where it is sprayed out under pressure to help separate the water from the tailings. ZCCM has established settling ponds at Nkana mine to reduce the suspended solids in the effluent which is discharged into the Kafue River system. It also has been able to revegetate the face of the tailings dam at Mindola although there has been no attempt to revegetate the several square kilometers of the tailings dump itself.

The worst problems seem to originate from the Chingola/Nchanga leach plant, which is one of, if not the largest leach plant in the world. The facility continues to release an unacceptable load of suspended solids to the Kafue. A mining expert says that a $1 to $2 million investment could largely rectify this problem. He also estimates that $1 to $2 million worth of copper are lost each year because of these releases (Littleford, personal communication). The suspended solids are of particular concern because they are associated with heavy metals, particularly copper, manganese and iron. Toxic substances like arsenic and lead are also detected in water samples. ZCCM does add lime to help neutralize the sulfuric acid in the waste water. While it is necessary to neutralize the acid to prevent fish kills and other environmental problems, the lime added is causing the upper Kafue River to become neutral in pH, or slightly alkaline (Mbumwae, 1992).

There are no data to indicate that the heavy metals polluting the upper Kafue River are reaching the middle and lower Kafue River, although this is likely. But this is little consolation for the people of the Copperbelt who receive their water supply from the upper Kafue. There is also no information how far downstream these suspended solids containing heavy metals might travel in succeeding cycles of precipitation and resuspension during periods of high river flow.

ZCCM does have an established environmental program headed by a Senior Environmental Advisor. This program consists largely of monitoring surface water quality on both the mining lease and along the Kafue River. Monitoring of the river is done at several points from Chililabombwe to Kitwe, and small streams on the mining leases are sampled regularly to monitor on-site pollution. Sampling is by grab samples which are taken at different times of the year. ZCCM uses water quality standards which have been set in collaboration with the Zambian Bureau of Standards and appear to be generally comparable with internationally accepted water quality criteria. The major exception is that no standards exist and no testing is done for organic chemicals. ZCCM reports that all quality analyses meet these standards. A number of studies dispute this claim. The Mine Safety Department of the Ministry of Mines is responsible for monitoring the quality of mine effluents, but relies primarily on ZCCM reports because it lacks the equipment or funding to do its own testing.

Pollution by organic chemicals is an important concern. These substances may originate from solvents, oils and greases used in operations at the mines, smelters or refineries and contain chlorinated hydrocarbons such as trichloroethylene and PCBs.
At present ZCCM has no capacity to perform detailed analyses for organic contaminants.

4.3.1.2. Kitwe water supply

The water supply for Kitwe is taken exclusively from surface-water sources, the Kafue and Mwambashi Rivers. No adequate sources of groundwater have been found in the Kitwe vicinity, apparently due to unfavorable geologic conditions. The river water is processed through a treatment plant constructed in 1968 and designed to serve a population of 200,000, while the present population is about 350,000. The plant was designed with a potential capacity of 18 million liters per day (90 liters/day/capita) but now produces only 12 million liters/day (35 liters/day/capita) because of old equipment. In addition to filtration, the water is theoretically treated with chlorine and aluminum sulfate in addition to being treated to remove manganese. But the equipment to remove manganese is not operational, and the supply of chlorine and aluminum sulfate is sporadic. Frequently there is no

money to buy the chemicals, and often the chemicals are not available when there is a little money. The Water Department recommends that water for drinking or cooking be boiled.

The Water Department has a severe staffing problem. Only 4 of an authorized 27 positions are filled. The critical positions of water engineer and wastewater engineer are both vacant.

The Kitwe Water Department budget projects water system revenues of K 260 million ($1.3 million) and expenses of K 206 million ($1.03 million), but the department often does not receive sufficient funding from the District Council to meet necessary expenses. Kitwe water revenues go into the general District Council coffers and funds are often not available to purchase chemicals, repair pumps, and finance the operation and maintenance of the water system. Parts of the system are metered, but many meters are not operating because the department has no spare parts to repair them.

The Water Department would like to reorganize as an independent company with direct control over water system revenues. Direct control of its own fiscal affairs would allow the company: to improve fiscal management, expedite purchases of necessary chemicals and equipment, control staffing, and apply for bank loans to finance capital improvements. The Director of the Water Department says that they need a donor "sponsor" to provide technical assistance and support for this "privatization". He cites the example of the Lusaka Water and Sewerage Company as what he hopes will be achieved, and the role of GTZ in supporting that development. The District Council has given permission for the Water Department to establish a separate bank account for water revenues beginning in August 1992.

4.3.1.3. Ndola water supply

The main water supply for the city of Ndola is taken from the Kafubu River, a small tributary of the Kafue which traverses the city and receives most of its sewage and industrial effluent. One intake for the water system is upstream from Ndola and the water quality is relatively good. The main intake is located in the reservoir formed by a dam on the Kafubu, downstream from Ndola. Water quality from the reservoir is not good. Ndola has a number of large industries within the Kafubu drainage, and this industrial effluent and the city sewage treatment plant all discharge into the Kafubu River, upstream from the reservoir. The Ndola Water Department Director says that the Kafubu has little flow during the dry season, except sewage. The Director says that Ndola is recycling almost all of its water between the sewage treatment plant and the water treatment plant. In the present drought, without the addition of water from the Misundu well field which is discharged into the Kafubu through the sewage treatment plant, the flow of the river downstream from the dam might cease completely.

Until recently, the Ndola reservoir was completely covered with Kariba Weed (Salvinia auriculata), an aquatic plant brought to the reservoir by pleasure boats returning from Lake Kariba. The weed caused severe water problems, by blocking sunlight from the water column and by the decomposition of dead plant material. It was also extremely prolific, doubling in quantity in 2.5 days and causing die-offs. With assistance of an expert from Australia, a weevil was recently introduced into the reservoir which feeds on the weed, with the result that the weed has been virtually eliminated. At this time it is believed that a permanent balance has been established with the weed still present in

small quantities and being held in check by the weevil. The Ndola Council has offered to supply the weevil for use in other locations plagued by the weed.

The treatment plant at the reservoir was designed to produce 80 million liters/day but its present operational capacity is only 50-60 million liters/day. Chlorination treatment for disinfection is sporadic, both because funds are lacking to purchase the chemicals or because the chemicals are not available. Occasionally, the water treatment plant is not able to remove all of the algae from reservoir water and tap water has a green color.

Water from the reservoir is supplemented by water from a well field at Misundu. The groundwater is of excellent quality and the only treatment necessary is a small amount of chlorination. The well field yields up to 50 million liters/day in the wet season, but this may fall to 25 million liters/day in the dry season. Only 11 of the 22 wells in the field are presently producing although pumps have been received for the other 11, and should soon be installed. The long-term potential of this well field is questionable, given the significant seasonal variation in yield and the fact that it some reports claim that it has caused dry orchards and sinkholes in the area.

The department would like to increase use of groundwater because the water quality is much better, allowing much lower water treatment costs. The Director says that Ndola spends 6 times as much as Lusaka on water treatment, even though it is a much smaller city. The department has proposed that the water supply be supplemented by water pumped from the Bwana Mkubwa Mine, an abandoned open pit mine several kilometers east of Ndola. Dewatering at this mine yielded about 80,000 m^3/day and was reportedly of very good quality. A study of the feasibility and cost of using this water as a source to supply Ndola was carried out in 1987. Although the conclusions were positive, no financing has been found to implement the project.

The Water Department at Ndola is also trying to move towards privatization, or at least control of the revenues from the water system. Progress is slow because the City Council is reluctant to lose control of the water revenues. The Director also expressed the opinion that Ndola would need a sponsor, much as GTZ had served as a sponsor for the privatization of the Lusaka Water and Sewerage Co.

A Water Users Association has recently been formed, and a constitution is being developed. According to the Natural Resources Officer in Ndola, the association includes a large representation from the industrial and commercial sector, and is set up in a structure similar to that of the Kafue Water Users Association.

The Ndola Council has reportedly established a fee system to charge polluters according to the Biochemical Oxygen Demand (BOD) of effluent released into the Kafubu or the sewage system. Public officials believe that industry will be willing to adhere to the proposed effluent standards. As yet there are no organizations or lobby groups pressuring government and industry for improved water quality.

4.3.2. Lusaka water supply

Water supply for the city of Lusaka and the surrounding urban area, with a population of about 1 million, is about evenly divided between groundwater and water brought by a pipeline from the Kafue River near Kafue (town). The amount of water delivered by pipe is on the order of 80-100,000 m^3/day. Water from the Kafue is treated in the Iolanda treatment plant located at the river, and pumped to a booster station at Chilanga. The water taken from the Kafue River is tested and monitored at the treatment plant and groundwater is periodically sampled and analyzed for bacteriological contamination.

Pollution is a serious threat to both surface and groundwater supplies. Pollution in the Kafue River is primarily due to the discharge of effluent from the Kafue (town) industrial park that is upstream from the intake for the Lusaka water supply. The Lusaka Water and Sewerage Co. has recently received a grant from the US Department of Commerce, Trade and Development Program to perform a feasibility study for the expansion of the water supply from the Kafue River. This study will include a component which addresses the Kafue pollution and evaluate the effectiveness of the treatment facility in meeting water quality standards (US Trade and Development Program, 1992).

A comprehensive study of groundwater occurrence and availability was carried out for Lusaka by the German Government in 1978 (German Institute of Geosciences and Natural Resources, 1980). The study concluded that the potential yield of the Lusaka aquifers is about 44 million m^3/year or 120,000 m^3/day, half from the 20 wells that the city was already using, and half from another 20 wells to be distributed over the entire aquifer. The study emphasized that this capacity was dependent on regeneration and would be reduced by up to 50 percent, should there be a succession of 3 years with rainfall less than 700 mm.

The study also highlighted the vulnerability of the very permeable karstified Lusaka dolomite aquifer to contamination from surface sources and recommended that groundwater protection measures be put in place to assure the long term quality of the water. The report states that the Lusaka master plan does not take the protection of groundwater into account. The master plan projects the expansion of the city to the south over the karst aquifer, rather than zoning to protect the aquifer. The study proposes additional wells that would not be affected by this expansion to the south.

The Lusaka Water and Sewerage Co. is currently pumping groundwater from 40 wells, primarily to supplement water supplies in urban townships. K 10 million has recently been granted to drill additional wells in these shanty town areas to improve access to clean water and reduce the threat of cholera and other water-borne diseases (Lusaka Daily Mail, Aug. 8, 1992).

Borehole drilling and exploitation of groundwater in Lusaka are completely unregulated, and appear to be out of control. The Senior Hydrogeologist from the Department of Water Affairs estimates that well over 1,000 boreholes exist in Lusaka and the surrounding urban townships, and that new boreholes are being drilled at a rate of 3 to 4 a day. This rapid increase in the number of boreholes poses a threat to well yields and to the sustainability of the water resource. In many instances these boreholes can be a source of groundwater contamination.

Leaks are a serious problem in Lusaka's distribution system and water pressure is not always adequate to supply all users. When water pressure is low, there is also a possibility that leaks can allow back seepage from pit latrines directly into the water distribution system or cross contamination between the water and sewer systems. This risk of pollution from human waste and other bacteriological contamination is generally recognized by officials and some steps to monitor and improve the situation have been taken. A second, and much less obvious threat to groundwater quality is that of industrial pollution.

Hazardous and toxic materials that are used in or generated by industry and commerce may be released to the environment by poor handling or improper disposal. These pollution sources are potentially a long-term threat to human health because the pollutants can be long-lived, and once in the soil or groundwater will not readily degrade under natural conditions. These hazardous materials and wastes include both inorganic substances such as heavy metals, and organic compounds such as benzene, chlorinated solvents, and agricultural chemicals such as pesticides. Hazardous and toxic waste management procedures to protect the environment and water resources are grossly inadequate in the industrial and commercial sectors of Lusaka. It is likely that serious groundwater pollution is taking place because of the proximity of the Lusaka aquifer to sources of surface pollution by industrial chemicals. At present, there is no effective monitoring or control of these types of hazardous materials. There is also no adequate disposal facility in Zambia to handle hazardous and toxic wastes, or even non-hazardous solid wastes.

The Environmental Protection and Pollution Control Act of 1990, clearly gives the NEC the responsibility to monitor and regulate hazardous and toxic wastes to license waste disposal sites. But the NEC has not yet written the actual regulations (as opposed to the authorizing legislation) and no monitoring or regulation is yet in progress. It may be several years before the NEC has a set of regulations and procedures so that enforcement can begin. Any wait increases the chance that hazardous and toxic chemicals will contaminate the aquifer, before any action to protect it begins.

Another issue which needs to be addressed is the sustainability of groundwater yield from the aquifer. Lusaka Water and Sewage pumping alone accounts for most of the 120,000 m^3/day, which the 1980 German study estimated to be the sustainable capacity of the aquifer. According to the Senior Hydrogeologist, there are now hundreds of additional boreholes in the aquifer. There has been no recent assessment to see if the present rate of extraction can be sustained, particularly during a drought.

One aspect of this sustainability, as well as protection of the aquifer from surface contamination, is whether there is sufficient groundwater for irrigated agriculture to be a wise land use in the immediate vicinity of the city. A feasibility study would be required, but it might be cheaper for the city to buy out irrigated farms and use the water for municipal supply, rather than increase the amount of water pumped from the Kafue. Irrigated agriculture on land over the aquifer, also poses a substantial risk with regard to chemical contamination of the groundwater.

4.4. The Kafue Basin and Kafue Flats

The Kafue River, while a tributary of the much larger Zambezi River, is arguably Zambia's most important water system. Zambia's major urban centers, mining operations, commercial agricultural

farms, industrial plants, and hydro-electric generating facilities all are located in the Kafue River Basin. Much of Zambia's irrigated agriculture is located in the basin, as are its largest national park and important wildlife reserves. The wetlands areas of the basin, particularly the Kafue Flats, constitute an important fishery resource. The Kafue system is the primary outlet for sewage and effluent from these towns, mines, and industries, and for agricultural run-off, while at the same time being a source of drinking water for at least one third of Zambia's population (Silangwa et al., 1991; cited in Mabbs-Zeno, 1992).

The Kafue Basin is a complex hydrologic unit which has many uses and stakeholders. The Kafue River rises in the Copperbelt, along the Zaire border. The headwaters are northwest of Chililabombwe and are entirely gazetted as national and local forest, to protect this important resource. However, anecdotal reports indicate that large areas in this forest reserve have been deforested and are being occupied by squatters. The Konkola mine near Chililabombwe is 4000 feet deep and requires constant dewatering. This water is reportedly of very good quality and contributes 200,000 m^3/day to the flow of the Kafue. The Kafue and its tributaries are also the primary recipients of mining effluent from the entire Copperbelt area.

The Kafue traverses the Copperbelt where it is the main water supply for many of Zambia's urban centers. It is the sole water supply for Kitwe, Zambia's second largest city, and a tributary, the Kafubu, is the primary source of water for Ndola, Zambia's third largest city. The Kafue is also the recipient of sewage and industrial effluent from all of these industrialized urban areas. Leaving the Copperbelt, the river is used for irrigation at Munkumpu and the basin system provides groundwater for irrigation at Mpongwe. The river is naturally connected to offstream storage in the Lukanga Swamp. The Lukanga is often attributed with filtering and cleaning water in the Kafue systems so that areas downstream are little affected by the pollutants received in the Copperbelt.

From the Lukanga swamp, the Kafue flows southwest through Kafue National Park and then south, forming the Eastern boundary of the park, to the Itezhi-tezhi dam. Much of the lake formed by the dam to help regulate water flow to the Kafue Gorge hydroelectric facility, is located within Kafue National Park. From Itezhi-tezhi it swings east and crosses the Kafue Flats, a 200 km stretch of wetlands that was flooded throughout the wet season and for several months afterwards, before regulation by Itezhi-tezhi dam significantly reduced this flow. Now the Kafue Flats are flooded only when Itezhi-tezhi releases enough water to allow it to flood. The reduced flooding has allowed encroachment by shrub species particularly *Mimosa pigra*. These shrubs are suspected of harboring ticks during the very limited flooding which now takes place, and exacerbating problems with tick born diseases in cattle. The Kafue Flats is the dry season grazing area for an important portion of Zambia's national cattle herd. Flooding is also essential for maintaining the habitat of the unique Kafue Flats Lechwe and for the fisheries. Due to limited rainfall and low river flow, the Itezhi-tezhi dam did not release enough water at any time to flood the flats during the 1991-1992 rainy season.

The eastern end of the Kafue Flats, approaching the town of Kafue (and Lusaka), is an important agricultural area. It includes several large irrigation developments, particularly the 13,000 ha Nakambala Sugar Estates, many irrigated private commercial farms and many traditional smallholdings. With the reduced water flow to the Kafue Flats in 1992, Nakambala has been forced to lower its water intake and is incurring increased pumping costs.

Near Kafue town the river serves as a source of water supply for Kafue town, and receives effluent from the industries at Kafue. Downstream from Kafue, water is extracted to meet about half of the water needs of Lusaka and surrounding urban townships, before being used to produce electricity at Kafue Gorge.

No system of planning now exists which integrates the needs of the many sectors which use the Kafue and regulates the competing interests of the many stakeholders who use the Kafue River and Basin. Something like the Zambezi River Authority is needed to mediate the different needs and interests and provide for the conservation of this important resource.

4.5. Opportunities for USAID Intervention

4.5.1. Lusaka Groundwater Survey

There is an urgent need for the protection and management of the groundwater resource for Lusaka. There is a need to inventory pollution sources, to identify and rank the most serious threats, and to take immediate action to control further pollution. A first step would be an inventory of all actual and potential sources of hazardous and toxic chemicals from industry, commerce and agriculture in Lusaka and the surrounding townships. This inventory should identify the location of these sources in relation to the several Lusaka aquifers.

A second step would be a regional study of groundwater occurrence and movement, concentrating on identification of recharge areas. The study should include an inventory of groundwater use in the Lusaka region by users other than the city. The study should also incorporate an inventory of agricultural chemical use and assess the likelihood of pollution from that source.

This is one type of activity which the NEC should be involved in, and may one day have the capacity to do when it is an established and functional institution. However, the consequences of groundwater contamination are likely to be so severe and so costly, that an effort should be made immediately to prevent this from happening. These activities could also be used to help the NEC develop regulations relevant to these types of problems.

4.5.2. Privatization of urban water departments

Urban water departments throughout Zambia need improved administration and fiscal management. While not necessarily requiring privatization per se, they do need the ability to collect and control revenues to establish a realistic budget and program expenses. Water departments generate substantial revenues, but typically these are controlled by City/District Councils. The terrible deterioration of water and sewage systems is primarily due to the failure of the Councils to invest in or even maintain the systems. Water departments often do not receive sufficient funding from the Councils to purchase the chlorine necessary to disinfect water being extracted from sources which are know to be polluted and likely to cause cholera. This is true even in cases where the water revenues are several times larger than the cost of the chemicals required. Many urban areas do need new and/or expanded water treatment and sewage treatment facilities, but without improved fiscal management, new facilities will provide at best only a short reprieve.

The lack of control of revenues has prevented water departments from contracting for necessary supplies or programming maintenance and repair expenses. With control of their revenues, water departments could let contracts for the supply of chlorine and other chemicals, so that they are consistently available. They could also purchase spare parts and plan a certain amount of repair and maintenance each year. The Kitwe water department reports that it can now take several months to process an order for parts, even when they are critical to daily operations. One instance was described where it took two years after two new pumps were received to get the funds to install them.

The money to invest in new or expanded facilities is, and will continue to be in short supply. Water departments are convinced that their best chance of obtaining such investment is through loans from major international financial institutions like the African Development Bank. The AfDB has provided major funding for the Lusaka Water and Sewerage Co. But to receive such a loan, at a minimum, the water departments must be able to show that their cash flow is sufficient to cover projected expenses and also repay the loan. Water department officials seem convinced that the best way to accomplish this is to become a private company. This conviction seems to be due in part to the example provided by the privatization of the Lusaka Water and Sewerage Company Ltd. Water department personnel also seem to believe that it will be difficult to improve fiscal management until they obtain a significant degree of independence from the local District or City Council.

USAID should consider providing support for the privatization of urban water departments. Strengthening the administration and fiscal management so that these companies become self-financing will improve the quality of urban water supply and help prevent health problems like cholera and dysentery. The prospect that these critical services can be provided to an important part of the population on a self-financing and sustainable basis provides an opportunity to have an important impact on Zambian development. If management and balance sheets of these utilities can be improved to the point where they can attract loan capital or other investment, this would provide a major improvement in the Zambian economy. Such companies should become a strong force in the industrial and commercial sector, promoting control of water pollution and improved management of the water resource.

Helping reorganize the water and sewer utilities of Kitwe and/or Ndola would seem to offer the opportunity to have the largest impact. To the extent that there are important economies of scale for water utilities, self-financing should be more feasible in these larger urban centers than in some of the smaller ones. An alternative approach would be a project which provided technical assistance and some support to utilities throughout the country, through something like a national association of water utilities. Given the success of group lending in other domains, an association of this nature might have a better chance of attracting loans than the individual utilities, especially those of the smaller urban areas.

4.5.3. Land and water-use management in the Kafue Basin

The Kafue Basin, Kafue River and Kafue Flats all seem to be facing a critical situation with regard to resource management and conservation, and competition for land and water rights. Both conflict between competing resource users and destruction of the resource seems most imminent in the Kafue Flats, but it is not clear whether management of the flats can be separated from the rest of the basin. Certainly most stakeholders in the Kafue Flats blame ZESCO's management of discharge from the

Itezhi-tezhi dam for many of their problems. But recently ZESCO has been blaming irrigated agriculture upstream from Itezhi-tezhi for using too much water. Certain groups like the Ila cattle herders and the fisherman in the Kafue Flats do not seem to have any political voice, even though they represent important sectors of the economy and their livelihoods are critically affected by decisions regarding land and water rights in the flats.

Improved land and water-use management and planning are as important to the sustainable productive use of the land and water resources as is pollution control.

An organization is needed which will coordinate planning and resource management across all sectors of the economy in the Kafue Flats/Basin. It needs to provide a forum in which the many stakeholders can express their needs and concerns, and which can mediate between conflicting demands. A Kafue River Authority has been proposed, based in part on the experience of the Zambezi River Authority, which has helped coordinate the activities of different governments of countries located along the river. The Kafue River Authority would have to be somewhat more of a grassroots affair, where groups of farmers, herders, fishermen, etc., as well as ZCCM, ZESCO, the Nakambala Sugar Estate and other large developments could have a voice. The NEC would certainly have an interest in the development of this type of institution, and might provide organizational support as well as an alternative model for how it might be organized. If the NEC should become bogged down in policing environmental regulations, supporting development of a Kafue River Authority would provide a means to become involved with a very important natural resource management program and working with the NEC, without also becoming involved in the policing activities.

The UNDP is financing a detailed study of the resources and problems of the Kafue Basin. Once this study is available, the UNDP may develop a Kafue Basin project. USAID should monitor this activity. The Kafue Flats is one of the most important and most threatened environmental resources in Zambia. If UNDP does not develop a program for the management and conservation of the Kafue Basin, USAID should certainly consider doing so.

4.5.4. Environmental protection

Zambia's water resources, particularly in the Kafue Basin, are in need of environmental protection and pollution control to conserve the resource and protect the many users dependent on water. This task has been entrusted to the NEC. But as a new institution, the NEC has as yet no capacity to carry out this assignment. The responsibilities are only described in the broadest of terms in the Environmental Protection and Pollution Control Act. The NEC's first job is to define the task, both in terms of establishing the regulations which will be enforced, but also the procedures which will be used for monitoring and implementation. The NEC is likely to need help, not only in establishing the regulations, but also in establishing systems and procedures which allow effective monitoring. This is true for all of the areas in which inspectorates are to be initiated: water quality, municipal waste, industrial pollution, toxic chemicals, hazardous waste and radioactivity, air pollution, forestry, wildlife and fisheries. Regulations and procedures are necessary in any particular area before enforcement can really begin. Preparing regulations and procedures will be an immense intellectual undertaking, in which the US has considerable experience. American technical assistance could make a significant contribution to this activity and help speed it along to a point where some action can be taken.

As mentioned earlier, a project to help develop the NEC as Zambia's environmental protection agency could be limited to a single area or cover the wide range of environmental issues which must be addressed. It could also be restricted to developing regulations and procedures or become involved in the wide range of implementation activities which will almost certainly develop.

4.5.5. Solid and hazardous-waste disposal

Hazardous and toxic waste from industrial and commercial pollution, are highlighted above as posing an acute threat to the groundwater aquifer of Lusaka. One aspect of this is to provide a means of safe and adequate disposal for waste material, as opposed to preventing fuel (hydrocarbons and other organic pollutants) from seeping into the ground from leaky underground tanks. As noted in the sections on agricultural chemicals (3.7.2, 3.9.7), Zambia has no means of safe and adequate disposal of simple solid waste, or the more dangerous hazardous and toxic wastes. Zambia needs a system of licensed and regulated disposal sites which are both located and managed to insure a minimum impact on people and the environment. These again are responsibilities of the NEC, but tasks which the NEC as a new institution has no present capacity to implement, and for which the NEC will need technical assistance and funding to develop appropriate activities. The technology should be as simple and robust as possible, because there is no guarantee that operational budgets will be adequate in the future. The US has the expertise and experience to provide a leadership role in developing and implementing improved solid waste disposal, and determining how safe and adequate hazardous and toxic wastes disposal can be provided.

4.5.6. Privatization of parastatal companies

One of the new government's major policy orientations is for the privatization of many of the parastatals which dominate the Zambian economy. Privatization is looked to as a part of structural adjustment which will generate private investment to revitalize the Zambian economy. There is a very important environmental factor which may have a significant impact on the privatization process, which has net yet been addressed. Many private, and particularly foreign, investors will be very concerned about the environmental liability facing companies available for privatization. The lack of any clearly stated government policy with regard to the environmental liability of investors for the companies which they might purchase, is likely to discourage many desirable (scrupulous) investors or significantly reduce the price which shrewd investors are willing to pay. Investors need a clear statement of what environmental standards companies will have to meet and what liability investors will have for the past environmental sins of the companies.

5. Institutions

In some respects, the recent history of environmental institutions in Zambia is more a case of process than of an organization per se. Following IUCN's release of the World Conservation Strategy in the early 1980s, President Kaunda invited IUCN to provide technical assistance to help Zambia prepare a National Conservation Strategy. The project was launched as a project of the Ministry of Lands and Natural Resources. The work, completed in 1984, was prepared by a thirty-person Technical Group, which represented the interests of various government, parastatal and private organizations. It was prepared under the guidance of a fifteen-person Task Force which also represented various sectors in

Zambia. The Task Force was chaired by the National Council for Scientific Research, which provided accommodation and technical facilities.

The National Conservation Strategy proposes that an Environmental Protection and Pollution Act be drafted and that this act should authorize the establishment of a National Environmental Council which would formulate regulations which would include statements of the responsibilities of the appropriate executing enforcing agencies. It took 5 years to develop and obtain legislative enactment of the Environmental Protection and Pollution Control Act (EPPCA) of 1990. It has taken 2 more years for the NEC to hold its first meeting. Now the hard task of formulating regulations can begin.

In the meantime: the government has changed for the first time after 27 years of continuity, the Ministry responsible is the newly created Ministry of Environment and Natural Resources (MENR), and the NEC has been created in the image of the Technical Group and Task Force which successfully completed the work which led to the National Conservation Strategy. This image is evident in the fact that the NCSR has been asked to chair the NEC, as well as in its structure consisting of 28 positions, 24 of which represent ministries and other institutions. The strength of the process since 1984 provides hope that the process will continue, regardless of the changes which have taken place in the institutions involved.

5.1. The new government

The people of Zambia inaugurated a new economic and political era when they went to the polls on October 31, 1991. By an overwhelming majority, they voted into power a party - the Movement for Multiparty Democracy - committed to an open political system in which human rights would be protected and to an open-market economy in which private initiative would be encouraged and rewarded. (GRZ, New Economic Recovery Program, 1992)

The new government has little tradition of governance, given that it is formed by an opposition party to a government which ruled for 27 years. One of the most basic changes which is occurring is the change from a state-dominated socialistic government to an open-market economy. An important institutional change is the elimination of party Wards, and their domination of local politics.

5.1.1. Government structure

Responsibility for the wide range of natural resource related activities carried out by the government have not been concentrated in a single department or ministry, even though there is a new Ministry of Environment and Natural Resources.

Responsibility for many other aspects of natural resource management is located in other ministries; these include: water, energy, mining, agriculture, livestock, fisheries, land-use planning, land tenure, wildlife, tourism, etc. Even a seemingly more restrained domain like land-use planning is shared among: The Ministry of Agriculture, Food and Fisheries; The Ministry of Lands; The Ministry of Planning and Development Cooperation; The Ministry of Housing and Local Government; The Ministry of Environment and Natural Resources; and The Commission of Town and Country Planning and the Resettlement Office in the Cabinet Offices.

In many cases, effective natural resource planning and management will require the collaboration of numerous ministries and groups. Sectoral planning within a given ministry often has resulted in national plans which ignore the fact that several projects or programs intend to use the same resource for different purposes.

Many project or programs in Zambia have advisory or management committees with representation from different institutions to help minimize these problems. While in many countries it would be almost impossible to accomplish a task which required working across ministries, in Zambia, working with several ministries at a time seems to be the normal state of affairs.[33] This is certainly one of the reasons why councils or commissions are a popular institutional setting for many programs. This system of councils, commissions or management committees may be a fairly clumsy institutional base for efficient day to day administration, it does seem to be a fairly effective way of organizing cross-sectoral activities.

5.1.2. Decentralization

In contrast to the strong centralization of power and authority characteristic of the former government, the new government would like to decentralize many government functions. Exactly what this will mean is often not clear, but for example, it is intended that people will be able to apply for land title at provincial land offices rather than having to go to a central ministerial office in Lusaka. There is also strong pressure on the 56 district councils to develop revenue sources which will support their budgetary requirements, rather than expecting financing from the central government. A very difficult transition is taking place with districts slashing employment, increasing rent in district owned housing by 300 to 1000 percent, increasing fees for water and other services, scrambling to find sources of revenue, and are still often unable to meet obligatory expenditures. The central government recently agreed to pay the retirement benefits of many of the employees who were terminated, but many of the districts still appear to be a long way from balancing budgets and achieving good fiscal management.

At the same time that this decentralization is taking place, the new MMD government is trying to eliminate the local ward structure established by the previous UNIP government. Many of the previous government's local efforts were channeled through the local ward officials of the party rather than through the district councils. For example, many of the squatters in shantytowns whose homes are in danger of being bulldozed by district councils, claim that ward chairmen gave them the plots on which they settled.

The reduction in employment and the increased cost of housing and other services will significantly decrease the standard of living for many families at the same time that they are being hammered by drought induced food cost increases. This poses a constraint both to the decentralization process and to the movement towards free-market prices on staple foods.

[33] At one point the ZATPID project had technical assistants working in something like 6 departments of 5 different ministries.

5.1.3. Bureaucratic climate

In real terms, the budgets of most government agencies have been falling for a number of years and are now taking another hit during the structural adjustment process. Bureaucracies which are required to operate with less funding and less staff than in recent history are often very unhappy institutions. This seems to be true in Zambia. Bureaucrats do not seem to accept that agencies will have to learn to function with fewer resources and must find new ways of operating. Instead, the immediate reaction from practically every bureaucrat in practically every agency is that they need more funding, more vehicles and more staff. All of the problems of almost any agency in question will be blamed on a lack of funding, vehicles and staff. There seems to be little tendency to focus on improving efficiency and enticing the private sector to undertake tasks which the agencies have previously performed. It may take some time before the government bureaucracy begins to look for new ways to accomplish old objectives with fewer resources.

5.2. Ministry of Environment and Natural Resources

The Ministry of Environment and Natural Resources (MENR) is a new ministry, created by the new government immediately after it was elected in October 1991. The Ministry is headed by a Minister, assisted by a Deputy Minister, both of whom are political appointees. The civil service staff of the Ministry is headed by a Permanent Secretary and Deputy Permanent Secretary.[34] The professional and technical expertise of the Ministry is located within the Forestry Department and the Natural Resources Department. Although the Ministry is new, these are established departments which have existed for some time in other ministries. In addition, the National Environmental Council is attached to the Ministry.

The MENR is the key ministry for forestry, some aspects of natural resource management, and environmental protection and pollution control. Responsibility for many other aspects of natural resource management are located in other ministries.

5.2.1 Forestry Department

The Forest Department is responsible for the conservation and management of Zambia's forest estate. The combined national and local gazetted forests cover about 74,000 km^2. Other protected forest areas include the 8.4 percent of Zambia devoted to national parks, but these areas are administrated by the National Parks and Wildlife Service Department in the Ministry of Tourism. The Forest Department also has jurisdiction to control and license tree cutting and collect stumpage fees in non-gazetted areas. The Forest Department has a Research Division which is responsible for forestry and forest product research, a Management Division responsible for forest inventories, a Forest Extension and Publicity Services Division produces seedlings primarily for use in commercial forestry, and a Beekeeping Division. Department personnel consists of 47 professional staff and 217 technical staff.

[34] This combination of Ministers who are political appointees and Permanent Secretaries who are civil servants is the typical ministry structure in Zambia.

The Forestry Department has the distinct disadvantage that its headquarters are in Ndola, which isolates it from many government and inter-agency activities. This location may have been advantageous when the departments's main activity was growing plantations of eucalyptus and pine on the Copperbelt, but at present there seems to be no reason for it to be there. ZAFFICO has been responsible for the plantations for many years and the Forest Department's activities are no longer heavily concentrated in that area. In fact it might be said that the Forest Department has never really found a new purpose, since the plantations were removed from its control. The Forest Department could be characterized as having been a paramilitary organization protecting the forest estate during the colonial era, and a plantation production organization during the post-independence era. Since losing the plantations, it has not yet found a new identity.

One symptom of problems within the department is a high rate of turnover. The department has requested funding to increase the size of the Mwekera Forestry College to generate more recruits to fill vacant positions. The real problem however, is that they can not retain the personnel they have. Part of this is rumored to be due to problems in department administration. Part of the personnel's negative attitude also seems to be due to this lack of an institutional purpose and identity.

The Forestry Department has never been much involved in managing natural forests except for protecting them from fire and humans. In recent years it has looked largely to exotic plantation species rather than the indigenous woodlands for the answer to Zambia's forestry needs. To complicate matters, the Forest Department is no longer effective at performing the tasks necessary to maintain the old identities. It is unable to effectively protect the 7 million ha of forest estate, not to mention the over 40 million ha of other woodlands, or to significantly increase the area devoted to plantation forestry.

Many of these problems are not of the Forest Department's making. The focus on plantations was encouraged by donor funding and the 1973 Revised Forest Act regulations do not promote forest management outside of the forest reserves. It also lacks provisions to encourage the sustained production of fuelwood, and discourages community forestry by claiming that all forest products belong to the state, and its agent the Forest Department.

The Forestry Department has also lost the means of enforcement.
Legislation has provided no significant disincentives for flouting Forest Department regulations. The fines or punishments which forest agents can impose on lawbreakers are insignificant and do not deter lawbreaking. Squatters can not be removed from forest reserves because they are protected and encouraged in their lawbreaking activity by local politicians. The "humanism" of the previous government protected many lawbreakers from the consequences of their actions. On the other hand, even the normal use and exploitation of the forest by a local community is illegal under the forest code. No protection and management of the woodlands can be expected of local communities when it is illegal for them to obtain any benefit from those efforts. The Forest Department can not enforce laws which are unacceptable to both members of the government and the society at large. Until the laws are changed, politicians stop supporting lawbreakers, and significant penalties are imposed to discourage lawbreaking, the Forest Department can not protect the nation's forests or even the forest estate.

The Forest Department will never have the staff and funding to manage the nation's woodlands, or even to manage sufficient plantations to provide Lusaka with charcoal and fuelwood, with department resources alone. The department estimates that it needs $1.5 to $2 *billion* over 5 years to effectively implement forest management programs. The Forest Department must find ways to facilitate and encourage forest production and the management of the woodlands by individuals and local communities. Until the forest code is changed and the Forest Department adopts a new and appropriate institutional purpose, it is unlikely to be an effective institution.

5.2.2. Natural Resources Department

The Natural Resources Department is responsible for conserving the natural environment outside of gazetted forests, national parks and fisheries. One major responsibility is improving fire protection for woodlands in traditional tenure areas. With little or no means to establish or promote fire lanes, the department concentrates on encouraging early burning as a feasible alternative. A second responsibility is the monitoring and rehabilitation of environmental degradation, in particular working with local communities to rehabilitate areas with serious gully erosion. A third task is the promotion of environmental education. The department works with agroforestry activities, particularly nursery and research programs.

The department is very small, and has only 6 professional staff and 38 technical staff. It has been heavily involved in Zambia's preparations for the Rio UNCED conference and the recent Natural Resources Expertise Profile. It is also involved in maintaining the Natural Resources Data Bank. Perhaps due to the relative isolation of senior Forestry Department staff at Ndola, the bright young staff of the Natural Resources Department seems to have become the "brain trust" of the ministry. Although at least as constrained as the Forestry Department in the execution of its assigned responsibilities, the Natural Resources Department seems to be more flexible in response to constraints; and has found a way to constructively channel its energies.

5.2.3. The National Environmental Council (NEC)

Most groups involved in environmental activities seem to agree that the NEC is now the key institution with regard to natural resource and environmental activity. As an institution, the NEC is a not yet fully functional, quasi-independent commission in a newly created ministry; in a new, democratically elected government which is only beginning to define and implement its program.

The government has been criticized for dragging its feet with regard to establishing the NEC, but the 9 months between the time the new government was elected and the first meeting of the NEC seems like a very reasonable bureaucratic time frame. Allowances might also be made for the fact that the GRZ is preoccupied with the acute problem of drought, and avoiding starvation. In fact in one sense the MENR rushed into creating the NEC by appointing a Director and staff members before the NEC itself had ever met. The first meeting of the NEC on July 27, 1992 was devoted primarily to ratifying the administrative arrangements which the MENR had already made. While this may have facilitated speeding up the establishment of the NEC, it also causes one to question how much independence it will have from the Ministry. A strong argument was made in the recommendations to set up the NEC that it should not be dominated by any one organization. The EPPCA provides the

NEC with the potential to be financially independent of the MENR. Most administrative aspects of the NEC's work require approval of the Minister.

The proposed NEC structure consists of a permanent Secretariat, headed by a Director who is the chief executive officer of the NEC, and carries out tasks assigned by the NEC. The Director will be supported by a deputy director and a very limited secretarial staff. The Secretariat will be supported by a Coordinating Unit to help coordinate donor funding and communications with organizations which work with the Council. A legal services office is also recommended.

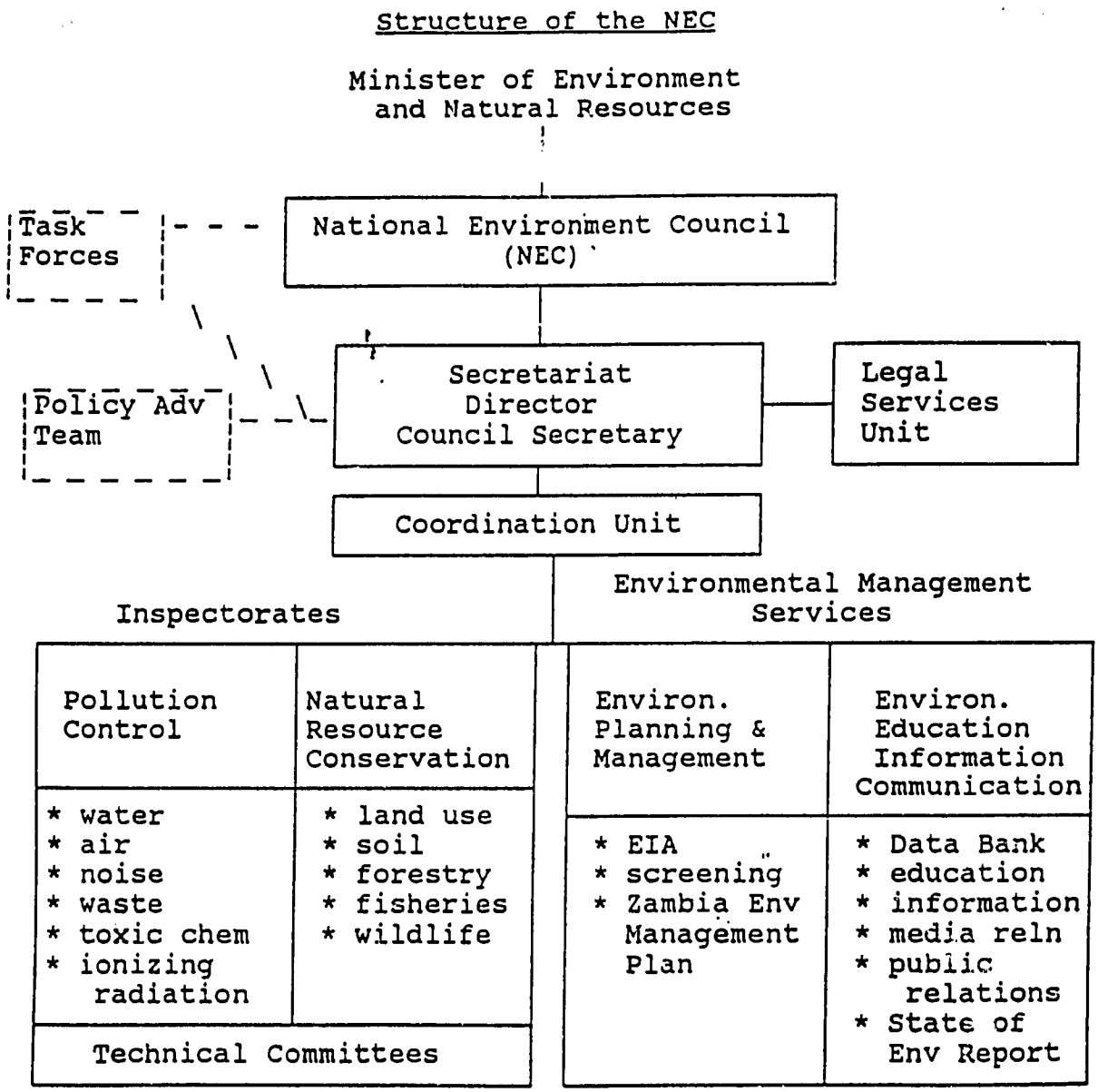
Under the secretariat will be 2 inspectorates, the Inspectorate of Pollution Control and the Inspectorate of Natural Resource Conservation. The Pollution Control Inspectorate will have responsibility for water, air noise waste, toxic chemicals and ionizing radiation. The Natural Resource Conservation Inspectorate will be responsible for land use, soil, forestry, fisheries and wildlife.

At the same level as the Inspectorates there will be the Environmental Management Services composed of the Environmental Planning and Management Unit and the Environmental Education, Information and Communications Unit. The Environmental Planning and Management Unit will be responsible for providing environmental impact assessments and policy and planning assistance, including the development of a long-term environmental management plan for Zambia. The Environmental Education, Information and Communication Unit will develop environmental education programs and be responsible for public relations.

How the NEC will interpret its role and responsibilities is not clear. One of the few clues to this role was a statement by the Minister of Environment and Natural Resources in his opening remarks for the World Bank Workshop on Natural Resource Use and Conservation in Zambia. In this statement the Minister talked about pollution of different types, strengthening the MENR, and strengthening the NEC to "make it the biting teeth of the Ministry". Only time will tell what role the NEC will play, but this focus on pollution control to the exclusion of environmental planning was disturbing, as was the very strong emphasis on enforcement. The MENR's other enforcement activities as exemplified by those of the Forest Service are so blatantly unsuccessful and ineffective that many of the forest reserves which they protect have been partially or totally deforested. Until the advent of ADMADE, the same was true of efforts to enforce anti-poaching ordinances by the Wildlife Department. There seems to be a lesson here that natural resources in Zambia can only be protected when local communities are involved and want those natural resources to be protected. The Minister's strong focus on enforcement "stick" without any mention of what the "carrot" might be, seems to ignore this lesson. If the stick only affected corporations and district councils this might be OK. But sooner or later it will affect communities and individuals through loss of jobs and higher costs of services, etc. Then the exercise will need strong public support to work through the problems. A more balanced approach with an emphasis on positive aspects of natural resource planning and conservation including improved planning, increased efficiency, collaboration and cooperation would seem to have a better chance of gaining public support.

As of July 1992, the NEC had established a water monitoring unit, a combined air and noise unit and separate solid waste and hazardous waste units. Activities focused on producing regulations and collecting baseline data. NEC personnel had not yet received any legal capacity to prosecute

NEC organizational diagram



Source: IUCN/GRZ, 1992, p. 15.

offenders and had no transportation to get out of Lusaka. An example of the type of problem facing the NEC is that although a primary activity of one of the four main NEC units is to provide environmental impact assessments (EIAs), the regulations requiring EIAs have not yet been enacted.

The NEC is expecting some funding and several technical assistants from CIDA. The funding will primarily be used for computers, vehicles and some field equipment. The NEC will make use of laboratories at UNZA, NCSR and the Department of Agriculture. The CIDA TA were originally slotted to be overall advisors to the Director. Recognizing that the NEC will need more TA than CIDA will provide, the job descriptions have been changed so that TA from other donors will not have to work under the supervision of the Canadians.

5.3. Local institutions

In Zambia, there is no obvious local institution at present, which will automatically be effective and efficient as an institutional base for development efforts. But institutions are in transition and democracy is in the air. If the process of participatory democracy continues, the process may prove more important than the institutions in question. If participatory democracy finds a local expression, whatever that institution may be, it will probably provide an effective base for development efforts.

The traditional structure of chiefs and village headmen has had its authority considerably diminished by both the colonial and post-independence government. Beyond this it is hard to generalize. Some chiefs have retained more of their power than others. It would appear that some chiefs who remained relatively influential under the old government became party regulars who accumulated traditional and political authority. It is not clear what will be the relationship between the MMD government and traditional leaders. From its public pronouncements, it would appear that the MMD government is trying to get traditional chiefs to leave politics, and believes that providing them with a monthly support stipend will help facilitate this departure. Since most chiefs involved in politics were in the UNIP party, it is not clear whether this is a long-term policy, or simply an expedient temporary strategy. It also is not clear whether giving them a monthly stipend frees them of the need to seek a (paid) party position, or makes them dependent on the government (or party) handouts. Dependence on the government seems to portend less authority in the future for the chiefs. In this government transition it must be difficult for chiefs to decipher what strategy or what role would help them maintain their authority.

Cooperatives also suffered as institutions under the old government. Attempts to control and manipulate the cooperatives for political gain destroyed the legitimacy which they might otherwise have obtained. Poor fiscal management and a lack of accountability and transparency have also reportedly left many of the cooperatives near financial ruin. There appear to be some grassroots efforts to reestablish some of the coops as legitimate local institutions. It is too early to tell if these efforts will be successful or whether the image of cooperatives is so tarnished by recent experience that people will prefer to search for a different institutional framework.

The ward became an important local institution under the old government and party ward chairmen wielded much authority, But since this was a party institution and the party has been voted out of office, the new party seems intent on eliminating the ward structure. Local politicians will probably continue to exercise a considerable degree of influence. It is not clear if this influence will be

expressed by participation in the district councils, or whether some other institution will replace the ward structure.

As part of the process of decentralization, district councils are supposed to become elective bodies which will represent local constituencies. In the past, district council officials have been primarily government officials and unofficial local leaders who were asked to serve or appointed. It is reported that local chiefs or their representatives serve on many of the councils for rural districts. If officials to the district council are elected, it should become a much stronger more dynamic local institution than it has been in the past. Whether politicians, local chiefs or other community leaders would be elected to represent people is unclear. But perhaps the essential fact would be that people are allowed to participate, at least to the extent of electing the officials who make local decisions. This element of participation is probably more important than the name or structure of the institution in question. If people are empowered to participate in decisions which affect their lives and livelihood, and if the basic tenants of democracy can be maintained, i.e. transparency, responsibility and accountability, then the institution should provide a very successful base for development efforts.

The new government has indicated that it will no longer provide the revenue to pay the salaries of district council staff or provide many service at the local level. This has created a crisis for many district councils, causing services to be reduced and staff to be laid off. Imposing fees for access to and the use of some natural resources may potentially provide some of the revenue needed. District councils have a better chance of collecting stumpage fees and other forestry related fees than does the forest service. Changing the law to allow the district council or some other local institution to collect these fees might help provide this revenue as well as improve the management and protection of forest resources.

Perhaps the existing institutions which seems to foster the greatest degree of participation are the sub-authorities which have been established in the GMA's taking part in the ADMADE program. The sub-authorities were established as the decision-making bodies for the community development projects funded by a percentage of the revenues generated from wildlife activities. The sub-authorities include both representatives of the local district council and representatives of the local village chiefs. While not a democratic institution per se, the sub-authorities provide representation for both modern and traditional views and are closer to the rural people involved in the project than are most other institutions, or the district capital. If participatory democracy does evolve at the local level, the level of the sub-authority might provide an even more appropriate base for development efforts and other rural activities than the district councils.