Table 1:   Extent of Ecosystems in Zambia

Biome	Ecosystem	Approximate extent	
		Square kilometres	Percentage
Forest	Dry evergreen	15835	2.10
	Deciduous	6735	0.90
	Thicket	1900	0.25
	Montane	40	0.01
	Swamp	1530	0.20
	Riparian	810	0.11
Woodland	Chipya	15560	2.07
	Miombo	294480	39.13
	Kalahari sand	84260	11.20
	Mopane	37010	4.92
	Munga	30595	4.06
	Termitaria	24260	3.22
Grassland	Dambo	75760	10.07
	Floodplain/swamp	129075	17.15
Aquatic	Lakes and rivers (15)	10500	1.40
Anthropic	Cropland and fallow, Forest plantations and built-up areas	24210	3.21
	Total	**752578**	

Source: MENR, 1998a.

Distribution of Ecosytems in Zambia

MAP .3

N
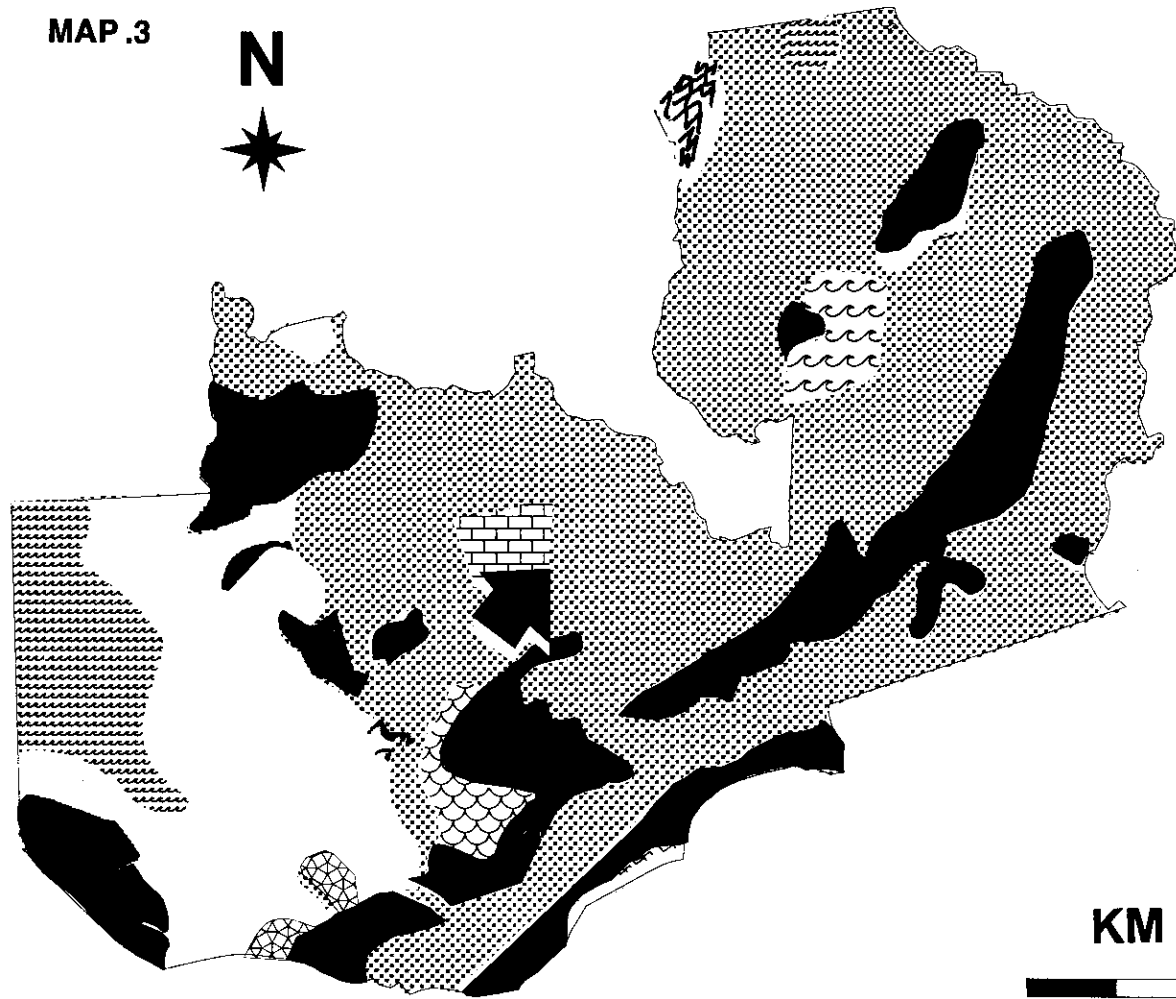
LEGEND

- ⚮ Aquatic
- ■ Chipya Woodland
- ✳ Dry Decidous Forest
- ■ Evergreen Forest
- Floodplain Grassland
- Kalahari Woodland
- ■ Kalahari Evergreen Forest
- □ Kalahari Termitary vegetation
- ▦ Miombo Woodland
- ■ Miombo Termitary Vegetation
- □ Miombo Wetland Vegetation
- ■ Mopane/Chipya/Termitary Woodland
- ■ Muunga Woodland
- ■ Muunga/Termitary Vegetation
- ▦ Termitary vegetation
- ▦ Wetland Grassland
- ■ Termitary/Wet grassland
- — International Boundary

KM

Based on Edmonds, 1976

AGRO ECOLOGICAL REGIONS OF ZAMBIA

N

IIa

IIa

IIb
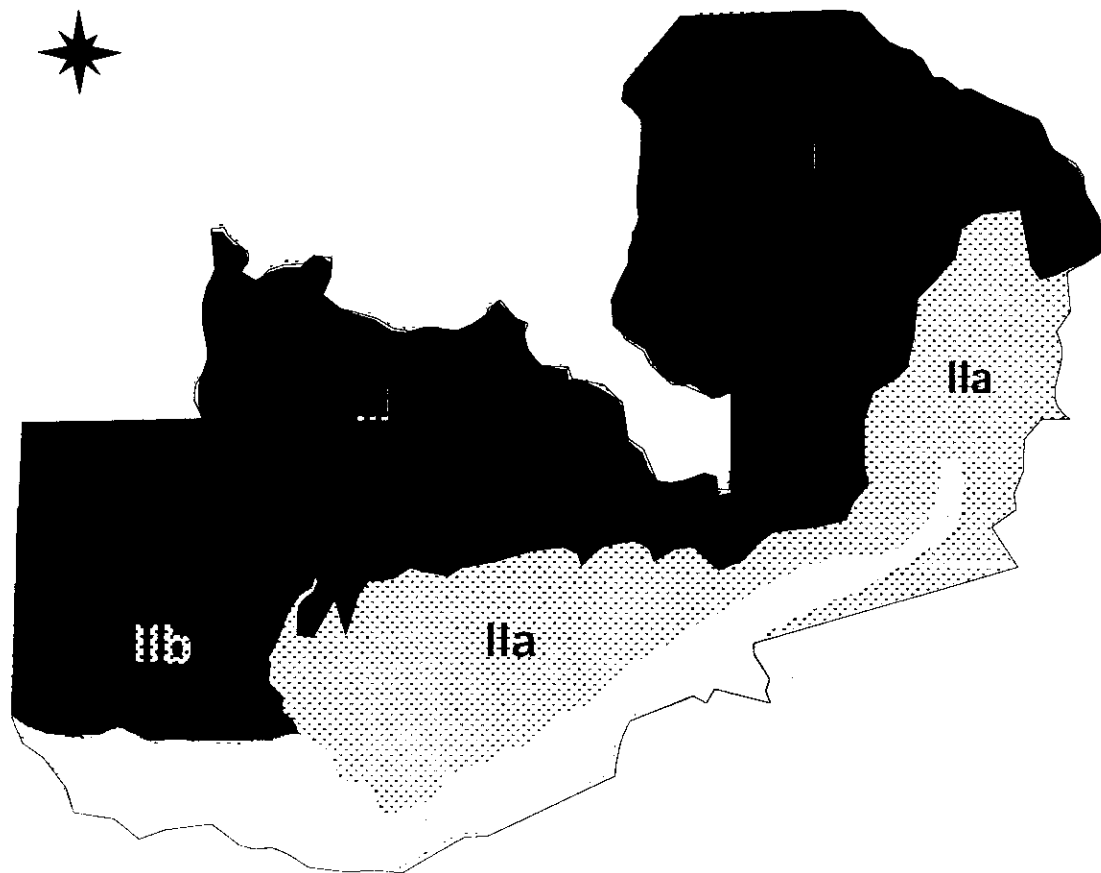
LEGEND

Region I
ILuangwa Zambia Rift valley

Region IIa
Central, Southern and Eastern Plateaus

Region IIb
Western Semi-arid plains

Region III Northern
High Rainfall zone

Km

MAP .4

Source: NEAP (1994)

1.19   Other factors which have played a significant role in altering the structure and functioning, and therefore the evolution of these ecosystems, are human or anthropic factors such as human settlements, clearing for cultivation, fire, wood harvesting for timber and energy and grazing and browsing. However, the current status and extent of these ecosystems is poorly known due to the fact that surveys have been irregular with the last one having been undertaken in the 1970s (Edmonds 1976; Schultz 1974).

1.20   The present distribution of ecosystems in the country is a consequence of the prevailing rainfall pattern and may change in response to climatic changes. Accordingly, a correlation analysis undertaken during the stock taking exercise shows that the most important determinant of ecosystem diversity in Zambia is latitude (MENR, 1998a).

1.21   **Species diversity.** The country study listed a total of 8017 species of organisms that occur in Zambia (ibid, 1998b). Microorganisms constitute 8 percent, plants 47 percent and fauna 45 percent of this biodiversity. There are a total of 316 endemic, 174 rare and 31 endangered/vulnerable species of plants and animals. These figures may be under-estimations because knowledge about most species is incomplete.

Table 2: Ranking of species diversity (species/degree square) by ecosystem type in Zambia

Ecosystem	Ferns	Seed plants		Inverte brates	Amphi bians	Rep tiles	Birds	Mam mals
		Endemic	Total					
Forests:								
dry evergreen	nd	10	5	6	8	6	1	8
deciduous	2	12	7	nd	nd	nd	nd	9
thicket	nd	5	nd	nd	nd	nd	nd	nd
montane	6	1	7	nd	nd	nd	nd	nd
swamp	nd	9	8	nd	nd	nd	nd	3
riparian	nd	6	2	nd	nd	nd	nd	nd
Woodlands:								
chipya	nd	4	nd	nd	nd	nd	nd	nd
miombo	1	2	4	3	6	5	2	7
kalahari	7	7	6	5	5	4	4	6
mopane	4	11	8	2	3	3	3	4
munga	2	3	6	1	1	2	7	1
termitary	nd	8	3	nd	2	8	5	5
Grassland	7	nd	1	nd	4	1	6	2
Aquatic	3	nd	nd	4	7	7	9	10
Other	nd	nd	nd	nd	nd	nd	nd	nd

nd = no data
Note: Diversity is ranked in descending order with 1 representing highest diversity.

1.22   Ecosystems with the highest biodiversity are munga and miombo woodlands and grasslands (Table 2). Montane forest, although of limited extent (Table 1), has the highest number of endemic woody plants. The diversity of ferns and orchids is correlated to ecosystem diversity while the diversity of some invertebrates (arachnids and butterflies) and ferns shows a

south-north increase while that of other invertebrates (hemiptera and hymenoptera) shows the opposite trend. These diversity gradients are related to rainfall/moisture gradient.

1.23   The following are the details of diversity of various species;

(i)   *Micro-organisms.* The study revealed that there are approximately 598 species of micro-organisms that have been identified in Zambia. The broad categories of micro-organisms include bacteria (12 species) fungi (446 species), protozoa (4 species) and viruses (35 species). Generally the spatial distribution of micro-organisms tends to be affected by rainfall with higher rainfall areas having higher abundance of micro-organisms.

(ii)   *Invertebrates.* About 2032 species of invertebrates have been identified in Zambia. The insect group is the most diverse followed by snails and roundworms. Some groups of invertebrates are relatively well known. These include groups of economically important insects such as biting flies, the grasshoppers, locusts and ticks. There are an estimated 127 grasshoppers of which 27 species are endemic to Zambia.

(iii)   *Botanical and forest reserves.* The study inventorised a total of 3,774 species of both lower and higher plants. The lower plants comprise 147 Algae, 129 Mosses, and 142 Ferns. Higher plants on the other hand comprise 530 grasses, 1610 wood plants and about 1216 of other herbs and crop species.

        A total of 3,356 seed plants were listed during the study. Grasslands have the highest diversity of seed plant species followed by riparian and termitary ecosystems. Miombo woodland is the centre of diversity of the genera Brachystegia and the Monotes which are represented by 18 and 11 species respectively.

        The diversity of orchids in Zambia is estimated at 397 species. Diversity by dominant ecosystems indicate that the highest orchid diversity is in the miombo woodland followed by mopane and munga woodlands. Sixteen species of orchids are said to be endemic to Zambia

        Woodland ecosystems have been greatly influenced by cultivation while fire has greatly influenced the structure of forest ecosystems.

(iv)   *Fish.* Zambia has abundant water resources in form of natural and artificial lakes, rivers, flood plains and swamps. These water bodies are home to about 409 species of fish. Lake Tanganyika has the highest diversity with 62 percent of the 409 total fish fauna in the country while Mweru-Wantipa has the lowest fish biodiversity (Figure 1). Lake Tanganyika is a distinct fishery with the least similarity with the other fisheries. The highest similarity is between Bangweulu and Mweru-Luapula at 72 percent probably as a result of sharing the same drainage basin. Upper Zambezi and Kafue also have a high similarity at 67 percent though belonging to different basins. Kariba and

Middle Zambezi are separated from Upper Zambezi by the Victoria Falls which is a major barrier to fish migration and this is probably responsible for the low similarity which is at 34 percent.

Figure 1- Fish biodiversity and endemism in Zambia.
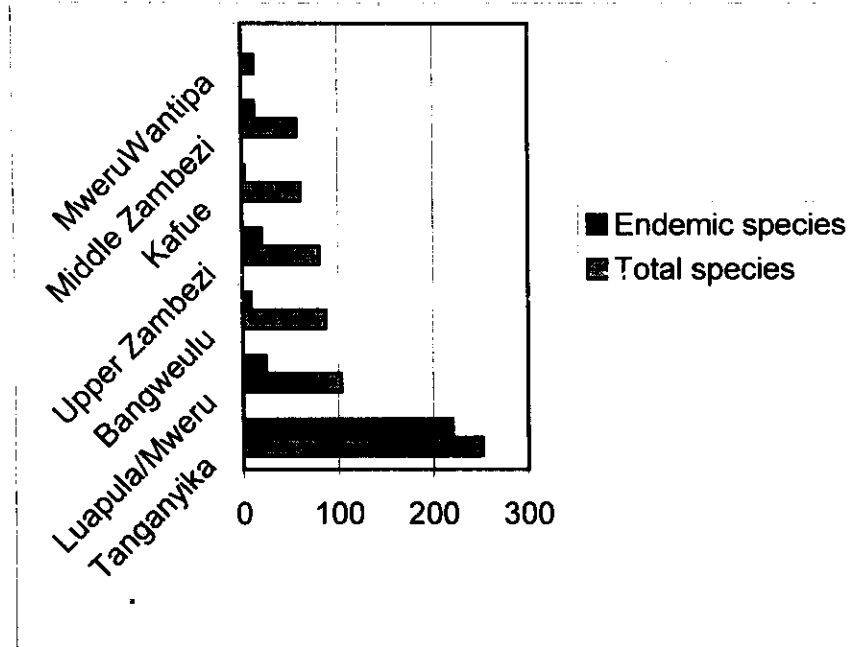
Fish species that are confined to one fishery are estimated at 289 and 76 percent of these belong to Lake Tanganyika which further confirms the uniqueness of this fishery. The other fisheries with a reasonable degree of endemism are Mweru-Luapuala (24 species); Upper Zambezi (20 species) and Kariba/Middle Zambezi (13 species). In Mweru-Wantipa endemism is zero whereas Lake Bangweulu has 9 species.

(v)   **Birds.** The total bird fauna in Zambia is estimated at 733 species. Seventy-six (76) of these are rare, occurring infrequently while 100 are endemic. There is no established relationship between bird species diversity and ecosystem diversity. The existence of a large expanse of wildlife reserves has, however, benefited important bird species through habitat protection.   In addition to the National Parks and Game Management Areas (GMAs), the country has established two national bird sanctuaries while private aviaries have been established in many parts of the country.   Although bird habitats appear to be well protected, there is a general lack of data and information on birds found in the country, in particular migratory species.

(vi)   **Mammals.**   Mammalian diversity in Zambia is estimated at 224.   There is only a slight correlation between ecosystem diversity and mammal species diversity (r-square = 0.58); with the highest diversity occurring in munga woodland and dambo grassland and lower diversity in dry deciduous forest.

Much of the wildlife in Zambia is found in 19 National Parks and 34 GMAs. The location of the National Parks and GMAs are shown in Map 5. Twenty-eight (28) animal species and sub species in Zambia are considered as either endangered or vulnerable according to World Conservation Monitoring Centre (WCMC), 1993.

(vii)   *Agricultural Biodiversity.* Agro-biodiversity is defined in accordance with the CBD and refers to the variability among living organisms associated with cultivated crops and domesticated animals and the ecological complexes of which they are part. Agro-biodiversity was assessed within the context of the major agro-ecological regions and farming systems.

About 100 cultivated plant species have been identified in Zambia. Of these 15 percent are classified as indigenous while 7 percent are naturalised having been under cultivation over a long period of time and thus evolved some useful adaptation. For the purpose of this report indigenous crops are those which have been domesticated in Africa and may have wild relatives occurring in Zambia. Naturalised crops on the other hand are those which were introduced relatively early and have evolved useful genetic diversity and have been incorporated into the traditional cropping systems while exotic crops are recent introductions which have not been incorporated into the traditional cropping systems and have not evolved substantial local genetic variation.

There are also wild plant species that are related to cultivated crops and these include wild relatives of rice (about 5 species), Cowpea, Sorghum, Sesame and various cucurbit species.

Crops with the most significant genetic diversity include cowpea *(Vigna unguiculata),* sorghum *(Sorghum bicolor),* bambara groundnuts *(Vigna subterranea),* beans *(Phaseolus vulgaris)* and maize *(Zea mays).* Crop genetic diversity is generally higher under traditional farming systems than under commercial farming.

The total diversity of domesticated animals is estimated at 16 species. These comprise of 10 and 6 species of animals and birds respectively. The majority of domesticated animals are cattle while chickens dominate the birds.

The main crops grown for food include, maize, sorghum, cassava, sweet potatoes and ground nuts.

ZAMBIA'S WILDLIFE ESTATE: NATIONAL PARKS AND MANAGEMENT AREAS

MAP .5

N

Tondwe GMA

Mweru Wantipa NP

Sumbu NP

Nyika NP

Lusenga Plain NP

Kaputa GMA

Luwingu GMA

Fulaza GMA

Chambeshi GMA

Bangweulu GMA

Isangano NP

Kalasa Mukoso GMA

Kwa Chifunda GMA

Musele-Matembo GMA

Mansa GMA

Lavushi Manda NP

North Lu

Lumimba GMA

Chibwika-Ntambu GMA

Luambe NP

West Lunga NP

Kafinda GMA

Machiya-Fungulwe GMA

Kasanka NP

South Luan

Chizera GMA

Lunga-Luswishi GMA

Lukusuzi NP

Munyamadzi GMA

Chisomo GMA

Liuwa Pla

Luano GMA

Lupande GMA

Kafue NP

Sandwe GMA

Mumbwa GMA

Blue Lagoon

West Petauke GMA

amwala GMA

Chiawa GMA

Rufunsa GMA

Lochiny

obezi GMA

Lower Zambezi NP

Kafue Flats GMA

Springs GMA

Sioma-Ng

Sichifulo GMA

Lake Kariba

Mosi-oa-Tunya NP

LEGEND

Lakes

National Parks

GMA'S

———— Boundary

Km

Source NPWS 1991

C.   Biodiversity and Development

1.24   The need to conserve biodiversity in Zambia derives its importance from the fact that the economic and livelihood activities of the general population (rural and urban) depends on natural resource utilisation. Directly, the sectors of agriculture and fisheries, forestry, wildlife and tourism are biodiversity dependent. Indirectly, other sectors including mining, manufacturing, transport, trading and financial services depend on biodiversity either for inputs or markets. However, the activities of the latter can impact negatively on boidiversity by changing the quality of the environment.

1.25   Thus farming supports 600,000 households or more than 1/3 of the total population. Formal and informal sector activities such as timber and wood processing, charcoal burning and trading employ more than half a million people. Although no employment figures are available for sectors such as tourism and fisheries and supporting sectors such as transport and resource based manufacturing, they must be equally large. In terms of contribution to GDP, agriculture, fisheries and forestry contribute about 18 percent of the total. Manufacturing from products of biodiversity (food, beverage and tobacco) contributes another 9 percent (GRZ, 1997). However, these figures are greatly underestimated because national accounts figures are institutional based, and therefore do not capture activities of small-scale producers who are the majority. Besides, figures from the forestry sector are not known precisely due to poor records emanating from the sector. Consequently, the figure appearing in statistics has remained the same for a long period.

1.26   Nevertheless, the importance of resource-based sectors to the general welfare of the economy goes beyond the monetary and employment figures referred to above. To these figures shoul be added such non- monetary benefits as raw materials for shelter construction (poles and thatch), hand crafts and tools (mortals, cooking sticks, baskets, mats etc.) medicines, food stuffs and many others which do not enter any statistics but are important to the livelihood of the population.

1.27   The intensity of the use of biodiversity in Zambia is to a very large extent related to the general macro economic and development policies of the government. Between 1964-1974 when the economy witnessed an economic boom fuelled by high copper production and earnings, all the sectors of the economy reflected this aspect. Thus, there was high growth in construction activity, employment levels, agriculture, trading, and manufacturing. In line with these developments, there was a boom in infrastructure development. Roads and railways, power stations and power lines, schools and hospitals were built. The impact on biodiversity of these high economic activities was the reduction in biodiversity as large trucks of land had to be cleared. Due to the abundance of financial resources and in line with socialist policies, the government provided free social services, subsidised agriculture production and urban consumption. As a result of the former policy, intensive agriculture was widely practised and traditional systems such as chitemene and fundikila among others declined. This led to improvements in the general living standards.

1.28   Economic decline set in 1976 following the collapse in both copper production and prices. The boom of the last decade burst. At first it was believed that the crisis was temporary and so the government resorted to international borrowing in order to maintain

the level of economic activity while waiting for the positive changes in the economy. However, by 1985 it was clear that the change was not temporal but permanent. In line with this realisation, the government started structural adjustment measures whose components were fiscal and monetary restraint and foreign exchange adjustment. These translated into reduction in budgetary expenditures, especially for capital projects, subsidy reduction, exchange rate liberalisation etc. But these measures proved too little too late.

1.29   The impacts of the economic changes on biodiversity were many. The impacts of these macro-economic policy changes on biodiversity were both positive and negative. For instance on the one hand was there was less clearing of forests for infrastructure development but on the other hand the need to expand areas for cultivation increased. The desire to produce more agriculture output without chemical fertilisers meant that larger areas had to be cultivated. The net effect of these and other such processes is not known due to absence of data.

1.30   The macro economic adjustment changes that began in the 1980's were broadened and intensified in the 1990's. In addition, the egalitarian policies of the past were abandoned and the government adopted a capitalist system. This has resulted in the sale of all state owned enterprises, total liberalisation of the foreign exchange and domestic money markets, public sector reforms, upward adjustment of service charges and the introduction of fees for social services. As micro enterprises adjusted to the changed macro economic situation, the combination of the above policies has resulted in job losses, near collapse of the producing sectors and increased poverty in the country.

1.31   The impact of the current policies on biodiversity has been overwhelming. Whereas people in the past sought for employment in the non-biodiversity sectors, for example, the mines, industry, and the various wings of government, this is no longer the case. In a country without adequate social security, people have resorted to informal activities for subsistence. The exploitation of natural resources has been the most attractive option as the initial capital investment is low with minimal restrictions. This is leading to over exploitation and declining production efficiency.

1.32   The need to conserve biodiversity in Zambia is therefore imperative for the reason that unless degradation and over exploitation are controlled, the livelihood of a large section of the population will decline further due to falling productivity of biodiversity.

CHAPTER 2 - BIODIVERSITY CONSERVATION AND MANAGEMENT IN ZAMBIA

A.   Values and uses of biodiversity

2.1 Biodiversity plays critical roles in the healthy functioning of ecosystems. These roles include nutrient and water cycling, land protection from erosion, climate stabilization through carbon sequestration and the production of crops through pollination. Forests are an important sink for carbon dioxide. In Southern Africa, Zambia has one of the highest pool of carbon in its forests/woodlands (Figure 2) but annual forest loss is poorly known. Plants also provide habitats for animals while animals play a crucial role in regeneration of plants through seed dispersal and germination.

Figure 2: Value of forests as carbon sinks in Southern African countries
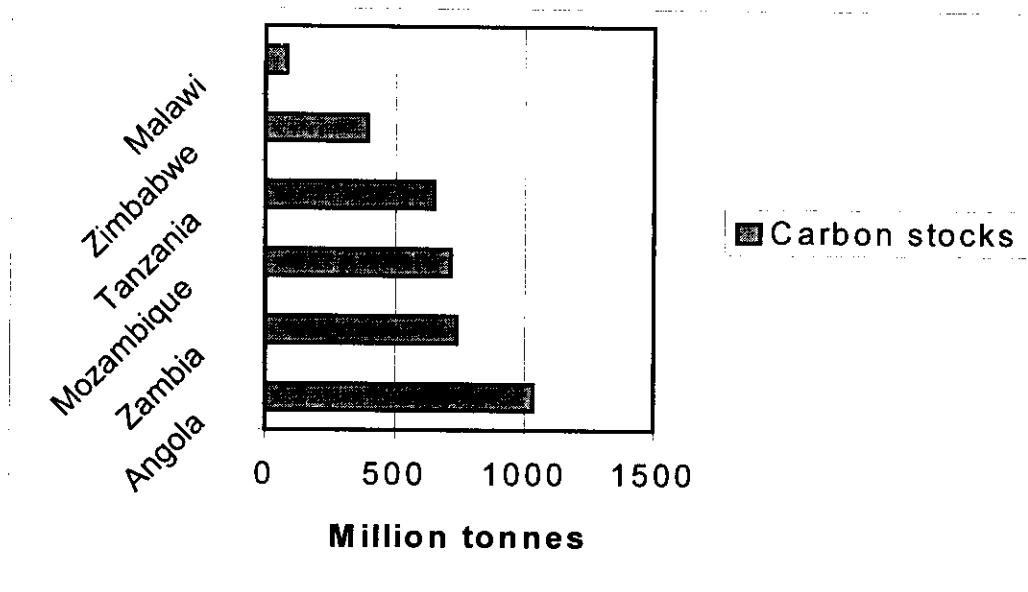
Source: WCMC (1993)

2.2   Biological resources support livelihoods of the majority of the rural population in Zambia. Forests provide ash fertiliser for shifting cultivation, timber, energy, household tools and construction materials. Wild plants and animals are important sources of food, especially during famine. Medicines and other valuable chemical products are obtained from both plants and animals.

2.3   The total contribution of biodiversity to national economy in Zambia is not known because the value of most activities based on the use of biodiversity is not reflected in national accounts. Nevertheless, the contribution of agriculture, forestry and fishing to GDP was 17.2 percent in 1996 and 16 percent in 1997. A sector-based analysis shows that biodiversity utilisation plays a significant role in the national economy. For example, the charcoal industry

employs about 450,000 people in production, distribution and marketing. In 1993 revenue from wildlife-based tourism was estimated at US$52 million which represented about 5.4 percent of Zambia's export earnings. These figures represent a narrow window through which the value of biodiversity resources to national economy is currently perceived.

B.   Sharing of Benefits from Biodiversity Use

2.4   Over the years, the change of property rights regimes from one form to another has affected the way in which benefits accruing from biodiversity use has been distributed. Property rights have generally moved from communal in the pre-colonial period, to state and private ownership in the colonial and post-independence era. The replacement of communal ownership of biological and other resources. by state and private ownership, which saw the government encroaching into customary land to develop forests, wildlife and water resources was based on the premise that the government could share the benefits more appropriately.

2.5   Thus, the state could expropriate surpluses by taxing resource users, and redistributing benefits to the populace (and especially to the cities). This kind of arrangement meant that the control by local communities over common properties had no room. However, no compensation was made to the communities for loss of subsistence and livelihood that used to come from the areas declared as National Parks and Forest Reserves.

2.6   The advancement of technology world over also contributed to the rampant inequity in the sharing of benefits arising from use of biodiversity. The powerful social segments, more especially those from urban areas, have access to natural resources from wide catchment, suffering few of the negative consequences of environmental degradation and erosion of biodiversity. Instead the ones who suffer the negative consequences are the communities who leave in the areas affected. For instance, game licences are mostly bought by the rich in urban areas. These go to slaughter animals in the face of helpless villagers who suffer the consequences of crop damage by the animals with no compensation. This inequitable sharing of benefits from the use of biological resources tends to promote opportunistic over-exploitation of resources by local communities. Under the Administrative Management Design for Wildlife Management (ADMADE) programme in the wildlife se tor the sharing of revenue from the use of wild animals with local communities was neither well understood nor transparent enough to the local communities. The ADMADE institutions were seen to be creations of government for managing natural resources on behalf of the local people. This perception by the local people reduced the sense of ownership of the programme by the majority of the local communities.

2.7   The ADMADE concept of sharing of benefits is now spreading through Community Based Natural Resources Management (CBNRM) programmes for other sectors such as forestry and fisheries.

C.   Biodiversity Management in Zambia

Management Regimes

2.8   **Protected areas and in-situ conservation.** The protected area system in Zambia consists of National Parks, bird sanctuaries, GMAs, game ranches, forest and botanical reserves and national heritage sites.

2.9   National Parks were established by government primarily for the conservation of biodiversity. There are 19 national parks in Zambia and these cover a total area of 6.358 million ha. Sustainable use of wildlife and its habitats in national parks is promoted through eco-tourism while settlements and hunting are prohibited.

2.10   Bird sanctuaries have the same status as National Parks but are usually smaller in size. There are two bird sanctuaries in the country.

2.11   Game management areas were established by government to control the hunting of game and protected animals through a licensing and monitoring system. There are 34 GMAs in Zambia which cover a total of 16.57 million ha. Because other forms of land use, such as settlements and agriculture are allowed, GMAs are not strictly protected areas.

2.12   Game ranches support both consumptive and non-consumptive uses of wildlife. There are 28 game ranches in Zambia that have been established by the private sector. Because of the substantial economic benefits derived from game ranching, a number of commercial farmers have opted for game ranching. Game ranching has therefore significantly contributed to biodiversity conservation, especially of rare and endangered animal species. Currently 26 species, mainly of the ungulate group, are conserved in game ranches.

2.13   Forest Reserves were established by government to conserve forest resources for sustainable use by local people in the case of local forests and to protect major catchment areas and biodiversity in the case of national forests. There are 432 Forest Reserves in Zambia which cover a total of 7.4 million ha. Settlements and cultivation are normally not permitted in Forest Reserves while removal of any plant is only permissible under license.

2.14   Botanical reserves were established by government for three objectives, namely; (i) to preserve some relic vegetation types and/or plant species; (ii) to act as sources of germplasm for multiplication and breeding programmes; and, (iii) to act as reference sites in determining human impacts on forest ecosystems outside the reserve. There are 59 botanical reserves in Zambia which cover a total area of 148,000 ha.

2.15   **Ex-situ Conservation.** The approach to ex-situ biodiversity conservation in Zambia has involved the establishment of botanical gardens, herbaria and gene banks. Munda Wanga botanical garden near Lusaka maintains a collection of both indigenous and exotic plants but the condition of the gardens has been poor due to lack of maintenance. There are a number of herbaria in the country but the larger ones include the Forest Department

herbarium in Kitwe, Mt Makulu herbarium and the University of Zambia herbarium in Lusaka. The national plant genetic resources centre at Mt Makulu was established to promote the conservation of plant genetic resources at the national level. The centre has 4570 seed samples collected from different parts of the country. Until now priority has been given to major food crops.

2.16 **Indigenous Conservation Practices.** Given a diversity of traditional systems among the seventy-three tribes in Zambia, various indigenous methods of conservation of biological and other resources exist. Traditionally, customary laws enabled people to develop management systems that acted as controls in the exploitation of natural resources. For instance, almost all the tribes in Zambia believed in the preservation of vegetation around traditional burial grounds as a way of respecting the dead. In this way, some piece of land was left almost undisturbed and were centres of great diversity in terms of biological resources. Similarly, seasonal bans in exploitation of resources especially fish, birds and animals were imposed in almost all the cultures, based on the understanding of the life cycles. Thus, allowing time for the breeding to take place in order to sustain the productivity of these resources.

2.17 The beneficial traditional conservation and wise use practices were accompanied and enforced by traditional institutions and political systems. The most important being the institution of chiefs, village headmen and heads of family households. The chiefs in collaboration with the village headmen played an instrumental role in administering some of the beneficial traditional conservation practices. At the household level, it was the duty of heads of households to conscientise young members of their families in the observance of these practices.

2.18 However, it should be noted that the colonial intervention which alienated communities from their resource base not only contributed to the destruction of most of these environmentally beneficial practices but also introduced deleterious practices to the environment. The expropriation of natural resources removed the need to continue with conservation practices. In some instances a 'scorched earth policy' was adopted in defiance to official regulation. Similarly, the colonial policy of confining local communities to much reduced tribal reserve lands contributed to serious environmental degradation. The results of such colonial maneuvers are very evident in the Southern Province where large tracts of land were alienated for white settlers and commercial agriculture. Though these conservation and wise use practices have been extensively modified by external influences such as colonialism, the traditional practices still reflect these in the conservation of plants and animals.

2.19 **Community-Based Management Systems.** Some of the positive aspects of indigenous conservation practices discussed above are now being resuscitated through the concept of CBNRM which emphasized participation of communities in natural resources management. Community participation in natural resource management is based on a number of principles. Some of the important ones are given in Box 3.

Box 3. Main Principles of Community Participation

- Common ownership based on community membership.
- Local communities are the primary stakeholders to natural resources found in their area.
- Benefits arising from natural resources should go to producer communities.
- Local communities know their natural resources better.
- Planning for the sustainable use of natural resources in a given area should be the responsibility of local communities.

The principles listed above point to the primacy of local communities in natural resource management and underline the fact that other stakeholders to natural resources such as the government, donors, NGOs and the private sector have a diminished claim to natural resources and as such, should act more as technical support personnel ready to give technical advise when communities require their inputs.

2.20   CBNRM principles have mainly found their niche in the Wildlife sector where community participation seems indispensable given the interaction of people and animals. Wildlife competes for space with many other land uses some of which have conflicting objectives. Because of intense human pressures on wildlife management, especially intensified poaching National Parks and Wildlife Services (NPWS) adopted a community participation approach to the conservation of wildlife known as ADMADE. The objectives being management of wildlife and to share revenue generated from utilization of wildlife with the communities involved in the management process. This wildlife management strategy gradually grew from a pilot project to a national program.

2.21   The principle has been expanded to most of Zambia's GMAs including the Wetland Conservation Program supported by World Wildlife Fund (WWF), the Luangwa Integrated Resource Development Project (LIRDP) supported by Norwegian International Development Agency (NORAD) and the upper Zambezi Wetlands and Natural Resources Management Programme Supported by International Union for Conservation of Nature (IUCN) - The World Conservation Union. It has now become part of government policy for managing wildlife approved by Cabinet in 1993 (GRZ, 1994). This is in recognition of the strength of the ADMADE principle which respect local people as the best custodians of wildlife and other renewable resources on their land. The ADMADE program has income generating activities and a revenue sharing strategy with the communities. Revenue is generated from the hunting industry and collected by the NPWS licensing unit.

Management Instruments

2.22   **Policies, Institutional and Legislative Framework at National Level.** Zambia has had a long history in the conservation of its biological resources as evidenced by its numerous legislative provisions. A recent survey carried out during the stock taking exercise

indicates that the country has more than thirty legislative instruments that address conservation issues or the protection of the quality of the environment (MENR, 1998b). Most of these were enacted more than thirty years ago. While some of them have been reviewed several times over the years (eg. Wildlife Act), some remain in their original format (eg. Water Act of 1949). Related to most of these pieces of legislation are policies together with designated institutions to administer the individual Acts. The following are some of the components of biodiversity with related legislation, policies and institutions for their management;

(i)   *Forestry.* The current Forestry Policy was adopted in July 1998 after a review of the one developed in 1969 (GRZ, 1998). The policy aims at increasing the country's forest cover and simultaneously meet the growing local needs for fuel wood, fodder, timber and minor forest products. It advocates for participatory Joint Forest Management in which the local communities collaborates with Government Agencies and the private sector in the protection, management and utilisation of forest resources.

The goals of forestry management in Zambia include:

a)   To put in place effective forest management systems and operating resources.

b)   To formulate and implement appropriate forest policies and programmes for Sustainable management and use of forest resources

b)   To promote participatory management and use of sustainable forests such that all stakeholders including, men, women and children take active and sustained interest in effective conservation, production, management and utilisation of the nation's forest resources.

In line with this new policy, the forest Act, Cap 199 of 1973 has recently undergone review. The Forest Act, 1999 provides for among others;

- the establishment of the Zambia Forestry Commission to replace the Forestry Department as the administrative body for the Act
- the participation of local communities traditional institutions, non-governmental organisations and other stakeholders in sustainable forest management.
- The conservation and sustainable use of forests and trees for the management of forest ecosystems and biological diversity
- The implementation of CBD and other related conventions.

(ii) *Wildlife.* The Wildlife Policy, 1993 provides for the establishment, control and management of National Parks and for the conservation, protection and enhancement of wildlife ecosystems biodiversity (GRZ, 1994a). The Policy addresses issues pertaining to opportunities for the equitable and sustainable use of the special qualities of National Parks and GMAs. The policy also provides for the conservation of wildlife including those species that may sometimes be in conflict with human

interests to ensure that these assets are never squandered for any short-term human gains for any purpose that is not in conformity with the principle of environmentally sound sustainable development.

From this Policy emanated the Zambia Wildlife Act No. 12 of 1998 which provides for the establishment of the Zambia Wildlife Authority (ZAWA) with the following functions -

a) controlling, managing, conserving, protecting and administering National Parks, GMAs, bird and wildlife sanctuaries;

b) sharing with local communities the responsibilities of management through the preparation and implementation of management plans for National Parks, GMAs, bird and wildlife sanctuaries;

c) adopting methods that ensure the sustainability, conservation and preservation in the natural state of ecosystems and biodiversity in the National Parks, GMAs, and bird and wildlife sanctuaries and to ensure the proper balance between the sustainable use of wildlife and the management of ecosystems in these areas;

d) enhancing the economic and social well being of local communities in GMAs;

e) granting hunting concessions in partnership with local communities to hunting outfitters and tour operators; and

f) assisting and advising the Community Resources Boards in the management of human and natural resources in GMAs and in areas that fall under their jurisdiction.

The Wildlife Policy has shortcomings in relation to identifying and prioritising the relevant ecosystems and natural resources, which require special care and management methods.

Implementation of the Wildlife Policy is the responsibility of the Department of NPWS in the Ministry of Tourism (MOT) which is soon to be replaced by the ZAWA.

(iii)   *Agriculture.* Agriculture policies at national level are based on a Policy Framework to the year 2000 adopted by the Ministry of Agriculture, Food and Fisheries (MAFF) to formulate the Agriculture Sector Investment Programme (ASIP) whose implementation started in 1996. This policy framework provides clear policy goals and strategies aimed at creating an enabling environment for increased private sector participation in the agricultural sector (GRZ, 1992). ASIP aims at facilitating and supporting the development of a sustainable and competitive agricultural sector that ensures food security at national and household levels and to maximise the sector's contribution to the national GDP.

Among the major shortcome of the policy framework is its vagueness in spelling out measures for conservations and sustainable use of agrobiodiversity. It further fails to address benefits for environmentally sound farming practices. As a result in part a new policy is being drafted.

Currently, MAFF is responsible for the administration of 33 separate pieces of legislation. However, only a few of them have direct bearing on the conservation and management of biodiversity, the main one being the Agricultural Lands Act, Cap 187 of 1960.

(iv)   *Fisheries.* The country's policy on the conservation and management of fisheries resources is enshrined in the Agricultural Policy Framework of 1990. The Fisheries Act Cap 200 of 1974 seeks to protect fish resources from unsustainable exploitation and to regulate the fishing industry. Under this Act the Government is committed to ensuring that the Fisheries sector continues to make maximum contribution to the national economy so that it improves nutrition, generates income and creates remunerative employment.

The Fisheries Policy, however, does not cover issues of community participation, threatened or endangered species and biological diversity. These deficiencies are being addressed under a new bill soon to be made law. The new Act will among other things provide for the following:

a)   the establishment of control and management of commercial fishery areas

b)   conservation and protection of aquatic biodiversity

c)   the sustainable use and management of fisheries resources

d)   ensure equitable sharing of benefits arising from the exploitation of fisheries   resources to local communities

Implementation of the Fisheries Policy is the responsibility of the MAFF.

(v)   *Overall Environmental and Natural Resources Management.* Zambia's environmental policy can be traced back to the National Conservation Strategy (NCS) of 1985 (Aongola, et al, 1997; GRZ, 1985). The NCS's objectives were to:

- Ensure sustainable use of Zambia's renewable natural resources;
- Maintain Zambia's biodiversity; and,
- Maintain essential ecological processes and life support systems.

The NCS recommended among, other things, strategies for involving communities in natural resources management including decentralisation and capacity building. It also recommended the enactment of a principal environmental legislation, which later became known as the Environmental Protection and Pollution Control (EPPC) Act. The EPPC Act was enacted in 1990.

The EPPC Act provides for the establishment of the Environmental Council of Zambia (ECZ) whose functions include:

a) providing advice to the government on formulation of policies relating to good management of natural resources and the environment;

b) recommending to the government measures aimed at controlling pollution;

c) coordinating the activities of all Ministries and other bodies concerned with the protection of the environment and pollution control;

d) advising on co-operation between nations and international organisations on environmental issues;

e) advising on the need for and embarking upon general educational programmes for creating awareness in the protection and improvement of the environment; and,

f) identifying, promoting and advising the government on projects likely to further conservation for sustainable development

In 1994, the NCS was updated through the preparation and adoption of the National Environmental Action Plan (NEAP). The overall objective of the NEAP was to integrate environmental concerns into the social and economic development planning process in Zambia (GRZ, 1994b). The NEAP process document was prepared through a rigorous analysis of environmental and natural resources sectoral issues in the country. The NEAP process identified major areas of environmental concern which were used to prepare sectoral plans in support of biodiversity conservation.

2.23 **International Conventions: The CBD.** Apart from legislation and policies at national level, conservation and management of biodiversity in Zambia has been influenced by international law and policy in support of biodiversity conservation and management. The principal influence among the international conventions comes form the CBD which Zambia ratified on 28 May 1993. Further information on the CBD is given in Box 4.

2.24 Zambia recognises the significance of the CBD objectives and obligations and has therefore used the Convention as an opportunity to try and integrate these objectives into on-going national policies, plans and programmes. Some of these programmes include the Environmental Support Programme (ESP), the Zambia Forestry Action Programme (ZFAP), the Provincial Forestry Action Programme (PFAP) and ASIP.

2.25 **Other International Conventions and Regional Initiatives.** Apart from being a party to the CBD, Zambia is also a party to other international conventions that deal with specific aspects of biodiversity such as the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (also known as Ramsar Convention), the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), the United Nations Framework Convention on climate change (UNFCC) and the United

Nations Convention to Combat Desertification those countries experiencing serious drought and/or desertification, particularly in Africa (CCD). Under the Ramsar Convention Zambia has listed two Wetland sites namely the Kafue and the Bangweulu flats. Zambia has also proposed the inclusion of various other potential sites on the listing. Under CITES, Zambia has assented to the listing of several species of flora and fauna in the three Appendices of the Convention.

2.26   At the regional level, Zambia co-operates with neighbouring countries through bilateral and regional agreements to conserve and ensure sustainable management of the region's biological resources. For example, Zambia has been co-operating with Zimbabwe on the cross border management of fish and wildlife resources along the two countries' common border. Zambia is also co-operating with Burundi, Tanzania and the Democratic Republic of Congo in developing a joint strategy and management plan of the resources in Lake Tanganyika.

Box 4. About the CBD

Objectives. The objectives of the CBD are "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources" (UNEP, 1992).

Parties' Commitments. The implementation of the CBD is guided by 42 Articles. Under Article 6 of the Convention, Parties have committed themselves, among other things, to:

- identifying components of biological diversity of importance for its conservation and the sustainable use of its components including the collection and evaluation of data needed for effective monitoring of these components.

- identifying processes and activities which have or are likely to have an adverse impact on biological diversity.

- evaluating the potential economic implications of the conservation of biological diversity and sustainable use of biological and genetic resources and to ascribe values to biological and genetic resources.

- suggesting priority action for the conservation of biological diversity and the sustainable use of its components.

Vehicle for Implementation. The main vehicle for implementation of the Convention at national level involve the development of strategies for the conservation and sustainable use of biological diversity.

Obligations. The Convention also obliges parties to carry out inventories and monitor the biodiversity within their own territories; to identify and regulate destructive activities; and to integrate consideration of biodiversity into national decision making. Parties are also required to take special measures to protect customary resource uses, traditional knowledge, innovations and practices of local and indigenous communities.

2.27 Zambia is also hosting the Southern African Development Community (SADC) Regional Plant Genetic Resources Centre (Gene bank) whose function is to collect and conserve the region's plant genetic material covering mainly cultivated crops and their wild relatives. More recently, Zambia has accepted to implement a national component of the SADC Regional Biodiversity Support Programme whose planning was completed on 16th April, 1999.

CHAPTER 3 - COUNTRY STUDY ANALYSIS OF BIODIVERSITY STATUS, THREATS AND EFFECTS

A. Threats

3.1 **Deforestation and Habitat Destruction.** The threat of deforestation in forest reserves is caused by excessive cuttings in illegal coupes and commercial harvesting, as well as, conversion of forest to agricultural land by encroachment in forest reserves. These, in turn, are driven by population growth and basic needs of people. Approximately 45 percent of the Zambian population lives in urban areas, mostly in three of the nine provinces. Because of this skewed population distribution, over-exploitation of forests has been concentrated in the immediate hinterlands of these urban areas, where excessive cutting for woodfuel has already led to increased degradation of woodlands. Due to the continuous over-exploitation, the harvesting cycle is shortened and late fires become more frequent. This leads to changes in species composition and threatens the regeneration of the forest and the threshold to convert depleted forest reserves to agricultural land declines.

3.2 In addition to demand for fuelwood, the pressure to convert forests in open areas into agricultural land is high. In open areas land for cultivation is allocated by traditional chiefs. In areas where enough land is not available in open areas, forest reserves are used because these are often considered as abandoned areas or communal land and therefore are more easily exploited.

3.3 Most wild fires that damage forest areas are caused by man. Timing and frequency of fires determine the effect of fire on the ecosystem. In the natural state, annual early fires burn the ground layer of the forest in the cool season (from May to mid-August) when trees are dormant. Severe fires, caused by late burning, are destructive to forests. The current forest use has affected fire frequency and timing. In the natural state most forests and woodland vegetation types have a closed canopy. Over-exploitation changes the light conditions of the forest and accelerates grass growth, which provides fuel for late fires. Frequent late fires prevent regeneration of fire-intolerant species and thus change species composition. The result is an open type chipya vegetation and ultimately grassland.

3.4 These threats to ecosystems have affected the status of forest reserves in the country. About 20 percent of forest reserves are either encroached or depleted due to over-exploitation of wood products, settlement and cultivation (MENR, 1998a). In fact there is a significant logistic correlation between the proportion of depleted/encroached forest reserves and provincial population density ($p = 0.994$). These threats to forest reserves have affected miombo woodland and grassland ecosystems more than the other ecosystems.

3.5 The mostly affected plant groups from habitat destruction include mosses and hydrophilous orchids and ferns whose habitats are being destroyed by drought, cultivation and fire. In some parts of the country, conversion of peat bogs to cultivation has permanently destroyed orchid habitats, and along with them, the orchids. Saprophytic fungi and flora are usually dependent on humus for establishment and maintenance. Conversion of dryland ecosystems to cultivation and livestock grazing destroys the humus layer on the soil which

triggers the disappearance of saprophytic organisms in the ecosystem. Similarly, epiphytic plants are destroyed due to deforestation and selective cutting of trees.

3.6   Botanical reserves are suffering the same fate as forest reserves. These reserves are managed by the Division of Forestry Research and District Forest Officers. Out of a total of 59 botanical reserves, 37.3 percent are either encroached upon or depleted, although no harvesting is allowed in botanical reserves. In some cases, the botanical reserve boundaries are not marked while in other cases, the district staff who are supposed to manage them, are not aware of their existence and/or location in their districts.

3.7   **Land Use Conflicts.** Ecosystems and wildlife have legal protection against consumptive use in National Parks; only non-consumptive utilization, such as, viewing and photographing, are allowed in national parks. Game hunting is regulated in GMAs through a licensing system but other forms of land use and infrastructure development are not. Consequently, land use conflicts and threats to ecosystems are more prevalent in GMAs than in National Parks. Threats to ecosystems in the wildlife estate include human encroachment, fragmentation of ecosystems/habitats, logging and mining.

3.8   Human encroachment are associated with cultivation, livestock grazing and deforestation. Settlements in GMAs are expanding due to population growth and immigration and more land is being converted to agriculture. Already ecosystems in 25 percent and 48 percent of national parks and GMAs, respectively, are degraded due to human encroachment. Much of the wildlife estate is unsuitable for human settlements and bovines due to the presence of tsetse-flies that cause sleeping sickness in man and trypanosomiasis in cattle. Tsetse-fly eradication programmes therefore enhance human encroachment into wildlife ecosystems. About two thirds of Zambia's GMAs are considered depleted and these cover $164,000Km^2$ or 45 percent of wildlife estates. In addition, three national parks have depleted annual populations-while the three others are heavily encroached (ibid).

3.9   Changes in fish biodiversity have also been affected by damming which regulates the normal riverflow. This regulation favours lacustrine fish fauna which replace riverine species. This has occurred at lake Kariba where the lacustrine green headed bream, *Oreochomis macrochir*, has replaced most of the riverine cyprids and characids (Harding, 1964).

3.10   Activities such as human settlements, road construction and mining further result in the fragmentation of ecosystems and habitats and obstruct migratory routes to breeding and feeding grounds used by wildlife.

3.11   **Climate change.** Scientists predict that global climate change due to build-up of green house gases in the atmosphere is likely to have effects in tropical countries including Zambia (IPCC, 1995). For example, global warming and reduction in rainfall is likely to contract aquatic and dry evergreen forest ecosystems. The Lukanga swamp in central Zambia almost dried up due to the frequent droughts of the 1990s. Shallow rooting trees, such as *Parinari curatellifolia* which support epiphytic flora ,e.g., orchids, are drought intolerant and die, along with their epiphytic associates, during severe droughts. Recurring droughts, especially in the southern part of the country, have resulted in crop failure and starvation of livestock which make the preservation of seed and animal breeds difficult.