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ILUA II Technical Report Series

ILUA II

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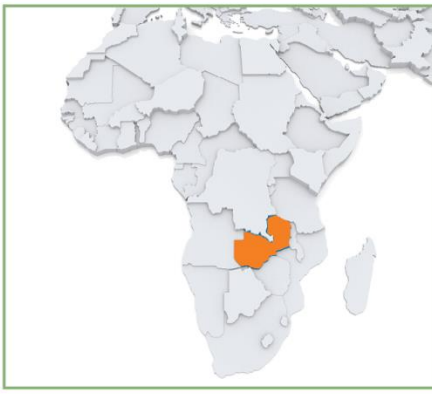
Biodiversity Report for ILUA II

Technical Report No. 2



Biodiversity Report for ILUA II

By E. N Chidumayo

Ministry of Lands, Natural Resources and Environmental Protection

FORESTRY DEPARTMENT

MINISTRY FOR FOREIGN AFFAIRS OF FINLAND

2016

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Biodiversity Report for ILUA II

Technical Paper prepared for the Forestry Department, the Ministry of Lands, Natural Resources and Environmental Protection and the Food Agriculture Organization of the United Nations as a part of the Integrated Land Use Assessment Phase II.

by

Emanuel N. Chidumayo[1]

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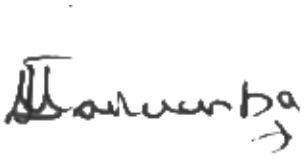
[1] [1] Prof. Emanuel N. Chidumayo, Ecologist and Manager at the Makeni Savanna Research Project in Lusaka, Zambia

FOREWORD

The majority of terrestrial biodiversity is found in forests and most of that is in the tropics. In Zambia, forests provide livelihoods for the majority of people — especially in the rural communities. Therefore, the assessment of forest biodiversity is a priority in forest management. In addition, countries are obliged to report information related to their forest sectors to a variety of international and regional conventions, agreements and bodies. Under the Convention on Biological Diversity (CBD), various attempts are being made to harmonize national reporting on biological diversity.

This biodiversity paper was reviewed during the planning phase of the Integrated Land-Use Assessment Phase II (ILUA II) and the REDD Readiness Projects for Zambia. This was done in order to obtain improvements in the quality and scope of biodiversity data and information to be collected within ILUA II, and to better serve the national forest-related biodiversity information needs for national and international decision making and reporting.

The paper not only provides for the refinement of the sampling design and priority indicators for biodiversity, but is also an excellent reference towards better understanding forest-based biodiversity in Zambia.



Ignatius N. Makumba
DIRECTOR - FORESTRY

Bwalya Chendauka
NATIONAL COORDINATOR - ILUA II

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ACRONYMS

BWZ	BirdWatch Zambia (formerly Zambia Ornithological Society)
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
EIS	Environmental Impact Statement
EMA	Environmental Management Act
FAO	Food and Agriculture Organization of the United Nations
FD	Forestry Department
GIS	Geographic Information System
GMA	Game Management Area
GPS	Global Positioning System
IBA	Important Bird Area
ILUA I	Integrated Land-Use Assessment PHASE I
ILUA II	Integrated Land-Use Assessment PHASE II
IUCN	World Conservation Union (formerly International Union for the Conservation of Nature)
JFM	Joint Forest Management
NBSAP	National Biodiversity Strategy and Action Plan
NCS	National Conservation Strategy
NEAP	National Environmental Action Plan
NFA	National Forest Assessment
NPC	National Project Coordinator
NPE	National Policy on Environment
PA	Protected Area
RAMSAR	Convention of Wetlands of International Importance
REDD	Reducing Emissions from Deforestation and Forest Degradation
REDD+	Reducing Emissions from Deforestation and Forest Degradation, Conservation, Enhancement of Carbon Stocks and Sustainable Forest Management
SABONET	Southern African Botanical Diversity Network
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNREDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation
WCMC	World Conservation Monitoring Centre
ZAWA	Zambia Wildlife Authority
ZEMA	Zambia Environmental Management Agency
ZOS	Zambia Ornithological Society, now BirdWatch Zambia

ABSTRACT

Forest biodiversity may be defined as diversity within forest species, between species, and of forest ecosystems. The protected area system in Zambia consists of national parks, bird sanctuaries, Ramsar wetland sites, important bird areas (IBAs), forest and botanical reserves, national heritage sites and game management areas (GMAs). The Southern African Botanical Diversity Network (SABONET) classified 143 plant species in Zambia as threatened; of these, 33% are woody plants and 67% are herbs, but the latter are rarely inventoried in forest surveys.

A number of forest diversity indicators were used in the first phase of the Integrated Land-Use Assessment (ILUA I) project, implemented from 2005 to 2008 in Zambia, including forest area by type, protected forest area by type and degree of forest degradation. The objective of the assessment was to improve the quality and scope of biodiversity data and information to be collected during the second phase (ILUA II, 2009-2014), and to better serve the forest-related biodiversity information needs for national and international decision making and reporting. The 1999 National Biodiversity Strategy and Action Plan (NBSAP) is the main instrument on which the management of biodiversity in Zambia is based.[2] The key objectives of the strategy are to (i) conserve Zambia's ecosystems and particular species through a network of protected and unprotected areas; (ii) sustainably use and manage biological resources; (iii) equitably share benefits from the use of Zambia's biological resources; and (iv) conserve the genetic diversity of Zambia's crops and livestock. This strategy and action plan is supported by a number of sectoral policies and laws covering agriculture, forests, wildlife, natural resources, energy, natural heritage and environmental protection. In addition, Zambia is a signatory to a number of international agreements and conventions concerning biodiversity, including the Convention on Biological Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Stakeholder requirements for biodiversity information are diverse and vary according to how the forest and its resources are used, e.g. (i) subsistence and livelihood uses, (ii) social and cultural uses, (iii) health care, (iv) commercial, and (v) ecological uses. Threats to forest biodiversity are caused by subsistence and livelihood activities, invasive species, and development activities, such as agriculture, forestry practices, energy supply, urbanization, mining and infrastructure. The Environmental Management Act (EMA) of 2011 prescribes that for any development project that is likely to have significant impacts on the environment, there is need to produce an Environmental Impact Statement (EIS) before project implementation. The major threat to forest reserves is caused by excessive cuttings in illegal coupes and commercial harvesting, as well as the conversion of forest reserves into mining, agricultural land and urban land use. Severe fires, caused by late burning, are also causing destruction to forests and its biodiversity.

The main sources of biodiversity data and information in Zambia are presented, the information needs for ILUA II are categorized and prioritized, and the following recommendations are proposed:

[2] A review and update of the NBSAP commenced in late 2013.

1. In order to meet the requirements of the CBD, species data from ILUA I should be analyzed to determine the conservation status of individual tree species at national level. ILUA II should also improve data on the identification of tree species. This should be done by providing each field crew with the *Check list of vernacular names of the woody plants of Zambia* by D.F. Fanshawe (1965), which also contains the corresponding scientific plant names.

2. There is a critical need to use remote sensing and other data sources to assess the prevailing status of protected areas (PAs) in the country, which was not adequately done under ILUA I. It is also important to correlate PA status with other variables, such as population density, land use, infrastructure and other development activities, so that scenarios can be made about the future status of the PAs. Although this may not be the core objective of ILUA II, the ILUA database could contribute relevant data for the country to carry out such a protected area assessment.

3. The ILUA II sampling design should include sample tracts and plots that were inventoried during ILUA I, so that trends in biological resources can be assessed for the period since ILUA I. Such information is required by many stakeholders and is also needed to meet CBD and other international requirements.

4. To guide decision making on what data to collect during the ILUA II field inventory, data collected during ILUA I have been classified into three categories: (i) essential data that needs to collected, (ii) optional data that can be collected if enough resources are available and (iii) data not required which should be left out. The reasons for classifying essential data are summarized.

5. Priorities in the analysis of ILUA II inventory data should also include the generation of information that is related to biodiversity indicators that represent information needs shared by many stakeholders.

1. INTRODUCTION

The goal of ILUA II, the second phase of the integrated land-use assessment project in Zambia, is to assess forests and integrated land-use practices to provide new qualitative and quantitative information on the current situation and trends regarding the state, use and management of natural resources. ILUA II will provide technically-sound information on the physical characteristics of forests and the socio-economic condition of communities living in and around these forests.

This assessment supports the implementation of ILUA II and the UNREDD projects. Specifically, the objective is to obtain improvements in the quality and scope of biodiversity data and information to be collected within ILUA II and to better serve the national forest-related biodiversity information needs for national and international decision making and reporting.

The specific tasks of this assignment are to:

i. identify key national policies and strategies relevant to forest-based biodiversity issues, as well as relevant international commitments; identify and map related biodiversity information needs.
ii. identify stakeholders in forest-based biodiversity issues (forest users and uses, development issues), identify and map different stakeholders' key information needs, and identify the most important longer-term (periodically recurring) information needs shared by stakeholders.
iii. review ILUA I data and make scenarios on how to use the ILUA I data for providing the identified required information.
iv. review and analyze relevant existing and other forest-related biodiversity data from the point of view of defining the ILUA II information needs, including reporting requirements for REDD+ safeguards.
v. identify and map existing and other potential information sources and data collection mechanisms in order to avoid duplication of data collection through NFA.
vi. propose a prioritized and structured classification for ILUA II information needs and a related prioritized list of biodiversity indicators and variables on which primary data could be collected through ILUA II for validation with key stakeholders [and the working group].
vii. adjust the prioritized and structured classification for ILUA II biodiversity information needs and the related prioritized list of biodiversity indicators and variables for ILUA II primary data collection based on key stakeholder consultation results.

The assignment was undertaken through literature review and consultation with the working group. Stakeholder biodiversity information needs were based on a review of biodiversity policies and action plans, and personal discussion notes based on the REDD+ and ILUA II stakeholder planning meetings held in 2011 at Mulungushi International Conference Centre and The Court Yard Hotel in Lusaka respectively. Matrices were used to summarize and analyze the data and information. Where appropriate, maps, other illustrations and annexes have been included in the paper.

2. REVIEW OF BIODIVERSITY DATA AND INFORMATION IN ZAMBIA

2.1. Biological diversity

The United Nations Convention on Biological Diversity (CBD) defines biological diversity, or biodiversity, as *the variability among living organisms and the ecological complexes of which they are part* (UNEP, 1992). This includes diversity within species, between species and of ecosystems. Species diversity is determined by the number of species present in a defined area. The CBD defines an ecosystem as *a dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit* (UNEP, 1992). Much of the data and information on biodiversity in Zambia is at species level and, to a limited extent, on ecosystems. Natural ecosystems classification in Zambia is based on vegetation types (Fanshawe 1969; Edmonds 1976) and these are presented in Table 2.1.

Table 2.1*Vegetation types in Zambia based on Fanshawe (1969)*

Broad subdivision	Vegetation category	Topographic/ Edaphic unit	Miscellaneous groupings	Floristic association
I: Closed forest	A:Climate	1. Low and medium altitude	(a) Dry Evergreen	i. *Parinari*
				ii. *Marquesia* (A: Lake basin Chipya)
				iii. *Cryptosepalum* (A: Kalahari Sand chipya)
			(b) Dry deciduous	i. *Baikiaea*
				ii. Itigi
		2. High-altitude	(a) Montane	*Aningeria-Cola-Myrica-Nixia-Olinia-Parinari-Podocarpus*
	B:Edaphic	1. Swamp		*Ilex-Mitragyna-Syzygium*
		2. Riparian		*Diospyros-Khaya-Parinari-Syzygium*
II: Open forest with grass	A: Woodland	1. Miombo		*Brachystegia-Julbernardia-Isoberlinia*
		2. Kalahari		*Brachystegia-Julbernardia-Isoberlinia-Guibourtia-Burkea-Erythrophleum*
		3. Mopane		*Colophospermum mopane*
		4. Munga		*Acacia-Combretum-Terminalia*
III: Termitaria		1. Miombo		*Brachystegia-Julbernardia-Isoberlinia*
		2. Kalahari		*Brachystegia-Julbernardia-Isoberlinia-Guibourtia-Burkea-Erythrophleum*
		3. Mopane		*Colophospermum mopane*
		4. Munga		*Acacia-Combretum-Terminalia*
		5. Riparian		*Diospyros-Khaya-Parinari-Syzygium*
IV:		1. Headwater		

Broad subdivision	Vegetation category	Topographic/ Edaphic unit	Miscellaneous groupings	Floristic association
Grasslands		valley		
		2. Riverine		
		3. Flood plain		
		4. Swamp	(a) Alkaline	
			(b) Other	
		5. Lake		

2.2. Protected areas and in-situ conservation

The CBD defines a protected area (PA) as *a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives*. Similarly, in-situ conservation refers to the conservation of ecosystems and natural habitats, and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

The International Union for Conservation of Nature (IUCN), or World Conservation Union, has defined 10 conservation area categories (Table 2.2).

Table 2.2 *Brief descriptions of the IUCN categories of conservation area*

Class	Description	Function and objective	PA equivalent in Zambia
I	Scientific or Nature reserve	Maintenance, in undisturbed state, of natural environments for biodiversity and education	None
II	National park	Protection of ecosystem features, flora, fauna, geomorphologic sites, etc.	National Park
III	National monument or Natural landmark	Protection of site(s) containing one or more specific natural features of outstanding significance	National Heritage site
IV	Nature conservation reserve or Managed nature reserve or Wildlife sanctuary	Protection of site(s) for conservation of rare plant or animal species	Bird Sanctuary and Botanical Reserve
V	Protected landscape	Maintenance of nationally significant areas that show the harmonious interaction of humankind and nature	None
VI	Resource reserve	Maintenance of wilderness areas, including compatible use by indigenous inhabitants	Ramsar sites and Important Bird Areas
VII	Anthropological reserve or Natural biotic area	Maintenance of habitat for the livelihood of traditional societies	None
VIII	Multiple use management area or Managed resource area	Intensively managed areas for the sustainable provision of economic goods and services	Forest Reserves and Game Management

Class	Description	Function and objective	PA equivalent in Zambia
			Areas
IX	Biosphere reserve	Spatially zoned landscapes/seascapes and managed for multiple purposes and having a core protected zone, buffer zone and restoration zone	None
X	World heritage natural site	Sites of outstanding universal value whether physical, ecological or cultural	National Heritage site

The protected area system in Zambia consists of national parks, bird sanctuaries, Ramsar wetland sites, important bird areas (IBAs), forest and botanical reserves, national heritage sites and game management areas (GMAs). National parks were established by the government primarily for the conservation of biodiversity. There are 20 national parks in Zambia and these cover a total area of 6.358 million hectares (ha).[3] Sustainable use of wildlife and its habitats in national parks is promoted through eco-tourism, while settlements and hunting are prohibited. Bird sanctuaries have the same status as national parks, but are usually smaller in size. There are two bird sanctuaries in the country. Important Bird Areas (IBAs) are identified based on internationally agreed criteria and are established for the long-term viability of naturally occurring bird populations across the range of those species for which a site-based conservation approach is appropriate. There are 42 IBAs in Zambia. Some of these are in national parks and forest reserves and they also include the two Ramsar wetland sites (Bangweulu Swamps and Kafue Flats) in the country. Game management areas (GMAs) were established by the 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 hectares. Because other forms of land use, such as settlements and agriculture, are allowed, GMAs are not in a strict sense protected areas.

Forest reserves were established by the 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 hectares. Settlements and cultivation are normally not permitted in forest reserves while the removal of any plant is only permissible under license, as is livestock grazing. Other forest reserves are managed as botanical reserves that serve three objectives: (i) preservation of relic vegetation types and/or plant species, (ii) genetic banks for multiplication and breeding programs and (iii) reference sites in determining human impacts on forest ecosystems outside reserves. There are 59 botanical reserves in Zambia which cover a total area of 148,000ha, but which form part of the country's forest reserve system.

Since the ratification of the World Heritage Convention in 1994, Zambia has listed the Victoria Falls as a World Heritage Site, which allows the protection of both the cultural and natural attributes of the Victoria Falls area.

[3] The most recent National Park, Lusaka National Park, 69ha, was established in 2011.

The representation of ecosystems in protected areas is not even; the proportion of montane, swamp and riparian forests (see Table 2.1) in protected areas is negligible. Itigi forest and floodplain/swamp grasslands are almost absent in forest reserves, while dry deciduous forest is absent in national parks.

2.3. Forest biodiversity

Forest biodiversity can be defined *as diversity within forest species, between species and of forest ecosystems*. The forestry approach defines diversity at three main levels: (i) genetic diversity or the diversity of genes within a species, (ii) species diversity or the number of species in a specified area and (iii) ecological diversity or the number of ecosystems in a landscape.

The analysis and monitoring of forest biodiversity requires (i) the demarcation of limits of investigation in order to specify focal areas, defining the depth of analysis and frequency of observations, and establishing biodiversity indicators to quantify change in space and time, and (ii) the repetition of the inventory at the same site using the same protocol or indicators. Indicators of genetic variation are important but generally require sophisticated laboratory-based analysis, and are therefore not usually included in inventories. At forest management unit level, the following biodiversity indicators are appropriate:

i. Forest area by type
ii. Protected forest area by type
iii. Degree of fragmentation of forest types
iv. Rate of conversion of forest cover (by type) to other uses
v. Area and percentage of forest affected by human and natural disturbances
vi. Complexity and heterogeneity of forest structure
vii. Number of forest-dependent species
viii. Conservation status of forest dependent species

Some of these indicators were used in ILUA II and require both spatial data on forest cover and ground-based inventory data which help to define forest types. Most forest inventories include data on species richness derived from species lists at inventory plots. Indicators relating to forest fragmentation require spatial data on forest cover at the landscape scale and include measures of the size, shape and connectivity of forest patches. Protection type depends on the legal status of the area and the degree of protection provided to biodiversity.

The national biodiversity study (Chidumayo and Aongola 1997) estimated the diversity of flora in Zambia at 3,774 species, consisting of 147 algae, 129 mosses, 142 ferns, 530 grasses, 1130 non-grass herbs, 1,610 woody plants and 86 crops. The approximate diversity of seed plants in the different ecosystems in Zambia is summarized in Table 2.3.

Table 2.3 *Diversity of seed plant species in Zambia by ecosystem*

Ecosystem	Approximate seed plant species[1]	Endemic species[2]
Dry evergreen forest	600	26
Dry deciduous forest	400	9

Ecosystem	Approximate seed plant species[1]	Endemic species[2]
Montane forest	400	74
Swamp forest	300	27
Riverine forest	900	40
Miombo woodland	650	57
Kalahari Sand (KS) woodland	500	35
Mopane woodland	300	10
Munga woodland	500	49
Termitary woodland	700	33
Grassland	1000	No data

[1] After Chisumpa (1990), [2] After Brenan (1978)

Centres of biological diversity are areas with high concentrations of taxa, while centres of endemism are areas with high concentrations of endemic taxa. Endemic species are those that have at least 75% of their geographical range within one ecosystem. Miombo woodland is the centre of diversity of the genera *Brachystegia* and *Monotes,* which are represented by 21 and 11 species, respectively, in Zambia. Three species of ferns are endemic to northern Zambia (Kornas, 1977). These are *Asplenium chaseanum*, *Athyrium annae* and *Selaginella subisophylla.* The latter two are confined to waterfalls. Brenan (1978) indicated that there were about 211 endemic plant species in the country; the distribution of some of these by ecosystem is given in Table 2.3.

Data collected during ILUA I focused on tree species. These data were analyzed to generate general patterns of tree species diversity in the country using statistical and spatial modelling techniques. Figure 2.1 shows that tree species richness declines in a south-westerly direction, as well as in a north-easterly direction, and the highest species richness occurs in miombo open forest (Figure 2.2), while mopane open forest has the lowest tree species richness.

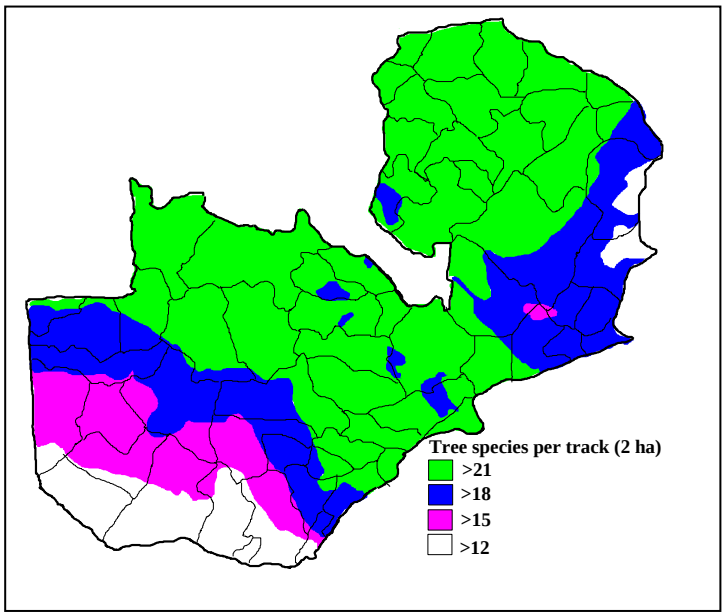

Figure 2.1 *Pattern of tree species density in Zambia. Based on ILUA I inventory data.*

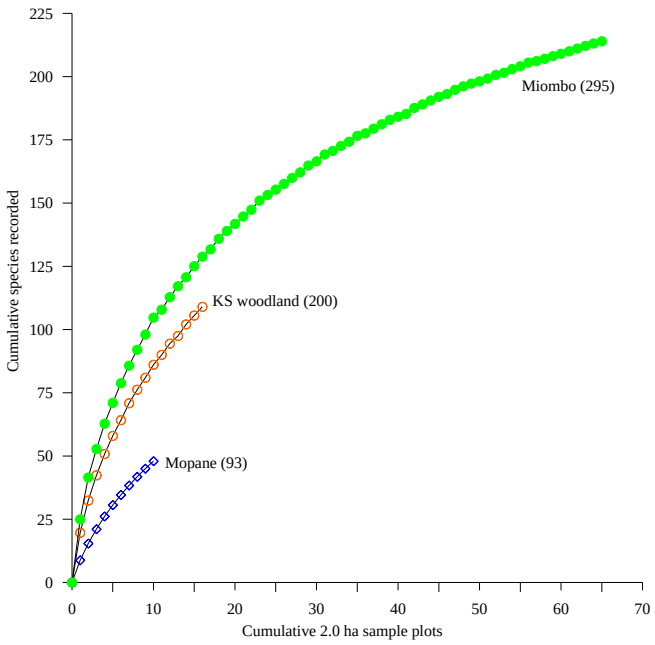

Figure 2.2 *Tree species accumulation curves for three open forests in Zambia. Based on ILUA I inventory data. The figures in parentheses indicate the estimated species in each forest type calculated using the second order Jacknife estimator (McCune and Mefford, 1)*

2.4. Threatened plant species

The international conservation status of a species is based on the World Conservation Union (IUCN) criteria as explained in Table 2.4.

Table 2.4 *Classification of species according to conservation threat.*

Threat class	Description
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be taken over a timeframe appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be taken over a timeframe appropriate to the taxon's life cycle and life form.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it is considered to be facing an *extremely high risk* of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it is considered to be facing a *very high risk* of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it is

Threat class	Description
	considered to be facing a *high risk* of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria, but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking.
Not Evaluated (NE)	A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

In a strict sense, Data Deficient is not a category of threat. Listing of taxa in this category simply indicates that more information is required and acknowledges the possibility that future research will show the appropriate threat classification.

The categories and criteria in Table 2.4 were designed for global taxon assessments. However, many people are interested in applying criteria to subsets of global data, especially at regional, national or local levels. When applied at national or regional levels, it must be recognized that a global category may not be the same as a national or regional category for a particular taxon. For example, taxa classified as Least Concern globally might be Critically Endangered within a particular region where numbers are very small or declining. Conversely, taxa classified as Vulnerable on the basis of their global declines in numbers or range might be Least Concern within a particular region where their populations are stable.

When applied to species threat classification, the term 'population' refers to numbers of mature individuals only, and in the case of taxa, which are obligately dependent on other taxa for all or part of their life cycles, e.g., epiphytes, the population of host taxon should be used. The number of mature individuals is the number of individuals known, estimated or inferred to be capable of reproduction.

The Southern African Botanical Diversity Network (SABONET) classified 143 plant species in Zambia as threatened (Golding, 2002; Annex 1); of these 33% are woody plants and 67% are herbs. The distribution of these threatened plants by ecosystem is given in Table 2.5. The category 'Unspecified' is derived from the fact that the ecosystem and habitat of 27 species was not indicated in the SABONET report, while the ecosystem of 17 plants occupying special habitats, such as cliffs, hills, rocky soils, lake dunes, limestone sites, rock and rock crevices, was also not given.

Table 2.5 *Distribution of threatened plants by ecosystem and habitat based on the SABONET Red Data list for Zambia (Golding, 2002). The full list of threatened plants is given in Annex 1.*

Broad habitat	Habitat	Species/subspecies	Proportion (%)
Forest	Evergreen	4	2.80
	Montane	7	4.90
	Swamp/Riverine	10	6.99
	Thicket	9	6.29
	Sub-total	**30**	**20.98**
Woodland	Miombo	18	12.59
	Kalahari Sand	3	2.10
	Unspecified	9	6.29
	Sub-total	**30**	**20.98**
Termitary		1	0.70
Grassland	Dambo	16	11.19
	Montane	9	6.29
	Swamp/Floodplain	11	7.69
	Unspecified	2	1.40
	Sub-total	**39**	**27.27**
Unspecified	Special	17	11.89
	Other	27	18.88
	Sub-total	**44**	**30.77**

Herbs are rarely inventoried in forest surveys and were therefore not recorded in ILUA I data. Furthermore, 27% of the threatened species are found in grasslands which are rarely included in forest inventories. The threatened species given in Table 2.5 belong to three threat classes: (i) vulnerable (93%), (ii) endangered (5%) and (iii) critically endangered (2%). The distribution of threatened woody species is dominated by shrubs, suffrutices and climbers (Figure 2.3) that are also usually not recorded in forest inventories.

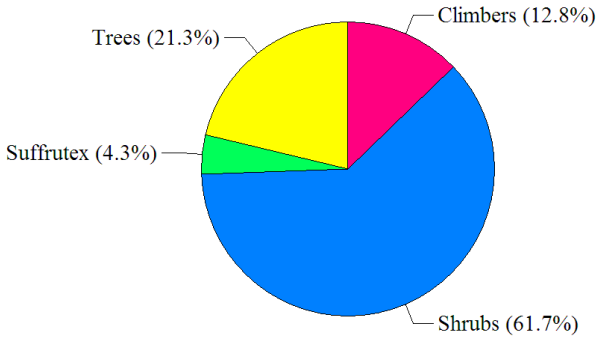

Figure 2.3 *Distribution of threatened woody plants in Zambia based on SABONET Red Data List (Golding, 2002).*

Out of the ten threatened tree species, the ILUA I recorded five (see Annex 1) and the distribution of four of these species is shown in Figure 2.4.

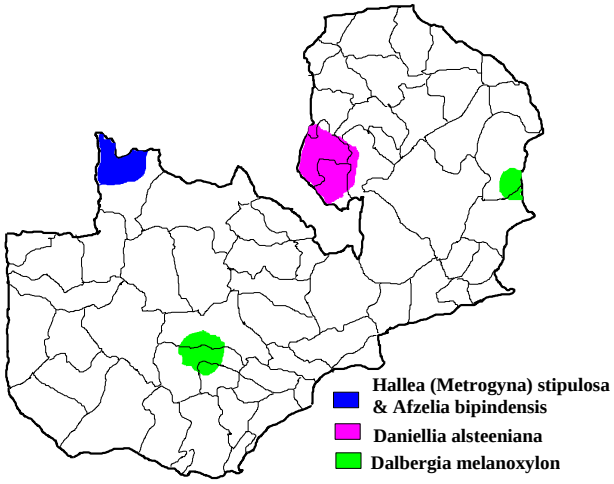

Figure 2.4 *Spatial distribution of four threatened tree species in Zambia, based on ILUA I inventory data.*

3. POLICIES AND STRATEGIES ON FOREST-BASED BIODIVERSITY

3.1. National policies and strategies

The development of legislation dealing with natural resources management dates back to the colonial era. The formulation of laws followed a sector approach as pieces of legislation were formulated to deal with forests, wildlife, land, water, fisheries, and many other natural resources separately. Given the poor coordination, the promulgation of these laws brought about duplication and gaps. The first attempt to coordinate various laws was done under the auspices of the National Conservation Strategy (NCS) of 1985. The NCS aimed to ensure the sustainable use of renewable natural resources and to maintain biological diversity and essential process and life-support systems. The NCS recommended key environmental issues and prescribed policy, legislative and institutional measures to address these issues. The strategy put in place processes such as community management of natural resources and decentralization, capacity building of key institutions, legislative reforms and the establishment of institutions such as the Environmental Council of Zambia, now the Zambia Environmental Management Agency (ZEMA).

The NCS was later updated in the form of a National Environmental Action Plan (NEAP) in 1994. The overall objective of the NEAP was to integrate environmental concerns into the social and economic development planning process in Zambia. The NEAP, through a rigorous analysis of environmental and natural resource-related sectors in the country, including the economic and financial policies, identified areas of concern and put together a time-bound action plan identifying

responsible agencies. A number of other sectoral policies/plans that are supportive to biodiversity conservation were also prepared by the government. These include policies in forest, wildlife, fisheries and agriculture.

The 1999 National Biodiversity Strategy and Action Plan (NBSAP) is the main instrument on which the management of biodiversity in Zambia rests. The key objectives of the strategy are:

i. To conserve Zambia's ecosystems and particular species through a network of protected and unprotected areas.
ii. To sustainably use and manage biological resources.
iii. To equitably share benefits from the use of Zambia's biological resources.
iv. To conserve the genetic diversity of Zambia's crops and livestock.

These strategic objectives are to be achieved through the implementation of the following:

i. Development of a database and information system on ecosystems and the status of particular species.
ii. Periodic assessment of the status of protected areas by land cover and use using remote sensing and ground surveys.
iii. Establishment of a monitoring system for biological resources.
iv. Development and adoption of a legal and institutional framework for the equitable sharing of benefits.
v. Periodic assessment of the status and distribution of traditional crop and livestock varieties and their wild relatives, and the identification of threats affecting them.

The other relevant policies, laws and strategies dealing with the different facets of biological diversity in Zambia are summarized in Table 3.1. Given the dualistic nature of the Zambian society, in addition to the statute law, there is also customary law that has implications for biodiversity management. Whilst statute law confers the rights to use components of biodiversity to holders of the leasehold title, under customary law, resource use rights are allocated to multiple users on the same piece of land.

Table 3.1 *Other relevant national policies and legislation on biodiversity in Zambia.*

Policy/law /strategy	**Purpose/Objectives**	**Responsible institution/key role players**	**Forest biodiversity requirements/Safeguards**
Forest policy/law	i. To ensure the integrity, productivity and the development of forest resources. ii. To promote investment in plantation forestry. iii. To ensure sustainable management of forest ecosystems and biodiversity	i. Ministry responsible for natural resources. ii. Forest Department iii. Local Authorities iv. Traditional rulers and institutions	i. Promotion of a land-use system that ensures the protection of headwaters, river basins and terrestrial resources ii. Development of a land-use policy that recognizes the role of forestry in maintaining ecological and

Policy/law /strategy	Purpose/Objectives	Responsible institution/key role players	Forest biodiversity requirements/Safeguards
	through scientific and technical knowledge. iv. To ensure the growth of forest-based industries	v. Local communities vi. Private sector vii. Non-Governmental Organizations viii. Education and Research institutions ix. Cooperating Partners	climatic functions iii. Identification of additional areas of representative ecosystems and high endemism and provision for their protection iv. Promotion of rehabilitation of degraded and threatened ecosystems
Wildlife policy/law	i. To ensure the provision for the proper protection, management and use of the wildlife estate ii. To maintain the ecological and aesthetic integrity of National Parks as prime samples of the nation's biodiversity and wild ecosystems iii. To provide for adequate protection of major ecological types and species and their habitats that are either not represented or are insufficiently represented in National Parks	i. Ministry responsible for wildlife resources ii. Zambia Wildlife Authority iii. Integrated Resources Development Boards	i. Conservation of entire ecosystems in order to conserve non-conspicuous species ii. Implementation of special measures for the protection of rare or endangered species iii. Assessment of the viability of existing protected area system and the complete representation of different biomes and ecological zones in the country
Environmental policy	i. To conserve, manage and utilize sustainably the country's biological diversity, ecosystems, natural and anthropic habitats, genetic resources and plant and animal species ii. To minimize the adverse impact of climate change and to reduce pollution and emissions of greenhouse gases	All sectors of the national economy	i. Identify valuable areas of biodiversity, particularly outside protected areas ii. Promulgation of a separate Biodiversity Act to support existing legislation iii. Promotion and strengthening of activities of the national gene bank and SADC Regional Plant Genetic Resources at Mt Makulu and national Institute for Scientific and Industrial research
Environ-	i. To provide for the declaration	i. Environmental	i. Protection of ecosystems,

Policy/law /strategy	Purpose/Objectives	Responsible institution/key role players	Forest biodiversity requirements/Safeguards
mental Manage-ment Act	of any wetland as an ecologically sensitive area and the imposition of development restrictions ii. To provide for the in-situ and ex-situ conservation of biological diversity iii. To provide for the effective administration of strategic environmental assessments and environmental impact assessments iv. To provide for the control of pollution and invasive alien species	Management Agency ii. Local Authorities iii. Relevant government institutions iv. The private sector v. Local communities	natural habitats and maintenance of viable populations in natural surroundings ii. Rehabilitation and restoration of degraded ecosystems and promotion of the recovery of threatened species iii. Prevention of the introduction of, control or eradication of invasive alien species which threaten ecosystems, habitats or species iv. Adoption of measures for the recovery and rehabilitation of threatened species and for their re-introduction into their natural habitats v. Inclusion in an environmental brief and environmental impact assessment of development projects of expected impacts on biodiversity, natural lands and geographical resources and the area of land and water that may be affected and their mitigation measures
Biosafety policy	i. To protect Zambia's biosafety and humans from possible adverse effects of genetically modified organisms	i. Ministry responsible for biosafety ii. Research institutions	i. Establishment of a biosafety framework ii. Monitoring impacts of genetically modified organisms on the environment and human health
Agricultural policy	i. To promote sustainable and environmentally sound agricultural practices ii. To promote conservation of aquatic biodiversity and fisheries resources	i. Ministry responsible for agriculture, livestock and fisheries ii. The private sector	i. Promotion of environmentally friendly farming systems, such as conservation farming, afforestation and agroforestry ii. Improved monitoring and creation of fish

Policy/law /strategy	Purpose/Objectives	Responsible institution/key role players	Forest biodiversity requirements/Safeguards
			resources
National Heritage and Conserva-tion Act of 1989	To provide for the conservation of ancient, cultural and natural heritage, relics and other objects of aesthetic , historical, pre-historical, archaeological or scientific interest	i. National Heritage Commission in the ministry responsible for tourism and culture	i. Conservation of natural heritage
Energy policy	i. To ensure environmentally sustainable exploitation of the biomass resource as an energy source	i. Department of Energy in the ministry responsible for energy	i. Development of a regulatory framework of biomass ii. Ensuring better management of woodlands and forests as sustainable sources of woodfuel iii. Improving the technology of charcoal production and utilization iv. Promotion of appropriate alternatives to woodfuel and reducing its consumption v. Expansion of the role of biofuels in the national fuel mix vi. Supporting investment in the biofuels industry through appropriate incentives, standards and research
Water resources policy/Act	i. Provides for the management of water resources	i. Water Affairs Department in the ministry responsible for water resources	i. Establishment of catchment councils to management water resources in catchment areas
Local Govern-ment Act	i. Provides for the system of local government administration at city, municipality and district council levels	i. Ministry responsible for local government ii. Local Authorities	i. Delegation of statutory functions with respect to development planning and participatory democracy
Town and Country Planning Act	i. Provides for the appointment of planning authorities	i. Town and Country Planning Department in the ministry responsible for local government	i. Preparation of structural, regional, integrated development and layout plans to guide physical urban and rural development ii. Preparation, approval

Policy/law /strategy	Purpose/Objectives	Responsible institution/key role players	Forest biodiversity requirements/Safeguards
			and revocation of development plans iii. Regulation of the development and subdivision of land

3.2. International Agreements and Conventions

Zambia is a party to a number of international agreements in the field of environment and biodiversity, and these agreements provide guidance to international environmental policy that stems from the need for countries to cooperate in environmental management. In June, 1992, at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, a number of international policy instruments aimed at achieving sustainable development were adopted. The principal document was Agenda 21 which spelt out a set of integrated strategies and programmes to halt and reverse the effects of environmental degradation, and to promote environmentally sound sustainable development in all countries. Also adopted at the Rio conference was the Convention on Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (UNFCCC).

By signing the CBD and ratifying it later, Zambia legally pledged its commitment to (i) conserve genetic, species and ecosystem diversity, (ii) use its components sustainably, and (iii) share equitably the benefits derived from the use of genetic resources. While emphasizing national actions and national decisions in the conservation of biodiversity, the Convention also sets out inter-country obligations which contracting parties must fulfil. In addition to Zambia's own national needs for developing strategies to arrest current trends in the depletion of its biodiversity and promoting the conservation and sustainable use of biodiversity, the nation has several obligations to fulfil under the Convention. Table 3.2 summarizes some of the obligations highlighted in the Convention in respect of which national action has to be taken in the policy, legal, scientific, technological and capacity building areas.

Table 3.2 *National actions required under the Convention on Biological Diversity.*

Convention Article(s)	Required action(s)
Article 6	Develop national plans, strategies, and/or policies to improve the capacity for biodiversity conservation and sustainable utilization of its components
Article 7	Conduct biodiversity inventories and surveys and identify activities that adversely affect biodiversity
Article 8	Establish/strengthen a system of national protected areas and develop/maintain necessary legislation, institutional capacities and other provisions for biodiversity conservation areas
Article 8, 9 and *10*	Adopt measures to support the conservation of biological diversity outside protected areas
Article 8 and *10*	Encourage traditional and customary use of biological resources that are compatible with conservation and sustainable use requirements

Convention Article(s)	Required action(s)
Article 11	Adopt economically and socially sound measures that act as incentives for conservation and sustainable use requirements
Article 12	Establish/maintain programmes for scientific and technical education and training and promote and encourage research
Article 13	Develop and implement education and public awareness programmes
Article 14	Introduce procedures requiring undertaking of EIA of proposed projects likely to have significant adverse effects on biological diversity
Article 15	Create conditions to facilitate access to genetic resources for environmentally sound uses

Besides the Convention on Biodiversity, there are other relevant conventions and agreements that deal with specific aspects of biodiversity and these are summarized in Table 3.3. The Convention on International Trade in Endangered species of Wild Fauna and Flora (CITES) is based on three lists of categorized species in respect of which international trade is prohibited, regulated strictly, or permitted.

Table 3.3 *International Agreements and Conventions with relevance to forest biodiversity.*

Agreement/Convention	Forest biodiversity requirements or safeguards
Convention Concerning the Protection of the World Cultural and Natural Heritage	Conservation of natural heritage and other objects of scientific interest
Convention on Biological Diversity (CBD)	Conservation of genetic, species and ecosystem diversity
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Regulation of trade in endangered species of animals and plants
United Nations Convention to Combat Desertification (UNCCD)	Conservation of the productivity of land and the control of land degradation
Lusaka Agreement on Co-operative Enforcement Operations Directed at illegal Trade in Wild Fauna and Flora	Control of illegal trade in animals and plants
United Nations Framework Convention on Climate Change (UNFCCC)	Reduction in emissions of greenhouse gases into the atmosphere from deforestation and forest degradation
Ramsar Convention	Conservation and management of wetlands of international biodiversity importance

4. FOREST-BASED BIODIVERSITY INFORMATION NEEDS BY STAKEHOLDERS

Stakeholder requirements for biodiversity information vary according to how the forest and its resources are utilized. The biodiversity uses can be divided into (i) subsistence and livelihood uses, (ii) social and cultural uses, (iii) health care uses, (iv) commercial uses, and (v) ecological uses.

4.1. Subsistence and livelihood uses

There are numerous wood and non-wood products derived from plant resources in Zambia, and the actual species utilized tend to be area-specific (see Annex 2 for an example). The products include fibres (bamboo, bark, grass, leaves, rattan, vines and papyrus), vegetal products (fruits, fungi, leaves, nuts, roots, seeds, shoots, stems, tubers, spices and flowers), wildlife (food and other animal products), medicines and cosmetics, and extractives (dyes, oils, fats, gums, latex, oil seeds, resins and tannins). Grass and papyrus are used extensively for thatching, especially in rural areas, and wild food sources include fruits, nuts, roots/tubers, leaves and mushroom, with some of these playing an extremely important role in food security during a famine. The national biodiversity study (Chidumayo and Aongola, 1997) estimated that one-third of rural households harvest wild food resources in the form of fruits, mushrooms and root/tubers, with a gross annual output of about 31kg per household. Harvesting is done by children, men and women and the impact of harvesting depends on the species. Grasses, reeds, bamboos and palms are useful for crafts, basketry and as house-building materials.

Honey is gathered from bark and log hives and is used as food, for beer brewing or it is sold. This is an important forest resource in some parts of the country, such as in North-Western Province. Edible caterpillars, especially of the emperor moth, *Elephrodes lactea*, are important sources of protein nutrition and cash for some rural households in some parts of the country. For example, large quantities of caterpillars are reported to be collected from miombo woodland in Mkushi, Mpika and Serenje Districts.

Kasumu and Ng'andwe (1996a, 1996b) have shown that households are the major users of timber from indigenous forests and account for 98% of the timber consumed in Luapula and Central Provinces. At the household level, wood is used for construction poles, fence posts, sawlogs, furniture and joinery, sawn timber, boats and canoes, carvings, mortars and pestles, axe and hoe handles etc. Harvesting for these products is selective, with certain species being preferred for certain products (Chidumayo, 1997). Annual consumption varies geographically but is estimated at about 1.0m^3 per household.

Relatively large amounts of wood biomass in the country are used for energy, in the form of firewood and charcoal. The consumption of firewood and charcoal varies not only among provinces but also between urban and rural areas. Annual consumption per household is about 8.0 tonnes of wood equivalent. Charcoal is produced for both subsistence use and sale. The latter is a major livelihood system in Copperbelt, Central and Lusaka Provinces but also for communities living in close proximity to towns in the other provinces.

4.2. Social and cultural uses

Many ethnic groups in Zambia believe in ritual ceremonies, most of which are conducted in the forests. Locally, there are patches of forest protected for this purpose. Trees are also used to indicate the sacred nature of grave yards in many Zambian traditions. Other traditional uses of trees include the protection of river banks, for ornamental purposes, and as meeting places. Often times, traditional use of trees may focus on a single tree or species. For instance, among the Ngoni of eastern Zambia, *Adansonia digitata* (Mlambe) and *Pseudolachnostylis maprouneifolia* (Msolo) are symbolized as holy trees and used as meeting places in villages, while *Euphorbia tirucalli* (Nkhadzi) is commonly planted around grave yards. However, the protection accorded to individual species may extend to other trees around it, resulting in the protection of large patches of forest.

4.3. Health care uses

The use of forests as a source of traditional medicines is common in Zambia. In Central, Copperbelt and Luapula Provinces, a survey showed that over 70% of the respondents had used traditional medicines for domestic and/or commercial use and that the trade in medicines is worth over K10 billion per year (Njovu, 1996). Nswana (1996) has listed 78 species of plants with medicinal value while Fowler (2002) describes about 177 plants used in healing by the Ila people of southern Zambia. Trees, shrubs and herbs in the forests are widely collected and used by both rural and urban populations as medicines. Traditional medicines derived from trees, shrubs and herbs in the forest are perceived to be cheaper, accessible and practical, especially where modern medical facilities are limited, or where these are available but not accessible due to cost. The medicines are used for treating human and animal diseases and to ward off witchcraft, or as charms or indicators of omens. Some species are also reputed for their cosmetic contents while some are used to produce pesticides. Plant parts used as medicine include tree bark, roots and leaves. Apparently, there is no gender bias in the collection, processing and dispensing of herbal medicines, although some cultural beliefs may impose temporary restrictions, e.g. for menstruating women or persons that are in mourning (Nswana, 1996; Njovu, 1996).

4.4. Commercial uses

Commercial uses of tree and forest resources are oriented towards sales. The distinction between livelihood use and commercial use is not always clear as these use-systems normally develop from subsistence and then increase to commercial use. Commercial uses of biodiversity contribute more in terms of assessing the economy of various resources.

Commercial uses of the forests are mainly in the form of timber production. Commercially valuable timber trees include *Pterocarpus angolensis* (Mukwa), *Afzelia quanzensis, Khaya nyasica*, *Baikiaea plurijuga* (Zambezi teak) and *Brachystegia* species. Generally, indigenous forests in Zambia are poor in commercial timber species. The stocking rate of valuable hard woods ranges from 0.5 to 2.0 tonnes per hectare. To supplement indigenous forests, government-owned forest plantations of tropical pines and eucalyptus have been established and these plantations cover about 61,000ha country-wide.

Charcoal production is also a major commercial use of indigenous forests in Zambia. At national level, about 85% of urban households and 15% of rural households use charcoal. Commercial

production of charcoal is concentrated along the old line of rail due to the proximity of large urban markets, but this type of production is spreading to other more rural provinces of the country.

Honey and beeswax are also major products that come from Zambia's forests. The major bee-keeping areas are mainly those in moderate to high rainfall zones covering the central to the northern parts of the country. At its peak, national production was estimated to exceed 1,500 tonnes of harvested honey.

4.5. Ecological uses

Vegetation forms important habitats for animals, while individual trees support a host of other life forms, such as epiphytes, saprophytes and arboreal animals. Symbiotic micro-organisms, such as bacteria and fungi, which live in roots of seed plants, are wholly dependent on their host plants for survival (see Annex 2). Some plants are ecological indicators. For example, *Brachystegia boehmii* and *Parinari curatellifolia* trees are indicators of shallow soils with partial waterlogging while *Diplorhynchus condylocarpon* and *Pseudolachnostylis maprouneifolia* often indicate the presence of copper or nickel. Other species, such as *Ficus sycamorus* and *Syzygium cordatum,* indicate the presence of an aquifer near the surface and are used to site water wells.

Forests and woodlands provide both goods and services that benefit mankind. The tangible goods provided by forests have been described above but other services performed by forests include the regulation of water flow, carbon sequestration, protection of land from soil erosion, and the provision of habitats for wildlife species. Through the regulation of water flow, forests contribute to the maintenance of wetland ecosystems, such as swamps and floodplains, and fish resources that wetlands harbour. Forests regulate stream flows by intercepting rainfall and absorbing the water into the underlying soil, and gradually releasing it into the streams and rivers of its watershed. This minimizes both downstream flooding and drought conditions. Water circulation is closely linked to the climate regulation function of forest ecosystems. Fresh water is intimately involved in the provision of food, wood and non-wood products through photosynthesis, maintenance of soil fertility, flood and erosion control. Forests also influence the local and global climate; they absorb atmospheric carbon and replenish the oxygen in the air we breathe. Although the impacts on human wellbeing of some ecosystem services provided by forests are indirect, they are nonetheless important for sustaining livelihoods, environmental health and security in the river basins.

4.6. Biodiversity information needs

The biodiversity information needs based on the different uses by stakeholders are presented in Table 4.1. However, given the limited resources for ILUA II, it may not be possible, or even efficient, to collect all data required to meet all stakeholder needs. Only in cases where ILUA II has a comparative advantage should such data collection be given a priority. This is something that should be agreed upon in the design stage of the project. Proposed priority information needs for which ILUA II has a comparative advantage are shown by highlighting in bold and an asterisk in Table 4.1. For most of these, the ILUA I database can be analyzed to generate the required baseline information. An example of such information is shown in Figure 4.1 for fruit trees in the country.

Table 4.1 *Forest-based biodiversity information needs by stakeholders. Bold font and asterisk indicates proposed priority information needs for ILUA II.*

Forest biodiversity use	**Stakeholders**	**Information needs**
Agriculture	Farmers	i. Land under agriculture by type of agriculture ii. Potential agricultural land iii. Potential areas for agroforestry iv. **Distribution of threatened ecosystems***
Construction/ building poles	Rural households	i. **Stocking rates of small, medium and large poles by type of forest*** ii. **Threatened species***
Wild foods	Rural households and traders	i. **Distribution of major wild food species*** ii. **Stocking rates of important wild food species*** iii. **Threatened species***
Bee keeping	Honey collectors and bee keepers	i. **Potential areas for beekeeping*** ii. **Distribution of major bee forage species*** iii. **Stocking rates of major bee forage species*** iv. **Threatened bee forage species***
Medicines	Traditional healers, Ministry of Health and pharmaceutical organizations	i. Distribution of major medicinal tree species ii. **Stocking rates of major medicinal tree species*** iii. **Threatened medicinal tree species***
Thatch	Rural households	i. Thatching grass production by forest types ii. Threats to thatch grass production
Grazing and browsing	Livestock farmers and ranchers	i. Grass production by forest types ii. Distribution of major fodder species iii. Stocking rates of major fodder species
Cultural/ spiritual services	Clans, local communities and Chiefs	i. Distribution of species associated with cultural and spiritual services ii. Distribution of forests with cultural/spiritual value/use
Carvings and other household tools and utensils	Rural households and traders, tour operators	i. Distribution of major species used for carvings and other household tools ii. Threatened species used for carvings
Timber	Forest Department, Rural households, pit-sawyers, saw millers and timber traders, conservation organizations	i. **Distribution of major timber species*** ii. **Stocking of major timber species*** iii. **Threatened timber species***
Wood energy	Forest Department, Energy Department, Ministry of Agriculture and Livestock, Local Authorities charcoal producers and traders, farmers, local communities,	i. Distribution of major firewood and charcoal species ii. Stocking rates of major firewood and charcoal species iii. Threatened firewood and charcoal species

Forest biodiversity use	Stakeholders	Information needs
	Chiefs and political leaders	
Nature conservation	Forest Department, Zambia Wildlife Authority, conservation organizations, tour operators, local communities, investors	i. Distribution and status of protected areas ii. Threatened ecosystems and habitats iii. Potential areas for nature conservation
Ecological services	Forest Department, Zambia Environmental Management Agency, Water Affairs Department, Zambia Wildlife Authority, conservation organizations, Zambia Electricity Supply Corporation, conservation organizations, local communities and international organizations	i. Distribution and status of watershed forests ii. **Biomass stocks by forest type*** iii. Distribution of protection forests iv. **Potential areas for ecosystem services***

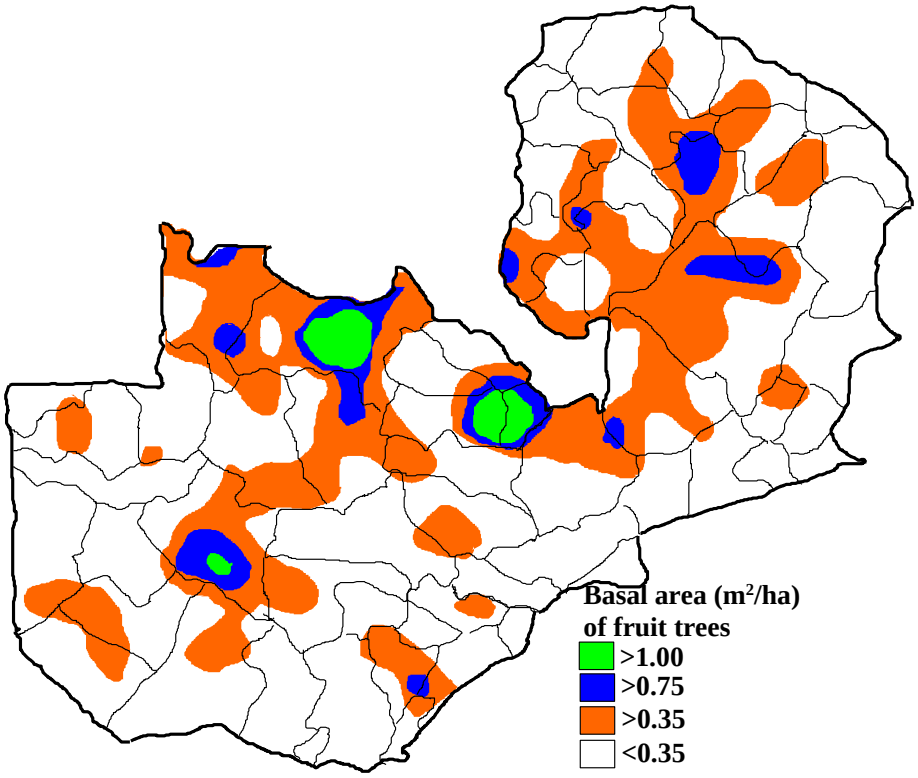

Figure 4.1 *Distribution of standing stock of trees that produce edible fruits in Zambia. Based on ILUA I database.*

5. DEVELOPMENT AND CONSERVATION ISSUES

5.1. Indigenous knowledge and conservation of plants

The harvesting of wood products by local people for subsistence needs is generally selective throughout Zambia. Selection is by species and size. For example, medium-size trees with a diameter at breast height of 3-6cm are preferred for construction poles (Figure 5.1). Such harvesting practices rejuvenate the forest that is usually already dominated by small stems. This arises from the high coppicing ability of indigenous trees. This traditional management practice appears to ensure the availability of a large pool of small-size stems with potential for recruitment into the desirable and more frequently used medium-size stems. However, over-exploitation of the medium-size stems often results in a shift in selection to small-size stems. When this occurs, coppice shoots on stumps are cut at shorter intervals with consequential higher stump mortality. In such cases, stem density may increase with decreasing harvesting pressure, which is associated with increasing distance from settlements.

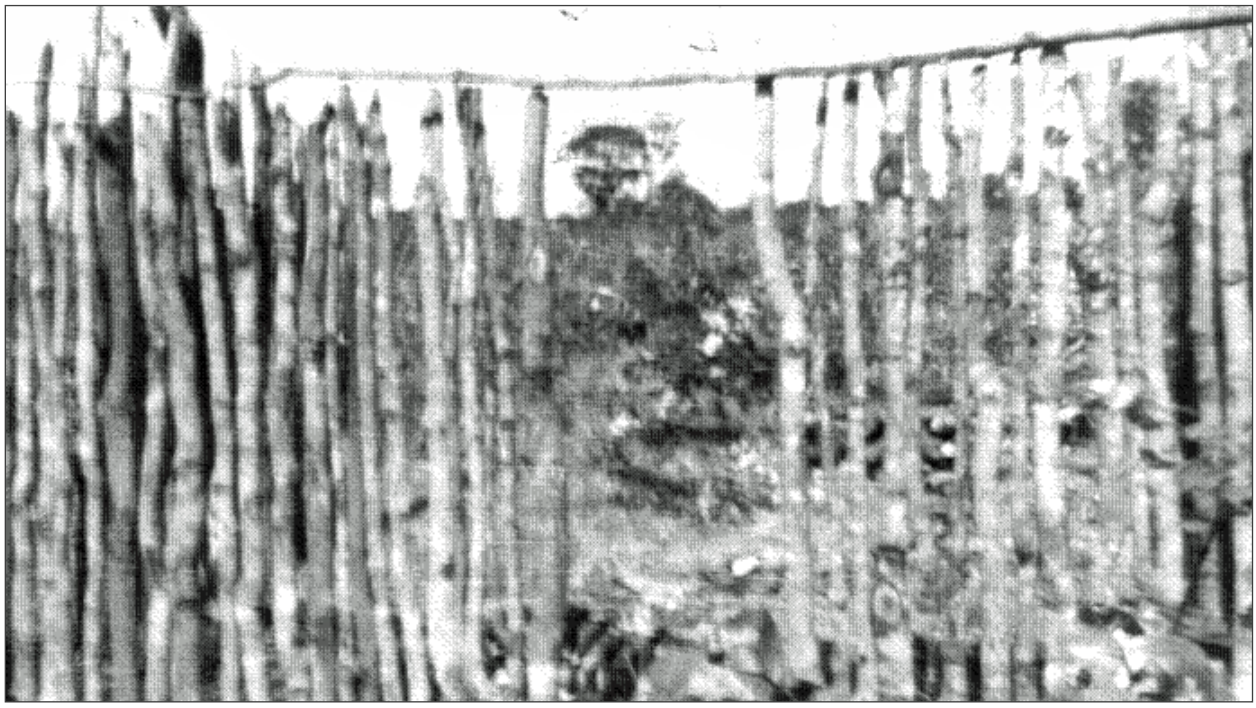

Figure 5.1 *Small poles (3-6cm dbh) for hut construction are harvested in regrowth miombo woodland.*

Traditional farmers, whenever clearing indigenous forests for cultivation, selectively leave some trees for different purposes, such as shade, fruit, fodder etc. The colonial administration discouraged this practice and in its place promoted clear-cutting by stumping (uprooting) trees, apparently to facilitate land tillage by ox-drawn and tractor equipment. Where there was a labour shortage, trees were ring-barked and died slowly, thereby precluding any chance of recovery by vegetative means during fallow. This imposed behaviour worked against the traditional land clearing practices which ensured the preservation of tree parts for future forest regeneration

during fallow. This was resisted in many parts of the country; consequently, the practice of leaving trees when clearing land for cultivation has continued in many parts of Zambia (Figure 5.2).

Figure 5.2 *Preserved trees in cultivated land and regenerating woodland in fallow strips in Chongwe area of Lusaka Province in July 2009.*

Traditional agroforestry systems have been documented among the Kunda in Luangwa and the Tonga in Zambezi valleys (Scudder, 1975). In these systems, selected trees are preserved when clearing land for cultivation. Such trees are valued for their fruit, and with some species, for their medicinal properties and shade. Such practices minimise the effects of bush clearing for cultivation on biodiversity. There are some trees in Zambia that are important for rangeland productivity, shade and fodder for both livestock and wildlife. The most common ones include *Faidherbia albida*, *Acaciaerioloba*, *Acacia sieberana*, *Colophospermum mopane*, *Diospyros mesipiliformis*, *Lonchocarpus capassa* and *Piliostigma thonningii*.

Most traditional shifting cultivation systems involve cutting trees by pollarding and lopping, in which parts of the stem and/or branches are removed to permit crop production, without necessarily killing trees. The lopped branches and tops are piled and burnt to provide ash fertiliser, e.g., chitemene cultivation in northern Zambia. The area is cropped for several years before abandonment, and during fallow, the stumps and roots provide the stock for forest regeneration. The prolonged cultivation under semi-permanent and permanent cultivation systems destroy the regenerative potential of the forest and therefore have a negative effect on forest recovery when abandonment occurs.

Little has been documented about protection and maintenance of flora in indigenous forest management regimes in Zambia. But, there are examples in which households have protected natural woodlots around their homesteads and these are maintained by thinning out undesirable shrubs and other trees (Chidumayo, 1997). The scarcity of valuable wood products from indigenous forests is also forcing farmers in some parts of the country, such as Eastern Province, to protect regrowth in fallows by regulating wood harvesting. The protection of valuable species in and around fields and homes, and the retention of strips of woodland on field contours and boundaries, is also practiced (Figure 5.2).

Management by taboo or religious sanction has in some cases ensured the survival of valuable flora and woodland areas. Taboos on cutting fruit trees, or trees associated with ancestral spirits, occur in some parts of Zambia. Among the Tonga of southern Zambia, the cutting of trees associated with spirits is strictly prohibited (Olsen, 1992; Sorensen, 1993). Sacred groves used for male circumcision, rainmaking ceremonies, meeting places for elders, burial grounds, and natural springs have been protected in this way. Again among the Tonga, each clan has territorial cult shrines called *Malende*, usually consisting of some *Faidherbia albida* trees which are protected by the clan leader (Olsen, 1992; Sorensen, 1993). The *Malende* is regarded as a home of ancestral spirits where people worship and perform rituals for rainmaking.

There are also isolated examples where people have nurtured seedlings, and even planted seeds, of indigenous plants. Olsen (1992) reports that the Tonga people of southern Zambia opportunistically nurture individual *F. albida* trees found growing naturally in fields, and also deliberately promote the growth of one tree with desirable characteristics by methodically pruning it and thinning out other seedlings and juvenile trees around it.

Once the scarcity of a forest resource is recognized, the tendency is often to institute management practices that stimulate tree growth, production and regeneration of useful species. For example, women in the Kafue Flats in Southern Province collect seeds of a *Hibiscus* spp. (used for flavouring fish and meat) from the wild for propagation, and seeds from the most productive plants are harvested and distributed to other interested women (Sorensen, 1993). This is an example of conservation of genetic resources by selection.

Traditional practices for harvesting fruit, edible caterpillars and honey rarely involved cutting down trees. Ripe fruit was harvested by bending over trees or after the ripe fruit had fallen to the ground either naturally or by shaking the tree. Honey collection from hives in hollow tree trunks did not, and to a large extent does not, involve the felling of trees. Traditional harvesting practices ensured that the forest suffered minimum damage. However, under commercial harvesting for local markets and export, these practices are disappearing and more and more often trees are cut to collect fruit; a practice that threatens sustainable fruit and caterpillar production.

5.2. Threats to forest biodiversity caused by livelihood activities

Threats to ecosystems also affect the status of forest biodiversity in the country. Among the most important of such threats are deforestation, forest degradation, cultivation and uncontrolled bush fires. Due to a lack of information, the threat status of the majority of plants in Zambia is not well known, although the situation is improving (see Annex 1). Nevertheless, a number of timber trees are known to be locally threatened due to overexploitation that has caused mature individuals to become rare. These include *Afzelia quanzensis*, *Daniellia alsteeniana*, *Pterocarpus angolensis*, *Khaya nyasica* and *Mitragyna stipulosa* (Chidumayo and Njovu, 1998). This is in spite of declaring some of these species as protected or reserved. Currently, 17 species of trees are reserved under the forest law and can therefore only be cut under licence, although in practice this is difficult to enforce. Trees are reserved on the basis of their timber value (*Afzelia quanzensis*, *Baikiaea plurijuga*, *Dalbergia melanoxylon*, *Entandrophragma delevoyi*, *E. caudatum*, *Guibourtia coleosperma*, *Parinari curatellifolia*, *Pterocarpus angolensis*, *P. antunesii*, *Schinziophyton rautanenii*, *Faurea saligna* and *Dialium* spp.) and fruit value (*Strychnos cocculoides*, *S. spinosa*, *Uapaca kirkiana*, *Anisophyllea* spp. and *Vangueriopsis lanciflora*). Out

of these species, only *E. delevoyi* and *D. melanoxylon* are internationally considered as endangered/vulnerable (see Annex 1). Overharvesting of edible tubers of some orchids, especially for sale, is also threatening some local orchid populations. Some of these are listed in Annex 1.

Fruit harvesting which involves cutting down trees (e.g. *Uapaca kirkiana* and *Anisophyllea* species) or excavating roots and tubers (e.g. *Rhynchosia* and Satyrium species) can have a negative impact on the species population size and structure. On the other hand, although harvesting of mushrooms has little impact, deforestation caused by other activities may negatively affect mushroom productivity of species that live symbiotically with trees (see Annex 2). When woodfuel is obtained from dead wood or wood cut for other activities, this use has a negligible impact on forests. However, when live trees are cut, wood fuel harvesting can deplete forest resources.

The main threat to plants is the destruction of their habitats. This includes mosses, hydrophilous orchids and ferns whose habitats are also being altered by climate change, extreme weather events such as drought, cultivation and wild fires. In some parts of Western Province, the conversion of peat bogs (swamp) 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. The conversion of dry-land 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 host trees.

5.3. Threats to forest biodiversity caused by invasive species

Some introduced species have become very invasive and pose threats to ecosystems and their constituent indigenous species. Among such weeds are lantana, *Lantana camara*, and *Mimosa pigra*. Lantana has become a serious weed in forest plantations in the Copperbelt area and at the Victoria Falls World Heritage site in Livingstone. Control of the weed is difficult because it regenerates both sexually and vegetatively, especially from roots. *Mimosa pigra,* together with the indigenous *Dichrostachys cinerea,* have been expanding their range in the Kafue Flats, perhaps due to climate change and flood regime regulation, at the expense of some indigenous herbaceous plants and wildlife animals (Indira 2007).

5.4. Threats to forest biodiversity caused by development activities

A number of development activities are known to have negative effects on forest biodiversity. These include (i) agriculture, (ii) forestry, (ii) energy supply, (iii) urbanization, (iv) mining and (iv) infrastructure (roads, power transmission and dams). The actual impacts of these activities on forest biodiversity have not been adequately documented in Zambia. However, a recent assessment by BirdWatch Zambia (Likando et al., 2010) provides an excellent example of how these activities impact on protected areas and their biodiversity (Table 5.1).

Table 5.1 *Major threats to Important Bird Areas in Zambia (Likando et al., 2010).*

Priority	Main threat	Specific threat	Proportion (%) of IBAs affected (n = 42)	
			2008	2009
1	Agricultural expansion and intensification	Shifting agriculture	63	38
		Small holder farming	50	27
		Agro-industry farming	32	8
		Small holder plantations	25	8
		Livestock farming and ranching	44	23
		Small holder grazing and farming	44	23
		Fresh water aqua-culture expansion	31	8
2	Residential and commercial development	Housing and urban areas	44	12
		Commercial and industrial areas	31	>5
		Tourism and recreation	38	15
3	Mining and quarrying		31	>5
4	Over-exploitation of species	Hunting and trapping	50	23
		Persecution	31	19
		Hunting and fishing	69	19
5	Invasive species		25	4
6	Pollution	Domestic and urban water pollution	19	12
		Industrial effluents	19	4
		Agricultural and forestry effluents and practices	25	4
		Garbage and solid waste disposal	19	4
		Air borne pollutants	31	4
7	Climate change and severe weather	Habitat shifting and alteration	44	15
		Droughts	50	19
		Abnormal temperatures	56	8
		Floods	50	12

It is a legal requirement under the Environmental Management Act (EMA) of 2011 for any development project that is likely to have significant impacts on the environment to produce an Environmental Impact Statement (EIS) before project implementation. According to the third schedule of the EIS regulations, the impacts and issues included in an EIS are those involving ecological considerations (Table 5.2). Many of these development projects are being implemented without the adequate fulfilment of biodiversity safeguards and therefore continue to be a source of concern for biodiversity conservation in the country.

Table 5.2 *Ecological issues included in environmental impact assessments of development projects*

Biological diversity issues	Sustainable use issues
Effect on number, diversity, breeding sites of flora and fauna	Effect on sink functions of wetlands, rivers soils and natural forests
Breeding populations of fish and game	Effect on regenerative capacities of renewable resources
Effects on gene pools of domesticated and wild flora and fauna	Effects on soil fertility
Effects on the survival of rare, endangered and/or threatened plant or animal species	Nutrient cycles
Effect on plant or animal species of significant conservational, educational or scientific value	Aquifer recharge capacity, water run-off rates, etc.
Effect on plant or animal communities of significant recreational value	Physical extent of habitats
The possibility of introducing plant or animal species alien to the region and which could have adverse effects on indigenous species	Bio-geographical processes
Effect on the ecological functioning of natural communities due to physical destruction of the habitat or reduction in the effective size of the community	Effect on ecosystem functions and processes

The threat of deforestation and forest degradation in forest reserves is caused by excessive cuttings in illegal coupes and commercial harvesting, as well as the conversion of forest to agricultural land by encroachment. These, in turn, are driven by population growth and the basic needs of people. In addition to the demand for fuel wood, the pressure to convert forests in open areas into agricultural land is high. The World Bank estimated that the agricultural gross domestic product in Zambia increased by 7% per year until the year 2000, largely from land expansion, and the conversion of forest to cultivation was projected to increase thereafter by 1.5% per year (Chidumayo, 1997). The major causes for the conversion of land use are population growth and internal migrations, e.g. from Southern Province to Central Province due to droughts of the 1990s. Under customary tenure, land for cultivation is allocated by traditional chiefs. If enough land is not available in open areas, forest reserves may be used because these are often considered as abandoned areas or communal land, and therefore are easy targets for unlawful exploitation and encroachment.

Because charcoal requires more wood for its production, due to wastage during conversion, the use of charcoal in urban areas of the country has serious implications on forest biodiversity. Deforestation has been defined as "the clearance of forest", while forest degradation refers to lesser anthropogenic changes that do not involve complete clearance (Grainger, 1999). Degradation is also defined as the *temporary or permanent reduction in the density, structure, species composition or productivity of vegetation cover*. The conversion of forest reserves to other land uses in urban fringe areas is exemplified by the situation in Lusaka Province (Figure 5.3) where forest reserves in the vicinity of Lusaka city have been converted to urban land use, while others have been either severely degraded, converted to agriculture resettlements or illegally encroached upon.

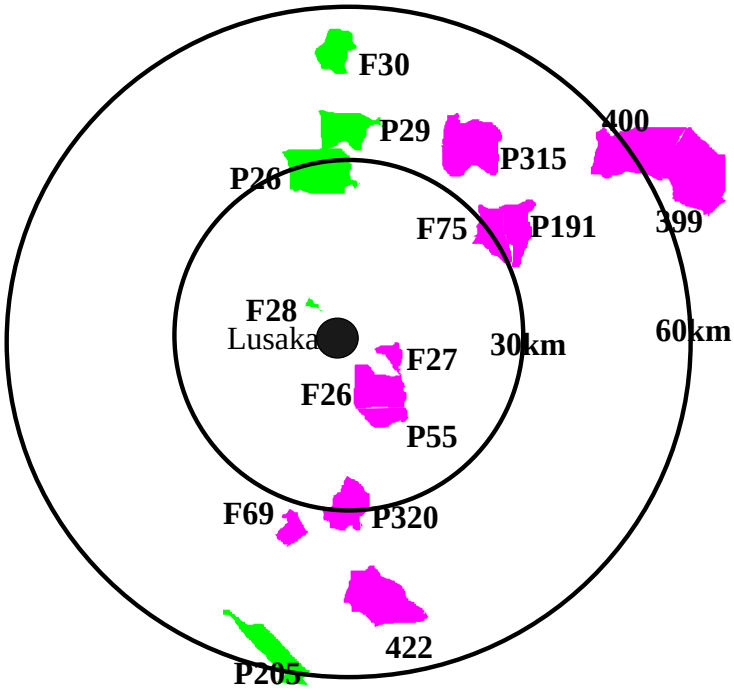

Figure 5.3 *Status of forest reserves in the area surrounding Lusaka City: converted to urban land use (F28, F26, P55 & F28), on the verge of conversion to urban land use (F27) converted to agriculture settlement (F27 and P191, degraded and encroached (P26, P315, 400, 399, F30, F69 and P320) and partially degraded (P29). The solid lines show the 30km and 60km radius from the city centre.*

Most wild fires that damage forest areas in Zambia are caused by man. The timing and frequency of fires determines the effect of the 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. Current unlawful forest practices have affected fire frequency and timing. In the natural state, most forests and woodland vegetation types have a closed and semi-closed canopy, respectively. 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 open "fire-trapped" vegetation that has a low species diversity and biomass.

6. EXISTING AND POTENTIAL DATA AND INFORMATION SOURCES

There are numerous sources of existing and potential biodiversity data and information. Many such sources are linked to specific projects, such as academic research, environmental impact assessments of development initiatives, general land resources assessments, and reports of conservation initiatives. It is not possible to produce a comprehensive list of such sources of biodiversity data and information in this study. The list of reference materials includes some of these sources and a few examples are given below to illustrate the diversity of such data and information sources.

6.1. IBA status and trends report

The Zambia Ornithological Society produced a report in 2009 (Likando et al., 2010) that assessed threats to Important Bird Areas (IBAs) in Zambia (see Table 5.1 above) and observed that woodlands in IBAs were under threat from charcoal production, unplanned dry season fires, timber harvesting and saw milling.

6.2. Graduate research projects

There have been a number of research theses on forestry and environmental sciences that generated data on biodiversity in the country. For example, Indira (2007) mapped the expansion of the invasive weed, *Mimosa pigra*, while Genet (2007) assessed the impact of *Dichrostachys-Mimosa* bush expansion on Kafue lechwe distribution in Lochinvar National Park in the Kafue Flats. The research by Lwando on *Lantana camara* revealed that this invasive bush significantly reduced *Bauhinia petersiana* seed germination and seedling growth and therefore has the potential to negatively affect the recruitment of *B. petersiana* (Lwando and Chidumayo, 2009).

6.3. Conservation initiatives

In 2000, Muzama Crafts Ltd produced a forestry inventory report for parts of Kabompo and Mufumbwe Districts. The report described the vegetation of the areas, the timber stocks and the regeneration. A more general forest management plan was produced for Chiulukire Local Forest in Katete District by the Cooperative League of the USA (2001). The report documented the use of tree and forest resources in Chiulukire Local Forest (Annex 2) and the measures needed for the sustainable use of these resources. The study found that out of the 63 plant species used by the people in and around Chiulukire, each had on average 2 uses (range 1–6) and a large number of species were used for medicines, bee foraging, edible fruits and mycorrhizal symbiosis that supported the production of edible mushrooms (Annex 2).

6.4. Land resources assessments

During the reconnaissance assessment of land resources of Northern and Luapula Provinces conducted during 1968 to 1970 (Mansfield et al., 1976), Lawton carried out an extensive vegetation survey with the following objectives.

i. To determine the vegetative pattern by means of quantitative sampling and to investigate the dynamic relationships within the vegetation
ii. To investigate the effect of fire and other human activities on the vegetation
iii. To determine the significance of the vegetation pattern (including particularly soil-vegetation correlation) in site quality assessment for land use purposes
iv. To determine appropriate methods for forest production and conservation, and
v. To recommend the cultivation of certain minor crops.

The vegetation was sampled at 398 sites, all of which, apart from 13, were located at a soil pit or soil auger boring to facilitate soil/vegetation correlation (Figure 6.1). These sites were chosen by studying the vegetation patterns on the air photographs at the soil sampling sites, and choosing those sites with the least disturbed vegetation.

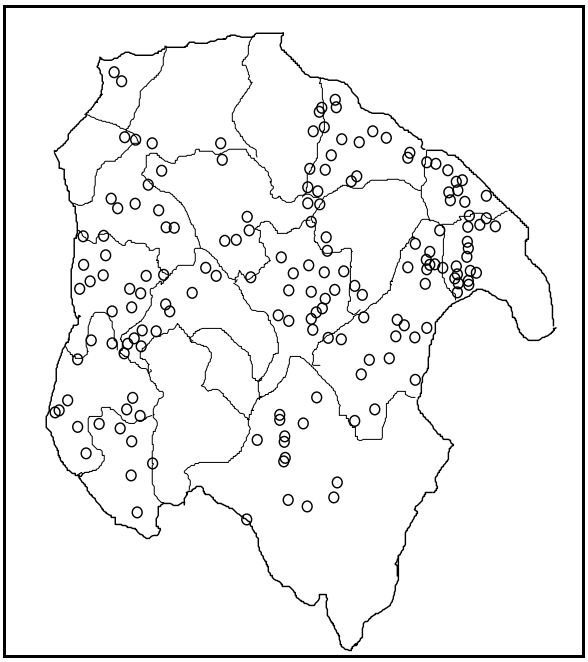

Figure 6.1 *Vegetation sample quadrants surveyed by Lawton (1968 – 1970) in Northern (including Muchinga, except Chama District) and Luapula Provinces in Zambia.*

The samples were 20m x 20m quadrants in which all the woody growth was recorded. Tree height and diameter at breast height (dbh) (1.3m above ground) were measured with a Suunto hypsometer and diameter tape, respectively. Plants <2m high or <5cm dbh were recorded and counted, but not measured. Coppice regrowth was counted in clumps or colonies; the individual shoots were not counted. Reports of such resource assessments can be valuable sources for biodiversity data and information in the country.

The Department of Agriculture, through the Soil Survey Unit, has carried out extensive soil surveys in the country that have been documented as technical reports and maps. The maps contain information on the distribution of soil types, soil fertility, acidity, and erosion hazard. Such maps are important sources of information for ILUA and UNREDD+ projects and can reduce the costs of collecting data on soils. This can be done by superimposing the location of inventory sites on the relevant soils maps and matching site quality characteristics with forest biodiversity variables to determine correlations. In a similar manner, the land-use map of Zambia (Schultz, 1974) although in need of updating, can be a source of information for relating biodiversity data to land use.

6.5. Environmental impact assessments

It is a legal requirement under the Environmental Management Act (EMA) of 2011 for any development project that is likely to have significant impacts on the environment to produce an Environmental Impact Statement (EIS) before project implementation. According to the third schedule of the EIS regulations, the impacts and issues included in an EIS are those involving ecological considerations (see Table 5.2). This means that EIS for development projects can be valuable sources of data and information on biodiversity for specific areas where projects are sited,

and can also be used by conservation organizations to make project developers accountable when they fail to implement biodiversity safeguards during project operation.

7. ILUA II INFORMATION NEEDS FOR MEETING NATIONAL AND INTERNATIONAL REQUIREMENTS

7.1. Monitoring biodiversity

Monitoring is the systematic measurement of variables and processes over time. Monitoring assumes that there is a specific reason for collecting the data, such as ensuring standards are being met (compliance purposes). Another definition of monitoring is "systematic observations of parameters related to a specific problem, designed to provide information on the characteristics of the problem and their changes with time".

Differences between environmental, biological and ecological monitoring are not always clear. Generally, environmental monitoring covers a wide range of activities, including monitoring physical and biotic variables and processes. Biological monitoring is the regular and systematic use of organisms to determine environmental quality. Ecological monitoring is somewhere in between as it often contains environmental and biological monitoring elements.

7.2. Biodiversity indicators

Indicators are variables that measure the status of biodiversity or its response to management activities. Changes in the abundance of species are the best way of determining the sensitivity of biodiversity to forest and land-use practices. In a broad sense, there are two types of indicators: response and pressure indicators. These are summarized in Table 7.1 below.

Table 7.1 *Response and pressure indicators that can be used in assessment and monitoring status of forest biodiversity.*

Indicator description	Indicator type	Indicator explanation/management requirements
Increase in area of deforestation or forest degradation	Response	Indicates overall change in function of forest areas
Abundance of introduced plant species	Pressure	An indicator of invasive problems
Abundance of invasive plants	Pressure	Controlling invasive plants is a critical management factor in conserving endangered species
Effective recruitment in populations of threatened species	Response	Recruitment is key to persistence in species or ecosystems of high value
Localized grazing pressure	Pressure	Specific to plant communities that need some areas protected from grazing

Indicator description	Indicator type	Indicator explanation/management requirements
		pressure
Extent and severity of environmental pollutants	Pressure	Discharges and emissions of pollutants may have significant local effects on sensitive plant communities
Fire frequency and extent within fire sensitive communities	Pressure	Fire is a threat to persistence and recruitment of fire sensitive species
Distribution and abundance of invasive species	Pressure	Determine expansion through formalized reporting of new presences
Fire frequency and extent across landscape	Pressure	Examine role of fire in changing habitat elements of landscape
Land tenure change	Pressure	Percentage of land class in each tenure may relate to land use and potential pressures
Landscape pattern metrics (patch sizes, connectivity)	Pressure	Indicators of fragmentation that can lead to loss of species

Data required for forest biodiversity assessment can be obtained through forest inventories, remote sensing and Geographic Information System (GIS) technologies. In some cases, additional field survey techniques may be needed to inventory taxa not usually included in forest inventory, such as herbs. Data obtained from typical forest inventories include the following.

i. Plot coordinates (latitude and longitude from GPS instruments)
ii. Diameter and height of trees
iii. Health of the stand or trees
iv. Topographical elements
v. Soils and geological substratum, including nature and depth of moisture horizons
vi. Ground vegetation, especially rare and unique species, such as fungi, bryophytes and lichens
vii. Occurrence and extent of regeneration (e.g., seedlings and saplings)
viii. Dead wood, both fallen and standing
ix. Human influence (i.e. cultivation, use-rights, clearing, felling, hunting etc.)
x. Unusual ecotones and species

The actual method for assessing and monitoring biodiversity depends on sampling. Often it is important to stratify the sample units in order to ensure that areas with high biodiversity are correctly represented in the sample. Remote-sensing images can provide a basis for stratifying field-sampling efforts and for mapping distributions of species that are closely associated with

distinctive vegetation types. However, remote-sensing currently cannot provide direct information on species-level diversity.

Remote sensing and GIS can be used both to generate spatial data, for example on forest cover distribution, and to extrapolate the results of intensive ground studies. GIS can also be used to combine data from a range of sources to examine linkages and relationships between different biodiversity indicators. For example, spatial data on species distributions or protected areas can be laid over maps of forest cover to examine the linkages between them.

The appropriate summary and presentation of data is also critical in the effective use of biodiversity indicators. In order to aggregate results of inventories and to monitor change over time, data can be summarized by categories and presented in relation to forest area. For example, forest fragmentation as evaluated by an index of spatial integrity can be expressed as forest area belonging to each class of spatial integrity (extent in km^2 of forest blocks). Similarly, species richness could be presented as the area of forest possessing more than a certain number of tree species per unit area or per 1,000 trees. Categories can be expressed in qualitative terms as dictated by local or national conditions. For example, disturbance classes of high, medium or low timber extraction could be defined based on the frequency of cut stumps encountered in inventory plots. In the case of fire damage, the categories could be based on the frequency of trees with fire scars in the inventory plots.

7.3. Classification and prioritization of information needs for ILUA II

Table 7.2 *Prioritization of information needs for ILUA II*

Priority	Class	Type of information	Basic data in ILUA I
A	Biodiversity indicators	Increase in area of deforestation or forest degradation	Land use and land cover maps and statistics
		Abundance of introduced plant species	Some data on exotic tree species
		Abundance of invasive plants	Not collected
		Effective recruitment in populations of threatened species	Some population data available
		Distribution and abundance of invasive species	Not collected
		Fire extent across landscape	Not collected
		Land tenure change	Data available
		Ecosystem size and connectivity	Land use and land cover maps and statistics
		Population of mature/reproducing conspecifics	Some population data available
		Land use change	Land use and land cover maps and statistics
		Forestry practices	Some data is available

Priority	Class	Type of information	Basic data in ILUA I
B	Threatened ecosystems/habitats	Size	Not available
		Integrity	Land use and land cover maps and statistics
		Connectivity	
		Land use	
		Land tenure	
		Distance from major urban area	Not available
		Distance to major road	Data available
C	Threatened woody species	Protected	Some data available
		Endemic	Not available
		Rare	Data available

7.4. Primary data to be collected during ILUA II

The data collection Forms F1-F6 used in ILUA I are very comprehensive for collecting field data for forest biodiversity, but to save on costs and time, the data questions have been evaluated to provide guidance for ILUA II. The data have been classified into three groups: (i) essential data that needs to collected, (ii) optional data that can be collected if enough resources are available and (iii) data not required which should be left out. Annex 4 gives details of this classification and includes new data variables that are considered essential and that need to be collected to the required detail during ILUA II. Table 7.3 gives reasons for classifying and collecting essential data and including new and/or expanded data variables to guide decision making. The adoption of these proposals should result in considerable cost and time savings for the field inventory during ILUA II.

Table 7.3 *Reasons for which essential data are required for ILUA II. Columns on Form, Section, Question and Data follow ILUA I. For the classification of all the data, see Appendix 4. The data will be collected using ILUA I Forms but adjusted to include proposed changes*

Form	Section	Question	Data	Comment	Reason(s)
F1a	A. Track location	7-14	Geographical description of track location	Essential	Important for relocation in future
	B. Crew/Owner/Information list	18-19	Crew leader and owner	Essential	Important for data queries and land ownership
	C. Population	25	Settlement history	Essential	For relating data to population history
	D. Proximity to infrastructure	26-28	Distance of track to road/settlement	Essential	For relating data to infrastructure
F2	A. Plot access	34	Detailed description of plot	Essential only for permanent plots	Important for plot relocation and access in the future
	B. Work record	48-51			
	D. Plot plan				
	C. Plot starting point	39-47			
		53	Notes	Essential	Important for descriptive data
	2. Track #			Essential	Relating data to track
	3. Plot #			Essential	Relating data to plot
		55	Tree #	Essential	For identity of sample trees and stumps and determining the conservation status of tree species for CBD requirements
		55b.	Stump	Essential	
		56	Species	Essential	
		56b.	Scientific name	Essential	
		57	Tree/stump location		For future relocation of trees and stumps
		57a.	Along plot axis	Essential for marker trees/stumps	
		57b.	Left and right axis		
		58	Diameter		For calculating volume and biomass for forest management and REDD+
		58a.	Diameter at 0.3m AG	Essential (New)	

Form	Section	Question	Data	Comment	Reason(s)
		58b.	Diameter at 1.3m AG	Essential	requirements
		60 (new)	Re-sprouts/Coppices	Essential	For estimating regeneration potential for forest management and REDD+ requirements
		61	Total height	Essential	For calculating volume for forest management and REDD+
		62	Bole height	Essential	
		66(new)	Reproduction		For assessing regeneration potential and bee foraging potential
		66a.	Flowers (False or True)	Essential	
		66b.	Fruits (False or True)	Essential	
		67 (new)	Fire damage (False or True)	Essential	For assessing fire impact on trees for forest management and REDD+ requirements
F4a (Subplots)	A. Soil	75aa (new)	Bulk density	Essential	For calculating carbon content for REDD+ requirements
		75ab	Organic matter	Essential	
		75ac (new)	Soil carbon	Essential	
	C. Tree measurement (H ≥ 1.3m and dbh ≤ 7cm)	77b	Scientific name	Essential	For plant identity and assessing advanced regeneration
		78a	Counts	Essential	
		78b	Total	Essential	
F5 (Land Use)	A. General	82	Protection status	Essential	For relating forest condition to status to protection and/or ownership
		83	Ownership	Essential	
	B. Land management	91	Stand structure (Expand): 91a. Closed forest 91b. Open forest 91c. Wooded grassland 91d. Grassland 91e. Plantation forest	Essential	For linking track/plot to forest/land use classification

Form	Section	Question	Data	Comment	Reason(s)
			91f. Cropland and fallow		
		92b	Shrub coverage	Essential	For identification of thickets
		94	Disturbances (Expand): 94a. Tree cutting for poles 94b. Tree cutting for firewood 94c. Tree cutting for caterpillar collection 94d. Tree cutting for charcoal making 94e. Digging for roots or tubers 94f. Pollarding 94g. Tree hollowing for honey 94h. Grazing 94i. Invasion by alien species 94j. Debarking for medicine	Essential	For assessing causes of forest degradation for forest management and REDD+ requirements
		95	Timber exploitation	Essential	For assessing causes of forest degradation for forest management and REDD+ requirements

8. RECOMMENDATIONS

Based on the analysis presented above, the following recommendations are proposed for consideration.

8.1 One of the main requirements of the CBD is the development of a database and information system on ecosystems and the status of particular species. The ILUA I report concentrated more on ecosystems and very little was reported on the status of particular species, although the database contains more useful data for the analysis of species status. See section 1.2 and 1.3 and especially. Figures 2.1, 2.2 and 2.4 as examples of how these data can be further analyzed to generate information for other national and international requirements.

i. It is recommended that the species data from ILUA I be made easily accessible to the different stakeholders for additional analysis and especially to determine the conservation status of individual tree species at a national level.
ii. ILUA II should also improve data on the identification of plant species. There are over 1,500 woody plant species in Zambia (see sub-Section 1.3) while ILUA I only reported 282 species and no statistical analysis was done to estimate total species from this sample of recorded species (e.g. using estimators of species richness for specific regions within the sampling universe). Plant identification in ILUA II can be improved by providing each field crew with the *Check list of vernacular names of the woody plants of Zambia* by D.F. Fanshawe (1965) which also contains scientific plant names. This publication is available at Forest Research Division in Kitwe. This issue has been discussed with the Forestry Department, which has agreed to acquire enough copies of this handbook for ILUA II.

8.2 Another requirement under CBD is the periodic assessment of the status of protected areas by land cover and use using remote sensing and ground surveys. The ILUA I report concentrated on responses from interviews to report on the status of PAs without integrating these results with field survey and remote sensing results. There is a critical need to use remote sensing and other data sources, such as reports from the Zambia Wildlife Authority (ZAWA), Forest Department, BirdWatch Zambia (BWZ), and others (see Section 5) to assess the prevailing status of protected areas in the country. For example, sample images could be obtained for a sample of PAs from Google Earth to assess the integrity of PAs in the country. It is also important to correlate PA status with other variables, such as population density, land use, infrastructure and other development activities, so that scenarios can be made about the future status of the PAs. Although this may not be the core objective of ILUA II, the ILUA database could contribute relevant data for the country to carry out such a protected area assessment.

8.3 ILUA I made recommendations concerning the establishment of a monitoring system for biological resources. The ILUA II sampling design should therefore include sample tracts and plots that were inventoried during ILUA I so that trends about biological resources could be assessed for the period since ILUA I. Such information is required by many stakeholders (see Section 3).

8.4 To guide decision making on what data to collect during ILUA II field inventory, data collected during ILUA I have been classified into three categories: (i) essential data that need to collected, (ii) optional data that can be collected if enough resources are available and (iii) data not required which should be left out. The reasons for classifying data as essential are summarized in Table 7.3.

8.5 A priority in the analysis of ILUA II inventory data should also include the generation of information that is related to biodiversity indicators (see Table 7.2) that represents information needs shared by many stakeholders.

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ANNEXES

Annex 1 Threatened plant species in Zambia based on the SABONET Red Data List (Golding, 2002). Growth form classification is based on White (1983) for woody plants. Threat status: VU for vulnerable, EN for endangered and CR for critically endangered.

Species	Threat	Other Status	Growth	Habitat
Adenia erecta	VU	Unknown	Climber	Dambo
Adenia tuberifera	VU	Unknown	Climber	Woodland
Adenium multiflorum	VU	Unknown	Shrub	Unknown
Aeschynomene lateriticola	VU	Endemic	Herb	Unknown
Aeschynomene stipulosa	VU	Endemic	Herb	Riverine
Aeschynomene venulosa	VU	Endemic	Herb	Woodland
Aframmi longiradiatum	VU	Unknown	Herb	Unknown
*Afzelia bipindensis**	VU	Unknown	Tree	Woodland
Ageratinastrum palustre	VU	Unknown	Herb	Wetland
Aloe excelsa	VU	Unknown	Herb	Rocky gorges
Antiaris toxicaria welwitschii	VU	Unknown	Woody	Riverine
Aphanocalyx trapnellii	VU	Endemic	Tree	Unknown
*Baikiaea plurijuga**	VU	Unknown	Tree	Unknown
Baphia speciosa	VU	Endemic	Tree	Itigi
Biophytum nyikense	VU	Endemic	Herb	Montane
Biophytum richardsiae	VU	Endemic	Herb	Cliff edges
Brachycorythis conica longilabris	VU	Unknown	Herb	Dambo
Buchnera chisumpae	VU	Endemic	Herb	Rocks
Buchnera cryptocephala	VU	Unknown	Herb	Miombo
Buchnera ebracteolata	VU	Endemic	Herb	Montane
Buchnera nervosa	VU	Endemic	Herb	Dambos
Burttia prunoides	VU	Endemic	Shrub	Itigi
Bussea massaiensis rhodesica	VU	Endemic	Woody	Itigi
Canscora kirkii	VU	Near-	Herb	Waterfall
Cassipourea fanshawei	VU	Endemic	Woody	Thicket
Celosia richardsiae	VU	Unknown	Herb	
Chionanthus richardsiae.	VU	Unknown	Herb	Sand and
Clutia whytei	VU	Endemic	Woody	Wetter
Coffea mufindiensis lundaziensis	VU	Unknown	Woody	Montane
Combretum mweroense	VU	Unknown	Climber	Chipya thicket
Crepidorhopalon involucratus	VU	Unknown	Herb	Woodlands
Crepidorhopalon tenuifolius.	VU	Unknown	Herb	Wetland
Crotalaria criniramea	VU	Endemic	Herb	Unknown
Crotalaria simoma	VU	Unknown	Herb	Unknown
Crotalaria trinervia	VU	Endemic	Herb	Miombo
Croton scheffleri	VU	Unknown	Shrub	
Cucumis humifructus	VU	Unknown	Herb	Swamp
Curculigo multiflora	VU	Endemic	Herb	Unknown

Species	Threat	Other Status	Growth	Habitat
Cyphostemma abercornense.	VU	Endemic	Herb	Hills
Cyphostemma rotundistipulatum	VU	Endemic	Herb	Miombo
Cystostemon hispidissimus	VU	Endemic	Herb	Miombo
*Dalbergia melanoxylon**	VU	Unknown	Tree	Unknown
*Daniellia alsteeniana**	EN	Unknown	Tree	Dry evergreen
Disa nyikensis	VU	Unknown	Herb	Montane
Disa roeperocharoides	VU	Unknown	Herb	Dambo
Disa ukingensis.	VU	Unknown	Herb	Montane
Disperis aphylla	VU	Unknown	Herb	Evergreen
Disperis bifida	CR	Endemic	Herb	Montane
Droogmansia pteropus	VU	Endemic	Suffrutex	Dambo
Embelia upembensis	VU	Unknown	Climber	Miombo
Eragrostis punctiglandulosa	VU	Endemic	Grass	Wetland Flats
Erythrocephalum albiflorum	VU	Unknown	Herb	Miombo
Euphorbia debilispina	EN	Endemic	Herb	Limestone
Euphorbia distinctissima	VU	Endemic	Herb	Unknown
Euphorbia fanshawei	VU	Endemic &	Woody	Unknown
Euphorbia perplexa	VU	Unknown	Herb	Unknown
Euphorbia speciosa	VU	Endemic	Herb	Unknown
Fadogia chlorantha	VU	Unknown	Woody	Kalahari sand
Fadogia schmitzii	VU	Unknown	Suffrutex	Kalahari sand
Fadogia variifolia	VU	Unknown	Woody	Grassland
Faroa corniculata	VU	Endemic	Herb	Rock crevices
Ficus usambarensis	VU	Unknown	Tree	Disturbed
Gladiolus serenjensis	VU	Restricted	Herb	Rocky
Gloriosa sessiliflora.	VU	Unknown	Herb	Floodplain
Gutenbergia mweroensis	VU	Endemic	Herb	Swamp
Gutenbergia spermacoceoides	VU	Unknown	Herb	Dambo
Gutenbergia trifolia	VU	Endemic	Herb	Wetland
Habenaria hebes	EN	Endemic	Herb	Wetland
Habenaria pasmithii	VU	Unknown	Herb	Wetland
Habenaria pubidens	VU	Near-	Herb	Montane
Habenaria tubifolia	EN	Endemic	Herb	Uapaca
Hallea (*Metrogyna*) *stipulosa**	VU	Unknown	Tree	Swamp and
Holothrix tridactylites	VU	Unknown	Herb	Montane
Homalium molle.	VU	Unknown	Woody	Forest
Humularia kapiriensis	VU	Endemic	Herb	Dambo
Humularia minima flabelliformis	VU	Endemic &	Herb	Unknown
Humularia minima minima	VU	Endemic	Herb	Kalahari sand
Humularia pseudaeschynomene	VU	Endemic	Herb	Dambo
Hypoxis dregei	VU	Unknown	Herb	Unknown
Hypoxis fischeri	EN	Unknown	Herb	Miombo
Hypoxis goetzei	EN	Unknown	Herb	Plateau
Hypoxis iridifolia	VU	Unknown	Herb	Miombo

Species	Threat	Other Status	Growth	Habitat
Hypoxis villosa	VU	Unknown	Herb	Unknown
Indigofera emarginella	VU	Endemic	Herb	Open
Ipomoea richardsiae	VU	Unknown	Herb	Woodland on
Jatropha seineri	EN	Endemic	Woody	Carbonaceous
Kotschya africana	VU	Near-	Shrub	Unknown
Kotschya longiloba	VU	Endemic	Shrub	Floodplains
Kotschya suberifera	VU	Endemic	Shrub	Woodland
Maerua paniculata	VU	Unknown	Shrub	Itigi
Malaxis katangensis	VU	Unknown	Herb	Woodland
Meiostemon tetrandrus australis	VU	Unknown	Herb	Acacia thicket
Meiostemon tetrandrus tetrandrus	VU	Unknown	Herb	Itigi
Memecylon zambeziense	VU	Unknown	Shrub	Riverine
Micrargeriella aphylla	VU	Endemic	Herb	Wetland
Milicia excelsa	CR	Unknown	Tree	Unknown
Monadenium discoideum	VU	Unknown	Herb	Unknown
Monadenium filiforme	VU	Unknown	Herb	Unknown
Monadenium friesii	VU	Endemic	Herb	Miombo
Monadenium hirsutum	VU	Unknown	Herb	Miombo
Monadenium pseudoracemosum	VU	Unknown	Herb	Unknown
Monadenium pudibundum	VU	Endemic	Herb	Unknown
Oldenlandia geophila	VU	Endemic	Herb	Sandy
Ophrestia breviracemosa	VU	Endemic	Herb	Uapaca
Oreobambos buchwaldii	CR	Unknown	Grass	Montane
Pavetta johnstonii breviloba	VU	Unknown	Woody	Unknown
Pavetta redheadii	VU	Unknown	Woody	Riverine
Pavetta subumbellata	VU	Unknown	Woody	Montane
Pentanisia confertifolia	VU	Unknown	Woody	Miombo
Platycoryne brevirostris	VU	Near-	Herb	Wetland
Pleiotaxis oxylepis	VU	Near-	Herb	Miombo
Protea caffra mafingensis	VU	Near-	Woody	Montane
Protea kibarensis	VU	Unknown	Woody	Miombo and
Pseudoprosopis fischeri	VU	Endemic	Shrub	Itigi
Psychotria mwinilungae	VU	Endemic	Sub-shrub	Riverine
Psydrax whitei	VU	Unknown	Herb	Evergreen
Rytigynia adenodonta adenodonta	VU	Unknown	Herb	Unknown
Rytigynia adenodonta reticulata	VU	Unknown	Herb	Montane
Satyrium microcorys	VU	Unknown	Herb	Montane
Satyrium monadenum	VU	Unknown	Herb	Montane
Satyrium princeae	VU	Unknown	Herb	Montane
Satyrium shirense	VU	Unknown	Herb	Montane
Schefflera abyssinica	VU	Unknown	Epiphyte	Waterfall
Sebaea perpusilla	VU	Endemic	Herb	Dambo
Securidaca welwitschii	VU	Unknown	Tree	Riverine
Selaginella imbricata	VU	Unknown	Herb	Lithosols on

Species	Threat	Other Status	Growth	Habitat
Spermacoce annua.	VU	Unknown	Herb	Dambos
Spermacoce bangweolensis	VU	Endemic	Sub-shrub	Lake dunes
Spermacoce perennis	VU	Endemic	Herb	Dambos
Stemodiopsis glandulosa	VU	Unknown	Herb	Rocks
Streptopetalum luteoglandulosum.	VU	Endemic	Herb	Grassland
Strophanthus eminii	VU	Endemic	Shrub	Itigi
Tephrosia kasikiensis	VU	Endemic	Herb	Riverine
Tragia micromeres		Unknown	Climber	Lake dunes.
Tragia prostrata	VU	Endemic	Climber	Wetter
Tragiella friesiana	VU	Endemic	Herb	Wetter
Uvaria edulis	VU	Unknown	Climber	Unknown
Vepris termitaria	VU	Unknown	Shrub	Termitary
Vernonia isoetifolia	VU	Endemic	Herb	Dambo
Vernonia mutimushii.	VU	Endemic	Herb	Dambo
Vernonia najas.	VU	Unknown	Herb	Dambo
Vernonia zambiana	VU	Unknown	Herb	Miombo
Vigna comosa abercornensis Verdc.	VU	Unknown	Herb	Rocks
Wahlenbergia ramossima	VU	Endemic	Herb	Wetland

Annex 2 Uses of plants in Chiulukire Local Forest, Katete District.

Species	Use																
	Bee forage	Fruits	Browse	Bark hive	Bark rope	Charcoal	Firewood	Caterpillars	Mushroom host	Medicine	Timber	Carving	Grazing	Thatch	Basketry / furniture	Brooms	Total uses
Acacia erioloba	x																1
Adansonia digitata	x	x															2
Adenia senensis	x								x								2
Afzelia quenzensis	x																1
Albizia harveyi			x							x							2
Annona senegalensis		x															1
Brachystegia allenii				x	x	x											3
Brachystegia boehmii							x		x								2
Brachystegia bussei							x	x	x		X						4
Brachystegia longifolia	x				x	x	x	x	x								6
Brachystegia manga				x	x	x		x									4
Brachystegia spiciformis				x	x		x										3
Brachystegia utilis									x								1
Bauhinia petersiana			x														1
Bridelia carthatica		x															1
Burkea africana								x			x						2
Cassia abbreviata										x							1
Combretum molle	x					x	x										3
Crossopteryx febrifuga								x				x					2
Cussonia arborea								x		x							2
Dalbergia melanoxylon												x					1
Dalbergiella nyasae	x								x	x							2
Dichrostachys cinerea			x														1
Diospyros kirkii		x						x									2
Diplorhynchus condylocarpon	x							x	x								3

Species	Use																
	Bee forage	Fruits	Browse	Bark hive	Bark rope	Charcoal	Firewood	Caterpillars	Mushroom host	Medicine	Timber	Carving	Grazing	Thatch	Basketry / furniture	Brooms	Total uses
Faiherbia albida			x														1
Faurea speciosa												x					1
Flacourtia indica		x								x							2
Garcinia huilensis		x															1
Grass spp.													x				1
Hexalobua monopetalus		x															1
Hyparrhenia spp.														x			1
Julbernardia globiflora	x						x	x	x			x					5
Julbernardia paniculata								x	x	x							3
Kirkia sp											x						1
Lannea discolor	x									x		x					3
Lannea edulis		x															1
Lochocarpus capassa								x									1
Oxytenanthera abyssinica															x		1
Parinari curatellifolia		x	x														2
Pavetta schumanniana										x		x					2
Pericopsis angolensis											x	x					2
Pilostigma thonningii			x					x		x							3
Pseudolachnostylis maprouneifolia	x		x						x								3
Pterocarpus angolensis										x	x						2
Pterocarpus rotundifolius	x																1
Schizophyton rautanenii												x					1
Sterculia africana	x																1
Strychnos cocculoides		x							x								2
Strychnos spinosa		x	x														2
Swartzia madagascariensis			x									x					2

Species	Use																
	Bee forage	Fruits	Browse	Bark hive	Bark rope	Charcoal	Firewood	Caterpillars	Mushroom host	Medicine	Timber	Carving	Grazing	Thatch	Basketry / furniture	Brooms	Total uses
Terminalia mollis									x								1
Terminalia sericea	x								x		x						3
Turraea nilotica										x							1
Uapaca kirkiana		x							x								2
Uapaca nitida									x								1
Uapaca sansibarica									x								1
Vellozia equisetoides																x	1
Xeromphis obvata										x							1
Ximenia americana		x															1
Zanha africana										x							1
Zanthoxylem chalybeum										x							1
Ziziphus abyssinica			x							x							2
Total species per use	14	13	10	3	4	4	6	12	16	15	6	9	1	1	1	1	

Annex 3 Review of data collected during ILUA I and recommendations for ILUA II

Form	Section	Question	Data	Comment
F1a	A. Track location	7-14	Geographical description of track location	Essential
	B. Crew/Owner/Information list	15 -17	Crew name and address of owner	Optional
		18-19	Crew leader and owner	Essential
	C. Population	21-24	Description of population	Optional
		25	Settlement history	Essential
	D. Proximity to infrastructure	26-28	Distance of track to road/settlement	Essential
	E. Track access	32-36	Access coordinates and proximity in time	Optional
F1b	B. Crew/Owner/Information continued	15 -17	Crew name and address of owner	Not required (Repeat of above)
		18-19	Crew leader and owner	Not required (Repeat of above
F1c	List of households	195-198	Enumeration/description of households within 5km of track centre)	Optional
F2	A. Plot access	34	Detailed description of plot	Essential only for permanent plots
	B. Work record	48-51		
	D. Plot plan			
	C. Plot starting point	39-47		
		53	Notes	Essential
F3a	2. Track #			Essential
	3. Plot #			Essential
		55	Tree #	Essential
		55b.	Stump	Essential
		56	Species	Essential
		56a.	Common (Vernacular) name	Optional
		56b.	Scientific name	Essential
		57	Tree/stump location	
		57a.	Along plot axis	Essential for marker trees/stumps
		57b.	Left and right axis	
		58	Diameter	
		58a.	Diameter at 0.3m AG	Essential (New)
		58b.	Diameter at 1.3m AG	Essential
		59	Diameter height	Not required
		60	Year(s) since cut	Not required
		60 (new)	Resprouts/Coppices	Essential
		61	Total height	Essential
		62	Bole height	Essential

Form	Section	Question	Data	Comment
		63	Stem quality	Optional
		64	Tree health	Optional
		64a	Tree condition	Optional
		65	Causative agents 65a. Fire scarring (**FS**) 65b. Debarking for fibre (**DF**) 65c. Ring barking (**RB**) 65d. Pollarding (**P**) 65e. Frost top-kill (**Fr**) 65f. Fire top-kill (**Fi**) 65g. Disease (**D**) 65h. Wildlife (**W**) 65i. Defoliation by caterpillars (**DC**)	Optional
		66	Branches	Not required
		66a	D1	Not required
		67a	L1	Not required
		66b	D2	Not required
		67b	L2	Not required
		66c	D3	Not required
		67c	L3	Not required
		66d	D4	Not required
		67d	L4	Not required
		66(new)	Reproduction	
		66a.	Flowers (False or True)	Essential
		66b.	Fruits (False or True)	Essential
		67 (new)	Fire damage (False or True)	Essential
F4a (Subplots)	A. Topography and soil	70a	Exposition	Optional
		71a	Slope	Optional
		72a	Relief	Optional
		73a	Soil texture	Essential
		74a	Soil drainage	Optional
		75aa (new)	Bulk density	Essential
		75ab	Organic matter	Essential
		75ac (new)	Soil carbon	Essential
	B. Area covered by forest	54aa	Width	Not required
		54ab	Length	Not required
		76a	Area	Not required
	C. Tree measurement (H ≥ 1.3m & dbh ≤ 7cm)	77a	Common (vernacular) name	Optional
		77b	Scientific name	Essential
		78a	Counts	Essential
		78b	Total	Essential

Form	Section	Question	Data	Comment
F5 (Land Use)	A. General	80-81	Land use	Optional
		82	Protection status	Essential
		83	Ownership	Essential
		84	Environmental problems	Optional
		85-87	Fire	Optional
	B. Land management	90	Stand origin	Optional
		91	Stand structure (Expand): 91a. Closed forest 91b. Open forest 91c. Wooded grassland 91d. Grassland 91e. Plantation forest 91f. Cropland and fallow	Essential
		92b	Shrub coverage	Essential
		93	Management plan	Optional
		94	Disturbances (Expand): 94a. Tree cutting for poles 94b. Tree cutting for firewood 94c. Tree cutting for caterpillar collection 94d. Tree cutting for charcoal making 94e. Digging for roots or tubers 94f. Pollarding 94g. Tree hollowing for honey 94h. Grazing 94i. Invasion by alien species 94j. Debarking for medicine	Essential
		95	Timber exploitation	Essential
		96	Silviculture	Optional
		97	Technology used	Optional
	C. Crop/grazing/services and management	138	Grazing activity	Optional
		140	Cropping system	Optional
		141	Water	Optional
		142	Nutrients	Optional
		143	Pest/weed	Optional
		144	Erosion	Optional
		145	Power sources	Optional
		148	Service categories	Optional
		98	Notes	Optional
F6	(Forest/Tree products and services)	99-99a	Product/service category and rank	Optional
		111	Species	Optional

Form	Section	Question	Data	Comment
		111a	Species rank	Optional
		104	Conflicts	Optional
		105	Demand trend	Optional
		106	Supply trend	Optional
		101	Harvester/User	Optional
		101a	Rank	Optional
		103	User rights	Optional
		102	End-use	Optional
		101b	Organizational level	Optional
		101c	Gender balance	Optional
		101d	Child labour	Optional
		108	Extraction frequency	Optional
		109	Extraction trend	Optional
		110	Extraction change reason	Optional
		101c	Legislation awareness	Optional
		101f	Legislation compliance	Optional
		101g	Forestry incentives awareness	Optional
		101b	Forestry incentives application	Optional

Technical editing by Gun Mickels-Kokwe
Copy-editing, layout and cover design by Katarina Zeravica

About Integrated Land Use Assessment (ILUA) Phase II

In 2005, the Government of the Republic of Zambia, through the former Ministry of Tourism, Environment and Natural Resources (now Ministry of Lands, Natural Resources and Environmental Protection; MLNRP) and in an effort to reduce poverty, promote economic growth, fill existing human capacity gaps and fulfil its international commitments, requested technical and financial assistance from the Food and Agricultural Organization of the United Nations (FAO) to design and implement an Integrated Land Use Assessment (ILUA). The aim of the project was to establish a permanent forest and tree monitoring system and to obtain baseline national-level data on forest and other related land use resources. This was in order to address the urgent need for knowledge on the state and trends of Zambian forestry resources, given the lack of existing national level surveys and the need to strengthen institutional and financial capacity. In this way, the ILUA served as a pilot to provide data on the national status of land cover, management and use. The ILUA results were seen as vital to supporting national policy processes and planning, but because ILUA was intended as a national-level inventory, the results had limited utility for informing provincial and district level land use planning and decision making due to limited available funds and therefore applied low sampling intensity.

Therefore, based on discussions held with project stakeholders, the continuation of ILUA through an extension was proposed, in March 2009, to the Government of Finland for financing. Since the Environment and Natural Resources Management and Mainstreaming Programme (ENRMMP) has been launched to bring improved coordination and implementation capacity to the environment and natural resource management sector in Zambia, the project is designed to be implemented during 2011-2014 under this programme, with technical assistance from the FAO.

While ILUA I generated baseline data, ILUA II, to be carried out from 2011 to 2016 aimed to enhance the use and development of data and information systems for forest resource monitoring and Sustainable Forest Management, particularly for provincial level land use planning as well as for selected districts. ILUA II aims to provide information on trends in forest change through refined methodologies, re-assessed field plots and a four-fold intensification of sampling density in order to report at the sub-national level. It also aims to cover socio-economic related information needs via the Forest Livelihoods and Economic Survey in order to better understand the drivers of deforestation and to inform policy interventions which support Sustainable Forest Management. Establishing a monitoring system that captures livelihood needs beyond the forests is critical to designing well-targeted and innovative policy solutions that can support and promote sustainable natural resource management. The principal objectives of the ILUA II project are to strengthen forest and land use inventories at the national and sub-national level, and to support the implementation of Sustainable Forest Management and initiatives to Reduce Emissions from Deforestation and forest Degradation (REDD) through better information, capacity building, dissemination of information, and improved multi-sectoral dialogue.

The main stakeholders of the project are: MLNREP and different departments and institutions with which it collaborates, Ministry of Finance and National Planning, Ministry of Agriculture and Livestock, Central Statistical Office, National Remote Sensing Centre (Ministry of Science and Industrial Research), University of Zambia, Copperbelt University, Centre for International Forestry Research, National Institute for Scientific Research, Zambian Agricultural Research Institute, other national and international education and research institutes, smallholder farmers, NGOs and civil society, UN-REDD and other projects, the FAO and other cooperation partners.

The intended beneficiaries of the project can be summarized as follows: policy and decision makers at all levels, forest industries with an interest in timber and non-timber forest products from forest areas, the international community and international organizations requiring reliable information on the natural environment, NGOs, academia and grassroots organizations with interests in forest resource management, environmental protection, timber trade and extension.

In line with the overall policy of the Government of the Republic of Zambia, the impacts of this project are that benefits of Sustainable Forest Management are increased and mainstreamed in the national economy and policies, thereby supporting sustainable development of environment and rural livelihoods and meeting the Millennium Development Goals in a changing climate.

The project's main outcome is ***"strengthened capacity in planning and implementation of Sustainable Forest Management and REDD through better information capacity building, dissemination of information and improved multi-sectoral dialogue"***. The three main outputs of the project are:

Output 1: Effective means of dissemination and utilization of the information for multi-sector dialogue

Output 2: Improved methodological and human capacity in collecting and analyzing forest resource information for Sustainable Forest Management, REDD monitoring and carbon inventory.

Output 3: Implementation of ILUA II Mapping and Field Survey

ILUA II
Integrated Land Use Assessment Project

Ministry of Lands Natural Resources and Environmental Protection
Forestry Department
P.O. Box 50042
Lusaka, Zambia
Tel. +260 211 221087

Food and Agriculture Organization of the United Nations
P.O. Box 30563
Lusaka, ZAMBIA
Tel: +260 211 252277
or +260 211 252558