REPORT ON

TESTING OF BIODIVERSITY AND LANDUSE ASSESSMENT TOOLS AS A PATHWAY FOR THE ESTABLISHMENT OF INSTITUTE OF BIODIVERSITY POLICY AND MANAGEMENT (IBPM) IN ZAMBIA

Prepared for

THE COPPERBELT UNIVERSITY
SCHOOL OF NATURAL RESOURCES

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ACKNOWLEDGEMENT

We would like to thank the Netherlands Environmental Agency for sponsoring this project. MNP has not only sponsored the project but also has provided experts to help in kick starting the biodiversity modelling project in Zambia.

All individuals from various government departments, research institutions and Non governmental organisations who participated in the practical training workshop are acknowledged.

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ACRONYMS

CBU	Copperbelt University
CLUE	Conversion of Landuse and its Effects
DRC	Democratic Republic of Congo
FNDP	Fifth National Development Plan
LCMS	Living Conditions Monitoring Surveys
MNP	Netherlands Environmental Assessment Agency
MSA	Mean Species Abundance
NGO	Non Governmental Organisation
SNR	School of natural Resources
V2030	Vision 2030
ZACS	Zambia Agriculture and Commercial Show
ZITF	Zambia International Trade Fair

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1 INTRODUCTION

The government of Zambia has for many years promoted the sustainable management of natural resources and the conservation of biodiversity and reduction of poverty. The management and conservation of biodiversity is highlighted in the Fifth National Development Plan (FNDP) (2006-2011), the National Policy on Environment, the Vision 2030 (V20300), the National Environmental Action Plan (NEAP), the National Action Programme (NAP) to Combat Desertification, and the Poverty Reduction Strategy Paper (GRZ 2005).

The testing of biodiversity and landuse tools project responds to Zambia's national environment and natural resources priorities on the management of land resources and conservation of biodiversity. The management of the environment and natural resources are enshrined in the Environmental Protection and Pollution Control Act 1990, Fisheries Act Chapter 200 of 1974 (and Fisheries Act No. 21 of 1974), Forestry Act of 1973 Cap 199 (and Forestry Policy of 1998), Land Act of 1995, Wildlife Act of 1998 (and Wildlife Policy of April 1998).

Biodiversity and landuse modelling project is on going whose initial stages continue to be sponsored by the Netherlands Environmental Assessment Agency (MNP). The project is being implemented by the School of Natural Resources (SNR) of the Copperbelt University (CBU) in Zambia. MNP also has assisted with the implementation of the project by not only providing funds but also allowing one of its staffs to travel to Zambia to help with the training course that was held in Zambia in March 2008.

The main objective of the project was to improve the national application of the biodiversity and landuse models developed by MNP and partners as a pathway for the establishment of IBPM in Zambia. The specific objectives of the first phase of the project was to run a training workshop for individuals from various government departments, Non governmental organisations (NGOs), research institutions in the application of the biodiversity and landuse models. The first phase of the project commenced in January 2008 and ended in August 2008. Part of the first phase included a training course in the theoretical background of GLOBIO3 and a follow up practical training course on the national application of GLOBIO3 and CLUE for the calculation and analysis of the current and future biodiversity and landuse status in Zambia.

This is a summary report of the results achieved since the project was started. The report also outlines the way forward for Zambia in as far as biodiversity and landuse modelling is concerned.

2 ZAMBIA AT A GLANCE

Zambia is a landlocked country covering an area of 752,614 square kilometers, with a terrain which is mostly plateau savanna and a climate which is dry and temperate. Rainfall varies between 700 mm and 1,500 mm per annum. The country is at the heart of the Miombo Ecoregion, listed as one of Wild Wide Fund for Nature (WWF)'s Global 200 Ecoregions due to its high species richness.

2.1 Macroeconomic

The primary focus of economic policy in Zambia remains that of reducing poverty through the implementation of policies that are both growth-oriented and pro-poor. Focusing on pro-poor growth will ensure that the poor participate in the development process. The main growth objective is, therefore, twofold: (a) increase the overall growth rate to an average 7 percent; and (b) ensure that growth benefits the poor. Table 1 shows the annual GDP growth rates in recent years.

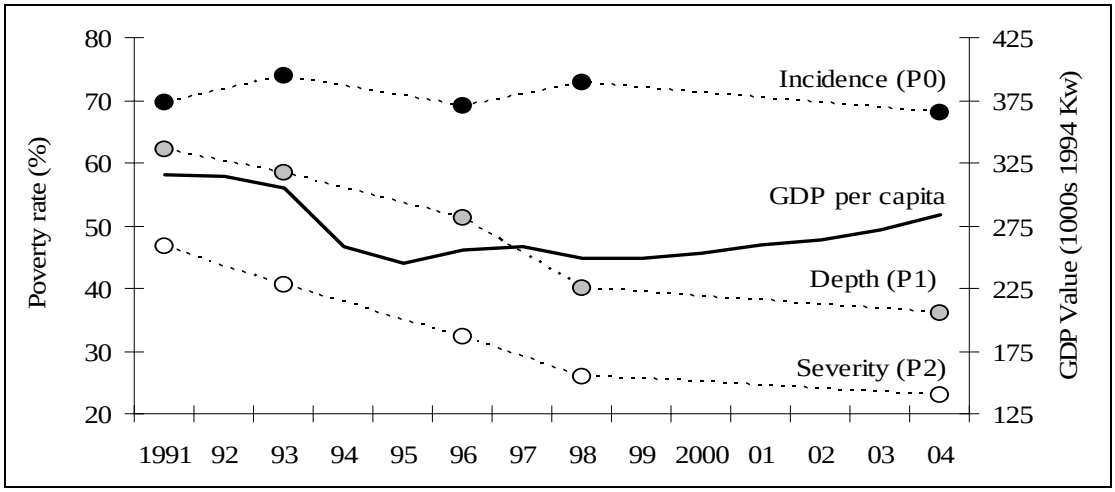
Table 1: Annual GDP growth rates, 1998-2005

	1998-2001 Average	2002 Actual	2003 Actual	2004 Actual	2005* Projections	Average 2002-2005
CONSTANT 1994 PRICES						
Primary sector	2.3	3.8	4.5	7.5	2.7	4.6
Agriculture, forestry, and fishing	1.0	(1.7)	5.1	4.2	2.8	2.6
Mining and quarrying	6.7	16.4	3.4	13.9	2..8	9.0
Secondary sector	4.7	7.2	10.9	9.1	6.4	8.4
Manufacturing	3.5	5.7	7.6	4.7	3.7	5.1
Electricity, gas, and water	4.2	-5.2	0.6	-1.9	5.4	-0.7
Construction	8.2	17.4	21.6	20.5	19.9	18
Tertiary sector	4.0	1.9	3.4	3.2	4.2	3.2
Wholesale and retail trade	4.0	5	6.1	5	6.1	5.3
Restaurants and hotels	8.3	4.8	6.8	6.4	12.1	6.5
Transport, storage, and communications	3.8	1.8	5	6.2	8.5	4.8
Financial intermediation and insurance	0.5	3.5	3.4	3.5	3.5	3.5
Real estate and business services	11.9	4.4	4	4	4	4.1
Community, social, and personal services	2.3	1.6	1.5	0.6	2	1.4
Other	1.0	-13.8	-7.8	-7.6	-11.4	-6.9
GDP at market prices	**2.4**	**3.3**	**5.1**	**5.4**	**5.1**	**4.6**

Government Republic of Zambia, 2006

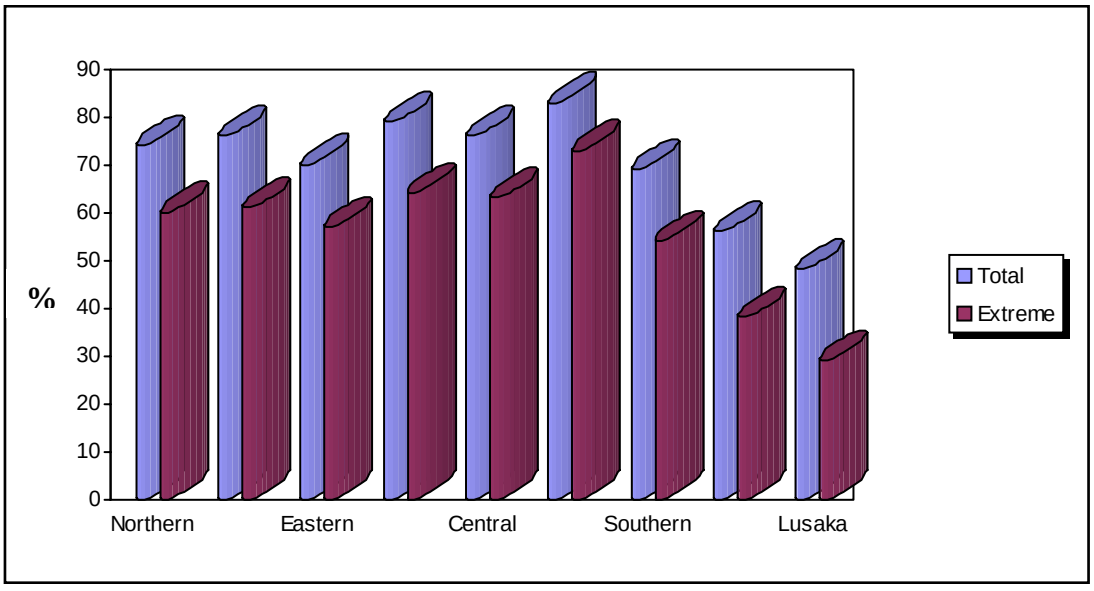
2.1.1 Poverty

In spite of the Poverty reduction support programmes and positive growth trends during the last few years, Zambia is yet to register significant declines in income poverty levels. According to the Living Conditions Monitoring Survey (LCMS) IV of 2004, as much as 68 percent of the population fell below the national poverty line, earning less than K111, 747 (35 USD). Figure 1 shows that poverty levels slightly fell in 2004 compared to 1998 when it stood at 73 percent. The depth and severity of poverty also remain high despite the slight decline since 1998 (Fig.2). The incidence of poverty by province is shown in Fig.2.



Source: Central Statistical Office, 2004

Fig.1: Growth and poverty trends, 1991-2004

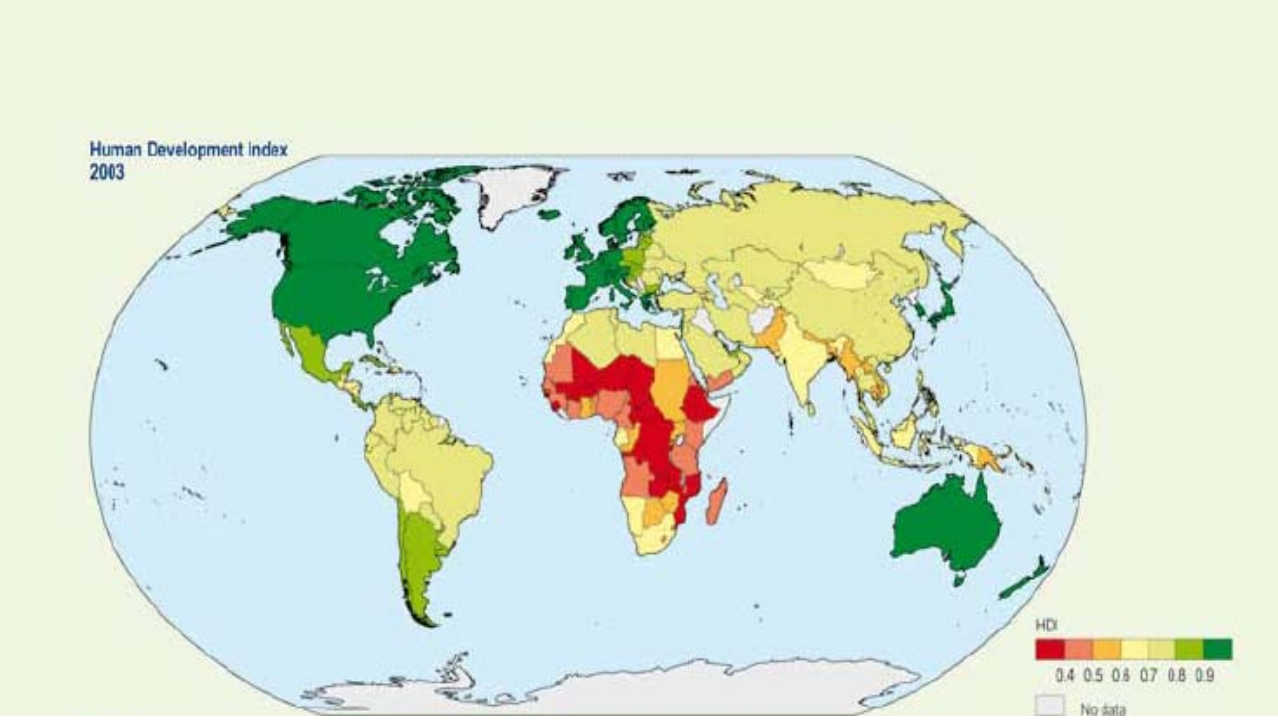


Source: LCMS, 2004

Fig.2: Incidence of poverty by province in 2004

2.1.2 Human Development Index (HDI)

Zambia's HDI is among the lowest averaging about 0.4 (Fig.3)



Source: MNP, 2008

Figure 3: Human development index for Zambia

The Zambian economy has historically been based on the copper-mining industry. However, output of copper had fallen to 228,000 tonnes annum^{-1} in 1998, continuing a 30-year decline in output due to lack of investment and low copper prices and uncertainty over privatization. Since 2001 copper output has been increasing, coupled with a surge in copper prices from 2004 to date rekindling international interest in Zambia's copper sector. Today copper mining is central to the economic prospects for Zambia, but concerns remain that the economy is not diversified enough to cope with unpredictable copper prices.

2.2 Population growth

The population, which is predominantly Christian, is currently estimated to be about 12 million (Fig. 4) with annual growth of about 2.9 percent (Central Statistical Office, 2000). Zambia is one of the highly urbanized countries in the Sub-Saharan Africa. About one-half of the country's 12 million people are concentrated in a few urban zones strung along the major transportation corridors, while rural areas are under-populated. Unemployment and underemployment are serious problems. Per capita annual incomes are currently about $1400 placing the country among the world's poorest nations. Social

indicators continue to decline, particularly in measurements of life expectancy at birth (about 50 years) and maternal and infant mortality (85 per 1,000 live births).

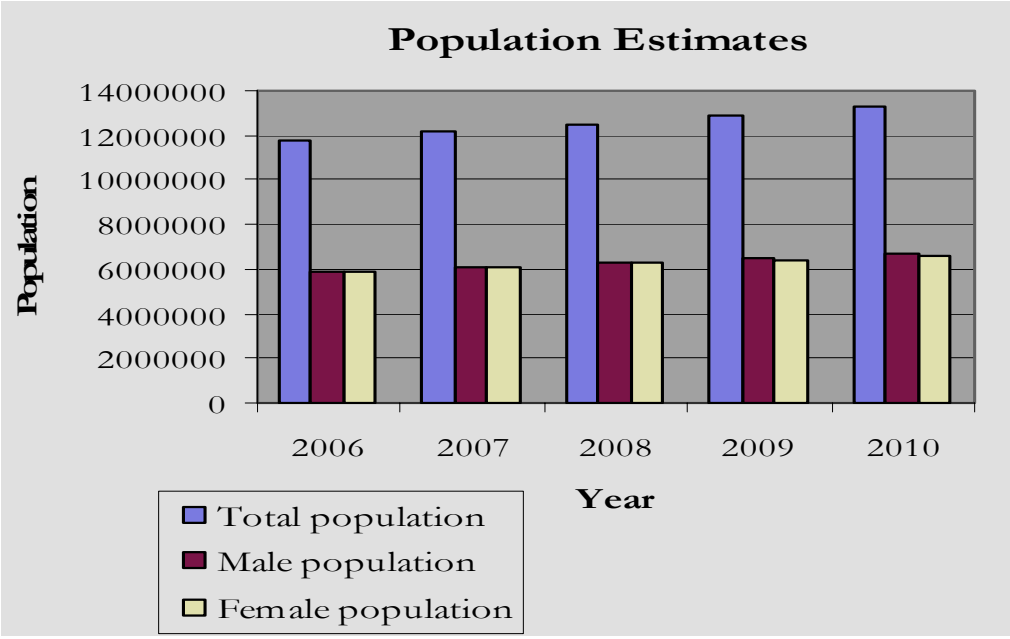


Fig. 4: Population estimates for Zambia

Source: Central Statistical Office 2000

2.3 Land cover distribution

The land cover distribution in Zambia is divided as shown in table 2.

Table 2: Land Cover distribution in Zambia

Landuse	Total area (km^2)
Protected Forests	72,100
National parks	63,500
Game management areas	156,400
Customary/traditional land	153,500
Agriculture land	150,900
Municipal and settlements	72,500
Swamps and grassland	75,500
Water	7,500
Total	**751,900**

The country is endowed with abundant natural resources, which include copper, cobalt, zinc, emeralds, water, forests, wildlife and fertile land. The Miombo Ecoregion supports important populations of fauna, particularly large mammals. The ecoregion is also floristically diverse, harboring some 8,500 plant species, of which approximately 54% are endemic. The southern African office for WWF has identified 26 special areas of biological significance within the ecoregion, based on a) the occurrence of endemic species; b) high species diversity; c)

important or globally significant populations and; d) incorporating, or essential for significant animal movements. Zambia has many areas of biological importance and according to WWF lies within the miombo ecoregion (F.g. 5 and 6)

The country presents one of the best country-level opportunities for conserving prime representative examples of the biodiversity of the Miombo Ecoregion. This opportunity is a function of the low rural population density, the still extensive areas of largely intact natural ecosystems and the political stability the country has historically enjoyed

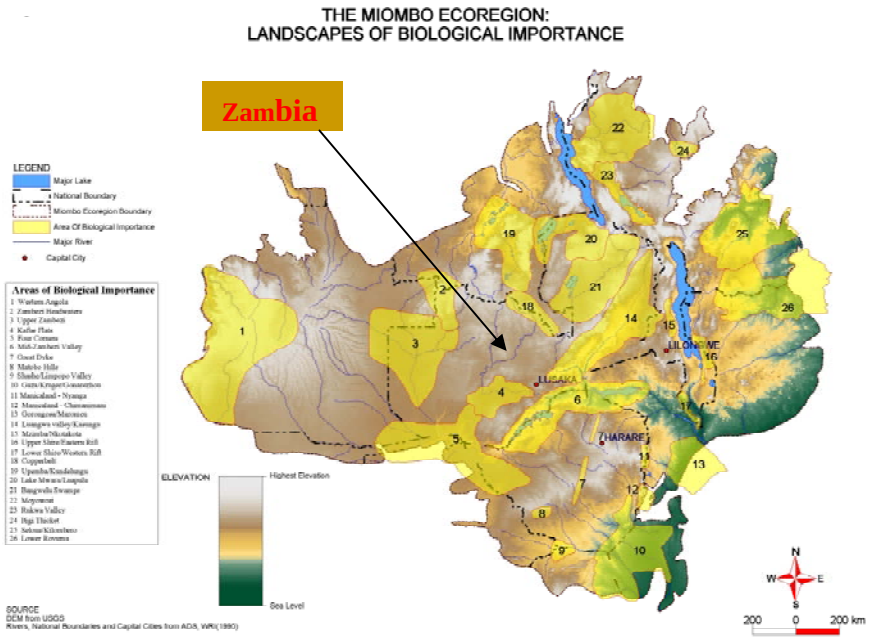


Fig.5: Areas of biological importance

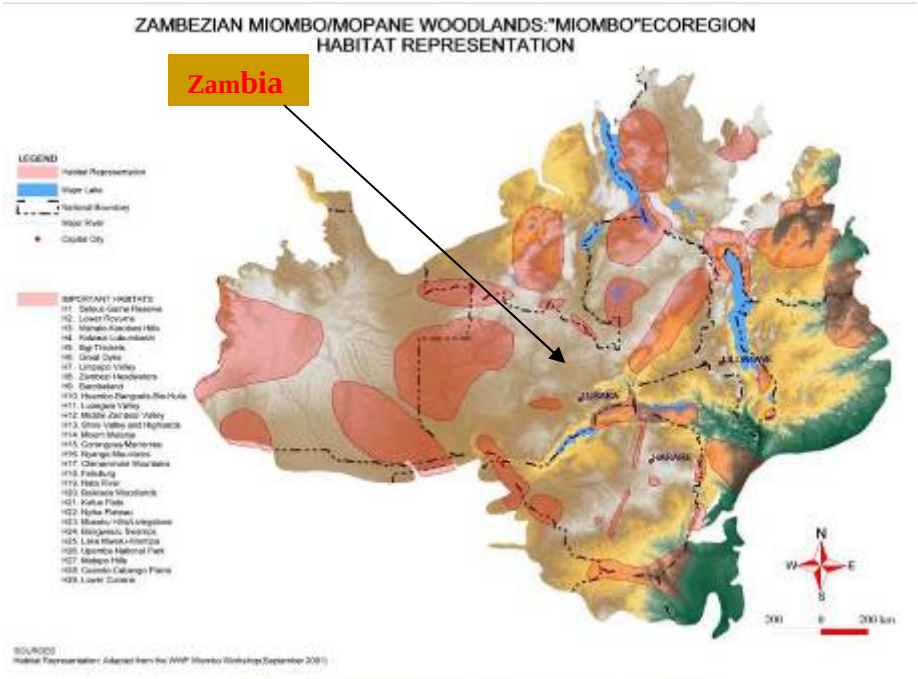


Fig.5: Habitat representation

2.4 Major environmental concerns in Zambia

The major environmental concerns in Zambia are as follows:

- Deforestation.
- Biodiversity degradation.
- Climate change.
- Waste management.
- Pollution

3 BIODIVERSITY AND LANDUSE MODELLING AND ANALYSIS

The first phase of the project involved two training workshops for individuals from different departments concerned with policy making. The first workshop was on the theory of biodiversity and landuse models developed by MNP and its partners. This workshop took three days and was held at the Copperbelt University. Following was a two week practical training workshop (Fig.7) for the same individuals who attended the first workshop. During the two weeks training, participants were able to use the local data sets available to produce the result with the help of an expert from MNP.

Fig. 5: Training session during the two weeks practical course

3.1 Institutions that were involved

The institutions that were involved included;

- Forestry Department.
- Ministry of Tourism, Environment and Natural Resources
- Environmental Council of Zambia.
- Meteorological Department.
- Copperbelt Environmental project
- School of Technology (CBU)
- School of Natural Resources (CBU)
- School of Built Environment (CBU)
- Ministry of Lands
- Ministry of Agriculture

3.2 Outputs

At the time of the workshop, the country had not produced a reliable landuse map that could be used in the exercise. However, the global 2000 landuse map was used. This was a major constraint because getting the country's landuse map from the GLC 2000 meant that most of the details were compromised and hence results not representative.

3.2.1 Landuse

3.2.1.1 Status of landuse for Zambia in 2000

Landuse status for Zambia in 2000 (Fig.8). The map was derived from the global land cover 2000. The disadvantage is that the map misses a lot of details such as plantations, irrigated areas and intensive agriculture

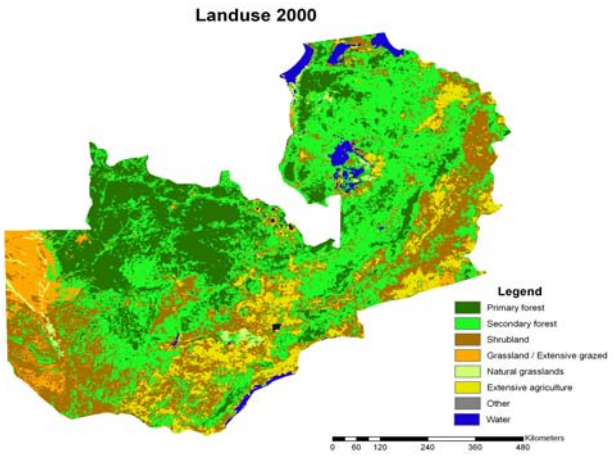
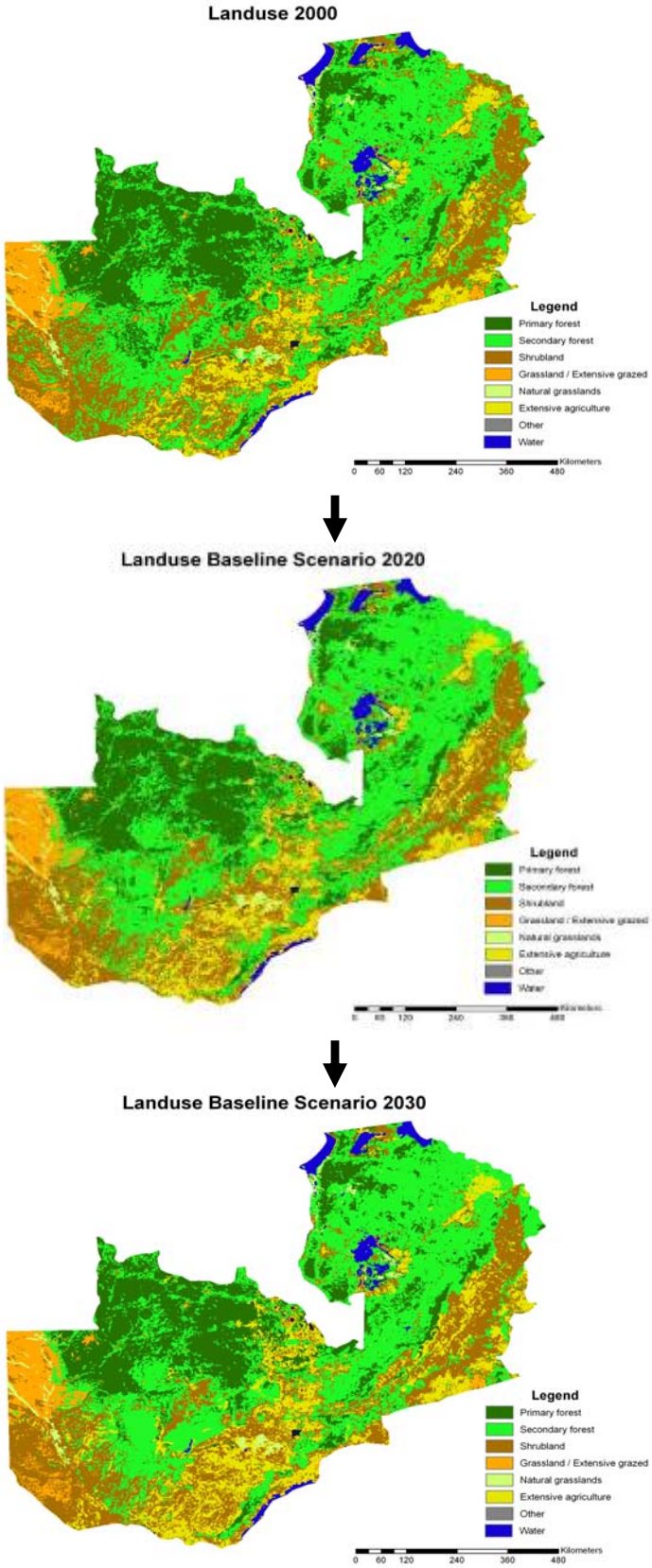


Fig. 6: Landuse status for Zambia in 2000

3.2.1.2 Future status of landuse in Zambia



The government documents were used in modelling landuse status in the future. The documents included the (FNDP) and the (V2030). With reliable landuse map, it could have been possible to come up with representative result (Fig. 9).

Fig. 7: Landuse status for Zambia in 2020 and 2030

3.2.1.3 Scenarios

Two scenarios were used to model future landuse in Zambia and these included:

1. Baseline Scenario:

- Cropland (Extensive Agriculture) demand: increase area under cultivation to 900000ha in 2030.
- In 2006, 12000km .sq. arable land – means 12000/64344 = 1/1.5362 part of the initial agricultural in the GLC Zambia map.

Assumptions

- Years 2000-2006: increase 5% / 5.362, years 2007-2016: increase 10% / 5.362,
- Years 2017-2026: increase 8% / 5.362years 2027-2030: increase 6% / 5.362

2. Forest conservation scenario (policy option):

The forest scenario is conservation oriented.

- Forest: total forest cover (indigenous primary class) in 2030 will reach 15% of country land area.
- An increase in secondary forest is assumed, primary forest remains constant.

The output of the two scenarios is shown in Fig. 10.

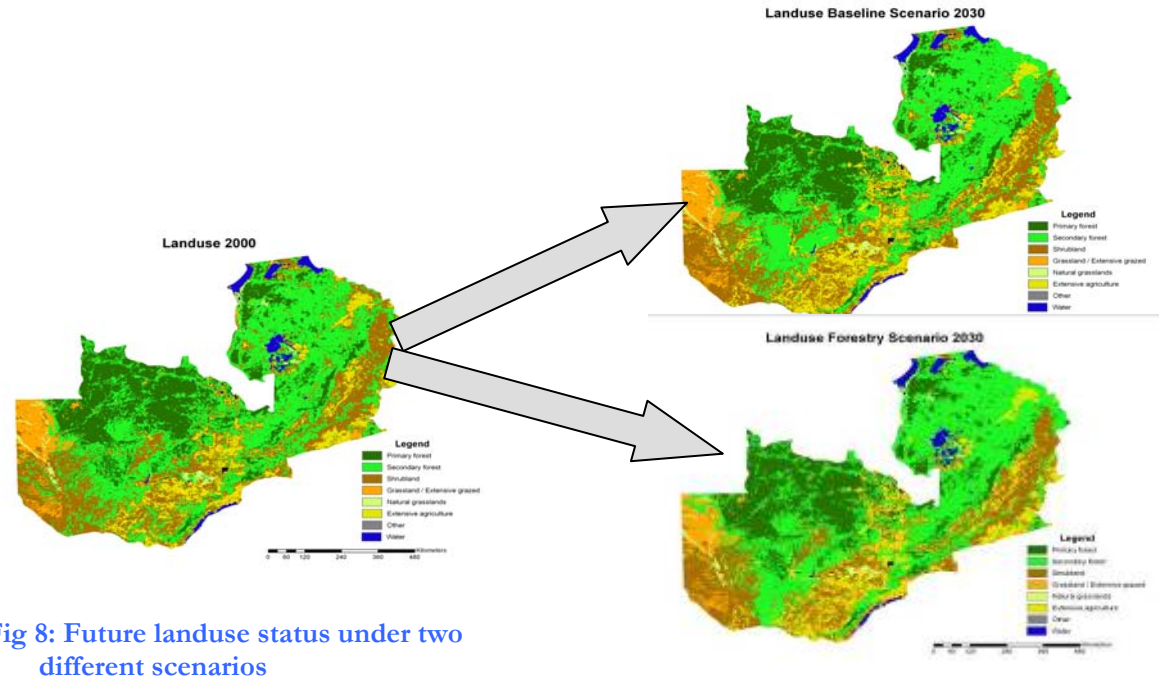


Fig 8: Future landuse status under two different scenarios

3.2.1.4 Probability Maps

The probability maps are useful to test whether the hypothesis for the driving factors of each land use type where correct. The probability for that land use type should then be high on the current locations. The propability maps for primary forest, secondary forest and extensive agriculture were calculated (F.g. 11, 12 and 13).

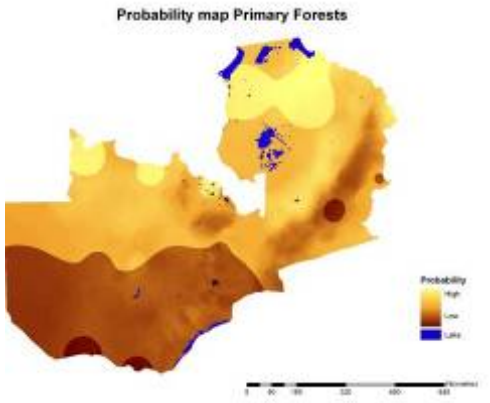


Fig. 9: Probability for primary forest

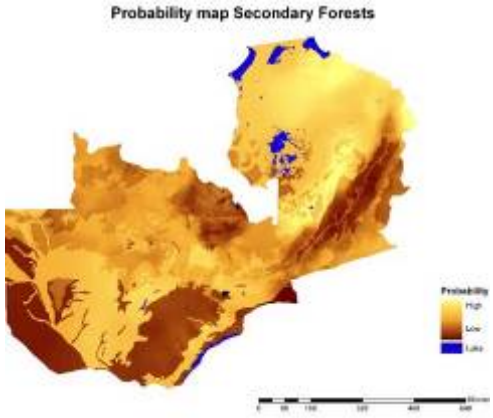


Fig. 10: probability for secondary forest

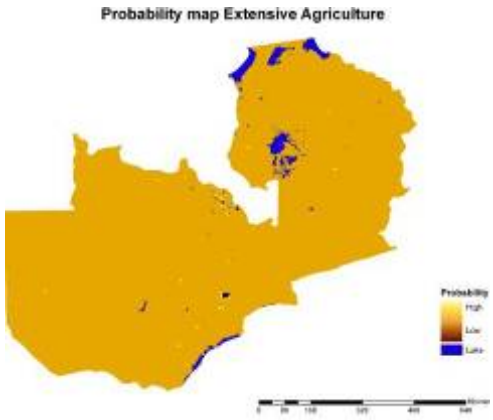


Fig. 11: Probability map for extensive agriculture

3.2.2 Biodiversity

3.2.2.1 Status of biodiversity for Zambia in 2000

The land use map used in coming up with the 2000 MSA map (Fig.14) was obtained from the global land cover map of 2000. The disadvantage is that much detail was lost making the result not so much representative.

Total Mean Species Abundance (MSA) for Zambia 2000

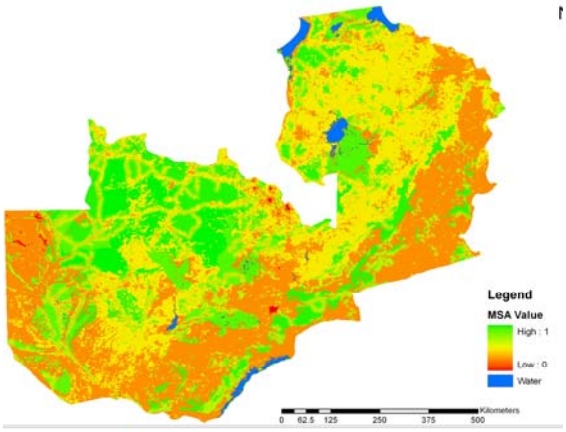


Fig. 12: MSA for Zambia 2000

3.2.2.2 Future status of biodiversity

The future status of biodiversity was also simulated (Fig. 15 and 16). The future landuse map produced using Conversion of land use and its effects (CLUES) was used in the coming up with the future status of biodiversity in Zambia. The government documents such as the FNDP and V2030 were used in the development of scenarios.

The baseline scenario is the business as usual. In this scenario agriculture continue to increase.

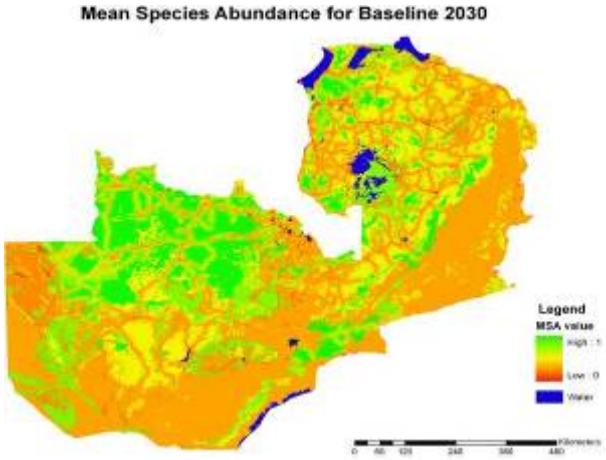


Fig. 13: Biodiversity in 2030 - Baseline scenario

The forestry scenario is a conservation oriented scenario.

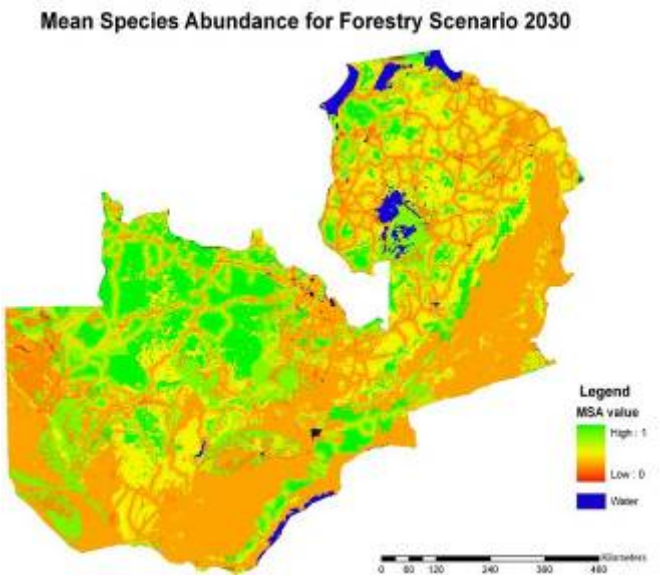


Fig. 14: Biodiversity in 2030 - Forestry scenario

3.2.2.3 Biodiversity per province

MSA loss per pressure per province was calculated (Fig. 17). Eastern province has the lowest remaining biodiversity followed by southern province.

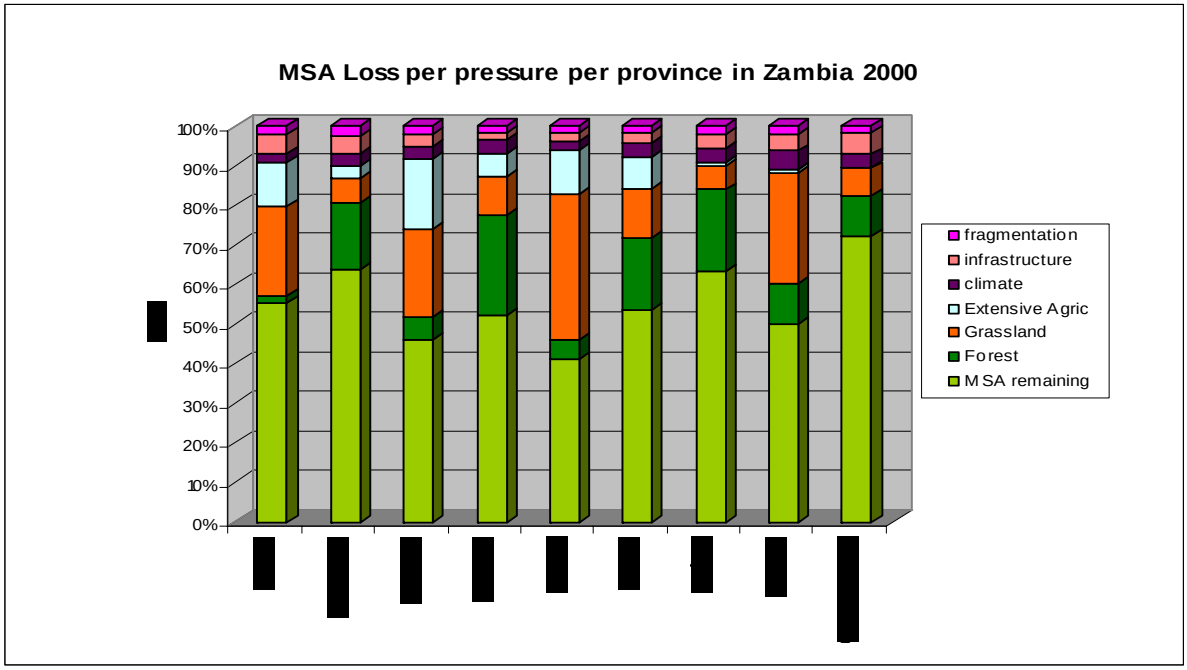
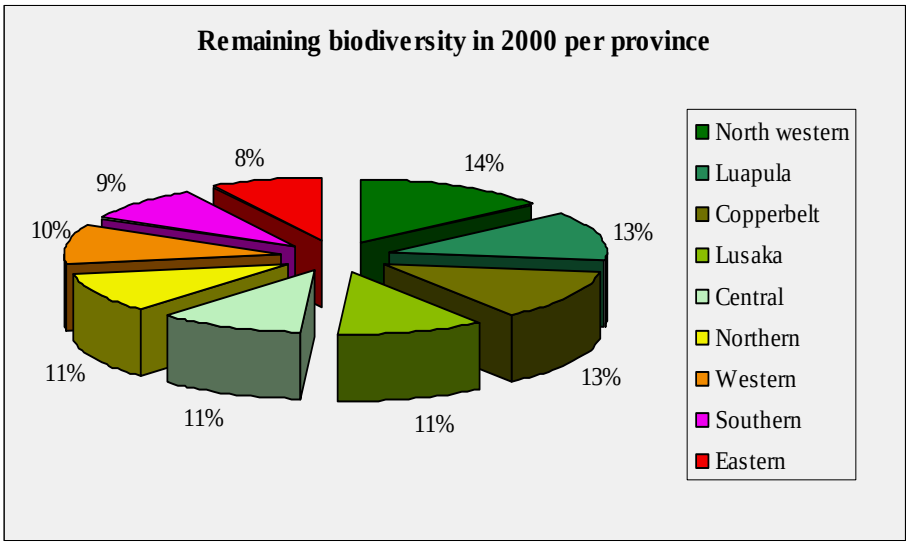


Fig. 17: MSA loss per pressure per province

3.2.2.4 Remaining biodiversity per province

Remaining biodiversity for 2000 and 2030 per province was also calculated (Fig. 18 and 19).



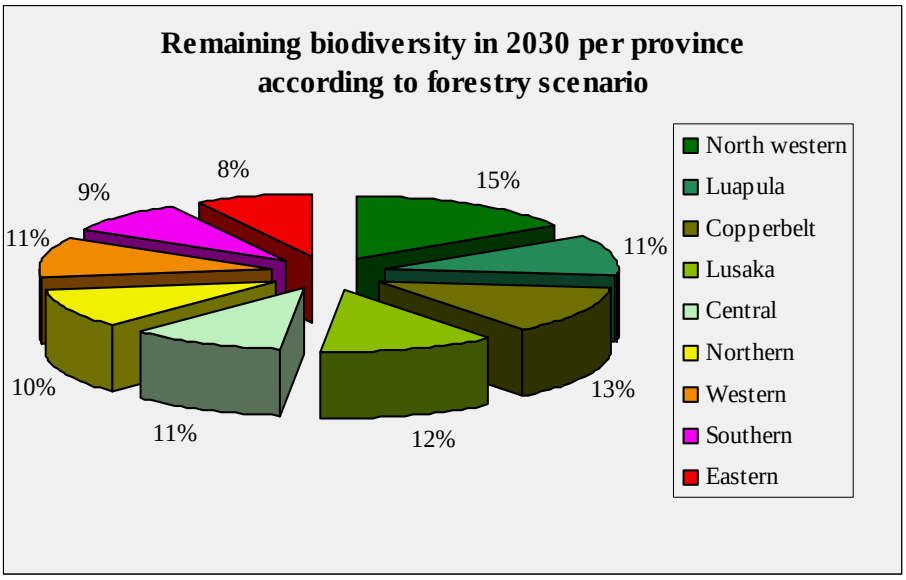


Fig. 16: Remaining biodiversity per province - 2030

3.2.2.5 Biodiversity remaining in protected areas

Protected areas are very important in as far as biodiversity conservation is concerned. It is vital for policy makers to know whether biodiversity hot spots lie in the protected areas or outside and therefore biodiversity remaining in protected area such as national parks was also simulated for 2000 and 2030 for the two scenarios (Fig. 20).

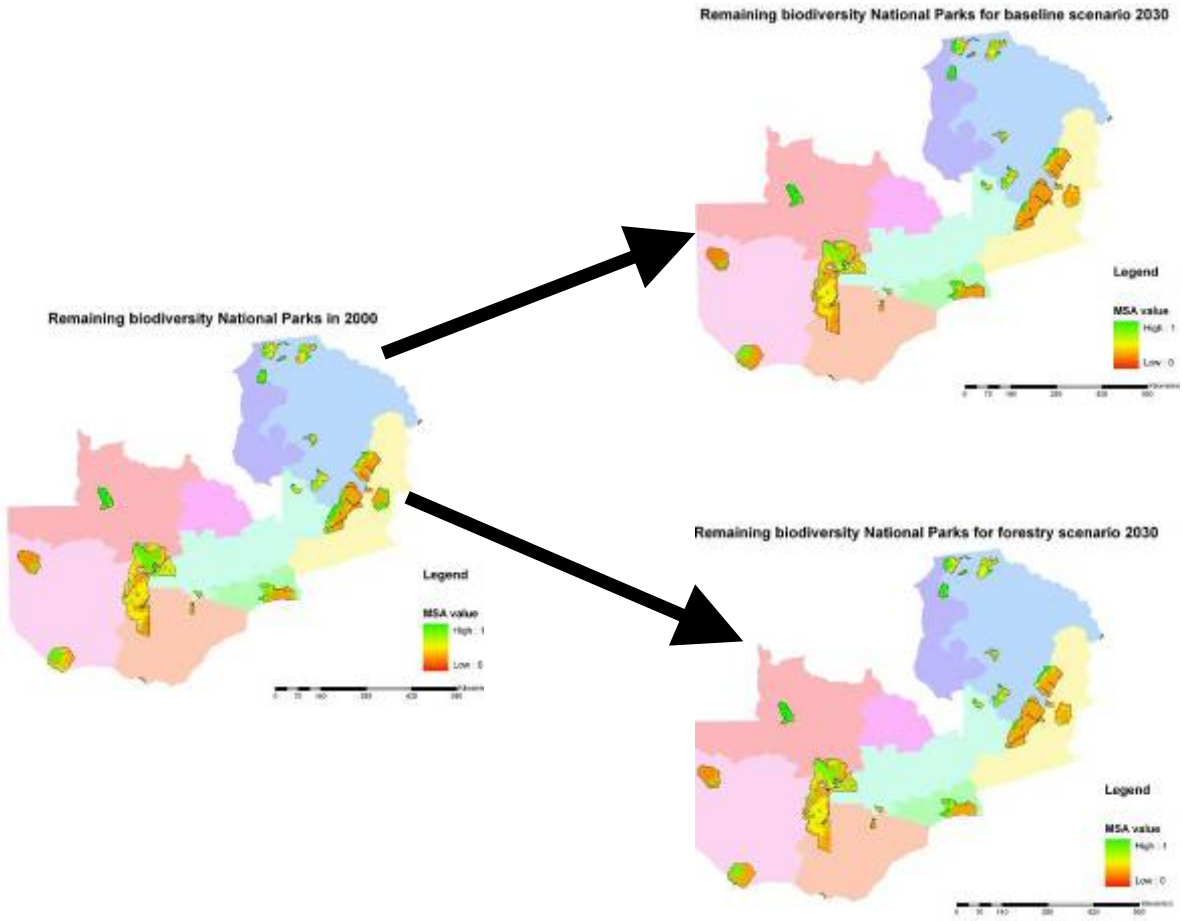


Fig. 17: Remaining biodiversity in protected areas

3.3 Results Dissemination

Much has not been done in communicating the results to relevant policy makers. However the results have been communicated to some stakeholders through exhibitions during the Agricultural and Mining show in Kitwe city in June 2008, at the Zambia International Trade Fair (ZITF) held in July 2008 in Ndola city and at the Zambia Agriculture and Commercial Show (ZACS) held in August 2008 in the Capital city Lusaka (Fig. 21, 22 and 24). Among the notable people who got to see the results was the Vice president of the Republic of Zambia

Fig. 18: Officials of the ZITF being shown the biodiversity modelling results

Fig. 20: Explaining the biodiversity results to ZITF officials

Fig. 21: Results displayed at the ZACS in Lusaka city August 2008

4 WAY FORWARD

The main limitation of biodiversity and landuse modelling in Zambia was the absence of an official landuse map. However, in July 2008, the country produced an official landuse map. Therefore the current biodiversity and landuse modelling is concentrated on the use of this local landuse map to improve the national biodiversity model. The biodiversity modelling team in Zambia is currently working on producing results on both the national and provincial levels. The results that will be produced from the local landuse map will be somehow representative and these results will be communicated to policy makers through workshops, brochures and CD ROMs.

After communicating the results to policy makers, efforts will be undertaken towards institutionalizing the biodiversity modelling and analysis in Zambia.

REFERENCES

Central Statistical Office, (2004). The living conditions monitoring survey

Central Statistical Office, (2000). Census of population, Lusaka

Government Republic Zambia, (2006). Vision 2030, Lusaka

Government Republic of Zambia, (2006). Fifth National Development Plan, Lusaka

MNP, (2008). The Netherlands in a Sustainable World - Poverty, Climate and Biodiversity, Second Sustainability Outlook, Bilthoven; The Netherlands