Republic of Zambia

MINISTRY OF TOURISM

Wildlife and Protected Area Accounts to Support Nature-based Tourism

Technical Report

WWF

Ministry of Finance and National Planning

GPS Global Program on Sustainability

WORLD BANK GROUP

THE WORLD BANK IBRD • IDA | IFC International Finance Corporation | MIGA Multilateral Investment Guarantee Agency

WAVES

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The Zambia Wildlife and Protected Area Accounts to Support Nature-based Tourism, covering the period 2008 - 2015 were produced by the Ministry of Tourism (MoT) with assistance from the Worldwide Fund (WWF) Zambia , the World Bank and the Global Program on Sustainability (GPS). Further information on the Wildlife and Protected Area accounts may be obtained from the addresses below:

The Permanent Secretary, Ministry of Tourism, P.O. Box 30575, Kwacha House, Cairo Road, Lusaka, Zambia, Tel: +260 211 223930

The Permanent Secretary, Ministry of Finance and National Planning, 2251, Fairley Road Ridgeway Lusaka, Zambia, P .O. Box 30147, Tel: +260 211 252 395 or +260 211 252 394

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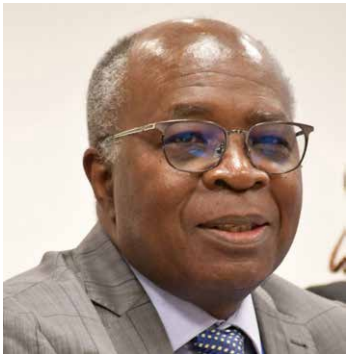
ACRONYMS

BoZ	Bank of Zambia
GDP	Gross Domestic Product
GMAs	Game Management Areas
IUCN	International Union for Conservation of Nature
MoT	Ministry of Tourism
MSUT	Monetary Supply and Use Table
MoFNP	Ministry of Finance and National Planning
MST	Measuring Sustainable Tourism
NCAs	Natural Capital Accounts
NHCC	National Heritage Conservation Commission
PSUT	Physical Supply and Use Table
SDG	Sustainable Development Goals
SEEA	System of Environmental Economic Accounting
SNA	System of National Accounts
TNCA	Tourism National Capital Account
TFCA	Trans frontier Conservation Area
TSA	Tourism Satellite Account
TTWGs	Tourism Technical Working Groups
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNWTO	United Nations World Tourism Organization
WAVES	Wealth Accounting for Valuation of Ecosystem Services
WPAA	Wildlife Protected Areas Account
WPOs	Wildlife Police Officers
WWF	Worldwide Fund for Nature
ZAMSTATS	Zambia Statistics Agency

FOREWORD

Hon. Rodney Sikumba MP.



Hon. Situmbeko Musokotwane MP

This report presents the first Wildlife and Protected Area Account (WPAA) for Zambia to support nature-based tourism using the System of Environmental and Economic Accounting (SEEA) methodology. The wildlife account shows the changes in animal populations, their use and partial accounts for the value of harvested wildlife. It also highlights land cover changes in protected areas, differentiating between the main land cover classes in Zambia such as forest, cropland, grassland, built up, wetlands and water bodies.

A key finding from the accounts is that wildlife and protected areas contribute substantially and increasingly to the economy via nature-based tourism but that animal stocks have declined between the years 2008 and 2015 putting nature-based tourism at risk. The decline can be attributed to various factors including poaching and the loss of habitat to agriculture with croplands within National Parks increasing by approximately 535.1 square kilometers between 2010 and 2014.

It is gratifying to note that Zambia has joined the global coalition on Natural Capital Accounting viz-a-vis the Wealth Accounting and Valuation of Ecosystem Services global programme (WAVES) and its successor the Global Sustainability Program (GPS) led by the World Bank with support from the Worldwide Fund for Nature. This effort has resulted in the development of the first ever wildlife account for Zambia which can inform the strategies for nature-based tourism. Going forward, it is imperative to further look at the recent wildlife datasets and narrow them down to landscape specific data to deepen understanding on which landscapes are highly affected in terms of habitat degradation and species loss.

Minister of Tourism

Minister of Finance and National Planning

FOREWORD

The Zambian government's continued efforts to expand their Natural Capital Accounting with the addition of the Tourism Accounts and updating of the Land and Water Accounts is exemplary. The completion of this first Tourism accounts is a good start to highlighting the interactions between natural assets, mainly wildlife and the economy.

Zambia has identified the tourism industry as one of the important sectors that has potential to contribute significantly towards the country's economic development therefore, a strategy to "Promote Tourism Growth" was included in the 8th National Development Plan. Aside from the Victoria falls and the eight well-known National Parks (South Luangwa, Kafue National, Lower Zambezi, Nsumbu, Kasanka, Lochinvar, Blue Lagoon, and Mosi-oa-Tunya National Park), the country has more "unexplored" nature-based tourist sites, especially in the Northern part of the country. To increase revenue of the economy and create more tourism related jobs particularly for the surrounding rural communities, there is need to invest more in infrastructure that will improve access to these potential sites as well as manage the wildlife and maintain their natural environment in a sustainable manner. In this vein the development of the Tourism natural capital account "Wildlife and Protected Area Accounts to Support Nature-based Tourism" is timely to guide the policy makers on potential public, private, and/or public private partnership investment opportunities for sustainable tourism.

This first iteration of the Account focused on changes in the Wildlife populations and protected areas shows the great value tourism has to the economy. The reported loss of habitat and decline in wildlife populations over this period (2008-2015) is of concern but is also an opportunity for the country to implement better policy interventions. These interventions can begin to address the challenges of crop land encroachment in National Parks and Game Management Areas, as well as the high ranger to wildlife ratio challenge that can help reduce poaching and result in more effective wildlife management.

We are glad to see that this account will be used to guide the management and promotion of nature-based tourism in Zambia. We hope that in future, the tourism accounts will be able to guide policies for sustainable tourism, particularly related to the development of eco-tourism options among other things. However, given the critical importance of this sector to the economy, it is imperative that more investments are made in preserving Zambia's wildlife assets and developing the tourism industry. As this reports highlights, it is really important that data quality and government accounts on wildlife assets and on the tourism sector itself is improved.

We wish to acknowledge the implementing institutions; Ministry of Tourism (MoT), National Remote Sensing Centre (NRSC), Ministry of Lands and Natural Resources (MLNR), Zambia Statistics Agency (ZamStats), Ministry of Water Development, and Sanitation (MWDS), University of Zambia (UNZA), Copperbelt University (CBU) and the program coordinators under the Ministry of Finance and National Planning (MoFNP) for their continued commitment to building the natural capital accounts in Zambia.

Iain G. Shuker
Practice Manager for Environment, Natural Resources & Blue Economy
The World Bank Group

ACKNOWLEDGEMENT

Evans Muhanga

Lois Mulube

We wish to take this opportunity to thank the Tourism Natural Capital Account Working Group for coming up with this Technical Report on Wildlife that will assist the Ministry of Tourism come up with interventions to help in managing various ecosystems by accounting for wildlife stock.

The work presented in this report would not have been possible without the dedicated effort of the Zambia Tourism Technical Working group led by Zondi Chilembo and Edward K. Chilufya, and the following members: Ignatius Mwamba Mwango; Michael Phiri; Chibemba Sikaneta; Moses A. Nyirenda; Tebuho Suuya; Georgina Mumba; Mweene Chaambwa; Priscila Sichone; Richard Mwamba; and Christopher Kaoma. In addition, the support rendered to the Technical Working Group by the Director of Planning and Information, Charles Mweshi, and the Acting Director of National Parks and Wildlife, Mr. Andrew Chomba is also acknowledged.

Appreciation also goes to the Ministry of Finance and National Planning for their coordination role, in ensuring that this exercise is done in collaboration with other natural capital accounts on Land, Forestry and Water. The coordinating team; Richard Lungu, Stanley Nkhuwa and Brian Musonda.

Further, we wish to thank the Worldwide Fund (WWF) Zambia and the World Bank for their financial and technical support rendered in coming up with this report. We also wish to express our gratitude to the Zambia NCA project task team at the World Bank; Ngao Mubanga, Prof. Michael Vardon, Prof. Lloyd Ching'ambo and Rebecca Naomi Munsanda Ngulube . To all the stakeholders that commented to enrich this report, we wish to thank you for your valuable input and insights.

Permanent Secretary

Ag. Permanent Secretary
(Planning and Administration)

EXECUTIVE SUMMARY

The Wildlife and Protected Area Account (WPAA) is meant to Support Nature-based Tourism for Zambia based on the methodology of the System of Environmental Economic Accounting (SEEA). The WPAA is using partial accounts for the value of harvested wildlife as well as the various fees charged under non-consumptive tourism. In order to understand the effects of encroachment on wildlife the WPPAA has used methodology used in developing the Land Account to highlight land cover changes in protected areas, differentiating between the main land cover classes in Zambia such as forest, cropland, grassland, built up, wetlands and water bodies.

Zambia's tourism being predominately nature-based, entails critical understanding of the levels of wildlife, the values of wildlife, the habitat used by wildlife, the extent of encroachments in protected areas, and contribution of non-consumptive use of wildlife to the economy. The country's wildlife estate covers approximately 236,376 square kilometers, equivalent to 31.4% of the country's area. This area consists of: twenty (20) National Parks; thirty-six (36) Game Management Areas (GMAs) which are largely on traditional land; two (2) Wildlife Sanctuaries and; one (1) Bird Sanctuary. The National Parks alone cover approximately 63,632 square kilometers which translates to 8.5 percent of the country's area.

The nature-based tourism is categorised into consumptive use, which refers to mainly hunting conducted in GMAs, and non-consumptive use which is mainly tourist activities such as safaris and photographic tourism concentrated in National Parks. The Eighth National Development Plan (8NDP) recognises tourism as a key sector for the country's economic growth. The value of nature-based tourism has increased from ZMW 20,327,215 to 49,074,586 (141% increase) between 2008 and 2015. To increase the level of nature-based tourism, it is desirable for the Department of National Parks and Wildlife to restock and protect the habitat of its protected areas.

To develop the Wildlife Protected Area Account to Support Nature-based Tourism for Zambia a Tourism Technical Working Group (TTWG) was established with members from the Ministry of Tourism (MoT), Zambia Statistical Agency (ZamStats), Bank of Zambia (BoZ), National Heritage Conservation Commission (NHCC), Ministry of Finance and National Planning (MoFNP), Ministry of Lands and Natural Resources (MoLNR), National Remote Sensing Centre (NRSC) and Worldwide Fund for Nature Zambia (WWF). The TTWG was guided by the System of Environmental and Economic Accounting Framework, which also considered the UNWTO statistical framework for Measuring Sustainable Tourism (MST), Tourism Satellite Account (TSA). These frameworks are based on the accounting framework for measuring the economy – the System of National Accounts (SNA).

The Wildlife Asset account was produced using nationwide population aerial surveys for large mammals conducted in 2008 and 2015. Although there have been various ecosystem based aerial surveys after 2015, there have been no large mammal national aerial surveys since 2015, thus, the TWG had no further data to work with. One key finding from the account was that animal stocks declined between the years 2008 and 2015, in terms of the abundance of species within the National Parks and Game Management Areas (GMAs).

The decline in wildlife could be attributed to various factors which include the loss of habitat to agriculture within national parks as shown in the Land Cover Accounts for Wildlife Protected Areas for 2010 and 2014. This decline occurred despite the legislation (Wildlife Act No 14 of 2015) which does not allow settlements or agriculture activities in the national parks. Settlements recorded an increase of 1.87 % while cropland increased by 101.34% (approximately 535.1 km^2), between 2010 and 2014. Further, deforestation in Zambia was also considered as one of the major drivers of wildlife loss with deforestation estimated at 250,000 hectares per year (GRZ, 2016). There is need to address the decline in wildlife and further research to ascertain the current levels of animal population based on national animal census and the extent of encroachment in National Parks. The Wildlife and Protected Area Accounts will need to be updated for the year 2020/2021 but will depend on the available aerial survey land use data from satellite maps, while information on the fees and charges associated with the consumptive and non-consumptive use of wildlife is also needed. In addition, aligning the reference years for the data on wildlife, land cover and consumptive and non-consumptive uses will increase the usefulness of future Wildlife and Protected Area Accounts for developing and managing nature-based tourism.

The accounts produced show the value of wildlife and protected areas to the economy and also the decline in wildlife abundance and loss of habitat for wildlife. The accounts and associated information can be used to prioritize public investments in wildlife protection and national park management, including law enforcement, as well as highlight areas where the private sector can contribute to both wildlife conservation and the growth of nature-based tourism to achieve sustainable development.

1.0 INTRODUCTION

The Government of the Republic of Zambia has embarked on establishing Natural Capital Accounts, under the coordination of the Ministry of Finance and National Planning (MoFNP). The Natural Capital Accounting (NCA) unifies information of stocks and flows, uses and users, scarcities, and potentials – to highlight how natural resources are contributing to the economy and how the economy affects the environment. Such information is vital for sustainable development planning.

The System of Environmental-Economic Accounting is the internal standard for NCA. The SEEA is an extension of the System of National Accounts (SNA) that adds, among other things, a description of the economy's use of natural resources such as land, forests, water, and wildlife. The SEEA provides a more comprehensive depiction of development than the standard economic measures from the SNA and the indicator Gross Domestic Product (GDP) which is a key output of the SNA, enabling natural resources to be included into traditional economic measurement and analysis.

In March 2017, Zambia formally joined the Wealth Accounting for Valuation of Ecosystem Services (WAVES) Partnership and became the first core implementing country under WAVES+. Zambia initially identified three key areas of priorities for NCA, namely, forestry, land and water. At a later stage, the modeling, tourism, mineral and energy accounts were included. So far Zambia has launched three accounts out of the five accounts targeted. These are the Land, Forestry and Water accounts.

Due to the very limited data available, and concerns about the completeness of the data available on Zambia's wildlife stocks and tourism sector, these accounts are a preliminary assessment of the wildlife and tourism sector. The report provides estimates based on the data available, with some recommendations on how this can be improved in time through improvements in the data collection system for this sector. It is a very important sector for the Zambia economy that would justify upgrading the governments wildlife and tourism accounts.

1.1 Tourism Technical Working Group

To support the development of the Wildlife and Protected Area Accounts (WPAA), the Tourism Technical Working Group was established with members drawn from the Ministry of Tourism (MoT), Zambia Statistical Agency (ZamStats), Bank of Zambia (BoZ), National Heritage Conservation Commission (NHCC), Ministry of Finance and National Planning (MoFNP), Ministry of Lands and Natural Resources (MoLNR), National Remote Sensing Centre (NRSC) and Worldwide Fund for Nature Zambia (WWF).

1.2 The Development Process

The Ministry of Tourism with the support of WWF and the World Bank and under the guidance of the MoFNP commenced the development of the accounts to support tourism in 2019. The development process included stakeholder workshops that were held in collaboration with WWF and the WAVES Programme. In attendance were representatives from MoT, MoLNR, Ministry of Water Development and Sanitation (MoWDS), MoFNP, NRSC, ZamStats, and BoZ. The purpose of bringing these stakeholders together was to take stock of the progress made by the Tourism Technical Working Group (TTWG) in the development of the accounts to support tourism, particularly a WPAA, as wildlife and protected areas underpin much of the tourism activities in Zambia. It also sought and to appreciate the interactions between the WPAA with the Land, Water and Forestry NCAs. Additional work and reviews have now culminated in the production of this report.

1.3 Tourism in Zambia

Tourism in Zambia is dominated by nature-based activities. The country has a varied topography, moderate climate, and an abundance of water bodies, including major rivers and lakes. Some of the most prominent natural wonders are the Zambezi, Kafue and Luangwa Rivers, as well as the Lakes Kariba, Bangweulu and Tanganyika. The country's floral diversity includes over 3,000 species, of which 211 species are endemic. The fauna diversity exceeds 3,600 species, of which 2,032 are invertebrates, 409 fish, 67 amphibians, 150 reptiles, 739 birds, 224 mammals and 598 species of microorganisms[1].

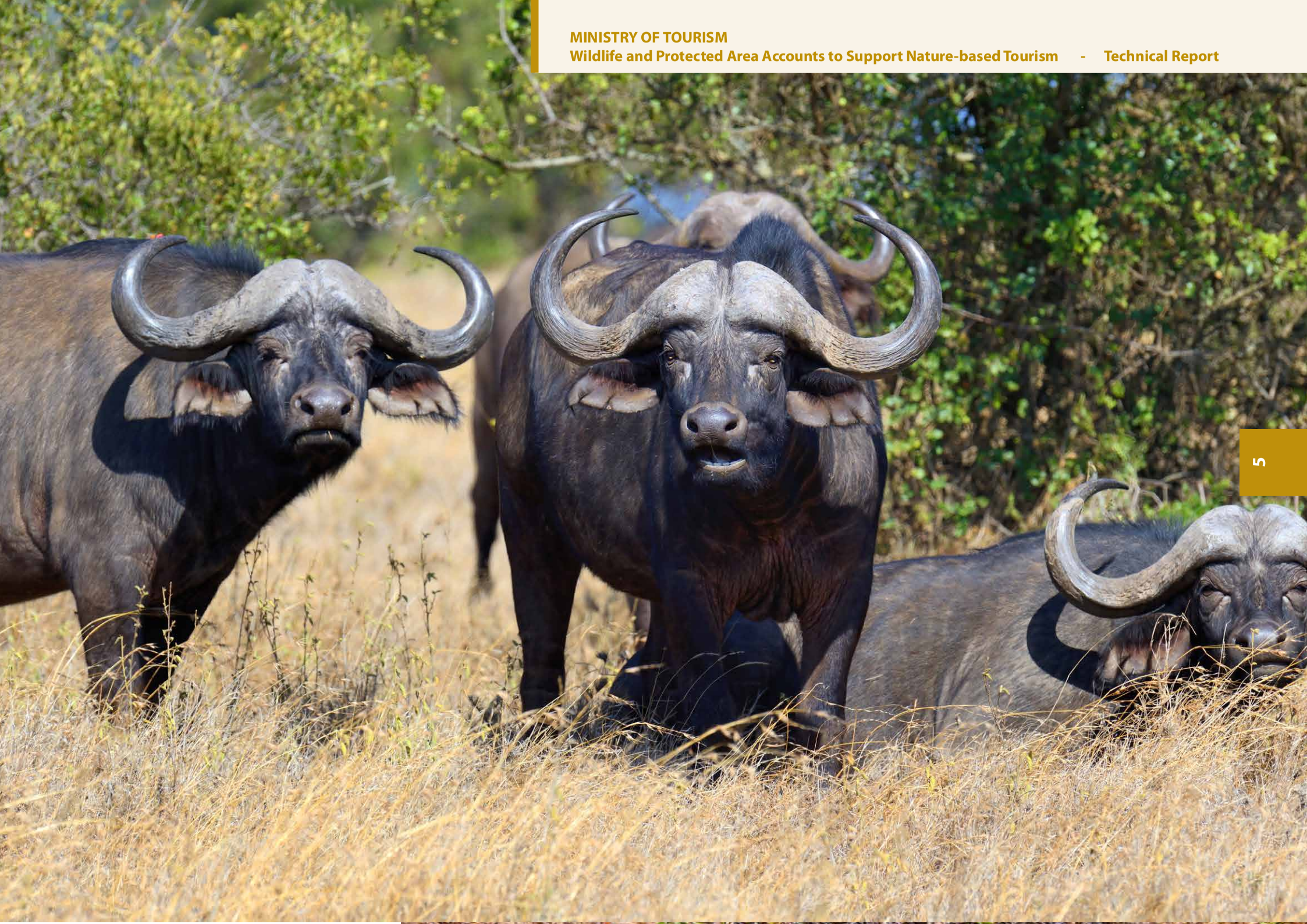
The key attractions are wildlife and the Victoria Falls, known locally, as Mosi-Oa-Tunya. Victoria Falls is among the seven natural wonders of the world and is a designated UNESCO World Heritage Site. Zambia has a vast wildlife estate covering approximately 236,376 square kilometers, equivalent to 31.4% of the country's area. This includes: twenty: (20) National Parks; thirty-six (36) Game Management Areas (GMAs) which are largely on traditional land; two (2) Wildlife Sanctuaries and; one (1) Bird Sanctuary. The National Parks alone cover approximately 63,632 square kilometers which translates to 8.5 percent of the country's area.

The nature-based tourism is categorised into consumptive and non-consumptive tourism based on the way wildlife is used. Consumptive tourism refers mainly to hunting conducted in GMAs while non-consumptive tourism refers to tourist activities, such as safaris and photographic tourism. Much of the non-consumptive tourism activities are concentrated in a few National Parks, namely, the South Luangwa, Kafue, Lower Zambezi, Mosi-Oa-Tunya, Lusaka, and Kasanka National Parks. The national accounts do not show the value of nature-based tourism separately, but these values are within the national accounts. This issue is discussed later.

1 National Parks and Wildlife Policy, 2018

The Eighth National Development Plan (8NDP) recognizes tourism as a key sector for the country's economic growth. International tourism increases foreign exchange earnings and creates jobs particularly in rural areas where most tourism assets occur. To make the National Parks more attractive to tourists, restocking wildlife populations is a priority for safari and photographic tourism to be viable.

To police all National Parks and GMAs in Zambia, there are about 1,600 Wildlife Police Officers (WPO) which translates to one officer per 211 square kilometers (1:211 km^2). This level is well below the one ranger/scout for every 10-50 km^2 advocated by the IUCN for protected area systems where elephants occur (David et al. 2016).



2.0 CONCEPTS, DATA SOURCES AND METHODS

2.1 Development of Conceptual Framework

Figure 1 presents the conceptual framework upon which the TNCA is constructed. It outlines how the Tourism Satellite Account (TSA), and the System of Environmental Economic Accounting (SEEA) frameworks interact. The TSA focuses on the economy (supply and demand of tourism services and products) while the SEEA focuses on the environment and natural resources. The linking of these two accounting systems is done to provide a more comprehensive view of the tourism sector and its dependence on the environment. Both frameworks are based on the accounting framework for measuring the economy – the System of National Accounts (SNA).

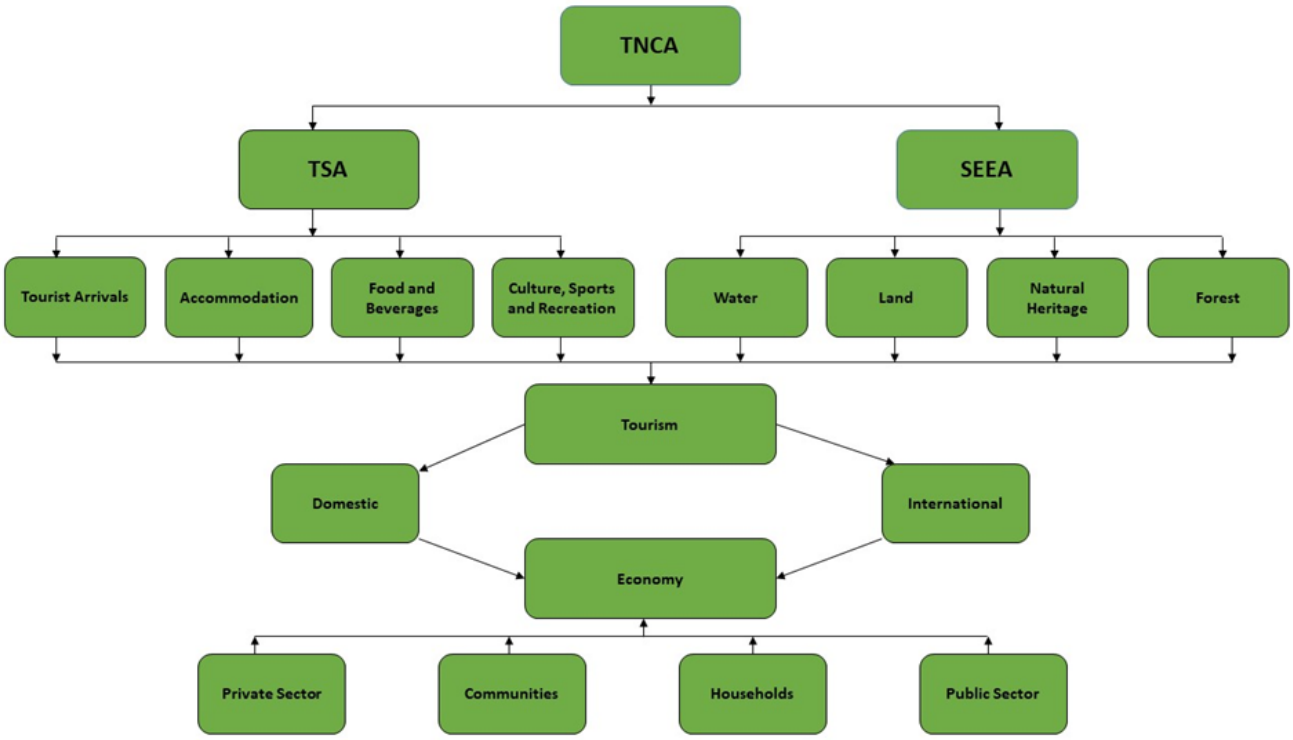


Figure 1: Detailed Conceptual Framework

2.1.1 Tourism Satellite Account (TSA)

The concepts and methods used in the TSA are based on international standards developed by the Organisation for Economic Co-operation and Development (OECD), Eurostat, the United Nations Statistics Division (UNSD), and the United Nations World Tourism Organisation (UNWTO). These standards are based on the 2008 SNA.

In the SNA, the products purchased by tourists, and produced by suppliers, are all part of the economic activity measured. However, while all the products that are produced and consumed in meeting tourism demand are embedded in the SNA, they are not readily

apparent because 'tourism' is not identified as an industry or product in international industrial and product classification standards. Instead of being defined by the characteristics of producers, tourism is defined according to the status of the consumer. That is, it is the characteristics of the consumer that determine whether the production is included within the scope of tourism. For example, tourists use services produced by the accommodation and recreation, food and beverage services and transport industries which are included in the SNA. An indication of the value of tourism is the value of the food and beverage service, accommodation industry, arts and entertainment which is shown in the national accounts as ZMW 3,645 million in 2015 and has been growing (Zamstats, 2017). The trends from 2008 to 2017 are highlighted in Annex 1.

A TSA enables the economic aspects of tourism to be identified separately with the SNA and hence be used to analyse the contribution of tourism to the economy. In fact, one of the major features of a TSA is that it is set within the context of the whole economy, so that tourism's contribution to major national accounting aggregates can be determined, and compared with other industries, and be used in economic models to judge the economic impacts of investments.

2.1.2 System of Environmental Economic Accounting (SEEA)

As noted earlier, the SEEA is a statistical framework that links the SNA to the environment. In this, natural resources, such as land, minerals, energy, water and wildlife, are connected to the SNA. The SEEA provides a comprehensive set of tables and accounts describing the stocks and flows of natural resources, including the use of natural resources by the economy from the environment, as well as flows of residuals (e.g., air pollution) to the environment from the economy. The SEEA is used around the world and guides the compilation of consistent and comparable statistics and provides information for policy making, analysis, and research.

2.1.3 Integrating TSA and SEEA

The general issue considered is that accounting in the SEEA framework covers the supply and use of natural inputs (e.g., water, land, wildlife, minerals, energy) to economic units and residual flows (e.g., air emissions, wastewater, pollutants) from economic units as well as assets. Land cover, wildlife and other natural resources are included in assets' accounts. Both the supply and use accounts and asset accounts can be compiled in physical or monetary terms.

On the other hand, tourism statistics and the associated TSA framework reflect a demand or consumption perspective whereby, the scope depends primarily on the characteristics of the consumer, i.e., whether or not the consumer is a visitor (Figure 2). TSA are usually presented in monetary terms only.

In measuring sustainable tourism four extensions or adaptations the frameworks were considered as follows:

- Extensions within the TSA framework for describing tourism industries.
- Connections between SEEA based accounts for individual environmental flows (e.g., water, energy, waste) and tourism activity.
- Accounting for produced and environmental assets relevant to tourism; and
- Spatial accounting for tourism activity applying the logic of SEEA based land and ecosystem accounting.

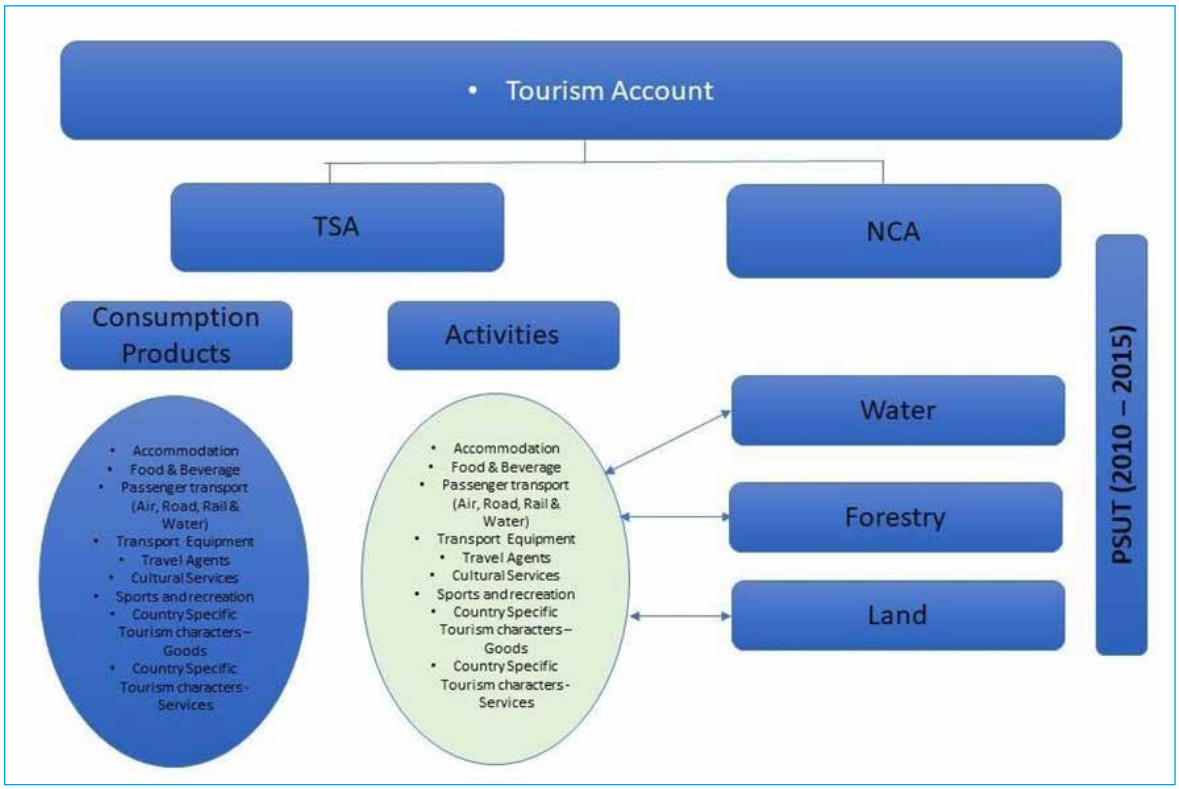


Figure 2: Integrating the TSA and SEEA

2.1.4 Measuring Sustainable Tourism (MST)

The third framework considered was the UNWTO Statistical Framework for Measuring the Sustainability of Tourism (MST). This framework provides all countries globally with a common framework to measure the impacts and contributions of tourism on the economy, society and the environment at both the national and sub-national levels.

The framework is a valuable guiding tool to produce credible, comparable and integrated data to better guide decisions and policy with respect to sustainable tourism - including the Sustainable Development Goals (SDGs). It encompasses economic, environmental and social dimensions. Overall, the MST provides an integrated information base to better inform on sustainable tourism, to facilitate dialogue between different sectors and to encourage integrated, locally relevant decision making. Again, due to a lack of data, the TTWG determined that a MST was not able to be developed at this time.

2.2 Data Sources

To compile the account, potential data sets were identified. The datasets identified in, and collected from, official reports and publications from key stakeholders (Table 1). The targeted data and indicators included wildlife, land, water, natural heritage, and forests, as summarised in Table 1.

Table 1: Targeted resources and indicators

Account	Indicators
Wildlife	Wildlife population Tourism Concessions Hunting Concession Live Capture Ecosystem Services
Forestry	Ecosystem Services
Water	Water coverage Water body size Water quantity/volume Water consumption Water monetary value
Natural Heritage	Aesthetic value-visitor attraction Geomorphologic process Cultural, spiritual and health value
Land	Land cover Land use

2.3 Identification of key stakeholders

For the creation of the tourism account, a list of key stakeholders was developed. Table 2 provides a summary of the key stakeholders and the category of the data to be provided for the tourism account.

Table 2: List of Key Stakeholders

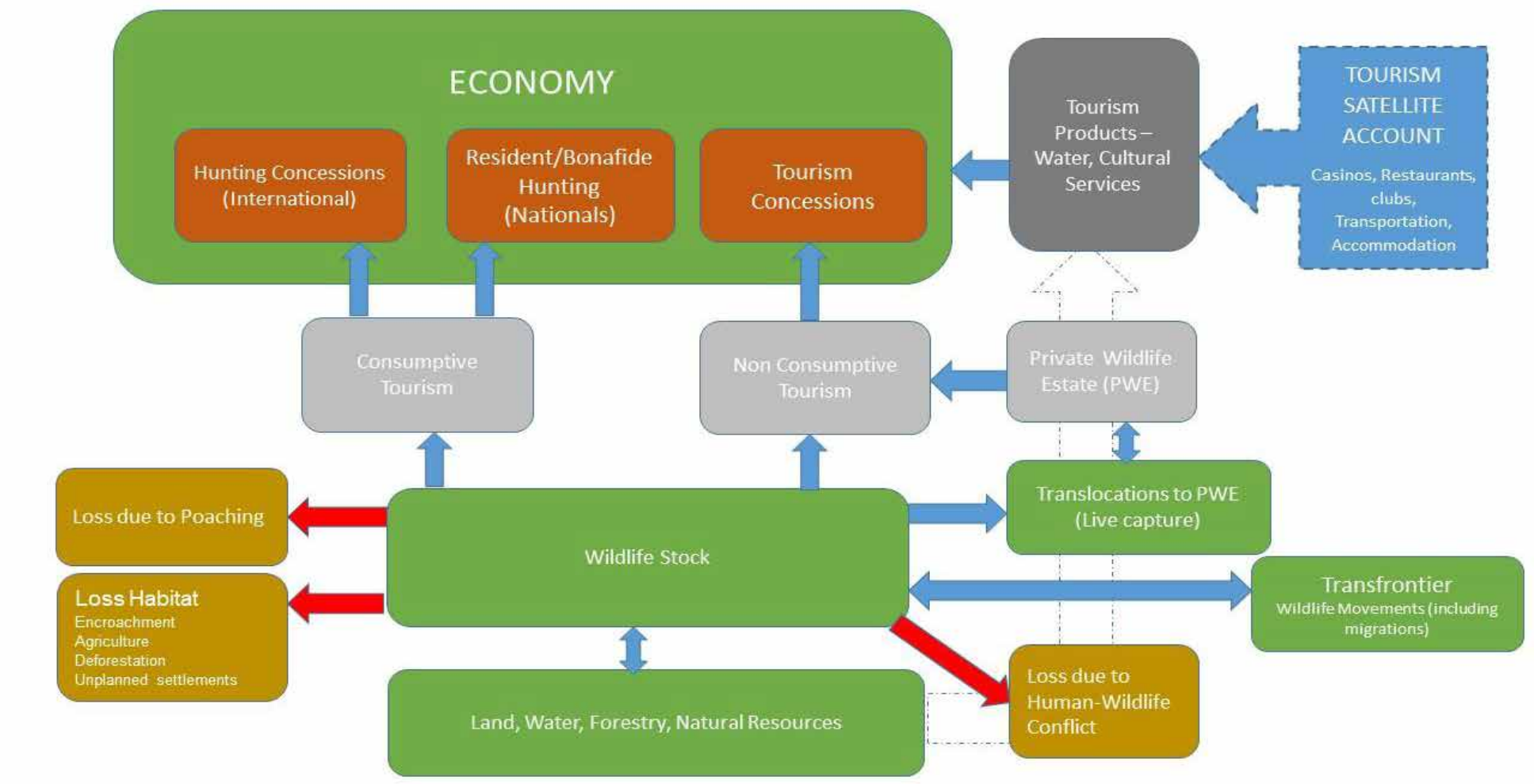
Institution	Category
Department of National Parks and Wildlife	Wildlife
Tourism Department	Tourist Information
Zambia Statistics Agency	National Accounts
Forestry Department	Forest Account
National Remote Sensing Centre	Land Account
Department of Water Resource Development	Water Account
Zambia Tourism Agency	Accommodation
National Heritage Conservation Commission	Heritage Statistics
Tourism Council of Zambia	Accommodation/Arrivals Statistics
Bank of Zambia	Balance of Payments Statistics -Travel
Immigration Department	Migration Statistics (Arrivals)
Planning and Information Department	Data Management
National Museums Board	Visitor Statistics

2.4 Conceptual Development

The MoT in 2015 developed an experimental TSA which showed the tourism sector's contribution to GDP standing at 3.4 percent per annum. However, it was noted that there were data gaps that needed to be filled. Domestic tourism and exit surveys were identified as activities that needed to be undertaken in order to fill up the data gaps that have been identified if Zambia is to compile a fully-fledged TSA. The lack of resources prevented conducting surveys to collect additional data hence it was determined that a TSA could not be developed at the time.

As a way forward the TTWG resolved to look at the various information components needed to inform sustainable tourism. Since wildlife and protected areas underpin much of the tourism in Zambia, it was determined that a SEEA account of assets for wildlife protected areas should be produced, along with supply and use tables showing how the consumptive and non-consumptive use of wildlife and protected areas contribute to the economy as well as the negative impacts of the economy and illegal activity on wildlife (e.g., poaching and the expansion of agriculture in protected areas). The TTWG further came up with a proposed Conceptual Framework for Wildlife, as shown in Figure 3 below. This framework will form the basis of the WPAA to be developed with a focus on wildlife sub-sector. The blue arrows show the wildlife stock movement while the red arrows represent losses or reduction in stock.

Figure 3: Conceptual Framework for Wildlife Protected Area Accounts



Source: Ministry of Tourism

3.0 Developing Account for Wildlife Protected Areas.

Based on the Conceptual Framework developed for the WPPA and SEEA, a wildlife account was designed by species, recording the populations in protected areas. Both supply and use tables and asset accounts were developed.

3.1 Method

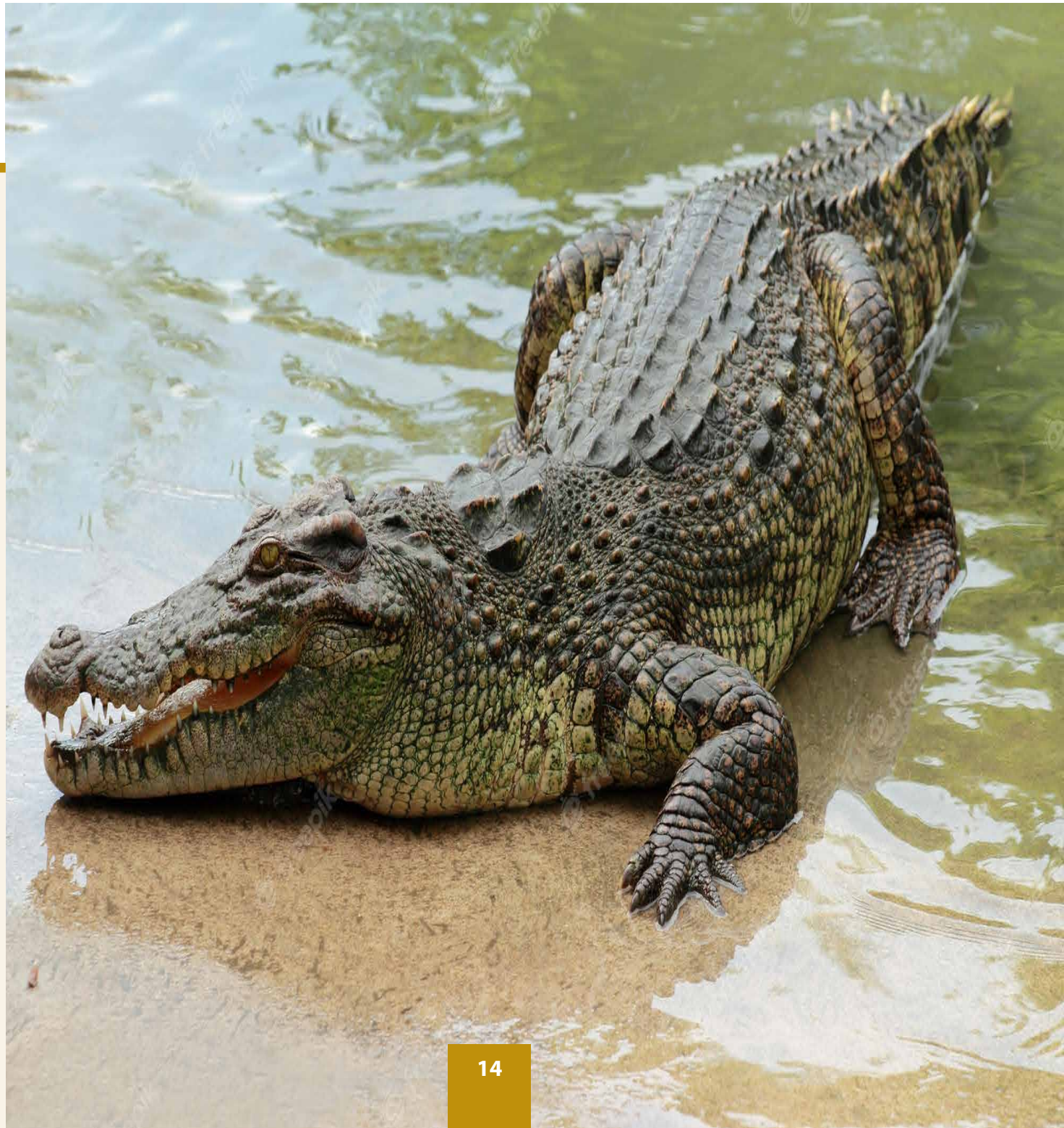
Accounts were produced based on nationwide population aerial surveys for large mammals which were conducted in 2008 and 2015. Although there have been various ecosystem based aerial surveys after 2015, there have been no large mammals national aerial survey since 2015, thus, this was the best available data TWG.

The abundance of species was assessed using a number of methods. Black Lechwe populations were based on the aerial surveys conducted by African Parks Network and focused on the animals that were actually seen rather than the extrapolated estimates. The population of hippos is based on the counts along 270 km of the Luangwa River South Luangwa National Park (SLNP), Luambe National Park, Lumimba Game Management Area and Lupande Game Management Area from the study was done in 2015. The population for the Crocodiles for 2017 was based on the survey done in 2017 on actual crocodiles seen. The length of the Luangwa River covered was 270 km and the method used was the Total Bank Count River Method.

Furthermore, the Kafue River system on crocodiles seen was added to the species population and was based on the counts done in 2016. For the 2008 Physical use table the Kafue Lechwe population is based on the Chansa and Kampamba (2005) aerial survey report. The lion population is based on the population in the Zambia Conservation Strategy and Action Plan for the African Lion, 2009. The population of the black Lechwe used was that of those seen rather than the estimates. The hippo and crocodile population are based on the counts that were done along the 270 Km stretch of the Luangwa River. The hippo population for 2008 was based on the estimate in the technical report produced by the Department of National Parks and Wildlife. The account did not take into consideration the trans frontier movement of wildlife species and the wildlife species hunted and poached on the PWEs.

Using a range of data physical and monetary supply and use tables were compiled. The value of the wildlife for 2008 and 2015 was based on a range of data sources. For the hunted wildlife, the 2007 and the 2015 resident and non-resident hunting licenses fees were used respectively. For the non-resident (safari) fees which were in United States Dollars (USD) the average annual Bank of Zambia exchange rate used were for the years 2008, (1USD ~ ZMW 3.75) and 2015 (1USD ~ ZMW 8.62). The 2008 resident and non-resident hunting

fees had to be rebased so that the amounts are comparable to the 2015 resident and non-resident hunting fees. The pricing for poached and animals lost due to Human Wildlife Conflict (HWC) was based on Citizen rate as prescribed on the residence and non-resident hunting fees list. This list is the one used by the courts to determine the fines for breaking wildlife laws. Furthermore, the following fees were used in the construction of monetary non-consumptive accounts for wildlife, and these included: Hunting Concession Fees (consumptive) and Tourisms Concessions fees, Park and vehicle entry fees, Bed night levies and Park landing fees (non-consumptive). Wildlife species that are not included on the hunting quotas, such as rhino, giraffe and cheetah were not included in the physical and monetary tables.



4.0 Supply and Use Tables for Wildlife.

Physical Supply and Use Tables show the supply and use of wildlife in physical units. This shows the number of particular species that were removed from populations of wildlife by activities such as hunting, poaching, translocation and those animals killed due to Human Wildlife Conflict (HWC).

The Table 3 below shows Physical Supply and Use of wildlife during 2008.

Table 3: Physical Wildlife Consumptive Supply and Use Table 2008 (1 January to 31 December)

Supply Side			Use Side					
2008 No. of animals			2008 No. of animals					
Species	***National Parks and GMAs***	***Total supply***	***Resident Hunting***	***Safari Hunting***	***HWC***	***Poaching***	***Translocation***	***Total use***
Buffalo	503	503	150	247	6	-	100	503
Crocodile	288	288	-	246	12	-	30	288
Lions	74	74	-	66	8	-		74
Leopard	86	86	-	86	-	-		86
Hippo	529	529	240	197	12	-	80	529
Eland	37	37	-	37	-	-	-	37
Hartebeest	156	156	75	81	-	-	-	156
Impala	1,051	1,051	547	304	-	-	200	1,051
Kudu	95	95	-	95	-	-	-	95
Red Lechwe	36	36	11	25	-	-	-	36
Kafue Lechwe	624	624	518	100	-	6	-	624
Black Lechwe	141	141	81	60	-	-	-	141
Puku	371	371	204	162	-	5	-	371
Roan	39	39	-	39	-	-	-	39
Sable	57	57	-	57	-	-	-	57
Sitatunga	63	63	-	62	1	-	-	63
Blue wildebeest	33	33	-	33	-	-	-	33
Cookson's wildebeest	38	38	-	38	-	-	-	38
Elephant	98	98	-	20	13	65	-	98
Other species	2867	2867	1898	867	0	2	100	2867
TOTAL	**7,186**	**7,186**	**3,724**	**2,822**	**52**	**78**	**510**	**7,186**

Table 4 below shows the monetary aspect of the Supply and Use table for the period 2008. The table shows that in 2008 a total of ZMW 20,327,215 (~USD 5,422,204) was the value of resident hunting, with safari hunting and translocations accounting for ZMW 804,649 (~USD214,637), ZMW 12,140,122 (~USD 3,238,329) and ZMW 223,920 (~USD 59,729.77) respectively. The loses due to HWC amount to ZMW 1,306,976 (~USD 348,631) while those to poaching amounted to ZMW 5,851,548 (~USD 1,560,877). It has to be noted that not all the loses due to poaching were taken into account otherwise the value of poaching would likely have been much larger.

Table 4: Monetary Wildlife Consumptive Supply and Use Table 2008 (1 January to 31 December)

Supply Side			Use Side					
2008 Value ZMW			2008 Value ZMW					
Species	***National Parks and GMAs***	***Total Supply***	***Resident Hunting***	***Safari Hunting***	***HWC***	***Poaching***	***Translocation***	***Total Use***
Buffalo	1,329,776	1,329,776	72,900	1,205,360	2,916	-	48,600	1,329,776
Crocodile	1,214,088	1,214,088	-	1,200,480	3,888	-	9,720	1,214,088
Lions	993,080	993,080	-	885,720	107,360	-		993,080
Leopard	734,440	734,440	-	734,440	-	-		734,440
Hippo	1,541,860	1,541,860	450,000	961,360	22,500	-	108,000	1,541,860
Eland	270,840	270,840	-	270,840	-	-	-	270,840
Hartebeest	267,057	267,057	10,125	256,932	-	-	-	267,057
Impala	195,413	195,413	34,461	148,352	-	-	12,600	195,413
Kudu	463,600	463,600	-	463,600	-	-	-	463,600
Red Lechwe	123,430	123,430	1,430	122,000	-	-	-	123,430
Kafue Lechwe	592,572	592,572	79,254	512,400	-	918	-	592,572
Black Lechwe	334,473	334,473	12,393	322,080	-	-	-	334,473
Puku	295,506	295,506	18,360	276,696	-	450	-	295,506
Reedbuck	155,862	155,862	41,670	114,192	-	-	-	155,862
Roan	666,120	666,120	-	666,120	-	-	-	666,120
Sable	751,032	751,032	-	751,032	-	-	-	751,032
Sitatunga	544,920	544,920	-	544,608	312	-	-	544,920
Blue wildebeest	104,676	104,676	-	104,676	-	-	-	104,676
Cookson's wildebeest	64,904	64,904	-	64,904	-	-	-	64,904
Elephant	7,996,000	7,996,000	-	976,000	1,170,000	5,850,000	-	7,996,000
Other Species	1,687,566	1,687,566	84,056	1,558,330		180	4,500	1,687,566
TOTAL	20,327,215	20,327,215	804,649		1,306,976	5,851,548	223,920	20,327,215
USD	5,416,163	5,416,163	214,398	3,234,721	348,242	1,559,138	59,663	5,416,163

Note: For 2008, 1USD ~ ZMW 3.75

Table 5 shows the physical supply and use table for the year 2015. Compared to 2008, the total number of animals hunted in 2008 reduced from 2,822 to 2,393 in 2015. In terms of key species, the total number of elephants poached increased from 65 elephants in 2008 to 131elephants in 2015.

Table 5: Physical Wildlife Consumptive Supply and Use Table 2015

Supply Side			Use Side					
2015 *No. of animals*			2015 *No. of animals*					
Species	***National Parks and GMAs***	***Total Supply***	***Resident Hunting***	***Safari Hunting***	***HWC***	***Poaching***	***Translocation***	***Total Use***
Buffalo	407	407	66	279	16	43	3	407
Crocodile	286	286		180	16	90	-	286
Lions	39	39	-	23	3	10	3	39
Leopard	96	96		76	-	20	-	96
Hippo	603	603	222	194	36	151	-	603
Eland	14	14	-	12	-	2	-	14
Hartebeest	98	98	8	49	-	41	-	98
Impala	623	623	104	364	-	155	-	623
Kudu	94	94	-	68	-	26	-	94
Red Lechwe	1	1	1	-	-		-	1
*Kafue Lechwe	178	178	39	20	-	119	-	178
**Black Lechwe	158	158	125	33	-		-	158
Puku	282	282	39	143	-		100	282
Roan	51	51	-	47	-	4	-	51
Sable	117	117	-	67	-	34	16	117
Sitatunga	34	34	5	29	-		-	34
Blue wildebeest	63	63	24	39	-		-	63
Cookson's wildebeest	67	67	4	53	-	10	-	67
Elephant	181	181	-	23	26	131	1	181
Other Species	1,242	1,242	54	607	1	483	0	1,242
TOTAL	**4,634**	**4,634**	**691**	**2,306**	**98**	**1,319**	**123**	**4,634**

The overall combined quota for resident and non-resident hunting shows a reduction of 52%. The resident hunting quota was reduced by 81% while the non-resident hunting quota decreased by 15%. This also corresponds to the notable reduction in wildlife stocks which have been observed in between 2008 and 2015 (as shown in the asset account presented later in the report). Hunting quotas set were based on the wildlife populations and were usually 2% of the estimated population. The reduction in the hunting quotas could be attributed to encroachments in the GMAs and the National Parks which are considered reservoirs for wildlife.

The other factors that could have contributed to the overall decline are poaching and habitat loss. Poaching and loss of habitat could also be attributed to the inadequate manpower of 1,600 WPOs instead of the minimum of 4,800 WPOs required for law enforcement to operate at optimal. This is compounded further by the inadequate funding to the wildlife

sector. Furthermore, not all stocks lost through poaching have been captured. The wildlife stocks that have not been considered, are natural mortalities and those lost through predation (especially for prey species).

Table 6 indicated the monetary consumptive supply and use table for the year 2015. The total value of the use side in 2008 increased from ZMW 20,327,215 (USD 5,422,204) to ZMW 49,074,586 (USD 5,541,365) in 2015 reflecting a 141 percent increase in ZWM. The increase could be attributed to the upward adjustment to animal prices, while foreign currency fluctuations meant the increase was lower when converted to USD.

Table 6: Monetary Wildlife Consumptive Supply and Use Table 2015

Supply Side			Use Side					
2015 Value ZMW			Value ZMW					
Species	***National Parks and GMAs***	***Total Supply***	***Resident Hunting***	***Safari Hunting***	***HWC***	***Poaching***	***Translocation***	***Total Use***
Buffalo	5,412,592	5,412,592	597,300	4,254,192	144,800	389,150	27,150	5,412,592
crocodile	3,062,640	3,062,640		2,744,640	48,000	270,000	-	3,062,640
Lions	1,530,936	1,530,936	-	920,598	90,000	400,260	120,078	1,530,936
Leopard	2,459,342	2,459,342		1,919,342	-	540,000	-	2,459,342
Hippo	6,434,612	6,434,612	1,887,000	2,958,112	306,000	1,283,500	-	6,434,612
Eland	311,900	311,900	-	285,900	-	26,000	-	311,900
Hartebeest	490,657	490,657	20,640	364,237	-	105,780	-	490,657
Impala	610,520	610,520	78,000	416,270	-	116,250	-	610,520
Kudu	1,243,564	1,243,564	-	1,036,864	-	206,700	-	1,243,564
Red Lechwe	2,700	2,700	2,700	-	-	-	-	2,700
*Kafue Lechwe	623,720	623,720	97,500	228,720	-	297,500	-	623,720
**Black Lechwe	822,133	822,133	287,500	534,633	-	-	-	822,133
Puku	733,612	733,612	45,240	572,372	-	-	116,000	733,612
Reedbuck	165,591	165,591	1,700	140,091	-	23,800	-	165,591
Roan	1,847,240	1,847,240	-	1,791,640	-	55,600	-	1,847,240
Sable	2,665,530	2,665,530	-	1,915,530	-	510,000	240,000	2,665,530
Sitatunga	792,276	792,276	18,440	773,836	-		-	792,276
Blue wildebeest	348,223	348,223	58,320	289,903	-		-	348,223
Cookson's wildebeest	723,872	723,872	12,000	681,872	-	30,000	-	723,872
Elephant	16,411,900	16,411,900	-	2,191,900	2,340,000	11,790,000	90,000	16,411,900
Other Species	2,381,026	2,381,026	45,256	1,658,722	375	676,673	-	2,381,026
TOTAL ZMW	49,074,586	49,074,586	3,151,596	25,679,374	2,929,175	16,721,213	593,228	49,074,586
USD	5,541,365	5,541,365	355,869	2,899,643	330,754	1,888,112	66,986	5,541,365

Note: For 2015, 1USD ~ ZMW 8.86

Table 7 shows other fees which are associated to consumptive tourism, other than the animal fees captured in Tables 4 and 6. These other fees which are associated with consumptive tourism included concession fee, bird licenses, import and export permits among others which generated ZMW 8,879,877.44 in 2008, as compared to ZMW 6,849,976.91 in 2015. Furthermore, the table shows that the grand total of consumptive revenue had increased by 91.5% from 2008 to 2015. The increase could be attributed to the exchange rate, as well as the increase in the animal fees (e.g. animal capture and hunting license).

Table 7: Other Revenues from Consumptive Wildlife Tourism (nominal)

Description	2008	2015	Change in %
REVENUE FROM HUNTING	**ZMW**	**ZWM**	
Concession fees	4,373,023.43	4,279,184.25	-2.1
Bird License - Safari	149,875.49	74,560.60	-50.3
Bird License -Local	65,915.14	193,520.49	193.6
Import/Export permits	442,260.61	635,142.35	43.6
Professional Hunters License	307,618.18	150,365.60	-51.1
Outfitters Safari License	426,760.00	785,472.50	84.1
Crocodile Eggs /Live Capture	2,729,738.06	5,716.00	-99.8
Others	384,686.53	726,015.12	88.7
Other Consumptive Revenue	**8,879,877.44**	**6,849,976.91**	-22.9
Animal Fees	**20,327,215.00**	**49,074,586.00**	141.4
Grand Total Consumptive	**29,207,092.44**	**55,924,562.91**	**91.5**
Non-Consumptive	**18,033,038**	**51,443,478**	**185.3**

Note: For 2008 1USD ~ ZMW 3.75 and for 2015 1USD ~ ZMW 8.86

In order to get a more accurate picture of what was happening in the WPAA. the non-consumptive supply and use tables for 2008 and 2015 (Tables 8 and 9) were taken into consideration. The non-consumptive supply and use table used the fees that the Ministry of Tourism collected which included; Park entry, Tourisms Concessions fees, Vehicle entry, Bed night (Variable fees) and Game drives among others. As shown in the Tables 8 and 9, apart from tourism concession fees and Bed night (Variable fees), the rest were broken into domestic and international tourists. While not complete, the table shows the importance of international tourists to the economy of Zambia.

The use side of the monetary non-consumptive tourism showed that non-consumptive tourism increased from ZMW 18,033,038 in 2008 to ZMW 51,443,478 in 2015 with notable increases in the park entry fees, tourism concession fees and bed night (variable fees). Non-consumptive tourism showed an overall increase of 185.3%. It has to be noted that the contribution of non-consumptive tourism to the total revenue had increased from 38% in 2008 to 48% in 2015.

Table 8: Monetary Wildlife Non-Consumptive Supply and Use Table 2008

Items		**Environment**				***Households (Individuals)***		***Industry (Establishments)***	***Total use***
	National parks	**GMA**	**PWES**	**All other areas**	***Total supply***	***Domestic***	***International***		
Park entry	7,196,050				***7,196,050***	2,524,981	4,671,068		***7,196,050***
Tourisms Concessions	2,824,471				***2,824,471***			2,824,471	***2,824,471***
Vehicle entry	211,754				***211,754***	74,301	137,453		***211,754***
Bed night (Variable fees)	4,439,888				***4,439,888***			4,439,888	***4,439,888***
Game drive	464,795				***464,795***	163,089	301,706		***464,795***
Other	2,896,080				***2,896,080***	1,016,189	1,879,891		***2,896,080***
Total	**18,033,038**				***18,033,038***	**3,778,561**	**6,990,118**	**7,264,359**	***18,033,038***

Note: For 2008 1USD ~ ZMW 3.75

Table 9: Monetary Wildlife Non-Consumptive Supply and Use Table, ZMW 2015

		Environment				Households (Individuals)			
Items	*National parks*	GMA	PWES	All other areas	*Total supply*	*Domestic*	*International*	*Industry (Establishments*	*Total use*
Park entry	26,103,837				***26,103,837***	*6,253,446*	*19,850,391*		***26,103,837***
Tourisms Concessions	6,430,621				***6,430,621***			*6,430,621*	***6,430,621***
Vehicle entry	546,698				***546,698***	*130,967*	*415,731*		***546,698***
Bed night (Variable fees)	12,914,372				***12,914,372***			*12,914,372*	***12,914,372***
Game drive	1,528,404				***1,528,404***	*366,145*	*1,162,259*		***1,528,404***
Other	3,677,629	241,917			***3,919,546***	*881,014*	*2,796,615*	*241,917*	***3,919,546***
Total	**51,443,478**				***51,443,478***	***7,631,572***	***24,224,996***	***19,586,910***	***51,443,478***

Note: For 2015 1USD ~ ZMW 8.86

5.0 Asset Accounts for Wildlife Abundance

Comparing the years 2008 and 2015 presented in the Table 10, it was observed that there was a general decline in the overall abundance of wildlife in the National Parks and GMAs. The decline could be attributed to various factors which include the loss of habitat to agriculture as noticed using the land account cover accounts (presented later). The major decline was noticed in the buffalo population which was 43,715 in 2015 down from 96,999 recorded in 2008 translating into a drop of 54.9 percent. This could mainly be attributed to the fact that the aerial survey of 2008 picked up a large heard of buffalo in its sample path hence the 54.9 percent difference.

In terms of the three species of lechwe (Red, Kafue and Black) only the Kafue Lechwe registered a decline which could be attributed to several factors including; poaching, disease, loss of habitat due to invasive plant species known as *Mimosa pigra*, low funding levels and inadequate manpower for law enforcement. It was further observed that the Bangweulu Plains, where the government was working with a private partner African Parks Network (APN) recorded an increase in the Black Lechwe population. The Black Lechwe increase could be attributed to improved funding and more effective law enforcement.

This was also true for the Blue Wildebeest in the Liuwa Plains National Park where APN is also a partner with the Government while Cookson's Wildebeest which is endemic to the Luangwa Valley showed a decline. Other species of value which showed a decline where Sable and Roan Antelopes and the Sitatunga. These species are considered as high value animals both for consumptive and non-consumptive tourism. Rhinos have continued to show a steady increase ever since they were reintroduced in Zambia. The reduction in the population of elephant cannot be entirely attributed to poaching but to the aerial survey method which is based on a sampling technique. Furthermore, most of the elephants exhibit transboundary movement hence this could explain the minor reduction in the population.

Table 10: Physical Wildlife Asset Account with Net Population Changes for the Years 2008 and 2015

Adapted asset account presentation	*No. of animals 2008*			*No. of animals 2015*			*Net change in no. of animals 2008 to 2015*			*Percentage net change population 2008 to 2015*		
Species	***National Parks and GMAs***	***PWEs***	***Total***	***National Parks and GMAs***	***PWEs***	***Total***	***National Parks and GMAs***	***PWEs***	***Total***	***National Parks and GMAs***	***PWEs***	***Total***
Buffalo	96,999	864	97,863	43,715	927	44,642	-52,357	63	-53,221	-54%	7%	-54%
Bushbuck	1,833	2,900	4,733	335	1,569	1,904	71	-1,331	-2,829	4%	-46%	-60%
Bushpig	772	2,462	3,234	775	-	775	3	-2,462	-2,459	0%	-100%	-76%
Duiker	5,447	2,470	7,917	4,025	-	4,025	-1,422	-2,470	-3,892	-26%	-100%	-49%
Crocodile	2,402	239,701	242,103	3,822	136,906	140,728	138,326	-102,795	-101,375	5759%	-43%	-42%
Rhinos	26	-	26	60	-	60	34	-	34	131%	0%	131%
Lions	3,575	9	3,584	2,500	76	2,576	-999	67	-1,008	-28%	744%	-28%
Leopard	4,675	-	4,675	5,000	42	5,042	367	42	367	8%	0%	8%
Hippo	10,230	-	10,230	16,153	-	16,153	5,923	-	5,923	37%	0%	37%
Eland	2,461	1,305	3,766	2,530	1,819	4,349	1,888	514	583	77%	39%	15%
Giraffe	1,085	215	1,300	618	-	618	-467	-215	-682	-43%	-100%	-52%
Grysbok	1,018	558	1,576	28	-	28	-990	-558	-1,548	-97%	-100%	-98%
Hartebeest	9,764	1,148	10,912	6,957	984	7,941	-1,823	-164	-2,971	-19%	-14%	-27%
Impala	52,010	13,496	65,506	52,369	16,135	68,504	16,494	2,639	2,998	32%	20%	5%

Adapted asset account presentation	*No. of animals 2008*			*No. of animals 2015*			*Net change in no. of animals 2008 to 2015*			*Percentage net change population 2008 to 2015*		
Kudu	3,431	2,746	6,177	3,383	927	4,310	879	- 1,819	- 1,867	26%	-66%	-30%
Red Lechwe	5,494	-	5,494	12,290	-	12,290	6,796	-	6,796	124%	0%	124%
*Kafue Lechwe	38,448	1,755	40,203	29,000	1,627	30,627	- 7,821	- 128	- 9,576	-20%	-7%	-24%

Table 10 continued. Physical Wildlife Asset Account with Net Population Changes for the years 2008 and 2015

Species	National parks and GMA	PWES	Total	National parks and GMA	PWES	Total	National parks and GMA	PWES	Total	National parks and GMA	PWES	Total
**Black Lechwe	10,660	99	10,759	45,313	130	45,443	34,783	31	34,684	326%	31%	322%
Oribi	302	656	958	166	-	166	- 136	- 656	- 792	-45%	-100%	-83%
Puku	33,023	2,555	35,578	23,538	3,358	26,896	- 6,127	803	- 8,682	-19%	31%	-24%
Reedbuck	877	1,660	2,537	981	1,608	2,589	1,712	- 52	52	195%	-3%	2%
Roan	9,047	236	9,283	6,261	573	6,834	- 2,213	337	- 2,449	-24%	143%	-26%
Sable	16,895	844	17,739	14,874	3,288	18,162	1,267	2,444	423	7%	290%	2%
Sitatunga	3,958	218	4,176	101	-	101	- 3,857	- 218	- 4,075	-97%	-100%	-98%
Warthog	13,278	2,187	15,465	12,626	-	12,626	- 652	- 2,187	- 2,839	-5%	-100%	-18%
Waterbuck	8,282	1,644	9,926	9,927	-	9,927	1,645	- 1,644	1	20%	-100%	0%
Blue wildebeest	72	498	570	2,955	583	3,538	3,466	85	2,968	4814%	17%	521%
Cookson's wildebeest	7,250	16	7,266	3,753	268	4,021	- 3,229	252	- 3,245	-45%	1575%	-45%

Adapted asset account presentation	*No. of animals 2008*			*No. of animals 2015*			*Net change in no. of animals 2008 to 2015*			*Percentage net change population 2008 to 2015*		
Zebra	10,362	1,785	12,147	10,768	1,552	12,320	1,958	- 233	173	19%	-13%	1%
Elephant	26,382	-	26,382	21,760	7	21,767	- 4,615	7	- 4,615	-17%	0%	-17%
TOTAL	**379,400**	**282,027**	**661,427**		**172,379**	**508,962**	**129,562**	**-109,648**	**-152,465**	**34%**	**-39%**	**-23%**

In terms of the cats (Lion and Leopard), the Lion showed a decline while the Leopard showed an increase in terms of population. Lions and Leopards population estimates for Zambia were based on various publications, hence the trends reflected may not show the true picture.

6.0 Land Cover and Protected Areas

6.1 Introduction

In Zambia, deforestation is considered one of the major drivers of wildlife loss, estimated at 250,000 hectares lost per year (GRZ, 2016). A comparison of the change in land cover between 2010 and 2014 for the National Parks (Table 11), shows that there was 101.34 percent increase of crop land within National Parks (approximately 535.1 square kilometers of habitat lost to crops). Figure 4 shows the Land Cover for National Parks and Game Management Areas which accounts for approximately 236,376 square kilometers, equivalent to 31.4% of the country's area.

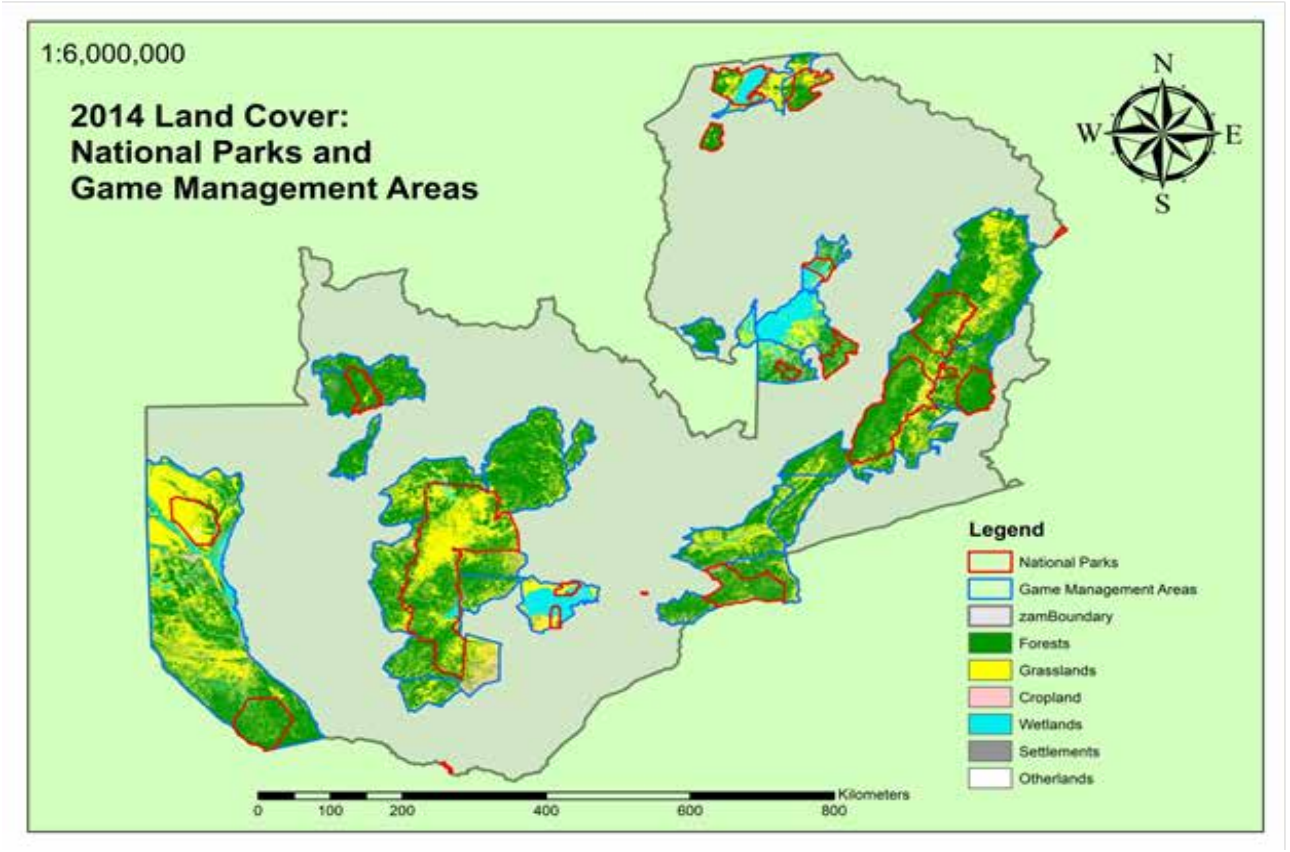


Figure 4: Land Cover for National Parks and Game Management Areas

To better understand the changes in wildlife habitat, a set of land cover maps for protected areas were developed. The main tools, methods, and data sets used to compile the land cover maps were:

- The SEEA which provided the concepts and methods needed to arrange the data from satellite imagery and land cover maps into accounts.
- The land cover accounts were created using the Sentinel-2 10-meter Land Cover/ Land Use (LULC) time-series data (2017-2021),) produced by the Impact Observatory for the Environmental Systems Research Institute (ESRI).

6.2 Sources of Data

The land cover/land use imagery was downloaded from the ArcGIS website (ESRI) using the Sentinel-2 10-meter Land Use/Land Cover time-series downloader. It is a global dataset and is available under a Creative Commons BY-4.0 license.

The dataset has nine classes and is available for each year from 2008 to 2015. All the years were generated using the Impact Observatory deep learning Artificial Intelligence land classification model which utilized billions of human-labeled image pixels developed by the National Geographic Society (ESRI, 2022).

Ancillary data was collected from the Zambia Statistical Agency (ZamStats), the National Remote Sensing Center and the Ministry of Lands and Natural Resources.

6.3 Compilation of LULC

The LULC changes were analyzed using the Zambia Land Cover Scheme I datasets for the years 2010 and 2014 (FAO & MNLR, 2017). These datasets are as a result of a mapping exercise of Zambia that was jointly undertaken by the Regional Centre for Mapping and Resource Development (RCMRD) and the Zambia Forestry Department with inputs from other technical partners such as the United Nations Food and Agriculture Organization (FAO), the National Remote Sensing Centre (NRSC) and the Zambia Survey Department. The datasets were derived using Landsat 7 and 8 images that covered the entire Zambia. Specifically, the bands used were the Red, Near-infrared (NIR) and Infrared. The images were accessed and mosaicked in Google Earth Engine (GEE). A reducer was used to create yearly mosaics for 2010 and 2014. Field data collected during the Integrated Land Use Assessment (ILUA) exercise (FAO & MNLR, 2017) was used to train a random forest algorithm. Approximately 30% of the training data was retained and not used in the training of the algorithm. The retained training data was used for validation purposes.

The Zambia Land Cover Scheme I land cover maps had six classes, namely forests (1), grasslands (2), croplands (3), wetlands (4), settlements (5) and other lands (6). The land cover classification scheme (FAO & MNLR, 2017) is attached as Annex 2.

6.4 LULC Change Detection Analysis

The Zambia Scheme I datasets were clipped to the boundaries of the Zambian National Parks. Land Use/Land Cover change detection was performed using the post-classification tools of the Semi-Automatic Classification plugin of QGIS. The year 2010 served as the initial observation and 2014 as the new observation. The change was analyzed pixel by pixel, checking each initial class against the new class. A change in the integer value depicted a change in land cover. Areas of consistency (areas of no change) were also included in the analysis. The results were presented in change matrices and physical supply and use tables.

7.0 Accounts for Land Cover and Protected Areas

Table 11 shows the land change matrix between 2010 and 2014 with 2010 taken as the base year. It was observed in 2010 that approximately 528 square kilometers of land in the National Parks was lost to cropland.

Table 11: Matrix showing Land Cover Change between 2010 and 2014 for National Parks in Square Kilometers

NP Land Cover	Croplands	Forests	Grasslands	Other lands	Settlements	Unclassified	Wetlands	Total 2010
Total 2010	**475.44**	**36,758.01**	**19,127.49**	**443.74**	**1.30**	**40.55**	**3,236.99**	**62,481.90**
Croplands		20.41	27.56	0.70	0.19	-	3.71	528.00
Forests	362.74		755.46	9.62	0.02	0.01	42.94	37,928.81
Grasslands	165.69	754.96		36.82	0.05	0.01	31.16	20,116.17
Other lands	3.72	9.36	37.60		-	-	2.49	496.90
Settlements	0.18	0.01	0.04	-		-	-	1.53
Unclassified	-	-	-	-	-		-	40.55
Wetlands	55.33	44.34	30.95	2.32	-	0.00		3,369.92
Total 2014	**1,063.10**	**37,587.10**	**19,979.09**	**493.19**	**1.56**	**40.57**	**3,317.29**	**62,481.90**

Despite the legislation that does not allow settlements or agriculture activities in the national parks (Wildlife Act No 14 of 2015), settlements recorded an increase of 1.87 % while crop land increased by 101.34% The combined effect is that at this rate Zambian will be losing approximately 528 square kilometers of the total land under national parks every four years (refer to Table 12 and Figure 5).

Table 12: Land Cover Change National Parks between 2010 and 2014

NP Land Cover	Opening Stock (Km^2) 2010	Closing Stock (Km^2) 2014	Net Change in Km^2	Net Percentage Change
Forests	37,928.81	37,587.10	(341.71)	(0.90)
Grasslands	20,116.17	19,979.09	(137.09)	(0.68)
Croplands	528.00	1,063.10	535.10	101.34
Wetlands	3,369.92	3,317.29	(52.63)	(1.56)
Settlements	1.53	1.56	0.03	1.87
Other lands	496.90	493.19	(3.72)	(0.75)
Unclassified	40.55	40.57	0.02	0.05
Totals	**62,481.90**	**62,481.90**		

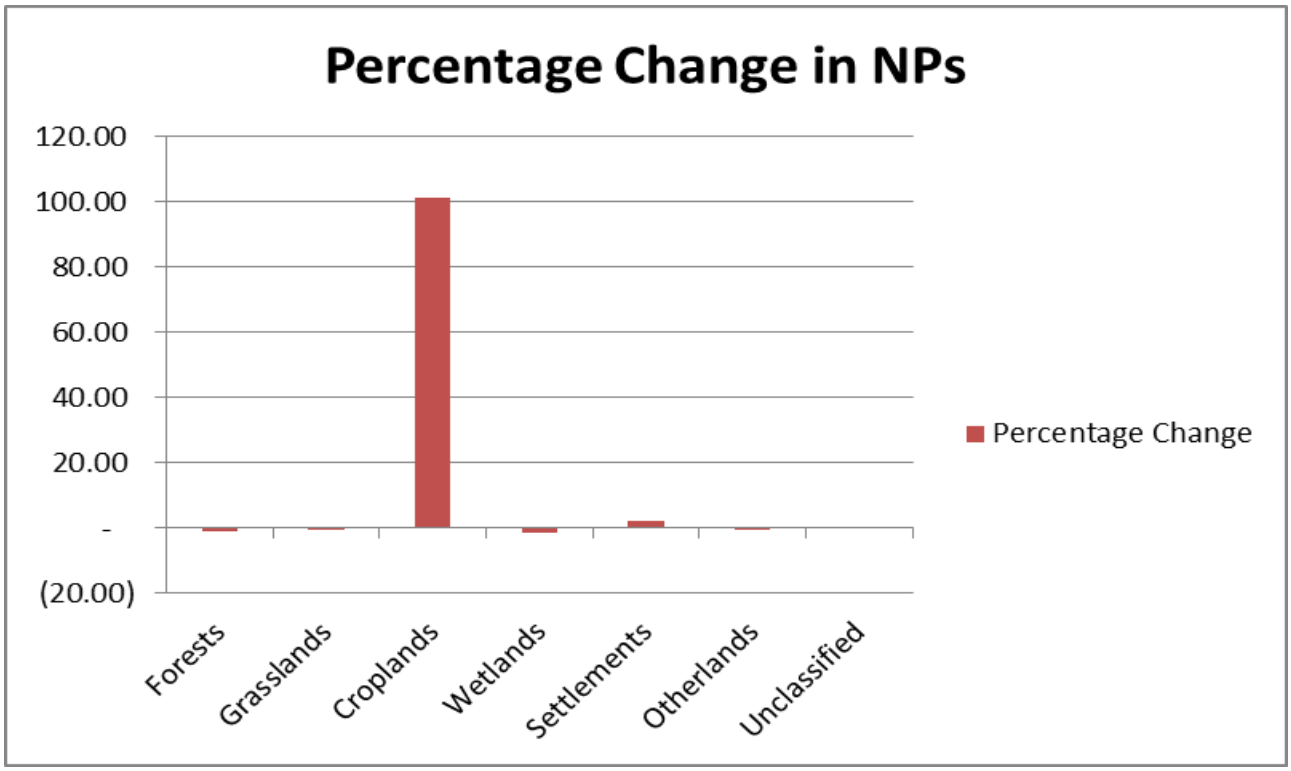


Figure 5: Percentage Change in National Parks

Table 13 below shows that by 2010 approximately 6,642.50 square kilometers was being utilised as cropland in the National Parks. This amount further increased to 8,870.64 square kilometers in 2014 showing a percentage increase of 33.54% in a space of four (4) years (see Table 13 and Figure 5).

Table 13: Matrix showing Land Cover Change between 2010 and 2014 for GMAs

GMA Land Cover	Croplands	Forests	Grasslands	Other lands	Settlements	Unclassified	Wetlands	Total 2010
Total 2010	**6,060.13**	**102,220.00**	**49,020.88**	**226.16**	**11.31**	**446.09**	**13,538.37**	**179,979.99**
Croplands		266.40	287.61	4.16	0.11	0.01	24.08	**6,642.50**
Forests	1,648.01		2,107.49	12.49	0.06	0.37	198.59	**106,186.99**
Grasslands	893.14	2,105.10		18.87	0.08	0.31	185.45	**52,223.82**
Other lands	9.19	11.26	18.12		0.01	0.02	7.38	**272.13**
Settlements	0.34	0.05	0.08	0.00		-	0.00	**11.79**
Unclassified	-	-	-	-	-		-	**446.09**
Wetlands	259.83	211.51	180.80	6.06	0.01	0.09		**14,196.66**
Total 2014	**8,870.64**	**104,814.31**	**51,614.97**	**267.73**	**11.58**	**446.88**	**13,953.89**	**179,979.99**

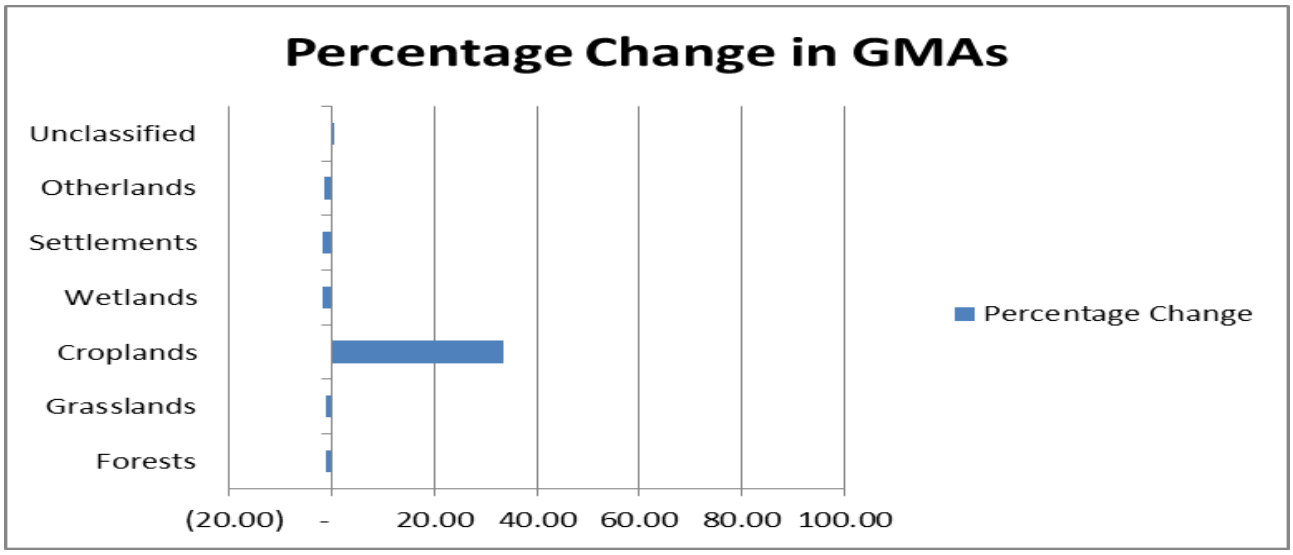


Figure 6: Percentage Land Use Change in GMAs between 2010 and 2014

Annex 3 shows some protected areas maps and how they have changed between 2010 and 2014. Blue Lagoon, Isangano, Lower Zambezi and Mweru Wantipa National Parks have shown an increase in cropland. This information can be used to target management and law enforcement activity. Figure 7 below is an example of where cropland has encroached in Lower Zambezi National Park, which, according to the Zambia Wildlife Act No. 14 of 2015 does not permit agriculture activities in the National Parks.

It has to be noted that the data used to generate the maps has some uncertainties and that the confidence levels are only 80 percent thus leaving room for wrong classification in certain areas as in the case of West Lunga National Park (Annex 3) which shows croplands within the park.

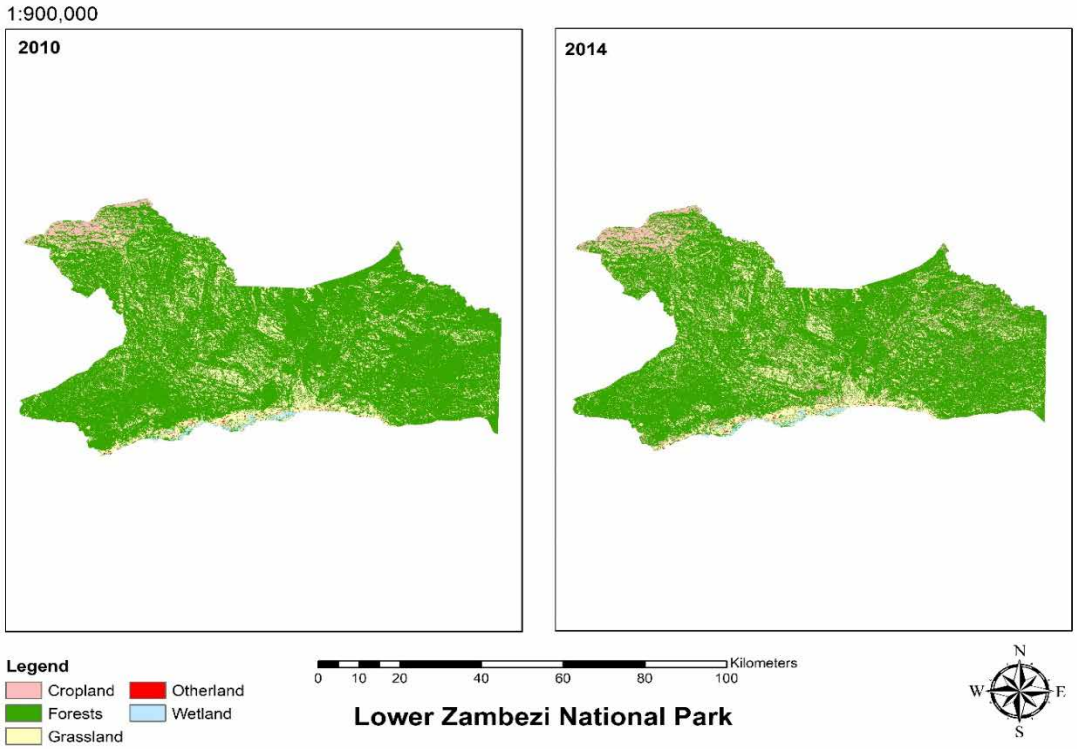
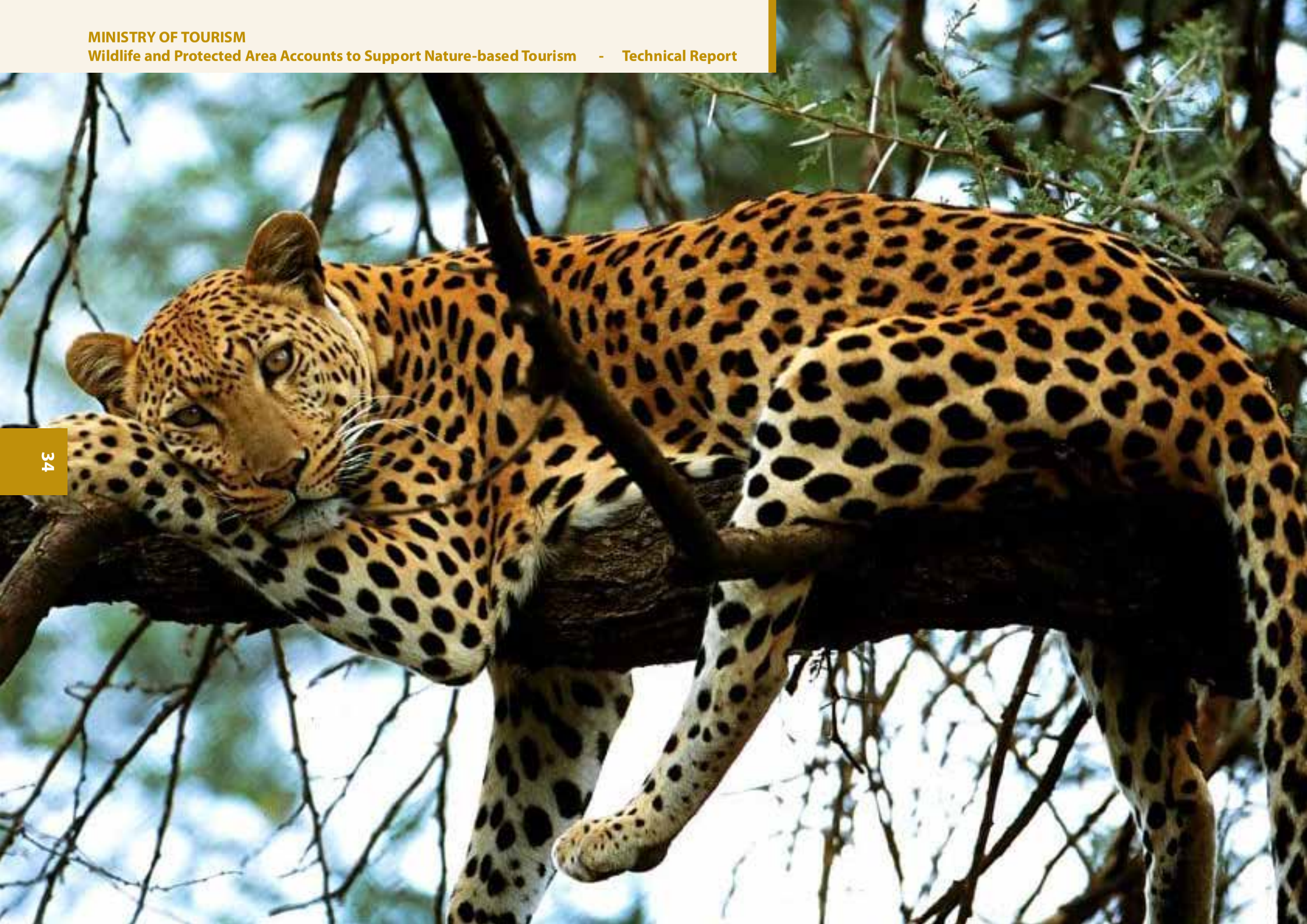


Figure 7: Land Cover changes in Lower Zambezi National Park (2010/2014)



8.0 CONCLUSION AND NEXT STEPS

8.1 Conclusion

The available data compiled into physical accounts for wildlife and land cover in protected areas and monetary accounts showed the value of these to the economy. These accounts are able to be used for the management and promotion of nature-based tourism in Zambia. The data showed the importance of the wildlife and protected areas for tourism and the national economy, as well as the decline in the overall abundance of wildlife in the National Parks and GMAs. The decrease is wildlife is attributable to a range of factors including an increase in crop land and poaching in the Game Management Areas, hence the need for more resources to facilitate effective policing and management of wildlife and protected areas to ensure the continued growth of nature-based tourism.

The accounts also highlighted the need for additional data on wildlife, land cover and the tourism industry for the update and ongoing production of accounts to support government policy on nature-based tourism. For the physical information, the current levels of animal abundance need to be determined and requires a national animal census. Annual land cover data are needed to determine the extent of encroachment in National Parks. For economic information, additional surveys are needed to determine the goods and services consumed by tourists. This can be obtained via additional surveys.

8.2 Next Steps

To update the accounts, additional data is needed and is dependent on the available animal population data (from aerial survey reports) and land use changes (using satellite data).

Next time around, it is proposed that ecosystem accounting is used so that the proposed interventions are based on the understanding of ecosystems, as well as the importance of the nature-based tourism to the economy, and ideally using a tourism satellite account. The following ecosystems and areas are the proposed as a focus for the next set of accounts:

1) Luangwa Ecosystem (consisting North and South Luangwa, Luambe and Lukusuzi National Parks and their adjacent GMAs. The Luangwa Valley is a well-known international tourist destination hence the importance of zeroing in on it. Furthermore, it is one of the highest revenue earners for the government.

2) Kafue Ecosystem (Kafue National Park and its surrounding GMAs). The Kafue National Park is Zambia's oldest and largest National Park: it is considered as the fourth highest revenue earner for the government. The KNP is also part of Kavango

Zambezi Transfrontier Conservation (KAZA-TFCA) Area and its continued stay in the TFCA is dependent on its continued connectivity to the rest of the TFCA.

3) Lower Zambezi Ecosystem (Lower Zambezi, Mosi-oa-Tunya and Sioma Ngwezi National Park, as well as Chiawa and Luano GMAs). The Lower Zambezi National Parks is also one of the government's top earners of revenue and part of the proposed Lower Zambezi – Mana Pools TFCA. The Mosi-oa-Tunya and Sioma Ngwezi National Parks are Zambia's second smallest and third largest National Parks respectively, and are both part of the KAZA TFCA.

4) Nsumbu – Mweru Wantipa Ecosystems (Nsumbu, Mweru Wantipa and Lusenga Plains National Parks and their associated GMAs. These parks are part of the Northern Circuit which is mentioned in the Presidential speech, Development plans and the Tourism Master Plan.

5) Kafue Flats Ecosystem (Blue Lagoon and Lochinvar National Parks and the Kafue Flats GMA). The Kafue Flats are home of the endemic Kafue Lechwe which is only found in Zambia and numerous water birds of international importance.

9.0 RECOMMENDATIONS

In order to have an accurate description and understanding on what is happening in Zambia's wildlife protected areas (the national parks and GMAs) and nature-based tourism, the following recommendations are made:

1) There is need for national aerial surveys for large mammals to be more frequent, like every two (2) or three (3) years to have more accurate national data on wildlife stock

2) More extensive research on the cats especially lions and leopards are required to have a better understanding of their population densities and distribution both at ecosystem level and national level.

3) Periodic surveys of hippos and crocodiles must be undertaken to determine the population of these animals in the river systems of Zambia. Currently, most of the populations are based on limited sampled areas

4) The future iteration of the wildlife account should be developed based on various ecosystems (Luangwa, Kafue, Lower Zambezi, Nsumbu – Mweru Wantipa) to help develop specific interventions for the ecosystems. This should also include the iterations of change in land use up to the year 2020/2021, showing a clear picture in terms of the land use changes.

5) It has been observed that change of land use to cropland is affecting protected areas, including National Parks where, by law, no settlements are allowed. There is need to develop and enforce the General Management Plans, especially for GMAs to reduce encroachment (unplanned settlements).

6) There is need to conduct a land audit for the GMAs to determine the exact amount of land dedicated to conservation activities considering that GMAs are a mixed land use kind of protected area.

7) There is need to have better economic data on tourism to better understand the contribution of nature-based tourism to the economy. This can be achieved through additional survey activity and the production of tourism satellite accounts.

Once the above recommendations are implemented there shall be additional information that could be used to inform policy and improve the protection of wildlife resources and the protected areas. For example, the need to increase the number of Wildlife Police Officers from 1600 to 4800 to enhance the protection of the wildlife and reduce encroachment of the protected areas. This information can also be used to promote private sector investment in nature-based tourism.

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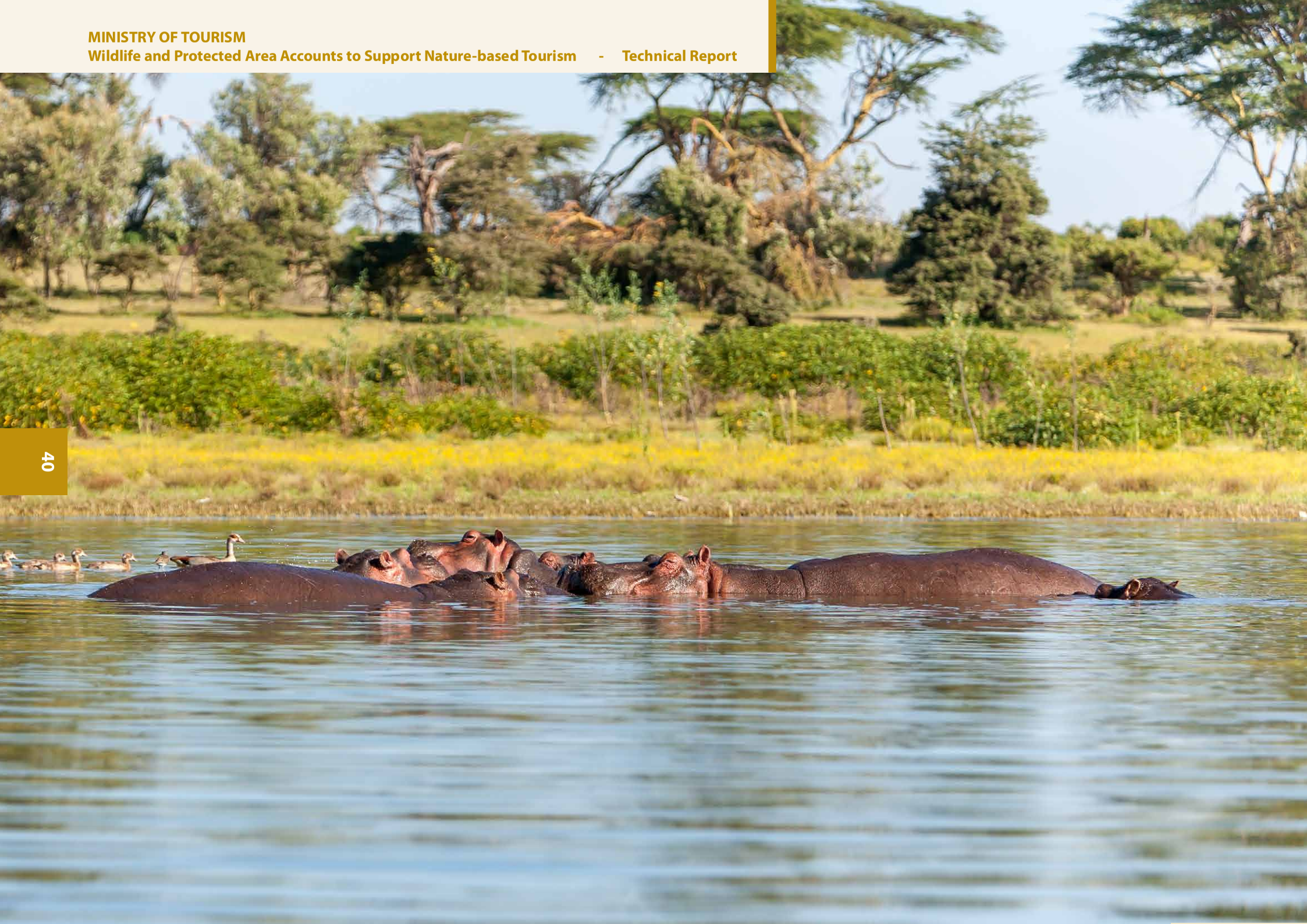


Annexes

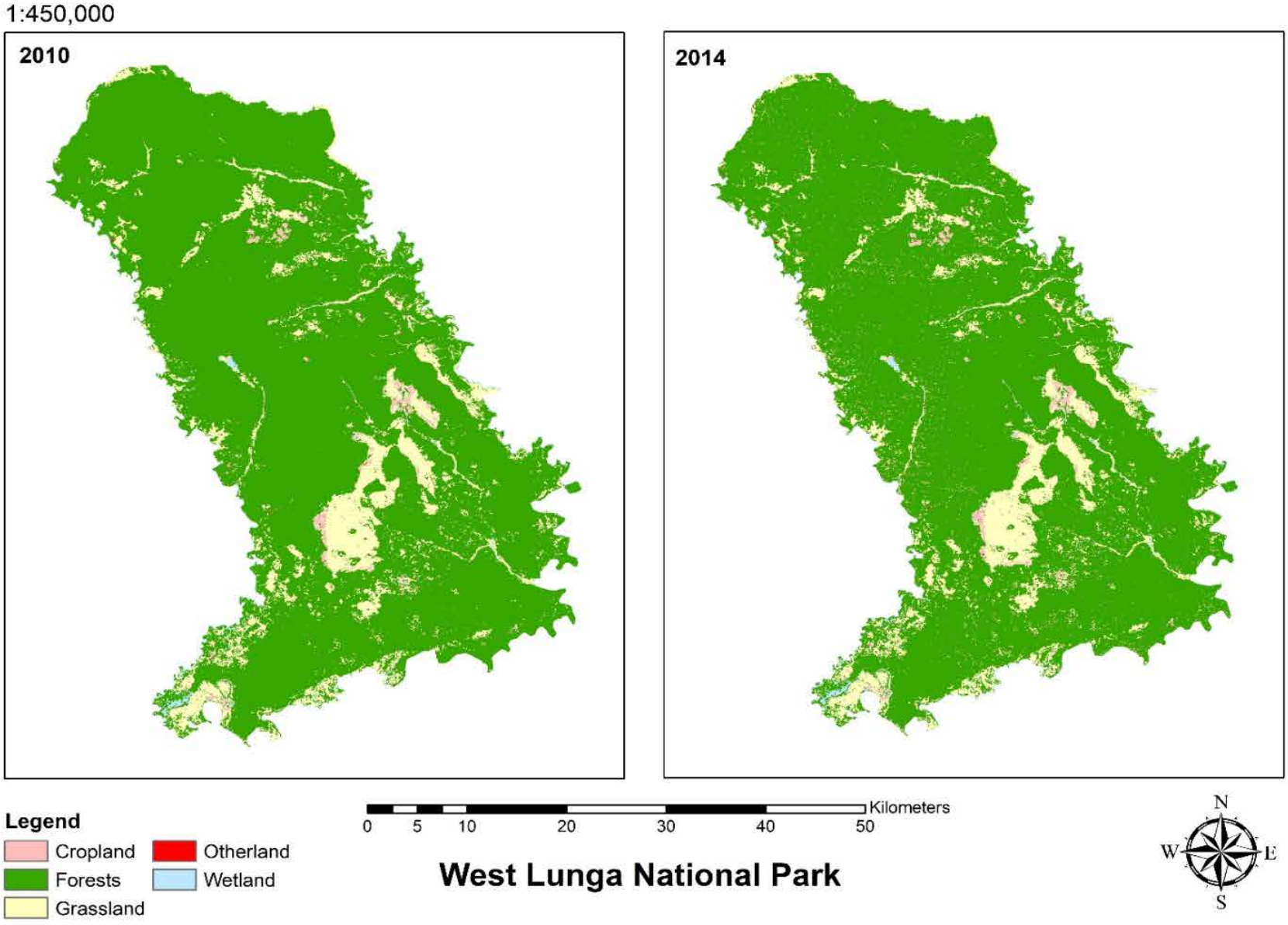
Annex 1. Tourism Contribution to the Economy

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Tourism (ZMW 'million)	1,734	1,521	1,967	2,101	2,752	3,203	3,275	3,645	4,249	4,504

Annex 2: Land Cover Key

No	Land Cover Category	National Land Cover Description
1	Forests	This is land covered by natural and/or planted forests which meets the threshold of 10% canopy cover and is grown over a minimum area of 0.5 hectares with trees above 5m height.
2	Grassland	This is land that includes wooded rangeland that may be covered mainly by grasslands, plains, and dambos and pans found along major river basins and water channels.
3	Cropland	This is land actively used to grow both annual and perennial crops which may be irrigated or rain fed for commercial, peasant and small-scale farms around urban and rural areas
4	Wetlands	This is land which is waterlogged, may be wooded such as marshland, perennial flooded plains and swampy areas. This category also includes surface water bodies.
5	Settlements	This is land covered mainly by densely populated and organized or irregular settlement patterns surrounding cities, towns, chiefdoms and rural centres commonly referred to as urban and rural built-up areas.
6	Other land	This is barren land covered by natural bare earth or soil such as sandy dunes, beach sand, rocky outcrops and can include old open quarry sites for mines and related infrastructure outside settlements.

Annex 3: Land Cover changes in Selected National Parks (2010/2014)



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2014
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Cropland
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Grassland
Wetland
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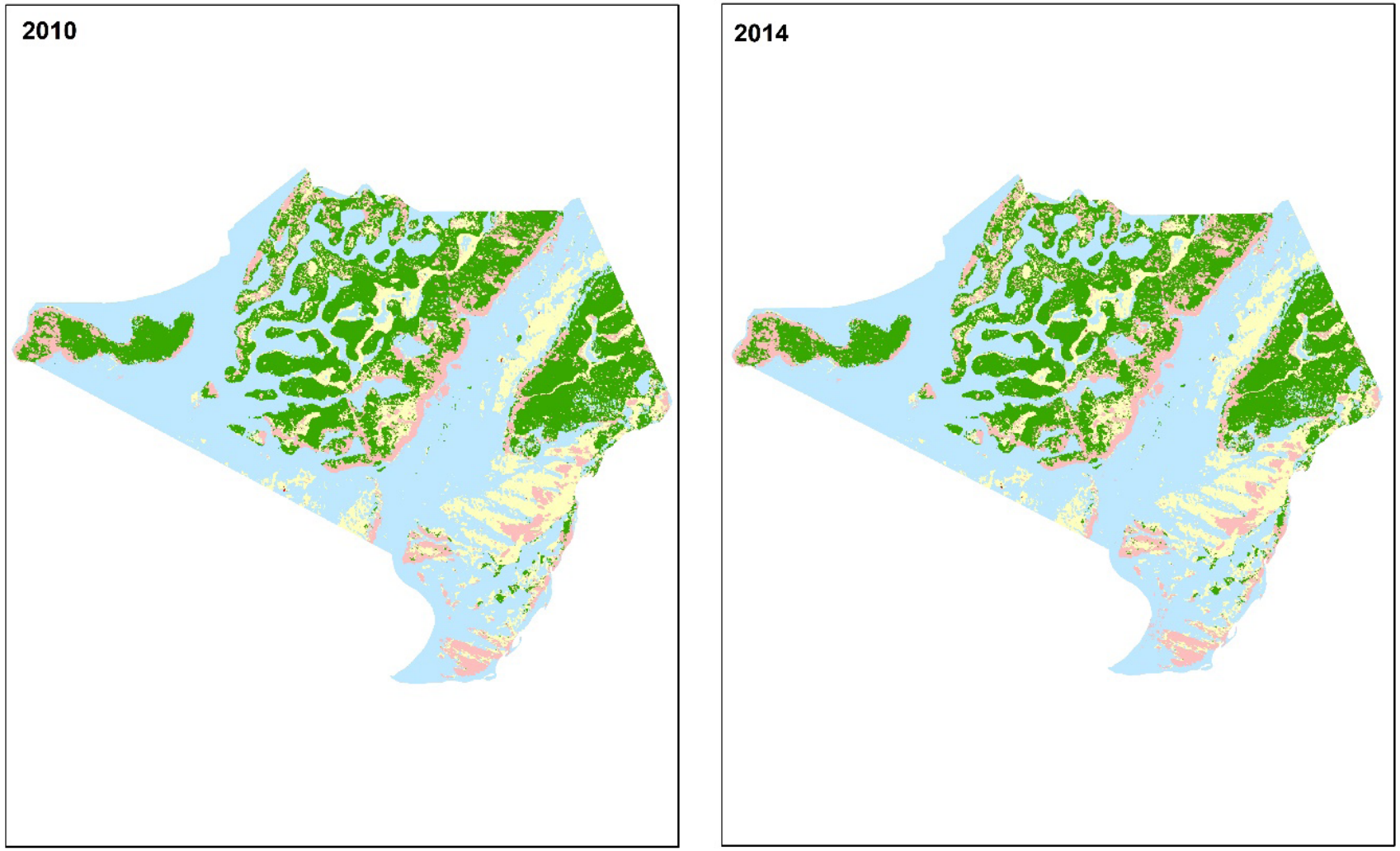
1:350,000


2010
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Grassland
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Kilometers
Isangano National Park
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1:900,000
2010
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Lower Zambezi National Park
Kilometers
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Cropland
Forests
Grassland
Otherland
Wetland

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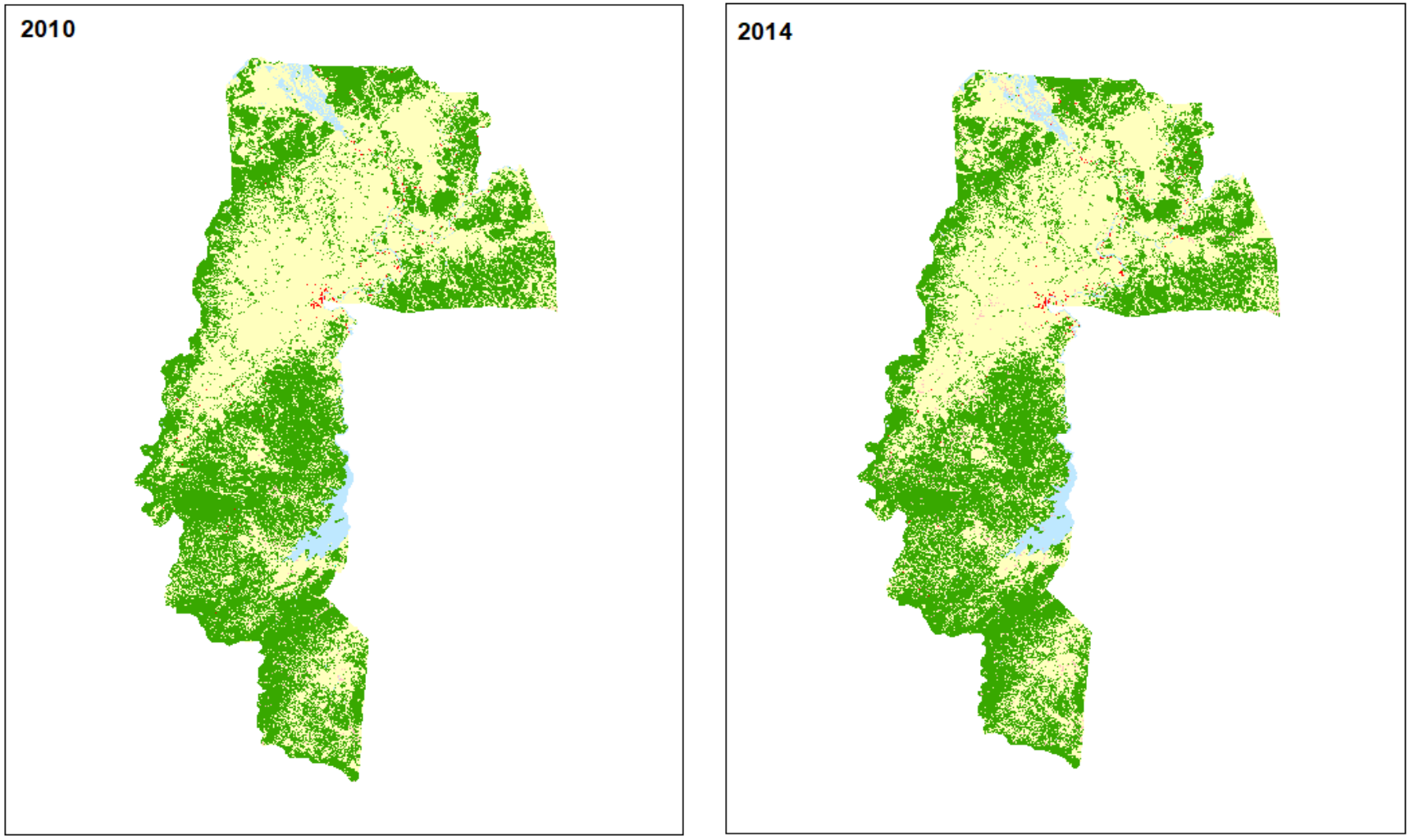
2010
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Cropland
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Mweru Wantipa National Park
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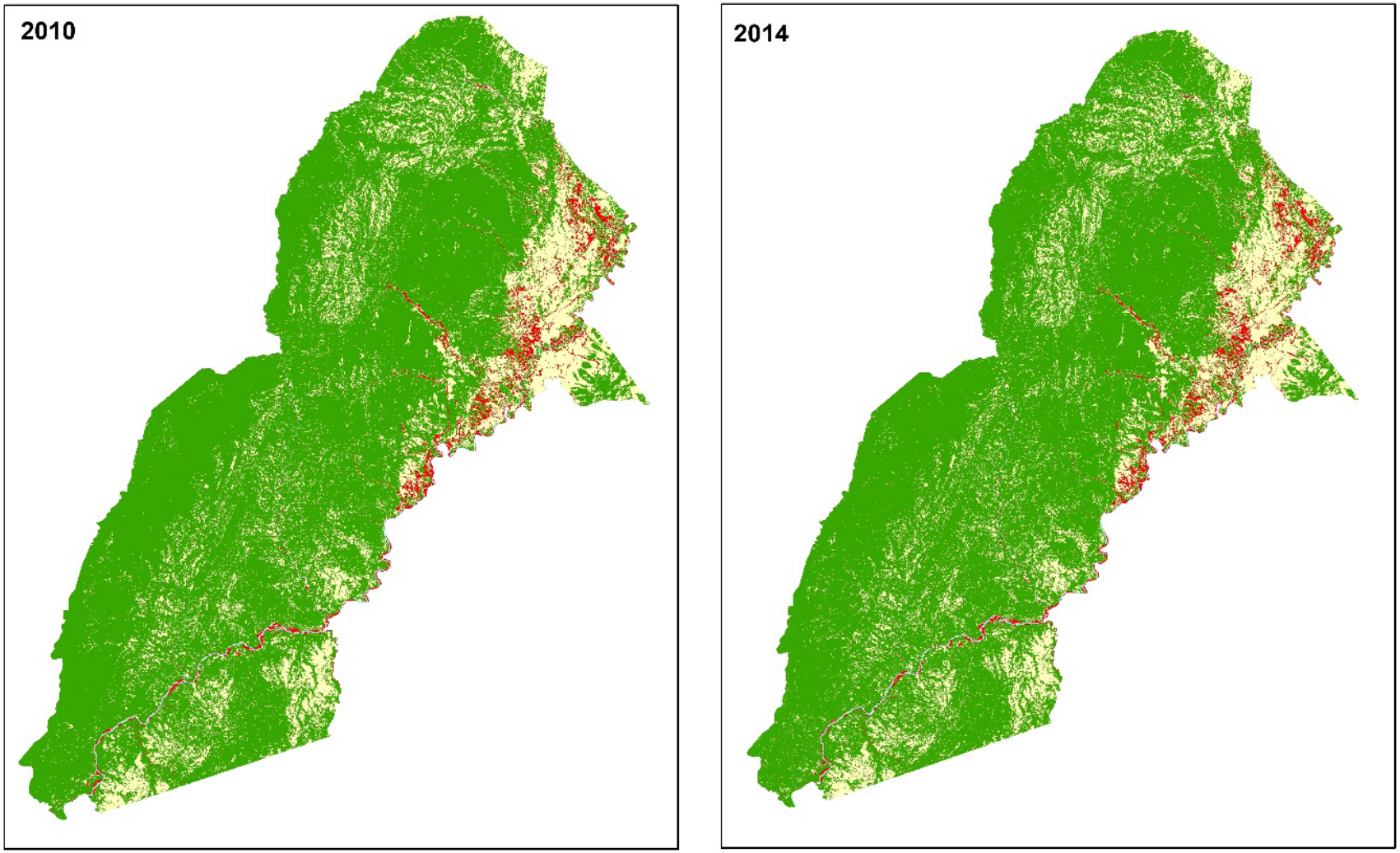

South Luangwa National Park

NOTES