Republic of Zambia

Ministry of Lands and Natural Resources

Forestry Department

NATURAL CAPITAL ACCOUNTS FOR FORESTS 2010 TO 2015

First Results and Next Steps

March, 2020

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Disclaimer

The Natural Capital Accounts (NCA) for Forests covering the period 2010 - 2015 were produced by the Forestry Department, Ministry of Lands and Natural Resources (MLNR) in collaboration with the Ministry of National Development Planning (MNDP) with technical assistance from the World Bank and the WAVES Global Partnership. Forests by law in Zambia mean "any land with a tree canopy cover of more than ten percent and area of more than zero point five hectares and includes young stands that have not yet reached, but are expected to reach, a crown density of ten percent and tree height of five meters that are temporarily under stocked areas" (Forest Act, 2015). A comprehensive database for the Forest Accounts is archived on the Forestry Department portal: www.zmb-nfms.org/portal/

The inferences and views expressed in this report are an analysis and interpretation of the data and results made by the technical working group (TWG) and do not necessarily reflect personal views and those of their respective institutions. Therefore, reasonable efforts have been made to ensure that the contents of this publication are factually correct and properly referenced. The authors do not warrant that the information in this report Is free from errors or omissions.

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Forewords

The Forestry Department under the Ministry of Lands and Natural Resources, is responsible for the rationalization of the exploitation of forest resources and the promotion of sustainable forest management (SFM) through the implementation of the Forests Act No.4 of 2015.

Forests occupy a large area of our country and provide much of the Zambian population with various products for their livelihoods. Therefore, forests and woodlands are significant to Zambia's social economic and cultural development. They have several ecological functions including providing habitat for wildlife, organic matter to fertilize and nurture the soil, protecting the soil from erosion and cleaning the air of greenhouse gases. Economic value of forests is also achieved through eco-tourism, timber and various wood-based products including source of fuel, medicines, fruits, honey and mushroom. The uses and functions of the forests in Zambia underscore the need to take care of them in a manner that they would continue to provide the benefits in a sustainable way. Unfortunately, assessments of the state of our forests indicate that there is a decline in forest resources due to degradation and deforestation which consequently worsen soil erosion and siltation to water bodies.

This report provides the findings of the first iteration for the Natural Capital Accounting (NCA) covering the period from 2010 to 2015 for the forestry sector in Zambia. It serves as a starting point towards harnessing the untapped potential of forest resources, proving that forest accounts can be produced for the nation but also recognizing that the forest accounts can be improved, expanded and institutionalized to address key policy issues in Zambia. This report has considered, to the extent possible, stakeholder reviews.

The report provides some critical findings and informative statistics on selected provisioning services such as timber and non-timber forest resources; wood fuel (wood for charcoal and firewood); liquid honey and bees wax used in the development of the forest accounts under the Wealth Accounting and Valuation of Ecosystem Services (WAVES) programme. The envisaged plan is to extend the development of the forest accounts to include Regulatory and Cultural services in order to provide a comprehensive analysis and outlook of the ecosystem services for the forest sector. The development of the forest account was technically led by the Forestry Department under the Ministry of Lands and Natural Resources.

It is our sincere hope that WAVES activities will be fully institutionalized in order to continue the collection of forest data and the development of forest accounts to inform policy. It is hoped that the capacity for National Forest Monitoring System (NFMS) can be built to regularly provide updates for the forest accounts.

Hon. Jean Kapata M.P.
Honorable Minister of Lands and Natural Resources
Ministry of Lands and Natural Resources

Hon Alexander Chiteme, M.P.
Honorable Minister of National Development Planning
Ministry of National Development Planning

Forewords

We cannot emphasize enough the relevance of Natural Capital Accounts (NCA) for the Republic of Zambia. Natural capital forms a large share of Zambia's wealth and is integral to its national development. The sustainable management of these natural resources is vital and keeping track of changes over time is imperative.

Zambia's Vision 2030 and Seventh National Development Plan (7NDP) express both an aspiration to live in a prosperous, sustainable middle-income economy with opportunities for all. This cannot be achieved without the use of NCA which provides detailed statistics on to inform and improve the management of the resources.

Prioritizing Natural Capital Accounting to contribute to economic development is not an easy task. Zambia has selected forest, land and water as priority sectors in the initial stages of, development and management of its NCA with the Forest and Water Accounts ready to be launched. We commend the Government of the Republic of Zambia for the substantial progress made. These three accounts have played and continue to play a key role in providing the data needed for informed decision-making in key sectors of Zambia's economy.

Since its inception in 2017, the WAVES program has provided technical support to the Government through its Ministry of National Development Planning (MNDP). This support focused on mainstreaming NCA into national development and extended to training and capacity building for focal points in key ministries. Once the first three initial NCA are successfully completed, the WAVES program will build on the results and develop new accounts that will further inform policy and decision-making.

Various studies have shown that Zambia has an abundance of natural resources, but their potential remains underutilized, and in some cases unsustainably used. The continuous development of NCA will give impetus to Zambia to drive and promote sustainable development and shared prosperity.

The World Bank continues to be committed to working with the Government of Zambia to ensure that the information from these accounts provides a strong basis for an optimal management of the natural resources.

We recognize the tremendous efforts of the Ministry of Lands and Natural Resources, Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP) in collaboration with the Zambia Statistical Agency (ZamStats) and the Ministry of National Development Planning (MNDP) and their focal points who continue to build and manage NCA for sustained growth but also for resilient ecosystems and livelihoods.

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Acknowledgments

Acknowledgments

The technical forest report for the Natural Capital Accounting (NCA) is the result of collaborated effort of a spirited team of technical officers that constituted the Zambia WAVES Technical Working Group (TWG) for the WAVES project, under the guidance of Iretomiwa Olatunji and Juan-Pablo Castañeda from the World Bank, who provided strategic and technical assistance in developing of the account. Gratitude and acknowledgement are extended to the Zambia WAVES TWG led by Abel M. Siampale (focal point person), Bupe Musonda, Isaac Nyirenda and Michael Phiri, who conducted field assessments, household surveys across the country, complied the data and wrote the report.

This report was privileged to receive valuable inputs from various stakeholders. The entire forest team would like to thank the following institutions who directly and indirectly facilitated the development of the forest accounts: Zambia Statistical Agency(ZamStats), Copperbelt University (CBU), National Remote Sensing Centre (NRSC), Zambia Agriculture Research Institute (ZARI), Zambia Forestry College (ZFC), Zambia Environmental Management Agency (ZEMA), Zambia Honey Council (ZHC), Zambia Forestry and Forest Industries Corporation (ZAFFICO), Zambia National Association For Sawmillers (ZNAS), Ministry Of Agriculture (MOA), Zambia Revenue Authority (ZRA), Ministry Of Local Government (MLG) and Academia.

The forest team acknowledges both the external peer reviewers and those from the World Bank, Michael Vardon (World Bank), Constantino Sebastian (Enheten for policy analysis) and Soulard François (EETSD/DSEET). This report also benefitted from a technical validation and review from relevant and impactful stakeholders and we would like to extend our gratitude to all listed in Annex 2 for their various expertise and valuable contributions.

We would also like to thank the following national stakeholder reviewers and validators of this document: Obote Shakachite from the Copperbelt University (CBU); Edward Zulu from Community Market for Conservation (COMACO); Pasco Mumba from Zambia Statistical Agency Office Information (ZamStats); Gambwe Sikantongwe from the Department of Climate Change and Natural Resource Management (DCCNRM); Kasongo Chawama from the Department of Energy; Rabecca Mundiya, Mishelle Sinda, Yvonne-Ruwe Mulala from National Museums Board (NMB), Chota Ngalande from Zambia Forest and Forestry Industrial Cooperation (ZAFFICO); Limbekuma Musole from Zambia Association of Timber and Forestry Based Industries; Ferdinard handavu, Ackim Phiri from Zambia Forestry College (ZFC); and Bill Kalaluka from Zambia Honey Council (ZHC).

The Ministry of Lands and Natural Resources would like to express the heartfelt gratitude and appreciation to the Ministry of National Development Planning led by Permanent Secretary-Mr Chola Chabala, Director of Development Planning-Mr Maketo Mulele and Richard Lungu (Zambia WAVES National Focal Person) from the Ministry of National Development Planning for their strategic oversight and coordination. And to the World Bank (WB) group with special thanks to Iretomiwa Olatunji, Sofia Elisabet Ahlroth, and Juan-Pablo Castañeda for the overall leadership, supervision and technical assistance, as well as the entire World Bank project team, Sonu Jain, Lloyd John Chanda Chingambo, Mercy Mwanje Soko, Rebbeca Naomi Munsanda Ngulube, Rosina Mbewe and Christabel Mutale.

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Executive Summary

Executive Summary

Forests play vital roles in people's livelihoods as major sources of timber, traditional medicine, wood fuel, and food and building materials. They are key factors in carbon and hydrological cycles, watershed and soil conservation, and are important for other landscape factors (e.g. soil erosion). Therefore, forests are closely linked to economic growth and well-being of any nation. However, there is limited information about the economic value of forest resources, and many other contributions of forests are underestimated. It is in this regard that the development of the forest accounts is designed to comprehensively account for the forest resources and attach the real monetary value.

This is the first iteration of the forest accounts for the Republic of Zambia and covers the period 2010 to 2015. The forest accounts are based on the System of Environmental Economic Accounting (SEEA). The accounts where compiled from a variety of information sources and show the flows of forest resources from the environment to the economy, forest product flows within the economy and residual flows from the economy to the environment.

The supply and use accounts for timber and non-timber forest product for the years 2010 to 2015 show the flows of six (6) forest products: (i) timber from the indigenous[4] forests; (ii) timber from exotic[5] plantations; (iii) charcoal; (iv) firewood; (v) liquid honey and (vi) beeswax. These are the first set of forest products addressed under the first iteration. However, there are other areas and uses of forest resources, such as tourism, carbon sequestration, biodiversity protection and water supply that were not accounted for during the first iteration of the forest accounts. These may be considered in the second iteration of the forest accounts.

The four (4) main findings from the forest accounts are:

1) The forest area is shrinking. Of the area of forest lost, 64.31% was to agriculture, 32.81% was to urban areas (including unplanned settlements) and the rest to mining and other activities;
2) There is an increasing demand for export of indigenous timber leading to uncontrolled[6] exploitation of valuable tree species such as Mukula (*Chrysothraxis angolensis*), Mukwa (Pterocarpus angolesnsis), and Muzauli (Guilbortia coloespermum).
3) Wood biomass is a major source of energy in the country. The extraction of wood-fuel (charcoal and firewood use) continues to increase, and there are inefficiencies in charcoal production, and;
4) For areas with forests and good forest management[7], markets for honey and bees wax are an increasingly important source of income.

Meanwhile, both timber forest products (TFP) and non-timber forest products (NTFP) are important to the Zambian economy. For example, honey production was 1,953 tons in 2015, while beeswax was 102 tons, and the price of liquid honey wax is estimated to be 22 kwacha per kg while beeswax is 100 kwacha per kg. Between 2010 and 2015, Zambia earned a total of 197.8 million kwacha ($21.98millio @ exchange rate of 9 kwacha in 2015) from the sale of honey and another 47.3 million kwacha *($5.25milion @ exchange rate of 9 kwacha in 2015)*.

The physical supply and use accounts also show the residual flows from some industries and it is planned that the next iteration of the accounts will include additional forest products (e.g. caterpillars, mushrooms, etc.) as well as ecosystem services derived from forests (e.g. carbon sequestration, water filtration, cultural and recreational services).

[4]Indigenous forest refers to natural (native) forests
[5]Exotic plantations refers to planted forests with trees of foreign provenancess
[6]Uncontrolled means not monitored because it is done illegally and in none designated (concession) areas
[7]Good forest management means sound or sustainable forest management (SFM)

Forest asset accounts show that the area of forest declined from 47.1 million hectares in 2000 to 45.9 million hectares in 2015. This was attributed to various reasons, with conversion to agriculture accounting for the biggest change.

The forest accounts shed light on some critical policy issues including: sustainable forest management through forest certification; water catchment management and recharge systems protection; formulation of forest management plans to ensure biodiversity conservation, expansion and policy support to liquid honey and beeswax production, and over exploitation of wood biomass for energy. For instance, wood biomass is shown to be an important energy source, with charcoal contributing 79% to total energy consumption, while firewood contribute 1%. Together charcoal and firewood produce well above 554.5 Tera-joules (TJ) of energy.

Going forward, work is needed to institutionalize the account, production and use in government decision-making processes.This will require continued cooperation between government agencies and technical and financial support from development partners.

Acronyms

7NDP	Seventh National Development Plan
CBU	Copperbelt University
COMACO	Community Market for Conservation
DCCNRM	Department of Climate Change and Natural Resource Management
DG	Director General
EIA	Environmental Impact Assessment
ERB	Energy Regulation Board
FAO	Food and Agriculture Organization
FD	Forestry Department
FRA	Forest Resource Assessments
GDP	Gross Domestic Product
GIS	Geographical Information System
GRZ	Government of the Republic of Zambia
ha	hectare
ICT	Information Communication Technologies
IEM	Integrated Ecosystem Management
ILUA	Integrated Land Use Assessment
IPCC	Intergovernmental Panel on Climate Change
m3	metres cubed
MLNR	Ministry of Lands and Natural Resources
MNDP	Ministry of National Development Planning
MoHE	Ministry of Higher Education
MWDEP	Ministry of Water Development and Environmental Protection
NCA	National Capital Accounting
NLAP	National Land Audit Programme
NMB	National Museums Board
NRSC	National Remote Sensing Centre
NSDI	National Spatial Data Infrastructure
NTFPs	Non-Timber Forest Products
REDD	Reduced Emissions from Deforestation and Forest Degradation
SDGs	Sustainable Development Goals
SEEA	System of Environmental-Economic Accounting
SNA	System of National Accounts
TFPs	Wood Forest Products
UN	United Nations
WAVES	Wealth Accounting and Valuation of Ecosystem Services
WBG	World Bank Group
ZAFFICO	Zambia Forestry and Forest Industry Corporation
ZATFBI	Zambia Association of Timber and Forestry Based Industries
ZDA	Zambia Development Agency
ZESCO	Zambia Electricity and Supply Corporation
ZFC	Zambia Forestry College
ZHC	Zambia Honey Council
ZamStats	Zambia Statistical Agency

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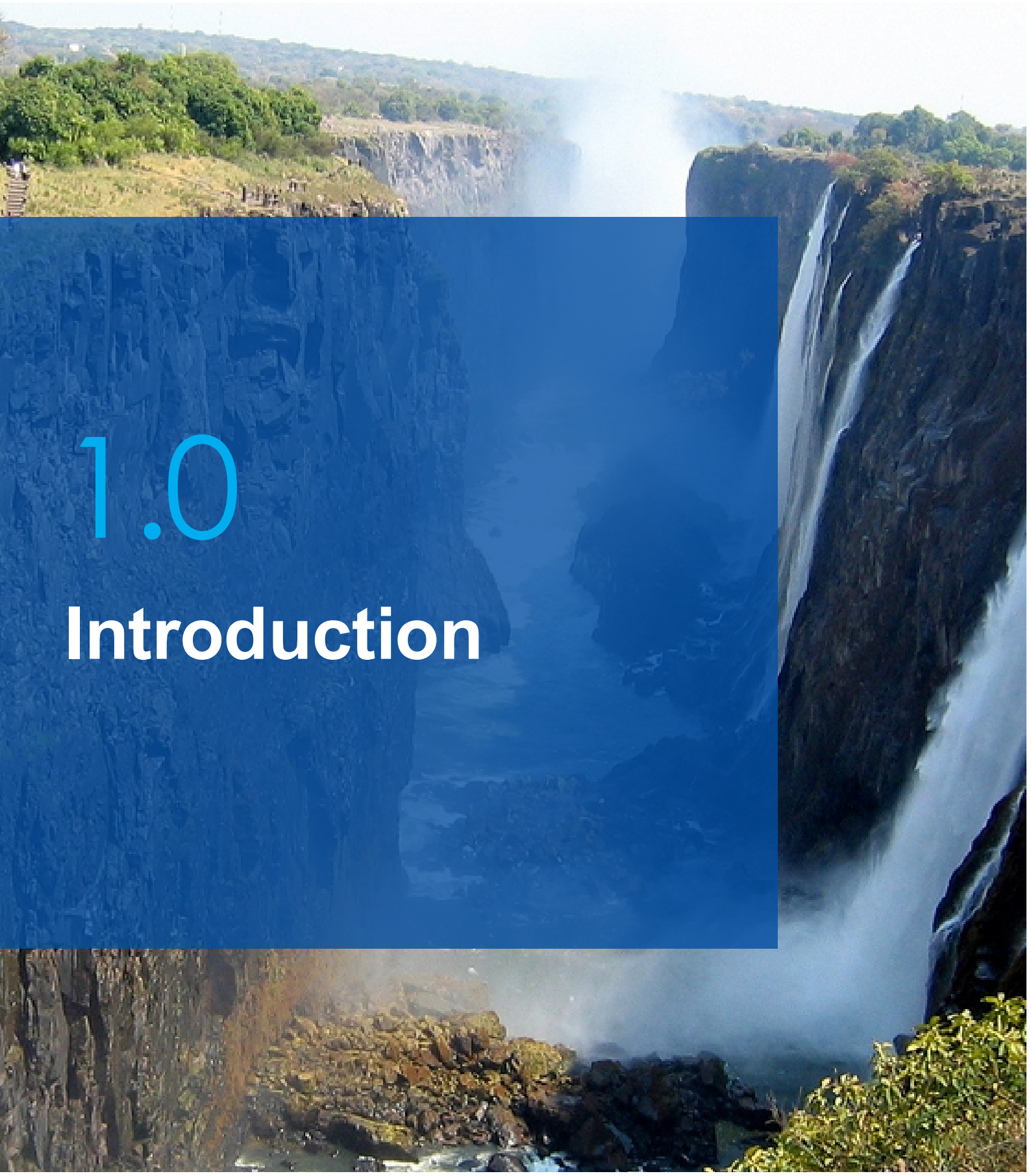

1.0 Introduction

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The Government of the Republic of Zambia is developing natural capital accounts (NCA). This work is directed by a Steering Committee led by the Ministry of National Development Planning (MNDP), and includes members from the Ministry of Lands and Natural Resources (MLNR), the Zambia Statistical Agency (ZamStats), Ministry of Water Development and Environmental Protection (MWDEP), Ministry of Higher Education (MoHE) and the National Remote Sensing Centre (NRSC). The accounts unify information on natural resources to show how they are contributing to the economy and how the economy may be affecting the natural resources. Such information is important for improving development decisions.

Wealth Accounting and Valuation of Ecosystem Services (WAVES) is a global partnership that uses natural capital accounting to mainstream natural capital considerations into economic policy. Natural capital accounting helps to underscore the contribution of natural resources to the economy as well as to highlight the impact of the economy on the environment. It is for this reason that the Government of the Republic of Zambia became part of the WAVES partnership supported by the World Bank.

This document is a technical report of the Forest Accounts for Zambia, covering the period 2010 to 2015. It follows extensive work by the Technical Working Group (TWG) on Forest Accounts, the World Bank Team and Consultants on natural capital accounting (NCA). This report is the first official iteration of a Forest Account for Zambia. It serves as a starting point, proving that forest accounts can be produced for the nation but also recognizing that they can be improved, expanded and institutionalized to address key policy issues in Zambia. It has taken into account, to the extent possible, stakeholder reviews (Annex 2).

It is hoped that the Forest Accounts will prompt discussions and action leading to more support for data collection, improved methods of accounting and also lead to applications of the findings from the accounts within government. The full spectrum of forest accounting is very broad, covering physical supply and use of timber and non-timber forest products, the physical extent and condition of forest accounts, and a range of monetary accounts. However, this report focuses on the physical asset accounts, supply and use accounts for timber and non-timber forest. The development of forest condition accounts and links to the ecosystem services from forest are issues that will be addressed in the next iterations of the Forest Accounts in Zambia after a full orientation of the technical working group. This is significant as there is recognition that forest ecosystems provide non-marketed goods and services that greatly contribute to the livelihoods of many in the country (World Bank, 2017).

General economic, environmental and social information about Zambia for those unfamiliar with the country is found in Box 1. Some of this information is also important for the derivation of indicators, for example, per capita use of timber products and the timber industry as a percentage of GDP.

Box 1. Information on Zambia

The Republic of Zambia is located in Southern Africa. The country has an area of 753 000 sq km, with 32% of this agricultural land and 65% forested area (2016, FAO country databases). In 2017, Zambia had a population of 17.1 million (ZamStats 2018). Approximately 57% of the population lived below the poverty line (World Bank 2019). Gross Domestic Product (GDP) was USD$25.868 billion (current price) in 2017, with an average annual growth rate of 3.4% (2016, World Bank database) while GDP per capita was USD$3,652 in 2016 (FAO country database). Mining contributes 14.8% to GDP while agriculture contributes 7.2% (2015 ZamStats national accounts). The development aspirations, opportunities and challenges of the country are outlined in 7th National Development Plan 2017-2021 (Ministry of National Development Planning 2017).

This report has six sections: Introduction (Section 1); Main findings (Section 2); Concepts, data sources and methods (Section 3); Next steps (Section 4), Acknowledgments (Section 5); and References (Section 6). The report also has an Annex containing tables showing the forest accounts and related diagrams for Zambia. Section 2 outlines the main findings which mostly give the impressions and policy issues derived from the Forest Accounts. The sources of the data that were used to compile the Forest Accounts as well as the basic approaches and assumptions used to make estimates are elaborated in Section 3. This section also briefly narrates the concepts for Compiling the Forest Accounts, following the System of Environmental Economic Accounting (SEEA) Central Framework (UN, 2014) and the Forest Accounting Sourcebook (Castaneda et al. 2016). Section 4 outlines the next steps for the continued development and application of Forest Accounts in Zambia.

1.1 Process of development

The Forest Accounts were developed between May 2017 and March 2019. The development process included the following steps:

1) The launch of WAVES programme in May, 2017;
2) Studying the core manuals for accounting (SEEA and Resource-books);
3) Outlining the main objectives for forest accounts
4) Listing of the available data and information (i.e. at provincial and national levels);
5) Identified the key players (to form the working group) for the account;
6) Appointing the technical working group (TWGs)
7) Mapping, collecting and organizing the datasets (cleansing process);
8) Creating a comprehensive database (i.e. pivot tables);
9) Data mining and manipulation (i.e. listing the required coefficients);
10) Detailed processing, analysis and compiling of the results;
11) Constructing diagrams and tables (i.e. asset, land matrix, supply and monetary);
12) Informative interpretation of the findings;
13) Compiling the technical reports and the policy briefs; and
14) Validation of the findings for the forest account.

1.2 The institutional and policy context for forest accounts

Zambia's forestry policy of 2015 covers both the forest plantations and natural forests, and these have multiple aims including: enhancing forest production; mitigating climate change; generating income; reducing poverty; creating jobs, and; protecting biodiversity. Another major aim of the policy is to motivate responsible forest management. As part of this, the forest policy encourages the definition of: stakeholder roles; resource tenure; developing for the sharing of the costs and benefits of forest management; and investing in forest industries.

Forest policy also needs to be viewed in the context of the Seventh National Development Plan (7NDP). The 7NDP recognizes Zambia's endowment of natural capital as a comparative advantage. It also stresses the importance of diversifying the economy through identification of growth sectors which are not dependent on single and finite resources, such as copper (MNPD, 2017). The plan specifically highlights the potential of forestry (p.24).

The 7NDP also addresses climate change mitigation and adaptation measures. Zambia has experienced the effects of climate change that have resulted in more extreme conditions such as droughts and floods as well as increased temperatures and increased rainfall variability. These conditions have affected the country's economic growth and development path (MNPD, 2017). For example, from 2006 to 2016, the production of 13 of the 18 major crops fell, largely due to erratic rainfall and it is estimated that the effects of climate change, will cost the country 0.4% of annual economic growth (MNPD, 2017). In 2015 and 2016, the country faced a major power crisis due to low water levels in dams reducing hydro-power generation and resulting in extensive power cuts forcing consumers to find alternative sources of energy such as charcoal, firewood, fossil fuels, and solar.

2.0 Main findings

2.0 Main findings

This section presents the main findings and policy issues emerging from the forest accounts for Zambia. It draws on the accounts compiled as well as other information to highlight key issues and the implications for policy. Four (4) key findings were:

1) The forest area is shrinking. Of the area of forests lost 64.31% was to agriculture, 32.81% was to urban areas (including unplanned settlements) and the rest to mining and other activities;
2) There is an increasing demand for export of indigenous timber leading to uncontrolled exploitation of valuable tree species such as Mukula *(Chrysothraxis angolensis)*, Mukwa (*Pterocarpus angolesnsis*), and Muzauli *(Guilbortia coloespermum)*.
3) Wood biomass is a major source of energy in the country. The extraction of wood-fuel (charcoal and firewood use) continues to increase, and there are inefficiencies in charcoal production, and;
4) For areas with forests and good forest management, markets for honey and beeswax are an increasingly important source of income.

2.1 Unsustainable use of forest

The land cover data for the years 2000 and 2015, show that human activities reduced the forest cover from 47.05 million hectares in 2000 to 45.94 million hectares in 2015. The loss of 1.1 million hectares 2000 to 2015 equivalent to an annualized loss (or deforestation) of 79,345 hectares per annum (0.17%).

The changes in forested land are presented in Figure 1 as well as in the land cover change matrix (Table A4.1) and the forest asset account (Table A4.2). In this, cropland increased from 6,467 million hectares in 2000 to 7,183 million hectares in 2015, while land under settlements increased from 0.137 million hectares to 0.502 million hectares in the same period. Wetlands and other land, which include economic activities such as water developments and mining, increased from 5,041 million hectares in 2000 to 5,078 million hectares in 2015 and from 0.136 million hectares in 2000 to 0.144 million hectares in 2015, respectively.

Table A4.1 Land cover change matrix , 2000 to 2015 (hectares)

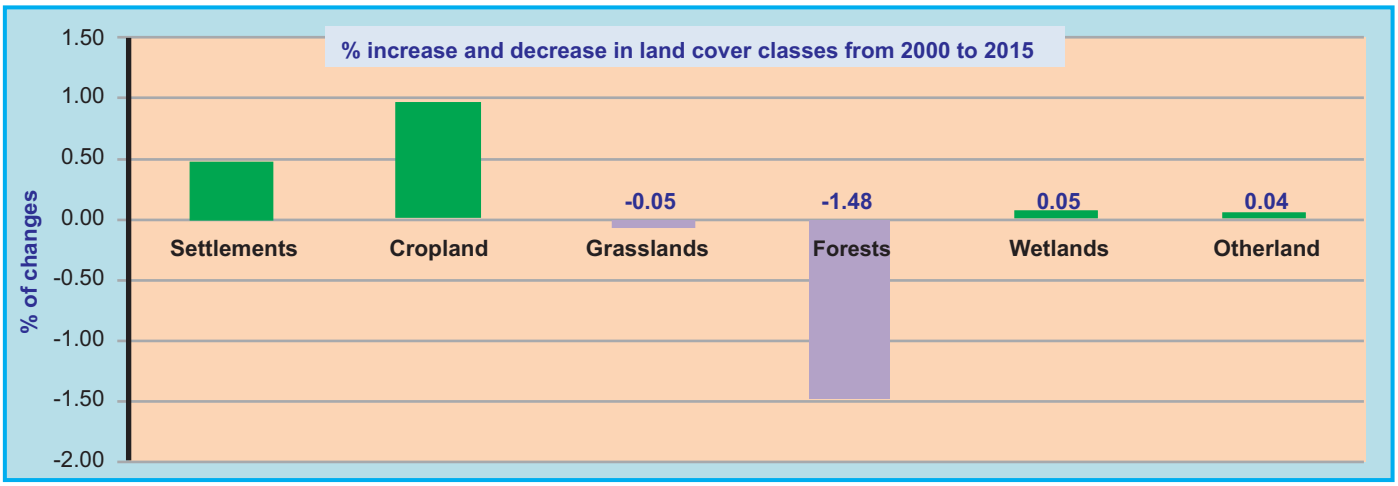
Land cover classes	Land area in Hectares (HA)								
	Opening area 2000	Forest land	Crop Land	Grassland	Wetland	Settlement	Other Land	Net change	Closing area 2015
Forest	47,054,148		-714,365)	0	-8,961	-364,413	-23,095	-1,110,834	45,943,316
Crop Land	6,466,555	714,363		-1,978	0	0	0	716,341	7,182,896
Grassland	16,426,337	0	1,978		-27,193	0	-6,983	-36,154	16,390,183
Wetland	5,041,472	8,961	0	27,193		0	0	36,154	5,077,626
Settlement	137,245	364,413	0	0	0		0	364,413	501,658
Other Land	135,643	23,095	0	6,983	0	0		30,078	165,721

Source: ILUAll Land-cover maps

Table A4.2 Physical asset account for the forests, 2000 to 2015 (hectares)

The forest land area stock estimates over the time span	Type of forest and other wooded land				
	Primary (pristine) forest land (*ha*)	Other naturally regenerated forest (*ha*)	Planted (exotic) forest land (*ha*)	Other wooded land (*ha*)	Total forest land (*ha*)
Opening Stock of forest and other wooded land (2000)	**10,756,578**	**27,771,311**	**56,512**	**8,469,747**	**47,054,148**
Additions to stock	**0**	**0**	**1,100**	**0**	**1,100**
Afforestation /Reforestation	0	0	1,100	0	1,100
Natural expansion	0	0	0	0	0
Reductions in stock	**-252,759**	**-664,124**	**-1,000**	**-192,950**	**-1,110,833**
Deforestation	(252,759)	(664,124)	(1,000)	(192,950)	(1,110,833)
Natural regression	0	0	0	0	0
Total reductions in stock	**252,759**	**664,124**	**1,000**	**192,950**	**1,110,833**
Closing stock of forest and other wooded land (2015)	**10,503,819**	**27,107,187**	**56,612**	**8,276,797**	**45,944,415**

Figure 1: Changes in the stock of land cover *(Percent change between 2000 and 2015)*



Source: ILUAII Final Report, 2016

The calculations in figure 1 were based on the difference between 62.52% (representing 47.05 million hectares) and 61.04% (representing 45.94 million hectares) of forest cover in 2000 and 2015 respectively against the total land area for Zambia. This is the difference in percentage of all land cover change, (62.52% and 61.04%) against the country's land area, and not the net change between the forest hectares in 2000 to the total forest hectares in 2015 (Table 1).

Table 1: Changes in the stock of land cover (Percent change between 2000 and 2015)

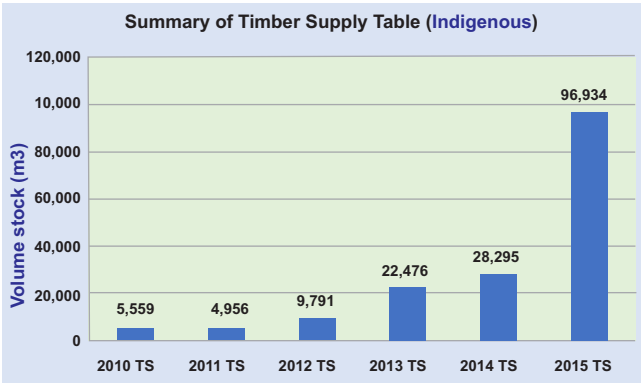
Land cover Class Type	Land Area, 000 Ha			Land Area in %		
	Yr. 2000	Yr. 2010	Yr. 2014	Yr. 2000	Yr. 2010	Yr. 2015
Settlement	137	208	502	0.18	0.28	0.67
Cropland	6,467	6,745	7,183	8.59	8.96	9.54
Grassland	16,426	16,375	16,390	21.83	21.76	21.78
Forest land	47,054	46,696	45,943	62.52	62.05	61.04
Wetland	5,041	5,093	5,078	6.70	6.77	6.75
Other land	136	144	166	0.18	0.19	0.22
TOTAL	**75,261**	**75,261**	**75,261**	**100.00**	**100.00**	**100.00**

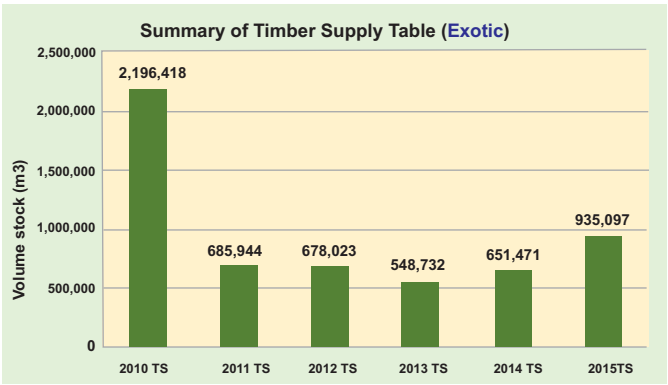
Source: ILUAII, 2016

2.2 Increasing demand for indigenous timber

In the period 2010 to 2015, Zambia supplied an average of 949,281 m^3 of timber per year from indigenous[8] and plantation forests (forest products physical supply and use tables, Tables A4.3 to A4.8). The supply of indigenous timber has increased dramatically during this time, while the supply of exotic timber significantly reduced between 2011 and 2013, but steadily started increasing in 2014 to 2015 (Figure 2).

Figure 2: The trends in the supply of timber





Source: Forest products account (Tables A4.3 to A4.8)

[9]Exotic timber is consumed mainly by the local markets, while about 85% of the indigenous timber is exported. China has become the largest importer of indigenous timbers such as Mukula (*Pterocarpus crysothrix)*, Mukwa (*Pterocarpus angolensis*) and Musauli (*Guilbourtia coleosperm*) from Zambia. For example, in 2015, Zambia declared timber exports of about 3,000 cubic metres at an approximate value of USD$900,000 (GRZ, 2015).

[8]Indigenous timber refers to timber from natural forests

[9]Exotic timber mainly refers to Eucalyptus and Pine trees with foreign provenances

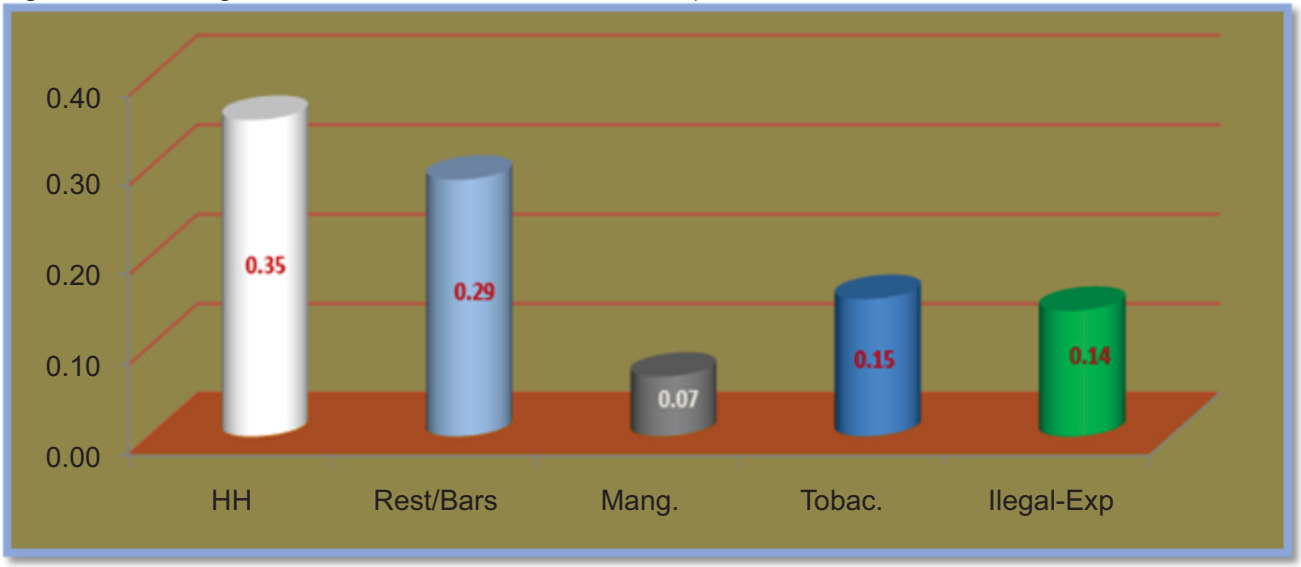
2.3 Wood biomass as a major source of energy

Charcoal and firewood are major energy sources in Zambia. Charcoal and firewood contribute above 80% of the total energy consumption in the country. Charcoal is the dominant energy source for urban house-holds especially in low cost residential areas. But is also used by households in medium and high, cost residential areas.

This may be due to increased electricity tariffs in the country (ERB, 2012). The main uses of charcoal are cooking, roasting, water heating, and space heating, and in low density areas it is still used in non-electrical pressing irons. In rural areas firewood is preferred to charcoal and is collected from areas around their houses and nearby forests.

The largest use of charcoal and firewood is by households at 35% of the total use (Figure 3). Restaurants and bars accounted for 29%, tobacco treatment 15%, "illegal" exports 14%, and other industries (e.g. schools, hospitals, prisons, some manganese plant, and poultry farmers) approximately 7% (see forest products physical supply and use tables (Tables A4.3 to A4.8).

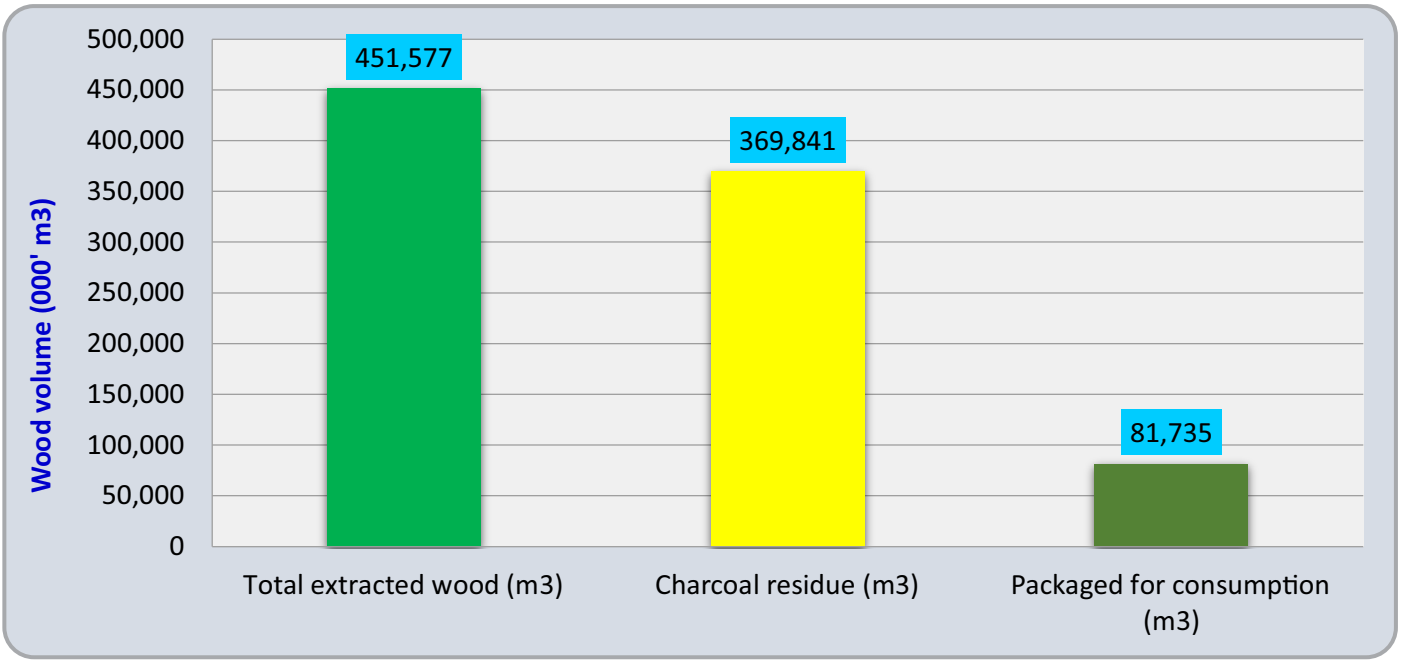
Figure 3: *Percentage of charcoal and firewood utilization by different end users, 2010*



Source: Forest products account (Tables A1.3 to A1.8). Key: HH = households; Rest/Bars = Restaurants/Bars; Mang. = Manganese; Tobac. = Tobacco; Ilegal Exp = Illegal exports.

The percentage of charcoal produced from the earth kilns supplied by wood is low (18.1%), resulting in large amounts of charcoal residue (Figure 4). Further, the findings on charcoal data indicates that only 1.6% is formally licensed by the Forestry Department through the production and conveyance fees, while 98.4% is unlicensed. This is attributed to the limited capacity of the Forestry Department to consistently and timely monitor the production and conveyance of charcoal country wide.

Figure 4: Wood extraction, charcoal residues production recovery (average 2010-2015)



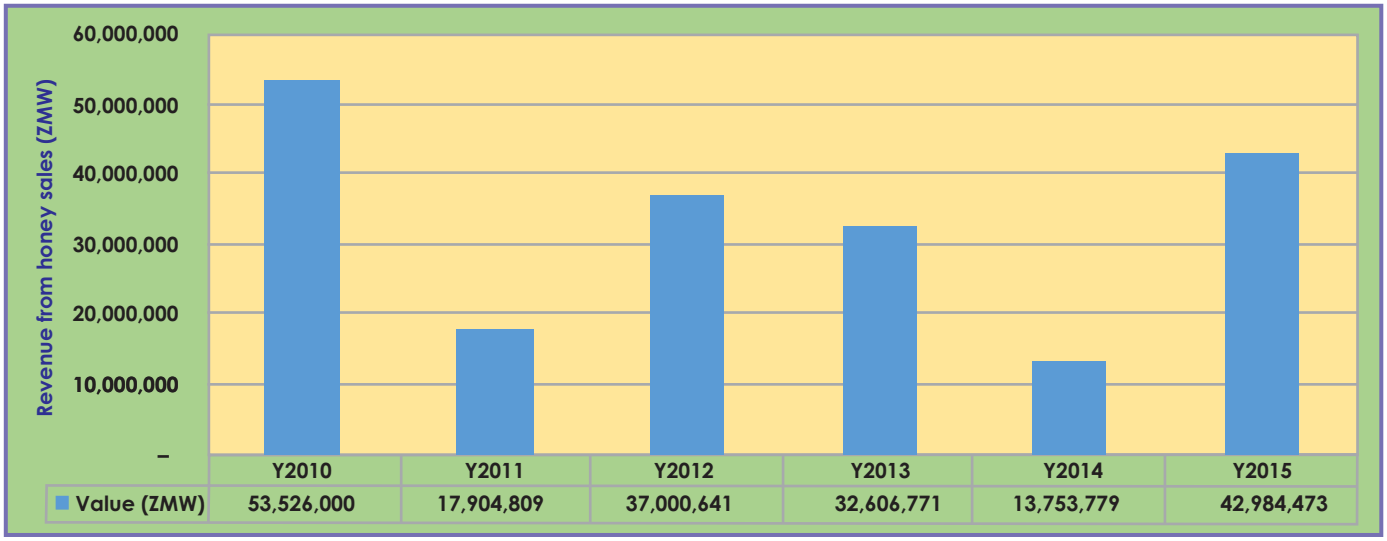
Note: Packaged for consumption is the amount of charcoal put in bags for sale

Source: Forest products account (Tables A4.3 to A4.8).

2.4 Increasing markets for honey and beeswax

Zambia earned 197.8 million kwacha from the sale of liquid honey and another 47.5 million kwacha from the sale of beeswax between 2010 and 2015 (Figure 5). Most is exported and the amount varies year to year (See tables A4.3 to A4.8).

Figure 5: Value of liquid honey sales, 2010 to 2015



Source: Forest products account (Tables A4.3 to A4.8).

The main markets for bee products are the United Kingdom (55%), Germany (35%), and South Africa (5%). Other markets (5%) have been Botswana, Libya, Tanzania and Zimbabwe. Honey and bee wax products have great market potential (ZHC, 2010), and good information is needed to help develop policies and processes to take advantage of this.

3.0

Concepts, data sources and methods

3.0 Concepts, data sources and methods

3.1 SEEA the conceptual framework for NCA

The System of Environmental-Economic Accounting 2012 - Central Framework (SEEA Central Framework; UN et al., 2014) is the statistical framework that guided the compilation of natural capital accounts in Zambia. The SEEA provides the agreed concepts and definitions for natural capital accounting and was produced under the auspices of the United Nations (UN), the European Commission, the Food and Agriculture Organization (FAO) of the United Nations, the Organization for Economic Co-operation and Development (OECD), the International Monetary Fund (IMF) and the World Bank Group.

The SEEA organizes of information from various data sources into tables and accounts in an integrated and conceptually coherent manner. This information can be used to create indicators consistent with the traditional SNA that can be used to inform decision-making for a wide range of purposes. The SEEA provides information allowing for the assessment of trends in the use and availability of natural resources, the extent of emissions and discharges to the environment resulting from economic activity, and the amount of economic activity undertaken for environmental purposes.

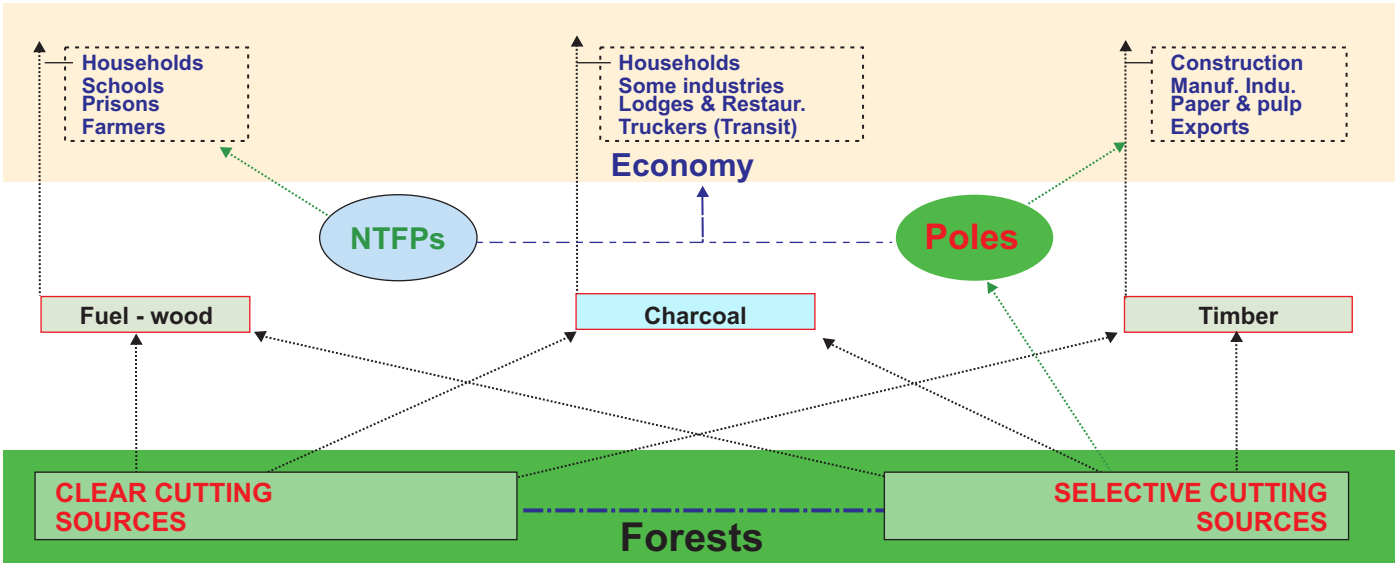
3.2 The conceptual framework for forests in Zambia

The conceptual framework for forest accounting in Zambia is shown in Figure 6, which outlines the timber forest products (TFPs) and non-timber forest products (NTFPs) extracted from the environment (i.e. indigenous forests and exotic tree plantations) and subsequently used in the economy.

Extraction of TFPs is done in two main ways: clear cutting and selective cutting. Clear cutting (or clear felling) is a practice in which most or all the trees in an area are cut down. In Zambia, clear cutting is more common in exotic tree plantations. In many cases, after trees are cleared the area is immediately replanted. In indigenous forests clear cutting occurs when land is converted for agriculture, infrastructure or other anthropogenic activities. In extreme cases, charcoal production may also result in clear cutting. Clear cutting is never practiced by indigenous forests concessionaires as timber species are selectively cut. Selective cutting (or selective felling) is the removal of trees that are most economically beneficial.

Selective cutting depends on the resource of interest. Trees may be selected based on species, age, size, location or any combination of these factors. This practice is commonly used by concession owners of indigenous forests as they target valuable commercial timber species. Selective cutting is more ecologically sound than clear cutting. However, it may still be detrimental to the environment as a tree species may be completely removed from a forest leading to forest degradation which can change the ecological balance.

Figure 6: Conceptual framework for accounting for forests and forest products in Zambia



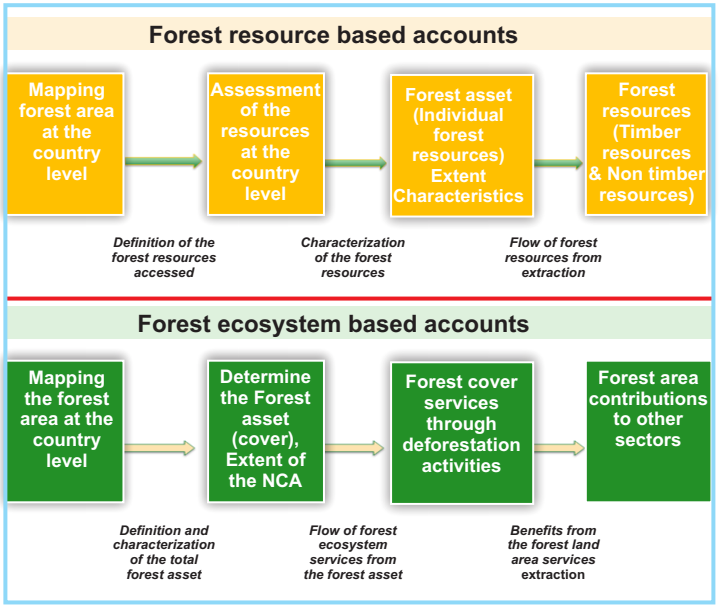
3.3 Methods

The approach has a number of steps, as described in Figure 7. However, only the steps for resource based accounts were considered for this iteration, while steps for the ecosystem based accounts in Figure 7 may be talked in follow-up iterations.

Therefore, the first step for the resource based accounts was to separate the forest cover from the rest of the land cover classes. This formed the scope of the forest account (i.e. land covered by forests). The second step was to identify and select the different forest products that would be accounted for within the forested landscape.

Six (6) forest products were selected: exotic timber, indigenous timber, charcoal, firewood, honey and bees wax. The next step was to determine the flow of each product into the economy. This was done in both physical and monetary units.

Figure 7: Forest resources and ecosystem-based accounts



Source: Castaneda et al. (2017).

3.4 Classifications and data sources

Data sources used for the forest account mainly came from the Forestry Department's annual production returns and forest resource assessments technical reports (Annex 1). However, other institutions such as the Zambia Forest and Forestry Corporation (ZAFFICO), Copperbelt University (CBU) and the National Remote Sensing Centre (NRSC) did provide some input data to the process of developing the accounts.

3.4.1 Forest asset accounts (Land use and land cover)

The data for the forest asset account came from the land cover maps officially published by the Forestry Department in the Integrated Land Use Assessment (ILUAII) final report (ILUAII, 2016), which uses the classifications of the intergovernmental panel on climate change (IPCC). The difference between the IPCC classification scheme and that recommended by SEEA is that the IPCC classification has six (6) main land cover/use classes where the forest land appears as one of the land cover classes (Table 2), while the SEEA classification has four (4) main classes of forests that includes: primary natural forests, other regenerating natural forests, forest plantations, other wooded land (Table A4.2) The land cover maps were generated from Landsat images covering the entire national territory of Zambia for years 2000, 2010 and 2015 and were accessed and processed via the Google Earth Engine (GEE).

National mosaics and change detection for Zambia were carried out using a GEE javascript processing chain and each mosaic was created from pixels derived from the full Landsat archive filtered using user-supplied parameters for date range, days of year, cloud cover and geographic extent. Each pixel was corrected for the latitudinal component of sun-sensor-target geometry and a 'weight' parameter was created that allowed the automatic selection of the single 'best' pixel available to be used in the final mosaics.

Table 2: Description of land cover classes

Land cover categories	National land cover descriptions
1. Settlements	Land covered mainly by densely populated and organized or irregular settlement patterns surrounding cities, towns, chiefdoms and rural centers commonly referred to as urban and rural built-up areas.
2. Cropland	Land actively used to grow agriculture (annual and perennial) crops which may be irrigated or rain feed for commercial, peasant and small scale farms around urban and rural settlements
3. Grassland	Land that includes wooded rangeland that may be covered mainly by grasslands, plains, dambos, and pans found along major river basins and water channels.
4. Forests	This is land covered both by natural and planted forest meeting the threshold of 10% canopy cover growing over a minimum area of 0.5 ha with trees growing above 5m height.
5. Wetlands	Land which is waterlogged, may be wooded such as marshland, perennial flooded plains and swampy areas (*surface water bodies included*).
6. Other land	Barren land covered by natural bare earth / soil such as sandy dunes, beach sand, rocky outcrops and may include old open quarry sites for mines and related infrastructure outside settlements.

Source: ILUAII, 2016

3.3.2 The land cover data analysis and quality

Direct change detection approaches were used to characterize forest cover loss and gains between time periods. Supervised image classification for non-forest areas was performed on the best-pixel (30 x 30m) composites and relied upon inputs from expert image interpreters during the initial phases of analysis. The spectral information from the imagery was collected at each of the identified sites, relating the known classes with a uniquely identifiable spectral signature as 'training data' used to construct or 'train' models for classifying the unknown pixels in the national mosaics. Training inputs were used in conjunction with Random Forest (RF) algorithms to create a final model for detecting deforestation for the three classes of interest; namely, stable forest, stable non-forest and change.

The final maps were then assessed for logical consistence, positional, thematic, temporal, and completeness accuracies for the years 2000 and 2015. In Zambia, the minimum acceptable overall accuracy for a national land cover map with 6 major land cover classes (i.e. IPCC schema I) is 85 to 90%. Similar land cover maps at provincial, district and local levels can be used for greenhouse gas inventory and related land cover mapping and is expected to be between 90% and 95% accurate (ILUAII-p25, 2016). All land cover maps are required to generate and report on the user[10] and producer[11] accuracies, including the Kappa[12] coefficient. This is the nationally set mapping standard for land cover maps that shall be acceptable and officially recognized in forestry mapping including for all REDD+ processes in Zambia (Tables 2 and 3).

The 2015 and 2010 land cover maps used to extract the stocks data returned an overall accuracy of 87.7% and 85.6%, respectively (ILUAII, 2016). Generally, all the land cover classes had better overall Kappa coefficient of 0.83, well above the minimum (*acceptable moderate agreement*) threshold of 0.5.

3.3.3 Supply and use of forest products

The data sources for the forest products supply and use accounts came from the monthly production records compiled by the Forestry Department through its country-wide districts. These data are reported to Forestry Department Headquarters (FDHQs) every quarter. Additional data for the exotic timber and poles came from the Zambia Forest and Forestry Industrial Corporation (ZAFFICO).

3.3.4 Monetary accounts

In order to compute the monetary value of forest assets related to volume of timber in the forest stock the first step was to calculate the total growing stock, (Table A4.9). ILUAII 2016 reports that there is an average 45.4 m^3/ha across all forests in Zambia. Therefore, 1,110,833 hectares cleared meant that approximately 50.4 million cubic metres of timber forest products (TFP) were harvested over the accounting period. Later, the monetary asset accounts (Table A4.10) were constructed and calculated using an average value of ZMW 293.4 as unit price per cubic metre of TFPs for both exotic and indigenous timber (Statutory Instrument No.52 of 2013).

Table 3: The accuracy assessment results for 2015 land cover map

2015 LandCover Acc. Assessment		Reference Data						Row Total	User Accuracy	Error of Com. %
		Settlement	Cropland	Grasslands	Forests	Wetlands	Other-land			
Classified Data	Settlements	94	23	0	0	0	3	120	78.3%	21.7
	Cropland	15	435	90	32	0	10	582	74.7%	25.3
	Grasslands	0	0	582	106	25	0	713	81.6%	18.4
	Forests	0	0	11	1674	39	0	1724	97.1%	2.9
	Wetland	0	11	40	11	234	0	296	79.1%	20.9
	Other-land	7	11	0	0	0	76	94	80.9%	19.1
Column Total		116	480	723	1823	298	89	3529	-	
Producer Accurancy		81.0%	90.6%	80.5%	91.8%	78.5%	85.4%	-	Overall accuracy (87.7%)	
Error of Omi%		19.0	9.4	19.5	8.2	21.5	14.6			

Source: ILUAII, 2016

[10]User accuracy is complement of the commission error on a map. It indicates the probability that prediction represent reality. The Commission Error (Ce) of a generic class x1 is the percentage of pixels classified as class x1 which do not belong to that class according to the reference data (commission), while the Omission Error Oe is the percentage of the pixels, belonging to class x1 in the reference data, which have not been classified as such (omission).

[11]Producer accuracy is the map accuracy from the point of view of the map maker (the producer). This is how often are real features on the ground correctly shown on the classified map or the probability that a certain land cover of an area on the ground is classified as such.

[12]Kappa coefficient is a measure of how the classification results compare to values assigned by chance. It can take values from 0 to 1. If kappa coefficient equals to 0, there is no agreement between the classified image and the reference image

4.0

Conclusions and next steps

4.0 Conclusions and next steps

4.1. Conclusions

Zambia has extensive forests that add significant value to the economy. However, the area of forest is decreasing, and the extraction of timber and non-timber forest products needs to be better managed. For example, the level of licensing is low, and for charcoal production it was just 3% in 2015, while export demand for indigenous timber is increasing and may be resulting in unsustainable harvest levels.

4.2 Next steps

The accounts will be analyzed further to see the potential impact of changes in forest policy and management and how the indicators from the accounts can inform the 7NDP. This may include using the accounts in modelling the impact of different policy options (e.g. increased levels of licensing or revenue collection from exports) on different parts of society and particularly reducing rural poverty. A separate document addressing the policy implications of the forest accounts is planned.

Institutionalization of the accounts is an important issue. The current set of accounts where produced as a research project with support from the World Bank Group. Going forward an on-going account production process will be needed and the capacity of government agencies within Zambia will need to be built and maintained. It is hoped that annual forest accounts can be produced to match the data from SNA and be used in annual government planning and budgeting cycles. A first step for this will be to extend the accounts to cover the years between 2016 and 2019 and beyond as data become available.

Future work may include accounting for forests' capacity in delivering ecosystem services such as carbon sequestration; management of water supply and water quality; protecting biological diversity; contributions to agricultural productivity and soil fertility protection; production of other non-timber forest products. Such work will require continued cooperation of agencies in the Forest TWG as well as interaction with the other thematic working groups under the Zambia's natural capital accounting program (e.g. land, water, modelling and tourism).

It would also be important to disseminate the findings of the first iteration to a larger audience. This can be achieved thorough exhibitions at different events such as the Zambia Commercial and Agriculture Shows (ZACS), Zambia Trade Fair (ZATF) and other such events.

5.0 References

5.0 References

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Annex 1 - Typical indicators and data sources for the account

Services	Indicator (s)/Units	Data Sources	Remarks
Provisioning services			
Timber	Harvested timber (m3, m3/ha) and fees	1, 6, 7, 9	First iteration
Poles	Harvested poles (m3, m3/ha) and fees	1, 6, 7, 9	First iteration
Charcoal	Harvested wood and produced charcoal (m3, kg, ton)	1, 6, 7	First iteration
Firewood	Headloads (m3)	1, 6, 7	First iteration
Honey	Quantity produced (kg, ton)	5, 6, 7, 8	First iteration
Beeswax	Quantity extracted (kg)	5, 6, 7, 8	First iteration
Other NTFP	Volume (m3); weight (kg, ton)	5, 6, 7	Second iteration
	Number of units		
Regulatory services			
Atmospheric / climate regulation	Net carbon storage (gains-losses) (ton)	1, 2, 3, 4	Second iteration
Water recharge & flow regulation	Canopy cover fraction in recharge areas	2, 3, 4, 5, 7	Second iteration
	Average daily and annual water flow in rivers		Second iteration
	Forest cover in strategic location (wetlands)		Second iteration
Pollination	Abundance and variety of pollinator species	1, 6	Second iteration
Soil retention and formation	Tree cover in steep slopes, vulnerable areas, erosion rates	5, 6, 7	Second iteration
Cultural services			
Recreation	Number/area of protected forest areas	2, 3, 4	Second iteration
Ecotourism services	Number/area of protected forest areas	2, 3, 4	Second iteration
Heritage conservation	Number/area of protected forest areas	2, 3, 4, 5	Second iteration
Spiritual and symbolic	Number/area of protected forest areas	2, 3, 4, 5	Second iteration
Research and information	Number/area of botanical reserves	2, 3, 4	Second iteration
Data sources 1. Forest inventories and Forest statistics 2. Space borne remote sensing 3. Airborne remote sensing 4. LC/LU data and maps 5. Non forest statistics 6. Production returns 7. Annual reports 8. Consultancy reports 9. Statutory instruments			

NB: Normally the data in annex 1 is collected annually by the districts as production returns, conveyed to Forestry Department Headquarters through their respective Provincial administrations. However, data on regulatory services which relate mostly to forest mapping is collected every 5 years alongside the mapping of land cover changes across the country.

Annex 2 – List of Stakeholders Consulted

Name	Email	Institutions	Station
1. Ackim Phiri	bsnyawali@yahoo.com	ZFC	Kitwe
2. Bill Kalaluka	afedi2002@yahoo.co.uk	ZHC	Lusaka
3. Charles Phiri	charlesphiri.ziflp@gmail.com	ZIFL-P	Lusaka
4. Robert Chimambo	kchimambo@gmail.com	ZamStats	Lusaka
5. Chota Ngalande		ZAFFICO	Kitwe
6. Edward Zulu	ezulu@itswild.org	COMACO	Chilanga
7. Ferdinand Handavu	fhandavu@yahoo.com	ZFC	Kitwe
8. Gambwe Sikantongwe	gambwes@yahoo.com	DCCNRM	Lusaka
9. Kasongo Chiwama	kasongo.chiwama@moe.gov.zm	DoE	Lusaka
10. Leonard Nkhoma	lnkhoma79@yahoo.com	MNDP	Lusaka
11. Limbekuma Musole	limbekumamusole@gmail.com	ZATFBI	Sesheke
12. Nasilele Amatende	nasileleamatende@gmail.com	ZamStats- MNDP	Lusaka
13. Obote Shakachite	obote.shakachite@cbu.ac.zm	CBU	Kitwe
14. Pasco Mumba	pascomumba@gmail.com	ZamStats- MNDP	Lusaka
15. Rabbecca Lubinda	rebeccalubinda@gmail.com	MNDP	Lusaka
16. Richard Lungu	richardxlungu@gmail.com	MNDP	Lusaka
17. Winfridah K. Kanjipite	winfrikanji@gmail.com	ZBS	Lusaka
18. Yvonne-Ruwe Mulala	yvonnemulala@gmail.com	NMB	Lusaka

Annex 3 – Forest products conversion tables

Code	Forest Products	Local Measure	Standard Units	Standard Measurements
1	Industrial wood	Cant/Beam (50 X 50cm)	M3	0.750
1	Industrial wood	Planks (50 X 150mm)	M3	0.023
1	Industrial wood	Planks (50 X 100mm)	M3	0.015
1	Industrial wood	Planks (50 X 50mm)	M3	0.008
1	Industrial wood	Pellets (15 X 15mm)	M3	0.001
1	Unit fees for timber	Number	M3	0.3
2	Wood for poles	1 Pole (Avg Size)	Kg	0.61
2	Wood for poles	1 Man-lord (6 Poles)	Kg	3.66
2	Wood for poles	1 Bundle (15 Poles)	Kg	9.14
2	Wood for poles	1 Pile (25 Poles)	Kg	15.23
3	Wood for wood carvings	Bracelets	Kg	0.05
3	Wood for wood carvings	Small piece	Kg	0.10
3	Wood for wood carvings	Medium piece	Kg	2.50
3	Wood for wood carvings	Large piece	Kg	5.00
3	Mortals (decoratives)	Decoratives	Kg	1.00
3	Mortals	Medium sizes	Kg	5.00
3	Mortals	Big sizes	Kg	10.00

Code	Forest Products	Local Measure	Standard Units	Standard Measurements
3	Pounding sticks (decoratives)	Small sizes	Kg	0.50
3	Pounding sticks	Big sizes	Kg	3.00
3	Cooking sticks	Small sizes	Kg	0.05
3	Cooking sticks	Big sizes	Kg	0.15
3	Paddling sticks	Piece	Kg	1.50
3	Drums (decoratives)	Small drums	Kg	1.50
3	Drums	Big drums	Kg	3.50
3	Canoes	Small canoes	Kg	35.00
3	Canoes	Big canoes	Kg	65.00
4	Fuel wood	1 Cord	M3	3 (1,000 kg air dry)
4	Fuel wood	1 Head-lord (women)	Kg	9.00
4	Fuel wood	1 Man-load (men)	Kg	12.00
5	Charcoal	"90 kg bag"	Kg	40.00
5	Charcoal	"50 kg bag"	Kg	30.00
5	Charcoal	"25 kg bag"	Kg	25.00
5	Charcoal	Large tin	Kg	3.00
5	Charcoal	Medium tin	Kg	2.00
5	Charcoal	Small tin	Kg	1.50
6	Wild fruits (strchynos spp)	1 Fruit	Kg	0.15
6	Wild fruits (strchynos spp)	Heap of fruits	Kg	0.75
6	Wild fruits (strchynos spp)	"25 kg bag"	Kg	30.00
6	Wild fruits (other spp)	Heap (handful)	Kg	0.01
6	Wild fruits (other spp)	BP Container	Kg	0.10
6	Wild fruits (other spp)	Meda	Kg	1.50
7	Nuts (variety)	Heap (handful)	Kg	0.75
7	Nuts (variety)	Cup	Kg	2.00
7	Nuts (variety)	BP Container	Kg	2.50
7	Nuts (variety)	Plate	Kg	3.50
7	Nuts (variety)	Meda	Kg	5.50
8	Berries (variety)	Heap (handful)	Kg	0.75
8	Berries (variety)	Cup	Kg	1.50
8	Berries (variety)	BP Container	Kg	2.50
8	Berries (variety)	Plate	Kg	3.00
8	Berries (variety)	Meda	Kg	4.50
9	Chikanda (raw)	Heap (handful)	Kg	0.75
9	Chikanda (raw)	Cup	Kg	1.00
9	Chikanda (raw)	BP Container	Kg	
9	Chikanda (raw)	Plate	Kg	2.50
9	Chikanda (raw)	"10 Kg bag"	Kg	15.00
9	Chikanda (raw)	"25 kg bag"	Kg	33.50
10	Mushrooms (air dry)	Heap (handful)	Kg	0.01
10	Mushrooms (air dry)	Cup	Kg	0.02
10	Mushrooms (air dry)	BP Container	Kg	0.50
10	Mushrooms (air dry)	Plate	Kg	0.25
10	Mushrooms (air dry)	Meda	Kg	1.75
10	Mushrooms (wet)	Heap (handful)	Kg	0.02
10	Mushrooms (wet)	Cup	Kg	0.50

Code	Forest Products	Local Measure	Standard Units	Standard Measurements
10	Mushrooms (wet)	BP Container	Kg	1.50
10	Mushrooms (wet)	Plate	Kg	1.50
10	Mushrooms (wet)	Meda	Kg	4.50
10	Mushrooms (wet)	Dish / Busket	Kg	7.50
11	Fodder (grass)	Bundle	Kg	250.00
11	Fodder (grass)	Ox-cart	Kg	1000.00
11	Fodder (plants)	Bundle	Kg	150.00
11	Fodder (plants)	Ox-cart	Kg	750.00
12	Rattan (raw)	Bundle	Kg	13.50
12	Rattan buskets	Small piece	Kg	1.50
12	Rattan buskets	Medium piece	Kg	3.50
12	Rattan buskets	Large piece	Kg	5.50
12	Reed (raw)	Bundle	Kg	11.00
12	Reed mats	Roll piece	Kg	5.50
13	Plant medicines (raw)	Heap (handful)	Kg	0.25
13	Plant medicines (raw)	Roots	Kg	0.50
13	Plant medicines (raw)	Bundle of roots	Kg	0.65
13	Herbs / spices (processed med)	Tea spoon	Kg	0.03
13	Herbs / spices (processed med)	Ball	Kg	0.50
13	Herbs / spices (processed med)	Cup	Kg	0.75
13	Herbs / spices (processed med)	Plate	Kg	1.15
14	Dying / tanning (liquid solution)	Cup	Millilitres	350.00
14	Dying / tanning (liquid solution)	Bottle	Millilitres	750.00
14	Dying / tanning (liquid solution)	Small container	Litres	2.50
14	Dying / tanning (liquid solution)	Big container	Litres	5.00
15	Seeds (sawing/regeneration)	Heap (handful)	Kg	0.15
15	Seeds (sawing/regeneration)	Cup	Kg	1.50
15	Seeds (sawing/regeneration)	Small bag	Kg	5.00
15	Seeds (sawing/regeneration)	Medium bag	Kg	10.00
15	Seeds (sawing/regeneration)	Large bag	Kg	25.00
16	Fibres (for ropes)	Roll	Kg	0.50
16	Fibres (for ropes)	Bundle	Kg	3.50
16	Sissal (for ropes)	Roll	Kg	1.25
16	Sissal (for ropes)	Bundle	Kg	5.00
17	Thatching (fine) grass	Roll	Kg	15.00
17	Thatching (fine) grass	Heap of Rolls	Kg	1000.00
17	Wildlife (bush meat)	Bundle	Kg	5.00
17	Wildlife (bush meat)	Piece	Kg	7.50
18	Honey (liquid)	Bottle	Millilitres	750.00
18	Honey (liquid)	Small container	Litres	2.50
18	Honey (liquid)	Medium container	Litres	5.00
18	Honey (liquid)	Large container	Litres	20.00

Code	Forest Products	Local Measure	Standard Units	Standard Measurements
18	Wax (honey by-product)	Small piece	Kg	5.00
18	Wax (honey by-product)	Medium piece	Kg	10.00
18	Wax (honey by-product)	Lage piece	Kg	30.00
18	Wax (honey by-product)	Block of wax	Kg	45.00
18	Liquid honey	1Kg	ZMW	22
18	Wax	1Kg	ZMW	80
18	Comb honey to Wax	19Kg	Kg	1
19	Caterpillars	Meda	Kg	5.00
19	Caterpillars	Gallon	Kg	0.25
19	Caterpillars	BP Container	Kg	0.15
19	Caterpillars	Plate	Kg	0.15
20	Other plant products (devils craw)	Heap	Kg	1.00
20	Other plant products (devils craw)	"25 kg bag"	Kg	20.00
20	Other plant products (devils craw)	"50 kg bag"	Kg	40.00

Table A4.3 Physical asset accounts for the forest and other wooded land area (volumes, m^3)

The volumetric quantities of the growing stock over the time	Type of forest and other wooded land				
	Primary (pristine) forest land (*m3*)	Other naturally regenerated forest (*m3*)	Planted (exotic) forest land (*m3*)	Other wooded land (*m3*)	Total forest land (*m3*)
Opening Stock of forest and other wooded land (2000)	**488,348,656**	**1,260,817,519**	**2,565,645**	**384,526,497**	**2,136,258,317**
Additions to stock	**0**	**0**	**49,940**	**0**	**49,940**
Afforestation/Reforestation	0	0	49,940	0	49,940
Natural expansion	0	0	0	0	0
Reductions in stock	**-11,475,259**	**-30,151,230**	**-45,400**	**-8,759,930**	**-50,431,818**
Deforestation	(11,475,259)	(30,151,230)	(45,400)	(8,759,930)	(50,431,818)
Natural regression	0	0	0	0	0
Total reductions in stock	11,475,259	30,151,230	45,400	8,759,930	50,431,818
Closing stock of forest and other wooded land (2015)	**476,873,397**	**1,230,666,290**	**2,570,185**	**375,766,567**	**2,085,876,439**

Table A4.4 Monetary asset for the forest and other wooded land (ZMW)

The monetary value of the growing stock over time	Type of forest and other wooded land				
	Primary (pristine) forest land (*ZMW*)	Other naturally regenerated forest (*ZMW*)	Planted (exotic) forest land (*ZMW*)	Other wooded land (*ZMW*)	Total forest land (*ZMW*)
Opening stock of forest and other wooded land (2000)	**143,281,495,591**	**369,923,860,192**	**752,760,184**	**112,820,074,354**	**626,778,190,320**
Additions to stock	**0**	**0**	**14,652,396**	**0**	**14,652,396**
Afforestation/Reforestation	0	0	14,652,396	0	14,652,396
Natural expansion	0	0	0	0	0
Reductions in stock	**-3,366,840,873**	**-8,846,370,765**	**-13,320,360**	**-2,570,163,462**	**-14,796,695,460**
Deforestation	(3,366,840,873)	(8,846,370,765)	(13,320,360)	(2,570,163,462)	(14,796,695,460)
Natural regression	0	0	0	0	0

The monetary value of the growing stock over time	Type of forest and other wooded land				
	Primary (pristine) forest land (*ZMW*)	Other naturally regenerated forest (*ZMW*)	Planted (exotic) forest land (*ZMW*)	Other wooded land (*ZMW*)	Total forest land (*ZMW*)
Total reductions in stock	3,366,840,873	8,846,370,765	13,320,360	2,570,163,462	14,796,695,460
Closing stock of forest and other wooded land (2015)	**139,914,654,717**	**361,077,489,427**	**754,092,220**	**110,249,910,892**	**611,996,147,257**

Table A 4.5 Physical supply and use table for forest products, 2010

Forest Resource Supply	Forestry ind.	Charcoal producers	Honey producers	Loggers	Sawmills	Warehouses	Carpentry	Construction	Other Industry	Households	Exports	Envi . (Forests)	TOTAL SUPPLY
Flows from the environment to the economy													
Indigenous timber (M3)	-	-	-	-	2,450,055	-	-	-	-	-	-	2,738,787	5,188,842
Exotic timber (M3)	-	-	-	-	385	-	-	-	-	-	-	2,191,086	2,191,471
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	-	-	-	71,744,940	71,744,940
Wood for firewood (M3)	-	-	-	-	-	-	-	-	-	-	-	210,099	210,099
Total WFP (M3)	-	-	-	-	***2,450,440***	-	-	-	-	-	-	76,884,912	79,335,352
Liquid honey (KG)	-	-	-	-	-	-	-	-	-	-	-	2,433,000	2,433,000
Bees wax (KG)	-	-	-	-	-	-	-	-	-	-	-	128,157	128,157
Total NWFPs (Kg)	-	-	-	-	-	-	-	-	-	-	-	2,561,053	2,561,157
Flows within the economy													
Indigenous timber (M3)	2,594,421	-	-	-	-	-	-	-	-	-	-	-	2,594,421
Exotic timber (M3)	1,577,859	-	-	-	-	-	-	-	-	-	-	-	1,577,859
Charcoal (M3)	-	12,985,834	-	-	-	-	-	-	-	-	-	-	12,985,834
Firewood (M3)	210,099	-	-	-	-	-	-	-	-	-	-	-	210,099
Total WFP (M3)	***4,382,379***	***12,985,834***	-	-	-	-	-	-	-	-	-	-	***17,368,214***
Liquid honey (Kg)	-	-	2,433,000	-	-	-	-	-	-	-	-	-	2.433.000
Wax (Kg)	-	-	128,053	-	-	-	-	-	-	-	-	-	128,053
Total NWFPs (Kg)	-	-	*2,561,053*	-	-	-	-	-	-	-	-	-	2,561,053
Flows from the economy to the environment													
Waste from indig. timber (M3)	72,183	-	-	-	1,225,028	-	-	-	-	-	-	1,297,210	2,594,421
Waste from exotic timber (M3)	-	-	-	-	105	-	-	613.507	-	-	-	-	613.612
Waste from wood for charc. (M3)	-	-	-	-	-	-	-	-	-	-	-	58,759,105	58,759,105
Waste from wood for firew. (M3)	-	-	-	-	-	-	-	-	-	-	-	-	-
Total WFP (M3)	-	-	-	-	***1,225,133***	-	-	***613,507***	-	-	-	***60,128,499***	***61,967,139***
Waste for honey (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
Waste for wax (Kg)	-	-	104	-	-	-	-	-	-	-	-	-	104
Total NWFPs (Kg)	-	-	***104***	-	-	-	-	-	-	-	-	-	***104***

Forest Resource Use	Forestry	Charcoal producers	Honey producers	Loggers	Sawmills	Warehouses	Carpentry	Construction	Other Industry	Households	Exports	Envi . (Forests)	TOTAL USE
Flows within the economy													
Indigenous timber (M3)	-	-	-	-	-	82,667	893,836	-	-	167,454	1,450,465	-	2,594,421
Exotic timber (M3)	-	-	-	-	-	-	197,177	1,140,203	458	-	240,021	-	1,577,859
Charcoal (M3)	-	-	-	-	-	-	-	-	1,290,312	8,846,909	2,848,612	-	12.985,834
Firewood (M3)	-	-	-	-	-	-	-	-	39,755	170,344	-	-	210,099
Total WFP (M3)	-	-	-	-	-	***82,667***	***1,091,013***	***1,140,203***	***1,330,526***	***9,184,707***	4,539,098	-	17,368,214
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	1.795.554	637.446	-	2.433.000
Wax (Kg)	-	-	1,537	-	-	-	-	-	92,966	-	33,550	-	128,053
Total NWFPs (Kg)	-	-	***1,537***	-	-	-	-	-	***92,966***	***1,795,554***	***670,996***	-	2,561,053

Table A 4.6 Physical supply and use table for forest products, 2011

Forest Resource Supply	Forestry ind.	Charcoal producers	Honey producers	Loggers	Sawmills	Warehouses	Carpentry	Construction	Other Industry	Households	Exports	Envi . (Forests)	TOTAL SUPPLY
Flows from the environment to the economy													
Indigenous timber (M3)	-	-	-	-	2,000,150	-	-	-	-	-	-	3,189,598	5,189,748
Exotic timber (M3)	-	-	-	-	702	-	-	-	-	-	-	681,184	681,886
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	-	-	-	86,218,267	86,218,267
Wood for firewood (M3)	-	-	-	-	-	-	-	-	-	-	-	2,949	2,949
Total WFP (M3)	-	-	-	-	***2,000,852***	-	-	-	-	-	-	***90,091,999***	***92,092,851***
Liquid honey (KG)	-	-	-	-	-	-	-	-	-	-	-	813,855	813,855
Bees wax (KG)	-	-	-	-	-	-	-	-	-	-	-	42,926	42,926
Sub Total (Kg)	-	-	-	-	-	-	-	-	-	-	-	***856,781***	***856,781***
Flows within the economy													
Indigenous timber (M3)	2,594,874	-	-	-	-	-	-	-	-	-	-	-	2,594,874
Exotic timber (M3)	490.958	-	-	-	-	-	-	-	-	-	-	-	490,958
Wood for charcoal (M3)	-	15,605,506	-	-	-	-	-	-	-	-	-	-	15,605,506
Wood for firewood (M3)	2,949	-	-	-	-	-	-	-	-	-	-	-	2,949
Total WFP (M3)	***3,088,782***	***15,605,506***	-	-	-	-	-	-	-	-	-	-	***18,694,288***
Liquid honey (Kg)	-	-	813,855	-	-	-	-	-	-	-	-	-	813,855
Wax (Kg)	-	-	42,834	-	-	-	-	-	-	-	-	-	42,834
Total NWFPs (Kg)	-	-	***856,689***	-	-	-	-	-	-	-	-	-	***856,689***
Flows from the economy to the environment													
Waste from indig. timber (M3)	467,077	-	-	-	830,360	-	-	-	-	-	-	1,297,437	2,594,874
Waste from exotic timber (M3)	-	-	-	-	191	-	190,736	-	-	-	-	-	190,928
Waste from wood for charc. (M3)	-	-	-	-	-	-	-	-	-	-	-	70,612,761	70,612,761
Waste from wood for firew. (M3)	-	-	-	-	-	-	-	-	-	-	-	-	-
Total WFP (M3)	-	-	-	-	***830,551***	-	***190,736***	-	-	-	-	***71,910,198***	***72,931,485***
Waste for honey (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
Waste for wax (Kg)	-	-	92	-	-	-	-	-	-	-	-	-	92
Sub Total (KG)	-	-	***92***	-	-	-	-	-	-	-	-	-	***92***

Forest Resource Supply	Forestry	Charcoal producers	Honey producers	Loggers	Sawmills	Warehouses	Carpentry	Construction	Other Industry	Households	Exports	Envi . (Forests)	TOTAL SUPPLY
Flows within the economy													
Indigenous timber (M3)	-	-	-	-	-	75,563	611,405	108,016	-	89,107	1,710,782	-	2,594,874
Exotic timber (M3)	-	-	-	-	-	-	109,198	291,458	-	90,303	-	-	490,958
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	1,975,585	11,367,123	2,262,798	-	15,605,506
Wood for firewood (M3)	-	-	-	-	-	-	-	-	131	2,818	-	-	2,949
Total WFP (M3)	-	-	-	-	-	***75,563***	***720,603***	***399,474***	***1,975,716***	***11,549,351***	***3,973,581***	-	***18,694,288***
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	600,625	213,230	-	813,855
Wax (Kg)	-	-	514	-	-	-	-	-	31,097	-	11,223	-	42,834
Total NWFPs (Kg)	-	-	***514***	-	-	-	-	-	***31,097***	***600,625***	***224,453***	-	***856,689***

Table A 4.7 Physical supply and use table for forest products, 2012

Forest Resource Supply	Forestry ind.	Charcoal producers	Honey producers	Loggers	Sawmills	Warehouses	Carpentry	Construction	Other Industry	Households	Exports	Envi . (Forests)	TOTAL SUPPLY
Flows from the environment to the economy													
Indigenous timber (M3)	-	-	-	-	2,199,389	-	-	-	-	-	-	4,228,870	6,428,259
Exotic timber (M3)	-	-	-	-	591	-	-	-	-	-	-	668,358	668,950
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	-	-	-	98,179,204	98,179,204
Wood for firewood (M3)	-	-	-	-	-	-	-	-	-	-	-	344,970	344,970
Total WFP (M3)	-	-	-	-	***2,199,980***	-	-	-	-	-	-	***103,421,402***	***105,621,382***
Liquid honey (KG)	-	-	-	-	-	-	-	-	-	-	-	1,681,847	1,681,847
Wax (KG)	-	-	-	-	-	-	-	-	-	-	-	88,616	88,616
Total NWFPs (Kg)	-	-	-	-	-	-	-	-	-	-	-	**1,770,463**	***1,770,463***
Flows within the economy													
Indigenous timber (M3)	3,214,129	-	-	-	-	-	-	-	-	-	-	-	3,214,129
Exotic timber (M3)	481,714	-	-	-	-	-	-	-	-	-	-	-	481,714
Charcoal (M3)	-	17,770,436	-	-	-	-	-	-	-	-	-	-	17,770,436
Firewood (M3)	344,970	-	-	-	-	-	-	-	-	-	-	-	344,970
Total WFP (M3)	***4,040,814***	***17,770,436***	-	-	-	-	-	-	-	-	-	-	***21,811,250***
Liquid honey (Kg)	-	-	1,681,847	-	-	-	-	-	-	-	-	-	1,681,847
Wax (Kg)	-	-	88,518	-	-	-	-	-	-	-	-	-	88,518
Total NWFPs (Kg)	-	-	***1,770,365***	-	-	-	-	-	-	-	-	-	***1,770,365***
Flows from the economy to the environment													
Waste from indig. timber (M3)	564,055	-	-	-	1,043,010	-	-	-	-	-	-	1,607,065	3,214,129
Waste from exotic timber (M3)	-	-	-	-	215	-	187,020	-	-	-	-	-	187,235
Waste from wood for charc. (M3)	-	-	-	-	-	-	-	-	-	-	-	80,408,768	80,408,768
Waste from wood for firew. (M3)	-	-	-	-	-	-	-	-	-	-	-	-	-
Total WFP (M3)	-	-	-	-	***1,043,225***	-	***187,020***	-	-	-	-	***82,015,833***	***83,246,078***
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
Wax (Kg)	-	-	98	-	-	-	-	-	-	-	-	-	98
Total NWFPs (KG)	-	-	***98***	-	-	-	-	-	-	-	-	-	***98***

Forest Resource Use	Forestry ind.	Charcoal producers	Honey producers	Loggers	Sawmills	Warehouses	Carpentry	Construction	Other Industry	Households	Exports	Envi . (Forests)	TOTAL USE
Flows within the economy													
Indigenous timber (M3)	-	-	-	-	-	50,158	1,123,474	25,079	-	-	2,015,418	-	3,214,129
Exotic timber (M3)	-	-	-	-	-	-	60,141	409,593	-	11,980	-	-	481,714
Charcoal (M3)	-	-	-	-	-	-	-	-	1,771,966	12,094,051	3,904,419	-	17,770,436
Firewood (M3)	-	-	-	-	-	-	-	-	65,400	279,570	-	-	344,970
Total WFP (M3)	-	-	-	-	-	***50,158***	***1,183,615***	***4,34,672***	***1,837,366***	***12,385,601***	***5,919,837***	-	***21,811,250***
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	1,241,203	440,644	-	1,681,847
Wax (Kg)	-	-	1,062	-	-	-	-	-	64,264	-	23,192	-	88,518
Total NWFPs (Kg)	-	-	***1,062***	-	-	-	-	-	***64,264***	***1,241,203***	***463,836***	-	***1,770,365***

Table A 4.8 Physical supply and use table for forest products, 2013

Forest Resource Supply	Forestry ind.	Charcoal producers	Honey producers	Loggers	Sawmills	Warehouses	Carpentry	Construction	Other Industry	Households	Exports	Envi . (Forests)	TOTAL SUPPLY
Flows from the environment to the economy													
Indigenous timber (M3)	-	-	-	-	4,321,785	-	-	-	-	-	-	4,810,905	9,132,690
Exotic timber (M3)	-	-	-	-	903	-	-	-	-	-	-	526,935	527,838
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	-	-	-	55,276,308	55,276,308
Wood for firewood (M3)	-	-	-	-	-	-	-	-	-	-	-	187,957	187,957
Total WFPs (M3)	-	-	-	-	***4,322,688***	-	-	-	-	-	-	***60,802,105***	***65,124,793***
Liquid honey (KG)	-	-	-	-	-	-	-	-	-	-	-	1,482,126	1,482,126
Wax (KG)	-	-	-	-	-	-	-	-	-	-	-	78,091	78,091
Total NWFPs (Kg)	-	-	-	-	-	-	-	-	-	-	-	**1,560,217**	***1,560,217***
Flows within the economy													
Indigenous timber (M3)	4,566,345	-	-	-	-	-	-	-	-	-	-	-	4,566,345
Exotic timber (M3)	380,104	-	-	-	-	-	-	-	-	-	-	-	380,104
Charcoal (M3)	-	10,005,012	-	-	-	-	-	-	-	-	-	-	10,005,012
Firewood	187,957	-	-	-	-	-	-	-	-	-	-	-	187,957
Total WFPs (M3)	***5,134,406***	***10,005,012***	-	-	-	-	-	-	-	-	-	-	***15,139,418***
Liquid honey (Kg)	-	-	1,482,126	-	-	-	-	-	-	-	-	-	1,482,126
Wax (Kg)	-	-	78,007	-	-	-	-	-	-	-	-	-	78,007
Total NWFPs (Kg)	-	-	***1,560,133***	-	-	-	-	-	-	-	-	-	***1,560,133***
Flows from the economy to the environment													
Indigenous timber (M3)	1,239,097	-	-	-	1,044,075	-	-	-	-	-	-	2,283,173	4,566,345
Exotic timber (M3)	-	-	-	-	208	-	147,527	-	-	-	-	-	147,734
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	-	-	-	45,271,296	45,271,296
Wood for firewood (M3)	-	-	-	-	-	-	-	-	-	-	-	-	-
Total WFPs (M3)	-	-	-	-	***1,044,283***	-	***147,527***	-	-	-	-	***48,793,566***	***49,985,376***
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
Bees wax (Kg)	-	-	84	-	-	-	-	-	-	-	-	-	84
Total NWFPs (KG)	-	-	***84***	-	-	-	-	-	-	-	-	-	***84***
Forest Resource Supply	**Forestry ind.**	**Charcoal producers**	**Honey producers**	**Loggers**	**Sawmills**	**Warehouses**	**Carpentry**	**Construction**	**Other Industry**	**Households**	**Exports**	**Envi . (Forests)**	**TOTAL USE**
Flows within the economy													
Indigenous timber (M3)	-	-	-	-	-	158,291	1,946,627	29,146	-	-	2,432,281	-	4,566,345
Exotic timber (M3)	-	-	-	-	-	-	79,117	299,966	-	1,021	-	-	380,104
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	924,168	6,956,074	2,124,770	-	10,005,012
Wood for firewood (M3)	-	-	-	-	-	-	-	-	35,557	152,400	-	-	187,957
Total WFPs (M3)	-	-	-	-	-	***158,291***	***2,025,744***	***329,112***	***959,725***	***7,109,495***	***4,557,050***	-	***15,139,418***
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	388,317	1,093,809	-	1,482,126
Bees wax (Kg)	-	-	936	-	-	-	-	-	20,438	-	56,633	-	78,007
Total NWFPs (Kg)	-	-	***936***	-	-	-	-	-	***20,438***	***388,317***	***1,150,442***	-	***1,560,133***

Table A 4.9 Physical supply and use table for forest products, 2014

Forest Resource Supply	Forestry ind.	Charcoal producers	Honey producers	Loggers	Sawmills	Warehouses	Carpentry	Construction	Other Industry	Households	Exports	Envi . (Forests)	TOTAL SUPPLY
Flows from the environment to the economy													
Indigenous timber (M3)	-	-	-	-	3,178,002	-	-	-	-	-	-	4,023,918	7,201,920
Exotic timber (M3)	-	-	-	-	1,788	-	-	-	-	-	-	623,388	625,176
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	-	-	-	99,560,648	99,560,648
Wood for firewood (M3)	-	-	-	-	-	-	-	-	-	-	-	2,900	2,900
Total WFPs (M3)	-	-	-	-	***3,179,790***	-	-	-	-	-	-	***104,210,853***	***107,390,643***
Liquid honey (KG)	-	-	-	-	-	-	-	-	-	-	-	625,172	625,172
Bees wax (KG)	-	-	-	-	-	-	-	-	-	-	-	33,020	33,020
Total NWFPs (Kg)	-	-	-	-	-	-	-	-	-	-	-	**658,192**	***658,192***
Flows within the economy													
Indigenous timber (M3)	3,600,960	-	-	-	-	-	-	-	-	-	-	-	3,600,960
Exotic timber (M3)	450,210	-	-	-	-	-	-	-	-	-	-	-	450,210
Wood for charcoal (M3)	-	18,020,477	-	-	-	-	-	-	-	-	-	-	18,020,477
Wood for firewood (M3)	2,900	-	-	-	-	-	-	-	-	-	-	-	2,900
Total WFPs (M3)	***4,054,070***	***18,020,477***	-	-	-	-	-	-	-	-	-	-	***22,074,547***
Liquid honey (Kg)	-	-	625,172	-	-	-	-	-	-	-	-	-	625,172
Bees wax (Kg)	-	-	32,904	-	-	-	-	-	-	-	-	-	32,904
Total NWFPs (Kg)	-	-	***658,076***	-	-	-	-	-	-	-	-	-	***658,076***
Flows from the economy to the environment													
Indigenous timber (M3)	98,946	-	-	-	1,701,534	-	-	-	-	-	-	1,800,480	3,600,960
Exotic timber (M3)	-	-	-	-	462	-	174,503	-	-	-	-	-	174,965
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	-	-	-	81,540,170	81,540,170
Wood for firewood (M3)	-	-	-	-	-	-	-	-	-	-	-	-	-
Total WFPs (M3)	-	-	-	-	***1,701,996***	-	***174,503***	-	-	-	-	***83,340,650***	***85,217,150***
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
Bees wax (Kg)	-	-	116	-	-	-	-	-	-	-	-	-	116
Total NWFPs (KG)	-	-	***116***	-	-	-	-	-	-	-	-	-	***116***

Forest Resource Use	Forestry ind.	Charcoal producers	Honey producers	Loggers	Sawmills	Warehouses	Carpentry	Construction	Other Industry	Households	Exports	Envi . (Forests)	TOTAL USE
Flows within the economy													
Indigenous timber (M3)	-	-	-	-	-	449,627	1,115,118	24,814	-	-	2,011,402	-	3,600,960
Exotic timber (M3)	-	-	-	-	-	-	61,086	295,985	-	93,139	-	-	450,210
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	1,790,067	12,277,886	3,952,524	-	18,020,477
Wood for firewood (M3)	-	-	-	-	-	-	-	-	99	2,801	-	-	2,900
Total WFPs (M3)	-	-	-	-	-	***449,627***	***1,176,203***	***320,799***	***1,790,166***	***12,373,826***	***5,963,926***	-	***22,074,547***
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	461,377	163,795	-	625,172
Bees wax (Kg)	-	-	395	-	-	-	-	-	8,621	-	23,888	-	32,904
Total NWFPs (Kg)	-	-	***395***	-	-	-	-	-	***8,621***	***461,377***	***187,683***	-	***658,076***

Table A 4.10 Physical supply and use table for forest products, 2015

Forest Resource Supply	Forestry ind.	Charcoal producers	Honey producers	Loggers	Sawmills	Warehouses	Carpentry	Construction	Other Industry	Households	Exports	Envi . (Forests)	TOTAL SUPPLY
Flows from the environment to the economy													
Indigenous timber (M3)	-	-	-	-	3,815,037	-	-	-	-	-	-	4,758,097	8,573,134
Exotic timber (M3)	-	-	-	-	1,059	-	-	-	-	-	-	838,861	839,920
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	-	-	-	40,597,486	40,597,486
Wood for firewood (M3)	-	-	-	-	-	-	-	-	-	-	-	262,146	262,146
Total WFPs (M3)	-	-	-	-	***3,816,096***	-	-	-	-	-	-	***46,456,590***	***50,272,686***
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	-	-	1,953,840	1,953,840
Bees wax (Kg)	-	-	-	-	-	-	-	-	-	-	-	102,938	102,938
Total NWFPs (Kg)	-	-	-	-	-	-	-	-	-	-	-	**2,056,778**	**2,056,778**
Flows within the economy													
Indigenous timber (M3)	4,286,567	-	-	-	-	-	-	-	-	-	-	-	4,286,567
Exotic timber (M3)	604,817	-	-	-	-	-	-	-	-	-	-	-	604,817
Wood for charcoal (M3)	-	7,348,145	-	-	-	-	-	-	-	-	-	-	7,348,145
Wood for firewood (M3)	262,146	-	-	-	-	-	-	-	-	-	-	-	262,146
Total WFPs (M3)	***5,153,530***	***7,348,145***	-	-	-	-	-	-	-	-	-	-	***12,501,675***
Liquid honey (Kg)	-	-	1,953,840	-	-	-	-	-	-	-	-	-	1,953,840
Bees wax (Kg)	-	-	102,834	-	-	-	-	-	-	-	-	-	102,834
Total NWFPs (Kg)	-	-	***2,056,674***	-	-	-	-	-	-	-	-	-	***2,056,674***
Flows from the economy to the environment													
Indigenous timber (M3)	328,258	-	-	-	1,815,025	-	-	-	-	-	-	2,143,284	4,286,567
Exotic timber (M3)	-	-	-	-	371	-	234,732	-	-	-	-	-	235,103
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	-	-	-	33,249,340	33,249,340
Wood for firewood (M3)	-	-	-	-	-	-	-	-	-	-	-	-	-
Total WFPs (M3)	-	-	-	-	***1,815,396***	-	***234,732***	-	-	-	-	***35,392,624***	***37,442,752***
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
Bees wax (Kg)	-	-	104	-	-	-	-	-	-	-	-	-	104
Total NWFPs (Kg)	-	-	***104***	-	-	-	-	-	-	-	-	-	***104***

Forest Resource Use	Forestry ind.	Charcoal producers	Honey producers	Loggers	Sawmills	Warehouses	Carpentry	Construction	Other Industry	Households	Exports	Envi . (Forests)	TOTAL USE
Flows within the economy													
Indigenous timber (M3)	-	-	-	-	-	56,274	1,144,564	28,137	-	-	3,057,593	-	4,286,567
Exotic timber (M3)	-	-	-	-	-	-	75,435	474,101	53,178	2,103	-	-	604,817
Wood for charcoal (M3)	-	-	-	-	-	-	-	-	712,509	5,041,351	1,594,286	-	7,348,146
Wood for firewood (M3)	-	-	-	-	-	-	-	-	49,665	212,481	-	-	262,146
Total WFPs (M3)	-	-	-	-	-	***56,274***	***1,219,998***	***502,238***	***815,352***	***5,255,934***	***4,651,879***	-	***12,501,675***
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	1,441,934	511,906	-	1,953,840
Bees wax (Kg)	-	-	1,234	-	-	-	-	-	74,657	-	26,942	-	102,834
Total NWFPs (Kg)	-	-	***1,234***	-	-	-	-	-	***74,657***	***1,441,934***	***538,849***	-	***2,056,674***

Annex 5. Supply Chain and Forest Account Diagrams

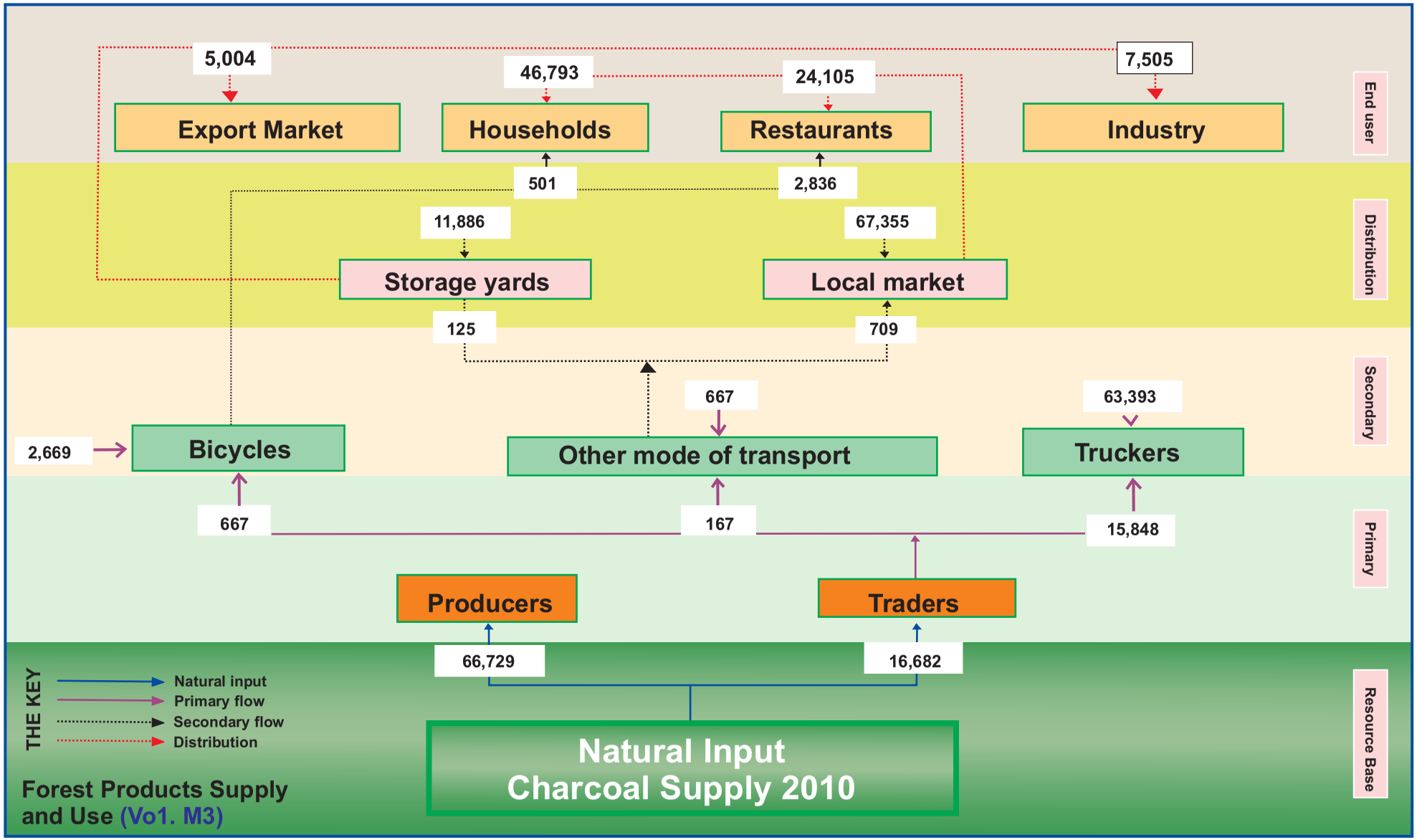

Figure A5.1: Diagram for the volume of licensed charcoal supply and use in 2010

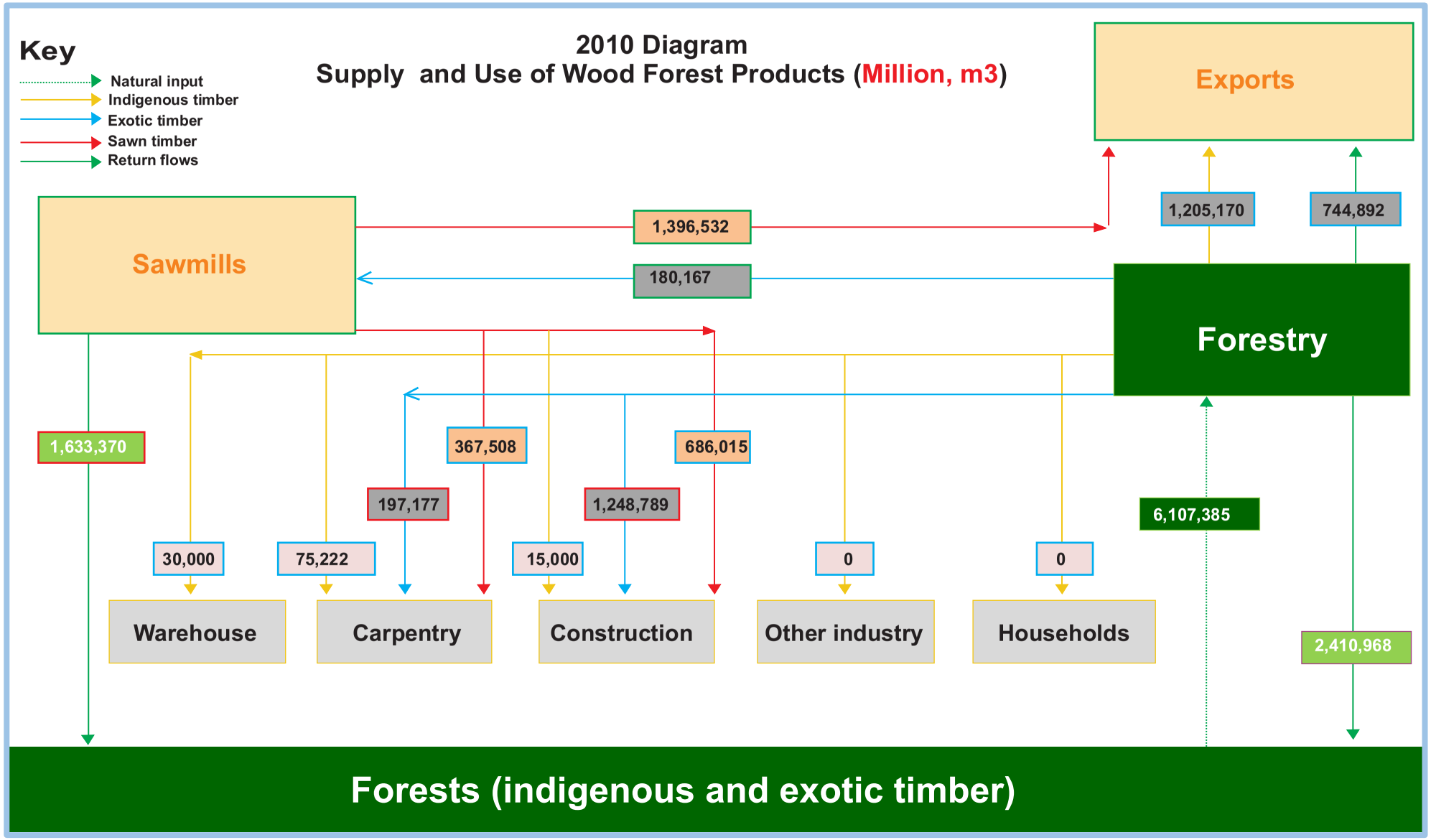

Figure A5.2: Diagram for the volume of timber supply and use in 2010

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