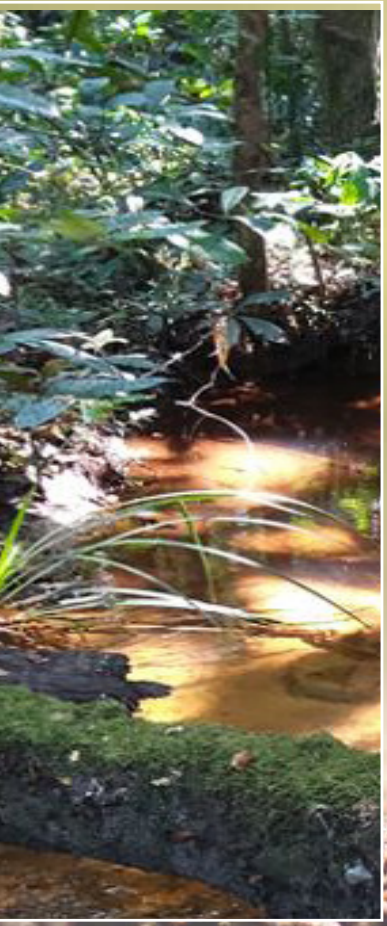
Republic of Zambia

Ministry of Green
Economy and Environment

Foresty Department

Zambia Natural Capital Accounts for Forests

TECHNICAL REPORT (2016 – 2020)

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GPS Global Program on Sustainability

MINISTRY OF GREEN ECONOMY AND ENVIRONMENT
Forestry Department

ZAMBIA NATURAL CAPITAL ACCOUNTS FOR FORESTS
2016 TO 2020
Technical Report

November 2023

The Natural Capital Accounts (NCA) for Forests covering the period 2016 to 2020 were produced by the Forestry Department, Ministry of Green Economy and Environment (MGEE) in collaboration with the Ministry of Finance and National Planning (MoFNP) with technical assistance from the World Bank and the Global Program on Sustainability (GPS). 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" (Forests 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.

Advisory and Technical Supervision

Environment, Natural Resources and Blue Economy, Global Practice, World Bank Office, Lusaka

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FOREWORDS

The Ministry of Green Economy (MGEE) has the mandate of ensuring the protection and conservation of the environment for a climate-smart and green economy. One of the components of the environment that the Ministry is mandated to manage and conserve are forests. The Forestry Department under the Ministry is responsible for the promotion and sustainable management and utilisation of forest resources through its legal frameworks.

Forests are natural assets that play important ecological and economic functions. They generate revenue through timber, eco-tourism, and a wide range of wood and non-wood-based products, such as furniture, handicrafts, medicinal plants, fruits, honey and paper. These functions provide livelihoods for many rural communities. However, the ecological and economic functions of forests are threatened by unsustainable exploitation and utilisation.

To addresses these issues, the Zambian government has implemented various policies and programs to promote sustainable forest management, including the National Forestry Policy, the Forest Act, and the National Reducing Emissions from Deforestation and Forest Degradation (REDD+) Strategy. These initiatives aim to promote sustainable land use, increase forest cover, and enhance the resilience of forest ecosystems to climate change.

Furthermore, the government is promoting community-based forest management approaches to involve local communities in forest conservation and management, providing them with economic incentives to protect and restore forest ecosystems. These initiatives are essential for ensuring the continued provision of benefits from forests while also enhancing the socio-economic wellbeing of local communities within Zambia's forests.

Hon. Situmbeko Musokotwane
Minister of Finance and National Planning

This report presents the findings of the second iteration of the Natural Capital Accounting (NCA) study for the forestry sector in Zambia, covering the period from 2016 to 2020. Building on the first report, which focused on identifying the untapped potential of forest resources, this report demonstrates the feasibility of producing forest accounts for the nation. However, it also recognizes that further improvements and institutionalization of forest accounts are necessary to address key policy issues related to sustainable forest management in Zambia.

To ensure the report's accuracy, stakeholder reviews were sought and taken into account to the extent possible, providing valuable input into the analysis and interpretation of the data. The report's findings highlight the importance of sustainable forest management practices for promoting the long-term conservation and sustainable use of Zambia's forest resources. The development of comprehensive forest accounts is essential for informing policy decisions that can help safeguard the ecological, economic, and cultural values of Zambia's forests for future generations.

The report provides statistics on selected forest resources, including timber, non-timber forest resources, wood fuel, liquid honey, and beeswax. The Forest Department led the development of the forest account under the Wealth Accounting and Valuation of Ecosystems (WAVES) program, and the plan is to expand it to include regulatory and cultural services. The hope is that WAVES activities will be fully institutionalized to continue collecting forest data and informing policy, with the capacity for regular updates from various data sources.

Hon. Eng. Collins Nzovu
Minister of Green Economy and Environment

FOREWORDS

The development of the second iteration of the Forest Accounts for Zambia in addition to the Land, Water and, Wildlife and Protected Areas Accounts is remarkable. It shows the country's continued commitment to using Natural Capital Accounting (NCA) as a tool to attain sustainable economic growth to attain *"a prosperous, sustainable middle-income economy with opportunities for all",* as planned for in Zambia's Vision 2030 and Eighth National Development Plan (8NDP). The Forest Accounts continue to provide statistics crucial for the planning and management of forest resources and they also play a critical role in biodiversity conservation and climate change mitigation.

The importance of "sustainable forest management" has been emphasized worldwide. The findings from this report continue to raise awareness and understanding of the impact of various land uses and economic activities that contribute to restoring or degrading forests, as well as the rate at which it is occurring. Through the public and private sectors, deliberate efforts can continue to be made to conserve the forests as various social economic activities are implemented in the communities. One example highlighted in this report was a downward trend in the use of wood biomass for tobacco curing, "possibly attributed to improved sensitization on the impact on forests".

An increase in market demand for selected forest products such as honey and timber seem to be on the rise, but the increasing rate of deforestation from 2018 to 2020, mainly attributed to increased cropped land, continues to be a concern. However, it is good to note that one of Zambia's objectives under the National Agricultural Policy 2012–2030 is to *"Promote **sustainable** increase in agricultural productivity of major crops with comparative advantage"*. If the sustainable agricultural practices are well implemented, this will contribute greatly to protecting and maintaining the forests and to improved compliance with existing forest policies.

We hope that with regular updates of the Forest Accounts, the findings will guide decision makers with timely assessments and monitoring of the effectiveness of the current government policies related to taxes and subsidies on the Forest Sector and related sectors, as well as trade policies and the implementation of International Treaties aimed at conserving the forests.

We look forward to the expansion of the Forest Accounts to include sub-accounts that will identify spatially important areas to monitor biodiversity trends within the forests.

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

Iain G. Shuker
Regional Director, Sustainable Development, Eastern and Southern Africa, The World Bank

The importance of "sustainable forest management" has been emphasized worldwide.

ACKNOWLEDGMENTS

This second Forest Account report was made possible by the dedicated effort of the Zambia WAVES Forest Account Technical Working Group (TWG) which included Sylvester Y. Siame, Keddy Mbindo, Isaac E. Nyirenda, and Bupe Musonda from the Forestry Department, Abel M. Siampale from WWF, Michael Katongo Phiri from the National Remote Sensing Centre (NRSC), Alice Pearce from the Policy Monitoring and Research Centre (PMRC) and Patience Tembo from the Planning and Policy Department of the Ministry of Green Economy and Environment. Their hard work and utilization of data on various forest products and services allowed for the compilation of this second technical report. Partners such as Community Markets for Conservation (COMACO), Zambia Forestry and Forest Industries Cooperation (ZAFFICO) PLC, beekeeping companies, and traders also provided data for the report. Their contributions are gratefully acknowledged. Special thanks are due to the Ministry of Finance and National Planning, led by the

Our gratitude goes to Permanent Secretary of Planning and Administration, Ms. Lois Mulube; Acting Director of Development Planning, Ms. Mwila M. Daka; Richard Lungu (Zambia WAVES National Focal Person); and Stanley Nkhuwa and Brian Musonda from the MoFNP for their strategic oversight and coordinating the various activities that made it possible to develop and update the Forest Account. Appreciation is also given to the Zambia WAVES (ZWAVES) project task team at the World Bank who supported Forest Account activities. The ZWAVES team includes Ngao Mubanga and Rebbeca Naomi Munsanda Ngulube.

Furthermore, the data provided by various stakeholder institutions played a crucial role in compiling the report. These institutions included the Forestry Department, the National Remote Sensing Centre, the Ministry of Energy, and the Zambia Statistical Agency (ZamStats). The team would like to express great appreciation to the reviewer from the World Bank and the valuable feedback received from local experts and stakeholder institutions, which helped shape this report.

Dr. Douty Chibamba
Permanent Secretary
Ministry of Green Economy and Environment

Ms. Lois Mulube
Permanent Secretary
Ministry of Finance and National Planning – Planning and Administration

CONTENTS

ACRONYMS

8NDP	Eighth 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
ESRI STATS	Environmental Systems Research Institute
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	Meters cubed
MGEE	Ministry of Green Economy and Environment
MoFNP	Ministry of Finance and National Planning
MWDS	Ministry of Water Development and Sanitation
NCA	National Capital Accounting
NLAP	National Land Audit Programme
NMB	National Museums Board
NRSC	National Remote Sensing Centre
NSDI	National Spatial Data Infrastructure
NTFP	Non-Timber Forest Product
PFA	Protected Forest Area
PMRC	Policy Monitoring and Research Center
REDD	Reduced Emissions from Deforestation and Forest Degradation
SDG	Sustainable Development Goal
SEEA	System of Environmental-Economic Accounting
SNA	System of National Accounts
TFP	Wood Forest Product
UN	United Nations
WAVES	Wealth Accounting and Valuation of Ecosystem Services
WB	World Bank
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

“The forest area reduced by 2.6 percent between 2016 to 2020 which is an indication of the unsustainable use of forests.”

EXECUTIVE SUMMARY

Forests are important to the people of Zambia. Forest industries directly contribute 3.7 percent to the Gross Domestic Product (GDP), while charcoal production and fuel wood collection account for an additional 2.2 percent and 0.8 percent respectively. Forests provide a wide range of ecosystem services such as non-wood forest products (honey and beeswax, mushrooms, caterpillars, fruits, etc.), air and water filtration, carbon sequestration, and cultural and recreational services. Forests also play a critical role in biodiversity conservation and climate change mitigation. With so many values attributed to forests, good information in the form of Forest Accounts is needed for forest planning and management

The first Forest Account for the country was published in 2019 and covered the period from 2010 to 2015. This, the second Forest Account, covers the period 2016 to 2020. Both accounts are based on the System of Environmental-Economic Accounting (SEEA) and were compiled from a diversity of data sources. They 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 second Forest Account shows the supply of timber and non-timber forest product for the years 2016 to 2020, while a Land Cover Account for the years 2018 to 2020 shows changes in the forest area. The Supply and Uses Accounts show the flows of six forest products: timber from the indigenous forests, timber from exotic plantations, charcoal, firewood, liquid honey, and beeswax. The land cover account shows changes in the areas of forest, grassland, cropland, human settlements, and wetlands.

The second Forest Account has four main findings:

1. There is an increasing demand for the 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*).

2. There was a continued increase in the use of charcoal and firewood as a source of energy.

3. The forest area reduced by 2.6 percent between 2016 to 2020 which is an indication of the unsustainable use of forests.

4. Markets for honey and beeswax continued to be an important source of income.

Both timber forest products (TFP) and non-timber forest products (NTFP) continued to be important to the Zambian economy. Data on timber production indicate that the total timber supply increased from 3.4 million meters cubed (m^3) in 2016 to 8.7 million m^3 in 2020, representing a 40 percent increase. During that period, honey and beeswax production increased compared to the previous reporting period. Honey production increased from 2,355 tonnes to 30,915 tonnes between 2016 to 2020.

The physical Supply and Use Accounts also show residual flows from some industries. However, additional forest products and ecosystem services derived from forests (e.g., carbon sequestration, water filtration, cultural and recreational services) are important but were not considered in these accounts. This is mainly due to capacity limitations.

Forest Asset Accounts show that the area of forest declined by 1.7 percent between 2016 to 2020. Further, analysis of wood fuel extraction from the forest showed that there was a continued increase in the use of wood fuel for various uses within households: 83,727 m^3 total use of wood fuel consumption. The decline in the forest area can be taken as an indication of the unsustainable use of forests.

The Forest Account sheds light on some critical policy issues, including the need for:

5. Sustainable forest management;

6. Water catchment management and recharge systems protection;

7. The formulation of forest management plans to ensure biodiversity conservation;

8. Strengthened monitoring of forest activities for compliance;

9. Support for the sustainable production and value chains of NTFP such as honey and;

10. The prevention of over exploitation of wood biomass for energy.

In addition, there is a need to institutionalize Forest Account production and use in government decision-making processes. This will require continued cooperation between government and non-government agencies, academia cooperating partners, and all sector players.

"Critical policy issues include water catchment management and recharge systems protection."

1.0 INTRODUCTION

The World Bank Zambia office supported the Government of the Republic of Zambia (GRZ) in collaboration with various stakeholders in the forestry sector, to create the second iteration for the Natural Capital Account covering the period 2016 to 2020 for the forestry sector in Zambia. This was meant to demonstrate the financial value of forests. The Steering Committee chaired by the Ministry of Finance and National Planning (MoFNP) oversaw this activity. Members of the Technical Working Group (TWG) from departments under line ministries were also involved. They included the Forestry Department, National Remote Sensing Centre (NRSC), Department of Policy and Planning (MGEE), Ministry of Water Development and Sanitation and the Ministry of Lands and Natural Resources.

The Wealth Accounting and Valuation of Ecosystem Services (WAVES) project, and its successor the Global Program on Sustainability (GPS), is a multinational collaboration that employs natural capital accounting to integrate natural capital issues into economic policy. Natural capital accounting emphasizes both the contribution of natural resources to the economy and the influence of the economy on the environment. In this regard, the GRZ joined the World Bank-supported WAVES and GPS programs.

This document is a technical report on Zambia's Forest Account for the years 2016 to 2020. It is the result of substantial efforts by the Forest Accounts TWG, the World Bank Team, and the NCA Consultants. This is the second official edition of Zambia's Forest Account. The first was compiled with data for the period between 2010 and 2015.

This second Forest Account is expected to spur action, which may result in improved support for data collection, enhanced accounting procedures, and uses of account findings within the government for decision-making and policy formulation and revision. Forest accounting covers a wide range of topics, including the physical supply and use of timber and non-timber forest products, the physical extent and condition of forest accounts, and a variety of monetary accounts. This report, however, concentrates on physical asset accounting, as well as the Supply and Use Accounts for timber and non-timber forest products. This Forest Account addresses the construction of Forest Condition Accounts and ties to ecosystem services from forests in Zambia.

This report comprises six sections:

1. Introduction (Section1);
2. Main findings (Section 2);
3. Concepts, data sources, and methods (Section 3);
4. Conclusions and next steps (Section 4),
5. References (Section 6).

The report also includes an Annex with indicators and data sources for the accounts, as well as the Physical Supply and Use.

1.1 Process of development

The second iteration of Forest Accounts was created with data that span from 2016 to 2020. The following actions were taken during the development process:

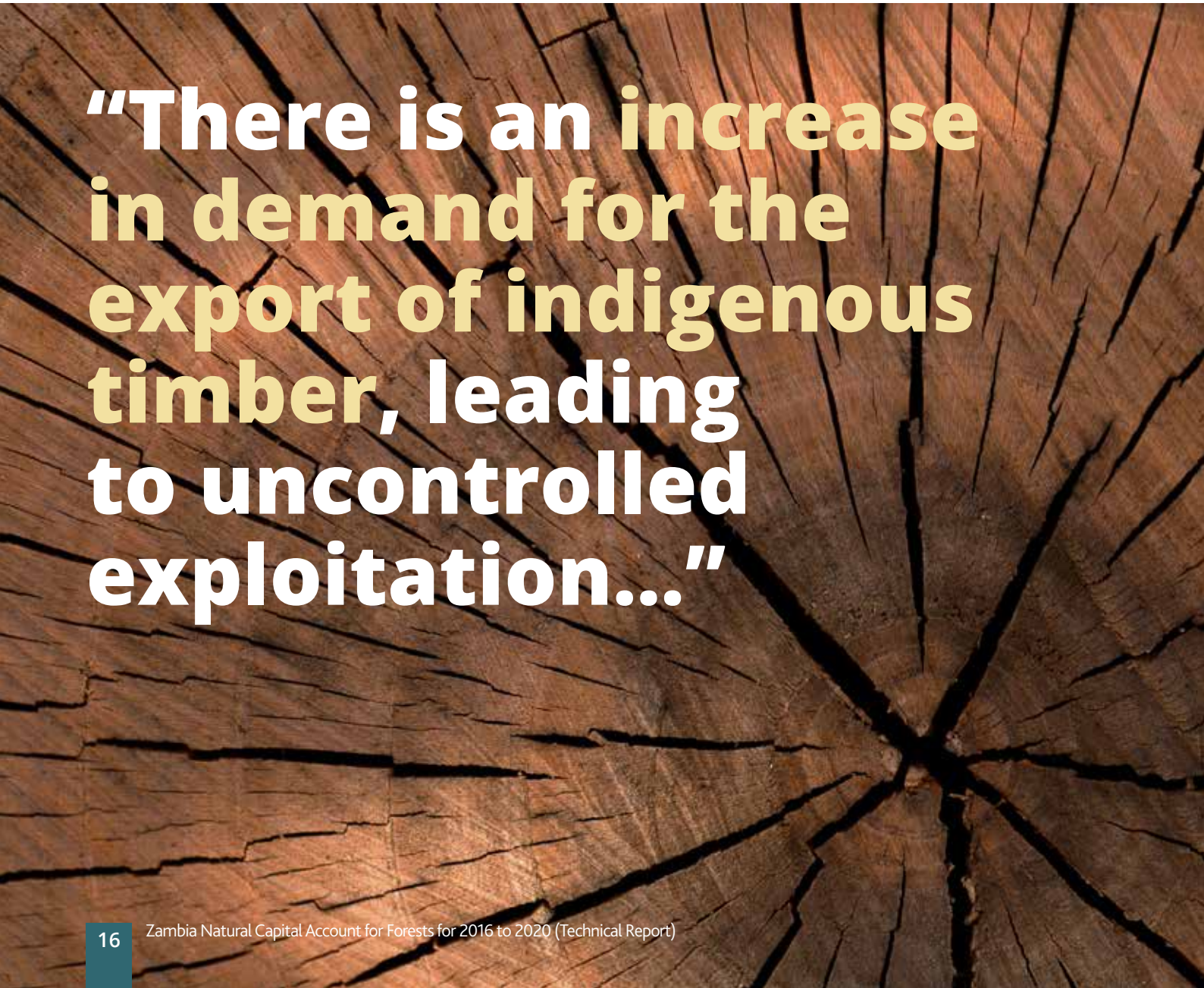
6. Mapping, collecting, and organizing datasets using a cleansing process.
7. Using tools such as pivot tables to create a comprehensive database.
8. Data mining and modification, including the listing of needed coefficients.
9. Carrying out extensive processing, analysis, and compilation of results.
10. Constructing diagrams and tables, such as asset, land, supply, and monetary tables.
11. Interpreting the findings in an informative manner.
12. Compiling the technical report that includes all of the processed data.

13. Validating the Forest Account findings to ensure correctness and dependability.

1.2 The institutional and policy context for forest accounts

Zambia's National Forestry Policy of 2014 covers both plantation and natural forests. The policy has 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; development a mechanism for the sharing of the costs and benefits of forest management; and investment in forest industries.

The Forestry Policy also needs to be viewed in the context of the Eighth National Development Plan (8NDP). The 8NDP has a new development area that emphasizes the need for environmental sustainability. It also underscores the importance of promoting green economic growth as a means of mitigating and adapting to the effects of climate change. Zambia has already experienced the effects of climate change, including more frequent extreme conditions such as droughts, floods, rising temperatures, and increased rainfall variability. These conditions have adversely affected the country's economic growth and development path (MNPD, 2017).



2.0 MAIN FINDINGS

This section presents the main findings and policy issues emerging from the Zambia Forest Accounts for the period 2016 to 2020. It draws on the accounts previously compiled, the primary data collected for the accounts, as well as other information to highlight key issues and their policy implications. The four key findings were:

1. There is a continued increase in demand for the export of indigenous timber, leading to uncontrolled exploitation of valuable tree species such as Mukula (*Chrysothraxis angolensis*), Mukwa (*Pterocarpus angolesnsis*), and Muzauli (*Guilbortia coloespermum*)

2. 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.

3. Forested land reduced between 2018 and 2020, which is an indication of the unsustainable use of the forests.

4. Sales of honey and beeswax continue to be an important source of income.

2.1 Increasing demand for indigenous and exotic timber

In the period under review, the country continued to show an increase in the quantity of indigenous and exotic timber harvested every year. The most commonly harvested indigenous tree species included Mukula (*Pterocarpus Chrysothraxis*), Mukwa (*Pterocarpus angolesnsis*), and Muzauli, rosewood (*Guilbortia coloespermum*). Most of the trees were exported to predominantly Asian countries. By law (SI No. 94 of 2015), only 75 percent of harvested indigenous timber is permitted for export, while 25 percent is to be utilized by the local market. The majority of the exotic timber harvested was from plantations and included Pine and Eucalyptus species. Annexes 4 to 8 show the volume of indigenous and exotic timber harvested between 2016 and 2020.

From 2016 to 2020, total timber production increased from 3.46 million m^3 in 2016 to 8.67 m^3 in 2020 (Annex 4 and 8). Figures 1 and 2 show a comparison of total timber harvested for the reporting periods 2010 to 2015 and 2016 to 2020 respectively. Figures 3 and 4 shows the trend of the total Indigenous timber supply for the period 2010 to 2015 and 2016 to 2020 respectively. The trends indicated that in 2010 to 2015, there were some slight dips and highs in the volume of timber harvested annually. However, exotic timber supply (mainly *Pinus* and *Eucalyptus* spp.) showed increases in 2017 and 2019 and a sharp reduction in 2020. This could be attributed to the shortage of mature trees in plantations—mainly under the Zambia Forest and Forestry Corporation (ZAFFICO)—due to the high demand for exotic timber, mostly for construction.

Figure 1: Summary of Timber Supply Table (2010 to 2015)

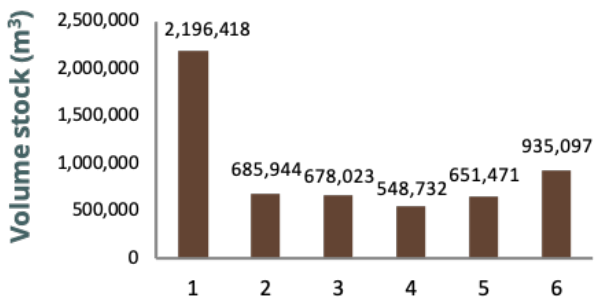


Figure 2: Summary of Timber Supply Table (Total Indigenous and Exotic) (2016 to 2020)

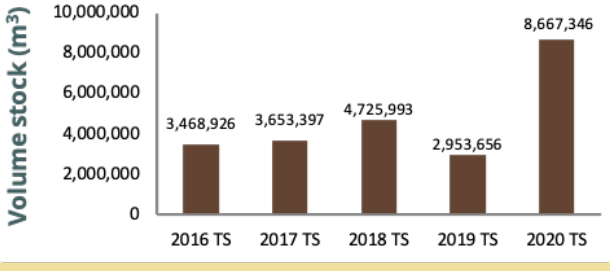


Figure 3: Summary of Timber Supply Table (Indigenous) (2010 to 2015)

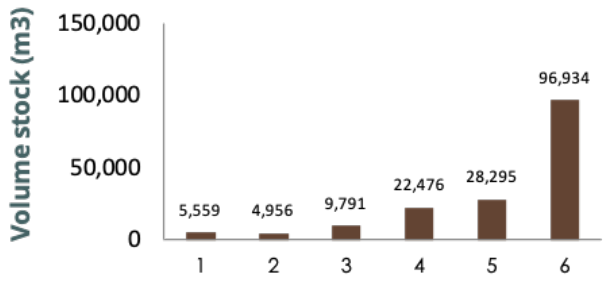
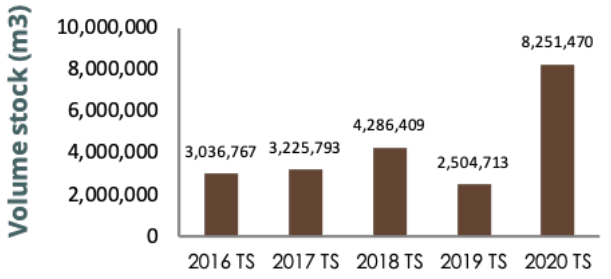


Figure 4: Summary of Timber Supply Table (Indigenous) (2016 to 2020)



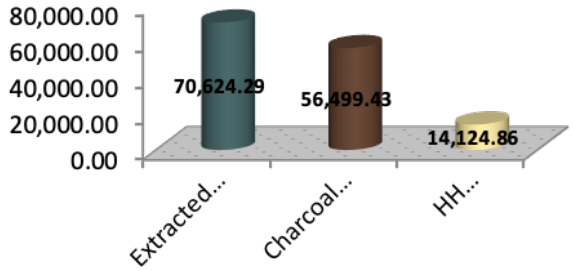
2.2 Wood biomass as a major source of energy

Charcoal and firewood remained major sources of energy, contributing to about 80 percent of total energy consumption. Without the availability of affordable and accessible alternative sources of energy, this trend is expected to continue. The majority of charcoal users are in the urban areas, especially in high-density residential areas. Firewood is predominantly utilized in rural areas, despite them being the source of most of the charcoal produced for consumption in urban areas.

This situation may be attributed to increased electricity tariffs in the country (ERB, 2012). The main uses of charcoal are cooking, water heating, and space heating. In rural areas, firewood is preferred to charcoal and is collected around residential areas and nearby forests. Based on the data collected for the Second Forest Account, the trend showed a slight increase in the percentage use of charcoal by households which stood at 44 percent, while restaurants and bars accounted for 37 percent. Its usage in manganese plants also increased to 13 percent from 7 percent reported in the previous account, while its usage in tobacco curing reduced from 0.15 to 0.02 percent. This is attributed to the reduction in the number of farmers growing flue-cured tobacco, possibly due to improved sensitization on the impact of flue-cured tobacco on forests. Illegal exports also showed a downward trend to 0.04 percent in 2020 from 0.14 percent in 2015. Figure 7 shows the percentage usage of charcoal in 2020.

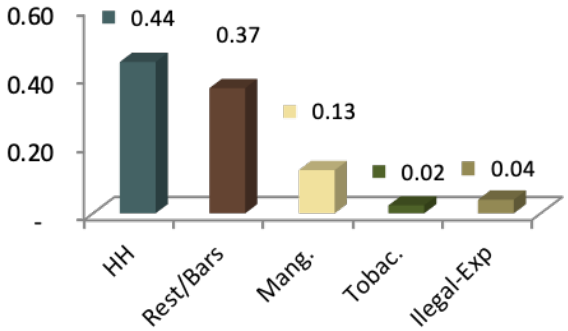
In addition, in the year 2020, the extracted volume for charcoal was 70,624.29 m^3, of which 56,499 m^3 was lost as waste in the form of residue, while 14,124.86 m^3 was consumed by households (see Figure 6). Overall, the extracted volume between 2016 to 2020 was recorded to be 439,800 m^3 (Refer to Annex 4 to 8: Product Supply and Use Tables).

Figure 5: Extracted Stock, Charcoal Residue and Household (HH) Consumption of Charcoal (2020)



Source: Adopted from the Forest Accounts Report (2010 – 2015)
Key: HH = households

Figure 6: Percentage of charcoal and firewood utilized by different end users (2016 to 2020)



Source: Adopted from the Forest Accounts Report (2010 – 2015)
Key: HH = households; Rest/Bars = Restaurants/Bars; Mang. = Manganese
Source: Forestry Department production returns data
Key: Tobac. = Tobacco; Ilegal Exp = Illegal exports.

For the period 2016 to 2020, total wood extraction for charcoal showed a slight reduction when compared to the 2010 to 2016 period; namely 439,800 m^3 compared to 451,577 m^3 (see Annex 4 to 8). The data was based on Forestry Department permits issued for charcoal extraction. Residues were calculated based on coefficients for the earth kilns, and showed that 351,840 m^3 was lost as wood residue from the extracted amount.

Wood recovery, in the form of charcoal for various uses—but mainly Household use—was only 83,727 m^3. Figure 7 shows the amount of wood extracted for charcoal, charcoal residues and recovery for Household consumption for the period 2016 to 2020, based on Forestry Department production returns data.

Figure 7: Total wood extraction, charcoal residue and recovery for HH consumption (2016 to 2020)

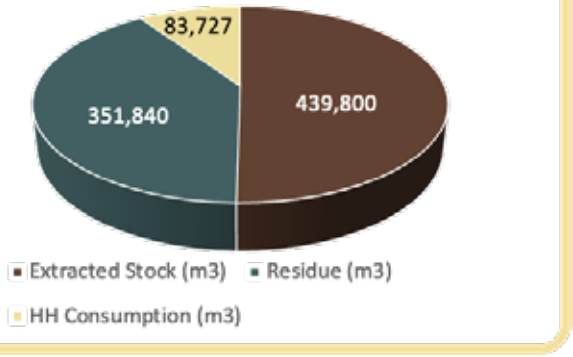


Table 1: Land Cover Change (2018 to 2020)

Land cover	Y2018 (ha)	Y2019 (ha)	Y2020 (ha)
Cropland	2,571,702.10	3,152,100.41	2,971,463.34
Forest	41,002,568.01	39,017,664.48	38,899,290.28
Grassland	27,887,840.48	29,660,235.80	29,691,066.61
Other land	1,118,396.05	1,140,446.59	1,134,001.14
Settlement	332,193.95	361,325.67	378,909.78
Wetland	2,348,699.41	1,929,627.05	2,186,668.85
TOTAL	75,261,400.00	75,261,400.00	75,261,400.00

Changes to forest cover were observed in protected forests. Forest area reduced from 5.5 million to 5.3 million hectares 27, a reduction of 2.6 percent (Table 2).

2.3 Reduction in forest land

The land use/land cover data was created using the Sentinel-2 10-meter Land Cover/Land Use (LULC) time-series data (2017 to 2021) produced by Impact Observatory, Microsoft and Environmental Systems Research Institute (ESRI). The ESRI classification scheme was converted to the Intergovernmental Panel on Climate Change (IPCC) classification Scheme that is commonly used for classification in forestry.

Statistics from the 2018 to 2020 land cover/land use were consolidated into a land cover account (Table1). The land cover change account shows that between 2018 and 2020, forests decreased from 41 million hectares (54.4 percent of the country's total land area) to 38.9 million hectares (51.7 percent of the country's total land area). Settlement and cropland increased from 0.3 million hectares and 2.6 million hectares to 0.4 million hectares and 2.9 million hectares, respectively (Table 1). A land cover change matrix was also computed for this period and is shown in Annex 3. The major land cover to which forests were converted to were cropland and grassland (Annex 3). This clearly indicates that agriculture expansion continues to be the main driver of forest loss in the country. The change matrix shows the overall accuracy of 90.49 percent (Annex 3).

2.4 Increasing markets for honey and beeswax

There was an increase in honey production from 2,355 tonnes in 2016 to 30,915 tonnes in 2020. This is attributed to the high demand for honey in both the local and international markets. Zambia earned 1.2 billion Kwacha from honey sales during this period, compared to 197 million Kwacha recorded in the previous reporting period (2010 to 2015). Further, part of the honey went towards exports to major importing countries, some of which included Norway, South Africa, the United Kingdom, and Zimbabwe.[1] Figure 8 shows the value of honey sales in 2010 to 2015, while Figure 9 shows the honey sales for 2016 to 2020.

In the case of beeswax, the trend was similar to that of honey, with an increase in the amount of beeswax extracted (Figure 10). The total beeswax extracted between 2016 to 2020 was recorded at 1,236 tonnes, translating into 51.5 million Kwacha in value.

Figure 10: Revenue form beeswax sales (ZMW) (2016 to 2020)

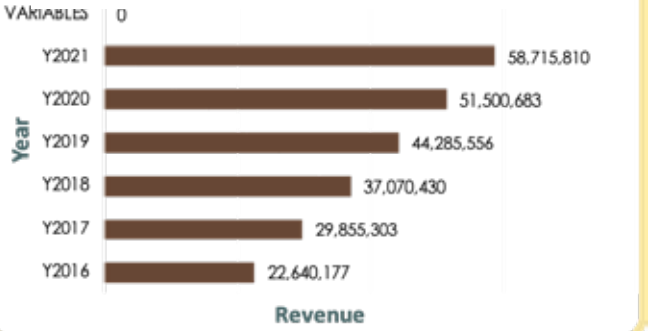


Figure 8: Value of liquid honey sales (2010 to 2015)

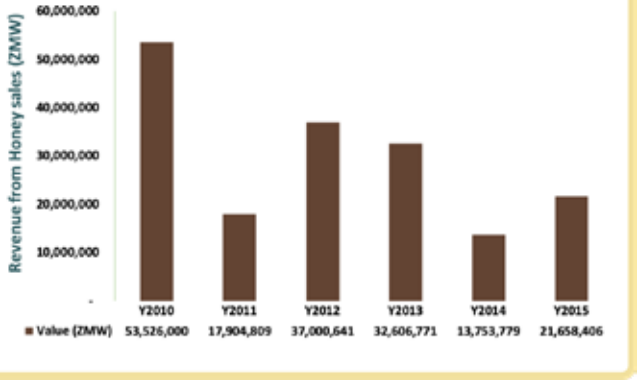
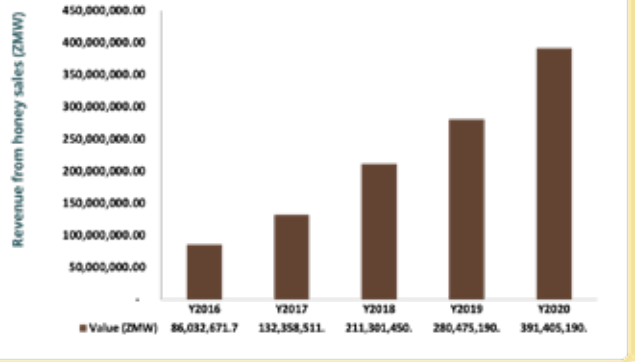


Figure 9: Value of liquid honey sales (2016 to 2020)



[1] https://trendeconomy.com/data/h2/Zambia/0409

3.0 CONCEPTUAL FRAMEWORK

3.1 SEEA the conceptual framework for NCA

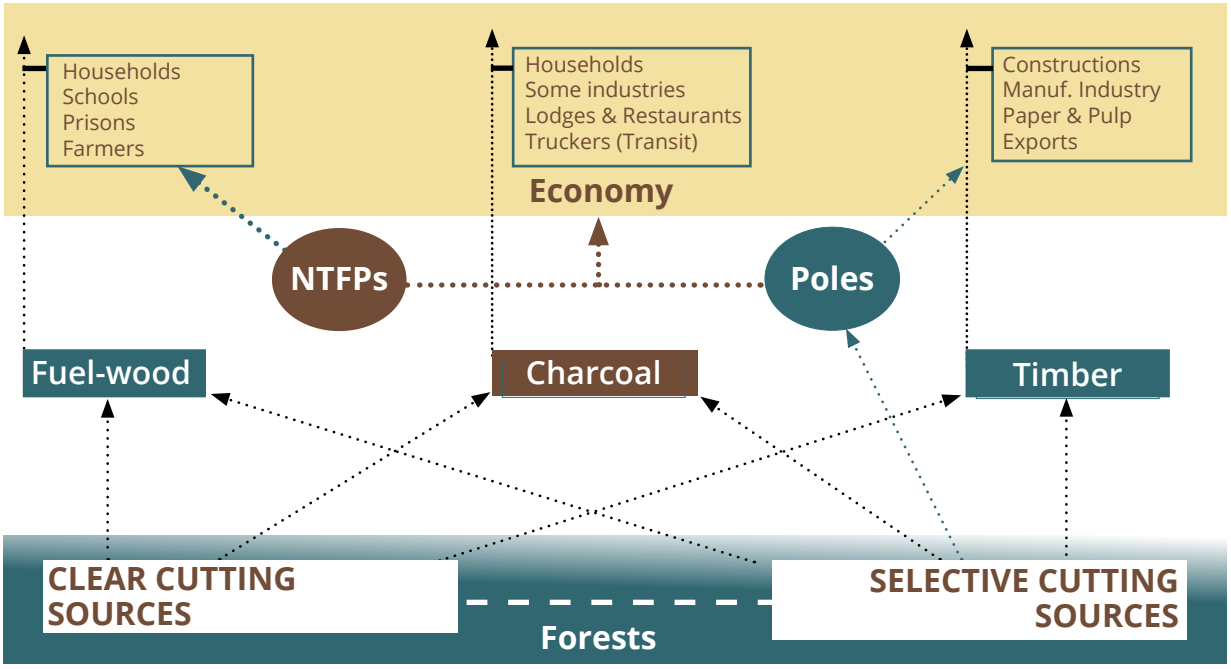
System of Environmental-Economic Accounting – Central Framework (SEEA Central Framework; UN et al., 2014) is the statistical framework that guided the compilation of natural capital accounts in Zambia. The SEEA provides the agreed concepts and definitions for natural capital accounting and was produced 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.

The SEEA organizes 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 System of National Accounts (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 into the environment resulting from economic activity, and the amount of economic activity undertaken for environmental purposes.

3.1.1 The conceptual framework for forests in Zambia

The conceptual framework for forest accounting in Zambia is shown in Figure 11, which outlines the timber forest products (TFPs) and non-timber Forest products (NTFP). Selective cutting (or selective felling) is the removal of trees that are most economically beneficial forest products (NTFPs) extracted from the environment (i.e., species are selectively cut 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 forest concessionaires as timber harvesting is done selectively only for preferred high value timber species.

Figure 11: Conceptual framework - Provisioning Services



3.2 Methods

The resource-based accounts approach comprised three steps. The first step was to separate 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 forest products were selected: exotic timber, indigenous timber, charcoal, firewood, honey and beeswax. The third step was to determine the flow of each product into the economy. This was done in both physical and monetary units.

3.3 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 ZAFFICO, Copperbelt University (CBU) and the NRSC also provided some input data during the process of developing the accounts.

3.3.1 Forest asset accounts (land use and land cover)

The data for the forest asset account came from the land cover maps generated by the NRSC. The land cover map and data adopted was also published in the Land Account Report for 2018 to 2021. The data was obtained through the analysis of images using the Environmental Systems Research Institute Geographical Information Systems mapping Software (ESRI STATS).

3.3.2 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 countrywide districts. These data are reported to Forestry Department Headquarters every quarter. Additional data for the exotic timber and poles came from ZAFFICO.

3.3.3 Monetary accounts

In order to compute the monetary value of forest assets related to the volume of timber in the forest stock, the first step was to calculate the total growing stock (Table A4.9). The 2016 Integrated Land Use Assessment (ILUA) II reports an average of 45.4 m^3 per hectare across all forests in Zambia. The monetary asset was then calculated based on the quantity of timber harvested with an average value of 293.4 Kwacha unit price per m^3 of TFPs for both exotic and indigenous timber (Statutory Instrument No.52 of 2013).


"Clear cutting is never practiced by indigenous forest concessionaires as timber harvesting is done selectively only for preferred high value timber species."

4.0 CONCLUSIONS AND NEXT STEPS

4.1. Conclusions

Zambia has extensive forests that are of both economic and ecological importance. However, the unsustainable extraction of forest products for uses such as timber and charcoal production poses a threat to the contribution of the forest sector to economic development. The increase in quantities of charcoal produced from indigenous forests calls for alternative sources of energy to biomass energy. Further, loss of forests to other land uses would require more effort in restoration activities to replenish the lost and degraded forests.

4.2 Next steps

Data gaps and the limited capacity by the Forest Accounts Technical Working Group will require improvement in order to expand the scope of valuation of services from forests. Supplementary analysis would also be required to ensure that additional statistics are derived in collaboration with other accounts such as energy, water, land and wildlife in order to inform policy and decision-making.

Further, the institutionalization of the accounts is an important issue. The current set of accounts were produced as additional work by various institutions with support from the World Bank. Going forward, an on-going account production process will be needed.

The capacity of government agencies within Zambia will need to be maintained and increased. It is hoped that annual Forest Accounts can be produced to match the data from SNA and used in annual government planning and budgeting cycles. Future accounting should aim to engage the private sector. This would be in order to obtain more data for account production and to raise the awareness, understanding and use of the accounts in the private sector.

4.3 Policy Prescriptions

The data on wood extraction for charcoal was also compared with the projected national wood fuel consumption for charcoal from the Ministry of Energy. The comparison revealed that the household consumption level based on data from permits issued by the Forestry Department only accounts for 1 percent of the total projected wood fuel (charcoal consumption). This implies that only 1 percent (83,727 m^3) of the charcoal extracted is legally licensed, while 99 percent (10,631,779 m^3) is unlicensed. This therefore calls for intensified enforcement and sensitization to ensure that there is compliance.

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"Going forward, an ongoing account production process will be needed."

ANNEXES

Annex 1 - Typical indicators and data sources for the account

Services	Indicator (s)/Units	Data Sources	Remarks
Provisioning services			
Timber	Harvested timber (m^3, m^3/ha) and fees	1, 6, 7, 9	First iteration
Poles	Harvested poles (m^3, m^3/ha) and fees	1, 6, 7, 9	First iteration
Charcoal	Harvested wood and produced charcoal (m^3, kg, ton)	1, 6, 7	First iteration
Firewood	Headloads (m^3)	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 (m^3); 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 and 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 and 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 - Forest products conversion tables

Code	Forest Products	Local Measure	Standard Units	Standard Measurements
1	Industrial wood	Cant/Beam (50 X 50 cm)	m^3	0.750
1	Industrial wood	Planks (50 X 150 mm)	m^3	0.023
1	Industrial wood	Planks (50 X 100 mm)	m^3	0.015
1	Industrial wood	Planks (50 X 50 mm)	m^3	0.008
1	Industrial wood	Pellets (15 X 15 mm)	m^3	0.001
1	Unit fees for timber	Number	m^3	0.3
2	Wood for poles	1 Pole (Average 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	m^3	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 / Bucket	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 baskets	Small piece	Kg	1.50
12	Rattan baskets	Medium piece	Kg	3.50
12	Rattan baskets	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	Sisal (for ropes)	Roll	Kg	1.25
16	Sisal (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)	Large 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	Beeswax	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 claw)	Heap	Kg	1.00
20	Other plant products (devils claw)	"25 kg bag"	Kg	20.00
20	Other plant products (devils claw)	"50 kg bag"	Kg	40.00

Annex 3 - Change Matrix

Land Cover	Cropland (Ha)	Settlement (Ha)	Grassland (Ha)	Forest (Ha)	Wetland (Ha)	Other land (Ha)	Opening Stock (Ha)
Cropland	1,139,108.20	2,864.82	540,232.58	99,048.09	1,022.27	482.22	1,782,758.19
Settlement	4,446.52	103,291.10	36,292.86	2,599.86	59.24	2,116.64	148,806.22
Grassland	394,925.81	11,316.71	15,531,599.27	3,675,340.12	22,281.51	8,533.11	19,643,996.53
Forest	20,627.12	598.08	2,279,354.24	51,178,975.61	5,673.71	114.56	53,485,343.32
Wetland	244.88	378.91	18,088.10	8,745.96	129,390.63	2,895.94	159,744.42
Other land	198.59	737.34	9,912.51	4,169.02	1,605.40	24,128.48	40,751.33
Closing Stock	**1,559,551.12**	**119,186.96**	**18,415,479.56**	**54,968,878.66**	**160,032.76**	**38,270.95**	**75,261,400.00**

No Change Values
Grand Totals/Stocks

Annex 4 - Physical supply and use table for forest products, 2016 (supply)

Forest Resource Supply	Forestry	Charcoal producers	Honey producers	Loggers	Saw-mills	Ware-houses	Carpentry	Construction	Other Industry	House-holds	Exports	Total Supply
Flows within the economy												
Indigenous timber licensed (m^3)	303,539	-	-	-	-	-	-	-	-	-	-	303,539
Indigenous timber unlicensed (m3)	1,500,000	-	-	-	-	-	-	-	-	-	-	1,500,000
Exotic timber (m^3)	1,299,71	-	-	-	-	-	-	-	-	-	-	1,299,071
Sawn timber (m^3)	0	-	-	-	450,055	-	-	-	-	-	-	2,450,055
Indigenous poles licensed (m^3)	3,114	-	-	-	-	-	-	-	-	-	-	3,114
Indigenous poles unlicensed (m^3)	1,230,114	-	-	-	-	-	-	-	-	-	-	1,230,114
Exotic poles (m^3)	114	-	-	-	-	-	-	-	-	-	-	114
Processed poles (m^3)	0	-	-	-	385	-	-	-	-	-	-	385
Charcoal licensed (m^3)	0	68,874	-	-	-	-	-	-	-	-	-	68,874
Charcoal unlicensed (m^3)	0	96,773	-	-	-	-	-	-	-	-	-	96,773
Firewood licensed (m^3)	861	-	-	-	-	-	-	-	-	-	-	861
Firewood unlicensed (m^3)	209,238	-	-	-	-	-	-	-	-	-	-	209,238
Total WFPs (m^3)	3,376,951	165,647	-	-	2,450,440	-	-	-	-	-	-	7,162,138
Liquid honey (Kg)	-	-	2,867,756	-	-	-	-	-	-	-	-	2,867,756
Beeswax (Kg)	-	-	150,935	-	-	-	-	-	-	-	-	150,935
Total NWFPs (Kg)	**-**	**-**	**3,018,691**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3,018,691**
Flows from the economy to the environment												
Waste for WFPs (m^3)	1,734,894	299,908	-	-	122,522	-	-	-	-	-	-	2,157,324
Waste for NWFPs (Kg)	-	-	468	-	-	-	-	-	-	-	-	468

Annex 5 - Physical supply and use table for forest products, 2016 (use)

Forest Resource Use	Forestry	Charcoal producers	Honey producers	Loggers	Saw-mills	Ware-houses	Carpentry	Construction	Other Industry	House-holds	Exports	Total Use
Flows within the economy												
Indigenous timber licensed (m^3)	-	-	-	-	9,106	-	12,142	-	-	-	282,291	303,539
Indigenous timber unlicensed (m^3)	-	-	-	-	180,000	30,000	75,000	15,000	-	-	1,200,000	1,500,000
Exotic timber (m^3)	-	-	-	-	-	-	38,884	246,266	-	-	1,013,921	1,299,071
Sawn timber (m^3)	-	-		-	-	-	367,508	686,015	-	-	1,396,532	2,450,056
Indigenous poles licensed (m^3)	-	-	-		-	-	-	3,114	-	-	-	3,114
Indigenous poles unlicensed (m^3)	-	-	-	-	-	-	-	578,154	-	467,443	184,517	1,230,114
Exotic poles (m^3)	-	-	-	-	-	-	-	101	-	-	13	114
Processed poles (m^3)	-	-	-	-	-	-	-	353	-	-	33	385
Charcoal licensed (m^3)	-	-	-	-	-	-	-	-	-	60,609	8,265	68,874
Charcoal unlicensed (m^3)	-	-	-	-	-	-	-	-	9,677	65,806	21,290	96,773
Firewood licensed (m^3)	-	-	-	-	-	-	-	-	-	861	-	861
Firewood unlicensed (m^3)	-	-	-	-	-	-	-	-	39,755	169,483	-	209,238
Total WFPs (m^3)	-	-	-	-	189,106	30,000	493,534	1,529,003	49,432	764,202	4,106,862	7,162,139
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	2,116,404	751,352	2,867,756
Wax (Kg)	-	-	1,811	-	-	-	-	-	109,578	-	39,545	150,935
Total NWFPs (Kg)	**-**	**-**	**1,811**	**-**	**-**	**-**	**-**	**-**	**109,578**	**2,116,404**	**790,897**	**3,018,691**
Flows from the economy to the environment												
Waste for WFPs (m^3)	2,157,324	-	-	-	-	-	-	-		-	-	2,157,324
Waste for NWFPs (Kg)	468	-	-	-	-	-	-	-		-	-	468

Annex 6: Physical supply and use table for forest products, 2017

Forest Resource Supply	Forestry	Charcoal producers	Honey producers	Loggers	Saw-mills	Ware-houses	Carpentry	Construction	Other Industry	House-holds	Exports	Total Supply
Flows within the economy												
Indigenous timber licensed (m^3)	41,151	-	-	-	-	-	-	-	-	-	-	41,151
Indigenous timber unlicensed (m^3)	1,780,145	-	-	-	-	-	-	-	-	-	-	1,780,145
Exotic timber (m^3)	513,626	-	-	-	-	-	-	-	-	-	-	513,626
Sawn timber (m^3)	-	-	-	-	2,000,150	-	-	-	-	-	-	2,000,150
Indigenous poles licensed (m^3)	4,196	-	-	-	-	-	-	-	-	-	-	4,196
Indigenous poles unlicensed (m^3)	1,400,301	-	-	-	-	-	-	-	-	-	-	1,400,301
Exotic poles (m^3)	196	-	-	-	-	-	-	-	-	-	-	196
Processed poles (m^3)	-	-	-	-	702	-	-	-	-	-	-	702
Charcoal licensed (m^3)	-	77,687	-	-	-	-	-	-	-	-	-	77,687
Charcoal unlicensed (m^3)	-	116,754	-	-	-	-	-	-	-	-	-	116,754
Firewood licensed (m^3)	2,258	-	-	-	-	-	-	-	-	-	-	2,258
Firewood unlicensed (m^3)	691	-	-	-	-	-	-	-	-	-	-	691
Total WFPs (m^3)	3,742,563	194,441	-	-	2,000,852	-	-	-	-	-	-	5,937,856
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 for WFPs (m^3)	1,827,828	157,359	-	-	100,043	-	-	-	-	-	-	2,085,230
Waste for NWFPs (Kg)	-	-	133	-	-	-	-	-	-	-	-	133

Forest Resource Use	Forestry	Charcoal producers	Honey producers	Loggers	Saw-mills	Ware-houses	Carpentry	Construction	Other Industry	House-holds	Exports	Total Use
Flows within the economy												
Indigenous timber licensed (m^3)	-	-	-	-	1,235	-	1,646	-	-	-	38,270	41,151
Indigenous timber unlicensed (m^3)	-	-	-	-	213,617	35,603	89,007	17,801	-	-	1,424,116	1,780,145
Exotic timber (m^3)	-	-	-	-	-	-	38,467	243,623	-	231,536	-	513,626
Sawn timber (m^3)	-	-	-	-	-	-	300,023	560,042	112,008	260,020	768,058	2,000,150
Indigenous poles licensed (m^3)	-	-	-	-	-	-	-	4,196	-	-	-	4,196
Indigenous poles unlicensed (m^3)	-	-	-	-	-	-	-	658,141	-	532,114	210,045	1,400,301
Exotic poles (m^3)	-	-	-	-	-	-	-	175	-	-	22	196
Processed poles (m^3)	-	-	-	-	-	-	-	642	-	-	60	702
Charcoal licensed (m^3)	-	-	-	-	-	-	-	-	-	68,364	9,322	77,687
Charcoal unlicensed (m^3)	-	-	-	-	-	-	-	-	11,675	79,393	25,686	116,754
Firewood licensed (m^3)	-	-	-	-	-	-	-	-	-	2,258	-	2,258
Firewood unlicensed (m^3)	-	-	-	-	-	-	-	-	131	560	-	691
Total WFPs (m^3)	-	-	-	-	214,852	35,603	429,143	1,484,620	123,814	1,174,245	2,475,579	5,937,856
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**
Flows from the economy to the environment												
Waste for WFPs (m^3)	2,085,230	-	-	-	-	-	-	-		-	-	2,085,230
Waste for NWFPs (Kg)	133	-	-	-	-	-	-	-		-	-	133

Annex 7: Physical supply and use table for forest products, 2018 (supply)

Forest Resource Supply	Forestry	Charcoal producers	Honey producers	Loggers	Saw-mills	Ware-houses	Carpentry	Construction	Other Industry	House-holds	Exports	Total Supply
Flows within the economy												
Indigenous timber licensed (m^3)	67,330	-	-	-	-	-	-	-	-	-	-	67,330
Indigenous timber unlicensed (m^3)	2,507,891	-	-	-	-	-	-	-	-	-	-	2,507,891
Exotic timber (m^3)	517,242	-	-	-	-	-	-	-	-	-	-	517,242
Sawn timber (m^3)	-	-	-	-	2,199,389	-	-	-	-	-	-	2,199,389
Indigenous poles licensed (m^3)	1,975	-	-	-	-	-	-	-	-	-	-	1,975
Indigenous poles unlicensed (m^3)	1,709,213	-	-	-	-	-	-	-	-	-	-	1,709,213
Exotic poles (m^3)	125	-	-	-	-	-	-	-	-	-	-	125
Processed poles (m^3)	-	-	-	-	689	-	-	-	-	-	-	689
Charcoal licensed (m^3)	-	101,451	-	-	-	-	-	-	-	-	-	101,451
Charcoal unlicensed (m^3)	-	132,897	-	-	-	-	-	-	-	-	-	132,897
Firewood licensed (m^3)	761	-	-	-	-	-	-	-	-	-	-	761
Firewood unlicensed (m^3)	344,209	-	-	-	-	-	-	-	-	-	-	344,209
Total WFPs (m^3)	**5,148,746**	**234,348**	**-**	**-**	**2,200,078**	**-**	**-**	**-**	**-**	**-**	**-**	**7,583,172**

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 for WFPs (m^3)	2,363,377	462,845		-	110,004	-	-	-	-	-	-	2,936,227
Waste for NWFPs (Kg)	-	-	274	-	-	-	-	-	-	-	-	274

Annex 8: Physical supply and use table for forest products, 2018 (use

Forest Resource Use	Forestry	Charcoal producers	Honey producers	Loggers	Saw-mills	Ware-houses	Carpentry	Construction	Other Industry	House-holds	Exports	Total Use
Flows within the economy												
Indigenous timber licensed (m^3)	-	-	-	-	2,020	-	2,693	-	-	-	62,617	67,330
Indigenous timber unlicensed (m^3)	-	-	-	-	300,947	50,158	125,395	25,079	-	-	2,006,313	2,507,891
Exotic timber (m^3)	-	-	-	-	0	0	39,551	250,492	-	11,980	215,219	517,242
Sawn timber (m^3)	-	-	-	-	0	0	329,908	615,829	21,433	988	1,231,231	2,199,389
Indigenous poles licensed (m^3)	-	-	-	-	0	0	0	1,975	0	-	-	1,975
Indigenous poles unlicensed (m^3)	-	-	-	-	0	0	0	803,330	0	649,501	256,382	1,709,213
Exotic poles (m^3)	-	-	-	-	0	0	0	111	0	-	14	125
Processed poles (m^3)	-	-	-	-	0	0	0	631	0	-	59	689
Charcoal licensed (m^3)	-	-	-	-	0	0	0	-	0	89,277	12,174	101,451
Charcoal unlicensed (m^3)	-	-	-	-	0	0	0	-	13,290	90,370	29,237	132,897
Firewood licensed (m^3)	-	-	-	-	0	0	0	-	0	761	-	761
Firewood unlicensed (m^3)	-	-	-	-	0	0	0	-	65,400	278,809	-	344,209
Total WFPs (m^3)	**-**	**-**	**-**	**-**	**302,967**	**50,158**	**497,547**	**1,697,447**	**100,123**	**1,121,686**	**3,813,246**	**7,583,172**

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**
Flows from the economy to the environment												
Waste for WFPs (m^3)	2,936,227	-	-	-	-	-	-	-		-	-	2,936,227
Waste for NWFPs (Kg)	274	-	-	-	-	-	-	-		-	-	274

Annex 9: Physical supply and use table for forest products, 2019 (supply)

Forest Resource Supply	Forestry	Charcoal producers	Honey producers	Loggers	Saw-mills	Ware-houses	Carpentry	Construction	Other Industry	House-holds	Exports	Total Supply
Flows within the economy												
Indigenous timber licensed (m^3)	628,861	-	-	-	-	-	-	-	-	-	-	628,861
Indigenous timber unlicensed (m^3)	1,990	-	-	-	-	-	-	-	-	-	-	1,990
Exotic timber (m^3)	474,607	-	-	-	-	-	-	-	-	-	-	474,607
Sawn timber (m^3)	-	-	-	-	4,321,785	-	-	-	-	-	-	4,321,785
Indigenous poles licensed (m^3)	1,516	-	-	-	-	-	-	-	-	-	-	1,516
Indigenous poles unlicensed (m^3)	1,872,346	-	-	-	-	-	-	-	-	-	-	1,872,346
Exotic poles (m^3)	679	-	-	-	-	-	-	-	-	-	-	679
Processed poles (m^3)	-	-	-	-	987	-	-	-	-	-	-	987
Charcoal licensed (m^3)	-	121,164	-	-	-	-	-	-	-	-	-	121,164
Charcoal unlicensed (m^3)	-	69,313	-	-	-	-	-	-	-	-	-	69,313
Firewood licensed (m^3)	815	-	-	-	-	-	-	-	-	-	-	815
Firewood unlicensed (m^3)	187,142	-	-	-	-	-	-	-	-	-	-	187,142
Total WFPs (m^3)	3,167,956	190,477	-	-	4,322,772	-	-	-	-	-	-	7,681,205
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												
Waste for WFPs (m^3)	1,477,103.67	302,095	-	-	216,139	-	-	-	-	-	-	1,995,337
Waste for NWFPs (Kg)	-	-	242	-	-	-	-	-	-	-	-	242

Annex 10: Physical supply and use table for forest products, 2019 (supply)

Forest Resource Use	Forestry	Charcoal producers	Honey producers	Loggers	Sawmills	Ware-houses	Carpentry	Construction	Other Industry	House-holds	Exports	Total Use
Flows within the economy												
Indigenous timber licensed (m^3)	-	-	-	-	18,866	-	25,154	-	-	-	584,841	628,861
Indigenous timber unlicensed (m^3)	-	-	-	-	239	40	100	20	-	-	1,592	1,990
Exotic timber (m^3)	-	-	-	-	-	-	40,320	255,360	3,001	1,021	174,905	474,607
Sawn timber (m^3)	-	-	-	-	-	-	648,268	1,210,100	140,123	12,789	2,310,505	4,321,785
Indigenous poles licensed (m^3)	-	-	-	-	-	-	-	1,516	-	-	-	1,516
Indigenous poles unlicensed (m^3)	-	-	-	-	-	-	-	880,003	-	711,491	280,852	1,872,346
Exotic poles (m^3)	-	-	-	-	-	-	-	604	-	-	75	679
Processed poles (m^3)	-	-	-	-	-	-	-	904	-	-	84	987
Charcoal licensed (m^3)	-	-	-	-	-	-	-	-	-	106,624	14,540	121,164
Charcoal unlicensed (m^3)	-	-	-	-	-	-	-	-	6,931	47,133	15,249	69,313
Firewood licensed (m^3)	-	-	-	-	-	-	-	-	-	815	-	815
Firewood unlicensed (m^3)	-	-	-	-	-	-	-	-	35,557	151,585	-	187,142
Total WFPs (m^3)	**-**	**-**	**-**	**-**	**19,105**	**40**	**713,842**	**2,348,507**	**185,612**	**1,031,458**	**3,382,643**	**7,681,205**
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	1,093,809	388,317	1,482,126

Wax (Kg)	-	-	936	-	-	-	-	-	56,633	-	20,438	78,007
Total NWFPs (Kg)	-	-	936	-	-	-	-	-	56,633	1,093,809	408,755	1,560,133
Flows from the economy to the environment												
Waste for WFPs (m^3)	1,995,337	-	-	-	-	-	-	-		-	-	1,995,337
Waste for NWFPs (Kg)	242	-	-	-	-	-	-	-		-	-	242

Annex 11: Physical supply and use table for forest products, 2020 (supply)

Forest Resource Supply	Forestry	Charcoal producers	Honey producers	Loggers	Saw-mills	Ware-houses	Carpentry	Construction	Other Industry	House-holds	Exports	Total Supply
Flows within the economy												
Indigenous timber licensed (m^3)	130,112	-	-	-	-	-	-	-	-	-	-	130,112
Indigenous timber unlicensed (m^3)	2,481,359	-	-	-	-	-	-	-	-	-	-	2,481,359
Exotic timber (m^3)	409,365	-	-	-	-	-	-	-	-	-	-	409,365
Sawn timber (m^3)	-	-	-	-	3,178,002	-	-	-	-	-	-	3,178,002
Indigenous poles licensed (m^3)	1,343	-	-	-	-	-	-	-	-	-	-	1,343
Indigenous poles unlicensed (m^3)	1,512,921	-	-	-	-	-	-	-	-	-	-	1,512,921
Exotic poles (m^3)	212	-	-	-	-	-	-	-	-	-	-	212
Processed poles (m^3)	-	-	-	-	1,904	-	-	-	-	-	-	1,904
Charcoal licensed (m^3)	-	70,624	-	-	-	-	-	-	-	-	-	70,624
Charcoal unlicensed (m^3)	-	134,255	-	-	-	-	-	-	-	-	-	134,255
Firewood licensed (m^3)	2,380	-	-	-	-	-	-	-	-	-	-	2,380
Firewood unlicensed (m^3)	520	-	-	-	-	-	-	-	-	-	-	520
Total WFPs (m^3)	**4,538,212**	**204,879**	**-**	**-**	**3,179,906**	**-**	**-**	**-**	**-**	**-**	**-**	**7,922,997**
Liquid honey (Kg)	-	-	625,172	-	-	-	-	-	-	-	-	625,172
Wax (Kg)	-	-	32,904	-	-	-	-	-	-	-	-	32,904
Total NWFPs (Kg)	-	-	658,076	-	-	-	-	-	-	-	-	658,076
Flows from the economy to the environment												
Waste for WFPs (m^3)	2,214,033	164,319	-	-	158,995	-	-	-	-	-	-	2,537,347
Waste for NWFPs (Kg)	-	-	102	-	-	-	-	-	-	-	-	102

Annex 12: Physical supply and use table for forest products, 2020 (use)

Forest Resource Use	Forestry	Charcoal producers	Honey producers	Loggers	Saw-mills	Ware-houses	Carpentry	Construction	Other Industry	House-holds	Exports	Total Use
Flows within the economy												
Indigenous timber licensed (m^3)	-	-	-	-	3,903	-	5,204	-	-	-	121,004	130,112
Indigenous timber unlicensed (m^3)	-	-	-	-	297,763	49,627	124,068	24,814	-	-	1,985,087	2,481,359
Exotic timber (m^3)	-	-	-	-	-	-	26,930	170,555	18,741	-	193,139	409,365
Sawn timber (m^3)	-	-	-	-	-	-	476,700	889,841	-	191,931	1,619,530	3,178,002
Indigenous poles licensed (m^3)	-	-	-	-	-	-	-	1,343	-	-	-	1,343
Indigenous poles unlicensed (m^3)	-	-	-	-	-	-	-	711,073	-	574,910	226,938	1,512,921
Exotic poles (m^3)	-	-	-	-	-	-	-	188	-	-	23	212
Processed poles (m^3)	-	-	-	-	-	-	-	1,742	-	-	162	1,904
Charcoal licensed (m^3)	-	-	-	-	-	-	-	-	-	62,149	8,475	70,624
Charcoal unlicensed (m^3)	-	-	-	-	-	-	-	-	13,426	91,293	29,536	134,255
Firewood licensed (m^3)	-	-	-	-	-	-	-	-	-	2,380	-	2,380
Firewood unlicensed (m^3)	-	-	-	-	-	-	-	-	99	421	-	520
Total WFPs (m^3)	-	-	-	-	301,666	49,627	632,902	1,799,556	32,266	923,084	4,183,894	7,922,997
Liquid honey (Kg)	-	-	-	-	-	-	-	-	-	461,377	163,795	625,172
Wax (Kg)	-	-	395	-	-	-	-	-	23,888	-	8,621	32,904
Total NWFPs (Kg)	-	-	395	-	-	-	-	-	23,888	461,377	172,416	658,076
Flows from the economy to the environment												
Waste for WFPs (m^3)	2,537,347	-	-	-	-	-	-	-		-	-	2,537,347
Waste for NWFPs (Kg)	102	-	-	-	-	-	-	-		-	-	102

Annex 13: Land cover change in protected forests, 2018 to 2021

Land cover	Year 2018 (ha)	Year 2021 (ha)	Net Change (ha)
Cropland	155,333.50	177,571.38	22,237.88
Forest	5,474,978.15	5,327,215.93	(147,762.22)
Grassland	1,834,207.84	1,956,569.87	122,362.03
Other Land	3,805.70	4,052.75	247.05
Settlement	11,871.19	14,821.31	2,950.12
Wetland	15,945.63	15,910.77	(34.86)
Total	**7,496,142.01**	**7,496,142.01**	**(0.00)**

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ZAMBIA NATURAL CAPITAL ACCOUNT FOR FORESTS (2016 – 2020)

TECHNICAL REPORT