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USAID ALTERNATIVES TO CHARCOAL

ANNUAL CHARCOAL PRODUCTION MONITORING REPORT.

YEAR 1: LITERATURE REVIEW AND ANALYSIS OF THE CHARCOAL PRODUCTION/VALUE CHAIN IN ZAMBIA.

Submitted: AUGUST 2021
Revision submitted OCTOBER 2021

This report is made possible by the support of the American People through the United States Agency for International Development (USAID). It was prepared by Tetra Tech

This document was produced for review by the United States Agency for International Development. It was prepared by Tetra Tech under the USAID Zambia Alternatives to Charcoal contract (No. 72061121C00001).

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Cover photo: Charcoal being transported into the city of Lusaka. Credit Bruce Mead.

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ACRONYMS AND ABBREVIATIONS

A2C	USAID Zambia Alternatives to Charcoal Activity
ATF	Alternative Technologies and Fuels
CFMG	Community Forestry Management Group
CLA	Collaboration, Learning, and Adaptation
CPS	Consumer Preferences Survey
ERB	Energy Regulatory Board
FAO	United Nations Food and Agriculture Organization
FD	Forestry Department
FREL	Forest Reference Emissions Level
GHG	Greenhouse Gas
GRZ	Government of the Republic of Zambia
LPG	Liquid Petroleum Gas
MLNR	Ministry of Land and Natural Resources
MoE	Ministry of Energy
NWFS	National Woodfuel Survey
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
VAT	Value-Added Tax
ZIFLP	World Bank Zambia Integrated Forest Landscape Project
ZRA	Zambia Revenue Authority

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EXECUTIVE SUMMARY

The objectives of this first annual charcoal monitoring report were to conduct a thorough review and analysis of available literature and data regarding charcoal value chains in Zambia. This included relevant policy and regulatory frameworks that pertain to charcoal production, transport and trade; dynamics and trends in the charcoal value chain; woodfuel supply and demand (including the relationship between deforestation and forest degradation and charcoal production); and the role of customary land tenure institutions as they relate to charcoal production and forest management.

Results from the literature review were used to identify data gaps and inconsistencies to be addressed by future research, and to inform the design and implementation of future technical assistance and capacity building by the USAID Alternatives to Charcoal (A2C) project. Future annual charcoal monitoring reports will be field-based, with a focus on metrics related to production estimates, pricing, transport, stakeholder mapping, permitting as well as monitoring and enforcement efforts. This first annual report complements additional research conducted by A2C in Zambia, including a political economy analysis of charcoal, a consumer preferences survey, and a field-based survey of the institutional uses of charcoal.

Analysis of policy and regulatory frameworks related to Zambia's charcoal supply chains reveals weak enforcement of regulations and policies; gaps in institutional mandates across the charcoal supply chain; insufficient institutional, financial, technical and human resources dedicated to implementation; limited accountability and transparency; and ultimately the lack of an integrated policy and regulatory framework that takes into consideration the entire charcoal supply chain and full diversity of institutions and sectors involved.

Almost two-thirds of Zambia's forests are located on customary land; therefore, it is not surprising that a significant amount of charcoal production has historically taken place on customary (versus state owned) lands. A review of the literature reveals that despite the important role of customary land tenure institutions as they relate to charcoal production and forest management, there are insufficient efforts to leverage customary systems to sustainably manage charcoal production and promote community forest management. The Political Economy Analyses completed by A2C also suggests that charcoal production trends are shifting, with charcoal increasingly (and illegally) being produced in Forest Reserves.

Key findings regarding the charcoal value chain are that there typically are two "levels" to the value chain, including an "organized" chain where workers are contracted by more wealthy and well-resourced individuals who operate at significant scale, and a "livelihoods" chain, comprised of individual households producing charcoal in smaller quantities to supplement their income. The methods by which charcoal is produced using earth-mound kilns is highly inefficient, with an estimated 80% of the total extracted wood volume lost as charcoal residue. Transport of charcoal is linked to Zambia's major highways, with the Great North and East Roads having the highest density. At the consumption end of the value chain, charcoal is the main urban cooking fuel across all income groups, driven by its low cost, widespread availability and long held cultural acceptability. Charcoal prices have steadily increased over the last three years for a standard 90Kg bag. Price increases have been most significant in Lusaka, Kitwe and Chipata with the highest prices seen in Lusaka district.

There is debate in the literature regarding whether charcoal production contributes to deforestation, forest degradation, or both. The answer depends in part where and how the charcoal is produced; the

species used; the extent and quality of forest cover; and regeneration rates among other factors. Deforestation is defined as a permanent change of land use from forest to other land uses such as agriculture, infrastructure or mining among others. Forest degradation refers to a temporal reduction in land cover, or a reduction in the forest cover or quality of the vegetation cover in a forest. Accordingly, A2C refers to both deforestation and forest degradation as a consequence of charcoal production in Zambia.

Charcoal production is currently the biggest single driver of wood extraction and the primary cause of forest degradation and deforestation in Zambia. Various data sources suggest the area of forest degraded and/or deforested by charcoal production annually has increased more than tenfold between 1969 and 2015. Given Zambia's 2.5% annual population growth rate and an annual urbanization rate of 3.2%, consumption, the demand for charcoal will continue to rise in the country's cities. High rates of forest degradation and deforestation occur mostly along the rail link between Livingstone and Chililabombwe.. Recent studies also indicate there are other emerging deforestation and forest degradation hotspots in North-Western Province, which are driven by rapid urbanization and industrialization. An analysis of charcoal production and transportation permits revealed significant inconsistencies between the number of transport versus production permits issued, uneven reporting across Provinces as well as a lack of standardized data collection and reporting.

1.0 INTRODUCTION

In 2014, forests covered 61 percent of Zambia's total land area, representing approximately 45.9 million hectares; 40% of the forest area constitutes miombo woodland dominated by the *Caesalpinioideae* tree species. The GRZ (ILUA-II, 2016) estimated Zambia's rate of deforestation between the years 2000 and 2014 to have ranged between 79,000 to 150,000 hectares annually, one of the highest in the world and a major source of the nation's GHG emissions. The production of charcoal is a leading cause of forest degradation with an estimated 190,000 ha of forest impacted (World Bank 2019). The charcoal supply chain is also a major source of income for millions of Zambians, including women and youth, with an estimated two million tons sold annually for an estimated value of USD $600 million. Despite its significance as Zambia's primary energy source, charcoal remains largely unregulated, poorly monitored and unsustainably managed.

The Alternatives to Charcoal (A2C) project in Zambia is a five-year activity (2021-2026) funded by the United States Agency for International Development (USAID) to reduce urban charcoal consumption and catalyze an increase in the use of low emission alternative energy technologies and fuels (such as LPG, bioenergy and electric) to reduce deforestation and forest degradation directly attributable to charcoal production.

The A2C activity will work to reduce charcoal energy consumption by 25% in Lusaka and by 5% in select urban areas outside of Lusaka. The project also aims to catalyze a 38% increase in the use of low emission alternative technologies and fuels (ATFs) in order to reduce deforestation and forest degradation attributable to charcoal production by approximately 7%. A2C will achieve these goals by implementing the following five objectives:

i. Identify and remove market barriers to household use of ATFs.
ii. Work with the Government of the Republic of Zambia (GRZ) to improve the business enabling environment (e.g., streamline regulations, policies, permitting and fiscal regimes) to support the growth of alternative fuels and technologies.
iii. Promote social and behavior change to increase consumer awareness and use of low emission ATFs and increase public perception of the negative impact of charcoal production on forests.
iv. Improve the monitoring, regulation and enforcement of the charcoal supply chain and support alternative livelihoods in charcoal-producing communities.
v. Integrate adaptive management throughout the project.

This first charcoal monitoring report is intended to provide an overview of Zambia's charcoal sector based on a detailed literature review. In subsequent years charcoal production monitoring reports will be field-based, with a focus on charcoal production in selected areas where A2C is implementing field-based interventions. Future charcoal monitoring reports will include charcoal price and market data, production estimates, transport routes, key stakeholders in the supply chain, number of permits issued and revenue collected from legally declared charcoal production, and updated information regarding monitoring and enforcement efforts. A2C will supplement this site-specific data by monitoring external research and/or through publicly available data at the national level.

The main objectives of this first charcoal monitoring report are to:

i. Summarize data and information from available literature about the charcoal sector in Zambia, including the relevant policy and regulatory frameworks, charcoal value chain dynamics, woodfuel

supply and demand and the role of customary land tenure in charcoal production and forest management.

ii. Identify data gaps and inconsistencies that can be addressed by future research.

iii. Share data to inform planning and decision-making by A2C staff, the Forest Department and other stakeholders.

iv. Inform future alternative livelihood interventions in charcoal producing communities.

2.0 METHODOLOGY

We conducted a literature review of available information about Zambia's charcoal value chains to obtain an understanding of the context, practices and trends related to the production, transport, trade and use of charcoal. This report is complemented by the Consumer Preferences Survey (CPS) undertaken by A2C during Year 1; in the present report we have put less emphasis on questions relating to the use/consumption of charcoal as these were the primary focus of the CPS.

The literature review analyzed both primary and secondary data sources including, but not limited to: relevant GRZ policies, statutory instruments, regulations, by-laws and strategic action plans; primary source data from the Forest Department; data from household surveys conducted by A2C; recent wood fuel demand and supply studies; Integrated Land Use Assessments; and numerous studies conducted by research institutions, cooperating partners and civil society. All documents and data used for the preparation of this report are referenced in Annex 1.

Several key informant interviews were also conducted with knowledgeable persons and key players in the charcoal value chain including personnel from Forestry Department (FD) and Ministry of Energy (MoE), charcoal vendors (distributors) and researchers.

3.0 POLICY AND REGULATORY FRAMEWORK

Charcoal production, transportation, trade, and consumption cuts across numerous sectors, resulting in multiple institutions having responsibility for developing and implementing relevant policy and regulatory frameworks. It is in fact charcoal's cross-cutting nature that makes its management and regulation so difficult, and institutional coordination so challenging.

The Ministry of Energy (MoE) and the Ministry of Lands and Natural Resources (MLNR) are the two primary institutions responsible for providing policy and regulatory oversight over woodfuels (including charcoal). The MoE is officially responsible for policy on all energy related matters and has an objective to reduce consumption and reliance on woodfuels, and promote cleaner, cheaper alternative energy sources. MLNR (and specifically the Forest Department) is responsible for the supply of woodfuels including the management of the forest resources, and the issuance of permits and licenses for extraction, production and transport of charcoal.

This division of responsibilities has resulted in the charcoal supply chain being regulated in a fragmented and "stovepipe" manner with MNLR focused exclusively on the supply side of the chain, and MoE on the demand side. As a result, there are major gaps in enforcement and regulation and the absence of a fully integrated approach. Given that woodfuel is the primary energy source in Zambia, and the majority of Zambians use charcoal to cook and heat their homes, it is critical that effective synergies are promoted between forest and energy policies in Zambia (Vinya et al. 2011).

MLNR and MoE are not however the only institutions that impact the charcoal supply chain. Policies and regulations related to land tenure, agriculture, infrastructure development, traditional leaders, local authorities, Zambia Environmental Management Agency, Law enforcement agencies, Zambia Revenue Authority and mining also impact the supply chain. In the absence of an integrated national charcoal strategy and policy it will remain difficult to effectively regulate the charcoal supply chain and promote alternative technologies and fuels. Research by Moombe et al. (2020) notes for example that "rules and laws aimed at regulating the use of forest resources exist within the sector, yet enforcement is generally weak and fragmented due to capacity constraints, overlapping or contradicting mandates and limited collaboration." Likewise, Gumbo et al. (2013) argue that charcoal production and trade are guided by policies and legal regulations that remain ineffective in either curbing illegal charcoal production or incentivizing legal production, transport and trade. As such, the indiscriminate harvesting of trees and the illicit trade and transport of charcoal continues largely unabated.

Field-based research conducted by Gumbo et al. (2013) across numerous border towns asked if permission from the Forest Department is obtained to produce and transport charcoal. Results confirmed the limited and uneven regulation and enforcement of the charcoal trade, particularly the cross-border trade (see Table 1 below). A review of the broader literature confirms these findings, with less than 2 percent of charcoal production in Zambia being legally permitted (MLNR 2020, GRZ 2017).

Good governance of the forest sector also requires accurate and timely data to inform and adapt policies and regulations. To date however, data and information about Zambia's forest sector has been fragmented and inconsistent. For example, although the GRZ submitted its Forest Reference Emissions Level (FREL; GRZ, 2021) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2020, the most recent national estimate of forest extent dates from 2014 (GRZ, 2016). This is, in part, due to the lack of appropriate resources within the FD, limited monitoring and enforcement and the widespread informality within the forest sector (World Bank, 2019).

Weak enforcement of regulations and policies governing the charcoal supply chain can be attributed to a range of factors including: fragmented authority; insufficient institutional, financial, technical and human resources; limited accountability and transparency; and ultimately the lack of an integrated policy and regulatory framework that takes into consideration the entire charcoal supply chain and full diversity of institutions and sectors involved.

Table 1: Do producers obtain permission to make and transport charcoal? A survey of border towns. (Gumbo et al. 2013)

Border	Permission Obtained?	Comments
Chirundu	Yes and No	There are more producers who do not obtain permits than those who do. As a result, producers move a lot of illegal charcoal at night to avoid being apprehended.
Kazangula	Yes and No	Some obtain permits from the Forest Department, while others do not. There are more who get them than those who do not.
Chipata	Yes and No	There are more people with licenses than without.
Katete	Yes and No	Very few producers get permission; many routes for charcoal movement.
Chililabombwe	Yes and No	More illegal than legal activities
Nakonde	No	Mostly illegal
Chinsale	No	Mostly illegal
Kasempa	Yes and No	Mix of illegal and legal
Nyimba	No	Mostly illegal. The FD focuses on confiscations and does not check on operations. The district is vast, with too many possible routes for charcoal.

As urbanization rates increase and the demand for charcoal grows, an integrated policy and regulatory framework is needed to transform the current informal charcoal supply chain into a regulated and sustainable income-generating sector. This could include sustainable charcoal production systems that are community-based, management of woodlands under long-term charcoal production cycles and policies and statutory instruments that enable designated authorities to tax charcoal production, transport and sales in order to offset the costs of monitoring, enforcement and also the societal externalities such as environment costs and health costs among others. A2C is engaging all the key stakeholders including, government and the private sector to make the alternatives to charcoal affordable, accessible and acceptable. The actions will include awareness raising for social behavior change and advocating for policy and regulatory incentives among others.

The following section summarizes the major policies, regulations and plans applicable to Zambia's charcoal supply chain to understand and analyze the role of policy and regulatory frameworks that guide how charcoal is produced, transported, sold and consumed. Table 3 at the conclusion of the section outlines the respective strengths, weakness and proposed recommendations of the various policy and regulatory frameworks.

3.1 SEVENTH NATIONAL DEVELOPMENT PLAN (2017-2021)

The Seventh National Development Plan (7NDP) is the country's blueprint for prioritizing development actions over a five-year period between 2017 and 2021. The current aims to ensure Zambia is a prosperous middle-income economy that offers employment opportunities for Zambians of different skills and backgrounds by harnessing opportunities for economic diversification and growth.

Outcome 4 of the 7NDP recognizes the need to shift Zambia's energy mix away from charcoal to more sustainable sources of energy. It focuses specifically on "improved energy production and distribution for sustainable development" and has a target of reducing the percentage of households using charcoal energy for cooking by 7.9% from 32.9% in 2015 to 25% by the end of 2021 (NDP Volume II). The plan also promotes sustainable alternatives to charcoal (although they are not specified in detail), and the development and use of renewable and alternative energy sources, such as solar, wind, biomass, geothermal and nuclear as a way of diversifying the energy mix and improving supply.

Finally, the 7NDP states that efforts will be made to develop a comprehensive national energy strategy including "a master plan for sustainable alternatives to charcoal and other household energy needs". Implementation of strategies are delegated to various line ministries and are coordinated by what are referred to as "clusters". Energy issues (including charcoal) fall under the economic diversification and job creation cluster. With respect to the impact of the 7NDP, the percentage of Zambian households using charcoal has *risen* since the NDP was published in 2017, indicating not only a lack of progress towards the target of reducing the number of households using charcoal energy for cooking, but back sliding.

3.2 SUSTAINABLE ENERGY FOR ALL ACTION AGENDA (SEA4ALL)

In 2011 the United Nations launched the Sustainable Energy for All Initiative (SEA4ALL) with the goal of ensuring universal access to modern energy and doubling the rate of global energy efficiency rates and percentage of renewable energy in the global energy mix by 2030. Zambia opted to join the SEA4All initiative in 2016 and produced an accompanying action plan and investment prospectus in 2019. The action plan overlaps with the timing of the 7NDP and aligns with Zambia's overarching energy policy framework. The action plan is organized around five themes: scaling up access to electricity; access to clean cooking solutions; energy efficiency; renewable energy; and regulatory framework and financing mechanisms.

With respect to clean cooking, the SEA4All action plan includes an ambitious target of 100% access to modern and clean cooking solutions for both urban and rural areas, including the use of electric, LPG, improved biomass cookstoves that use wood fuel, biomass pellets and briquettes. The plan also set a target for 100% access to electricity in urban areas by 2030.

To achieve the clean cooking target by 2030 in urban areas, the action plan outlines a 20-40-20-20 strategy, whereby electricity, charcoal and fuelwood consumption would decrease, and LPG would increase. More specifically, by 2030 20% of the urban population would be using electricity for cooking (this would be a reduction from the baseline of 34.5%), 40% would be using LPG, while charcoal and fuelwood would be used by 20% each. The '20-40-20-20' strategy presumes a sharp increase in LPG consumption, estimating that by 2030 total LPG consumption for urban areas is expected to reach 139,000 tons. The action plan notes this can only be achieved by increasing local LPG production capacity, as well as addressing LPG related infrastructure challenges, including cylinder exchange and distribution.

To achieve the broader target of 100% access to modern and clean cooking solutions in both urban and rural areas, the action plan outlines the following strategies:

1. Distribute improved cookstoves by 2030 including improved charcoal cookstoves as well as other high efficiency cooking solutions that use pellets and other biomass residues.
2. Provide financial and fiscal instruments to stimulate the production of alternative technologies and fuels including smart subsidies, concessional loans, loan guarantees, blended financing provision of tax incentives and waivers on biomass energy capital equipment.
3. Scale up biogas in rural areas and promote a large scale and more cost-effective LPG supply chain. However, the plan notes this is a major challenge as it requires upstream (bottling facilities, transport) and downstream infrastructure (cooking equipment, distribution networks).
4. Strengthening the regulatory framework including minimum standards related to labelling and product certification to support producers and distributors of improved cookstoves.
5. Conduct a national awareness and communication campaign regarding the benefits of switching to improved cookstoves and other clean cooking solutions.

The SEA4ALL investment prospectus lists the projects aimed at reaching the 20:40:20:20 targets, which together with the action plan was to be used to source for funding from donors, UN agencies, Government and private sector to fund these activities. The officer responsible for SEA4All in the Ministry of Energy reported to A2C that while the documents have been presented at various 'high level' Ministers' meetings to attract investment and funding "there has not been any results". He also noted the SE4All Hub was supposed to provide complimentary funding to help kickstart activities has not been established. As such, no activities are currently being implemented that can be directly attributed to the SE4All initiative.

3.3 FORESTS ACT NO. 4 OF 2015

The Forests Act No. 4 of 2015, is an act of Parliament enacted to control and regulate the use of forest resources in Zambia. The Act provides for the establishment of forest reserves, sustainable forest management, community forest management and issuance of permits and licenses among other provisions. The production and the transportation of charcoal are regulated by the Forests Act. Section 87, under which there are two permits needed to trade in charcoal: the Cordwood Permit covering production and the Conveyance Permit covering transportation. The cordwood production permit grants authority to either individuals or institutions to fell trees and produce charcoal, while the conveyance permit authorizes the movement of charcoal from one location to another.

Currently, a cordwood permit costs 270 ZMW per cord (i.e. 3 cubic meters) and is valid for 14 days. In February 2021 the Department of Forestry launched an online portal for cordwood permit applications which will presumably result in greater data transparency and ease of application. However, interviews with FD staff revealed that only a few officers have been trained on the portal, user profiles have not been created for all the licensing officers responsible for approving transactions, and most FD Offices lack the requisite hardware and internet connectivity to make the system fully operational.

Eligibility for a cordwood permit requires either proof of a Title Deeds or Lease Agreements where the trees will be felled, or a Consent Letter from Traditional Authority/Leader in the case of Customary Land. There are no restrictions on the number of cords that can be harvested. Conveyance permits can be issued to either commercial entities or individuals, are valid for 14 days. The conveyance permit specifies the person or entities name, the location where the charcoal is to be collected and the destination. There is however no standard regarding the specificity of the location where the charcoal is being collected or deposited so locations range from districts, sub districts, chiefdoms and other units.

Statutory Instrument 52 of the Forests Act specifies the cost of conveyance permit is based on a 50-kilogram bag, when in practice charcoal bags weigh much more than 50 kg during transport. Officially, the current cost for a conveyance permit is ZMW 13.15 per 'bag", but the weight of the bag is rarely checked. Issuance of a conveyance permit is also supposed to linked to a valid production permit, but this is also rarely verified by the issuer.

Figure 1: 'The Dumpster'. This is a '90kg' bag (the white bit at the bottom left) with a massive 'head'.

Figure 2: This is the '110' kg bomber. Its a 90kg bag at the base, with a massive head.

Figure 3: The '110 kg' bomber under construction using a bicycle rim.

3.4 NATIONAL FOREST POLICY OF 2014 (ZNFP)

The vision of Zambia's National Forestry Policy (ZNFP) is "to attain sustainable forest management of all types of forests to enhance forest products and services, that will contribute to mitigation of climate change, income generation, poverty reduction, job creation and protection of biodiversity." The policy emphasizes participatory forest management for sustainable forest management, marking a departure from the earlier (1998) Forest Policy. The 2014 ZNFP provides for broad stakeholder participation, implementation of Multilateral Environmental Agreements, promotion of value addition and capacity building, sustainable harvesting and encourages sustainable charcoal production methods. Under the national forestry policy, government recognizes the importance of charcoal as a source of energy and income for peri-urban and urban populations. The specific measures identified in the ZNFP that concern charcoal are:

a) Create public awareness on the impact of unsustainable charcoal production on the environment, socio-economic and climate change;
b) Design and set aside charcoal production areas in each district;
c) Provide guidelines for charcoal production on farmlands and other productive areas;
d) Put in place charcoal production tracking system to ensure sustainable harvest of trees and production of charcoal;

e) Promote and provide technical support for small, medium enterprise in charcoal production to enhance sustainable management;
f) Regulate the export of charcoal; and
g) Promote efficient charcoal production methods.

While the measures articulated above are sound in principle, there has been limited implementation due severe resource constraints (human, financial, and technical) within the FD. Many of the measures listed above do however align with A2C objectives, including raising public awareness, and improving monitoring of the charcoal supply chain. While A2C does not focus on improving charcoal production methods or the export of charcoal *per se*, the project will focus on building the capacity of Community Managed Forest Groups and Forest Department officials to more effectively manage and regulate charcoal production in their respective jurisdictions.

3.5 NATIONAL REDD+ STRATEGY

Reducing Emissions from Deforestation and Forest Degradation (REDD+) is a mechanism aimed at encouraging developing countries to contribute to climate change mitigation efforts by reducing greenhouse gas emissions (GHG) by slowing, halting and reversing forest loss and degradation and increasing removal of GHGs from the earth's atmosphere through the conservation, management and expansion of forests. Zambia's national REDD+ Strategy aims to attain a prosperous climate change resilient economy by 2030, anchored in the sustainable management and utilization of Zambia's natural resources towards improved livelihoods. The REDD+ strategy is intended to coordinate efforts aimed at reducing deforestation and forest degradation through improved management of forests and livelihoods.

The National REDD+ strategy (2015) identifies charcoal as one of the main drivers of deforestation and degradation and proposes two strategic interventions related to charcoal and clean cooking. These are: (i) enhancing models for sustainable and regulated wood fuel production, and (ii) promotion of energy-efficient wood fuel utilization technologies (including improved cookstoves and other energy efficient technologies). Another relevant aspect of the REDD+ program for A2C is the Measurement, Reporting and Verification (MRV) component which is the measurement, reporting and verification of Zambia's forest, and associated GHG emissions and removals, including their changes over time.

The institutional arrangements to implement the REDD + strategy include government and traditional institutions working side by side with donors, private sector, NGOs, CSOs and local communities in the implementation, monitoring, evaluation and reporting. REDD+ is overseen by a National Committee of Permanent Secretaries (NCPS) from relevant GRZ ministries who are responsible for providing policy guidance, evaluating programmatic progress and challenges, approving annual budgets and ensuring synergy in donor support to the national climate change program.

3.6 NATIONAL INVESTMENT PLAN TO REDUCE DEFORESTATION AND FOREST DEGRADATION (2018-2022)

Zambia, with support from World Bank and other implementing partners, developed the National Investment Plan to Reduce Deforestation and Forest Degradation in 2018 to supplement the National REDD+ plus strategy. Anchored in the Forest Department, but cross cutting in nature, the plan divides the country into priority landscapes for the implementation of REDD+ activities. The Investment Plan identifies charcoal as one of the major threats to forests in Zambia due to the huge demand for charcoal in urban areas. The Plan prioritizes: (i) investments aimed at the promotion of alternatives to charcoal

(including biogas, LPG, solar), (ii) measures to reduce the urban demand for charcoal, and (iii) alternative livelihoods for charcoal producers as priorities to reduce charcoal production.

The National Investment Plan is useful in that it clearly identifies and prioritizes activities, clarifies the responsible line ministries and departments and provides estimated budgets for activities. It also specifies that "Zambia will mobilize resources from different sources to implement the Investment Plan including domestic sources of tax revenue, multilateral development banks, bilateral organizations, private sector, and international partnerships to international NGOs." To date however very few of the proposed actions and priorities that pertain to charcoal have been implemented (with the exception of the Zambia Integrated Forest Landscape Project or ZIFLP). This is in part because the limited ability of the GRZ to mobilize international or national financial resources.

3.7 FORESTS (CHARCOAL PRODUCTION AND TRADE) REGULATIONS, 2021

The Forestry Department is currently in the process of revising the national Charcoal Regulations which supplements the provisions contained in the Forests Act No. 4 of 2015. The revised regulations maintain the Forestry Department as the sole authority responsible for assessing and authorizing where charcoal production takes place, and all charcoal produced and transported must have clearance from Forestry Department. All citizens, charcoal producer groups, community forest management groups, registered companies and other recognized legal entities are eligible to produce charcoal as prescribed under these revised regulations.

A new feature of the revised regulations is the devolution of authority to charcoal producers to establish Charcoal Producer Groups (CPGs), which are recognized and approved by the Director of the Forestry Department. Likewise, every Community Forest Management Group is encouraged to form charcoal associations. Registered CPG's have the responsibility to facilitate the sustainable production of charcoal, develop and implement a Code of Practice for the purposes of self-regulation and sustainable charcoal production and assist the Department in enforcing the provisions of the Forest Act relating to sustainable charcoal production, transportation and marketing.

Criteria the Forest Director may take under consideration when approving a CPG are listed below:

- Resources available and proposed harvesting levels proposed by the CPG.
- Quality of environmental impact assessment undertaken in respect of charcoal production.
- Quality and feasibility of the forest management plan and its regeneration plan
- Social economic contribution to the surrounding community and employment creation.
- Consent from the chief, owner, or authorized person of the land where charcoal is to be produced.
- Tree species, number of trees and estimated volume to be used for charcoal production.
- Reforestation or conservation plan for the area where charcoal production will be managed.

Once approved, CPGs will be given exclusive authority to produce charcoal (and exclude other people from producing charcoal) within the specified geographical locations. Eligible areas for charcoal production include National Forests, Plantation forests, Open areas, Private forests, Community forests, and Joint Forest Management Areas.

Changes to the permitting process in the revised regulations include: extending the validity of cordwood permits from 14 days to 6 months; requiring persons engaged in wholesale or retail in charcoal trading to keep a record of the sources of charcoal, and copies of the certificates of origin and movement permits; and specifying the transport of charcoal may only take place between 6 a.m. and 6 p.m.

The draft regulations have undergone several levels of stakeholder consultations and a regulatory impact assessment but remain in draft form. Feedback from the consultations mentioned:

- A concern the regulation may not achieve the desired outcomes because it only covers part of the charcoal value chain (production and transport).
- The regulation should be extended to include how and where charcoal is traded, a proposal which the FD said was beyond their mandate.
- The criteria for approval of CPGs are onerous, costly and beyond the capacity of most charcoal producers thereby potentially undermining compliance.
- Lack of innovative solutions to incentivize compliance.
- Regulation does not provide solutions to increase revenue collection to support monitoring and enforcement.
- Lack of attention to regulating the (illegal) cross-border trade in charcoal.

3.8 DISTRICT CHARCOAL LEVIES

In addition to the cordwood and transport permits issued by the Forestry Department, there are a number of District Councils across Zambia which have under the Local Government Act enacted bylaws requiring payment of a "charcoal levy" to the Council for all charcoal transported out the District. The Kapiri Mposhi District Council, for example, has very specific levies by bag weight as shown below.

ZMW 2 – 50 kg bag
ZMW 7 – 90 kg bag

Bags of charcoal are inspected during their transport at various check points around the District by collection agents who are paid from the proceeds of the levy. Penalties are also severe; in Kapiri Mposhi District for example the penalty for non-payment (in the first offence) can be up to a period of six months imprisonment. Unlike the official FD permits which regulate less than 2-3% of all charcoal produced, this decentralized permitting system (where it exists) appears to be more regularly enforced.

3.9 NATIONAL ENERGY POLICY (2019)

The overall objective of the National Energy Policy (NEP) 2019 is to optimally meet Zambia's domestic and non-domestic energy needs at the lowest total economic, financial, social, environmental and opportunity cost and establish Zambia as a net exporter of energy.

The Policy recognizes biomass as the predominant source of energy in Zambia, accounting for more than 70 percent of the total primary energy supply with the main forms and products of biomass being woodfuel (charcoal and firewood), biogas, pellets, briquettes, biofuels and gel fuel for household cooking and heating. The Policy notes that among these, woodfuel is the most widely used fuel for cooking and that its utilization is considered unsustainable because the harvest exceeds the re-growth of biomass thereby contributing to climate change. The high dependence on wood fuel is attributable to its affordability, ease of accessibility, unreliable electricity supply, and high cost of efficient alternatives.

To this effect, Objective 4 of the NEP aims to "promote the sustainable exploitation of biomass and alternative energy to wood fuel resources in order to increase socio-economic development". There are two policy measures to this effect:

1. Promote efficient and sustainable exploitation of biomass for household utilization.
2. Promote the use of alternatives to wood fuel.

Other activities under the NEP which pertain directly to A2C include the development of a biomass

strategy; awareness campaigns on the use of alternatives to wood fuel energy; and support to private companies to produce more efficient biomass cook stoves.

The NEP has the advantage of being concise with an action plan that is time bound with budgets included. This eases the identification of activities to be implemented as Government priorities are clearly outlined. However, the policy focusses only on the consumption part of the charcoal value chain and does not provide for other aspects such as the charcoal trade. Further, although the policy has an activity to "undertake joint operations for the enforcement of biomass regulations", there are no associated regulations in place to be enforce either in the Policy or the Energy Regulation Act.

3.10 GENDER EQUALITY STRATEGY AND ACTION PLAN FOR THE ENERGY SECTOR OF ZAMBIA (2021)

The 2021 Gender Equality Strategy and Action Plan (GESAP) recognizes that the high dependency on biomass in Zambia disproportionately affects women, including their time and health. Likewise, it acknowledges that the recent large-scale investments in renewable energy, such as solar mini grids. don't accommodate electric stoves and cookers and have unequal uptake by women. Accordingly, the GESAP is aimed at ensuring the attainment of gender equality in the energy sector development processes by helping to redress the existing gender imbalances.

The GESAP is both a strategy and tool to guide the gender mainstreaming within energy sector and is a linked to the National Energy Policy 2019. The GESAP has five (5) specific objectives:

1. To increase access and use of clean energy by women for domestic and productive purposes,
2. To increase social and gender integration in energy infrastructure projects,
3. To promote equal representation and participation of women as decision-makers, employees, and entrepreneurs in the energy sector,
4. To strengthen institutional capacity to mainstream gender in energy policies, energy programmes, and within organisations; and,
5. To increase coordination, collaboration, and financing on gender equality in the energy sector.

Under Objective 1 the GESAP proposes the following actions relevant to A2C:

- Design and implement a nation-wide Clean Energy for Cooking programme aimed at increasing the uptake of clean cooking solutions. This includes increasing demand through increased end-user input into stove design, behavioural change communication and innovative consumer finance models that target women.
- *Strengthened supply* through investments/loans to stove manufacturers and distributers, exploring carbon financing, increased participation of women in the value chain.
- *Improve the enabling environment* through VAT removal on improved/clean cookstoves; developed standards and testing protocols; development of a biomass strategy, regulatory framework aiming at introducing an LPG cylinder exchange program, etc.
- *Develop creative financing mechanisms to improve access to clean energy technologies for productive and domestic use.* This includes scaling up pay-as-you-go models, savings and loan schemes, subsidies and improving access to credit for women.

The GESAP acknowledges that implementation of the proposed actions will require adequate human, financial, material, and technical resources, and the Ministry of Energy has the primary responsibility of committing adequate financial resources for the implementation of the plan. In addition to the national energy budget, the GESAP proposes that resources from Energy Fund, as provided for in the Energy Regulation Act No. 12 of 2019, be allocated towards gender mainstreaming.

3.11 NATIONAL ENERGY EFFICIENCY STRATEGY AND ACTION PLAN (2021)

With support from the European Union a National Energy Efficiency Strategy and Action Plan were drafted in 2021. The documents clarify the necessary objectives and measures to achieve the overall targets identified in the 2019 NEP. The Strategy includes 6 pillars, of which several align closely with A2C's objectives including: strengthening the regulatory environment to support energy efficiency, promoting the adoption of market-based strategies, encouraging the adoption and use of sustainable and alternative energy sources, and awareness raising about energy efficient alternatives. The Strategy and Action Plan are notable for their focus on Zambia's reliance woodfuels and the need to promote efficient alternative energy sources for clean cooking in Zambia.

Key recommendations for A2C from the National Energy Efficiency Strategy include:

a) Adapt the legal and regulatory framework to introduce an LPG cylinder exchange program to facilitate the market uptake of LPG among households.

b) Promote a market-based approach to support clean cooking technologies such as electric, biomass pellet stoves, biogas units, and LPG.

c) Put in place custom free charges on energy efficient cooking technologies that are imported, as well as tax-free fees on products that are locally manufactured.

d) Require that large scale facilities (i.e., industries, commercial buildings, institutional buildings) to adopt energy efficient technologies to reduce dependence on wood fuels.

e) Specialized training programs for women empowerment in energy should be designed and implemented.

f) Nationwide behavioral change campaign is needed to raise awareness about energy efficient alternatives and address misperceptions about technologies such as LPG.

A summary of key activities from the plan are provide below:

Table 2: Key Activities from the Energy Efficiency Action Plan

Alternative Fuel	Actions	Target
Biogas	Produce biogas from organic waste in public buildings for cooking purposes	20% of the public/ administrative buildings equipped with biodigesters
LPG	Increase number of LPG distribution and storage centers and adapt legal and regulatory framework to promote cross cylinder exchanges	Not specified
Pellet Stoves	Raise awareness, supply chain development for crop residues, technology transfer from international pellet/stoves manufacturers, public-private partnerships and financing schemes	100,000 stoves in use by 2025 200,000 tons of wood pellets produced per year by 2025
Electric	Market demand study, awareness campaigns regarding the benefits of E-Cooking, pilot project with 2000 free E-Cooking equipment, personal concessional loans mechanism to finance E-Cooking equipment.	20% of households using electric equipment to cook

3.12 THE ENERGY REGULATION ACT (2019)

The Energy Regulation Act of 2019 is completely silent on the topic of regulating woodfuels, despite the fact the woodfuel (including charcoal) makes up at least 70% of Zambia's total energy consumption.

Table 3: Strengths, weaknesses & recommendations for relevant policy, regulatory and strategic frameworks to impact the charcoal supply chain.

Policy Name	Strengths and Weaknesses	Recommendations
Seventh National Development Plan (2017-2021)	Strengths • Target of reducing charcoal consumption by 8% is achievable. • Prioritizes sustainable alternatives to charcoal calls for a master plan for sustainable alternatives to charcoal. Weaknesses • Resources not identified to implement plan. • Target to reduce charcoal consumption not achieved. • Does not mention need for an integrated approach to shift away from charcoal.	• Next plan should call for data gathering about the current rates of wood fuel production and consumption. • Prioritize coordination between institutions responsible for woodfuel. • Identify adequate resources to achieve targets. • Call for the drafting of a national charcoal / woodfuel strategy. • Develop improved efficiency standards for charcoal cookstoves (currently underway with support from the World Bank).
Sustainable Energy for All Initiative (SEA4ALL) Action Agenda	Strengths • Access to clean cooking is one the five central themes. • Acknowledges the up and downstream challenges associated with scaling up LPG. Weaknesses • Targets are overly ambitious. • Resources not identified or mobilized to implement action plan. • Proposed regulatory changes (LPG cross cylinder exchange for example) never followed up on.	• Renew efforts to establish the SEA4ALL hub drawing on USGs renewed focus on clean cooking. • Renew GRZ and Cooperating Partner focus on mobilizing investment for activities in action plan. • Revise targets for access to modern clean cooking solutions to be more realistic.
Forests Act, 4/2015	Strengths • Launch of online portal for permits Weaknesses • Weak enforcement: 97 percent of the charcoal from unlicensed sources. • No enforcement regarding the size or weight of charcoal bags. • Reporting by FD on permitting is inconsistent and occasionally contradictory. • Cost of cordwood and transport permits are woefully low • No restriction on the number of cords harvested for charcoal.	• Increase cordwood and conveyance fees in associated SI. • Clarify and standardize reporting requirements associated with cordwood and conveyance permits. • Reduce the number of days a permit is valid. • Conveyance permit should specify a standard weight per bag and have a standard bag type sold by FD to earn revenue.

	• Permits lack sufficient specificity regarding location of charcoal production and/or final destination by transporters.	
Zambia National Forest Policy of 2014 (ZNFP)	Strengths • Promotes participatory management of forests. • Acknowledges need to support community livelihoods through an "integrated approach" including community forest management and benefit-sharing mechanisms. Weaknesses • Lack of implementation due to resource constraints. • No implementation plan or targets /milestones identified. • Lack of coordination across GRZ institutions. • Measures listed which fall outside jurisdiction of the FD.	• Scale-up finance, and technical support to Public Forest administration to effectively implement 2014 ZNFP.
National REDD+ Strategy	Strengths • Very active when first launched, including extensive capacity building • Explicit focus on sustainable woodfuel production and energy-efficient wood fuel technologies. Weaknesses • Insufficient resources provided over the long term for implementation. • Most recent national estimate of forest cover is outdated. • Weak coordination across relevant GRZ institutions.	• Convene the FD and relevant Cooperating Partners that fund forest cover monitoring, including MRV, to identify what funding, capacity and technical gaps and needs are within the FD. • Renew support to FD for MRV and forest cover monitoring including training and equipment.
National Investment Plan to Reduce Deforestation and Forest Degradation	Strengths • Identifies charcoal as one of the major threats to forests in Zambia. • Clearly specific actions, institutions involved and potential costs. • Considers unintended impact of regulating charcoal and raising prices for most vulnerable. Weaknesses • Not marketed aggressively to secure financial resources. • Lack of progress on charcoal related priorities. • Not clear who is the lead to ensure implementation.	• Evaluate, review and renew the plan to address shortcomings in implementation • Get buy in from implementing and Cooperating partners prior to finalizing the Plan to ensure financial commitments. • Provide long term support to the GRZ to execution and monitoring of the plan.
Revised Charcoal Regulations (still in Draft)	Strengths • Devolution of authority over production to local producers. • Emphasis on sustainable management and production of charcoal. • Greater specificity around local authority to exclude outsiders.	• Ensure regulations are not overly onerous and expensive to comply with. • Draw on examples from neighboring countries, such as Malawi's National Charcoal Strategy to harvest lessons.

	Weaknesses • Criteria for approval of CPGs are onerous, costly and beyond the capacity of most charcoal producers. • Covers only the production and transport aspects of charcoal value chain. • Licenses do not display regulations. • Lacks proposals to increase revenue collection. • Lack of attention to regulating the (illegal) cross-border trade in charcoal.	• Regulation should balance incentives and enforcement • Regulation should be comprehensive across stakeholders in the supply chain and can be practically enforced. • Include harvest and transport regulations on permits. • Ensure self-sustaining revenue stream. • Revise regulations to take into consideration the seasonal and opportunistic nature of many charcoal producers.
National Energy Policy (2019)	Strengths • Concise with an action plan that is time bound with budgets Weaknesses • Focuses only on the consumption part of the charcoal value chain. • No regulations in place to be enforced either in the Policy or the Energy Regulation Act.	• Policy should explicitly emphasize increased coordination with the Forestry Department. • Future revision so the policy should consider expanding the focus to regulate the charcoal trade. • Integrate the role of the ERB in regulating the charcoal trade.
Gender Equality Strategy and Action Plan for the Energy Sector of Zambia (2021)	Strengths • Recognizes the high dependency on biomass in Zambia disproportionately affects women. • Provides clear recommendations to increase access and use of clean energy by women for domestic and productive purposes. • Takes a market-based approach including improving the enabling environment and increasing access to finance. • Proposes a nation-wide Clean Energy Cooking program that targets men and women. Weaknesses • Ministry of Energy has the primary responsibility of committing adequate financial resources, which may not be realistic. • External resources and funding to support increased access and use of clean energy by women not provided.	• Identify appropriate financial, technical and human resources to implement the strategy, both internally and from external resources. • Ensure recommendations are followed up on through forums such as the Energy Sector Advisory Group. • Promote synergies with Ministry of Gender about the strategy to make energy a priority, Provide specific funding to enable gender focal point in MoE to promote gender mainstreaming in the energy sector.
National Energy Efficiency Strategy and Action Plan (2021)	Strengths • Explicitly addresses MoE's role related to woodfuels and the need to shift to alternative fuels and technologies for cooking/heating. • Explicit attention to clean cooking solutions, including LPG, electric, biomass and biogas. • Promotes a market-based approach.	• Prepare projections of what proposed activities will cost. Identify appropriate financial, technical and human resources to implement the strategy, both internally and from external resources. • Explicitly address the role of fuel stacking to set realistic targets that encourage shifts towards greater

	• Implementation bodies clearly identified. Weaknesses • Cost of proposed actions are not projected • Source of resources not identified to implement the strategy and action plan. • Does not emphasize strongly enough the need for institutional coordination and greater synergy between energy and forestry policies as well as other regulatory bodies such as ERB.	use of renewable energies, not exclusively fuel switching.

4.0 LAND TENURE AND CHARCOAL

The starting point for the charcoal value chain are the forests and the land they grow on. Almost two-thirds (31 million ha or 63%) of Zambia's forests are located on customary land, while 24% (12 million ha) falls under state authority and approximately 5 million ha is located on leasehold land (Mulenga et al. 2015).

Accordingly, understanding the role of customary land tenure institutions as they relate to charcoal production and forest management is essential. Customary land tenure (in which forestry management is embedded) dictates how forests are accessed, used and protected as well as who has the right to benefit from forests and how/who enforces sanctions and penalties when rules are broken. Decades of research has shown that forest deforestation and degradation are intricately tied to a complex range of socioeconomic and political factors, among which land tenure and land tenure security are critical.

In Zambia, land administration is guided by the Lands Act of 1995, which recognizes two types of land tenure systems: customary and statutory Land under customary tenure is further divided into Trust and Reserve land, which are both administered by traditional chiefs and the headmen/women under them. Chiefs and their headmen/women make decisions on land-use and allocation, but the state maintains *de jure* ownership.

Charcoal production in Zambia takes place on both customary and state land, however most charcoal production is done on customary land as most state land has been set aside as forest reserves and national parks. The draft Political Economy Analysis of Zambia's Charcoal Value Chain [PEA] (USAID Zambia Alternatives to Charcoal Activity, 2021) however indicates that's this appears to have changed since 2015 when there was an increase in charcoal production in customary areas. Traditional authorities and customary tenure systems therefore have a significant role to play within the charcoal supply chain including how customary systems can be leveraged to reduce deforestation and degradation from charcoal production, improve compliance, enforcement and promote community forest management.

Research conducted by Moombe et al. (2020) clarifies that under customary governance arrangements, villagers usually first request permission from a headman/woman prior to felling trees and producing charcoal. The headperson then selects an area within the customary land boundary and issues a letter allowing the applicant to manufacture charcoal. The letter is then taken to the chief for endorsement, and informal payments are due to both the headperson and the chief. The payments vary widely but are generally correlated with the size of the area to be harvested and the amount of charcoal expected to be produced. In some cases, the headmen/women inspect the production area before issuing authorization, however there are no comprehensive management or production practices related to the wood being harvested.

The example above confirms other research in Zambia highlighting the lack of effective forest management on customary land. Kalinda et al. (2008) report that 41% of Zambia's forests are traditionally managed but have no formal management plans in place. Only 23% of forests are formally managed with elaborate forest management plans in place, and another 36% of forests are assumed not to be under any form of management. Furthermore, most forests on customary land are managed based on limited knowledge and management capabilities.

While there may be an absence of *formal* management plans, land under customary ownership is subject to a set of complex governance and compliance arrangements. For example, in Central and Eastern province respondents described rules related to the production of charcoal including no cutting down trees near stream/rivers, mountains, graveyards, and settlement areas; when opening land for agricultural production, tree cutting is allowed only on the portion of land to be used for agricultural production, and a prohibition of dry season burning in forest areas (Mulenga 2015).

Because compliance is so low, enforcement of even these basic rules is however difficult. Community members explained that rule-breakers are usually armed and ready to defend themselves creating few incentives to sanction rule breakers. Similarly, research by Moombe et al. (2020) in Choma District revealed production and trade of charcoal takes place within a context of legal plurality, often under informal arrangements and without enforcement. At present, there are no overarching laws or policies regarding the woodfuel value chain, and there are no clear links to resource management plans around harvesting and the issuance of related documents.

In summary, Zambia's customary land administration systems do not include clear and strong rules to support local forestry management, and there is low compliance to the formal regulations thereby making enforcement of the existing rules very difficult. Under such circumstances, rapid deforestation and degradation due to charcoal production is only likely to increase. To address this challenge, Vinya (2011) and Mulenga (2015) highlight the importance of building the capacity and effectiveness of customary institutions to undertake forest management and sustainable charcoal production, coupled with improving security of tenure to encourage sustainable local forest management by local users. Mulenga further recommends promoting alternative livelihood strategies to help shift labor away from wood fuel production and/or marketing.

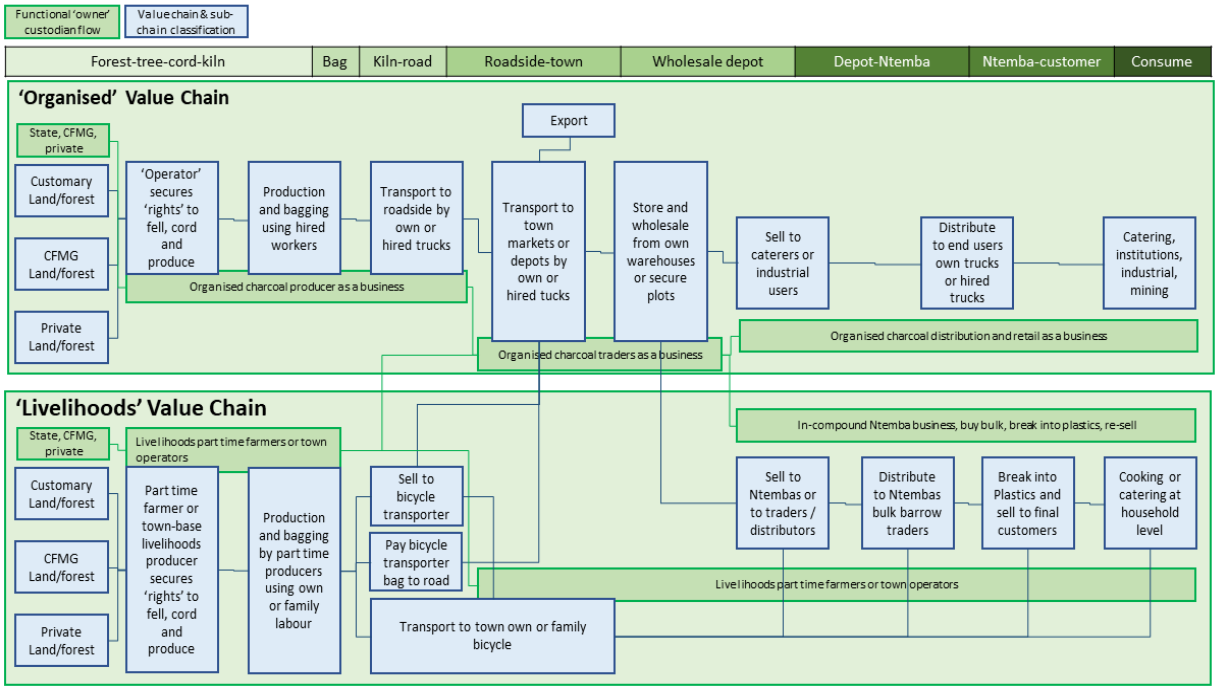
Additional recommendations (Moombe et al. 2020) include the development of a woodfuel production and trade governance and monitoring framework on customary land with clear roles, responsibilities and benefits accompanied by incentives for compliance, and enforcement and sanctioning for defaulters. This should include alignment of access controls such as permit issuance by the state and customary authorities.

Perhaps add some sentences on the need for (and opportunities to) invest in rehabilitation and restoration of formerly deforested and degraded areas?

5.0 CHARCOAL VALUE CHAIN

It has been estimated that the charcoal sector in Zambia is worth 2.2% of GDP (Kalinda et al. 2008). However, less than 2% of charcoal is estimated to be legally permitted (GRZ 2017, Natural Capital Accounts for Forests 2020), while the remaining 98% is unregulated and un-taxed. The charcoal value chain provides income generating opportunities for around 500,000 (Kalinda et al. 2008) people and is structured in an hour glass shape, whith a large number of producers at one end, relatively few transporters and wholesalers in the middle and a large number of retailers at the other end, serving millions of urban consumers.

Figure 4: Value chain schematic of two charcoal value chains (Source: USAID Alternatives to Chacoal)



Typically there are two "levels" to the value chain based on how formally organised the actors are. In the "organised" chain, workers are contracted by more established and well resourced individuals, who operate at significant scale. These large and organized value chain operators also supply 'bulk' consumers, including mining processing, agriculture processing and large-scale catering operations (hostels, schools, hospitals, resturants etc.). Whereas in the "livelihoods" value chain, individual households produce charcoal in smaller quantities to supplement their income. At the consumption end of the value chain, charcoal is the main urban cooking fuel across all income groups, driven by its low cost, widespread availability and long held cultural acceptability. Furthermore, over recent years the proporiton of households cooking with charcoal has increased due to increased electricity tariffs and prolonged occurences of loadshedding which have pushed households away from electric cooking.

5.1 PRODUCE AND PACK

Charcoal production is undertaken by a wide range of stakeholders including small holder farmers, illegal encroachers, pastoral communities, and contracted workers. All producer types supply charcoal to more organized groups for transport and wholesale. The production part of the value chain is typically

dominated my men and younger people; however, women are increasingly becoming involved in the production process (Gumbo et al. 2013). In a bid to meet increasing charcoal demand, production is no longer a dry season activity, contrary to what is presented in much of the literature. However, dry season is preferred because it most often coincides with land preparation for crop production — timber from clear-felled fields also being used to produce charcoal [ibid]. The draft PEA report however reveals that there has been a shift trends as there are more areas which are being opened up primarily for charcoal production, with lots of full-time operators producing charcoal as the main source of livelihood with a bit of agriculture on the side.

Rural communities are attracted to the sector for several reasons: there is a ready market driven by high urban demand; it provides a reliable source of income which can be invested in other opportunities; it has low barriers to entry; and charcoal is a non-perishable. According to Chidumayo (2001) charcoal production has been observed to have increased per capita income even when other sectors are not doing well in rural areas. For example, although rural per capita income from forestry and crop agriculture declined from US$37.07 in 1990 to US$17.33 in 2000. The contribution of charcoal to rural per capita cash incomes increased from 65 percent to 83 percent over the same period. However, according to the National Wood Fuels Survey, 49% of charcoal producers indicated that revenue from charcoal production was insufficient to sustain their families. Interestingly, the increasing demand for charcoal has resulted in instances where producers are paid in advance, prior to production (GRZ 2017). The PEA report revealed that despite the perceived informality of the charcoal value chain, there a various financing mechanisms which have evolved including "crowd funding", credit and loans from friends and family.

In the first stage of charcoal production, a site close to roads and marketplaces is identified, where preferred tree species of suitable diameter classes exist (Chidumayo 1997; Chirwa 2008). The process starts with cutting trees about 25 cm above ground; both clear felling and selective cutting are practiced. The felled trees are crosscut into 1-2 m billets which are left out to dry. The drying process may take from a few weeks to several months. Air dried billets are gathered and carried to a kiln spot, while the twig or brush wood is abandoned.

The most commonly used tree species for charcoal production, including fruiting and commercial timber species, are listed in the table below. It is not uncommon for these species to be rapidly removed from woodland once charcoal production begins, which affects the species composition of woodlands (in this case, miombo).

Acacia nigrescens	*Erythrophleum suaveolens*
Acacia sieberana	*Julbernadia globiflora**
Acacia spp.	*Julbernadia paniculata**
Afzelia quanzensis	*Khaya anthotheca*
*Bauhinia thonningii**	*Lannea schimperi*
Boscia salicifolia	*Ozoroa obovata*
Brachystegia boehmii	*Parinari curatellifolia**
*Brachystegia spiciformis**	*Pericopsis angolensis**

Burkea africana	*Pterocarpus angolensis*
Combretum	*Pterocarpus rotundifolius*
Sclerocarya birrea	*Schrebera trichoclada*

Charcoal can be produced using a number of different kiln technologies, however, the most common in Zambia is the earth mound kiln. Generally, kilns are constructed close to the wood source and new kilns are constructed as producers move from location to location. The kiln is made by piling layers of billets crosswise on stringers up to a height of 1.5-3.0 m. The kiln is covered with soil lumps dug from holes in the vicinity of the kiln; the earth wall on the sides of the kiln may be 20-35 cm thick. The kiln is ignited through a hole at the base which is plugged with soil after combustion has started. During carbonization the kiln temperature may reach 500 °C and the resultant heat dehydrates the wood, following which the wood begins to char. The process of carbonization of the wood takes at least two weeks [FAO and GRZ, 2020]. According to the National Woodfuel Study, charcoal producers make anywhere between 2 – 16 kilns per year, ranging in size from 14.5m^3 – 96m^3; typically, the larger the kiln, the fewer constructed each year.

Once charring has ended, the temperature of the kiln drops and this cooling process allows the charcoal to be recovered. The charcoal is then packed into bags, while the charcoal fines and the burnt soil are left at the kiln. This method of charcoal production is 25% efficient on oven dry weight basis and it is estimated that over 80% of the total extracted wood volume is lost as charcoal residue (Gumbo et al., 2013).

5.2 TRANSPORT AND WHOLESALE

Once produced, charcoal is transported to rural aggregation sites, from where it is moved to urban wholesale points for further sale to retailers. While transport is dominated by men, a major part of the wholesale trade is dominated by women [GRZ 2017].

The movement of goods and people in Zambia is largely linked to the country's major highways. Starting from footpaths and tracks, charcoal is moved to feeder (or secondary, mostly gravel) roads, then to highways such as the Great North, Great East, Lusaka-Kafue-Chirundu, Livingstone-Sesheke, Lusaka-Mumbwa-Mongu and Chingola-Solwezi roads. The highway with the greatest density of charcoal markets is the Great North Road, which links Lusaka, the Copperbelt, Nakonde and beyond; the Great East Road has similarily high densities of charcoal markets but these are restricted to the Luangwa Valley (Gumbo et al. 2013).

A report by IAPRI (2015) indicated various methods used in the transportation of charcoal from the production sites to marketplaces. According to their findings, charcoal is mainly transported in trucks with 47% of the transporters indicating that they use this mode of transport. This is followed by bicycles, wheelbarrows, and oxcarts, at 26%, 16% and 10% respectively. Similarly, the National Woodfuels Study (2017) by GRZ found that cars (54%), bicycles (14%), heavy trucks (17%) and light trucks (8%) were the most common forms of transport for charcoal through Chongwe check point in Lusaka. However, it is worth noting that these values may be inaccurate as it does not capture the charcoal which avoids going through the checkpoints.

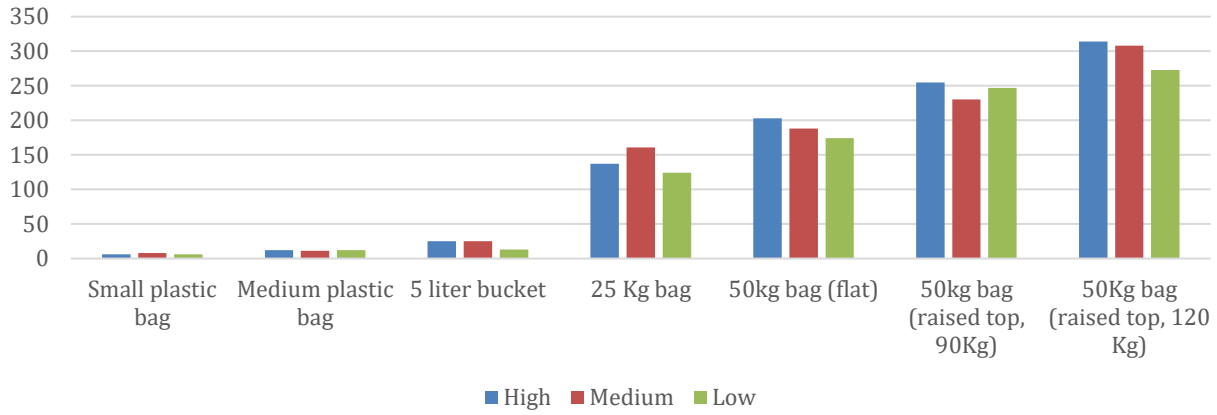
In Lusaka district it has been found that the flow of charcoal peaked between 19:00 and 01:00 [GRZ, 2021] suggesting that transporters are attempting to conceal their loads, likely due to lack of permits and licenses. This assertion is supported by CIFORs observation that charcoal is often transported at night, early in the monring or late in the afternoon, as well as weekends, "presumably to avoid apprehension by FD staff and, in some cases, district council officials."

5.3 RETAIL

Charcoal is sold in all the major urban centers of Zambia. This stage of the value chain typically has the greatest representation of women and is a key income generating opportunity in urban areas. According to findings from the A2C Consumer Preference Study, most of the charcoal in Lusaka is sold in local markets with consumers generally traveling less than 2 kms to their nearest retail point. However, many higher income consumers also purchase it from mobile sellers without having to leave their homes.

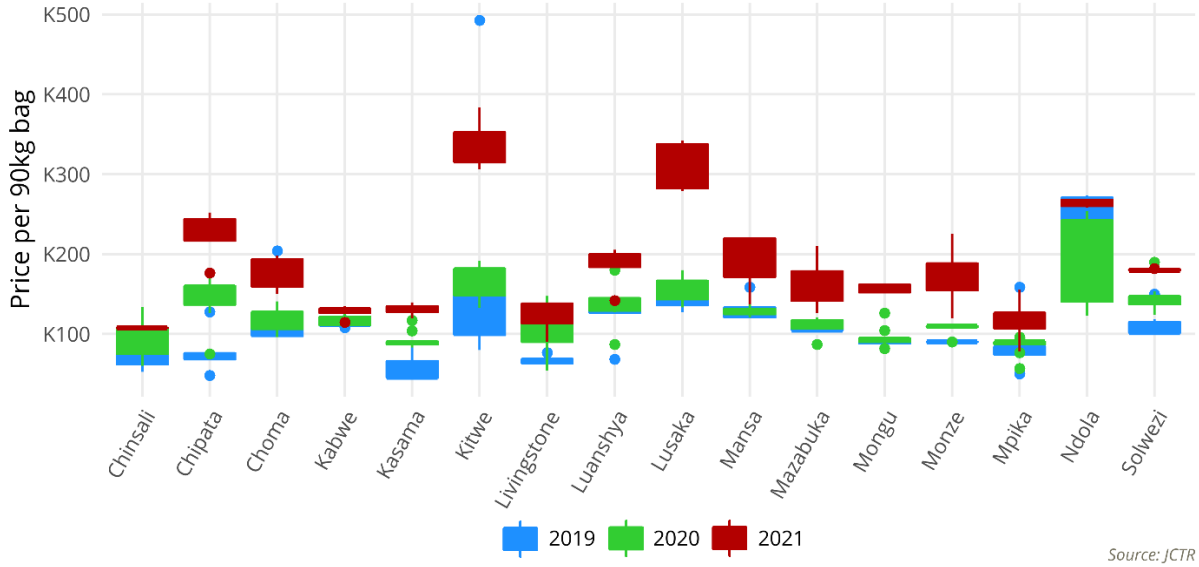
Charcoal is packed into a range of different sizes from small plastic bags, through to 25Kg and 50kg sacks, costing between ZMW 6 and ZMW 314, allowing nearly unmatched flexibility. This flexibility in sizing and pricing allows charcoal to be purchased for daily or monthly use, matching the ability and willingness to pay of differnet income groups.

Figure 5: Charcoal prices by volume purchased and income level (high, medium, low)



Charcoal price data collected by the Jesuit Centre for Theological Reflection in 16 districts indicates that prices for a standard 90Kg bag have steadily increased over the last three years. Price increases have been most significant in Lusaka, Kitwe and Chipata with the highest prices seen in Lusaka district of approximately ZMK 300 per bag.

Figure 6: Average price of charcoal in each district in 2019, 2020, and 2021

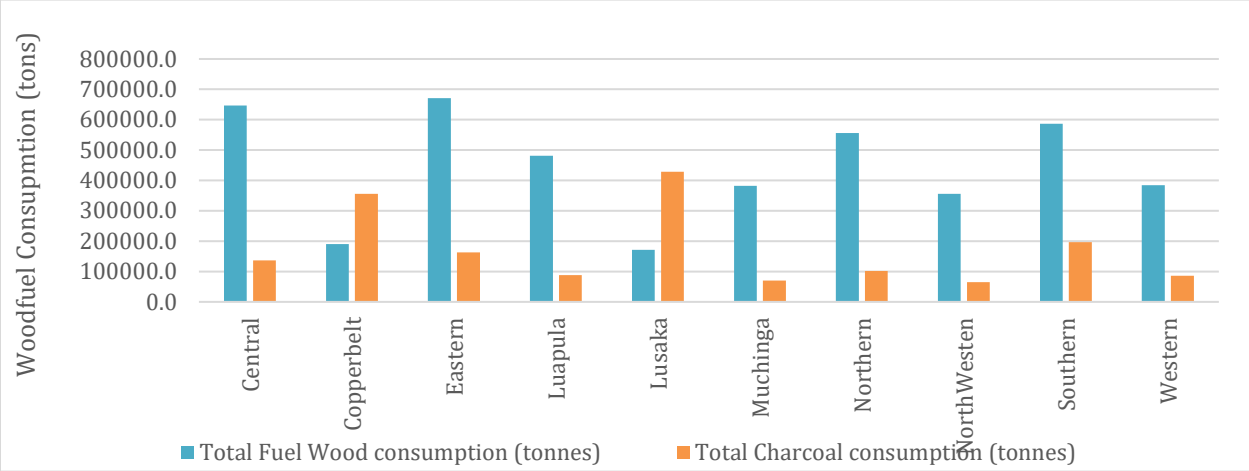


5.4 CONSUMPTION

Charcoal is the most widely used cooking fuel in Zambia and charcoal use is ubiquitous across all income groups. Furthermore, with increasing populaiton size and high urbanisation rates, demand for charcoal is set to increase substsantially in Zambia over the coming years.

The Consumer Preference Study undertaken by A2C found that while preference for, and use of, charcoal declines as incomes increase, it is still used in combination with other ATFs through the practice of fuel stacking. In fact, even in high income households it is the most used fuel, with 60% continuing to use it daily to meet their cooking needs. Typically, charcoal is used in combination with other fuels like electricity or wood. Stacking occurs throughout the day (different fuels for certain meals) and throughout the week (different fuels on different days). As income levels increase the proportion of electricity in the stack also increases, and as incomes decrease, the proportion of charcoal and firewood in the stack increases. Users point to its affordability, accessibility and cooking attributes (faster/better) as primary reasons they use it.

Figure 7: : Charcoal Consumption by Province (adapted from the National Woodfuels Study 2017)



The National Woodfuel Study (2017) determined that the daily national average household charcoal consumption for the cold season was 3.1 kg while the rainy season was estimated at 3.3 kg per day, giving a national daily average household charcoal consumption across the seasons of 3.2 kg per household, translating to an annual average consumption of 1,168kg per household. Furthermore, the study determiend that Lusaka and Copperbelt Provinces were the highest consumers of charcoal, while Northern and Muchinga provinces consumed the least. These findings align with the WISDOM study which identified the Copperbelt and Lusaka Privinces as having the highest demand for woody biomass (firewood and charcoal). The WISDOM study also demonstrated that households have by far the highest demand for woody biomass at 82%, followed by other commercial and public sectors (13%), fish (3%) and tobacco (2%).

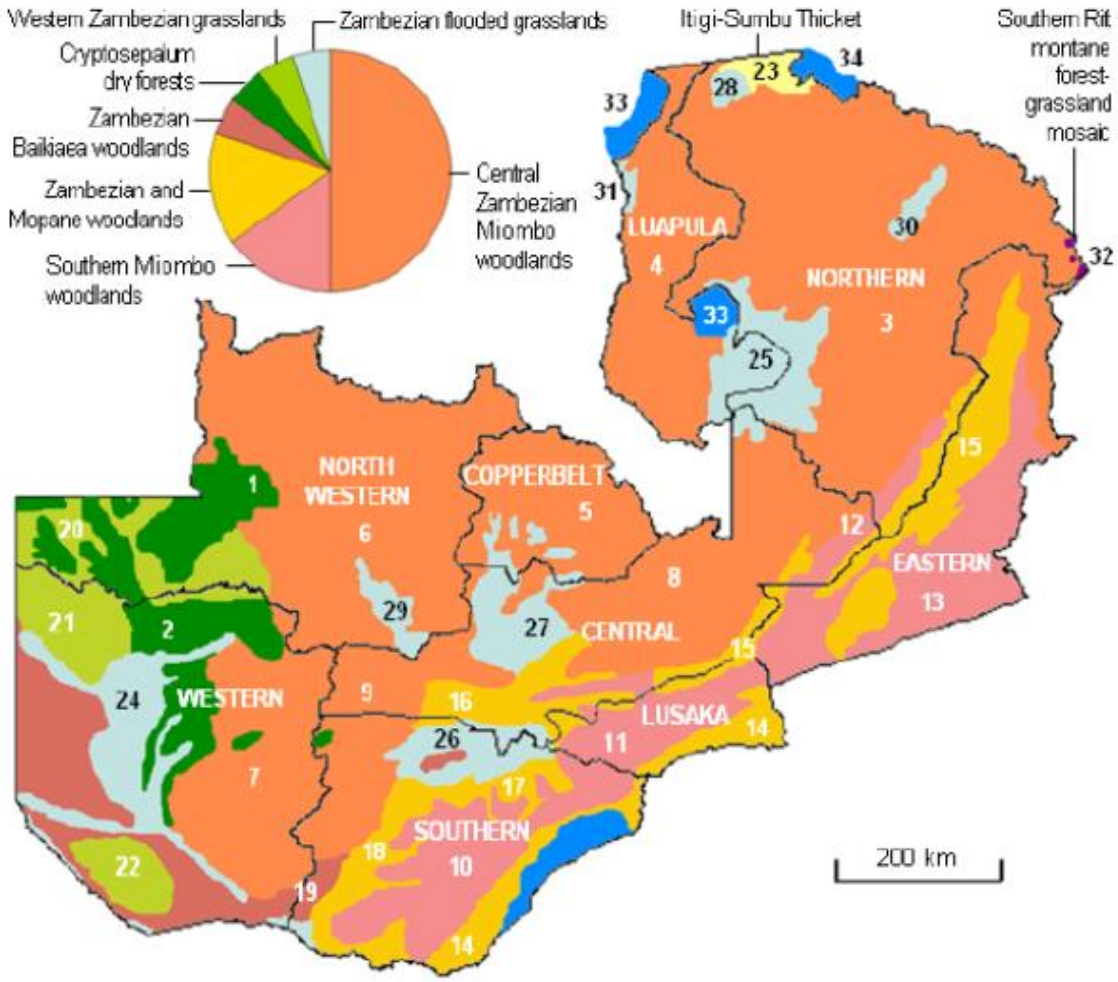
Table 4: Charcoal Demand by Province and use (adapted from WISDOM 2016)

Woody Biomass (firewood and charcoal) Demand by Sector					
Province	**Household**	**Other**	**Tobacco**	**Fish**	**Total**
Central	1,113	153	100	66	1,432
Copperbelt	1,453	313	0	9	1,775
Eastern	1,416	163	79	52	1,710
Luapula	965	139	0	15	1,119
Lusaka	1,361	351	15	10	1,737
Muchinga	646	86	0	33	765
Northern	1,004	118	0	42	1,164
North-Western	638	99	0	14	751
Southern	1,309	138	129	84	1,660
Western	784	107	0	30	921
Zambia	10,689	1,667	323	355	13,034
Percentage Share	82%	13%	2%	3%	
NOTE: Other includes woodfuel consumption in commercial and public sectors as well as industrial roundwood					

6.0 FORESTS AND CHARCOAL

6.1 FOREST COVER IN ZAMBIA

Figure 8: Map of land cover types in Zambia



Zambia's total land area is 75.3 million hectares, of which forests account for 61% (ILUA-II, 2016). According to the national WISDOM study the total stock of woody biomass was estimated at slightly over 2 billion tons DM in 2010 [FAO WISDOM, 2016], which is supplied from the five main types of forest in Zambia:

Miombo woodland is the major forest type in Zambia, covering approximately 45% of total land area (Kalinda et al. 2008; Stringer et al. 2012) which is dominated by species representing the genera *Brachystegia, Isoberlinia* and *Julbernardia*, and include key species such *Brachystegia spiciformis, B. boehmii, Julbernardia globiflora, J. paniulata;* and *Isoberlinia angolensis* as well as the dipterocarp, *Marquesia macroura* (CIFOR, 2014).

Kalahari or ***Baikiaea–Terminalia* woodland** is found on Kalahari sands of the upper-Zambezi basin in Zambia's Western and North- Western provinces (Mulombwa 1998; Sekeli and Phiri 2002). This

woodland covers approximately 9% of the country's land area (Siampale 2008), Kalahari woodland is the main source of commercial timber for Zambia. (CIFOR, 2014).

Mopane woodlands are distributed in a band stretching from southern to eastern Zambia (Kindt et al. 2011). The woodland covers approximately 3.5% of the country's land area (Siampale, 2008). Mopane woodland is important economically for timber and edible caterpillars, as well as **charcoal and fuelwood**. Mopane woodland is dominated by *Colophospermum mopane*, which often grows in relatively mono-dominant stands with a limited shrub layer (Timberlake 1999, CIFOR, 2014)

Munga or **Acacia–Combretum** woodland is a more open or park-like deciduous woodland. Often viewed as secondary woodland, the Munga woodlands are found over a large part of central and southern Zambia, covering almost 4% of the land area (Mulombwa 1998; Siampale 2008). The woodland lacks the main species of miombo and mopane woodlands and is dominated by *Acacia, Combretum and Terminalia* species (Chidumayo 2012a, CIFOR 2014).

Dry evergreen forests are part of the transition of forest types from Guineo Congolian rainforest to Zambian dry woodlands. Dry evergreen forests cover 3–5 percent of the country's land area and are restricted to North- Western and Western provinces in Zambia. Dominant species (dependent on the forest type) include *Cryptosepalum exfoliatum, Guibourtia coleosperma, Marquesia acuminata, Marquesia macroura, Parinari excelsa, Syzygium guineense*, and *Anisophyllea pomifera* (CIFOR, 2014).

Table 5: Forest area by province in the years 2000, 2010, and 2014 (adapted from the National Wood Fuels Survey 2017)

Province	Total Land Area (ha)	Forested Area (ha) 2000	Forested Area (ha) 2010	Forested Area (ha) 2014	% Coverage in 2014
Central	11,002,944	6,123,456	5,959,915	5,701,471	52%
Copperbelt	3,132,839	2,018,962	1,949,123	1,896,348	61%
Eastern	5,097,587	3,613,221	3,614,115	3,599,412	71%
Luapula	5,056,908	3,305,671	3,286,495	3,269,517	65%
Lusaka	2,550,745	1,415,912	1,412,234	1,409,189	55%
Muchinga	8,680,596	6,389,648	6,383,372	6,359,200	73%
Northern	7,692,748	4,298,113	4,289,187	4,277,891	56%
North-western	12,582,637	9,115,834	9,052,223	8,833,712	70%
Southern	6,825,816	3,781,349	3,770,178	3,756,345	55%
Western	12,638,580	6,991,982	6,979,332	6,840,231	54%
TOTAL	75,261,400	47,054,148	46,696,174	45,943,316	61%

The table above summarizes Zambia's forest cover in 2014. The North-Western province contains the largest area of forest at 8,833,712 hectares. It also contains all of Zambia's dry evergreen forests and Kalahari woodland. Lusaka province has the smallest total forest area at 1,409,189 (2014) and is dominated by southern Miombo woodlands. Based on percentage of forest cover, Muchinga Province has the largest remaining amount at 73%, significantly above the national average of 59%, while Central Province has the lowest coverage at 52%. Both provinces are covered predominantly in central

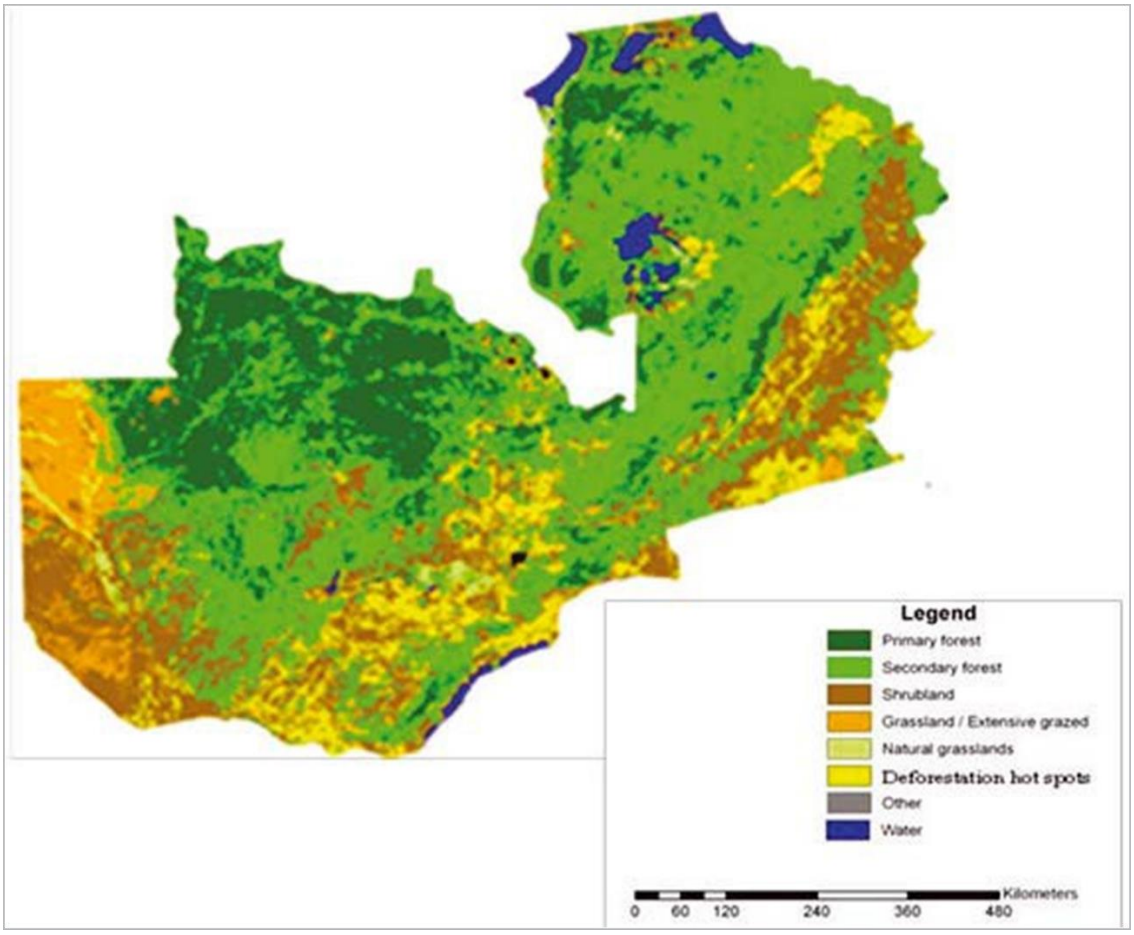
Zambezian miombo woodland. In 2014, North-Western, Western, Muchinga and Central provinces accounted for 60% of the country's total Forest Land.

6.2 CHARCOAL, DEFORESTATION, AND FOREST DEGRADATION

Deforestation for the period 2000 to 2010 has been estimated at 250,003 hectares per annum, while for the period 2010 to 2014 deforestation rate was higher still at 341,067 hectares per annum (ILUAII, 2016). Land clearance for agricultural expansion, settlement, logging and fuel wood (firewood and charcoal) extraction are widely considered to be the main driving forces behind the high deforestation rates in Zambia (GRZ, WISDOM, IAPRI) Although timber is extracted from Zambian woodlands for construction and manufacture of wood products, charcoal production is the biggest single driver of wood extraction and the primary cause of forest degradation and deforestation (CIFOR 2014 quoting: Clarke and Shackleton 2007; Vinya et al. 2011). Overall, the national demand for wood products in 2010, including charcoal, fuelwood, construction material and timber was estimated to be 13 million tons DM, 82% of which was fuelwood and charcoal for the residential sector (FAO WISDOM, 2016).

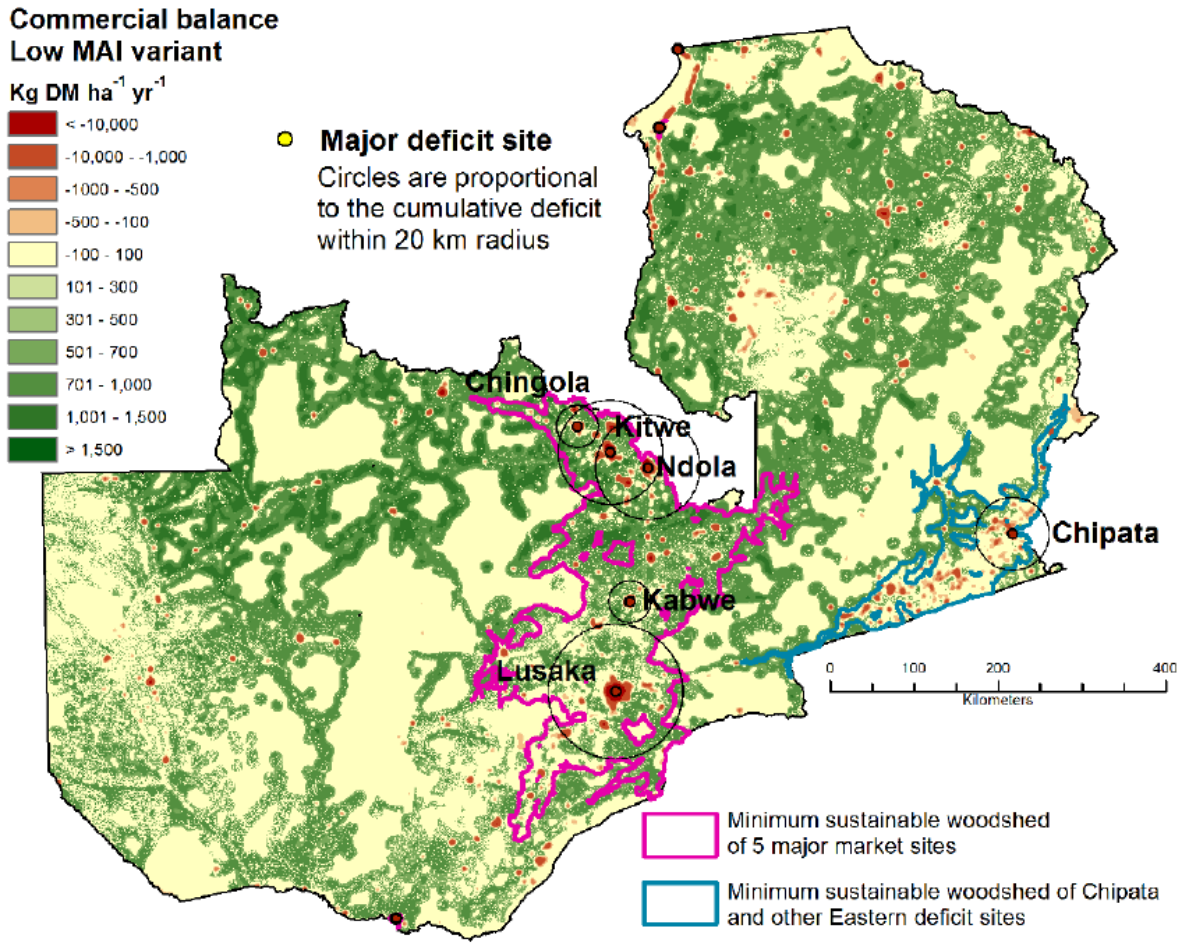
The contribution of charcoal production to deforestation and forest degradation has been increasing steadily since independence (Chidumayo 2010), and the growing urban population has been partly blamed. Given Zambia's 2.5% annual population growth rate and an annual urbanisation rate of 3.2%, consumption and demand for charcoal will continue to rise in the country's cities (Gumbo, D et al. 2013).

Figure 9: Map of forested areas and deforestation hot spots



The above figure developed using the CLUE-S (Conversion of Land Use and its Effects) model [Verburg and Veldkamp (2004)] illustrates characteristic patterns of deforestaiton in Zambia and identifies a number of hotspots, which are closely associated with urbanization and industrialization. High rates of deforestation and forest degradation occur mostly along the rail link between Livingstone and Chililabombwe, with these areas making up the major corridor of deforestation hotspots in Zambia. This stretch covers four key provinces (Southern, Lusaka, Central and Copperbelt). However, there are other emerging deforestation and degradation hotspots in North- Western Province, which are driven by rapid urbanization and industrialization. The close link between urbanization, degradation and deforestation suggests that areas experiencing high population growth are likely to be more severely affected by forest degradation and deforestation in the near future (Vinya et al 2011).

Figure 10: Map showing the WISDOM study's estimates of woodfuel surplus and deficit.



The WISDOM study found that around half of the national demand for wood products (47%) is concentrated in a relatively small area along the central axis of the country covering the main markets of Chingola, Kitwe, Ndola, Kabwe and Lusaka; with the accessible resources along the axis under highest harvesting pressure and thus under higher risk of degradation.

The WISDOM analysis showed that charcoal production was sustainable with respect to consumption across much of the area of Zambia. The Area outlined in pink above shows the minimum area that could supply charcoal demand in the five major urban areas while maintaining a sustainable harvest.

Nine of ten provinces had a province-wide fuelwood surplus (Lusaka being the only exception with a provincial deficit) while out of 74 districts, only 12 – generally small urban districts – have a district-wide deficit. However, charcoal production is highly unsustainbale in the areas that are within a commercially-viable distance[1] from urban centers. In the harvesting zone servicing the five major markets, 19% of charcoal used is estimated to be non-renewable (WISDOM study) – i.e. it leads directly to forest degradation.

The degree of forest clearing for charcoal production can vary considerably depending on the site (Malimbwi et al. 2010). If charcoal demand is low in an area, harvesting is more selective in terms of species and size classes used; whereas, in times of high demand, clear-fell harvesting of woodland is more common (Clarke and Shackleton 2007). Chidumayo has reported removal of 50–97% of the woody biomass from plots in miombo woodlands in Zambia (Chidumayo 1991, 1993). However, following harvesting, tree density can recover significantly within 30 years (Chidumayo 1993). Therefore, charcoal production may not lead to forest clearance, just degradation [CIFOR OP 113, 2014]. This supports the WISDOM study assertion that what matters most is what happens after land clearance, regardless of the underlying driver.

According to the National Woodfuels Study it requires between 5 and 10 tonnes of wood to produce one tonne of charcoal, irrespective of the area cleared and effects on the ecosystem. Estimates by the FAO [2017] indicate that wood biomass used for charcoal production has increased from 1.38 million tonnes in 1969 to 12.6 million tonnes in 2015, corresponding to 196,646 hectares of forest degradation. While estimates in 2010 by IAPRI [2015] indicated that 23,268 hectares were cleared annually to provide charcoal to Lusaka city alone. Similarly, the National Woodfuels Survey [GRZ 2021] determined that 52,142 hectares of forest was cleared in 2015 due to charcoal production, contributing about 19% of the deforestation rate.

However, the extent to which demand for charcoal and firewood is driving deforestation in Zambia is somewhat unclear. According to the WISDOM study there is no correlation between district-level demand for wood and deforestation rates. They state that the practice of clearing forests patches is common to several land uses and what matters most is what happens after the land is cleared. With charcoal producers unlikely to return to the same forest site too soon, considering there is currently abundant forest resources available in the surrounding area, forest areas can regrow if the regenerating forest is correctly managed and rotation period between harvesting is adequate.

6.3 TRENDS IN CHARCOAL PRODUCTION

As noted elsewhere in this report, charcoal production has been increasing in Zambia for a number of years. Data from the Food and Agriculture Organization suggests that charcoal production increased from 0.34 million tons in 1969 to an estimated 1.50 million tons in 2015. The National Woodfuel Survey estimated that 2015 production was even higher at 2.67 million tons. Looking at the relationship between charcoal production, wood biomass, and forest degradation, this increase suggests that the

[1] The WISDOM study assumed a 16-hour limit as the threshold beyond which charcoal production would no longer be commercially viable.

area of forest degraded by charcoal production annually increased more than tenfold between 1969 and 2015.

Table 6: Charcoal produced, wood biomass used, and associated forest degradation (NWFS)

Year	Charcoal production (FAO estimate, (millions of tons)	Wood biomass used (millions of tons)	Estimated forest degradation (hectares)
1969	0.33	1.38	17,000
1980	0.49	2.04	26,000
1990	0.69	2.85	36,000
2000	0.91	3.77	48,000
2008	1.39	5.80	73,000
2015	1.50	12.61	196,646

At provincial level, the National Wood Fuels Survey estimated that Lusaka, Central and Northern provinces produced the largest volumes of charcoal at 0.61, 0.55 and 0.53 million tons respectively. To put this in perspective, each of these provinces produced more charcoal in that year than the entire country did each year between 1969 and 1980. However, as noted in the National Woodfuel Survey 2021, due to its informal nature, a lot of charcoal production and usage goes unrecorded, making it difficult for the government (and others) to know exactly how much is being produced and consumed. Accordingly, the figures below should be used cautiously.

Table 7: Data on household and provincial production of charcoal

Province	Number of households	Average # of kilns (HH per year)	Average # of 50 Kg bags in a kiln	Charcoal Produced (million tons)
Central	24,203	13	48	0.55
Copperbelt	37,698	2	126	0.39
Eastern	1,697	6	28	0.01
Luapula	17,271	7.8	69	0.38
Lusaka	7,135	16	125	0.61
Muchinga	14,791	7	27	0.06
Northern	24,124	7.8	69	0.53
N-western	4,093	2	97	0.03
Southern	21,982	8	48	0.11
Western	225	8	52	0
Zambia	153,218	7.8	69	2.67

6.4 PERMITTING OF CHARCOAL PRODUCTION AND TRANSPORT

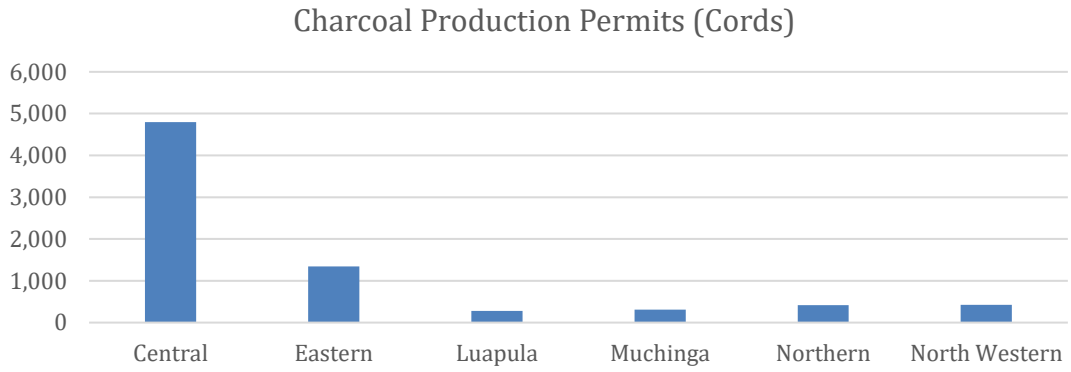
In an attempt to better manage the charcoal sector, the Forests Act No. 4 of 2014 provides for the establishment of forest reserves, sustainable forest management, and issuance of permits and licenses. As such, the production and transportation of charcoal are regulated under Section 87 of the act which states that "subject to the other provisions of this Act, a person who, not being a holder of a license or permit under this Act, manufactures wood into charcoal or offers for sale, sells or removes charcoal in or from any State Land or customary area commits an offence".

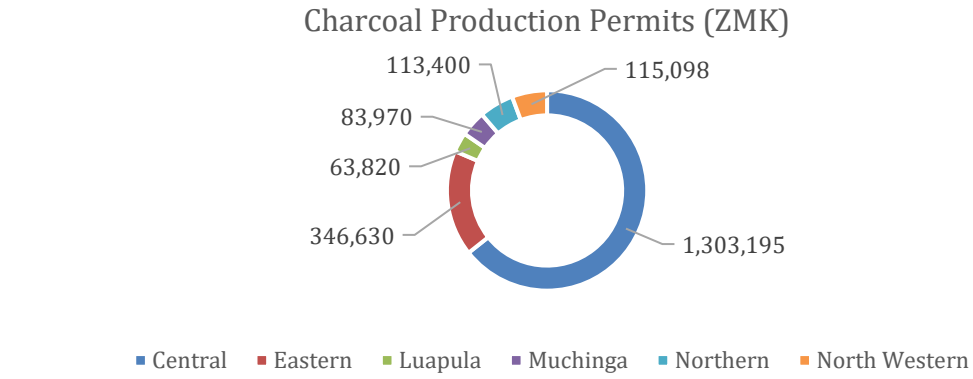
Table 8: Permits issued for charcoal production and transport by province (2015)

Province	Production (CORDS)	Conveyance (Bags)
Eastern	638	8,277
Central	791	24,232
Copperbelt	542	50,205
Luapula	313	2,009
Lusaka	570	8,170
Muchinga	106	1,335
Northern	215	2,433
North – Western	183	4,757
Southern	620	8,492
Western	3,466	4,285
TOTAL	7,447	114,195

According to the National Wood Fuel Survey, a total of 7,447 charcoal production permits and 114,195 conveyance permits were issued in 2015, amounting to 0.01 million tons of charcoal; significantly less than the 2.67 million tons produced that year. The highest number of production permits issued was in Western province, while the highest number of conveyance permits issued was in Copperbelt province. During routine stops at highway checkpoints the National Woodfuel Study questioned 2,021 charcoal transporters at 21 checkpoints across 10 districts and determined that only 5.4% (123) held a valid permit. Of the 123 transporters holding a permit, 110 were identified in Lusaka district.

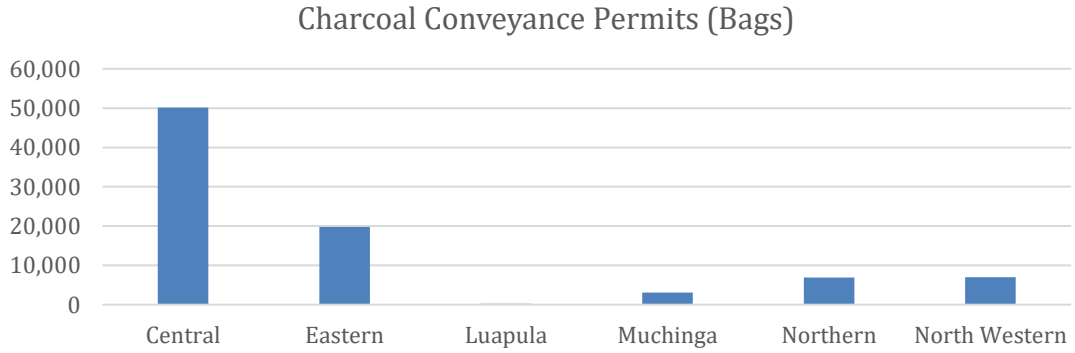
Based on data from the Forestry Department annual provincial reports (2020), A2C has been able to build up a picture of the charcoal production and conveyance licenses granted in six provinces in 2020; however, it should be noted that for some provinces data was deficient or presented in an aggregated manner that did not allow for interrogation.

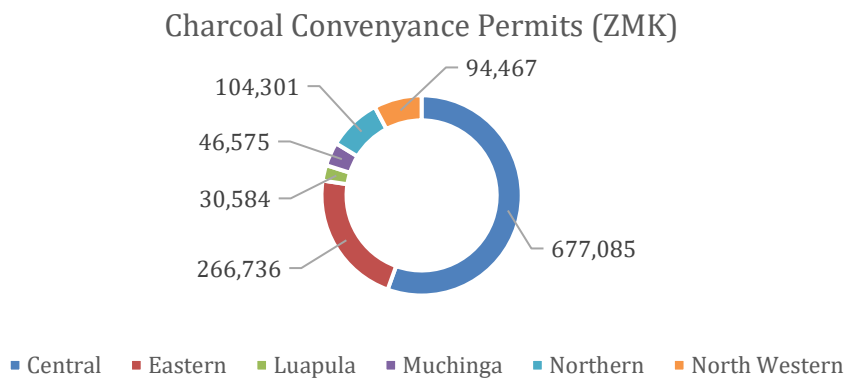




In terms of charcoal production, most licenses were issued in Central Province with a total of 4,794 licenses issued, each relating to one cord. However, out of the 5 other provinces where data was available, most issued less than 1,000 permits, with Eastern Province issuing slightly more at 1,341 licenses. Unsurprisingly, revenue generation followed a similar pattern with Central Province generating 1.3 million ZMK, Eastern Province generating 346,630 ZMK and the remaining districts around, or less, than 100,000 ZMK.

Permits for transport followed a similar pattern to production, with Central Province issuing the highest number (50,155) and collecting the most revenue (ZMK 677,085), followed by Eastern province which issued 19,736 permits and collected ZMK 266,736. In the remaining provinces less than 10,000 conveyance permits were issued, generating approximately ZMK 100,000 or less in revenue per province in 2020.





7.0 RECOMMENDATIONS

7.1 POLICY ENHANCEMENT

The National Woodfuels Study published by the GRZ (2019) Ministry of Energy presents an assessment of the charcoal sector in Zambia, however given the informal nature of the trade and the lack of consistency regarding how charcoal bags are weighed these figures need to be treated with caution As such, the design, data collection, analysis and final report could be strengthened to improve the quality and useability of the results. Therefore, it is recommended that A2C engage with the MoE and the FD to identify areas of support that A2C could provide moving forward to ensure future publications continue to be made available and to the highest quality.

7.2 INFORMATION GAPS

While it is clear that charcoal production occurs across Zambia, it is not well understood from the literature which areas of the country produce the largest volumes of charcoal. It is recommended that A2C works with GRZ to better understand where charcoal production hotspots are and how these align with forest resources, deforestation trends and numbers of charcoal production and conveyance permits issued.

Observed information gaps include:

- Updated data regarding volume charcoal produced, wood biomass used, and associated forest degradation
- Average annual urban household consumption of charcoal.
- Number of production and conveyance permits issues by Province.
- Revenue collected (ZMW) from production and conveyance permits by Province.
- Verify current rates of deforestation to overcome the high variability of reported estimates
- Extent to which charcoal production contributes to deforestation and degradation.
- Contribution of charcoal production to GDP and household income.
- Inconsistent and conflicting data about the amount of charcoal legally produced and transported by District.
- Data regarding who and how finances and organizes the commercial charcoal value chain.
- Impact of load shedding on charcoal production and forest degradation.

Recommendation: It is unclear from the literature how much revenue is lost by the Forestry Department due to unpaid permits for charcoal production and conveyance. A2C should undertake an assessment to

accurately estimate a figure, which can be used advocate the GRZ for better enforcement of the Charcoal Regulations. This assessment could potentially take the form of an "enforcement cost benefit analysis."

Recommendation: Identify which information gaps listed above can be addressed by A2C in future charcoal monitoring reports (see below) or other research studies supported by A2C or other cooperating partners. Support the Ministry of Energy to conduct an update to the National Woodfuel study ensuring data is collected on household and institutional charcoal consumption by district and province. Support the Forestry Department to strengthen the collection and reporting of timely and credible data related to permitting and monitoring of the charcoal supply chain.

7.3 CHARCOAL PRODUCTION MONITORING METRICS

Given the amount of information that is unknown, outdated or contradictory about the charcoal value chain, it is recommended that future field-based charcoal monitoring reports conducted by A2C collect data on the following metrics:

- Volume of charcoal produced (metric tons) in select areas where A2C interventions are occurring.
- Average annual household consumption of charcoal in major urban areas.
- Percentage of volume produced that has a cordwood and/or transport permit.
- Stakeholder mapping of people engaged in the charcoal value chain in select areas.
- Estimated annual revenue earned by stakeholders in the charcoal value chain in select areas.
- Number of cordwood and conveyance permits issued by the Forestry Department in select areas.
- Establish the actual weight is of charcoal units sold and what the standard variation of these weight measurements are.
- Value of charcoal sold to transporters using standardized weights of 25kg, 50kg and 90kg.
- Revenue generated from legally declared charcoal production in select areas.
- Price of charcoal sold in major markets in Lusaka, Ndola and Solwezi (25kg, 50kg and 90kg)
- Awareness levels of charcoal regulations, permitting requirements and costs
- Gender of the actors in the value chain
- Seasonality of charcoal production
- Seasonal market price of charcoal in major urban areas
- Drivers of charcoal production at household level
- % of household income derived from the charcoal sector
- Location of charcoal production (land tenure, proximity to road networks)
- Drivers affecting location of charcoal production (land cleared for agricultural expansion, land assigned by local leaders, own land, unclaimed land)
- Length of production cycle
- Type of kilns used for production
- Size of kilns constructed
- Number of trees/volume of wood used per kiln
- Output of kilns (tons, standard 50Kg bags)
- Tree species preferred for charcoal production
- Tree species used for charcoal production
- Weight of charcoal lost as residue at the kiln site
- Number of CFMGs at production sites
- Number of Charcoal Producer Groups (including number of members)

7.4 CHARCOAL REGULATION ENFORCEMENT

A review of the literature indicates Zambia's regulation of the charcoal supply chain is weak, uneven, inefficient and uncoordinated. Moreover, the impacts of charcoal production on deforestation and degradation are aggravated by limited monitoring and law enforcement, overlapping areas of regulatory authority, lack of resources and the absence of an integrated policy and regulatory framework that takes into consideration the entire charcoal value chain. The export and sale of charcoal are also not officially taxed, resulting in lost revenue and the promotion of informal trading.

Recommendation: Develop a National Charcoal Policy and Action Plan. Existing policies and regulations related to trade, energy, agriculture, environment and customs all influence the charcoal supply chain and need to be harmonized with forestry and energy policy if production and trade of charcoal is to be effectively and sustainably managed. The policy should be accompanied by a statutory instrument (SI) or regulation that calls for sustainable charcoal production and a sales tax on charcoal sold from unsustainable/unregulated sources. The establishment of an Intergovernmental Charcoal Taskforce will enable cross-institutional monitoring and evaluation of the policy and statutory instruments.

Recommendation: Gaps between traditional rules and statutory provisions for accessing and controlling charcoal production should be identified and addressed as part of the National Charcoal Policy and Action Plan. The roles of traditional leaders should be clarified in the management and control of charcoal production including determining which local rules for resource allocation and control can reinforce statutory provisions under the Forest Act. Furthermore, given the significant amount of charcoal production that occurs on customary land it is recommended to conduct awareness raising about the impacts of charcoal production on the environment with customary leaders, and meaningful engage and support customary authorities in sustainably managing charcoal production.

Recommendation: The revised charcoal regulations should be drafted to incentivize, not discourage, compliance. The criteria for Charcoal Producer Groups to be registered should be more flexible and take into consideration the capacity and resources available to members.

Recommendation: Decentralize the newly introduced online permitting and licensing system for charcoal production and management. The Forest Department does not have the capacity or resources alone to effectively or efficiently regulate the charcoal supply chain. Decentralizing charcoal permitting and licensing to Districts and Community Managed Forest Groups will increase the accessibility of permits, raise revenue to strengthen enforcement, and enable communities to directly benefit from sustainable charcoal production and trade thus incentivizing more effective management of forests. Furthermore, current District Council by-laws only include the collection of levies but could be expanded to include the sustainable production of charcoal.

Recommendation: Data on charcoal production and conveyance permits is patchy and difficult to obtain, making it difficult to understand the degree to which compliance is achieved. It is recommended that A2C works with the Forestry Department to improve data collection and reporting to ensure reliable information is available to decision makers.

7.5 CHARCOAL VALUE CHAIN

While the "Livelihoods" charcoal value chain is reasonably well studied and understood, the more "Organized" value chain is less well understood. It is recommended that A2C, through its PEA and

district level support to the Forestry Department, develops a deeper understanding of the "Organized" value chain to inform activity design and implementation.

Given the low efficiency of earth mound kilns, A2C should draw lessons from the CEDAIR Zambia Charcoal Cost Benefit Analysis to better understand the financial costs and potential benefits to charcoal producers who adopt improved kiln technologies. Attention should be paid to how charcoal production shifts location and how this impacts the number of kilns that must be constructed.

As demand for charcoal increases in the major urban centers, and deforestation rates accelerate, charcoal production sites will increasingly move away from the consumption centers. Therefore, A2C should better understand how the final retail price of charcoal is affected by the distance between production site and consumption location. This understanding could help to inform enforcement strategies, as well as the future cost competitive of ATFs.

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