

The charcoal value chain in Kenya

Actors, practices and trade flows in selected sites



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The information is based on knowledge and understanding at the time of writing. However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up-to-date and to check currency of the information with the appropriate agricultural or forest officer or an independent advisor.

Front cover photo: Graded charcoal for sale in a Nairobi market. Photo: CIFOR/Axel Fassio

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List of abbreviations & acronyms

ASAL	Arid and Semi-Arid Land
CIFOR	Centre for International Forestry Research
CPA	Charcoal Producers' Association
DRC	Democratic Republic of Congo
FHH	Female Heads-of-households
GM	Gross Margin
GOK	Government of Kenya
HH	Household
ICRAF	World Agroforestry
IDRC	International Development Research Centre
IEA	Institute of Economic Affairs
JIRCAS	Japan International Research Centre for Agricultural Sciences
KES	Kenya Shillings
KFS	Kenya Forest Service
KII	Key Informant Interview
LPG	Liquified Petroleum Gas
MENR	Ministry of Environment and Natural Resource
MHH	Male-headed Household
NGO	Non-Governmental Organization
NORCAP	Norwegian Capacity
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SEI	Stockholm Environment Institute
SSA	Sub-Saharan Africa
USD	United States Dollar
WFP	World Food Program

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Executive summary

The charcoal sub-sector is one of the most important sources of energy in Kenya, especially in urban areas. The sub-sector has been reported to be worth billions of dollars in market value. Between 40-75% of the charcoal is produced in arid and semi-arid lands (ASALs) using inefficient processing technologies and unsustainable tree harvesting practices. Given the critical role the sub-sector plays in energy provision and economic development, this study sought to assess the charcoal value chain to understand: i) actors and their motivation for engagement; ii) production technologies and processes; iii) the economics of product flow among different actors at different stages of the value chain; and iv) factors influencing performance in the value chain.

Questionnaire surveys were conducted with 447 respondents in September to November 2018. Tree and charcoal production data was collected from systematically-sampled landowners and charcoal producers in Kitui, Kwale and Baringo counties. These areas were purposively selected as they were either project sites and/or charcoal hotspots. Data on transportation and trade was collected from transporters, traders (wholesalers, retailers, brokers) and consumers in Nairobi and Mombasa, the two largest urban markets for charcoal in the country.

The study findings indicated that over 90% of charcoal producers sourced trees from their own farms. This means that they did not need to pay for the wood, thus, the value of wood is rarely captured in the final farmgate price of charcoal. Most charcoal producers incurred minimal production costs; utilizing trees from family land prepared using family

labour or at a cost of less than KES 100². All producers produced their charcoal in traditional, inefficient earth kilns.

In addition, less than 10% of the producers were members of Charcoal Producers' Associations (CPAs). Most charcoal was sold to retailers and local brokers. Thus, in spite of the ban on charcoal trade outside the county that was in place at the time of the study, the product was being transported from production sites in rural areas to markets in urban centres. The Kitui-Nairobi transport route was the most lucrative for traders, owing to low expenses and the higher price of charcoal. Traders on the Busia-Nairobi route had lower returns due to the higher cost of charcoal sourced from Uganda. Wholesalers and retailers indicated that as much as 85% and 15% of the charcoal sold in Nairobi and Mombasa, respectively, was said to be from Uganda, DRC and/or South Sudan.

Generally, all value chain actors had competitive gross profit margins per bag of close to 20%, with over 45% for transporters. Retailers realized even higher gross margins when they sold charcoal in tins than in bags. Women accounted for 43% of the surveyed charcoal producers, though their participation varied along the whole value chain. Surprisingly, men also dominated charcoal retail (86.1%) which could have been a result of the ban and logging moratorium; this presented additional challenges for women.

Charcoal was a primary energy source for more than half of the respondent consumers with proportions of 57% in Nairobi and 67% in Mombasa. LPG was the next most used

² KES 100 = 1 USD

primary fuel in both cities as reported by 43% and 33% of the respondents in Nairobi and Mombasa, respectively. More than 60% of charcoal consumers bought the product in small quantities using tins, buckets and small bags, which reflects the low purchasing power of majority of the customers. Charcoal prices in both cities have been steadily increasing with the highest increase recorded from March/April 2018, the period when the national ban began.

We conclude therefore that: i) the charcoal value chain in Kenya is very resilient and adaptive, as there is an insatiable demand for cooking and heating energy sources in both urban and peri-urban areas; ii)

income generation and employment is the main driver and motivation for value chain actors to engage in the charcoal business; iii) processes and technologies used are inefficient, leading to unnecessary tree cutting, and finally; iv) charcoal production and trade is a competitive business for all actors in the value chain. Thus, in the short- and medium-term there is need to invest in making woodfuel value chains green, sustainable and competitive, as transition to cleaner cooking is still a long way off in Kenya and Sub-Saharan Africa (SSA) in general.

Key words: Charcoal value chain, sustainable charcoal, gender in the charcoal value chain, Kenya, energy source, charcoal ban



Photo by Axel Fassio/CIFOR



1

Introduction

The charcoal sub-sector in Kenya is one of the most important sources of employment, with reports showing that by the year 2000, the sub-sector employed about 0.5 million people as producers, traders and transporters (Cheboiwo, 2016; Iiyama et al, 2014; Mugo and Gathui, 2010). These beneficiaries further supported over 2 million people as dependents. In the same year, the sub-sector was reported to have a market value of KES 32 billion (USD 427 million), thus highlighting the important role it plays in the Kenyan economy (Mutimba and Barasa, 2005). By 2013, it was estimated that the number of people employed by the sub-sector was about 0.64 million, while the market value had increased to KES 135 billion (USD 1.6 billion), signifying a growth of 25% in jobs and 150-321% growth in the market value within a period of 13 years (MENR, 2013).

By 2000, it was estimated that about 1.6 million tonnes of charcoal was being consumed in the country annually (Cheboiwo, 2016; Mugo and Gathui, 2010). In 2013, the then Ministry of Energy and Natural Resources reported that the figure had grown to 2.5 million tonnes (MENR, 2013). Based on earth mound kilns with 10% efficiency, 25 million tonnes of wood would have been required to meet the demand (IEA, 2015; Mugo and Gathui, 2010).

About 40-75% of the charcoal consumed in Kenya is produced in natural woodlands of the arid and semi-arid lands (KFS, 2017; Iiyama et al, 2014; Burrow and Mogaka, 2007) and especially in the Eastern region (Tharaka Nithi, Kitui, Makueni and Machakos counties), Rift Valley region (Narok, Kajiado, Baringo, Laikipia, Turkana), Coastal region (Kilifi, Kwale, Taita Taveta and Tana River) and North Eastern region (Marsabit and Garissa) (GOK, 2018; MENR, 2015; Burrow and Mogaka, 2007; GOK, 1997). Nairobi is the largest charcoal market in the country, accounting for 10% of all charcoal consumed (Njenga et al, 2013). The supply network of the capital city spreads across the Rift Valley, Eastern and North Eastern (Garissa) regions (Onekon and Kipchirchir, 2016; MENR, 2015). According to Onekon and Kipchirchir (2016), 35% of the charcoal sold in Nairobi comes from Narok, while 20% each comes from Kajiado and Ukambani regions.

The aim of the study was to contribute to the development of sustainable charcoal value chains in Kenya by mapping out and analysing their characteristics in selected sites including actors, technologies, profits, costs, benefits and challenges.





2

Methods



Charcoal kiln under preparation in Kitui. Photo by Geoffrey Ndegwa

2.1 The value chain approach

The value chain approach improves the understanding of the direction of economic goods and services flow among different actors at different stages of engagement from production, through distribution/ transportation, trading to consumption (Kaplinsky and Morris, 2002). According to Sepp (No date), the charcoal value chain has six generic stages and categories of actors as shown in Figure 1.

Not all these generic elements are found in all value chains. Indeed, MENR (2013) reported that the shorter the value chain, the higher the likelihood of the key actors getting more benefits. Introduction of agents into the value chain leads to sharing of the benefits even further among the actors, thus making the products more expensive for the final consumer (Ndegwa et al, 2011; Ndegwa, 2010). When the key elements and categories of actors have been mapped out in the value chain framework, quantifiable data on income and profit, prices and quantities of the goods handled by the different actors is then added (Ndegwa et al, 2020). Using this information, an economic analysis is conducted to ascertain

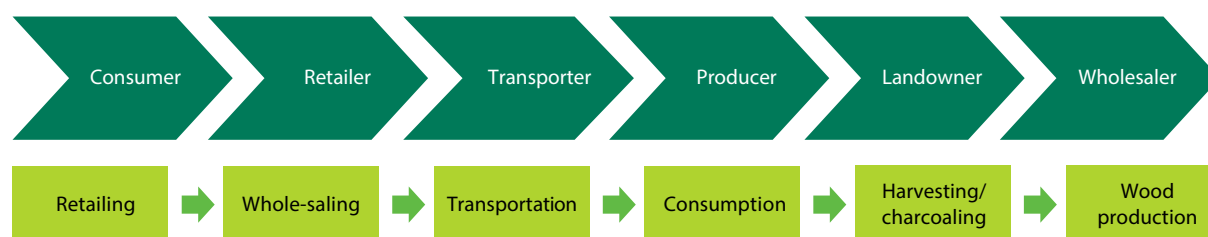
the distribution of income and profit within and among the groups along the value chain. In the end, the analysis should help to:

1. Better understand the overall economic significance of charcoal;
2. Identify and gauge trends of development, of supply, demand, induced degradation, flow, financial benefits, etc. and,
3. Identify intervention priorities and opportunities for improvement.

2.2 Study area

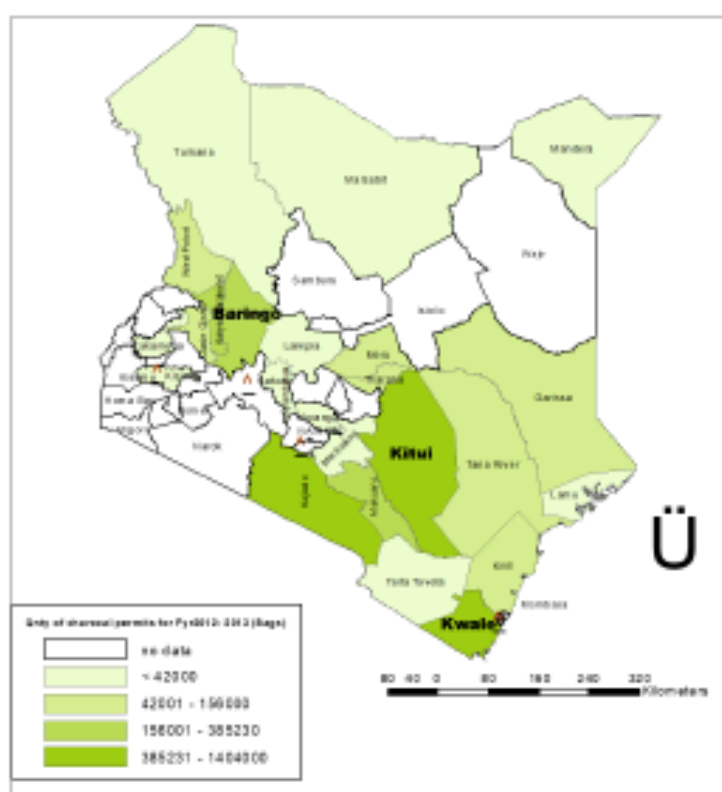
Tree and charcoal production data was collected from three counties, namely, Kitui, Kwale and Baringo (Figure 2), which are known to supply charcoal to major urban centres in the Coastal, Eastern, Nairobi and Rift Valley regions. Baringo County was selected because it is one of the project study sites.

The specific sub-locations were selected randomly from a list of all the sub-locations in each county where production was highly prevalent as guided by the key informants. The final list of selected sub-locations is presented in Table 1.



Source: Sepp, no date.

Figure 1. The generic elements of a charcoal value chain



Source: MENR, 2013

Figure 2. Study sites

Table 1. Specific study sites

County	Sub-county	Ward	Sub-location
Baringo	Marigat	Mukutani	Kiserian
		Ilchamus	Salaban
		Mochongoi	Mbechot
Kitui	Kitui East	Endau, Malalani	Ndetani, Katumbi
	Mwingi Central	Nuu	Malawa, Nguuni
Kwale	Kinango	Puma	Puma, Vigurungani
		Ndavaya	Ndavaya

elders. From each sub-location, the study targeted a sample of 33 households which were selected through systematic random sampling. Since the study was conducted during the logging moratorium, only resident charcoal producers could participate. Of the 345 respondents, 307 were landowners and 252 were both landowners and charcoal producers as shown in Table 2.

Table 2. Households sampled in each study site

County	Total sampled	Tree/landowners	Charcoal producers
Kitui	150*	150	99
Baringo	99	99	94
Kwale	96	58	59**
Total	345	307	252

*Data was collected in four sub-locations while in the others it was collected in three.

**In Kwale, 38 households were interviewed as charcoal producers but not as tree/landowners.

2.3 Sampling

Tree/landowners and charcoal producers:

A list of all the households in each of the target sub-locations was compiled with the assistance of local administrators and village

Traders: Data was collected from tree/landowners and charcoal producers who were also involved in charcoal trade, as well as from traders based in Nairobi and Mombasa. Both sites were stratified based on the living standards of most residents in each sub-county as presented in Tables 3 and 4.

Table 3. Charcoal traders survey sites in Mombasa

Sub-counties	Wards sampled	High-, middle- or low-income area
Changamwe	Port Reitz, Kipevu, Airport, Miritini, Chaani	Middle
Jomvu	Jomvu Kuu, Magongo, Mikindani	Middle
Kisauni	Mjambere, Junda, Bamburi, Mwakirunge, Mtopanga, Magogoni, Shanzu	High
Nyali	Frere Town, Ziwa la Ng'ombe, Mkomani, Kongowea, Kadzandani	Middle/high
Likoni	Mtongwe, Shika Adabu, Bofu, Likoni, Timbwani	Low
Mvita	Mji wa Kale/Makadara, Tudor, Tononoka, Shimanzi/ Ganjoni, Majengo	Middle/low

Table 4. Charcoal traders survey sites in Nairobi

Sub-county	Wards sampled	High-, middle-, or low-income area
Westlands	Parklands, Highridge, Kangemi	Middle/high
Dagoretti	Riruta, Dagoretti Corner, Kawangware	Middle/low
Lang'ata	Kilimani, Kibra	Middle/low
Embakasi	Utawala, Embakasi, Dandora Phase 2, Kayole, Mukuru Kwa Njenga	Middle/low
Njiru	Spring Valley, Njiru	Low
Kasarani	Roysambu, Kahawa, Mwiki	Middle
Kamukunji	Eastleigh North, Eastleigh South	Middle
Starehe	Ngara	Middle
Makadara	Maringo, Harambee	Low

The enumerators visited the charcoal vending sites in each of the sampled wards and interviewed the traders. A total of 92 traders, exclusive of transporters, were interviewed: 66 from Nairobi and 26 from Mombasa (Table 5).

Transporters were difficult to identify in the course of the study since transportation was largely done in secret due to the national ban on charcoal. As such, snowballing was used to identify them. Charcoal producers and traders were requested to assist in contacting the transporters after which they were requested to participate in the study. A total of 10 transporters were interviewed: five based in Mombasa/Kwale and five in Nairobi (Table 5).

Consumers were interviewed at the charcoal vending sites in Mombasa and Nairobi (as they came to buy charcoal) during the traders' survey using a semi-structured questionnaire. A total of 14 consumers were interviewed in Nairobi and 12 in Mombasa.

2.4 Data collection

Data was collected between September and November 2018 for a 12-month recall. The survey used a mixed methods research design which integrates both qualitative and quantitative research tools. A structured questionnaire (Appendix 1) was used to collect data from the value chain actors (tree/landowners, producers, traders and transporters) while a short semi-structured questionnaire was used to collect data from consumers (Appendix 2). The study also used a spring balance to measure the weight of the charcoal bags at production and vending sites. Qualitative methods used in the survey include: key informant interviews (KIIs) which were conducted using an open interview schedule, and; direct observation (especially on charcoal production and trade processes) recorded either as field notes or photographs. Some of the key informants interviewed included forest officers, local administrators, leadership of the producers' and traders' associations and, county and national government officials.

Table 5. Traders interviewed in Nairobi and Mombasa

County	No. of Respondents	Retailers	Wholesaler/Retailer Urban	Transporters
Mombasa	31	24	14	5
Nairobi	71	62	34	5
Total	102	86	47	10

2.5 Study limitation

The main limitation of the study is that it was undertaken six months into the national Logging Moratorium and Kitui Charcoal Ban of 2018. This means that some of the responses were confounded and/or influenced by these circumstances as value

chain actors were unwilling to divulge some information. Since charcoal movement was curtailed it was difficult to identify, let alone sample, transporters and traders. In addition, critical actors could have been left out of the sampling, specifically migrant charcoal producers and their labourers who often operate in state forests.



3

Results



A new kiln by the roadside in Kitui. Photo by Geoffrey Ndegwa

3.1 Baringo County charcoal value chains

Crop production was reported as the main source of household income by 96.8% of all households interviewed. This was followed by charcoal production and livestock keeping which were reported by 93.7% and 81.1% of households, respectively. Notably, 12.6% mentioned business entities such as kiosks, *boda-boda* and fruit vending as their main sources of income. Crop production was the most important income source, contributing to 46.1% of the households' income. This was followed by charcoal production (26.4%) (Figure 3).

Landholding in Baringo study sites ranged from 0.5 to 70 acres with most households having approximately three² acres. On average, respondents in the county have been producing charcoal from their own land for the last 5.2 years. However, some households had engaged in charcoal production for almost 20 years. In addition, about 54.5%, and 23.7% of the land was under crops and trees, respectively. Majority of trees harvested for charcoal were mainly on farmlands as reported by 65.3% of households.

3.1.1 Tree management and access

Majority of the landowners (65.3%) didn't undertake any management practices to support tree regeneration after harvesting. One of the major reasons given was that *Prosopis juliflora*, which is the main tree species for charcoal production, is a self-propagated invasive species. Nevertheless, 34.7% reported undertaking different forms of management practices to support regeneration of indigenous trees such as watering to enhance growth, fencing the area to protect seedlings and saplings from animal destruction, and pruning to ensure faster growth.

Majority (96.8%) of landowners interviewed had at least one member of the household engaged in charcoal production. They also sold trees or gave to other producers (migrant

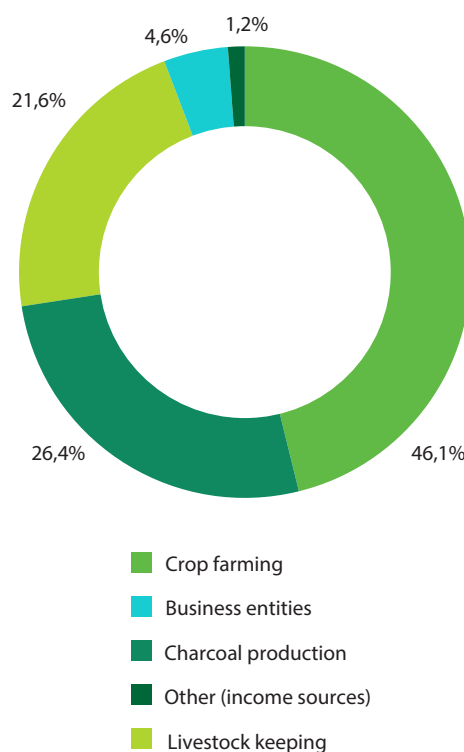


Figure 3. Main sources of household income in Baringo County

producers) for a share of charcoal as reported by 35.5% and 8.4%, respectively. Trees were sold for KES 500 to KES 1500 depending on the size, species and status of the producer (local or migrant). Landowners who opted to barter their trees for a share of charcoal received about 20% to 30% of the quantity produced.

The study also suggested that, on average, 51.6 bags of charcoal were produced by each individual between October 2017 and September 2018, with minimum and maximum production amounting to eight and 210 bags per year, respectively. There was also a general perception that the preferred tree species for charcoal production were mostly scarce³ as reported by 71.6% of the respondents. However, a section of respondents (28.4%) felt that the preferred tree species were still in abundance.

² The median was used since the mean was skewed by the few individuals who had large parcels of land.

³ It was explained to the respondents that: **Abundant** meant there are plenty of trees of the preferred species and size; **Scarce** meant that there are only a few suitable trees of the preferred species and size left, while; **Completely depleted** meant there are hardly any trees of the preferred species and size.

Majority of the respondents (94.7%) reported that they were aware of the rules and regulations governing tree harvesting for charcoal production. These regulations were aimed at controlling harvesting, production and movement. Eighty percent (80%) of the respondents were also aware of regulations that required acquisition of a permit to harvest trees, produce and even transport charcoal. Another 7.8% were also aware of regulations that prohibit harvesting of trees along riverbanks, while 5.6% were aware of regulations prohibiting clear-felling of trees.

Other regulations mentioned by respondents include prohibition of harvesting of immature trees and the requirement to utilize only dead wood and stumps for woodfuel. Moreover, majority of the respondents reported that enforcement of these regulations was the responsibility of the chiefs (73.7%) and KFS officers (34.7%) (Figure 4).

Among the landowners interviewed, only 4% reported that they had received some support on tree growing activities. This would include provision of tree seedlings, sensitization on the need to plant trees after felling and the importance of using dead/windfall wood in charcoal production, training/information on agroforestry, intercropping and other environmental conservation practices, marketing, and training on pruning techniques.

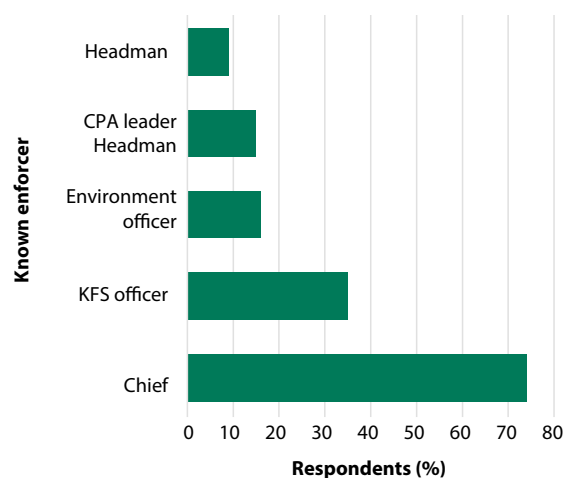


Figure 4. Regulators known to value chain actors

3.1.2 Charcoal production

Most people started producing charcoal because they perceived that it was very profitable (58.5%) or was an easy business to get into due to the low level of skills required (55.3%). Moreover, 25% joined the charcoal business because of the low capital requirement compared to other activities. Although large tracts of land in the study sites were colonized by *Prosopis juliflora*, only 4.3% of the respondents started producing charcoal to control its spread. In 45.7% of these households, it was the husband who was responsible for making the charcoal, whilst wives were responsible in only 6.5% of the households (Figure 5).

Most producers (96.8%) in Baringo sourced trees for charcoal from their own farms, harvesting mostly *Prosopis juliflora* (84%) and *Acacia lahai* (67%) (Figure 6). Tree preference was mainly based on availability of species (72%) and customer preference (63%). Other influencing factors were that it produced the best charcoal and was easy to work with. However, 77% of producers indicated that the preferred trees were scarce, while others indicated they were abundant (23%).

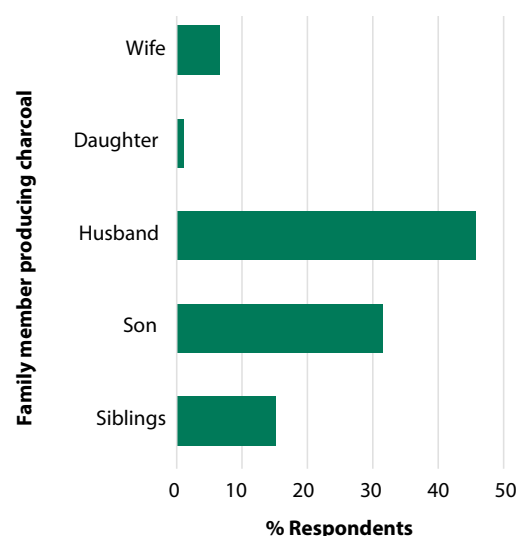


Figure 5. Family member involved in charcoal production

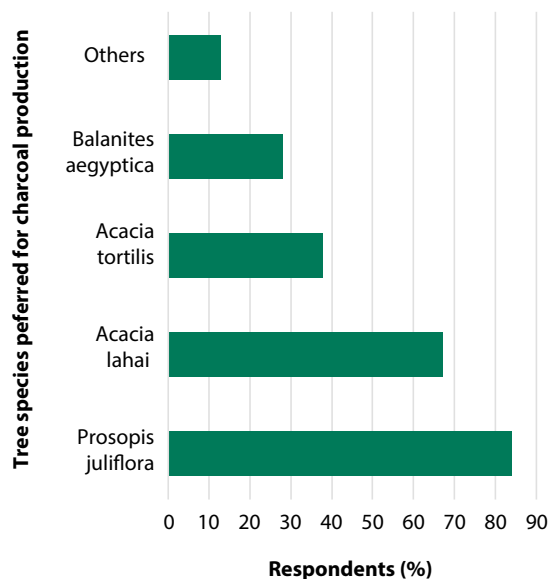


Figure 6. Main trees species preferred for charcoal production in Baringo

Charcoal production sites were generally located within a mean distance of 1.5 km from a road. They were located about 3 km from a tarmacked road and 2.1 km from a charcoal collection centre where bags of charcoal were being aggregated for the transporters. There were 17 collection centres in the study sites, 10 of them located in Salabani sub-location. These centres were as far as 42 km and 22.9 km from Marigat town, which is the biggest urban centre in the area (Table 6).

The survey results indicated that none of the respondents belonged to any producers' association, even though this is a legal requirement. About 70% of the respondents stated that they had not joined any association because they were not aware of any that they could join, while 28% stated that they were not interested. The rest of the respondents gave diverse reasons for not joining CPAs such as lack of awareness of benefits, lack of capacity/facilitation to form an association, and misinformation by brokers who prefer to deal with individual producers who they can easily exploit. All the respondents reported that they used traditional earth mound kilns to produce charcoal. About 90% of them indicated that they were pre-drying their wood before carbonization to improve the overall yield. On average, pre-drying of wood took 5.3 days and a production run, from kiln establishment to offloading was four days. The kiln yield was about six bags per run (Table 7).

About 64% of the producers indicated that they produced charcoal between the months of January and March, while 20% produced in the other months. January-March is the agriculture offseason. The highest level of production of about 15 bags per producer was reported between October 2017 and March 2018 which was before the charcoal ban took effect in the country. The production then dropped slightly to about 11 bags per producer from March 2018, which may have been

Table 6. Accessibility of the charcoal production sites in Baringo

	Distance from nearest motorable road (km)	Distance from nearest tarmac road (km)	Distance from nearest collection centre (km)	Distance to nearest rural centre (km)	Distance to nearest major town (km)
N	94	94	94	94	94
Mean	1.5	3.0	2.1	2.3	22.9
Median	1.0	2.0	2.0	2.0	25.0
Std. Deviation	0.7	1.9	1.2	.99	10.3
Range	0.5 -4	1 -12	0.5 -7	.5-6	1-42

Table 7. Charcoal production statistics in Baringo

	Wood pre-drying days	Average charcoal yield of a kiln (90-kg recycled bag)	Production-run duration
N	85	94	94
Mean	5.3	6	3.8
Std. Deviation	1.8	2.1	1.9
Range	1 -14	2 -15	2 -14

caused by the national logging moratorium and charcoal ban. Based on actual field measurements, the average weight of a bag of charcoal in Baringo was estimated to be 38 kg. Using Equation 1 below and the parameters in Figure 7, the weighted annual production (W_p) per producer in Baringo was estimated at 49 bags.

Equation 1

$$WP = \left[\left(\sum_{n=1}^{n=4} (Y * X) \right) \div 4 \right] 12$$

Where: W_p is Weighted annual production per producer
 Y is the percentage of active producers in quarter n
 X is the number of bags produced in quarter n
 4 is the number of quarters
 12 is the number of months in one year

Charcoal production was undertaken during periods when there were no farming activities (36%), during seasons when the community was struggling to cope with drought (28%) and when there were no alternative sources of income (19%) (Figure 8). Low production in other months was due to commitment of labour in farming activities (81%); unfavourable weather conditions, especially rain that leads to destruction of kilns and makes access roads impassable (12%), as well as low charcoal demand leading to poor prices (9%).

3.1.3 Charcoal sales by producers

Over 95% of the charcoal produced in Baringo was sold to local brokers located in various centres in Kiserian, Mbechot and Salabani sub-locations. According to some brokers, charcoal was aggregated at collection points and sold to transporters who transferred it to various destinations including Nakuru, Nairobi and even

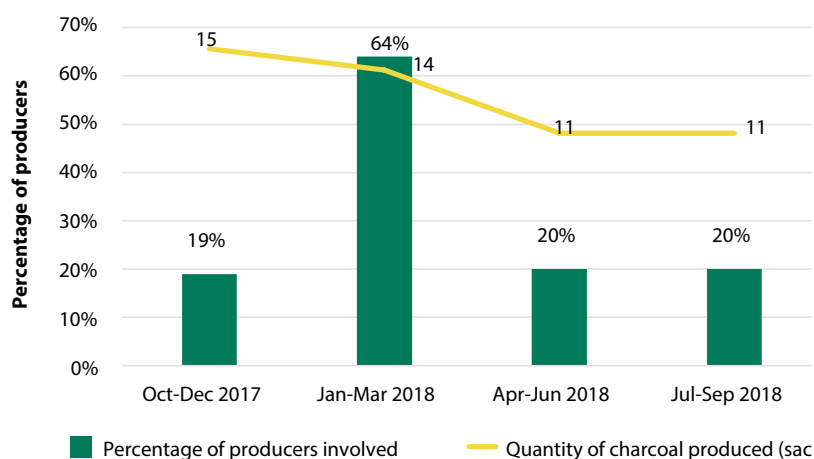


Figure 7. Average rate of charcoal production and duration of involvement in Baringo

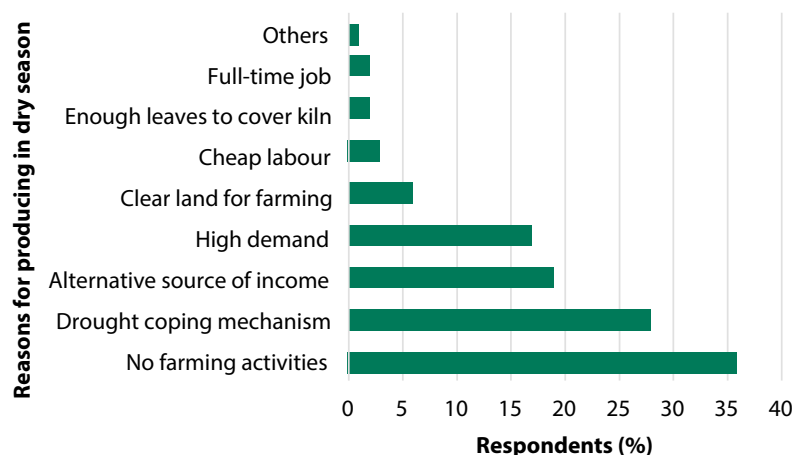


Figure 8. Reason for higher charcoal production during the dry season in Baringo

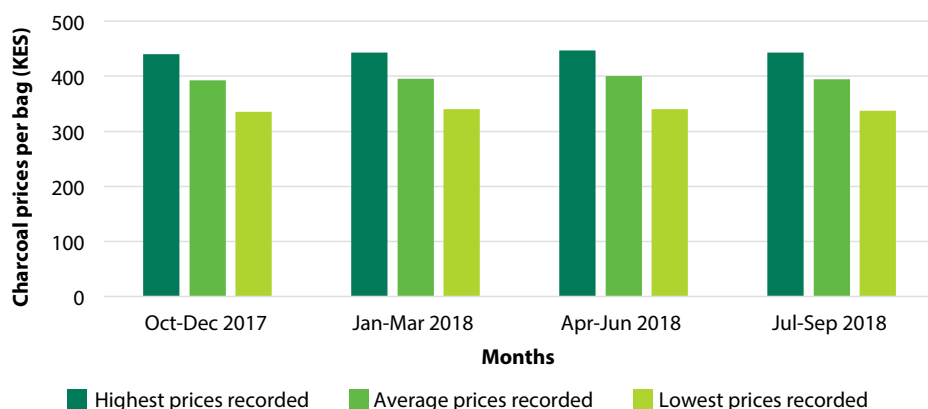


Figure 9. Charcoal producer prices in Baringo over 12 months prior to the survey

Mombasa. The highest producer prices for charcoal as reported over the four quarters in focus was between KES 440 and KES 447 per bag (Figure 9). Likewise, there was a negligible difference between the highest and the lowest price paid to the charcoal producers between the four quarters.

The price offered by brokers and transporters, and demand and supply for charcoal were key factors that influenced the selling price as mentioned by 50% of the producers. Distance to the market was also reported as another factor that had an impact on the selling price, with producers closer to urban centres attracting higher prices. Majority of producers (81%) reported that they sold charcoal at or near the production site. This was because most of the buyers were local brokers with good knowledge on the location of most sites. However, about 53% of producers reported that they transported their charcoal to common collection centres where it was sold to customers. In addition, 33% reported displaying charcoal by the roadside, especially along roads passing through Mosuro, Ipunyaki, Sokotei as well as those leading to Marigat town.

Majority of the traders transported charcoal either on foot (68%) or on motorbikes (19%) as they sold their charcoal at or around the production site. However, 14% reported that they transported the charcoal to clients using a truck or pick-up, signifying the long distance and/or the large quantity required. Of the people who transported the product to clients, 67% did not own the means, thus relied on hiring, while 33% owned the means of transport used.

3.1.4 Main challenges faced by the charcoal producers

The main challenges highlighted in the county included: poor road infrastructure (75%), price fluctuations (42%), and extreme weather conditions, especially floods which damage charcoal kilns and make roads impassable (31%) (Figure 10). All the respondents also reported that they had never received any support from either the government or non-governmental organizations (NGOs) in the course of their charcoal production activities. The top three suggestions by producers to improve the charcoal production business in Baringo were; i) improving access to training and extension services on improved charcoal production technologies and skills (48.9%), ii) improving the road infrastructure to ease transportation (46.8%) and iii) putting in place measures that will lead to improved and stable market prices (38.3%).

3.2 Kitui County charcoal value chains

3.2.1 Land ownership and management

As many as 63% of landowners' households in Kitui County were male-headed. The mean age for the household head was 44 years, while mean household size was seven members.

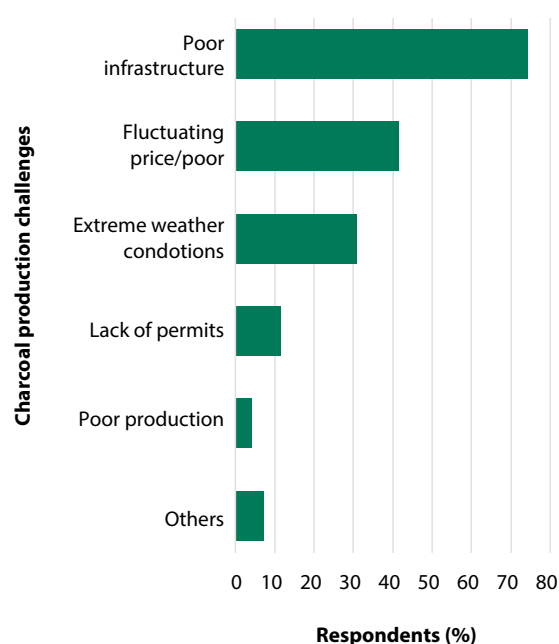


Figure 10. Main challenges faced by the charcoal producers in Baringo

In addition, 11% and 3% of landowners had attained secondary and post-secondary education respectively, whilst 49% and 12% had attained upper primary (Class 5-8) and lower primary (Class 1-4), respectively. However, almost a quarter (25%) had never attended any formal education system. The main source of household income was said to be crop production (89.9%), livestock rearing (70.5%) and charcoal production (40.9%). Moreover, crop production was the main income source for most landowners (39.3%), followed by livestock rearing (17%), and charcoal production (14.4%), as shown in Figure 11.

The median landholding in Kitui was about 20 acres. Approximately half (51%) of the land was reported to be under crops and 35% under trees. Most of the trees harvested for charcoal production often came from the land under trees (58%), grazing land (23.5%) and cropland (17%) (Table 8).

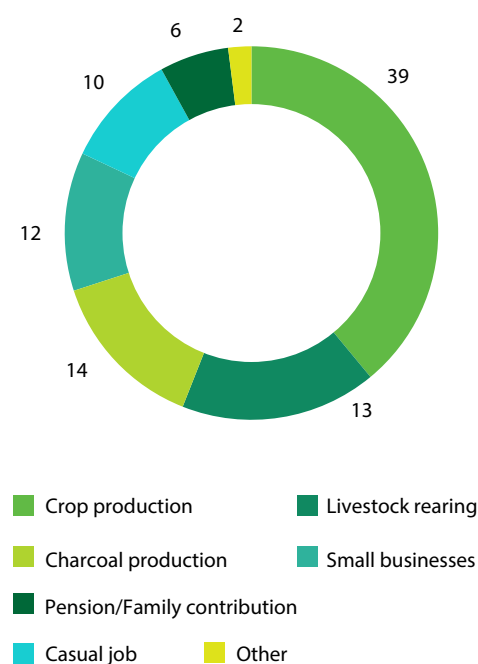


Figure 11. Contribution of different sources of income to households in Kitui

Table 8. Current and future sources of trees for charcoal in Kitui

Land use	Idle/Fallow	Grazing	Farming	Other
Current	58	23	17	1
Future	61	34	17	3

Majority of landowners (70%) did not engage in any management practice that supports tree regeneration after harvesting. Some of the reasons given were that: they were too old to engage in tree planting and management; they lacked tree planting and management skills; and, the indigenous trees regenerated naturally. However, about a third (30%) were undertaking some management practices to support regeneration, including fencing the harvested area to prevent destruction of saplings by livestock. Landowners were selling their trees to other charcoal producers at costs ranging from KES 100 to KES 3000. The cost of trees in the area was dependent on size, species and type of producer (local or migrant). Landowners also traded trees for a share of charcoal charged at the rate of 30-50% of the total quantity of charcoal produced.

3.2.2 Charcoal production

Most households interviewed (90%) had at least one member who engaged in charcoal production. In most cases it was the husband (38%), wife (26%) or son (17%) (Figure 12). Only in 1% of households was a daughter involved. Study results further indicated that producers in Kitui produced an average of 43.9 bags of charcoal between October 2017 and September 2018. About 64% of producers felt that their preferred tree species were scarce, with only 25% indicating they were still in abundance. Furthermore, 11% of the respondents reported that their preferred tree species had been completely depleted.

Majority of the respondents (90%) reported that they were aware of the regulations governing tree harvesting for charcoal in the study sites. These regulations included the ban on charcoal production (69%), seeking permits from chiefs to harvest mature trees (19%) and restricted use of power saws for mass harvesting of trees (13%). Among the

landowners interviewed, only 3% reported receiving support on tree growing activities. The support included training on good tree management practices (planting, caring and pruning) and efficient charcoal production technologies.

Crop production was the main income source for many (88%), followed by livestock rearing (70%), and charcoal production (61%). In fact, crop production accounted for 41% of the charcoal producers' household income, followed by charcoal and livestock production at 21% and 17%, respectively. Casual labour and running small businesses such as fruit vending, sale of handicrafts, retail shops, hotels and small kiosks were also significant contributors (Figure 13). Several of the respondents indicated that high profit margins (60%) and lack of alternative income sources (59%) were the main factors pushing people to the charcoal production business (Table 9). However, about 12% joined the charcoal trade as it was a common family business.

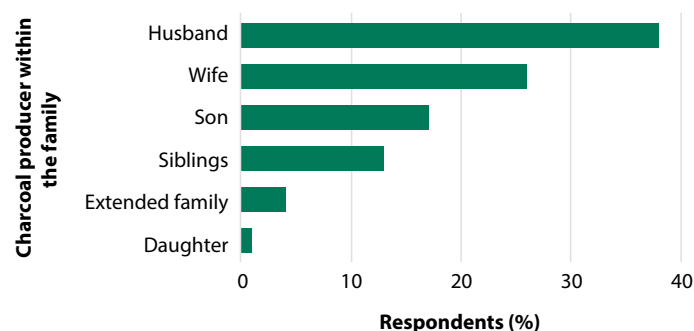


Figure 12. Person responsible for actual charcoal production in family land in Kitui

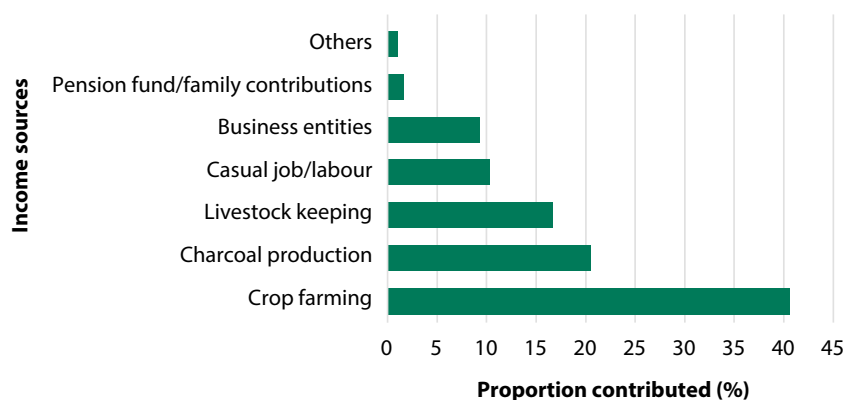


Figure 13. Main sources of household income for charcoal producers in Kitui

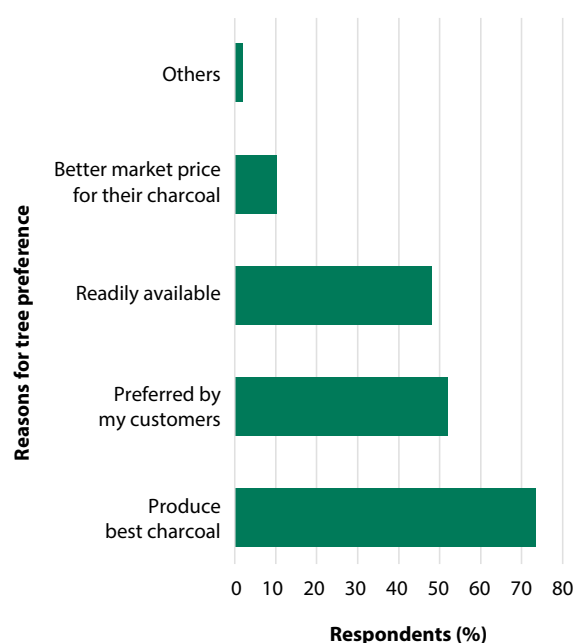
Table 9. Reasons for joining the charcoal production business in Kitui

Reasons	% Respondents
Manage invasive species	2
Common trade in the family	12.1
Little to no initial capital requirement	14.1
Easy to get into	15.2
Only income-generating option	58.6
Very profitable	59.6

Table 10. Main trees species preferred for charcoal production in Kitui

Species		% respondents
Scientific name	Local name	
Others		5
<i>Boscia coreacea</i>	Kisivu	2
<i>Terminalia Klimandscharica</i>	Kiyuuku	3
	Kituu	3
<i>Manilkara machisa</i>	kinako	4
<i>Acacia melifera</i>	Kitha/muthia	5
<i>Commiphora africana</i>	Itula	5
<i>Newtonia hildebrandtii</i>	Mukame	5
<i>Albizia amara</i>	Kyunduo	7
<i>Strychnos spinosa</i>	Mwae/kyae	10
<i>Acacia nilotica</i>	Musemei	13
<i>Cassia abbreviata</i>	Mwathandathe	14
<i>Acacia elatior</i>	Munina	19
<i>Delonix elata</i>	Mwange	24
<i>Acacia gerrandii</i>	Musuisui	25
<i>Dombeya rotundifolia</i>	Mutoo/kitoo	53
<i>Acacia tortilis</i>	Mwaa	64

Majority of the charcoal producers in Kitui (92%) reported that they sourced trees from their own farms. In addition, 13% of respondents sourced trees from neighbouring farms either for free, at a fee or in exchange for charcoal with the landowner at the rate of 20% of charcoal produced. Only 3% said they sourced trees from private forests/ranches. For those who bought trees, a tree with wood that could produce about 10 bags of charcoal was sold for between KES 500 and KES 1000. The most preferred tree species for making charcoal were *Acacia tortilis* and *Terminalia prunioides* as indicated by 64% and 53% of producers, respectively. Other trees species used included *Acacia gerrardii*, *Delonix elata* and *Acacia elatior* (Table 10). Tree preference was said to be influenced by quality of charcoal produced (74%), customer preference (52%) and availability (48%) (Figure 14). However, 64% of the respondents indicated that their preferred tree species were already scarce, while 19% reported that their preferred tree species had been depleted.

**Figure 14. Reasons for producer preference of certain tree species for charcoal in Kitui**

All the respondents used traditional earth mound kilns. A majority (83%) were not pre-drying wood before carbonizing. On average, wood pre-drying took 6.7 days and a production run, 8.7 days. A charcoal kiln was said to yield about 12 bags of charcoal (Table 11).

Table 11. Charcoal production statistics in Kitui

	Wood pre-drying days	Average charcoal yield of a kiln (sacks)	Production-run duration
N	17	99	99
Mean	6.7	11.9	8.7
Std. Deviation	3.3	8.3	4.3
Range	2-14	2-40	2-21

Charcoal production sites were located about 3 km from an all-weather road and 77 km from a tarmacked road. The average distance between production sites and collection centres was just over a kilometre (Table 12).

Collection centres were located in Ndetani, Katumbi, Nguuni and Malawa sub-locations, which were about 4 km to 92 km from the nearest major towns such as Kitui, Mwingi, Thika and Nairobi.

About 88% of the respondents indicated that they often produced charcoal between the months of July and September (Figure 15). The highest rate of charcoal production in the 12 months preceding the survey was between October and December 2017 at 31 bags per producer per month. Very low volumes of production were reported from January 2018. This was attributed to the ban on charcoal by both the County of Kitui and national government which was stringently enforced. Based on actual field measurements, the average weight of a bag of charcoal in Kitui was 46 kg. The weighted production per producer calculated using *Equation 1* was 33 bags per annum.

Producers engaged in charcoal production for various reasons including: i) when there was no farming (42%) especially between January

Table 12. Accessibility of charcoal production sites in Kitui

	Distance from nearest motorable road (km)	Distance from nearest tarmac road (km)	Distance from nearest collection centre (km)	Distance to nearest rural centre (km)	Distance to nearest major town (km)
N	99	99	13	99	99
Mean	3.3	76.7	2.2	3.5	92.5
Std. Deviation	4.5	34.8	1.4	4.0	18.4
Minimum	<25	17-137	0.1 -5	<25	55-137

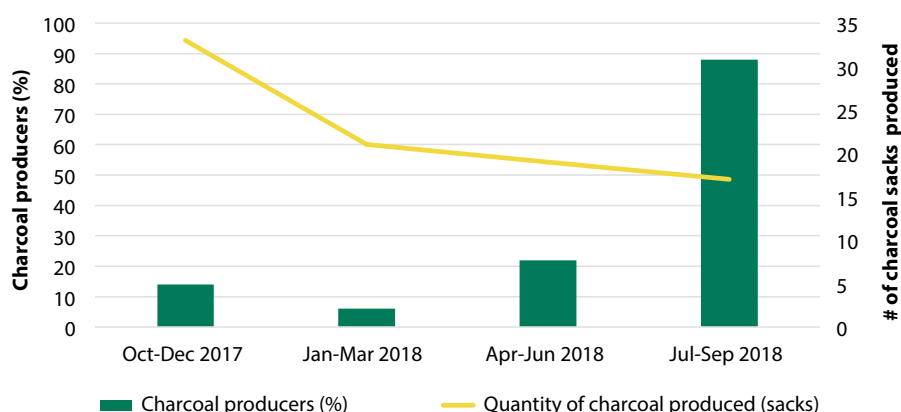


Figure 15. Average rate of charcoal production and duration of involvement in Kitui

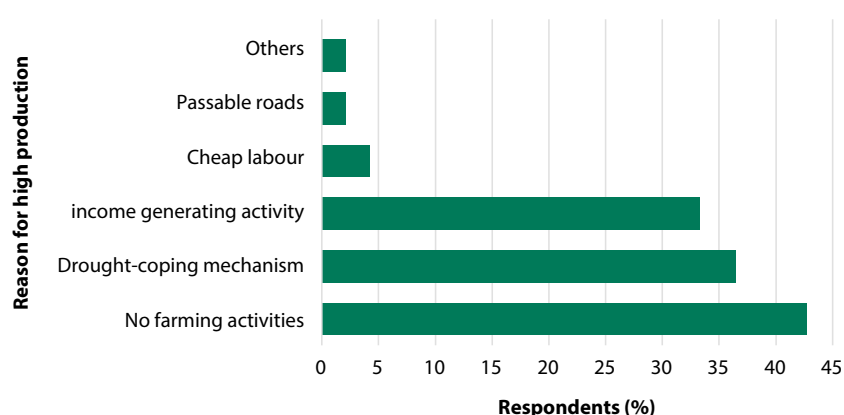


Figure 16. Reasons for higher engagement in charcoal production in Kitui

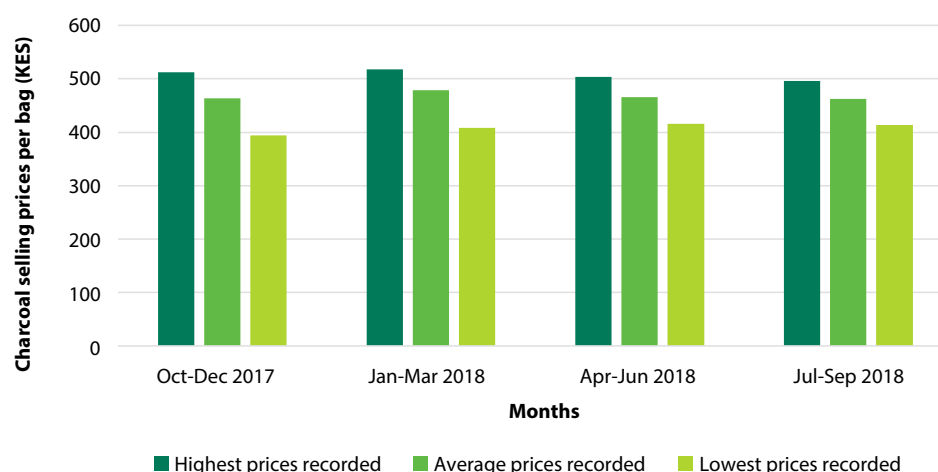


Figure 17. Charcoal producer prices in Kitui over a period of 12 months prior to the survey

and March, and July and September; ii) as a coping mechanism during drought (37%); and, iii) as an income-generating activity (33%) (Figure 16). Conversely, there were some months with low production mainly due to: i) commitment of labour to farming activities, especially between the months of April and May (88%), or ii) unfavorable weather conditions especially during rainy days leading to destruction of kilns besides making access roads impassable. Other reasons for reduced production were adequate household food resources and lack of casual labourers to support production activities.

3.2.3 Charcoal transportation and sales

Majority of the producers (66%) in Kitui sold their charcoal to wholesalers while 24% sold to transporters. Only 5% and 3% sold their products directly to retailers and local brokers respectively, while a few (2%) sold to households within their neighbourhood. Charcoal brokers acted as a conduit for transporters or wholesalers. The average producer price was relatively stable at around KES 464, except in the months of January to March 2018 when it stood at KES 479 (Figure 17). However, the lowest price paid to

charcoal producers crossed the KES 400 mark in 2018 from KES 394 in the months of October to December 2017. The prices were said to be largely influenced by charcoal demand and supply dynamics (75%), and seasons (21%) with higher and lower prices reported during the wet and dry seasons, respectively. Other factors that affected producer prices were informal taxes (bribes), government ban and lack of transportation, a burden that is mostly passed on to consumers. Thus, the ban created scarcity and increased avenues for informal taxation, resulting in price increases.

About 74% of producers sold their charcoal to customers both within and around the production sites. Moreover, 27% displayed some of their products along the roadsides to attract customers who were then led to where charcoal was stocked. Some (less than 5%) transported their charcoal to common collection points, delivered to customers or supplied local markets. The main mode of transportation used by producers was by foot (73%), while others used motorcycles (12%), handcarts or donkey carts (9%). Many transported the charcoal on foot because majority of their customers, charcoal collection points or markets were close to the production sites. For those who used other means of transport, only 33% owned the means of transport, while the rest had to hire.

The survey indicated that only 10% of producers were members of charcoal associations. Most respondents indicated that

there were no associations to join (82%) whilst others, (around 5%), reported lack of interest, feared demands and/or showed apathy due to poor performance of these groups. However, several associations were identified in the study sites. Joining fees were said to range from KES 100 to KES 500 (Table 13). Sometimes there were additional levies paid for every bag of charcoal produced through the association. Those who were members of associations indicated that they had not yet begun to produce charcoal through their groups.

3.2.4 Main challenges faced by charcoal producers

The two main challenges faced by charcoal producers in Kitui include: i) lack of proper equipment/tools (65%) especially power saws; and ii) price fluctuations (22%) (Figure 18). In addition, producers indicated that they were yet to receive any support from either the government or NGOs on charcoal production (97%). Only 3% of the producers interviewed noted that they had received some form of support from KFS – tree seedlings, plus training on tree harvesting and charcoal production using improved kilns.

Producers identified some key interventions to improve the industry including: i) increase charcoal prices (42%); ii) formation of CPAs (32%); iii) provision of support/extension services (23%) such as training on improved technologies, and promoting access to loans and tree seedlings (Figure 19).

Table 13. List of Charcoal Producers' Associations in Kitui and some of the membership requirements

Name of association	Year formed	No. of members	Registration fee	Other requirements
Ndetani Charcoal Production Association	2015	150	300	Resident of the village
Mitaani Charcoal Burners	2016	20	100	KES 100 deducted for every bag of charcoal produced
Engamba Charcoal Farmers	2014	60	100	None
Wakalwa Self-Help Group	2014	80	300	Be a charcoal producer
Mwalili Farmers' Association	2016	100	100	None
Katwikila Coal Association	2015	15	500	Be a charcoal producer
Mwingi East CPA	2012	150	200	Be a charcoal producer

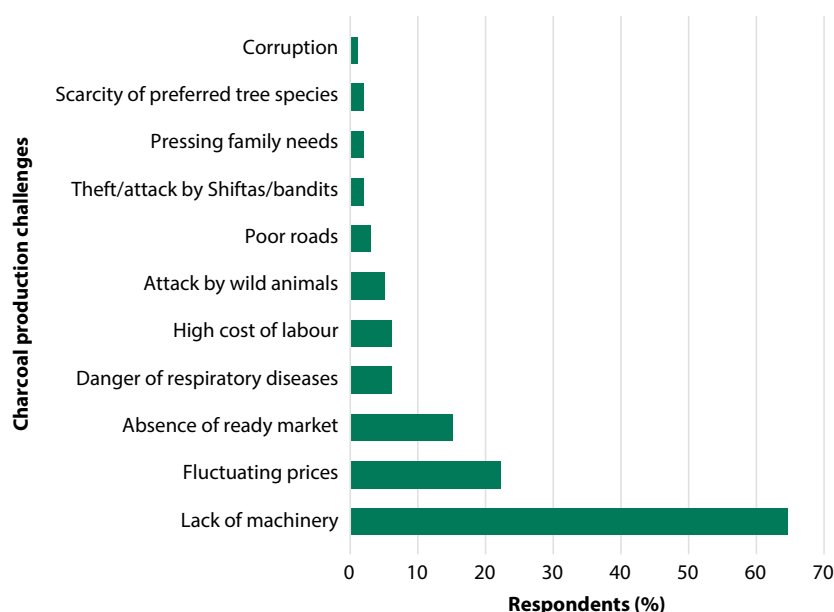


Figure 18. Main challenges faced in the course of charcoal production in Kitui

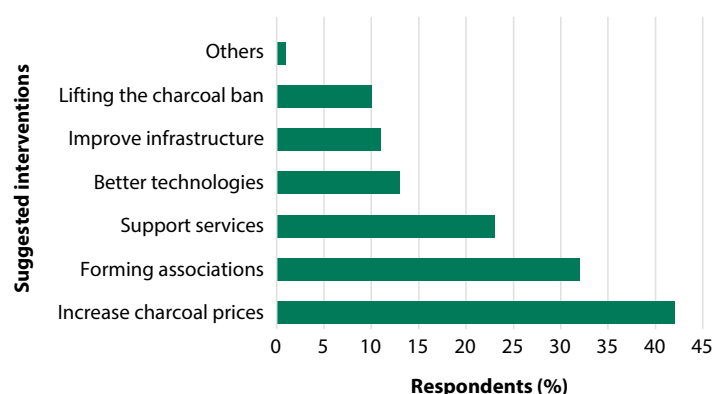


Figure 19. Interventions to improve charcoal production business in Kitui

3.3 Kwale County charcoal value chains

3.3.1 Land ownership and management

About 87% of households in the survey were male-headed. The average age of the household head was 44 years, while household size stood at nine members. Of those interviewed, 29% and 26% of respondents had attained upper and lower primary education, respectively, whilst less than 6% had attained secondary and post-secondary education. A number of respondents (36%) had never been through any kind of formal education.

Crop production, charcoal production and livestock rearing were the main sources of income for 97%, 74% and 48% of respondents, respectively. Other sources of income included small businesses (10%) and formal employment. Crop production contributed the largest share to total household income, followed by charcoal production and livestock rearing (Figure 20).

Results from the study showed that the mean landholding in Kwale was 17.1 acres per family with a minimum and maximum of two and 200 acres, respectively. On average, households had undertaken charcoal production in the study area for 8.8 years, with the longest duration reported being 30 years. Most of the land in the study site was under crop production (61%), while 26% and

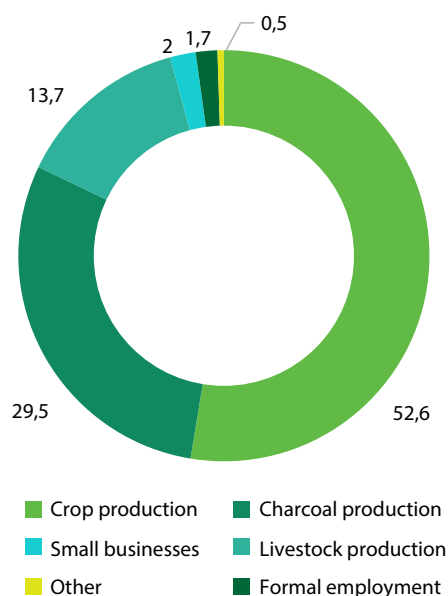


Figure 20. Contribution of different sources of income to households in Kwale

13% was under trees and fallow, respectively. The study indicated that 74% of landowners did not undertake any management practices to support tree regeneration. The main reasons cited include lack of relevant skills, harsh weather conditions that do not support tree planting, water scarcity and competition with other crops. However, 26% reported that they were undertaking various management practices such as manure application, planting tree seedlings and pruning.

Most of the respondents (83%) reported that they were not aware of any regulations that governed cutting of trees for charcoal. However, 17% noted that they were aware of some regulations such as, "cut one tree and plant five trees"; "cut one tree and plant 10 trees"; ban on logging; and, the requirement to apply for licenses. Only 4% of respondents had received some form of support in tree growing either from the government or NGOs. Those who received support stated it was mostly in the form of tree seedlings.

3.3.2 Charcoal production

Almost all (97%) of charcoal producers were male. In these households, average age of the head was 45 years, and each family comprised about 10 members. About 36% and 34% of

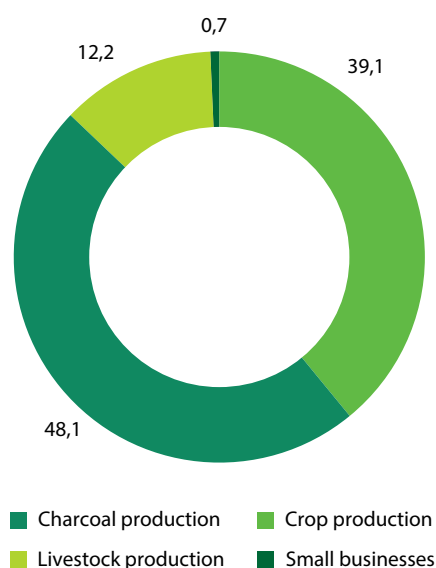


Figure 21. Household income contribution for charcoal producers

producers had attained lower primary (Class 1-4), and upper primary (Class 5-8) education, respectively. Approximately 7% had attained secondary education, whilst 24% had not undergone any form of formal education.

Main sources of income for households were: charcoal production (100%), crop production (98%) and livestock rearing (64%). Other sources of income reported by respondents were small businesses such as kiosks. Charcoal production, crop production and livestock rearing accounted for 48%, 39% and 12% of the total household income, respectively (Figure 21).

About 94% of the households had at least one member who was engaged in charcoal production. In these households, husbands (54%) and sons (28%) were the ones mainly responsible for charcoal production (Figure 22). Only in rare instances did households sell trees to locals and migrant producers. They produced an average of 54 bags per month between October 2017 and September 2018.

Majority of the charcoal producers (97%) were involved in the business because it was the only available income-generating activity in the area. In addition, 51% indicated that charcoal is a common trade practised by the family, while 31% reported that it required little or no capital

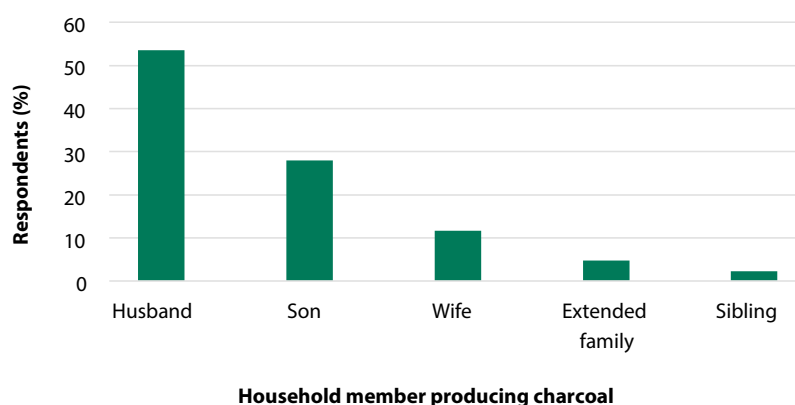


Figure 22. Persons responsible for charcoal production in family land in Kwale

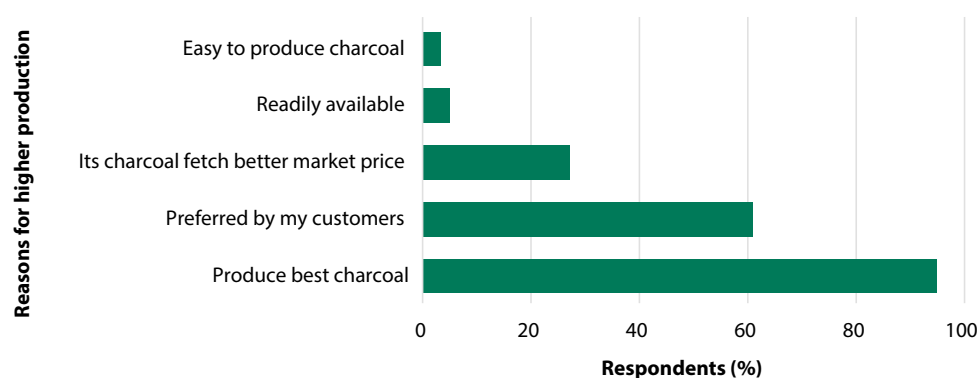


Figure 23. Reasons for producer preference of certain tree species for charcoal in Kwale

Table 14. Main tree species preferred for charcoal production in Kwale

Tree species		% respondents
Scientific name	Local name	
<i>Manikara mochis</i>	Mnago	68
<i>Terminalia prunioides</i>	Mwanga	56
<i>Acacia drepanolobium</i>	Mongololi	53
	Mlozi	20
<i>Diospyros cornii</i>	Mkulu	20
<i>Grewia bicolor</i>	Mkone	17
	Mchirang'ombe	14
<i>Acacia senegal</i>	Kikwata/Chikwata	7
	Kinyerere	7
<i>Thespesia danis</i>	Muhohe	5
<i>Tamarindus indica</i>	Mkwaju	3
Others		3

to start. Producers in Kwale indicated that they sourced trees for charcoal mostly from their own farms (68%) and government forests (34%). The most preferred tree species include *Manikara mochiso* (64%), *Terminalia prunioides* (56%) and *Acacia drepanolobium* (53%). Others were *Diospyros cornii*, Mlozi, *Grewia bicolor*, Mchirangombe, *Acacia senegal* and *Thespesia danis* (Table 14).

Majority of the respondents (71%) reported that their preferred tree species had become scarce over the years with only a few left on farms. In addition, 22% reported that suitable tree species for charcoal had been depleted. Preference for species was mainly based on the quality (calorific value and burning characteristics) of charcoal produced (95%), preference by customers (61%) and market price (27%) (Figure 23). Factors such as availability of trees and ease of working with trees had little influence on the choices made by producers.

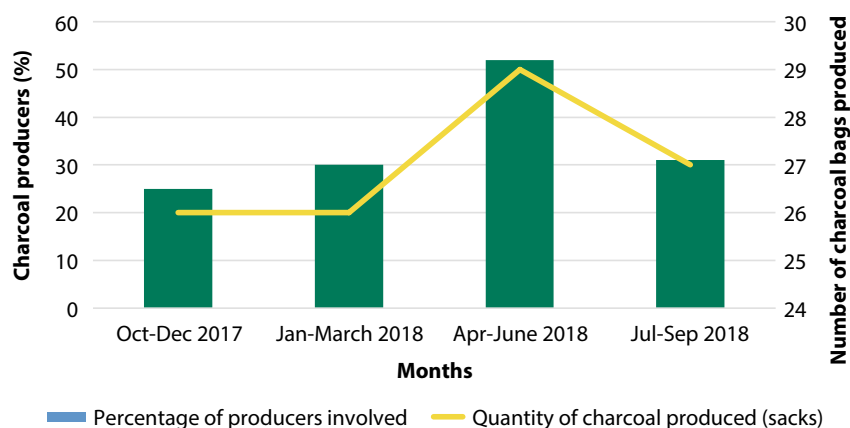


Figure 24. Average rate of charcoal production and duration of involvement in Kwale

All the respondents used traditional earth mound kilns. In addition, most (96.6%) were not pre-drying their wood before carbonization. Those who were pre-drying wood, reported that the exercise usually took 6-14 days. Furthermore, the overall charcoal production process from establishment of kiln to final offloading took about seven days, with an average kiln producing approximately 15 bags of charcoal.

The proportion of producers involved in the trade rose steadily from October-December 2017 to April-June 2018, and declined in the third quarter – July-September 2018 (Figure 24). The rise in the number of producers was mainly influenced by: i) high prices of charcoal (54%); ii) it was a more reliable alternative income-generating activity than farming (31%); and, iii) coping strategy during seasons of drought (15%). Equally, some individuals did not produce any charcoal when prices were too low (51%) and when there was high labour demand for farming (47%).

3.3.3 Charcoal movement and sale

The average distance of charcoal production sites was about 5 km from a motorable road and 59 km from a tarmacked road (Table 15). The distance between production sites and charcoal collection centres, the nearest markets and major towns were 20 km, 17.5 km and 63.6 km, respectively.

Local brokers were the main buyers of charcoal as reported by 93% of respondents. A few (about 5%) of the transporters and wholesalers purchased from producers. Just like the production levels, charcoal prices rose steadily from the last quarter of 2017 (October-December) to the second quarter of 2018 (April-June), coinciding with the period when the national charcoal production ban took effect (Figure 25), and then declined slightly. The average producer prices for a bag of charcoal ranged from KES 382 to KES 445.

Table 15. Accessibility of charcoal production sites in Kwale

	Distance from nearest motorable road	Distance from nearest tarmac road	Distance from nearest collection centre	Distance to nearest rural centre	Distance to nearest major town
N	58	59	32	58	59
Mean	5.0	59.2	20.0	17.5	63.6
Std. Deviation	3.5	24.1	9.0	13.9	22.7
Minimum	0.1-15	0.2-105	5-40	0.5-70	30-105

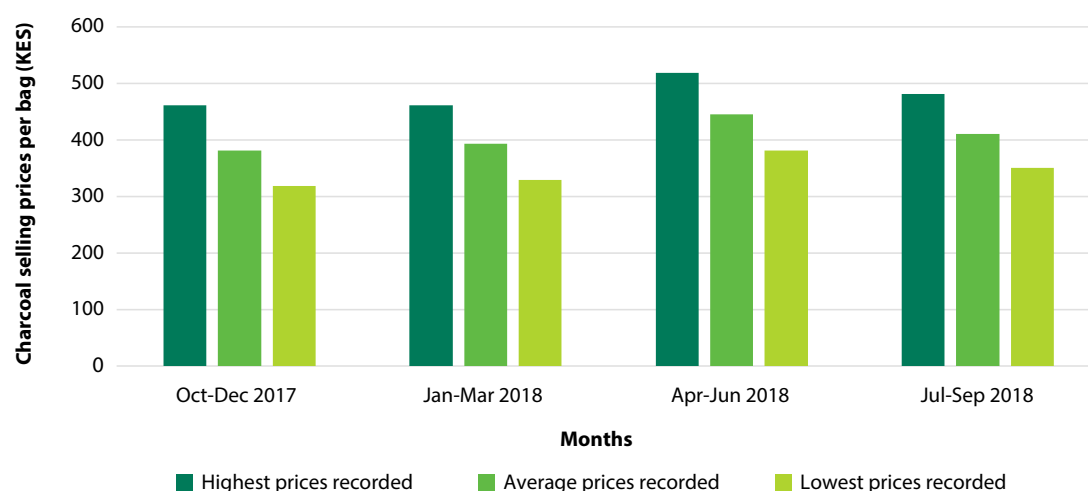


Figure 25. Charcoal producer prices in Kwale over 12 months prior to the survey

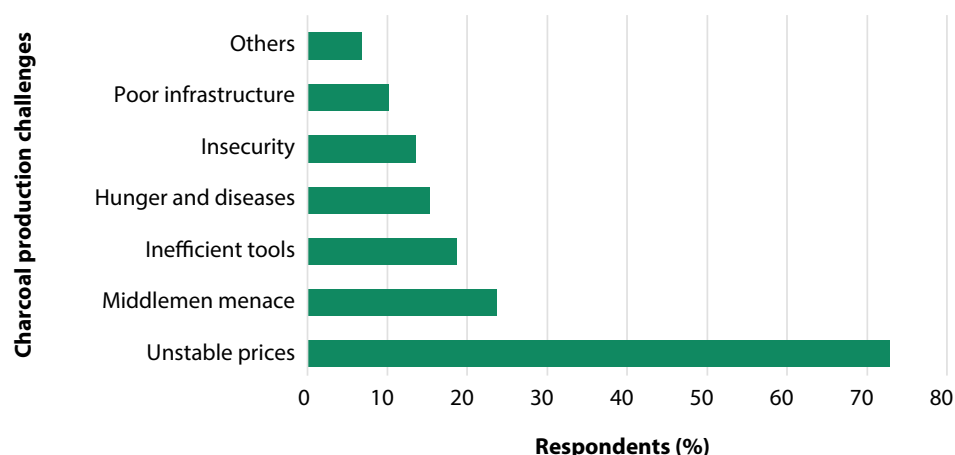


Figure 26. Main challenges faced in the course of charcoal production business in Kwale

According to some respondents, key factors influencing the price of charcoal in Kwale included type of trees used to produce charcoal (48%) and the dynamics of demand/supply (37%). Seasons, and availability of food in the locality also had some influence on the price. Almost all producers (98%) reported that they were selling charcoal at or close to production sites. A few others (2%) reported that they either displayed the product by the roadside or transported it to their customers' premises. Out of those who transported charcoal to markets, most (83%) used motorcycles. However, 11% transported their charcoal on foot, as they did not own any means of transportation, while a very small proportion (2%) cycled or used trucks/pick-ups.

The main challenges faced by charcoal producers in Kwale were price fluctuations (73%); exploitation by middlemen (24%); and, lack of proper working tools and equipment (19%). Hunger and diseases, insecurity and the national charcoal ban were also mentioned as minor challenges (Figure 26). Despite all this, none of the respondents had received any support from either a governmental or non-governmental institution. Key suggestions to address the challenges were: i) enhancing access to and provision of training and support services (53%); and, ii) improving the entire market system and charcoal prices (49%). In addition, none of the producers interviewed were members of charcoal-related associations. The reason given was that there was no association to join (100%), and some lacked interest to join/form an association (31%).





4

**City charcoal
trade flows**

4.1 Nairobi City trade

4.1.1 Transportation to Nairobi

A total of five transporters based in Nairobi, all male, were interviewed during the study. Two of them were involved in charcoal transport from Baringo to Nairobi, two from Busia (Uganda/South Sudan) to Nairobi and one from Kitui to Nairobi. Results in Table 16 indicate that they were making between two and five trips per month and about one trip per week. Transporters from Kitui and Busia, shipped the highest volume of charcoal per trip (160-170 bags) while those from Baringo transported between 90-110 bags using a smaller truck. One transporter from Busia and another from Baringo used long-distance cargo trucks on their way to Mombasa to transport charcoal at a flat fee of KES 200 and KES 300 per bag transported, respectively. The study further revealed that one of the transporters on the Busia-Nairobi and another on the Baringo-Nairobi route owned the means of transport, while a third one mostly used hired transport. The main clients for all transporters were wholesalers and retailers, although they sometimes sold the product directly to institutions.

The Baringo-Nairobi route transporters had their own charcoal yards in the city where

hundreds of bags of charcoal were offloaded before selling them at a wholesale price. However, the Busia-Nairobi and Kitui-Nairobi transporters didn't have yards and preferred selling the product from the trucks. They do this by giving the truck to brokers who drive around the city selling the charcoal to wholesalers or retailers at a mark-up of 20-50% on the price demanded by the transporters. This was reported as one of the factors that had resulted in the overall high cost of charcoal in the city.

The respondent transporters from Busia were buying charcoal from other transporters who sourced the product from either Uganda or South Sudan. A bag of charcoal was bought at a cost of KES 900 and the transporter had to pay custom duty at the rate of KES 94 per bag to cross the border. A transporter would lodge in Busia for about two to three days as they bought the charcoal and organized for transport. The cost of lodging ranged from KES 4000 to KES 7000 depending on duration of stay and the facility providing accommodation. Other costs associated with procurement of charcoal were loading and offloading fees, cess and market fees as shown in Table 17. The transporters then offload the charcoal onto their vending sites from where they would sell to either wholesalers, retailers or businesses.

Table 16. Volumes and prices along various transportation routes

Transporter	Route	No. of trips per month	No. of bags per trip	Own the means of transport	Mode of distribution/selling	Main clients
1	Baringo-Nairobi	4	110	No	Offloads and sells from own yard	Wholesalers, institutions, retailers
2	Baringo-Nairobi	5	90	Yes	Offloads and sells from own yard	Wholesalers, businesses
3	Busia-Nairobi	4	160	No	Gives the truck to brokers to vend around city	Brokers who sell to wholesalers, retailers and institutions
4	Busia-Nairobi	2	170	Yes	Gives the truck to brokers to vend around city	Brokers who sell to wholesalers, retailers and institutions
5	Kitui-Nairobi	4	170	No	Gives the truck to brokers to vend around city	Wholesalers and retailers

Table 17. Key charcoal business statistics for Nairobi-based transporters

Cost item description	Transporter 1	Transporter 2	Transporter 3	Transporter 4	Transporter 5
Charcoal source	Transporters from Uganda/ S. Sudan	Transporters from Uganda/ S. Sudan	Producers or CPAs in Baringo	Producers or CPAs in Baringo	Producers in Kitui
Buying price (KES/bag)	900	900	450	450	450
Custom fee per bag (KES)	94	94	-	-	-
Cost of hiring truck/flat charge per bag* (KES)	32,000 (200)	-	27,000 (300)	-	45,000*** (265)
Cost of driver per trip (KES)	-	5000 (29)	-	4000 (44)	-
Cost of driver assistant per trip (KES)	-	3000 (18)	-	-	-
Loading labour (KES per bag)	20	18	32	40	20
Offloading labour (KES per bag)	50	53	-	-	-
Cost of fuel (KES)	-	20,000 (118)	-	15,000 (167)	-
Cost of servicing car per month (KES)	-	4000 (12)	-	8000 (18)	-
Accommodation per trip (KES)	4000 (25)	7000 (41)	1500 (14)	700 (8)	1200 (7)
Cess per trip (KES)	1000 (6)	1000 (6)	-	-	-
Parking (KES)	-	3000 (18)	-	-	600 (4)
Market fee per day (KES)	-	200 (1)	-	-	1500 (9)
Total expenses per bag (KES)	395	408	346	277	305
Total cost of charcoal (KES)	1295	1308	796	560	805
Selling price (KES)	1750	1750	1500**	1500**	1650**
Estimated informal payments per trip (KES)	20,000 (125)	20,000 (118)	20,000 (182)	20,000 (222)	30,000 (176)
Net income per bag (KES)	330	324	522	551	669
Net income per month (KES)	211,200	110,160	229,680	198,360	454,920

*Inclusive of driver and assistant driver expenses

**The price given to brokers who then sell at between KES 1,700-2,300 per bag

***Includes KES 20,000 cost of fuel paid by the vehicle owner

Note: figures in brackets represent associated cost per bag

Before importing charcoal from Uganda, a transporter is expected to apply for a "*Letter of no objection to import charcoal from Uganda*", issued by the KFS and verified by the County Ecosystems Conservator, Busia County. When in possession of this letter, the transporter should be able to transport charcoal without any problems at roadblocks. However, there were reports of demands for bribes from the border crossing, at police roadblocks and from some KFS officials both in Busia and at the destination county, which was estimated to be as high as KES 20,000 per trip.

Transporters from Baringo were buying charcoal either from producers or CPAs. Each bag was bought at KES 450 and a fee of about KES 30 to KES 40 charged for loading onto the truck. Each charcoal consolidation trip often took two to three days and transporters spent KES 700-1500 on accommodation. Other costs include car fuel and servicing if one used personal means of transport. Transporters from Busia did not have a selling yard in Nairobi and therefore engaged the services of brokers. They handed over the entire consignment to brokers at an agreed price to sell around the city for a 20-50% mark-up (Table 17). For example, transporters reported that in 2018 they handed over the charcoal to brokers to sell at a price of KES 1500 per bag, and the brokers sold a bag at KES 1700 to KES 2300 which is a 13%-53% mark-up on the transporter price.

The transporter from Kitui had not been transporting charcoal since early 2018 when the national ban took effect. However, based on previous activities, charcoal was bought directly from producers at a cost of KES 500 per bag. The transporter hired a truck at KES 45,000 for a trip that lasted about three to four days. During each trip, the transporter would move an average of 170 bags. In addition, they would need to pay for loading, accommodation, parking and market fees per day. As was the case with the Baringo-Nairobi transporters, the Kitui-Nairobi transporter often left the charcoal with brokers to sell at a price of KES 1650 per bag. The broker would in turn sell each bag at KES 1800 to KES 2300 (Table 17).

Based on the estimates shown in Table 17, a transporter on the Busia-Nairobi route could make a profit of KES 324-330 per bag; this translates to a profit of about KES 207,360 to KES 211,200 per month if the transporter carries 160 bags per trip per week. Likewise, a transporter on the Baringo-Nairobi route could make a profit of KES 522-551 per bag which would translate to a profit of KES 198,000 to KES 230,000 per month for four trips in a month. A transporter on the Kitui-Nairobi route could make about KES 669 per bag which translates to KES 455,000 per month if the transporter carried 170 bags per trip for four trips a month.

4.1.2 Nairobi traders

All the traders interviewed engaged in retail; over half of them (55%) were also involved in wholesale trade. In addition, the survey results showed that 84% of the charcoal traders interviewed were male while the rest were female. The average age of those interviewed in Nairobi was 40.7 years. On average, the traders have been in the business for almost 10 years. The results further indicated that 48% and 27%, of traders interviewed had attended secondary and upper primary (Class 5-8), respectively. However, about 7% had never attended formal schools.

According to the study results, 88% of traders interviewed in Nairobi reported charcoal trade as their main source of income with crop production also contributing marginally to household earnings. About 76% of them had joined the trade mainly because it was very profitable, while 48% noted that it was the only income-generating opportunity at their disposal (Table 18).

Table 18. Reasons for involvement in charcoal trade in Nairobi

Reasons for charcoal business	% respondents
Common practice in family	3.2
Little to no initial capital required	4.8
Easy to get into	21
Only income-generating option	48.4
Very profitable	75.8

Table 19. Associations reported by respondents in Dagoretti

Name of the association	Year formed	No. of members	Registration fee
Dagoretti Charcoal Traders' Association	2008	50	500
Kawangware Digital Group	2006	50	200
Makaa Youth Group	2000	100	1000

Only 5% of the traders interviewed belonged to a charcoal-related association, with majority (81%) indicating lack of associations to join in their locality as the main reason. About 11% indicated that they were not interested in joining any association while 3% noted that they were unable to meet the demands for membership. Traders who were members of a charcoal association were all from Dagoretti Sub-County and belonged to three groups namely: Dagoretti Charcoal Traders' Association, Kawangware Digital Group, and Makaa Youth Group as presented in Table 19. When the respondents were asked to state the benefits of joining an association, 42% reported financial support, especially access to loans at low interest rates, while 29% noted that the associations had been advocating for the welfare of the traders. In contrast, 34% believed that there were no benefits in joining an association, while 31% said they were not aware of any benefits.

4.1.3 Charcoal wholesaling and retailing

All traders in Nairobi were buying their charcoal stock in recycled 90-kg bags (polypropylene sacks) each containing about 54 kg of charcoal (Table 20). On average

wholesale/retail traders and retailers bought 96 bags of charcoal per month at KES 2101 and 22 bags per month at KES 2096, respectively.

The main mode of charcoal delivery to the traders' premises (wholesalers) in Nairobi was largely by truck (97%), with only 3% of retailers reporting that they collected charcoal directly from the sellers' yards (wholesalers). The study indicated that most (86%) of the charcoal traded in Nairobi at the time originated from Uganda/South Sudan/DRC through the Busia border. This was attributed to the national charcoal ban that made it difficult to source the product locally. Other minor sources of charcoal reported include Tana River, Kitui, Garissa and Turkana counties (Figure 27). Most of the charcoal (96%) sold by retailers was packaged in tins, while 4% used buckets. The traders who engaged in both wholesale and retail reported that they sold 76% of their charcoal in tins, 21% in bags and 3% in buckets.

As reported earlier, the median weight of a bag of charcoal was estimated at 54 kg. However, Mugo et al (2007) reported that between 10-15% of the content of a charcoal bag consists of charcoal dust. Therefore, using the average figure of 13%, the actual sellable content of a bag of charcoal was 47 kg. This was bought at an average price of KES 2100, which translates to KES 45 per kg (Table 21). Thus, a bag of charcoal was sold at KES 2314, which implies that a kilogram of charcoal costs about KES 49. Each tin of charcoal weighed 1.5 kg and was sold at KES 88, translating to KES 56 per kg. The results further demonstrated that when a trader sold charcoal in bags, their gross margin per bag was 9% compared to when they sold in buckets and tins in which case the gross margin rose to 24% and 31%, respectively.

Table 20. Key charcoal trade statistics in Nairobi

Value chain actors	Wholesale/retailers		Retailers	
	Range	Mean	Range	Mean
Weight of charcoal (kg)	48-59	54	48-59	54
Buying price (KES)	1700-3000	2101	1800-2500	2096
Quantity sold per month per trader (bags)	5-500	96	2-100	22

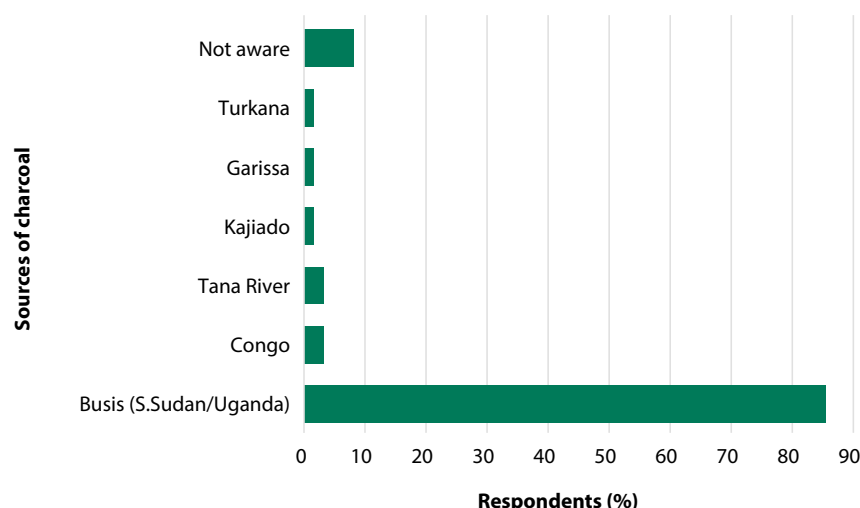


Figure 27. Sources of charcoal for Nairobi traders

Table 21. Charcoal buying and selling prices in different measures

Package (Weight of charcoal)	Buying price	Buying price (KES) per kg	Selling price (KES)	Selling price (KES) per kg	Gross margin (%)
90-kg recycled bag (47 kg)	2100	45*	2314	49	4 (9%)
Bucket -10 kg cooking oil (4.5 kg)	203	45	250	56	11 (24%)
Bucket -17 kg cooking oil (7.0 kg)	315	45	400	57	12 (27%)
Tin (1.5 kg)	68	45	88	59	14 (31%)

*Based on 54 kg per bag and 12.5% charcoal fines per bag

4.1.4 Nairobi customers

The main clients for both wholesalers and retailers were the consumers (households and businesses). Wholesalers/retailers sold 51% of their charcoal to households, 47% to businesses and the rest to fellow traders, while retailers only sold their charcoal to households (53%) and businesses (47%). The most common expenses incurred by the wholesale/retail traders in Nairobi were: rent and security (KES 56 per bag); transport (KES 19 per bag) and informal payments/bribes (KES 11 per bag) (Table 22). For retailers, the expenses incurred included: rentals amounting to KES 124 per bag; security costs of KES 27 per bag and business license fee. Based on these estimates, the total expenses, per bag, of charcoal sold by wholesalers and retailers amounted to KES 2243 and KES 2254, respectively. Charcoal traders in Nairobi

reported that the main challenges they faced were high charcoal prices (40%); poor quality of charcoal (24%) and low charcoal supply (18%), among others, including competition from alternative fuels, especially LPG, and the charcoal ban (Figure 28).

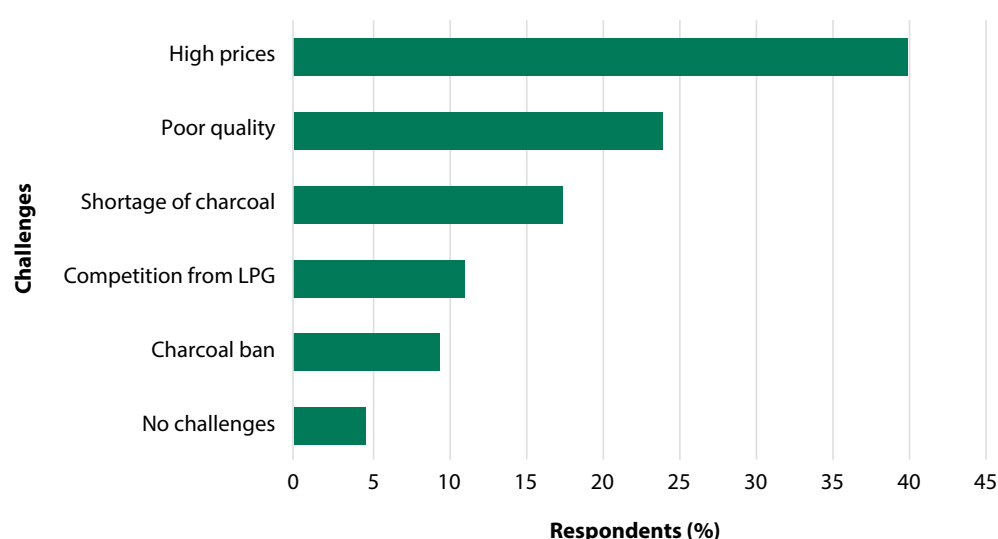
4.1.5 Nairobi consumer households

The survey established that the average household size of charcoal consumers in the city ranged from three to 10 members. They further indicated that consumers who bought charcoal in tins prepared up to three meals per tin. When charcoal was used together with other forms of energy, a tin of charcoal could prepare up to six meals. Consumers who bought charcoal in bags prepared 42-66 meals. When supplemented with other forms of energy, an average of 81 meals could be prepared.

Table 22. Traders expenses per bag/month

Expense	Wholesale/retail		Retail	
	Cost (KES) *	Cost per bag*	Cost (KES)	Cost per bag (KES) **
Cost of charcoal	2100	2100	2100	2100
Rent	5385	56	2725	124
License	969	1	667	3
Transport	12,000	19	0	0
Security	5410	56	583	27
Informal payments	500	11	0	0
Total expenses		2243		2254

*Based on 96 bags per month; **Based on 22 bags per month

**Figure 28. Challenges facing traders in Nairobi**

About 57% and 43% of respondents preferred charcoal and liquefied petroleum gas (LPG) as their primary source of energy, respectively. In addition, another 43% considered charcoal and LPG as their secondary source of energy. Consumers in Nairobi preferred charcoal as their primary source because of its high calorific value (63%), was readily available and efficient to use (25%), among other reasons. Similarly, the study showed that 67% of the respondents preferred LPG as a primary source of energy due to its availability and efficiency. Other reasons given for preference of LPG use were that it is clean, safe and lasts long (Figure 29).

Sixty-four percent (64%) of charcoal consumers in Nairobi bought the product in tins, whilst 36% bought it in bags. Comparatively, the price trend of charcoal using tins steadily rose from KES 66.7 to KES 92.2 over the 12-month period between October 2017 and October 2018. In contrast, the price trend using bags first decreased sharply, then increased at some point during the same period (Figure 30). For example, the cost of a bag of charcoal sharply declined in the month of April 2018 while that of a tin of charcoal increased during the same month. Factors that affected the prices included the ban on charcoal as indicated by 60% of consumers, and the politics around charcoal value chains (Figure 30).

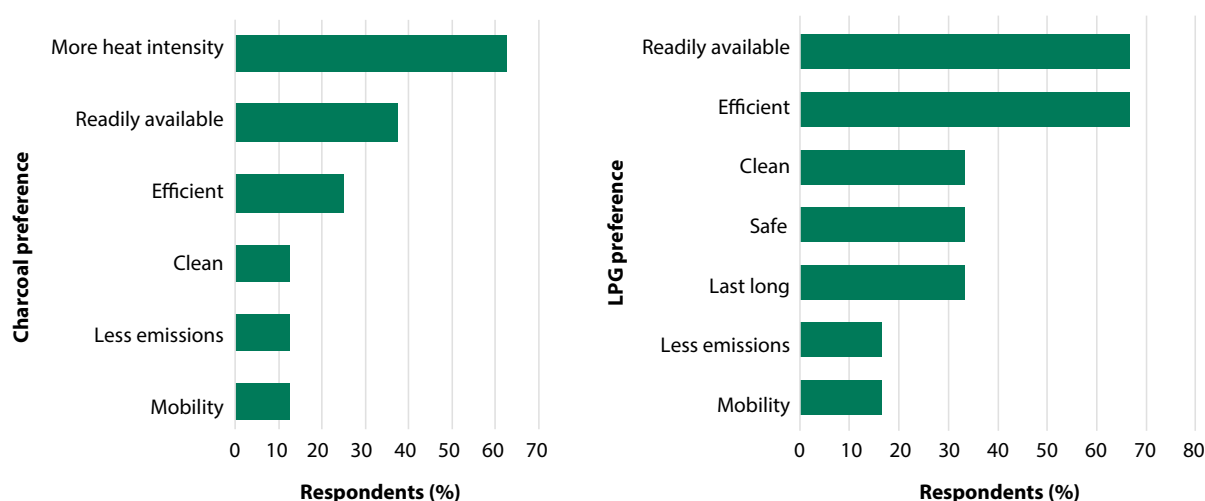


Figure 29. Reasons for using charcoal as a primary energy source (left) and reasons for using LPG as a primary energy source (right) by consumers in Nairobi

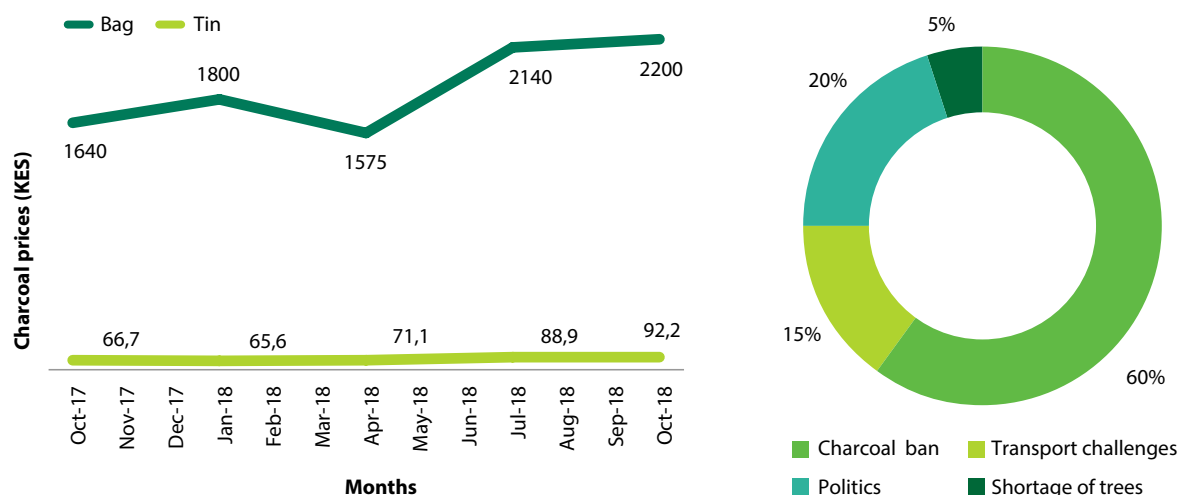


Figure 30. Charcoal prices over a period of 12 months based on the unit of sale in Nairobi (left) and factors affecting charcoal prices (right)

The study established that up to 79% of respondents had no knowledge of tree species from which charcoal was produced; only 21% had some knowledge (they only mentioned *Acacia spp*). This was because the charcoal from *Acacia spp* is said to be of high quality in terms of burning for long periods compared to that from other sources. Consumers reported that they use weight (67%) and size (33%) to establish the quality of charcoal and tree species from which it was produced.

Majority (86%) of the consumers in Nairobi had one main supplier. Key reasons for preferring charcoal from their main supplier were that they were guaranteed good quality charcoal (57%), their suppliers were friendly (57%), better customer service (43%), and the charcoal was always available (36%) (Figure 31). In Nairobi County, the survey revealed that one could easily encounter about 10-19 charcoal vendors within a 10-minute walking distance, especially in Dagoretti, Kasarani and Lang'ata sub-counties. In other sub-counties such as Westlands, Embakasi, Eastleigh and Njiru, the number of vendors was about 10.

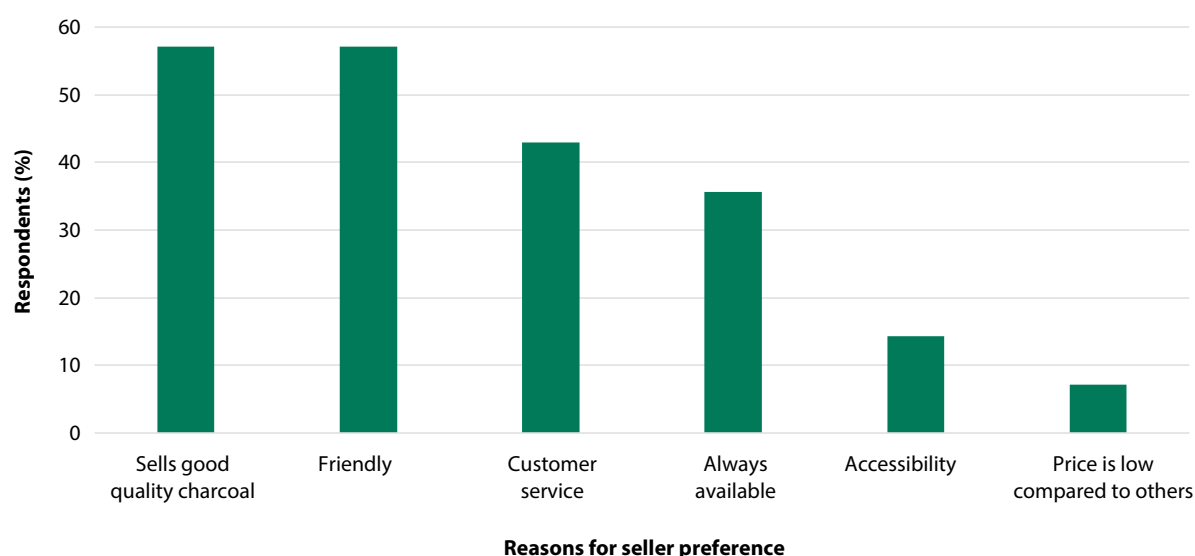


Figure 31. Reason for buying charcoal from a particular supplier

4.2 Mombasa City trade

4.2.1 Transportation to Mombasa

A total of five transporters operating between Mombasa and Kwale were interviewed to understand the operations and associated expenses in the coastal region. Most of them made two trips per month to allow producers to produce enough charcoal and also to be able to sell most of the product. Transporters bought charcoal from producers at a price of KES 400 per bag (Table 23). The charcoal was transported to various locations within Mombasa and Malindi and sold directly to wholesalers and retailers at KES 1700. Only one of the transporters used a personal truck; the rest used hired vehicles. Two of the transporters used lower capacity trucks that could carry 100 bags of charcoal per trip, while the others used trucks that could carry 150-160 bags per trip. The costs incurred by transporters include hiring or fuel cost, drivers' expenses, accommodation, cess, loading and offloading costs (Table 23).

Based on the estimates, expenses associated with procurement of a bag of charcoal ranged from KES 616 to KES 777. Most of the transporters were making two trips a month, translating to an overall monthly income of between KES 200,000 and KES 217,000 for

the lower capacity truck transporters, while for larger capacity trucks, monthly income estimates ranged from KES 297,000 to KES 326,000. Just like the Nairobi-based transporters, those from the coast reported prevalence of rent seekers along the transport routes and even at the destination markets. However, none was able to give an estimate of such payments per trip. As such, the absolute income for a transporter could be slightly lower than what is estimated in this study.

4.2.2 Mombasa traders

About 35% and 12% of charcoal traders interviewed in Mombasa exclusively engaged in retail and wholesale trade respectively, whilst slightly more than half of them (54%) engaged in both. In addition, charcoal traders interviewed were mostly male (85%). Furthermore, 69% and 15% of the traders had completed lower primary (Class 1-4) and upper primary (Class 5-8), respectively while 8% had undergone secondary education and tertiary education. The mean age of the charcoal traders was 32 years, while average household size was seven members. On average, the charcoal traders had been in the business for eight years. The charcoal business was the main household income source for most traders

Table 23. Key charcoal transporters business statistics for Mombasa/Kwale transporters

Cost item description	Cost per trip of a truck in KES (Per bag in brackets)				
	Transporter 1	Transporter 2	Transporter 3	Transporter 3	Transporter 4
Charcoal source	Kwale	Kwale	Kwale	Kwale	Kisauni
Truck load in bags per trip	100	100	160	160	150
Buying price (KES/bag)	400	400	400	400	400
Cost of hiring truck per trip (KES)	-	15,000 (150)	40,000*(250)	40,000* (250)	30,000*(200)
Cost of driver per trip (KES)	5000 (50)	-	-	-	-
Cost of fuel (KES)	8000 (80)	8000 (80)	-	-	-
Cost of assistant driver per trip (KES)	3500 (35)	-	-	-	-
Loading labour (KES per bag)	500 (5)	2000 (20)	6400 (40)	2000 (13)	7500 (50)
Offloading labour (KES per bag)	600 (6)	2000 (20)	8000 (50)	2000 (13)	9000 (60)
Vehicle security per trip (KES)	500 (5)	1000 (10)	-	-	-
Cost of servicing car per month (KES)	5000 (13)	-	-	-	-
Accommodation per trip (KES)	1500 (15)	1000 (10)	1000 (6)	1000 (6)	-
Cess per trip (KES)			1000 (6)		
Parking per night (KES)	200 (2)	500 (5)	-	-	-
Market fee per day (KES)	500 (5)	500 (5)	-	-	-
Total expenses per bag (KES)	216	300	352	345	377
Total cost of charcoal (KES)	616	700	752	745	777
Selling price (KES)	1700	1700	1700	1700	1700
Net income per bag (KES)	1084	1000	948	1018	990
Net income per month (KES) Most transporters make about 2 trips per month.	216,800	200,000	303,360	325,760	297,000

*Includes cost of fuel

Note: figures in brackets are cost per bag

(90%). Other activities included casual labour, small business enterprises, farming and livestock rearing. Reasons for engaging in the charcoal trade: it is the only available income-generating opportunity for many (92%); it is a very profitable venture (46%) and a traditional business for the family (12%) (Figure 32). The study indicated that none of the traders belonged to an association. Reasons given include: lack of charcoal traders' associations to join in their locality (42%); requirements that are very difficult to meet (39%); and, lack of interest (19%). Challenges faced by the traders included high charcoal prices (31%), poor quality of charcoal (31%) and low supply (23%) (Figure 33).

4.2.3 Charcoal wholesaling and retailing

All traders in Mombasa bought their charcoal stock in recycled 90-kg and 50-kg polypropylene bags each containing about 47 kg and 22 kg of charcoal, respectively. The average buying price for the recycled 90-kg and 50-kg bag of charcoal was KES 1700 and KES 1250, respectively (Table 24). The charcoal traders reported that 54% of charcoal sold in Mombasa was from Malindi Sub-county in Kilifi County (Figure 34). The second most important source was Tanzania (through the Lunga Lungu border) reported by 27% of the respondents, followed by Kwale

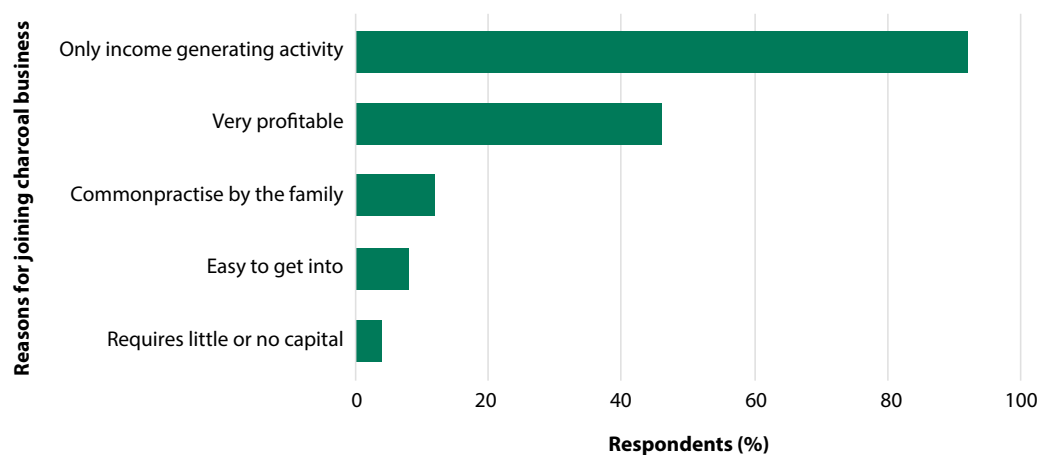


Figure 32. Main reason for joining charcoal business in Mombasa

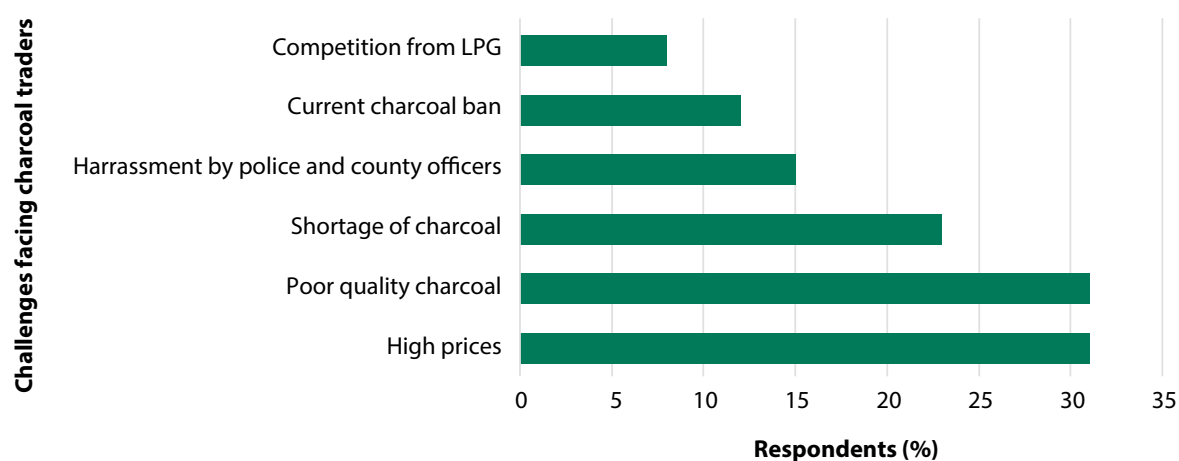


Figure 33. Challenges facing charcoal traders in Mombasa

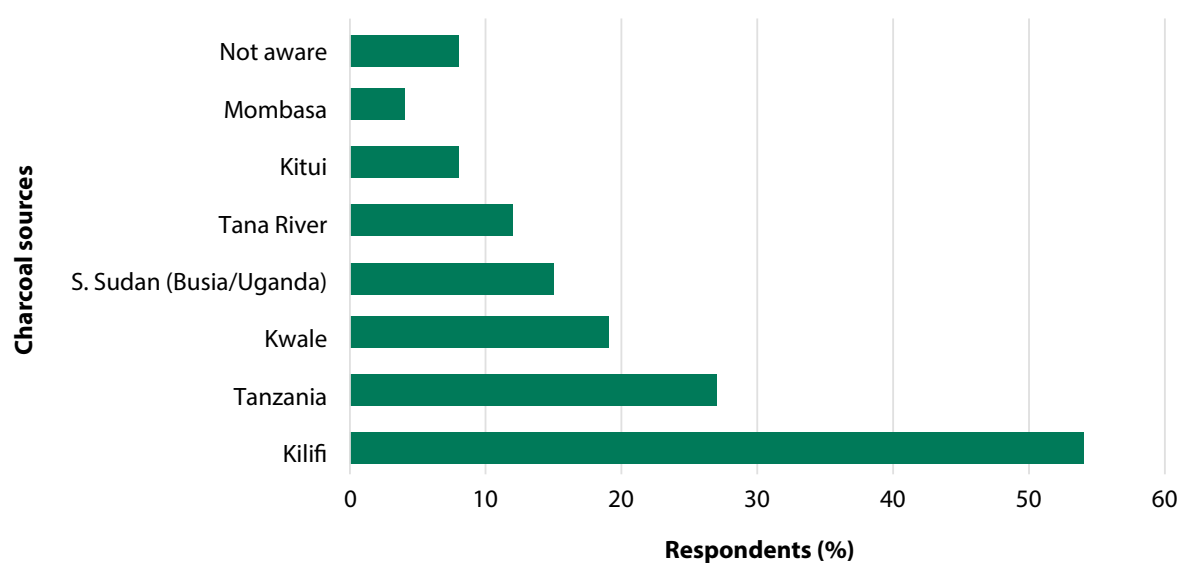


Figure 34. Sources of charcoal in Mombasa

Table 24. Key charcoal trade statistics in Mombasa

Unit of sale	Statistic	Weight of charcoal (kg)	Buying price (KES)
90-kg recycled bag	Range	40-50	1600-2000
	Average	47	1700
50-kg recycled bag	Range	18-30	1000-1500
	Average	22	1250

County which was reported by 19% of the respondents. Uganda and South Sudan were also reported as a source of charcoal by 15% of the respondents. A wholesaler sold about 208 bags, whilst a retailer sold about 25 bags of charcoal per month.

Most wholesalers/retailers sold 71% of their charcoal in bags and the rest in tins, buckets and modified plastic bags. For the retailers, only 12% of their charcoal was sold in bags and the rest in smaller units. A bag of charcoal was sold at KES 2300 whilst tins and smaller bags containing about one kilogram of charcoal were sold at an average of KES 70 (Table 25).

4.2.4 Main customers and trade-related expenses

The main clients for both wholesalers/retailers and retailers were consumers (households and businesses). The main buyers from the

wholesaler/retailers, were businesses (46%) and households (46%), with retailers and brokers accounting for only 8%. Likewise, retailers indicated that 47% and 45% of their clients were the households and businesses, respectively. Traders who were both wholesalers and retailers reported that they had four main monthly costs associated with their operations including rent, trade license, transport and security amounting to just over KES 1,786 per bag per month. Retailers, on the other hand, reported only two costs associated with their operations, namely, rent and trade licenses amounting to KES 1,776 per bag per month (Table 26).

4.2.5 Mombasa consumer households

The survey established that the average household size of charcoal consumers in Mombasa was seven, with a minimum and maximum size of four and 10 members, respectively. The study results further showed that consumers who bought charcoal in a recycled 2-kg cooking oil tin, dubbed *kasuku*, cooked about three meals. However, when supplemented with other forms of energy, a *kasuku* of charcoal cooked up to six meals. Consumers who bought charcoal in buckets of about 8 kg, managed to cook 21 meals. When supplemented with other forms of energy, the bucket of charcoal could be used to cook between 21 and 42 meals.

Table 25. Charcoal buying and selling price in different measures

Package	Weight (kg)	Buying price	Buying price (KES) per kg	Selling price (KES)	Selling price (KES) per kg	Gross margin (%)
90-kg recycled sack	47	1,700	36	2,300	49	13 (36%)
Weighing or tins	1	36	36	70	70	34 (94%)

Table 26. Monthly charcoal traders' expenses in Mombasa

Expense	Wholesale/retailers		Retailers	
	Cost (KES) *	Cost per bag	Cost (KES)**	Cost per bag
Cost of charcoal	353,349	1700	41,100	1700
Rent	2200	11	850	34
License	10,000	4	10,000	33
Transport	12,000	58	0	0
Security	2750	13	0	0
Total expenses		1786		1767

*Based on 208 bags sold per month; **Based on 25 bags sold per month

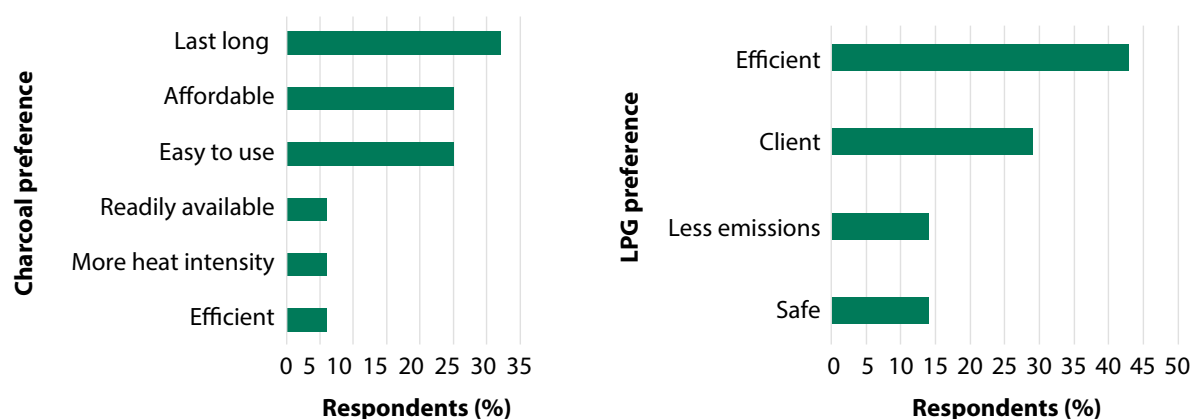


Figure 35. Reasons for using charcoal as a primary energy source by consumers (left) and reasons for using LPG as a primary energy source by consumers in Mombasa (right)

The study indicated that 67% and 33% of respondents preferred using charcoal and LPG as their primary source of energy, respectively. Furthermore, 33% and 25% of the consumers considered charcoal and LPG as their secondary sources of energy, respectively. However, 42% of consumers interviewed used either charcoal or LPG as the only source of energy for cooking. Results showed that majority (32%) of the charcoal consumers in Mombasa preferred charcoal as the primary source of energy mainly because it burns for longer, it is easy to use (25%) and is affordable (25%). Similarly, 43% and 29% of the respondents preferred LPG as a primary source of energy, citing its efficiency and consideration as a clean source of energy, respectively (Figure 35). About 60% of charcoal consumers stated that the ban on the product was the main cause of increase in prices. Furthermore, 20% attributed the price increase to politics around charcoal, while 15% attributed it to transports challenges (Figure 36).

The study results established that 75% of the respondents had knowledge of the tree species their preferred charcoal was produced from, while 25% were not aware. Consumers who had knowledge about their preferred charcoal tree species mentioned *Acacia spp*, *Markhamia lutea* and *Casuarina equisetifolia*, in that order. The consumer preference for charcoal produced from the three tree species was informed mostly by the quality produced (67%) and ability to burn longer (33%) compared to charcoal from other species.

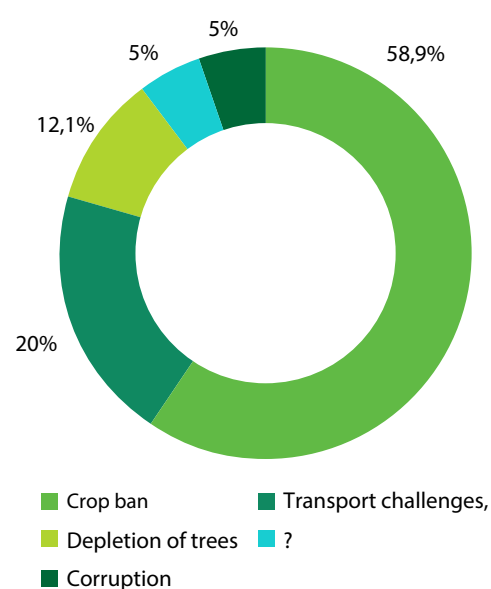


Figure 36. Factors affecting consumer charcoal prices over the last 12 months in Mombasa

Consumers identified the charcoal from the mentioned species by using their colour, texture, weight and size characteristics; darker, heavier and bigger pieces were reported to be of better quality. All consumers interviewed in Mombasa bought charcoal from one main supplier. Some of the reasons given included easy accessibility (75%), sold good quality charcoal (68%), friendly (42%) and charcoal was always available (33%). In Mombasa County, the survey suggested that there were up to nine charcoal vendors within a 10-minute walking distance.



5

Economics of the charcoal value chain



Charcoal displayed in tins in Nairobi. Photo by Moses Kirimi

5.1 Value chain actor income

Landowners

Landowners in the three counties indicated that they neither planted, managed, nor ever incurred any direct investment cost on trees for charcoal production. Over 90% of the trees were used by a member of the family to produce charcoal, hence they didn't need to pay for the wood. Thus, the value of wood was rarely captured in the final farmgate price of charcoal. In the few cases where landowners sold trees for charcoal production, the average price paid for wood to produce one bag of the product was KES 100.

Producers

Most of the producers incurred minimal costs as charcoal production was done using trees from family land. In addition, they used family labour (Table 27). For the few individuals who bought wood, the cost was estimated at KES 100-220 per bag of charcoal. One expenditure item which cut across the counties was tree felling and chopping. This amounted to about KES 35 per bag of charcoal in Kwale, KES 45 in Baringo and KES 60 in Kitui. Transport

cost and CPA levy fees were only reported in Baringo at KES 50 and KES 10 per bag, respectively. In Kitui, some respondents reported engaging casual labour to prepare the kilns at a cost of KES 300 per kiln, which produced approximately 10 bags of charcoal; this translates to KES 30 per bag. In summary, the total expenses incurred by charcoal producers in Baringo, Kitui and Kwale was estimated at KES 105, KES 200 and KES 135 per bag, respectively, when the cost of wood is factored in for Kitui and Kwale. When the cost of wood is not included, as people rarely buy wood for charcoal, the total cost of production in Kitui and Kwale reduces to KES 120 and KES 35 respectively.

Based on the expenses tabulated in Table 28 and the weighted annual production per producer, it is estimated that the annual net income of a producer is KES 14,259, KES 8,184 and KES 30,849 in Baringo, Kitui and Kwale, respectively. However, if the wood is free in Kitui and Baringo, the net income rises to KES 11,484 and KES 42,149, respectively.

Table 27. Charcoal producers' expenses

County	Expenses	Cost description	Cost per bag (KES)
Baringo	Cost of wood	Wood is never sold as there are plenty of Prosopis and other Acacia species.	0
	Tree felling (Power saw)	KES 600 per litre of fuel used by power saw to fell and chop the tree. This can produce 10-20 bags of charcoal.	30-60 (Average 45)
	Transport	KES 50 to transport 1 sack to collection centre or KES 200 to transport 4 bags to roadside.	50
	CPA levy	KES 10 per bag (At collection centre)	10
	Total		105
Kitui	Cost of wood	KES 100 per bag	100
	Labour	KES 300 for kiln preparation to produce 10 bags.	30
	Tree felling and chopping into logs with power saw	KES 500-700 to fell a tree that can produce 10 bags (Charged at KES 500 to fell and chop the tree or KES 700 for every litre of fuel used by the power saw during the work)	50-70 (Average 60)
	Packaging material	Recycled polypropylene sack	30
	Total		220
Kwale	Cost of wood	KES 2000 for a tree that can produce 20 bags	100
	Tree felling and chopping into logs with power saw	KES 700 for every litre of fuel used by the power saw during the work. This can produce about 20 bags of charcoal	35
	Total		135

Table 28. Charcoal producers' income

	Baringo	Kitui	Kwale
Cost of producing a bag of charcoal (KES)*	105	220 (120)	135 (35)
Average number of bags produced per annum	49	33	113
Selling price per bag	396	468	408
Net profit per bag	291	248 (348)	273 (373)
Net income per annum	14,259	8184 (11,484)	30,849(42,149)

*Item without the cost of wood shown into brackets

Table 29. Charcoal transporters' estimated expenses and income*

	Baringo-Nairobi	Busia-Nairobi	Kitui-Nairobi	Kwale-Mombasa
Capacity of truck (bags)	100	170	170	160
Cost of charcoal (KES)	450	900	450	400
Average expenses (KES)	262	411	305	318
Informal payments (KES)	202	122	176	-
Total expenses (KES)	914	1433	931	718
Selling price (KES)	1500	1750	1650	1700
Net income per bag (KES)	586	317	719	982
Number of trips	4	4	4	2
Net income per month (KES)	234,400	215,560	488,920	314,240

* Might not capture all the expenses as it is based on a small sample and informal taxes were not included

Transporters

The income of a transporter was largely dependent on the capacity of the truck as well as frequency of trips made (Table 29). The Kitui-Nairobi route was the most lucrative, owing to minimal expenses and the higher price of charcoal compared to Baringo-Nairobi. The Busia-Nairobi route had low returns principally due to the high cost of charcoal from Uganda. The Baringo-Nairobi route also had relatively low returns mostly due to the low price of charcoal at designated market points in the city as dictated by "market barons". The Kwale-Mombasa route was relatively lucrative, with transporters making two trips per month.

Vendors

In Nairobi, the study established that there were two categories of charcoal traders: those who sold in both retail and wholesale⁴, and those who only operated as retailers. Based on the reported sales and expenses, it is

estimated that the net monthly income of a wholesaler/retailer in Nairobi was about KES 40,997, while that of a retailer was KES 11,277. In Mombasa, the net monthly income of a wholesaler was estimated at KES 141,112 while that of a retailer was estimated at KES 25,865 (Table 30).

Charcoal market channels

Due to spatial and temporal differences in locations where the data was collected, there were some slight differences between the prices reported by different actors.

For example, the average selling price of charcoal reported by producers in Kitui was KES 468, while the buying price reported by transporters was KES 450 (Table 31). To harmonize these figures, the average price was calculated from the two given prices, where applicable. Wholesale prices are the calculated prices per bag from specific areas, while retail prices are those calculated when charcoal was sold in smaller units such as tins or using weighing balances.

⁴ Wholesale traders mostly sell in bags, while retailers mostly sell in smaller units like tins, buckets or even use weighing scales.

Table 30. Charcoal vendors' expenses and income

Expenses		Nairobi		Mombasa	
		Wholesaler/retailers	Retailers	Wholesaler/retailers	Retailers
Cost of charcoal (KES)		2,100	2,100	1,700	1,700
Other expenses (KES)		143	154	86	67
Quantity of charcoal sold (Bags) per month		96	22	208	25
Individual sales units breakdown (% in brackets)	Tins	73 (76%)	21 (96%)	-	-
	Bags-	20 (21%)	-	148 (71%)	3 (12%)
	10-kg oil bucket	3 (3%)	1 (4%)	-	-
	Other units	-	-	60 (29%)	22 (88%)
	Total bags	96 (100%)	22 (96%)	208 (100%)	25 (100%)
Income from one bag based on units of sale	Tins	2773	2273	-	-
	Bags-	2300	2300	2300	2300
	10-kg oil bucket	2632	2632	-	-
	Other units	-	-	2870	2870
Total revenue based on units sold (KES)		256,325	60,865	512,600	70,040
Total expenses based on bags sold		215,328	49,588	371,488	44,175
Net monthly income (KES)		40,997	11,277	141,112	25,865

Table 31. Harmonized prices for different actors

Route	Kitui-Nairobi		Kwale-Mombasa		Baringo-Nairobi		Busia-Nairobi	
Item	Average price reported	Calculated average	Average price reported	Calculated average	Average price reported	Calculated average	Average price reported	Calculated average
Producer selling price (KES)	468	459	408	408	396	423	-	900
Transporter buying price (KES)	450		400		450		900	
Transporter selling price (KES)	1650	1650	1700	1700	1500	1500	1750	
Broker buying price (KES)	1650		-		1500		-	
Broker selling price* (KES)	2000	2050	-	1700	2000	2050	-	1925
Vendor buying price (KES)	2100		1700		2100		2100	
Wholesaler selling price (KES)	2300		2300		2300		2300	
Retailer selling price (KES)		2773		2870		2773		2773

*Average between KES 1700-2300

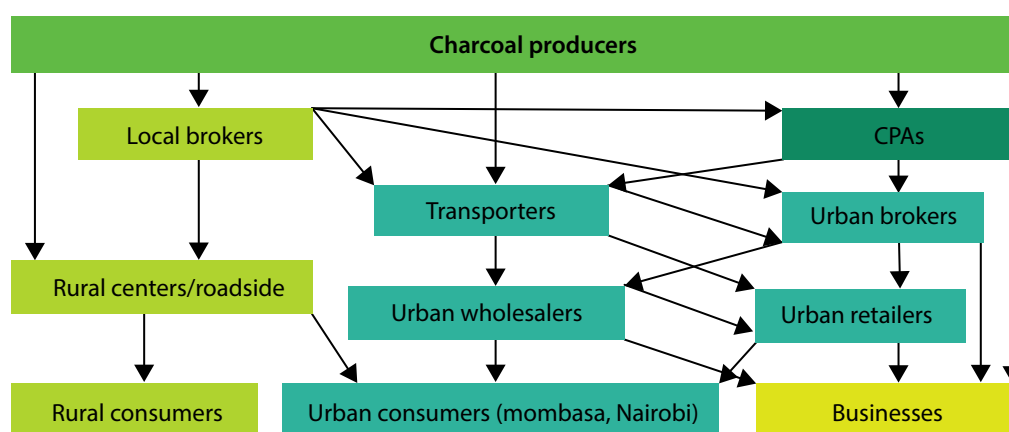


Figure 37. Common charcoal market channels

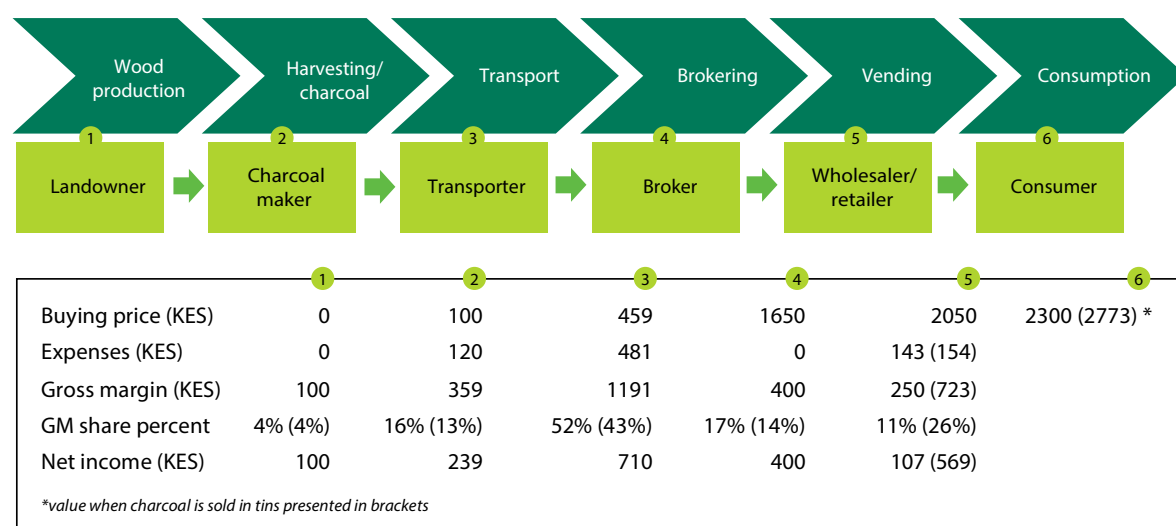


Figure 38. Kitui-Nairobi charcoal supply chain

There were a number of charcoal marketing channels available to producers as shown in Figure 37. The shortest channel was from producers to consumers through rural market centres or roadside display. This was observed in Kitui and Baringo. Longer channels involved local brokers, CPAs, transporters, urban brokers, wholesalers and/or retailers. These were mostly for supplying cities like Nairobi which made charcoal quite expensive compared to other smaller centres. For example, transporters from Baringo reported that they shipped their charcoal to Nairobi and sold through brokers, whilst those from Busia had their own yards.

5.1.1 The Kitui-Nairobi supply chain

The Kitui-Nairobi supply chain is a long one that includes brokers in the city. The result is

reduced returns for both vendors and transporters. The transporter's margin accounts for the largest share of the final price of charcoal in the supply chain at 52% when the product is sold in bags or 43% when it is sold in tins (Figure 38). When retailers sell charcoal in tins, their margin as a proportion of the final price comes in second at 26%, but this reduces to only 11% if the charcoal is sold in bags. The brokers are third when charcoal is sold in bags with 17%, followed by producers with 16% of the share of the final price. For net income per bag, transporters take a large share of KES 710, followed by retailers (when they sell charcoal in tins) at KES 569. Brokers made a net income of KES 400 while producers made KES 239 per bag.

5.1.2 The Baringo-Nairobi value chain

The Baringo-Nairobi supply chain had brokers in Nairobi and sometimes CPAs at the production end, making it a long chain. The transporters' gross margin accounted for the largest share of the final price of a bag: 47% when charcoal is sold in bags and 39% when it is sold in tins. Retailers were second with a share of 26% when the charcoal is sold in tins, followed by brokers at 24% and producers at 18%. The transporters also had the largest net income per bag of KES 613, followed by retailers when they sold charcoal in tins at KES 569. The brokers had a net income of KES 500 while producers made KES 318 per bag (Figure 39).

5.1.3 The Busia-Nairobi value chain

The Busia-Nairobi charcoal supply chain could only be traced from the Kenya-Uganda border at Busia. As such, all calculations were done based on the Ugandan charcoal transporters in Busia as the source. The study established that the Kenyan transporter's gross margin accounts for the largest share of the final price of a bag at 45% (Figure 40). The Ugandan transporter's margin is second at 39% of the final price share, while the share of retailers is third at 16% or 31% if the charcoal is sold in bags or tins, respectively. In terms of net income per bag, the retailer who sells charcoal in tins makes KES 781 per bag while a transporter makes KES 492.

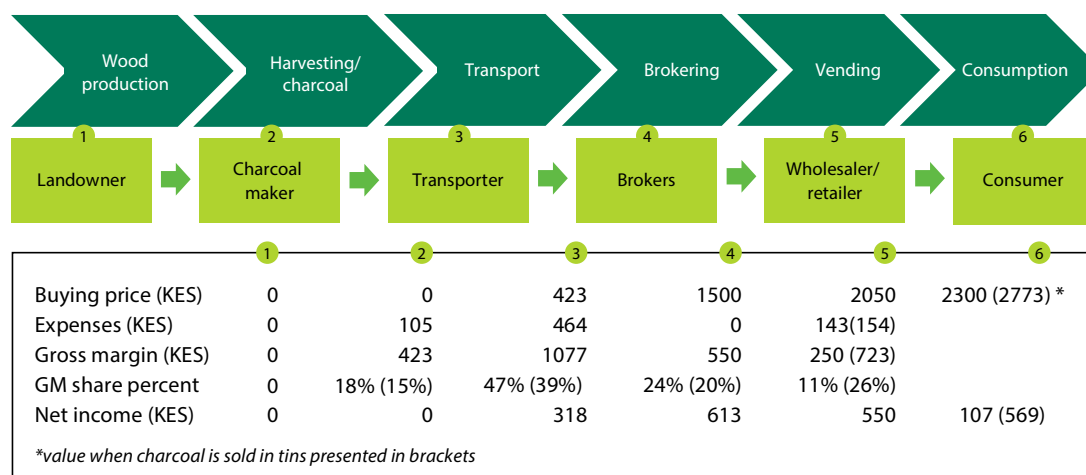


Figure 39. Baringo-Nairobi charcoal supply chain

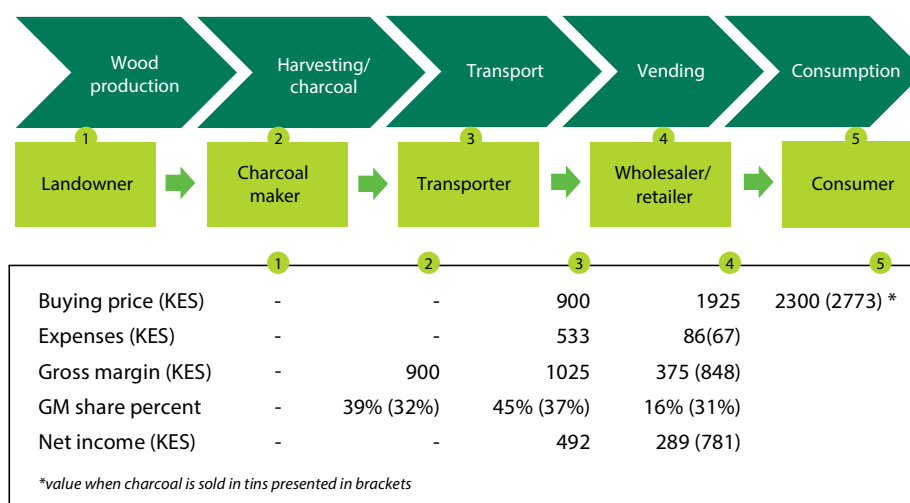


Figure 40. Busia-Nairobi charcoal supply chain

5.1.4 The Kwale-Mombasa supply chain

Charcoal transporters between Kwale and Mombasa sold directly to wholesalers, retailers and small businesses. The transporters' margin accounted for the largest share of the final price (56%) when the charcoal was sold in bags (Figure 41). The retailer's margin accounted for 41% of the final price when the charcoal is sold in tins, but only 26% when it is sold in bags. The charcoal producers' margin accounted for only 13% of the price share, while the landowners' share was only 5%. If retailers sell their charcoal in tins, they make the largest net income from a bag of charcoal at KES 1103. However, this reduces to KES 514 when charcoal is sold in bags. The transporters also make a net income of KES 941, while the producer and landowner make KES 173 and KES 100, respectively.

5.2 Effects of the charcoal ban

On 24th February 2018, the Government of Kenya imposed a moratorium on logging and timber harvesting in the country, which prohibited production or transportation of charcoal. Though this study did not dwell on the ban and its impact thereof, findings indicated that it had a direct impact on the sourcing, production and pricing of charcoal. Further interactions with communities in Kitui revealed that the charcoal trade had been driven underground as the "3-bag policy" allowed transporters and traders to make several trips. However, this had an impact on the operations of the Charcoal Producers' Associations who were rendered redundant. Visibly empty were the CPA-run collection points and bulking centres (Figure 42). Yet, they are a key institution in the implementation of the Forest (Charcoal) Rules 2009 (revised 2012) which aims to promote sustainable production and trade of charcoal (GOK, 2009).

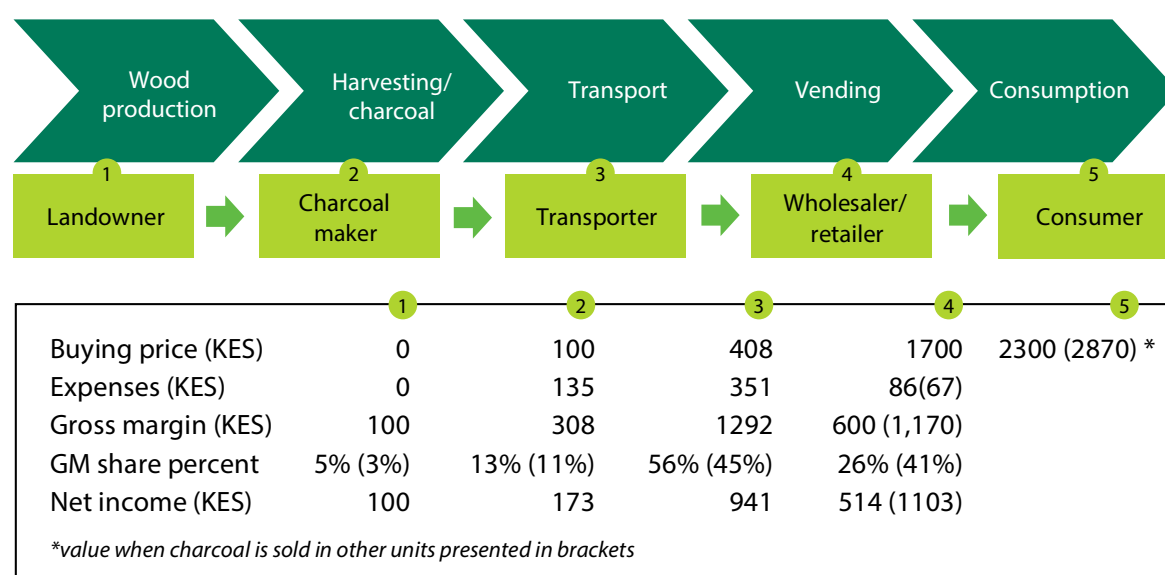
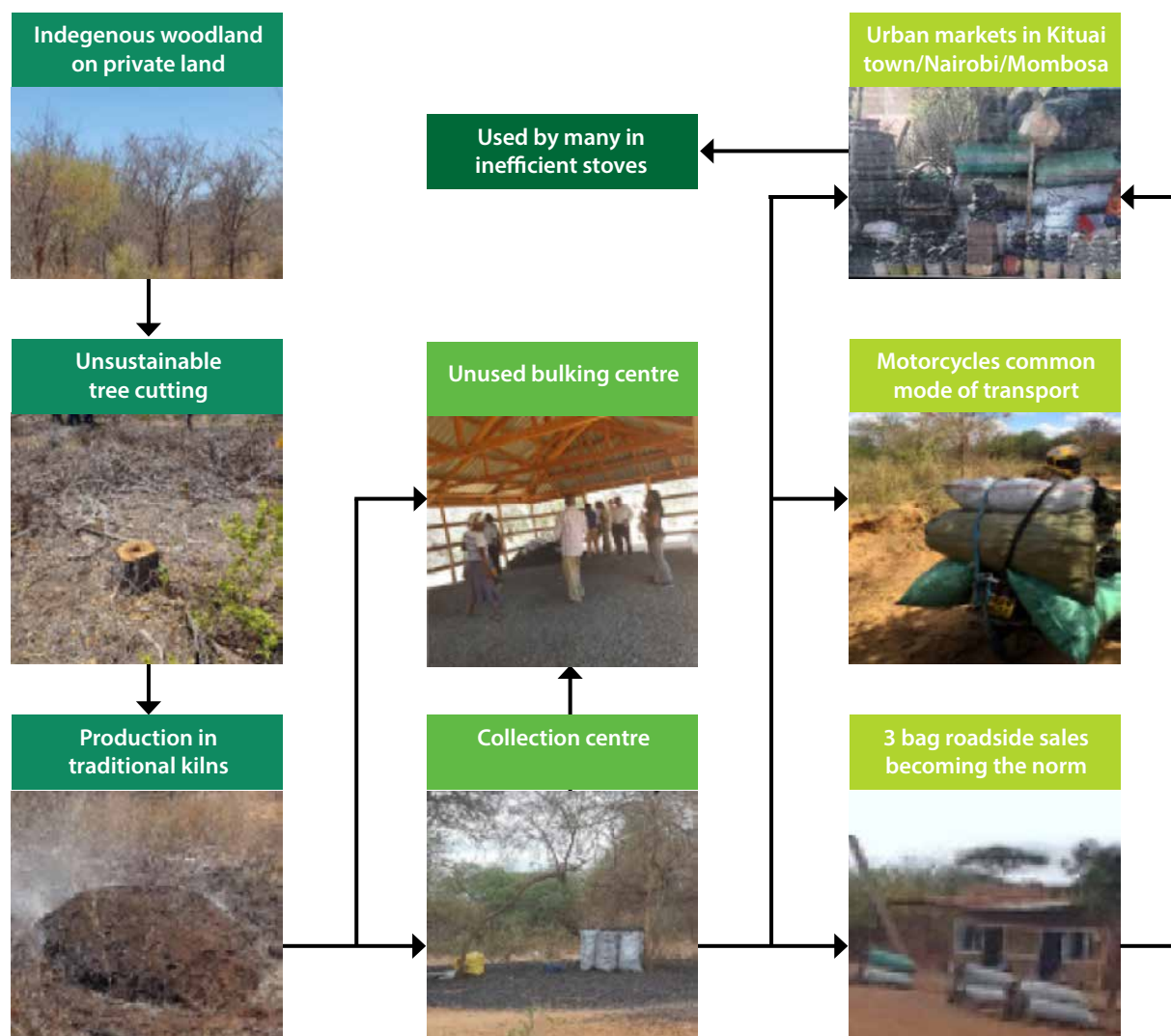


Figure 41. Kwale-Mombasa charcoal supply chain



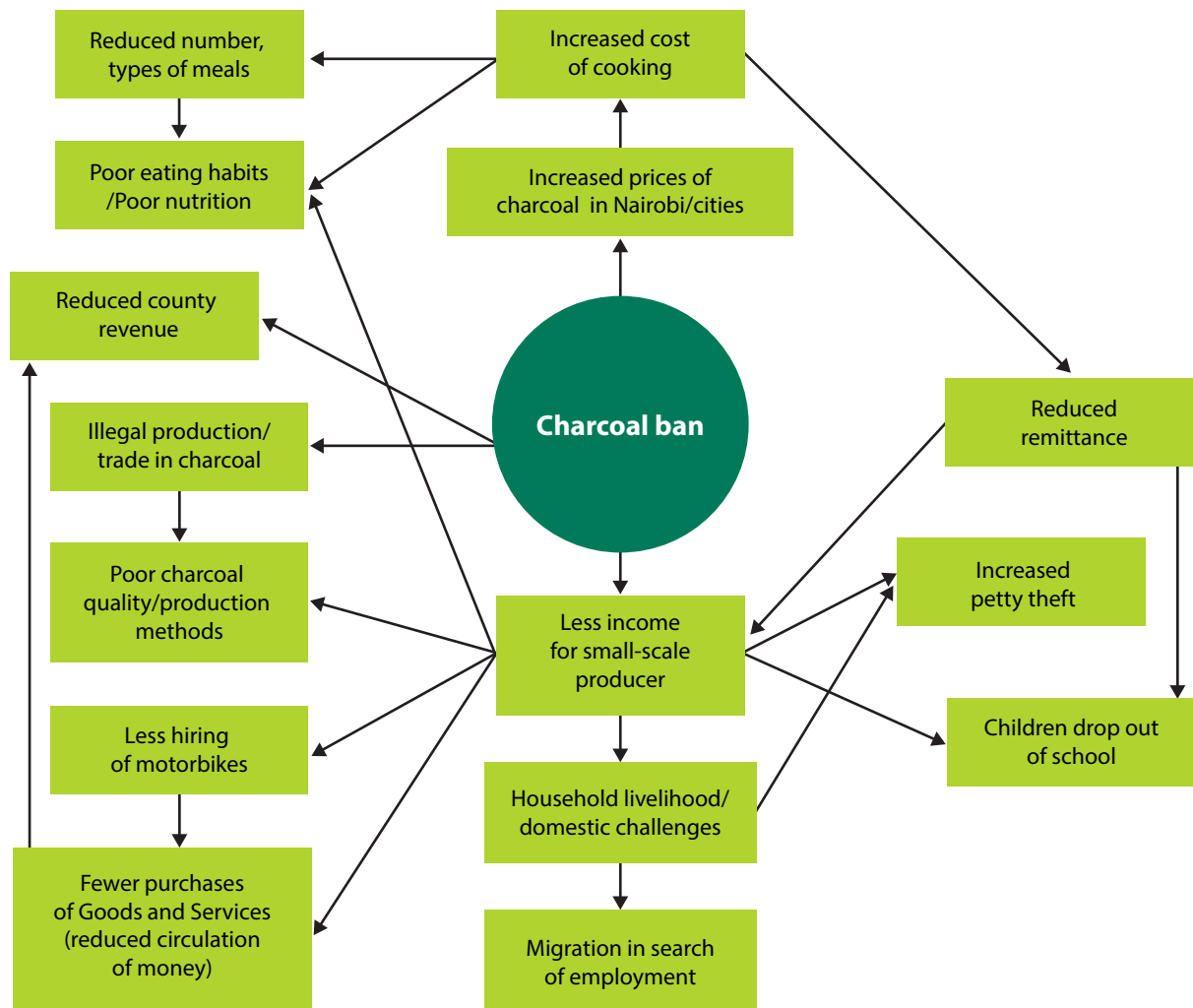
Source: Sola et al, 2020

Figure 42. Pictorial representation of Kitui charcoal production trade flows during the ban

Significant amounts of charcoal was said to be sourced from the neighbouring countries of Uganda and South Sudan, both legally and illegally. This is a typical demonstration of leakage, where internal conservation challenges are transferred to neighbouring countries because parts of the charcoal value chain have been criminalized, and no alternative energy sources availed for the vast majority of the population. Moreover, charcoal is a key source of household income in the three study areas contributing 48%, 26% and 14% of the overall household income in Kwale, Baringo and Kitui, respectively. This dependence on charcoal explains why the proportion of producers did not change significantly during the ban, except in Kwale. However, the quantity produced per respondent dropped significantly

especially in Kitui. The charcoal ban therefore had a significant negative impact on the livelihoods of producers, especially those with less diversified income sources (Figure 43).

Finally, although the charcoal ban resulted in minimal change in average producer selling price in the three study locations, it led to a substantial increase in consumer prices. For example, the price of a bag in Nairobi was reported to increase from KES 1575 in March 2018 to KES 2200 in October 2018, representing a 40% increase. Likewise, the price of a tin was reported to increase from KES 71.1 in March 2018 to KES 92.2 in October 2018, representing a 30% increase. This translated to a huge financial burden for most charcoal consumers who reside in urban centres.



Source: Sola et al, 2020

Figure 43. Kitui stakeholder perspectives of impacts of charcoal ban



6

Gender perspectives in the charcoal value chain



6.1 The participation of women and men in the charcoal value chain

On an aggregate level, women accounted for 43% of the surveyed charcoal producers – a considerably high figure for a sector conventionally perceived as male-dominated (e.g., Zulu and Richardson, 2012). Women also accounted for nearly half (45.9%) of surveyed landowners. Only one of the 10 surveyed brokers was a woman, while women similarly accounted for 10% of the predominantly urban wholesalers surveyed for this study. Charcoal transport was found to be dominated by men, with women accounting for roughly a quarter of transporters⁵. Even more men dominated charcoal retail (86.1%) which could have been a result of the ban and logging moratorium presenting additional challenges for women (Table 32). This is in stark contrast to earlier studies, which have found charcoal retail in Kenya to be heavily female-dominated (e.g., Ndegwa et al, 2016).

There are stark differences between counties. In Baringo and Kitui, women accounted for around half of all producers (47% and 55% respectively), while only 17% of producers in Kwale were women. However, most female producers in Baringo lived in male-headed households (93%) while female heads-of-households (FHHs) constituted the majority of female producers in Kitui (65%). In Kitui, women – mainly FHHs – also accounted for more than half (57%)

Table 32. Participation in charcoal value chain by gender

Value chain role	Gender (% proportion)		Sample
	Male	Female	N
Landowners	54.1	45.9	231
Producers	56.7	43.3	252
Transporters	72.4	27.6	29
Brokers	90	10	10
Wholesalers	89.7	10.3	58
Retailers	86.1	13.9	101

of all surveyed landowners, compared to 43% in Baringo and 33% in Kwale. A relatively higher share of resident women following a high incidence of male out-migration in Kitui is a plausible explanation for this difference.

This study was not able to assess any potential impact that the ongoing charcoal ban might have had on women and men's participation. Profitability and lack of alternative income sources were the key reasons for engaging in the charcoal value chain for men as indicated by 27% and 28% of the respondents, respectively. Slightly higher proportions of female heads-of-households, 35% and 33%, gave these two reasons as well. Women in male-headed households, however, placed relatively more importance on ease of entry (33%) and limited capital requirements (Figure 44).

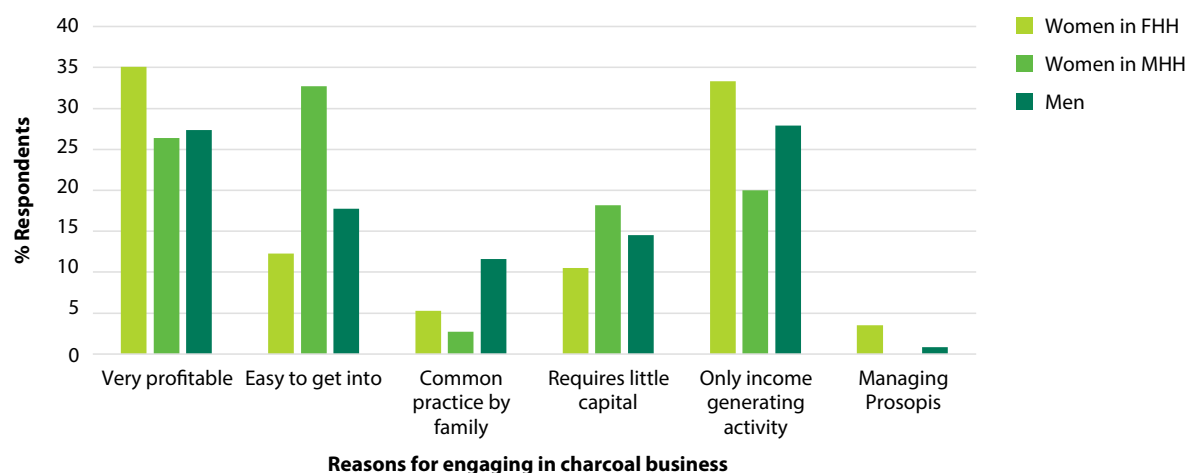


Figure 44. Reasons for engaging in charcoal business by gender

⁵ 20 out of 21 transporters were surveyed in Kwale

6.2 Sources and ownership of trees

Regarding the sourcing of trees, 'own farm' was by far the most common source for both women (87%) and men (84.5%). It was particularly common for women in MHHs (90%, compared to 81% of FHHs). Interestingly, however, no women sourced trees from government forests, while this was reported by one out of 10 men. At the same time, neighbourhood farms were the second most common source for FHHs (14.9%), in contrast to 3.2% for men. Comparing male and female landowners, men were slightly more likely to have a member of the household produce charcoal out of their trees at 65.5% and 52.8% respectively (Table 33). Interestingly, fewer female landowners sold or exchanged trees with 8.3% and 22.6% for women and men, respectively.

Table 33. Sources of trees by gender

% Respondents	Women in FHH	Women in MHH	Men
Own farm	81	91	84
Neighbour's farm	15	3	3
Government forest	0	0	9
Private forest	2	1	1
Community land	2	0	1
Other sources	0	4	1

Regarding producers' reasons for preferred charcoal tree species, availability of the resource was stressed by more women in male-headed households (44%) than men (27%) and women in female-headed households (24%). However, while more female-headed households (47.6%) preferred species that produce the best charcoal, fewer men (19%) valued that attribute. Instead, more of them (35.8%) favoured species preferred by their customers. This could be an indication of weaker links between female heads-of-households and their customers, as nearly three out of four FHHs reported selling their charcoal near the production site compared to their male counterparts (Figure 45).

6.3 Charcoal production

When asked about the months during which women and men produced the most and the least, the findings suggest a clear peak in production for women between late June and October, with limited activity during the rest of the year. At the same time, production volumes tended to peak towards the end of the year, suggesting a potential mismatch between producers' preferred period of engagement and peak demand for charcoal. Interestingly, while the last quarter of the year was associated with the highest charcoal prices in Kitui, the same period correlated

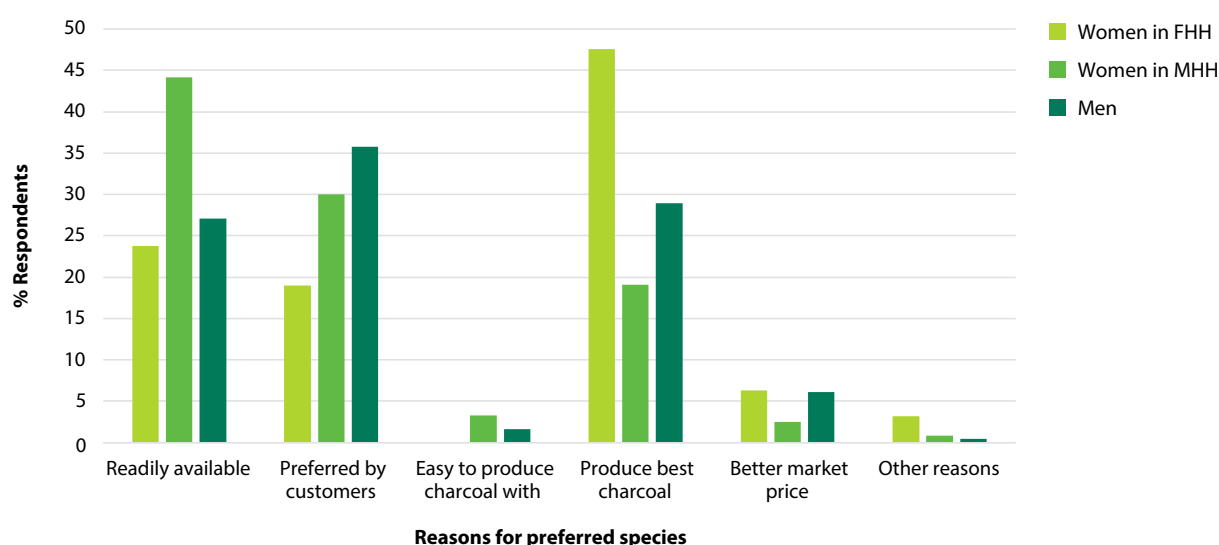


Figure 45. Preferred tree species by gender

with low prices for producers in Kwale and Baringo. Price fluctuations across the year were found to be far higher in Kitui, where selling prices nearly doubled during the final quarter of the year.

Male producers reported producing more evenly throughout the year, although this is likely influenced to some extent by seasonal differences in production peaks between counties. Both FHHs and women in MHHs showed a similar production pattern, suggesting that women's involvement may be more flexible and influenced by seasonal activities and expenses (Figure 46). While no differences were observed in production techniques, male producers produced between two and three times as much as female heads-of-households throughout the year. However, production volumes reported by women in male-headed households were similar to those of male producers, again suggesting some degree of collaboration and labour-sharing within the household.

At the same time, average earnings received by both female heads-of-households as well as women in male-headed households tended to be lower throughout the year in both Kitui and Baringo, where most of the surveyed female producers were located. Generally, across all sites, earnings received by men tended to be 11% higher than female heads-of-households and 24% higher than women in male-headed households. However, in all the sites, the logging moratorium and ban on movement of charcoal could have influenced pricing, more so in Kitui where there was a local ban (Figure 47).

6.4 Charcoal transportation

When quizzed about transport, 90% of interviewed FHHs either transported their charcoal by foot (40%) or didn't transport it at all (50%). While no FHHs transported by motorcycle, 22% of women in MHHs did – potentially suggesting some degree

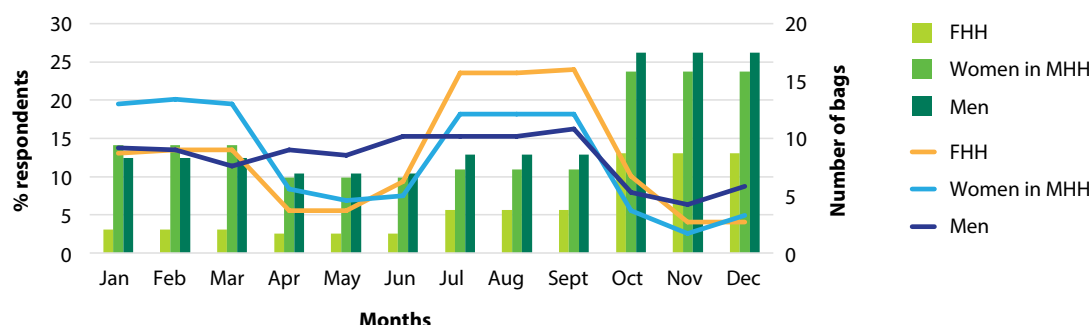


Figure 46. Charcoal production trends by gender

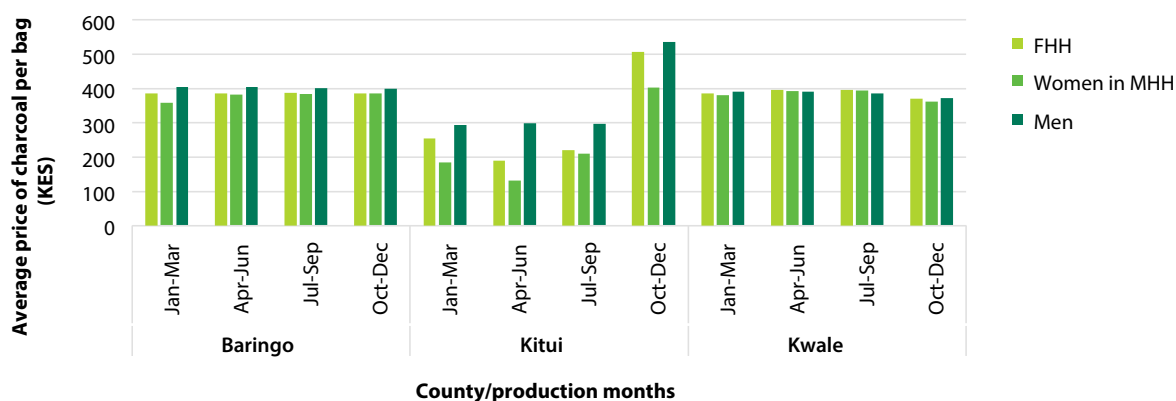


Figure 47. Average selling price per bag by gender

of collaboration or coordination within the household. At the same time, more than a third of male charcoal producers reported using motorized transport. The observed gender segregation of transport means is in line with earlier studies in Kenya (e.g., Delahunty-Pike, 2012) and could suggest a greater involvement of women in more localized value chains.

However, this pattern became less evident among the interviewed transporters. While the study only identified seven female transporters – constituting roughly a quarter of all surveyed transporters – six of them reported using either a truck or motorcycle (Figure 48). Given the limited sample size and the targeted sampling of individuals, these results are inconclusive in terms of gender equity.

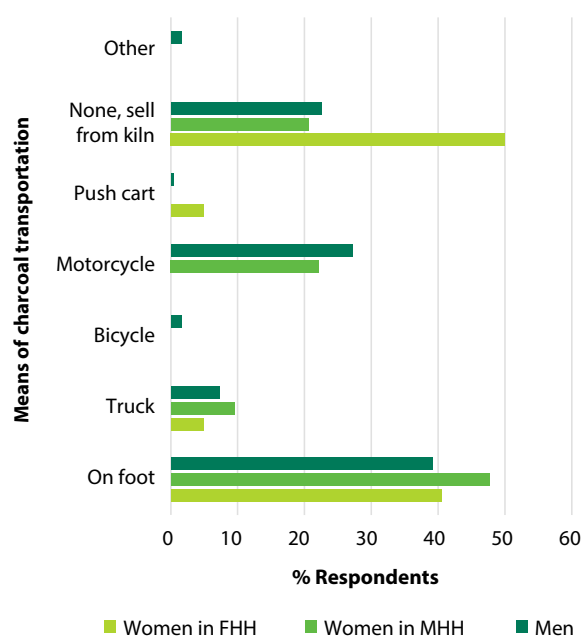


Figure 48. Means of charcoal transportation by gender

6.5 Charcoal trade

As demonstrated earlier, the survey suggests that the charcoal trade is dominated by men. A particularly surprising finding is the considerably low share of women among charcoal retailers (14%), a node identified as female-dominated by a number of earlier studies (e.g., Ndegwa et al, 2016; KFS, 2013). The considerable male dominance in both urban wholesale and retail could perhaps, to some extent, be explained by the fact that during the time of the survey, importation of charcoal into urban areas was inhibited by the ban and logging moratorium. When asked about key challenges in the charcoal business, findings indicated that female traders highlighted low quality, charcoal ban and harassment by law enforcement more often when compared to their male counterparts (Figure 49).

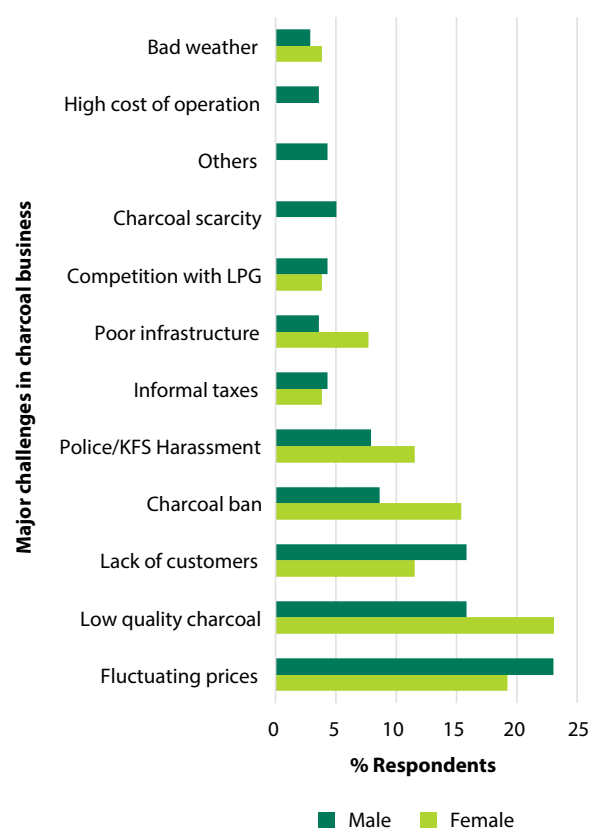


Figure 49. Main challenges in the charcoal business by gender



7

Conclusion and recommendations



Informal charcoal collection point in Kitui. Photo by Geoffrey Ndegwa

The last comprehensive charcoal value chain study in Kenya was conducted almost a decade ago by KFS (2013). Still, the findings confirm the trends reported in these studies. These trends have shown that the charcoal value chains in Kenya are very resilient and adaptive, as there is an insatiable demand for cooking and heating energy sources in urban and peri-urban areas, making charcoal an indispensable energy source for most urban households.

High dependence on woodfuel is driven by both lack of alternatives and preferences. A large proportion of the population uses both LPG and charcoal to manage expenditure and respond to diversity of cooking practices and dietary preferences. It is the urban poor who are more reliant on the charcoal as more than 60% of consumers bought the product in small quantities (tins, buckets and small packets) which reflects the low purchasing power of most of the consumers.

Thus, charcoal plays a critical role in the energy sector, providing fuel for more than half of the urban households and income for many rural households. It remains the second most important income source, an attractive economic venture after agriculture and a coping strategy for many. Income generation and employment are the main drivers and motivation for value chain actors to engage in the charcoal business. Thus, production and trade of this commodity is a viable business as all actors made more than 20% in gross profit margins, with transporters netting more than 45% per bag. In addition, producers realized 50% to 100% in net profits. However, there are critical issues like lack of valuation of wood used for charcoal production.

Although the charcoal value chain is dominated by men, women make up a significant proportion of up to 45% at the production-end, but just about 10% at the trade-end of the value chain. This could have been exacerbated by the logging moratorium and charcoal movement ban. Equally, there were very few women in the middle of the value chain as it requires some means of production, absence from home, and interacting with regulators, thus exposing them to rent-seeking officials (Ndegwa et al, 2020). In addition, this study showed that there were differences between women heads-

of-households and women in male-headed households which should be taken into account when promoting gender equity along the charcoal value chain.

Improvements in the nature, processes and technologies employed during production cannot be over-emphasized if unnecessary tree-cutting is to be reduced. Value chain actors do not have access to adequate technical services which could catalyze improvements in technological efficiencies in tree-growing and wood carbonization. Charcoal production practices and technologies are still very traditional and wasteful; there is a lot of unnecessary tree cutting and most landowners are not involved in tree planting or any tree management practices that would promote tree regeneration and growth. Production is mostly done using earth mound kilns and producers rarely undertake wood pre-drying to improve the efficiency of their production process. Landowners, charcoal producers and traders require support to address various challenges, and improve operations and efficiency in the value chain in order to retain more trees in the landscape.

Legal provisions for formalizing and legalizing charcoal production were hardly complied with. Very few charcoal producers were members of associations, even though it is a legal requirement. The charcoal ban had an impact on the value chain; there was a significant reduction in production, changes in major supply basins, routes and mechanisms most of which resulted in price increases. Charcoal prices had been steadily increasing over time, but the highest increase was recorded in March-April 2018, the period just after the national logging moratorium was announced.

Therefore, in the short- and medium-term there is need to invest in making woodfuel value chains green, sustainable and competitive. Transition to clean cooking is still a long way off. Contrary to the long-standing assumptions of the energy ladder, people are falling back or stacking energy sources to manage expenditure, reliability, meal diversity and cultural preferences. Therefore, the solution is not just transition, but reducing the amount of charcoal consumed in the household energy-mix by providing appropriate, affordable and reliable alternatives, and ensuring efficient and sustainable sourcing and production of charcoal.

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Appendices

Appendix 1. Questionnaire for value chain actors (tree/landowners, producers, traders and transporters)

Date.....

Name of interviewer.....

County..... Sub-county.....

Name of town/market.....

Geographical location

Latitude: **S** .

Longitude: **E** .

Section 1.1 Personal / Socio Demographic and Economic characteristics

Q1. Name of respondent

Q2. Relationship with the household head

Q3. Gender of respondent: 1. Male ☐ 2. Female ☐

Q4. Level of education of VC actor

- | | | | |
|-------------------------------------|--------------------------|-------------------|--|
| 1. Lower primary school (class 1-4) | <input type="checkbox"/> | 4. Tertiary level | <input type="checkbox"/> |
| 2. Upper primary school (class 5-8) | <input type="checkbox"/> | 5. University | <input type="checkbox"/> |
| 3. Secondary school | <input type="checkbox"/> | 6. None | <input type="checkbox"/> Specify |
| 4. Other | <input type="checkbox"/> | | |

Q5. Age of VC actorYears

Q6. Size of household (residing together and eating from same pot)

Q7. What are the three main sources of household income and level of contribution (as %) to household income needs?

- | | |
|-------------------------|----------------------------------|
| 1. Main activity..... | % contribution to HH income..... |
| 2. Second activity..... | % contribution to HH income..... |
| 3. Third activity..... | % contribution to HH income..... |

Q8. Role in Charcoal value chain (Multiple responses accepted)

- | | | | |
|-----------------------|--------------------------|----------------|---------------------------------------|
| 1. Producer | <input type="checkbox"/> | 5. Transporter | <input type="checkbox"/> |
| 2. Broker (Rural) | <input type="checkbox"/> | 6. Retailer | <input type="checkbox"/> |
| 3. Wholesaler (Rural) | <input type="checkbox"/> | 7. Other | <input type="checkbox"/> Specify..... |
| 4. Wholesaler (Urban) | <input type="checkbox"/> | | |

Q9. Number of years in charcoal production/trade.....

Q10. Location(s) of operation (forest/land; shop/yard; route etc) and sub-county and county

- 1.....
- 2.....
- 3.....
- 4.....

Section 1.2 Land owners/tree growers

Q11. Fill in the following table in relation to your land ownership.

1	Total land size from all parcels (acres)	
2	Tenure (with/without title deed, group ranch etc)	
3	Percentage of land under crop cultivation	
3	Percentage of land left fallow	
4	Percentage of land under trees	

Q12. What are the main tree species in your land?

	Local Name	English name	Majority planted (P) or grew naturally (N)?	Estimated number of mature trees	Suitable for charcoal production?
1			P <input type="checkbox"/> ; N <input type="checkbox"/>		YES <input type="checkbox"/> ; NO <input type="checkbox"/>
2			P <input type="checkbox"/> ; N <input type="checkbox"/>		YES <input type="checkbox"/> ; NO <input type="checkbox"/>
3			P <input type="checkbox"/> ; N <input type="checkbox"/>		YES <input type="checkbox"/> ; NO <input type="checkbox"/>
4			P <input type="checkbox"/> ; N <input type="checkbox"/>		YES <input type="checkbox"/> ; NO <input type="checkbox"/>
5			P <input type="checkbox"/> ; N <input type="checkbox"/>		YES <input type="checkbox"/> ; NO <input type="checkbox"/>
6			P <input type="checkbox"/> ; N <input type="checkbox"/>		YES <input type="checkbox"/> ; NO <input type="checkbox"/>
7			P <input type="checkbox"/> ; N <input type="checkbox"/>		YES <input type="checkbox"/> ; NO <input type="checkbox"/>
8			P <input type="checkbox"/> ; N <input type="checkbox"/>		YES <input type="checkbox"/> ; NO <input type="checkbox"/>
9			P <input type="checkbox"/> ; N <input type="checkbox"/>		YES <input type="checkbox"/> ; NO <input type="checkbox"/>
10			P <input type="checkbox"/> ; N <input type="checkbox"/>		YES <input type="checkbox"/> ; NO <input type="checkbox"/>

Q13. What are your main reason (s) for the choice of species mentioned for charcoal production?

1.
2.
3.

Q14. For the **charcoal trees** that were planted, what were the costs of planting and how long do they take to reach a size suitable for charcoal production?

	Species planted	Cost of planting and management (KES/tree)	Years to maturity	Estimated size (DBH)	Estimated quantity of charcoal from mature tree (bags)
1		1. Seedlings 2. Fertilization 3. Management 4. Others			
2		1. Seedlings 2. Fertilization 3. Management 4. Others			
3		1. Seedlings 2. Fertilization 3. Management 4. Others			
4		1. Seedlings 2. Fertilization 3. Management 4. Others			
5		1. Seedlings 2. Fertilization 3. Management 4. Others			

Q15. What methods of biomass harvesting for charcoal do you use and reason for adopting them?

- | | |
|-----------------------------------|--------------------------------------|
| 1. Clear felling | <input type="checkbox"/> Reason..... |
| 2. Selective harvesting | <input type="checkbox"/> Reason..... |
| 3. Pruning/pollarding | <input type="checkbox"/> Reason..... |
| 4. Collection of dead woods/stump | <input type="checkbox"/> Reason..... |

Q16. How do you avail trees to charcoal producers?

- | | |
|--|---|
| A member of the household makes charcoal | <input type="checkbox"/> State relationship |
| Sold to local producers | <input type="checkbox"/> Price per tree (KES) |
| Sold to migrant producers | <input type="checkbox"/> Price per tree (KES) |
| Given to producers for a share of charcoal | <input type="checkbox"/> Percentage/amount |
| Given to producers in exchange for farm labour | <input type="checkbox"/> Explain |
| Given freely to the producers | <input type="checkbox"/> Explain |
| Other | <input type="checkbox"/> Explain |

Q17. How much charcoal has been produced from your land over the last 12 months?..... Bags.

Q18. What is the current level of availability of charcoal production tree species in the land?

Abundant (There are many trees of the preferred species and size)

☐

Scarce (There are only a suitable few trees left in the farm)

☐

Completely depleted (one can hardly find any trees of the preferred species and size)

☐

Q19. What is current and planned future landuse of the land where the trees were/are being harvested for charcoal production?

Current landuse.....

Planned future landuse.....

Q20. After tree harvesting for charcoal, are there any management practices undertaken to support regeneration?

YES ☐ Explain.....

NO ☐ Explain.....

Q21. Are there any regulation governing tree cutting for charcoal in this area?

YES ☐ Explain.....

NO ☐

Q22. If you answer is yes, who enforces these regulations?

Q23. Have you received any kind of support as tree growers/land owners? (for example, seedlings, training, financial support, marketing etc)

YES ☐ State From:

NO ☐

Section 1.3 Charcoal producers

Q24. Why did you get involved in the charcoal production business?

1. It is very profitable ☐

2. It is easy to get into ☐

3. It is a common trade practiced by the family ☐

4. Requires little or no capital ☐

6. It is the only income generating activity available ☐

7. Other (Specify)..... ☐

Q25. What is your main source of trees

1. Own farm ☐ Location

2. Neighborhood farms ☐ Location

3. Government forest ☐ Location

4. Private forest/ranch ☐ Location

5. Other ☐ Specify

Q26. If NOT getting trees from own farm, what is the costs associated with sourcing trees?

1. Free ☐ Explain

2. Buying ☐ Cost (KES)

3. Exchange with portion of produced charcoal ☐ Percentage/quantity.....

4. Exchange with labor for farm clearance ☐ Explain.....

5. Other ☐ Specify

Q27. What is the amount of charcoal (bags) you have produced in the last 12 months?

Charcoal produced	Quantity*	Highest price	Normal price	Lowest price
Oct-Dec 2017				
Jan-Mar 2018				
April-Jun 2018				
Jul-Sep 2018				
Estimated weight of bagkg				

Q28. What factors determine your final selling price?

1. _____
2. _____
3. _____

Q29. Which months are you usually involved in charcoal production?

Q30. What are the main reasons for your involvement in these months?

1. _____
2. _____
3. _____

Q31. Which months are you usually less/not involved in charcoal production?

Q32. What are the main reasons for less/lack of involvement in these months?

1. _____
2. _____
3. _____

Q33. Name three trees species that you mostly produce charcoal from.

1. _____
2. _____
3. _____

Q34. Give reasons why you make charcoal from these tree species (multiple answers accepted)

1. They are readily available ☐
2. They are preferred by my customers ☐
3. They are easy to produce with ☐
4. They produce the best charcoal ☐
5. Charcoal from the trees fetches better market prices ☐
6. Others ☐ Specify.....

Q35. List three tree species that customers prefer charcoal from

1. _____
2. _____
3. _____

Q36. State the reasons why customers prefer charcoal from these tree species.

1. _____
2. _____
3. _____

Q37. Give an indication of the availability of the preferred tree species in your production locality?

1. Abundant (There are many trees of the preferred species and size)
☐
2. Scarce (There are only a suitable few trees left in the farm)
☐
3. Completely depleted (one can hardly find any trees of the preferred species and size)
☐

Q38. What production kilns do you use?

1. Earth-mound kiln ☐
2. Drum kiln ☐
3. Brick kiln ☐
4. Casamance kiln ☐
5. Other ☐ Specify

Q39. If using other kilns apart from earth-mound kilns, how does wood get to the production site?

1. Transport wood to the kiln site ☐
2. Transport kiln to the site where wood is harvested ☐
3. Other (Specify)

Q40. How long does a normal production run last from kiln establishment/setting up to unloading?
.....Days

Q41. What is the average charcoal yield of such a kiln?bags

Q42. Do you pre-dry your wood before producing charcoal?

- YES ☐ How long.....days
- NO ☐

Q43. In terms of percentage of charcoal you sold in the last 12 months, rank your main customer categories?

	Customer	Location (market/town)	Rank	% of charcoal bought
1	Local broker			
2	Transporter			
3	Wholesaler			
4	Retailer			
5	Consumers-household			
6	Consumers-Institutions			

Q44. How do your customers procure charcoal from you?

1. They come to/around the production site ☐
2. I display the charcoal by the roadside ☐
3. They come to my market/selling point ☐
4. I transport to a common collection/selling point ☐
5. I transport to their premises ☐
6. Others ☐ Specify.....

Q45. If you transport, what means of transport do you use?

1. On foot ☐
2. By truck/pick-up truck ☐
3. By bicycle ☐
4. By handcart/donkey cart ☐
5. Others ☐ Specify.....

Q46. If transportation is NOT on foot, do you own the means of transport you use? 1. YES ☐ 2. NO ☐

Q47. If you do not own the means, how much does it cost to transport one bag of charcoal (KES)?

Q48. How far is your charcoal production location from the nearest motorable earth road (km)?

Q49. How far is your charcoal production location from the nearest tarmac road (km)?.....

Q50. a. How far is your charcoal production location from the nearest charcoal collection center (km)...
b. Name of the collection center

Q51. a. How far is your charcoal production location to the nearest rural center (km)?
b. Name of the rural center

Q52. a. How far is your charcoal production location to the nearest major town (km)?
b. Name of the major town.....

Q53. Are you a member of a charcoal producer association? 1. YES ☐ 2. NO ☐.

Q54. If YES, go to questions 55. If No, please answer question 63

Q55. What is the name of the association?

Q56. When was the association formed?

Q57. How many members does the association have?

Q58. Registration fee (KES)

Q59. Other requirements to become a member of the association

1.
2.
3.
4.
5.

Q60. Do you produce all your charcoal through the association? 1. YES ☐ 2. NO ☐.

Q61. If NO, what percentage do you produce as an individual?.....

Q62. What would you say are the benefits of belonging to the association?

1.
2.
3.

Q63. Why have you not joined any association?

1. There are no associations to join ☐
2. I am not interested ☐
3. It is too expensive ☐
4. It is difficult to meet their demands ☐
5. Other ☐ Specify

Q64. List the main final destinations (towns and county) of the charcoal produced from this locality

1. Percentage
2. Percentage
3. Percentage
4. Percentage
5. Percentage

Q65. What are the main challenges that you face in the course of your charcoal production business?

1.
2.
3.

Q66. Who regulates charcoal production in your area?

Q67. He you received any support as charcoal producers? (for example, training, financial support, technology/equipment etc)

1. YES ☐ State support & source
2. NO ☐

Q68. In your own opinion, what should be done to improve the charcoal production business?

1.
2.
3.
4.

Section 1.4 Charcoal traders

Q69. Why did you get involved in charcoal trade?

1. It is very profitable ☐
2. It is easy to get into ☐
3. It is a common trade practiced by the family ☐
4. Requires little or no capital ☐
5. It is the only income generating activity available ☐
6. Other (Specify)..... ☐

Q70. Category of trader

1. Rural broker ☐
2. Rural wholesaler ☐
3. Urban broker ☐
4. Urban wholesaler ☐
6. Retailer ☐
7. Other ☐

Q71. Who is your main charcoal supplier?

	Supplier	Operation county	Operation Subcounty
1	Broker <input type="checkbox"/>		
2	Transporter <input type="checkbox"/>		
3	Wholesaler <input type="checkbox"/>		
4	Retailer <input type="checkbox"/>		
5	Other (specify) <input type="checkbox"/>		

Q72. What is the main unit of charcoal that you buy and how much do you buy per month?

	Unit	Estimated weight (kg)	Price (KES)	Quantity bought per month
1	Bag <input type="checkbox"/>			
2	Bucket <input type="checkbox"/>			
3	Tin <input type="checkbox"/>			
4	Kasuku <input type="checkbox"/>			
5	Other (specify) <input type="checkbox"/>			

Q73. If you are aware, kindly list the places where your supplier(s) sources charcoal from.

	Name area	County	Sub-county
1			
2			
3			
4			

Q74. How does the supplier deliver the charcoal to you?

1. On foot ☐
2. By truck/pick-up truck ☐
3. By bicycle ☐
4. By handcart ☐
5. I collect from his shop/yard ☐
6. Others ☐ Specify

Q75. What is the main unit of charcoal that you sell and what is the selling price?

Unit of sale	Estimated weight (kg)	Price (KES)	Percentage of total sales
Bag			
Bucket			
Tin			
Kasuku			
Other (specify)			

Q76. Who have been your main customers over the last 12 months?

1. Transporters ☐ Percentage of total sold
2. Wholesalers ☐ Percentage of total sold
3. Brokers ☐ Percentage of total sold
4. Retailers ☐ Percentage of total sold
5. Business (restaurants, kiosk etc.) ☐ Percentage of total sold
6. Institutions ☐ Percentage of total sold
7. Households ☐ Percentage of total sold
8. Others ☐ Specify

Q77. Which are the main tree species the charcoal you sell is produced from?

Tree species		Preference rank
Local name	English/common name	

Q78. What is reason why you sell charcoal from these tree species?

1. Easily available ☐
2. Customer preference ☐
3. Lower cost thus higher profit margin ☐
4. Other ☐ Specify

Q79. What are the main expenses that you incur in KES per month/day/trip?

Expenses	Specify month/day/trip	Paid to	Point of payment	Amount (KES)	Payment frequency (per day, month, trip, bag)	Description
Rent						
Transport 1						
Transport 2						
Security						
Cess 1						
Cess 2						
Cess 3						
Market fee 1						
Market fee 2						
License 1						
License 2						
License 3						
License 2						
Bribes 1						
Bribes 2						
Bribes 3						
Other						
Other						
Other						

Q80. Do you belong to any charcoal traders' association? Yes ☐ No ☐

If **YES** continue with question 81, If **Not** go to question 87

Q81. Name of the Association

Q82. When was the Association formed?

Q83. How many members does the association have?

Q84. Registration fee (KES)

Q85. Other requirements to become a member of the association

1.
2.
3.
4.
5.

Q86. What would you say are the benefits of belonging to the association?

1.
2.
3.
4.

Q87. Why have you not joined any association?

1. There are no associations to join
2. I am not interested ☐
3. It is too expensive ☐
4. It is difficult to meet their demands ☐
5. Other ☐ Specify.....

Q88. What are the main challenges that you face in the course of your business?

1. _____
2. _____
3. _____
4. _____
5. _____

Q89. Who are the main agencies controlling charcoal trade?

1. _____
2. _____
3. _____

Q90. In your own opinion, what should be done to improve the charcoal business?

1. _____
2. _____
3. _____
4. _____
5. _____

Section 1.5 Charcoal transporters

Q91. Why did you get involved in charcoal transportation?

1. It is very profitable ☐
2. It is easy to get into ☐
3. It is a common trade practiced by the family ☐
4. Requires little or no capital ☐
5. It is the only income generating activity available around ☐
6. Other (Specify) ☐

Q92. Where do you mostly transport your charcoal from (multiple locations accepted)?

	Location	Subcounty	County
1			
2			
3			
4			

Q93. Which are your most common final destinations for your charcoal?

	Location	Subcounty	County
1			
2			
3			
4			

Q94. Who were your main charcoal transport clients in the last 12 months?

	Client	Location	Percentage of total transported
1	Producers (individuals) <input type="checkbox"/>		
2	Producer associations <input type="checkbox"/>		
3	Brokers <input type="checkbox"/>		
4	Wholesalers <input type="checkbox"/>		
5	Registered company <input type="checkbox"/>		
6	Retailers <input type="checkbox"/>		
7	Other <input type="checkbox"/> Specify		

Q95. What is the transport arrangement between you and the clients?

1. They procure/make the charcoal and hire me to transport ☐
2. They place and order which I procure and deliver at an agreed price ☐
3. I buy the charcoal and sell it to them from the truck on a need-basis ☐
4. Other (Explain)

☐

Q96. What means of transport do you use?

Means of transport	Capacity (Tonnage)	Capacity (bags)
Truck <input type="checkbox"/>		
pick-up truck <input type="checkbox"/>		
Bicycle <input type="checkbox"/>		
Handcart/donkey cart <input type="checkbox"/>		
Other <input type="checkbox"/> Specify		

Q97. Do you own the means of transport? Yes ☐ No ☐

Q98. How is the charcoal delivered to you?

1. On foot ☐
2. By truck/pick-up truck ☐
3. By bicycle ☐
4. By handcart ☐
5. I collect from collection center ☐
6. I collect from production point ☐
7. Others ☐ Specify

Q99. Who were your main customers over the last 12 months?

Customer	Location	Percentage of the total bought
Transporters <input type="checkbox"/>		
Wholesalers <input type="checkbox"/>		
Brokers <input type="checkbox"/>		
Retailers <input type="checkbox"/>		
Business (restaurants, kiosk etc.) <input type="checkbox"/>		
Institutions <input type="checkbox"/>		
Households <input type="checkbox"/>		
Others <input type="checkbox"/> Specify.....		

Q100. What are the main tree species the charcoal you sell is produced from?

Tree species		Rank
Local name	English/common name	

Q101. What is reason dealing in charcoal from these tree species?

1. Easily available ☐
2. Customer preference ☐
3. Lower cost thus higher profit margin ☐
4. Other ☐ Specify

Q102. What are you're the expenses you incur in the course of your transport business from different locations?

Item	Location 1	Location 2	Location 3	Location 4
Estimated kilometers				
Length of travel (Days)				
Vehicle hire (if applicable)				
Cost of fuel				
Cost of driver				
Cost of driver assistant				
Cost of labour- rural				
Cost of labour- urban				
Cost of parking- rural				
Cost of parking- urban				
Security				
Accommodation				
Cess 1- Point paid				
Cess 2- Point paid				
Cess 3- Point paid				
License 1- Point of payment				
License 2- Point paid				
License 3- Point paid				
Informal tax 1- Point paid				
Informal tax 2- Point paid				

Q102. Continued

Item	Location 1	Location 2	Location 3	Location 4
Informal tax 2- Point paid				
Vehicle servicing				
Market fees				
Other costs- Specify				
Other costs- Specify				
Other costs- Specify				
Cost of charcoal (bags)- common price				
Capacity of vehicle (Bags)				
Number of trips per month				

Q103. Is there a difference in the buying price of charcoal between months? Yes ☐ No ☐

Q104. If the answer is YES, fill-in the following table

Location	Description	Price/months	Reason for price variation between months
.....	High price		
	Months of high price		
	Common price		
	Months of common price		
	Low price		
	Months of low price		
.....	High price		
	Months of high price		
	Common price		
	Months of common price		
	Low price		
	Months of low price		
.....	High price		
	Months of high price		
	Common price		
	Months of common price		
	Low price		
	Months of low price		

Q105. Do you belong to any charcoal related association? Yes ☐ No ☐

If **YES** continue with question 106, If **Not** go to question 112

Q106. Name of the Association.....

Q107. When was the Association formed?.....

Q108. How many members does the association have?.....

Q109. Registration fee (KES).....

Q110. Other requirements to become a member of the association

1. _____
2. _____
3. _____
4. _____
5. _____

Q111. What would you say are the benefits of belonging to the association?

1. _____
2. _____
3. _____
4. _____
5. _____

Q112. Why have you not joined any association?

1. There are no associations to join ☐
2. I am not interested ☐
3. It is too expensive ☐
4. It is difficult to meet their demands ☐
5. Other ☐ Specify.....

Q113. What are the main challenges that you face in the course of your business?

1. _____
2. _____
3. _____
4. _____
5. _____

Q114. In your own opinion, what should be done to improve the charcoal business?

1. _____
2. _____
3. _____
4. _____
5. _____

Appendix 2. Charcoal Consumers Rapid data collection tool

(To be administered at charcoal selling sites)

SECTION 2.1 RESPONDENT INFORMATION

Name:	Date of interview:
Sub-county:	Location:
Sub-location:	Village/town/estate:

Relationship to the household head or position in business/institution.....

SECTION 2.2 FOOD FLOW INFORMATION

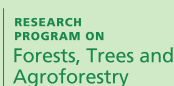
1	State your primary and secondary cooking energy sources
	Primary (Used for majority of household cooking activities):
	Secondary (Used to supplement the main primary source like to cook light meals, meals that take a long time to cook, cook in main house etc).....
2	What is the reason for using these energy sources as primary and secondary respectively?
	Primary: Affordable <input type="checkbox"/> ; Readily available <input type="checkbox"/> ; Less emissions <input type="checkbox"/> ; Efficient/less fuel <input type="checkbox"/> ; More heat intensity <input type="checkbox"/> ; Clean <input type="checkbox"/> ; Safe (fire risk) <input type="checkbox"/> ; Easy to use <input type="checkbox"/> ; Mobility(stove) <input type="checkbox"/> ; Culture <input type="checkbox"/> ; Lasts long <input type="checkbox"/> ; Others <input type="checkbox"/> ; Specify.....
	Secondary: Affordable <input type="checkbox"/> ; Readily available <input type="checkbox"/> ; Less emissions <input type="checkbox"/> ; Efficient/less fuel <input type="checkbox"/> ; More heat intensity <input type="checkbox"/> ; Clean <input type="checkbox"/> ; Safe (fire risk) <input type="checkbox"/> ; Easy to use <input type="checkbox"/> ; Mobility(stove) <input type="checkbox"/> ; Culture <input type="checkbox"/> ; Lasts long <input type="checkbox"/> ; Others <input type="checkbox"/> ; Specify.....
3	What is the MAIN unit of charcoal that you buy?
	1. Bag/Sack <input type="checkbox"/> ; Estimated weight
	2. Bucket <input type="checkbox"/> ; Estimated weight
	3. Kasuku <input type="checkbox"/> ; Estimated weight
	4. Tin <input type="checkbox"/> ; Estimated weight
	5. Others <input type="checkbox"/> ; Specify.....
	Based on this unit, state the charcoal prices over the last 12 months and specify the unit of sale.
	October 2017
	January 2018
	April 2018 Unit of sale.....
	July 2018
	October 2018
	What are the factors that have affected charcoal pricing over the last 12 months?
	1.
	2.
	3.

SECTION 2.2 FOOD FLOW INFORMATION

4	<p>What is the size of your household/population you serve food?</p> <p>When using only charcoal for cooking, how many days does one unit last?</p> <p>When using charcoal with other sources of energy, how many days does one unit last? Quantity..... Units.....</p>
5	<p>What are the three main tree species that you prefer charcoal from?</p> <p>1. _____ Reason: _____</p> <p>2. _____ Reason: _____</p> <p>3. _____ Reason: _____</p> <p>How easy is it to identify charcoal from these species?</p> <p>1. Easy (can easily and accurately identify) <input type="checkbox"/></p> <p>2. Moderate (can only identify some of them depending on some key feature like size) <input type="checkbox"/></p> <p>3. Difficult (cannot distinguish between charcoal from different species) <input type="checkbox"/></p> <p>Which characteristics enable you to identify charcoal from these species?</p> <p>1. Size of charcoal pieces <input type="checkbox"/>; Explain</p> <p>2. Weight of charcoal <input type="checkbox"/>; Explain</p> <p>3. Color of charcoal <input type="checkbox"/>; Explain</p> <p>4. Texture of charcoal <input type="checkbox"/>; Explain</p> <p>5. Smell of charcoal <input type="checkbox"/>; Explain</p>
6	<p>Is this seller (point of interview) your main supplier of charcoal?</p> <p>1. Yes <input type="checkbox"/>;</p> <p>2. No <input type="checkbox"/>, State the main one</p> <p>Why do you prefer buying charcoal from your main supplier?</p> <p>1. Price is low compared to others <input type="checkbox"/></p> <p>2. Sells good quality charcoal <input type="checkbox"/></p> <p>3. Friendly <input type="checkbox"/></p> <p>4. Accessibility <input type="checkbox"/></p> <p>5. Customer service (transport, packaging) <input type="checkbox"/></p> <p>6. Always available <input type="checkbox"/></p> <p>7. Others <input type="checkbox"/>, Specify</p>
7	<p>How many charcoal sellers are located within 10 minutes' walk (about 500 meters) from your house?</p> <p>1. 0-9 <input type="checkbox"/></p> <p>2. 10-19 <input type="checkbox"/></p> <p>3. 20-29 <input type="checkbox"/></p> <p>4. 30-39 <input type="checkbox"/></p> <p>5. 40-49 <input type="checkbox"/></p> <p>6. 50 and above <input type="checkbox"/></p>



Kenya's charcoal sector is worth billions of dollars in market value and is one of the most important sources of energy in urban and rural areas. This study sought to create greater understanding about the charcoal value chain to understand its structure, function and actors and their roles. The study was carried out through a questionnaire survey in Baringo, Kitui, and Kwale which are key sources of charcoal consumed in Nairobi and Mombasa. Findings indicated that less than 10% of the charcoal is sold through the Charcoal Producer Associations (CPAs), though this is a legal government requirement. About 85% and 15% of the charcoal sold in Nairobi and Mombasa respectively was imported from Uganda which could be due to the logging moratorium and charcoal ban in the country since the beginning of the year 2018. Women accounted for close to 50% of the charcoal producers but their participation was low in the transportation and vending stages of the value chain. The gross margin for landowners, charcoal producers and transporters was between 0-5%, 11-18%, 37-56 whilst that of vendors (wholesalers and retailers) was 11-26% when the charcoal is sold at wholesale price in sacks and 26-41% when sold in small quantities at retail price. From the study, we conclude that: i) the charcoal value chain in Kenya is very resilient and adaptive, as there is an insatiable demand for cooking and heating energy ii) income generation and employment is the main driver and motivation for value chain actors to engage in the charcoal business; iii) processes and technologies used are inefficient, leading to unnecessary tree cutting, and finally; iv) charcoal production and trade is a competitive business for all actors in the value chain. In the short- and medium-term there is need to invest in making woodfuel value chains green, sustainable and competitive.



World Agroforestry (ICRAF)

World Agroforestry (ICRAF) is a centre of science and development excellence that harnesses the benefits of trees for people and the environment. Leveraging the world's largest repository of agroforestry science and information, we develop knowledge practices, from farmers' fields to the global sphere, to ensure food security and environmental sustainability. ICRAF is a CGIAR research centre.

