



Octa Journal of Environmental Research

(Oct. Jour. Env. Res.) ISSN: 2321-3655

Journal Homepage: <http://www.sciencebeingjournal.com>



PROSOPIS JULIFLORA PRODUCTS MARKET CHAIN ANALYSIS IN GARISSA AND TANA RIVER COUNTY, KENYA

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Received: 5th Nov. 2022 Revised: 12th Dec. 2022 Accepted: 15th Dec. 2022

Abstract: *Prosopis juliflora* may have been introduced into Kenya by livestock from Sudan or southern Africa or by traders from India or southern Africa. *Prosopis juliflora* is a multi-purpose tree that provides various benefits ranging from non-wood to wood products. It produces good quality fuel of high-quality calorific value, which burns well even when freshly cut. It provides a useful resource for poor communities because it requires low investment to develop and manage. However, in the introduced areas, the extent to which it is utilized varied widely around different areas of the world. Communities' knowledge and perception on *P. juliflora* have negatively affected its management and utilization. Stakeholders participate in all stages of the market value chain that plays specific roles along the value chain. The survey was undertaken in Garissa and Tana River Counties. A total of 150 respondents were sampled and interviewed. The survey established that *P. juliflora* was utilized for charcoal production (42%), poles/posts (29%), bee forage (17%), and pods (12%). Trading in *P. juliflora* products is a major source of income amongst the community members in Garissa and Tana River Counties. Prosopis charcoal contributes a total amount of from Ksh 3 million to 16 million in Garissa County and Ksh 60 million to 200 million in Tana River County annually. The markets of *P. juliflora* products were characterized by local brokers who affect the prices of the products in both Counties. Prosopis *Juliflora* products were locally in Garissa Ndogo, Livestock Market, Bulla Iftin in Garissa County, and Bura Tana, Hola, Madogo, and Jarendete in Tana River County. The challenges in marketing *Prosopis juliflora* products were low demand for some products such as firewood and pods, high transport costs, inadequate entrepreneurial skills, and uncoordinated stakeholders. Therefore, there needs to enhance the entrepreneurial and value-addition skills of Prosopis products producers and market dealers.

Keywords: Market; Products; Value Chain; *Prosopis juliflora*; Charcoal

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INTRODUCTION

Pressure from human population increase, developmental projects like the introduction of exotic plants such as *Prosopis* species and animals coupled with climate change impacts poses serious challenges in the conservation of resources within Arid and Semi-arid Lands (ASALs). Some of the introduced tree species have turned to be invasive hence posing challenges for humans and animals. Among other tree species, *Prosopis juliflora* was

introduced in Kenya to solve environmental challenges. The introduction of Prosopis was based on its ability to tolerate drought, coppice, and generate multiple products. *Prosopis juliflora* grows to form a dense impenetrable thicket that can be used to rehabilitate ASALs. It provides a useful resource for poor communities because it requires low investment to develop and manage (Geesing *et al.*, 2004). It is utilized for timber, poles, posts, and pods for livestock and human, floor tiles, furniture, handicrafts, possible medicinal value, gum production, and

tannin extraction to bee forage hence the need to be regarded as a species of commercial importance (Pasiiecznik, 2001). The tree is used for shade, conservation and rehabilitation of degraded and saline soils. The wood and pods are used to make a range of products at local and industrial levels (Mwangi and Brent 2005, Pasiiecznik, 1999 and Pasiiecznik et al. 2001). Changes on land use, competitive ecological advantages and climate change are factors that influence the probability of invasion (Pasiiecznik et al., 2001). Locally, *Prosopis juliflora* is highly valued and is of significant socio-economic benefits to countryside communities. *Prosopis juliflora* grows well in most of the Arid and Semi-arid Lands (ASALs) of Kenya which account for about 80% of the country's land area. In Kenya, *P. juliflora* was introduced by livestock from Sudan or southern Africa or by traders from India or southern Africa. However, there were already few isolated *Prosopis* trees in the 1930 though the official documentation of *P. juliflora* introduction in Kenya was done in 1973. The documentation illustrated that seeds were imported from Brazil and Hawaii for the rehabilitation of quarries in the saline soils at Baobab Farm near Mombasa and Menengai (Nakuru County) (Jama and Zeila, 2005). *Prosopis juliflora* was introduced in Kenya for fodder, shade and ornamental purposes. The first major planting programmes of 1980s were undertaken as a dryland forestation programme supported by the FAO and other agencies in Garissa, Wajir, Mandera, Baringo, Turkana, Taita Taveta, Tana River & Turkana counties (Choge et al., 2002). However, there were no efforts to manage the plantations leading to naturalization and invasion which were both observed as the local communities were unaware of the risks posed by the invasive species. In the 1990s, *P. juliflora* spread quickly, aided by livestock and water runoff (Choge et al., 2002). Subsequent spontaneous diffusion of this knowledge and skills base between community groups in Baringo County provides further evidence of its acceptability and usefulness by beneficiary groups. This demonstrates how knowledge can change perceptions, turning a problem into a valuable resource (Pasiiecznik et al., 2006). *Prosopis juliflora* potential to provide

essential services in extreme marginal conditions is not fully exploited (Choge et al., 2002).

Among other *P. juliflora* products, Charcoal production has increased annually from 1990 44 million tons in 2000 (World Agroforestry Centre, 2006). *Prosopis* charcoal is widely acknowledged to be of high quality and is more popular than that from other trees according to a recent KEFRI survey. However, Kenyan Government policy is that the production and transport of charcoal are illegal unless a license has been applied for and approved (Pasiiecznik et al., 2006). The annual domestic charcoal consumption in Kenya stands at about 2 million tons. Therefore, *P. juliflora* provides an opportunity for poverty reduction as a source of livelihood to the affected communities (World Agroforestry Centre, 2006). In 1990, Baringo County reported that charcoal retailed at an average of Ksh 200 while fetching an average of Ksh 800 in Kisumu, Eldoret, Nakuru and Nairobi. Mwangi and Brent, 2005 indicated that in Kenya *Prosopis* was extensively used though the uses differed between the sites. Marketing of *P. juliflora* products has been difficult as its substitutes were already abundant throughout the market. Mutimba and Barasa 2005 states that in Garissa, *P. juliflora* was the main source of raw material for charcoal production. Local communities in Garissa clear and produce charcoal from *Prosopis juliflora* in an effort to save pastures for their livestock. *Prosopis juliflora* earned an average monthly income of 5.0 million at Marigat Sub-County over a four-month period in 2009. *Prosopis juliflora* produces quality fuel of high calorific value, which burns well even when freshly cut (Pasiiecznik, 2001). Thus, a study was undertaken to analyze market chain of *P. juliflora* products in in Garissa and Tana River Counties. The objectives of the study were to identify the main *Prosopis juliflora* products in Garissa and Tana River County and assess its market chains for the key *Prosopis* products in Garissa and Tana River County.

MATERIAL AND METHODS

Study Sites

Association (CPAs) and Charcoal Producers Group (CPGs) officials. Observations and photographing were also made during the survey to supplement information collected through interviews. Secondary data was collected through literature review of related publications, reports from relevant offices such as Kenya Forest Services and Ministry of Environment and Forestry. A total of 150 respondents involved in harvesting and marketing of *P. juliflora* products were randomly sampled and interviewed. The data was coded and entered into computer using Microsoft excel spread sheet. It was cleaned and transferred to SPSS computer package version 21 for analysis. The data was analysed for frequencies, mean, minimum, maximum and range and results summarised into graphs, tables, and pie charts.

RESULTS AND DISCUSSION

Socio-economic characteristics of Producers

The average age of household heads in Garissa and Tana River County involved in *Prosopis juliflora* harvesting and utilization was 41 years. In Garissa County, 52% of the respondents registered no-formal education where as 48% had attended primary level of education. On the other hand, in Tana River County 77% attended primary education while 23% attained secondary education level. The average household size in both counties was seven (7) members per household. Furthermore, 65 % of the family members were children aged between 6 and 25 years while 35% were aged above 25 years. The survey established that major sources of income in Garissa and Tana River counties were farming (40%), charcoal production (30%) and bee keeping (30%). The annual household income was farming (Ksh 62,000), charcoal production (Ksh 227,491), wages (Ksh 112,500), poles (Ksh 99,300) and fodder (Ksh 76,667). Land tenure system in Garissa and Tana River County is 63% communal and 37 % private. Those who owned private land, 73% owned an average land size of 8 acres while 27 % had less than 3 acres of

land. Majority of those who owned land had no title deeds. The lack of title deeds is attributed to the fact that most land is communal and subdivided into ranches. The survey showed that 70% were involved in crop farming while 30% were involved in livestock farming and other activities. Most cultivated crops and fruit trees included tomatoes (20%), watermelon (20%), bananas (16%), maize (16 %), mangoes (15%) and pepper (4%) and lemon (4%) on average land size under of 2.2 acres.

Utilization of *Prosopis juliflora* as an enterprise

Majority of the locals (80%) were involved in utilisation of *P. juliflora* despite its disadvantages. *Prosopis juliflora* (Figure 2) was utilized for charcoal production (42%), poles/posts (29%), bee forage (17 %) and pods (12%). Trading in *P. juliflora* products is a major source of income amongst the community members in Garissa and Tana River Counties it provides income, employment and subsistence products to the host communities right from harvesting, processing, and transportation and marketing. *Prosopis juliflora* enterprise employed an average four (4) people along products chain (harvesting, processing, transporting and marketing/selling).

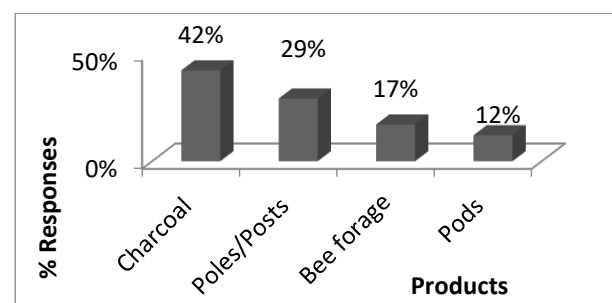


Figure 2: *Prosopis juliflora* products

Prosopis juliflora Value Chains

Market value chain analysis helps to match supply and demand and to establish an efficient marketing channel. A value chain it refers to the full range of activities that are required to bring products and services from conception through the different phases of production to the final consumer and even disposal after use (Kaplinsky 1999; Kaplinsky and Morris 2002). When designing a marketing strategy for *P. juliflora* that brings livelihood benefits to

producers, it is important to consider carefully the enterprise scale and type, in terms of markets, products and social organisation. The *P. juliflora* products market value chain starts from tree growing, harvesting, processing, packaging, transportation, retailing and distribution and ends with its consumption including all the economic activities undertaken between these stages (Figure 3). Different stakeholders participate in all stages of the value chain by playing specific roles (Shively et al. 2010). Kakuru, 2010 identified key players to be land owner at the level of tree growing, forest authorities, harvesters, processors, transporters, traders (retail and wholesale) and consumers. Some value chains also include middlemen. Sustainable management of *P. juliflora* can be achieved through utilisation, offering a win-win approach to food and energy security and sustainable land management, especially in the face of an increasingly uncertain climate. Therefore, this study was undertaken in Garissa and Tana River Counties where *P. juliflora* invasion is being experienced by analysing market chain of *P. juliflora* products. The two counties utilize it through clearing of the thickets for various products while saving pastures for their livestock. *Prosopis juliflora* products value chain comprise of tree growing, harvesting, processing, packaging, transportation, retailing and distribution and consumption.

Prosopis juliflora has colonised Tana River basin both in Garissa and Tana River Counties hence providing raw materials for their production and other uses. In this case, harvesting of the raw materials was done in Wadhajir and Maramtu farms in Garissa County and Hola, Bura Tana, Madogo and Jarendente for Tana River County. The survey revealed that harvesting of *P. juliflora* took 2-3 days to assemble adequate quantities before transportation. Harvesting process was carried by 2-4 people depending on the products being harvested.

Transportation of *P. juliflora* Products

Most products were transported from production to selling points mostly in town centres. The common mode of transporting *Prosopis*

products were by lorries (43%), motorcycle 43% and Donkey cart 14% (Figure 4). Motorcycles were used to avoid obtaining movement permits; for example, motorcycles were supposed to carry 3 bags per trip as stipulated within the rules but would go for more than two trips in a day. A total of 72% members owned donkey carts for transportation of the *Prosopis* products to the markets where as 28% would hire donkey carts for Ksh 300 per trip. For instance, depending on the size of the cart, it carried an average of 140 pole/posts per trip. Donkey carts were used for short distance transport whereas other means of transport would be sought when transporting for long distance.

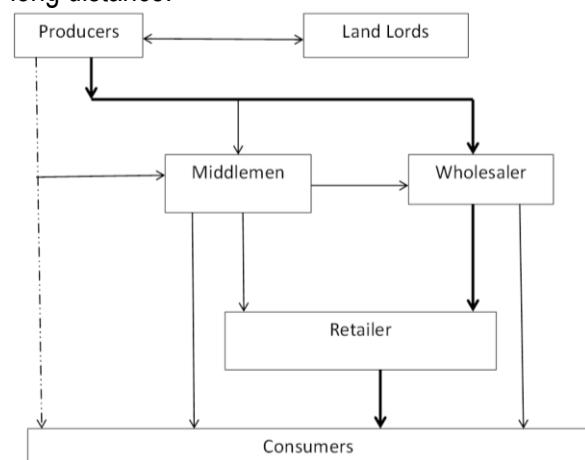


Figure 3: Market channels of *P. juliflora* products

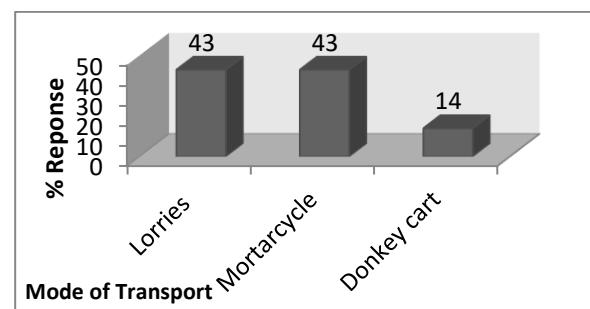


Figure 4: Mode of transport

Prosopis products were transported from producers either to wholesalers or small-scale retailers or even directly to consumers. *Prosopis* products prices vary with distance, the ban by the government and bargaining power of the CPA (specifically for charcoal). The prices are mainly determined by the transporters and middlemen with the prices being higher during the government bans, during drought and

hunger seasons. However, forest products can only be transported between 6.00 am and 6.00 pm. For instance, *P. juliflora* charcoal is always transported either directly to the next market or to the roadside to await buyers, with transportation from the production site done by the buyer. However, *P. juliflora* charcoal producers did not incur much transport cost because brokers sourced charcoal at farm gate using Lorries to Nairobi. Among other products, charcoal was transported to Nairobi (90%), Garissa town (10%) from production in Garissa and Tana River counties at an average cost of Ksh 26,500 per lorry trip. However, there was no

value addition/technology done on the products. The survey showed that the *Prosopis* products like charcoal were available (90%) throughout the year except for honey and pods (10%) that were available by seasons. The study revealed that each Lorry transported an average of between 1000 and 1500 bags of *P. juliflora* charcoal on weekly basis. Transporters paid Ksh 20 to 50 per bag as CESS fees both in Garissa and Tana River County. However, there was an outcry from the transporters that they were forced to pay illegal taxes at police checkpoints along the highways which contributed to high prices once the product reaches Nairobi.



Figure 5: Transportation of *Prosopis juliflora* products

Marketing of *Prosopis juliflora* products

The market of *P. juliflora* products was characterised by local brokers who affects prices of the products in both Counties. Only 10% of the respondents in Garissa and Tana County were involved in *Prosopis* products trade while the rest practiced farming. *P. juliflora* products (Figure 6) available in the market were charcoal (50%), poles/posts (38%), firewood (6%) and withies (6%). *Prosopis juliflora* products were sold in local markets of Garissa Ndogo, Livestock Market, Bulla Ifin and Bulla Mzuri market, Korakora, Warable Market, Kamuthe, Nanighi Jambale, Guyo and Dar esalam in Garissa County and Bura Tana, Hola, Madogo, Jarendete in Tana River County. Poles/posts were taken direct from the farm to the market hence no brokers were involved in marketing of the products. An average of 3,900 *P. juliflora* poles/posts were sold in the market per week for Ksh 50 (small poles) and Ksh 150 for the big sized posts/poles. Most of the poles/posts were sold without processing or value addition.

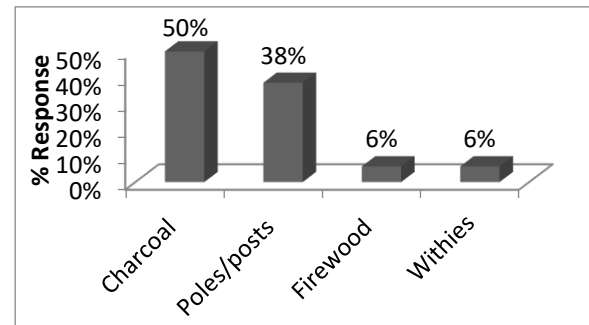


Figure 6: *Prosopis* products in the market

A key observation on firewood, pods and honey was that there is no standardised unit for measuring firewood quantities like in charcoal production. However, firewood, pods and honey enterprise was done at a very low scale unlike *P. juliflora* charcoal. It was found that firewood was sold at Ksh 150 per head load whereas pods were sold at Ksh 125 per bag (90 Kg bag) and honey at an average price of Ksh 700 per kilogram. *Prosopis juliflora* charcoal supply chain consists of three levels. First, the transporters visit the production site or a designated collection point of the bulked charcoal. They then transport the charcoal to

vendors (wholesale or retail) mostly in urban areas. In a national survey done by Mutimba and Baraza, 2005, it was reported that 56% of producers sold their charcoal to vendors via transporters as well as directly to households, food businesses, and other customers including social institutions. At production, charcoal was packaged using 50kg gun bags which carry about 35kg of charcoal. At the retail level, charcoal was sold in different quantities. On one end there are outlets for bulk purchases using bags, while at the other end are small-scale retailers, found within very close proximity to households (CHAPOSA, 2002). The survey revealed that the main *Prosopis* charcoal markets (Figure 7) were commercial enterprises (70%), households (20%) and institutions (10%).

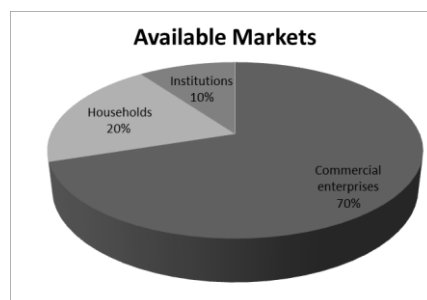


Figure 7: Available markets for *P. juliflora* charcoal

In the market, charcoal takes the bulky part in *Prosopis* utilization where the prices of charcoal range from Ksh 250- 550 of 50kg bag and Ksh 1000 of 90 kg bag. Local dealers reported to sell an average of 480 -600 bags of charcoal per month.



Figure 8: *P. juliflora* products in the market

Contribution of *P. juliflora* charcoal in Garissa and Tana River County

P. juliflora charcoal played a big role in revenue generation in in the two counties. It contributed total amount of from Ksh 3 million to 16 million in Garissa County and Ksh 60 million to 200 million in Tana River County annually (Table 1). However, fluctuations were experienced in both counties as a result of diminishing of *P. juliflora* in Tana River County, floods and government ban on logging.

Table 1: Charcoal Sales in Garissa and Tana River Counties (Qty in Tons)

Year	Garissa County	Tana River County
2012	-	91,353,900
2013	13,130,040	69,301,030
2014	19,030,620	278,843,720
2015	64,687,350	67,230,280
2016	3,002,950	217,004,700
2017	16,037,700	91,550,550

Source: Kenya Forestry Service Office, Tana River

Key Stakeholders along the *P. juliflora* charcoal value chain

According to the charcoal rules 2009, commercial charcoal producing individuals or groups organise themselves into charcoal producers' associations (CPAs). Sometimes producers within a particular area first organise themselves into charcoal producers' groups (CPGs) and join together to form CPAs. CPGs are registered with the ministry of social services as community-based organizations (CBOs). Whereas CPAs register with the Attorney General's (AG) office and the Kenya Forest Service (KFS) and are charged with facilitating sustainable production of charcoal by the membership and ensuring the implementation of reforestation and conservation plans. The production and marketing of *Prosopis juliflora* charcoal in Garissa County was organised under an umbrella body that houses eight (8) Charcoal Producers Associations with an average of 24 members. The CPAs are located

in Fafi, Jambale, Nanighi, Kamuthe, Bulla Baluku and Guyo. Furthermore, the CPAs consists 24 Charcoal Producers Groups (CPGs) with unlimited number of memberships. Among other CPGs, Fafi CPAs has two (2) CPGs that include Bura Youth Association (CPG) and Bura Agro-forestry Association. The functions of the umbrella body are to coordinates charcoal activities in the County. There are some efforts in pipeline to ensure that the charcoal produced by various CPAs is branded. The motivation for the formation of associations/groups was

attributed to management and control of invasive species particularly *P. juliflora*, availability of resources that were being exploited by the non-residents. Furthermore, the Fafi CPA engages youth to collect Ksh 8,000 per lorry per day, Ksh 20 per bag for the other CPAs, Ksh 20 per bag is also collected by the CPGs and sawing of the bags is done at Ksh 10 per bag. Other stakeholders in both counties were Kenya Forest Service, Administrative chiefs, County government and Civil Society Organizations (Table 2).

Table 2: *Prosopis juliflora* stakeholders along the value chain

Stakeholders	Role	Gaps
Kenya Forest Service	<ul style="list-style-type: none"> Is in-charge of the sustainable management, conservation and rational utilization of forest resources for the socio-economic development of the counties Licensing of charcoal production 	<ul style="list-style-type: none"> Limited resources to roll out implementation of charcoal regulations in the entire country Inadequate capacity to enforce and promote conservation and sustainable utilization to the relevant groups
Kenya Forestry Research Institute	<ul style="list-style-type: none"> Conduct research on <i>Prosopis juliflora</i> in the counties Provide technical support to <i>Prosopis juliflora</i> stakeholders Dissemination of research findings to the stakeholders 	<ul style="list-style-type: none"> Low rate of adoption of technologies
CPAs, CPGs and individual tree resource owners	<ul style="list-style-type: none"> Promotes conservation and sustainable utilization of <i>Prosopis juliflora</i> Facilitate the issuance of certificate of origin to transporters Consolidate charcoal at the collection/bulking sites for transporters Sell charcoal to transporters and receive money on behalf of the producers Keep records of charcoal deliveries to collection centers and give payments to producers 	<ul style="list-style-type: none"> Limited capacity to offer upfront payment to producers Limited capacity to transport charcoal to the market Not all producers are registered with CPAs
Middlemen	<ul style="list-style-type: none"> Buys charcoal from transporters and sells to retailers 	<ul style="list-style-type: none"> Offer low prices to transporters Leads to increased prices of charcoal
Chiefs	<ul style="list-style-type: none"> Confirming land ownership status Resolution of conflicts 	<ul style="list-style-type: none"> Contradictory policies Corruption
County governments	<ul style="list-style-type: none"> Manages community land on behalf of the local people Collection of CESS fees during charcoal transportation 	<ul style="list-style-type: none"> Lack of resource-use plans Variation in CESS fees
Ranch managers /land owners	<ul style="list-style-type: none"> Lease out ranches/farms for tree harvesting 	<ul style="list-style-type: none"> Lack of resource-use plans
Transporters / Wholesalers	<ul style="list-style-type: none"> Buy charcoal from producers Transport charcoal from production sites to urban areas, Sell charcoal to either brokers, wholesalers or retailers 	<ul style="list-style-type: none"> Lack of reliable means of transport Have in place weak transport associations Not registered with KFS The charcoal rules do not explicitly recognize transporters or their associations

		<ul style="list-style-type: none"> Limited understanding of roles
Civil Society Organizations	<ul style="list-style-type: none"> Awareness creation, capacity building 	<ul style="list-style-type: none"> Uncoordinated activities Dependent on donor goodwill Do not always support charcoal (whether sustainable or unsustainable)

Challenges in marketing of *Prosopis juliflora* charcoal

Despite *P. juliflora* being a source of livelihood, various challenges were experienced along the value chain of *Prosopis* products. The reported challenges in production and the marketing *Prosopis* products include: Low demand of some products such as firewood and pods; high of transport costs of the products from one point to the other; Inadequate entrepreneurial skills hence hinders innovation; Poor coordination of marketing in both counties; current government ban on logging has made *Prosopis* utilization very difficult hence a decline in the supply; high cost of permits and other documents; Poor market structures; Low producer prices which is made worse by middlemen.

Recommendations

Therefore, there is a need for well-established market of *Prosopis* products in the two counties. Hence, it is recommended that:

- Communities need to be sensitized on the importance and potential uses of *P. juliflora* as an important tree beside the negative impacts. This will contribute to the communities changing their perceptions and considering the tree as a resource.
- There is need to promote the utilization of *P. juliflora* for products such as charcoal production and poles, posts by the County Government of Garissa and Tana River in order to improve livelihoods.
- Strengthen the CPAs, CPGs in the County through formal registration and trainings on entrepreneurship
- Ensure technical and financial support by the County governments in order to access better prices for the products.
- Enhance the producer's entrepreneurial and value-addition skills in *Prosopis* products production and marketing.

- The County Government to enact regulations to regulate charcoal production and marketing.
- Promote the use of efficient charcoal production technologies to encourage large production of *Prosopis* charcoal.
- Allow charcoal producers to utilize *P. juliflora* instead of other tree species as a strategy for controlling the invasive weed.

CONCLUSION

Prosopis juliflora is utilized by 80% of the locals in Garissa and Tana River County as a source of livelihood. Its main products charcoal, poles and firewood. The *P. juliflora* products market value chain starts from tree growing, harvesting, processing, packaging, transportation, retailing and distribution and ends with its consumption including all the economic activities undertaken between these stages. *Prosopis* charcoal generates millions annually in Garissa and Tana River counties. *P. juliflora* charcoal played a big role in revenue generation in the two counties. It contributed a total amount of from Ksh 3 to 16 million in Garissa County and Ksh 60 to 200 million in Tana River County annually. However, the markets of *P. juliflora* products was characterised by local brokers who affects prices of the products in both Counties. *Prosopis juliflora* products were locally in Garissa Ndogo, Livestock Market, Bulla Iftin and Bulla Mzuri market, Korakora, Warable Market, Kamuthe, Nanighi Jambale, Guyo and Dar es Salaam in Garissa County and Bura Tana, Hola, Madogo, Jarendete in Tana River County.

Acknowledgments: The authors acknowledge the support received from producers, traders, Kenya Forestry Service (KFS), the national government especially the national administration officers, Garissa & Tana River Counties during the entire survey period. They also appreciate Kenya Forestry Research

Institute (KEFRI) for the financial and technical support that gave the team during the survey.

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Source of Financial Support: Kenya Forestry Research Institute.

Conflict of Interest: None, Declared.