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ANALYSIS OF SOCIO-ECONOMIC CONTRIBUTION OF PROSOPIS JULIFLORATO THE LIVELIHOOD OF LOCAL COMMUNITIES IN TANA RIVER ANDGARISSA COUNTIES IN KENYA

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ABSTRACT: This study sought to assess the socio-economic contribution of Prosopisjuliflora productsinto the livelihood of local communities living in Tana River and Garissa Counties, Kenya.Previous studies had indicated that the potential benefits of the species have not been wellcaptured to mitigate its impacts and promote utilization contrary to the realities on theground. Reality check shows that most communities where the species are prevalent innorthern Kenya continue to utilise it for subsistence and commercial purposes. The studytargeted Tana River and Garissa Counties in Kenya where both primary and secondary datawere collected. Primary data was collected using two sets of semi-structured questionnairesthat were administered to 150 randomly selected households involved in the harvesting,processing and marketing of prosopis products such as charcoal. The respondents were drawnfrom twenty-two (22) Charcoal Producers Associations in the study area. Quantitative andqualitative primary data was analysed using Predictive Analysis Software. The findings showthat poles/posts, fuelwood and pods were the major products harvested from P. juliflora inthe study areas. Its economic benefits translate to an annual income of Ksh 1,497,120 andKsh 240,000 from charcoal and poles per producer respectively. It was further establishedthat charcoal production and marketing was more entrenched in Tana River County comparedto Garissa due to the social-cultural differences between the local communities in the twostudy areas. Prosopis product market awareness among the local communities was rankedhigh. Therefore, the study recommends that the local Community Participatory ManagementTeams be strengthened towards management and utilisation of P. juliflora, awarenesscreation be intensified on the social and economic benefits of P. juliflora, while linking thelocal communities to the market and undertaking legal reforms to support the utilization of P.juliflora through research and innovations.

Key Words: Benefits, Prosopis Products, livelihood, local communities

I. Introduction

Concerns over deforestation, desertification and fuelwood shortages in the 1970s and 1980spromoted a wave of projects that introduced P. juliflora and other hardy tree species to newenvironment across the world. Prosopisjuliflora commonly known as “Mathenge” in Kenya,is mostly found in Arid and Semi- Arid Lands (ASALs) of Kenya which account for about80% of the country’s land area. These ASALs continue to witness massive natural resourcedepletion, declining land productivity, a sharp rise in demand for food, fibre, wood and otherraw materials due to increasing human population coupled with high poverty levels thatnegatively impacts on our environment (Bakewell-Stone, 2006). The natural vegetation in theASALs comprises Acacia species and bushes of Slavadorapersica (Anderrsson, 2005).

Prosopisjuliflora was introduced to Kenya at varied dates from its native range in SouthAmerica. It is reported to have been introduced in Kenya in the 1930s for fodder, shade andas ornamental plant (Mwangi& Swallow, 2005). In the 1970s and owing to drought, therewas increased planting of P. juliflora to rehabilitate degraded areas and mitigate recurrentfamines and massive losses of human and livestock population. The first records ofpropagation of Prosopis in Kenya was through species trials of 1973 in Mombasa andMenengai (Nakuru County) to produce fodder or high value cash crops (Maghembe, Kariuki& Haller, 1983).

The species is drought tolerant, establishes rapidly and grows to form a dense impenetrablethicket (Maghembe et al., 1983). Millions of hectares within the ASALs continue to beinvaded in Africa, Australia, Asia (Berhanu& Tesfay, 2006; Maundu, Kibet, Morimoto,Imbumi& Adeka, 2009). The fast growing invasion and adaptability of P. juliflora ispositively influenced by land use changes, competitive ecological advantages and

climatechange making the species to be rated as one of the world's 100 least wanted species (Vander Maesen& Oyen, 1997). The species grows fast and chokes other vegetation, wateringpoints and canals and colonizes most of the areas that are not cropped, including the riparianenvironments (GoK, Tana River second PID, 2018). It prefers occasionally water-loggedareas and regeneration is triggered by such seasonal flooding. Prosopis has both fibrous andtap roots making it a better competitor compared to other species.

Prosopisjuliflora is characterised by both negative and positive impacts and if managed wellcan improve the livelihood of host communities (Lenachuru, 2003). P. juliflora positivelyimproves the environmental degradation and boosts livelihood of the host communities(Hajji, 2018). Prosopisjuliflora is a secure source of goods (fuel wood and timber, posts andpoles, gums, honey, medicines) and services (conservation and rehabilitation of degraded andsaline soils, nitrogen-fixation, and shelter, windbreaks and shelterbelts and shade). Prosopiswood and pods is easily converted into a wide range of products at cottage and industriallevels (Mendes, 1988). . The species should be discouraged on irrigated land due to itspotential host to pathogenic such as nematodes (Castro, 2002). P. juliflora has the ability togrow on saline and alkaline soils hence valued as soil reclaimer in very poor soil sites. Itstabilizes sand dunes on coastal zones and bunds around mangrove creeks (Felker, 2003). Ithas an overall positive impact on soil where sodium, Sulphur, organic matter and soluble saltsare increased threefold within the upper 4.5 m of soil under mesquite (Felker, 2003). Thecarbohydrates, protein and sugar-rich pods are used as food and fodder especially during drypell (Geesing, Al-Khawlani& Abba, 2004).

The negative effects associated with Prosopis foliage is that the green leaves are not palatablewith the cattle restricted to eating the buds and immature pods (Geesing, et al., 2004). Direct browsing of the foliage can negatively impact on tree development (Oduor& Githiomi,2013).

The introduction of P. juliflora in Kenya was received with mixed perceptions over the yearsespecially on costs and benefits. The species is an important source of income throughcharcoal sales (Admasu, 2008) while positively contributing towards enhanced foodproduction in Ethiopia (Zeray et al., 2017). However, the species negatively impacts onranchers, pastoralists and agro pastoralists as it invades pastures and farm lands (Esther &Brent, 2008). Esther and Brent (2008) through their study on rural residents of Lake Baringo,Kenya concluded that the potential benefits from Prosopis had not been well captured withonly few individuals realizing the net benefits from the widespread presence of the tree.

The Prosopisjuliflora invasion in Garissa and Tan River Counties continue to receivedincreased attention from the county government and other development agencies. Stronglocal support towards management and control appears to be well justified. However,sustainable utilization may require considerable investment in the development of newcommercial enterprises P. juliflora with the potential to improve livelihoods of localcommunities. Despite the numerous negative impacts on associate with P. juliflora especiallyon livestock and crop farming; blocking of passage, the species , has the potential as a securesource of income for improved livelihoods of the locals in Garissa and Tana River Counties.

In this regard, the objectives of the study were to identify the products generated fromProsopis plant, to determine the social economic contribution of prosopis products to thelivelihoods of local communities in Garissa and Tana River Counties and to determine themarket chain of prosopis products in Tana River and Garissa Counties in Kenya.

II. Methodology

The study was conducted in Tana- River (Bisigidera, Tana north, Bangale, Gubatu and SalaRiverline) and Garissa (Fafi, Jambele, Nanighi, Kamuthe, Bulla Baluku and Guyo) Counties(Figure 1). Tana-River County is located off-coast line between latitudes 0 0 0'53" and 2 0 0'41"South and longitudes 38 0 25'43" and 40 0 10'29" East. The county borders Tana Delta to theSouth, Garisa and Fafi to the Northeast, Ijara to the East, Motomo to the West, Mwingi to theNorthwest and Garbatula to the North. The County covers a total area of 22,453 Km2, where90% is trust land. The vegetation is characterised by scattered trees, shrubs and perennialGrasses. (Tana River second CIDP II, 2018).

Garissa County is part of the former North Eastern Province and borders Wajir County to theNorth, Tana River County to the West, Isiolo County to the North West, Somalia to the Eastand Lamu County to the South. The County covers a total area of 44,057Km 2 and rises froman elevation of 200m to 400m above sea level. The county falls under ecological zone V &VIthat is characterised by low erratic and unreliable rainfall. The rains are bimodal in naturewith long rains occurring from mid-March to May and the short rains occurring from mid-October to late November. The temperatures are high all-year-round. The County is home tonomadic pastoralists who practice livestock production and subsistence farming aroundhomestead and irrigated agricultures along River Tana. Most lands are held under communaltenure system (Garissa CIDP II, 2018).

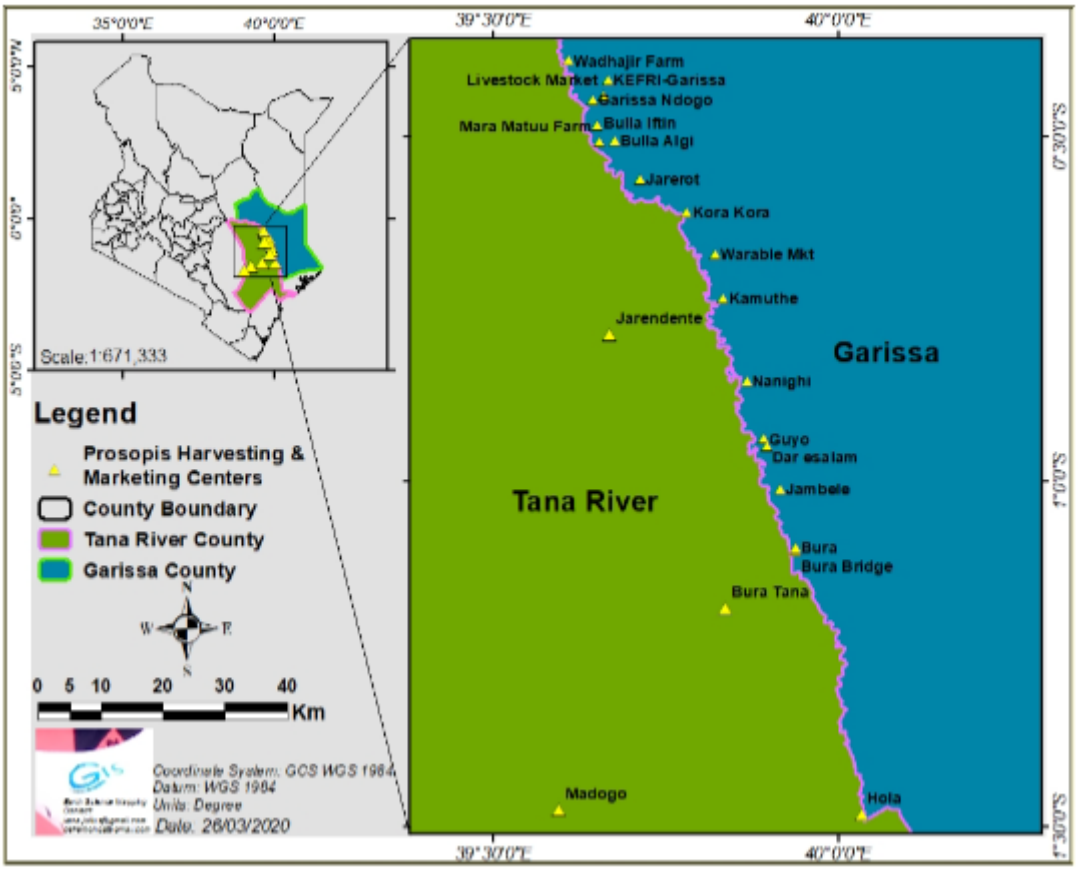

Figure 1: Location Map of study area

III. Data Collection

Primary and secondary data were collected. Primary data was collected through groupdiscussions, interviews and observations. The interviews were undertaken using two sets ofsemi-structured questionnaires and a checklist that targeted producers, entrepreneurs and keyinformants. The questionnaires were administered separately to producers and entrepreneurof P. juliflora products in Garissa and Tana River Counties. The questionnaires sought toestablish the types of Prosopis products harvested and marketed, technology and innovationin harvesting, processing and marketing. Furthermore, information on household income,farming, agro-forestry practices was gathered. Data on the management and utilization, valueaddition and marketing of Prosopis products was also captured. The checklist was used tosolicit information from key informants drawn from Kenya Forest Service, CharcoalProducer Associations (CPAs) and Charcoal Producer Groups (CPGs) officials. Datacollection was supplemented through observations and photographing. Secondary data wascollected through literature review on related publications, Kenya Forest Services andMinistry of Environment and Forestry reports. A total of 150 households were randomlysampled and interviewed in Tana River and Garissa counties. Eight (8) Charcoal ProducersAssociations with an average of 24 members and 14 Charcoal producer's association with anaverage of 30 members drawn from Garissa and Tana River participated in the study.

IV. Data Analysis

The secondary data gathered from Kenya Forest Service (KFS) and quantitative primary datacollected using structured questionnaires was coded and entered into computer using aMicrosoft Excel computer package. Once all the data entries had been done and verified, thesheet was exported to Predictive Analysis Software (PASW) for analysis. The data wasanalysed as percentages and frequencies and presented in form of bar graphs, pie charts and tables. Qualitative data from the interviews was thematically analysed and presented in anarrative.

V. RESULTS AND DISCUSSIONS

Social economic characteristics of respondentsThe production and marketing of P. juliflora charcoal in Garissa and Tana River Counties areorganised under an umbrella body, the Charcoal Producer Association (CPA). According tothe Charcoal rules 2009, commercial charcoal producing individuals or groups shouldorganise themselves into CPAs. The producers within a particular area organises themselvesinto charcoal producers group CPGs which merges together to form CPAs. CharcoalProducer Groups are registered with the Ministry of Social Services as Community BasedOrganisations (CBOs). Alternatively, CPAs with recommendation from Kenya ForestryService (KFS) are registered with the AG's. The CPAs are charged with the responsibility offacilitating sustainable production of charcoal by the membership and ensuring theimplementation of reforestation and conservation plans.

The umbrella body in Garissa consist of eight (8) Charcoal Producers Associations with anaverage of 24 members per group while there are fourteen (14) Charcoal producer'sassociation in Tana River with an average of 30 members per group. The functions of theumbrella body are to coordinates charcoal activities in the respective counties. There weresome efforts to ensure that the charcoal produced by various CPAs is branded. Themotivation for the formation of associations/groups was attributed to management andcontrol of invasive species particularly P. juliflora, and availability of resources that werebeing exploited by non-residents. Furthermore, the Fafi CPA engages youth to collect Ksh8,000 per lorry per day, Ksh 20 per bag for the CPAs, Ksh 20 per bag per CPGs and Ksh 10per bag as packaging fees.

The survey established that the family size per households in Garissa and Tana River were 6and 7 people respectively. Land is still under communal ownership arrangements in bothCounties. These families reside on approximately 8.0 and 2.0 acres of land in Garissa andTana River respectively. The main livelihood economic activities practised by the localcommunities in both the counties are mixed farming, pastoralism and small-scale businesses.

Most of the respondents who practise mixed farming were involved in keeping livestockmainly goats and sheep) and subsistence farming (mainly grow maize). Some of thecommunity members owned farmlands along the Tana river banks where they grow differentkinds of food crops such as maize, bananas and mango trees. These food crops were mainlygrown for domestic use with the exception of mangoes which are sold on both local andnational markets. Pastoralism is practised mainly by the Somali community living in GarissaCounty, who keep camels, cattle and goats that provide a secure source of income. Somerespondents were involved in transport businesses using motorbikes as source of income.

The main source of income among the households was farming (40%), charcoal production(30%) and livestock keeping (30%). Those involved in farming produced cereals, vegetablesand fruits. The annual income per households from key economic activities in the twocounties was: charcoal production (Ksh 1,497,120), livestock (Ksh 1,224,000), faming (Ksh888,996) and Prosopis poles (Ksh 240,000). This depicts that Prosopis charcoal productioncontributed the highest income earner hence a good opportunity for improving localcommunity livelihoods in the study sites. Prosopisjuliflora produce high quality charcoal,the wood does not split, produce sparks, or emit much smoke and its commonly referred to aswooden anthracite. Moreover, the durability, strength, less shrinkage and cracking and hardness make the wood of P. juliflora more useful for many purposes (Victor, Pillay, & Al-Minji, 2007).

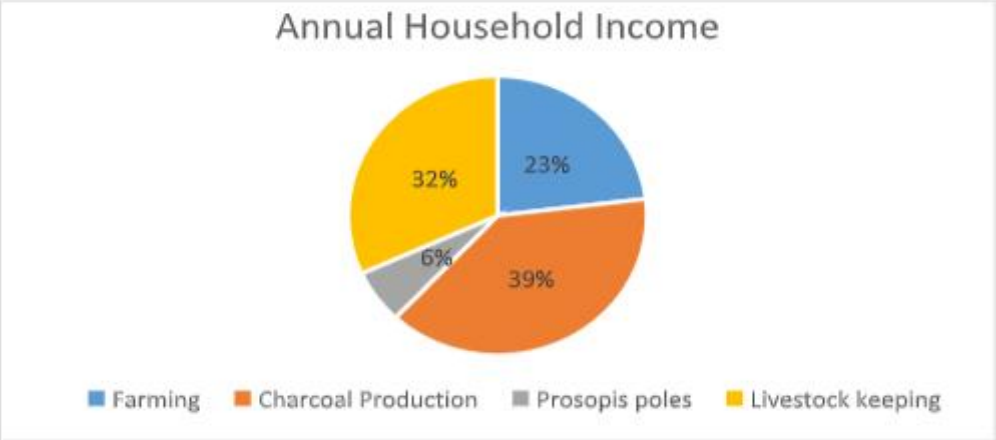

Fig 2; Annual households' incomes

Prosopis Products as a source of livelihoodMajority of respondents (80%) were involved in utilization of P. juliflora besides itsdisadvantages with 20% of the respondents indicating prosopis is useless and a nuisance.Prosopis was mainly utilised for firewood, poles/posts and charcoal. Charcoal was mainlyproduced using the traditional charcoal kilns (Figure 2). The harvested products wereobtained through pruning and clear felling of trees to minimise on the effect of colonisation.

The common hand tools used in harvesting and processing of P. juliflora products includeanga (39%), axe (32%), spade (19%) and fork jembe (10%). The local community memberswere involved in charcoal production (42%), poles /posts production (29%), bee forage (17%) and pods production (12%) from P. juliflora (Figure 2). Trade in P. juliflora productsprovided a secure and major source of income with of four to six family members perhousehold being employed in harvesting, processing, transportation and marketing. However,harvesting of P. juliflora products is labour intensive.

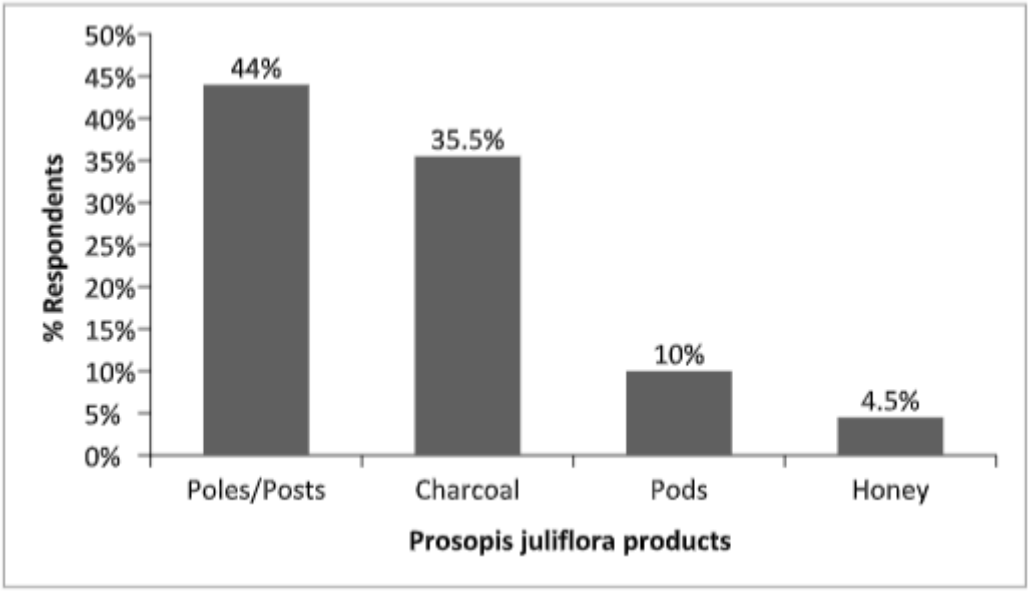

Figure 3. The main Prosopis products identified in the study areas

It was established that P. juliflora charcoal positively contributed to the livelihoods of the community through income while firewood was the main source of energy used for cooking food. Most of the local people use P. juliflora poles/posts for house construction though the wood is normally attacked by borers after a very short time. The other ecosystems services were reduction of dust storms, wind break and improvement of soil fertility. In this regards, P. juliflora is a multi-purpose resource that positively provide both tangible and intangible benefits.

The commercial and subsistence use of Prosopis products in Tana River and Garissa Countiescannot be disputed. Income and employment opportunities provide a sustainable copingmechanism to the recurrent drought and famine. The annual income earning per householdfrom Prosopis Charcoal in Tana River and Garissa Counties was Ksh 3,028, 692 and Ksh1,931,477 respectively. The annual income earning from poles are Ksh 139,992 and Ksh99,300 respectively. The Prosopis fodder and firewood was sold in small quantities.

Fig 4: Various Prosopis products identified within study site (or you may name them)

Charcoal production in Garissa and Tana River CountyCharcoal production from P. juliflora mostly was reported in Garissa and Tana RiverCounties. The production was mainly for commercial purposes (75%) and domestic uses(25%). It was reported that all the charcoal producers paid a fee of Ksh 50 for every bag ofcharcoal to the landowners. The producers targeted only matured P. juliflora which wasbelieved to produce high quality charcoal in the colonised areas within the counties.

However, charcoal production requires 2-4 people since it was labour intensive as comparedto other products. Production of charcoal in both counties was mainly produced usingtraditional earth kiln method (100%). A single charcoal kiln could yield 8-20 bags of charcoaldepending on the size of the kiln. In a week, a producer would make 5 to 10 charcoal kilns depending on availability of P. juliflora logs. Thus, a producer could produce an average of00-600 bags of charcoal per month. At the production site, charcoal was packaged intogunny bags with twine ropes weaved on top to secure the charcoal. Since there are nostandards for the weight of a bag of charcoal, observations made within different sites visitedrevealed variations in bag sizes and weight filled with charcoal. Ready charcoal was alwayspackaged in either 50kg or 90kgs of gunny bags ready for transporting or sale.

Between 2012 and 2017 the Prosopis charcoal production in Garissa County varied from20,000 to 140,000 bags annually while production in Tana River County ranged between150,000 and 200,000 bags. The variations in production between the years and between thetwo counties can be attributed to various factors like the local culture, change in attitude,government ban on logging and trade in charcoal, insecurity and weather changes such asfloods (Figure 4). Whereas the Somali communities in Garissa are predominantly pastoral,the community in Tana River practice agro-pastoralism. The peak was attributed to variousfactors such as migration of youth from Kitui, Tana River, Kakamega and Bungoma countieswho are able to produces more charcoal than the other years. On the other

hand, the increasein invasion of P. juliflora positively contributed to the availability of raw material leading tomass production of charcoal in the county resulting into higher sales.

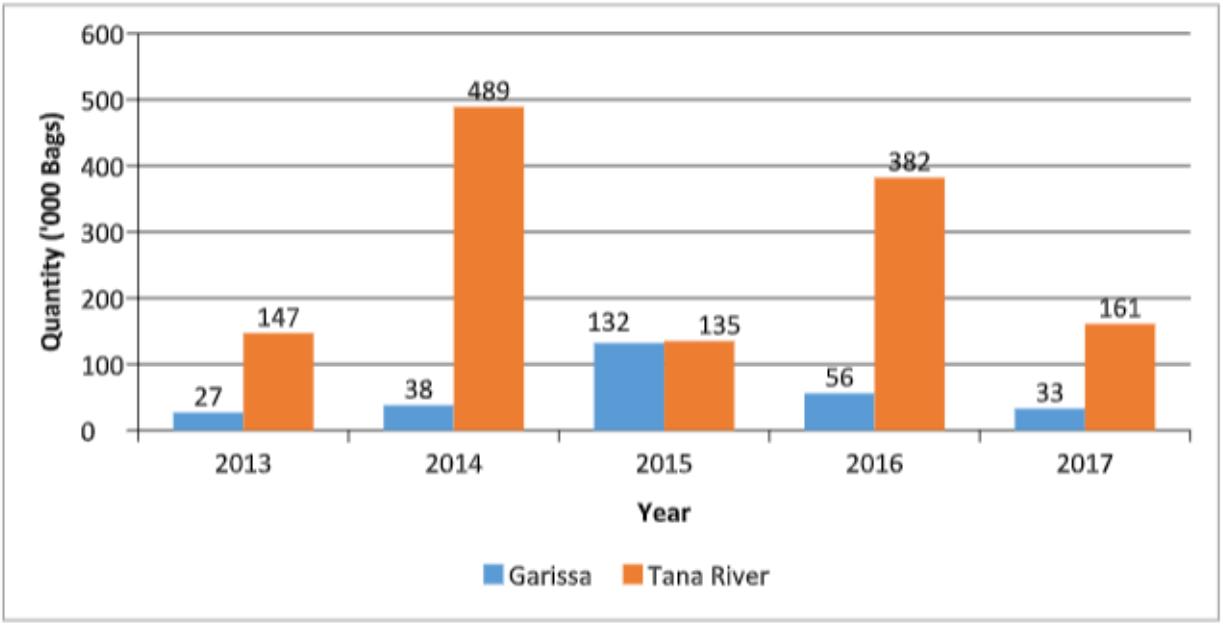

Figure 5. Charcoal production in Garissa and Tana River Counties from 2013 to 2017
(Source: Kenya Forestry Service Office, Garissa and Tana River)

Marketing of Prosopis Charcoal in Tana River and Garissa Counties

Prosopisjuliflora charcoal played a big role in revenue generation in in the two counties. Itcontributed a total amount of from Ksh. 3,000,000 to 65,000,000 in Garissa County and Ksh.60,000,000 to 300,000,000 in Tana River County annually (Figure 5). However, fluctuationswere experienced in both counties as a result of floods and government moratorium onogging.

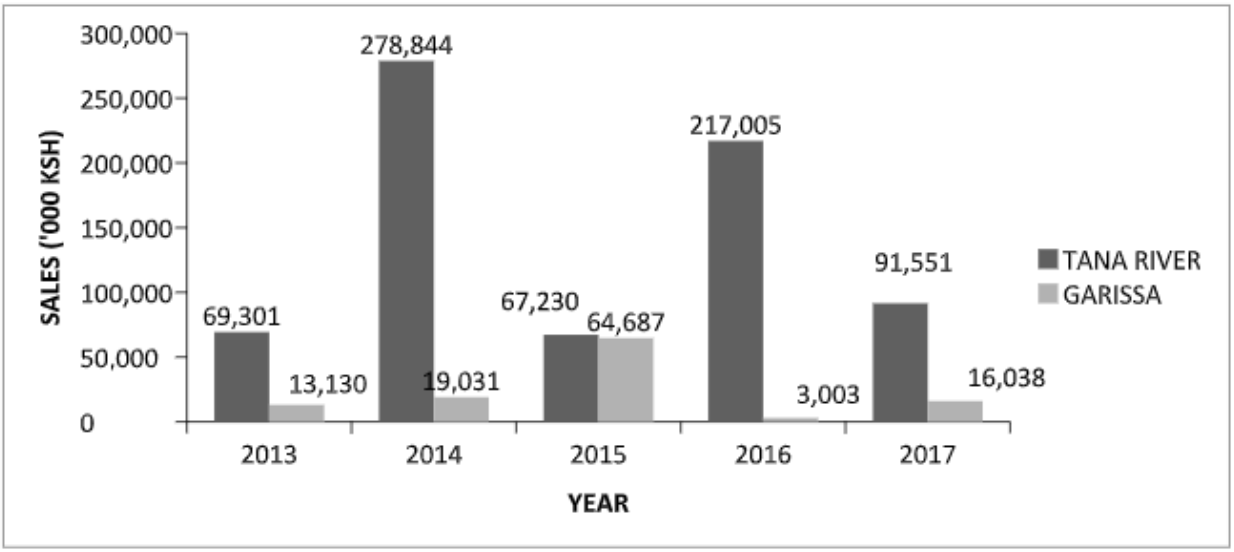

Figure 6. Revenue from Prosopis charcoal (2013-17)

Other Prosopis productsFirewood from P. juliflora was collected locally from the heavily invaded sites in bothcounties mostly for domestic use (85%) and sale (15%). Only dried P. juliflora stands werecollected and packed into head loads for easy carrying on the back/head or on a cart.Firewood collection was done by women and children (100%) in both counties. Firewoodrequired no processing as it was cut into sizeable pieces ready for sale or use.

Prosopisjuliflora pods provided fodder for livestock (e.g. cattle and goats) during dryseasons. Like firewood collection, pods were collected by women and children since itsincome were very low compared to charcoal. Collection was quite involving and timeconsuming, thus few individuals were engaged in the activity. Pods were collected andpackaged into 90 kg bags for sale. It was established that pods collection was more prominentin Garissa County (90%) than in Tana River County (10%) because of their livelihooddependency on it. Prosopisjuliflora was one of the best bee forage species for honeyproduction. An average quantity of 1,500 Kg to 2,000 Kg were produced and sold in the localmarket per month in Garissa County. It was reported that the production of honey in GarissaCounty had declined due to massive charcoal production and pole/posts harvesting activitiesthat have reduced the forage.

Marketing of the Prosopis ProductsThe Prosopis products value chain starts at production and end at consumption and includesall the economic activities undertaken between these stages. Many different stakeholdersparticipate in the value chain; right from wood production, carbonization, packaging andtransportation, retailing and distribution, and consumption. The Prosopis products value chaininvolved producers, middle men, transporters and consumers as the main players. Productionof Prosopis charcoal was being done using the traditional method that was characterised bylow recovery rate of 15%-20%.

According to Kambewa, et al., 2007, a study on charcoal consumption, trade and productionin Malawi revealed that there were several channels for charcoal from the producer toconsumer. First channel was from producer to consumer, whereby a small-scale producertakes the charcoal directly to the consumer. The second route was from producer to buyer toconsumer, where a buyer purchases the charcoal from the producer and takes it directly toconsumers' homes. The third route was from producer to primary buyer to secondary buyerto consumer which was a more complex option in which there is both wholesale and retail markets. Therefore, all the stated channels were being applied in both counties though thefirst two channels were applicable locally in the counties and the third channel was applicablewhen charcoal was transported from the counties to Nairobi.

However, every product had its own unique channel different from others. Poles and postswere harvested for sale (55%) and local uses (45%). Poles were mainly used in constructionof houses in the villages and cattle bomas and fencing. Poles and posts of different sizes wereprocessed by cutting and removed thorns as one of safety measures. They were arranged andpacked in bundles for transportation by donkey carts, or vehicles to the market orconstruction sites. Very few respondents were engaged in the promotion of their charcoal(38%) locally. The rest of the respondents did not promote (62%) their charcoal. Prosopisjuliflora is associated with goods and services it provides to the local community.

Pricing of Prosopis charcoal was determined by Charcoal Producer Groups before thecharcoal ban took effect in the two counties. An individual or group or business entityrequires a movement permit from the Ecosystem Conservator of forests to transport morethan 3 bags of charcoal. The charcoal movement is restricted to between 6.00 am and 6.00pm. Charcoal is always transported either directly to the local market or roadside. Generally,the transportation of charcoal from the production sites is undertaken by the buyer. However,findings from this study revealed otherwise. Before the ban on charcoal production, a largenumber of producers through their CPGs ferried charcoal from production sites to designatedcharcoal collection points. Alternatively, transporters were equally ferried charcoal fromproduction sites. Since the implementation of the ban, utilization of P. juliflora has been verydifficult hence making pricing very difficult for the producers to sell their charcoal at a verylow price. Following the moratorium on charcoal production and trade in the country, veryfew respondents' producers were still engaged in charcoal production on a small scale. A90kg bag of charcoal was retailing at KES 400 per bag at the farm gate. This was because ofthe involvement of middlemen/brokers who lower prices of the charcoal. Other products suchas poles were sold at KES 60 per pole. The charcoal market awareness (Figure 6) was ratedhigh (50%), very high (32%) and medium (18%) due to the help of CPGs.

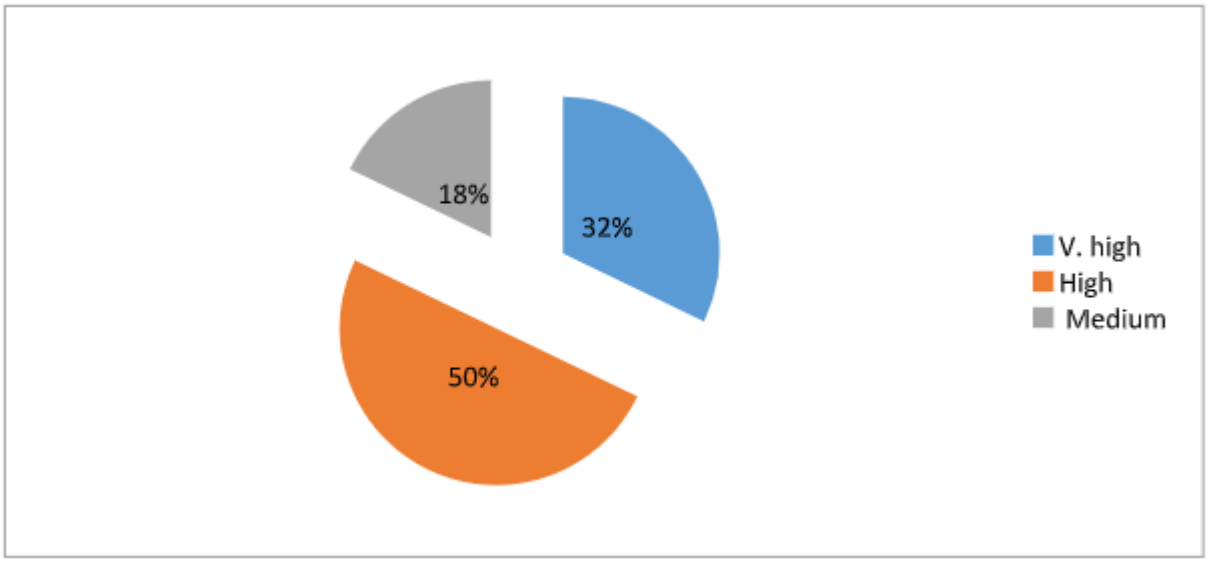

Figure 7. Level of Market Awareness on prosopis uses

Challenges in the Production of Prosopis CharcoalDespite P. juliflora providing a secure source of livelihood, various challenges wereexperienced along the Prosopis products value chain. The reported challenges include: lack of protective gear that leads to injuries and accidents; lack of technology and innovation in theharvesting and processing of Prosopis products; high cost of transport; lack of training skillsin the management and utilization of Prosopisjuliflora; harsh/extreme weather conditionsincluding floods and scotching sun (working under high temperatures caused by the hot sun);the government ban on charcoal production and marketing by the County government hadresulted into harassment, arrests and decline in the supply (directly linked to the nationalmoratorium); insecurity resulting into low production; poor roads infrastructure.

VI. CONCLUSION

The findings indicate that there is a substantial potential to improve household livelihoodsthrough commercialization of prosopisjuliflora products. The main source of livelihoodamong the communities in the study areas were mixed farming, pastoralism and small-scalebusinesses. The key P. juliflora products in the study area were; poles/posts, fuelwood andpods. The P. juliflora charcoal contributed through income earnings whereas firewood wasthe main source of energy used for cooking. Most of the local people use P. julifloraposles/posts for house construction.

The Prosopis charcoal production was the key economic benefit derived from in the studyarea where a 90kg bag was sold at KES 400 or Ksh 1,497,120 per year. Alternatively,prosopis poles were sold at KES 60 per pole or Ksh 240,000 from poles per annum. Prosopisproduct market awareness among the local communities was highly ranked (82%).

VII. RECCOMMENDATIONS

Given the huge potential provided by Prosopis species and its products, the studyrecommends that the local communities be encouraged to form Community ParticipatoryManagement Team geared towards management of P. juliflora, intensification of educationalprogrammes to create awareness and understanding of the benefits associated with themanagement of P. juliflora, link the communities to the markets, undertake legal reforms tosupport the management and utilization of P. juliflora and strengthen research andinnovations in the management of the species. Further research to investigate the role ofinformal institutions such as CPAs and CPGs in the production and marketing systems gearedtowards the formulation of compatible interventions. Enhanced cash-flows can be achievedthrough improved production, local value addition and post-harvest handling, and resourceaccess and market among others. Adopt an integrated approach in exploring the commercialopportunities of the Prosopis products for improved livelihood of the local communities.

VIII. ACKNOWLEDGEMENT

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REFERENCES

[1]. Andersson, S. (2005). Spread of the introduced tree species Prosopisjuliflora (Sw.) DC inthe Lake Baringo area, Kenya.
[2]. Bakewell-Stone, P. (2006). Marketing of Prosopis products in the UK: feasibility report.HDRA, Coventy, UK, 39pp.
[3]. Berhanu, A. & TesfayE, G. (2006). The Prosopis Dilemma, Impacts on Dryland Biodiversityand some Controlling Methods. Journal of the Drylands, 1, 158-164.
[4]. Castro, A. P. (2002). Sustainable Livelihoods Analysis:An Introduction. Public Goods andPublic Bads in Nature: From Landscapes to Genomes in South Asia [Online].
[5]. Available: http://www.einaudi.cornell.edu/southasia/workshop/pdf/livelihoods.pdf
[6]. Esther, M. & Brent, S. (2008). Prosopisjuliflora invasion and rural livelihoods in the LakeBaringo area of Kenya. Cons. Soc. 6(2):130-140.
[7]. Felker, P. (2003). Management, Use and Control of Prosopis in Yemen. Mission report,Project Number:TCP/YEM/0169 (A). 14 August 2003 (Revised).
[8]. Geesing, D., Al-Khawlani, M. & Abba, M. L. (2004). Management of introduced Prosopisspecies: can economic exploitation control an invasive species? Unasylva, 55 (7), 217,36 – 44.
[9]. Maghembe, J. A., Kariuki, E. M. & Haller, R. D. (1983). Biomass and nutrient accumulationin young Prosopisjuliflora at Mombasa, Kenya. Agroforestry Systems, 1(4): 313-321.
[10]. Maundu, P., Kibet, S., Morimoto, Y., Imbumi, M. & Adeka, R. (2009). Impact of Prosopisjuliflora on Kenya's semi-arid and arid ecosystems and local livelihoods. Biodiversity,10(2-3), 33-50.
[11]. Mendes, B. V. (1988). Prosopis in Brazil. In: The current state of knowledge on Prosopisjuliflora. Habit, M.A. and Saavedra, J.C. (Eds). FAO, Plant Production and ProtectionDivision, Rome, Italy.
[12]. Mwangi, E. & Swallow, B. (2005). Invasion of Prosopisjuliflora and local livelihoods: Casestudy from the lake Baringo area of Kenya. Nairobi, Kenya: World AgroforestryCentre.
[13]. Oduor, N. M. & Githiomi, J. K. (2013). Fuel-wood energy properties of Prosopisjulifloraand Prosopis pallida grown in Baringo District, Kenya.
[14]. Van der Maesen, L. J. G. & Oyen, L. P. A. (1997). Prosopisjuliflora (Swartz) DC. Recordfrom Proseabase. FaridahHanum, I. and van der Maesen, L. J. G. (Editors). PROSEA(Plant Resources of South-East Asia) Foundation, Bogor, Indonesia
[15]. Victor, R., Pillay, A. & Al-Minji, S. (2007). Copper Tolerance to Germination in Mesquite, aPotential Tree Species for Restoring Mined-lands in Oman. Journal of Agricultural,Food, and Environmental Sciences, 1(1): 78-98
[16]. GoK, (2018). Tana River County: Second County Integrated Development Plan, 2018-2022.244 pp. Government Printer, Nairobi-Kenya.
[17]. Government of Kenya (2018). Second Garissa County Second County IntegratedDevelopment Plan 2018-2022
[18]. Zeray, N., Legesse, B., Mohamed, J. H. & Aredo, M. K. (2017). Impacts of Prosopisjuliflorainvasion on livelihoods of pastoral and agro-pastoral households of Dire DawaAdministration, Ethiopia. Pastoralism 7(1), 7.
[19]. Haji, J., Schaffner, U., Legesse, B. & Dadie, K. B. (2018). Impacts of Prosopis spp. OnEnvironment and Livelihoods in East Africa: Evidence from Ethiopia and Kenya.
[20]. (Doctoral dissertation, Haramaya University).Admasu, D. (2008). Invasive plants and food security: The case of Prosopisjuliflora in theAfar region of Ethiopia, 1–13. FARM-Africa, IUCN, Ethiopia.
[21]. Lenachuru, C. (2003). Impacts of Prosopis species in Baringo District. In Proceedings ofworkshop on integrated management of Prosopis species in Kenya, Workshop held atSoi Safari Club, Lake Baringo (pp. 1-2).