J. Bamboo and Rattan, Vol. 16, No. 1, pp. 33-45 (2017)

Potential of Bamboo as a Source of Household Income in South Western Uganda

Fred Kalanzi[1*], Christine Mwanja[1], Hillary Agaba[1] and **Reginald T. Guuroh[2]**
[1]*National Forestry Resources Research Institute (NaFORRI), P.O. Box 1752, Kampala, Uganda*
[2] *CSIR-Forestry Research Institute of Ghana, P. O. Box 63, KNUST - Kumasi, Ghana*

Abstract: Bamboo is one of the most valuable Non-Timber Forest Products in the world. However, despite documented uses of bamboo the extent to which it contributes to improved household income in Uganda is quite unclear. This study was conducted in south western Uganda in areas adjacent to bamboo-rich Echuya forest reserve to ascertain the nature of products processed from bamboo and their contribution to household income. Households involved in bamboo harvesting were selected using systematic random sampling by proportional allocation using a sampling frame that was generated with the help of local leaders and Nature Uganda field staff. A total of 114 bamboo harvesters were selected and interviewed using a semi-structured questionnaire. Group discussions, field observations and market surveys were also used to supplement the data collected through individual interviews. Data collected were analysed using descriptive statistics while income calculation was based on gross margins. The results indicate that 87% of the respondents obtained bamboo from the forest. The main products from bamboo were baskets, beehives, winnowing trays, stakes, poles and firewood. Generally, men dominated the bamboo activities. The average total income obtained from the sale of bamboo products in south western Uganda was UGX 125,902 with a gross margin of 51.6%. Our study reveals that there is a wide range of bamboo products developed based on local knowledge. Such products offer additional income to local people. We recommend interventions that can build on the local expertise in product design to enhance the quality of these products and generate more market opportunities to local communities.

Keywords: Bamboo products, Socio-economic, Echuya Forest, Livelihoods

INTRODUCTION

Bamboo is an evergreen multipurpose plant that is widely distributed in the tropical and subtropical regions of the world. Worldwide, there are over 1400 species of bamboo belonging to the family Poaceae and subfamily Bambusoideae with the highest diversity being in Asia (Bystriakova *et al.,* 2004; Bitariho and Mosango, 2005). In Uganda, there are three naturally occurring bamboo species (Bystriakova *et al.,* 2004; Lobovikov *et al.,* 2007) with *Yushania alpina* and *Oxytenanthera abyssinica* being the most common (Kigomo, 1988). Most of the bamboo is found in protected areas (national parks and forest reserves) of about 67,000 ha (Lobovikov *et al.,* 2007).

*To whom correspondence should be addressed: kalfrem@gmail.com

Bamboo is one of the most valuable Non-Timber Forest Products (NTFPs) in the world with over half of the world's population sharing in its trade and subsistence use at an estimated value of US$ 7 billion per annum (Van der Lugt and Lobovikom, 2008, Midmore, 2009). Environmentally, bamboo is used restore canopy cover, sequester carbon dioxide, reduce soil erosion and improve water infiltration in soils thereby stabilizing landscapes and water tables (Patel *et al.,* 2017, Escamilla and Habert, 2014). Bamboo can be used to produce modern products such as panels and boards that may successfully compete with wood products in performance (Hakeem *et al.,* 2015). The production and marketing of bamboo products is highly gender sensitive. The role played by women and men in the value chain varies in different countries (Carr and Hartl, 2008; FAO, 2012). In most countries, women tend to carry out lower paying activities such as developing products for direct household use while men specialize in producing marketable products (Carr and Hartl, 2008).

In Uganda, bamboo has already been integrated in the national development agenda. Both Uganda's vision 2040 and the Uganda's forest policy provide a framework for sustainable production of non-wood forest products including bamboo. There is evidence to support the importance of bamboo in socio-economic aspects of the resource adjacent communities (Buyinza, 2009). Some of the traditional uses of bamboo include food, medicine, utensils, furniture, handcrafts and small-scale construction materials. However, the economic value of bamboo is not well known since products are mainly traded locally with little or no documentation. The bamboo resource in Echuya forest provides a perfect case in Uganda to understand the local utilisation of bamboo by adjacent communities. However, most of the research on bamboo in Echuya has focused on ecology and distribution (Ssali and Bitariho, 2013; Bitariho and McNeilage, 2007). Little is known on how the local people utilize the bamboo resource for their livelihood. There is limited information regarding the nature of products being developed by local communities and their potential to contribute to household income. Such information is necessary to guide interventions related to poverty alleviation strategies in the area. This study generally aimed at: (1) documenting the various bamboo products in the area; (2) assessing the potential of these products for income generation for the local people; and (3) assessing gender involvement in different bamboo activities.

MATERIALS AND METHODS

Study area

This study was conducted in seven sub-counties adjacent to Echuya Forest Reserve (Figure 1). Echuya FR is situated in south-western Uganda in the Albertine rift region. It is located in the districts of Kabale and Kisoro and borders the north-eastern part of Rwanda. Echuya forest reserve covers an area of 3400 ha between 1º 14'- 1º 21' S and

29º 47'-29º 52' E and has an altitudinal range of 2270 - 2570 m asl. It is situated on the high-altitude range running between Lake Bunyonyi, 5 km to the east, and Mgahinga Gorilla National Park, 13 km to the south west. Echuya is particularly known for its montane bamboo (*Yushania alpine* K. Schum) which constitutes about 20% of the forest area.

The areas surrounding the forest have a high population density of 358 people per km^2 (UBOS, 2016). Over 85% of the population in the study area is engaged in subsistence farming. The limited options in agriculture often compel people to turn to extractive forestry as a source of socio-economic livelihood. It is normally the very poor who largely depend on the forest where they derive their basic needs for survival.

Figure 1: Study area (Adapted from www.wri.org/resources/data-sets/uganda-gis-data.)

Data collection methods

This study was based on primary data obtained through a household survey, key informant interviews, group discussions, a market survey and field observations. The household survey was conducted between June 2015 and December 2015 in four sub-counties: Bufundi and Muko in Kabale district, and Kanaaba and Murora in Kisoro district. The household survey covered socio-economic characteristics, bamboo harvesting, bamboo products, quantity of products sold per month, total number of culms consumed and/or sold annually, prices and income. In addition, key informants (National Forestry Authority, Nature Uganda, Uplift the Rural Poor, sub-county

environment committee and local council leaders) were interviewed using a semi-structured questionnaire. Four group discussions were conducted, one in each sub-county, consisting of local bamboo processors/harvesters and community leaders mobilized with assistance of nature Uganda field staff. A market survey was also conducted in the local markets with the objective of collecting price information on tradable bamboo products as well as identifying the marketing channels.

Sampling

Household bamboo survey was conducted in four sub-counties, two in each of Kabale and Kisoro districts of south western Uganda. Households were selected using systematic random sampling by proportional allocation based on a sampling frame that was generated for each of the sub-counties with the help of local leaders and Nature Uganda field staff. A bamboo harvester in this study was defined as a person who collects bamboo from the forest or own-farm. This bamboo may be utilized for domestic purposes and/or sold either in raw form (bamboo culms/poles) or as manufactured secondary products. Systematic random sampling was considered more appropriate since the area is made up of steep slopes and valleys – conditions that make it almost impossible, time consuming and labour intensive to conduct simple random sampling. A total of 114 bamboo harvesters were selected; among them 57 from Bufundi, 8 from Muko, 27 from Kanaaba and 22 from Murora. In addition, 14 bamboo traders were selected purposively and interviewed following the value chain networks from the producers. Purposive sampling was used as the total population of the traders was not known.

Data Analysis

Data were coded and entered into IBM SPSS statistics 20 and analysed using descriptive statistics. The income calculation was based on market prices in 2015. The total production cost of bamboo products was computed from purchase of bamboo culms, transportation cost and allowance towards self-labor. Production of bamboo products was highly informal and home-based using small tools like knives and pangas. Therefore, fixed costs such as permanent structures, depreciation costs, rent and bills, taxes on incomes were excluded from the analysis. The gross margin for sale of bamboo products was calculated as below:

$$\text{Gross Margin (\%)} = \frac{\text{Revenue-Cost of Goods Sold}}{\text{Revenue}}$$

Qualitative data collected through group discussions, key informant interviews and observations were summarized and were used to elaborate the results from quantitative analysis (Yin, 2009).

RESULTS AND DISCUSSION

The socio-economic characteristics of the respondents are summarized in Table 1. Most of the majority of the sampled households (79%) were male headed. The average family size was 6 people (ranging from 1 to 15 members) which is slightly higher than the national average of 4.7 (UBOS, 2016). The average age of the respondents was 44 years with the majority (54%) aged between 36 and 60 years followed by the youth (41%). This shows that it is mainly the youths and middle-aged group that engage in bamboo activities while the older age group probably participates in less labour intensive activities. The youths and middle aged group are still actively seeking for livelihood options. As such, they participate more in cash generating activities such as bamboo product processing and marketing (Mekonnen *et al.,* 2014). Many of the majority of the respondents (58%) had attained primary education while 36% were illiterate. Only 5% and 1% had completed secondary school and tertiary education respectively. Government programmes of Universal Primary Education (UPE) and Universal Secondary Education (USE) have uplifted the education levels especially among the youths. However, illiteracy levels remain quite high among the middle and old age groups especially in rural areas. The Bakiga ethnic group were the dominant tribe (48.2%) among the bamboo harvesters/processors followed by the Batwa (43%) and then Bafumbira (8.8%). Most of the majority of the respondents (68.4%) had private land ownership while 23.7% were landless.

Table 1: Socio-demographic characteristics of the respondents

Parameter	Category	Percentage
Sex	Female	21.1
	Male	78.9
Age	18 - 35	41.2
	36 - 60	53.5
	>60	5.3
Education level	Primary	57.9
	Secondary	5.3
	Tertiary	0.9
	Not educated	36.0
Marital status	Married	90.4
	Single	9.6
Ethnic group	Bakiga	48.2
	Bafumbira	8.8
	Batwa	43.0
Land ownership	Private	68.4
	Rented	7.9
	Landless	23.7

Main sources of income

A majority of the respondents (55%) indicated that bamboo was their main source of income followed by agriculture (29.1%), paid work (11%), trade (1%) and beekeeping (1%). Even though most of the respondents were Bakiga, the Batwa relied more on bamboo for income (50%) (Figure 2). This can be attributed to the fact that the Batwa have traditionally lived in the forest and continue to earn a living from various forms of resources extraction (NEMA, 2012).

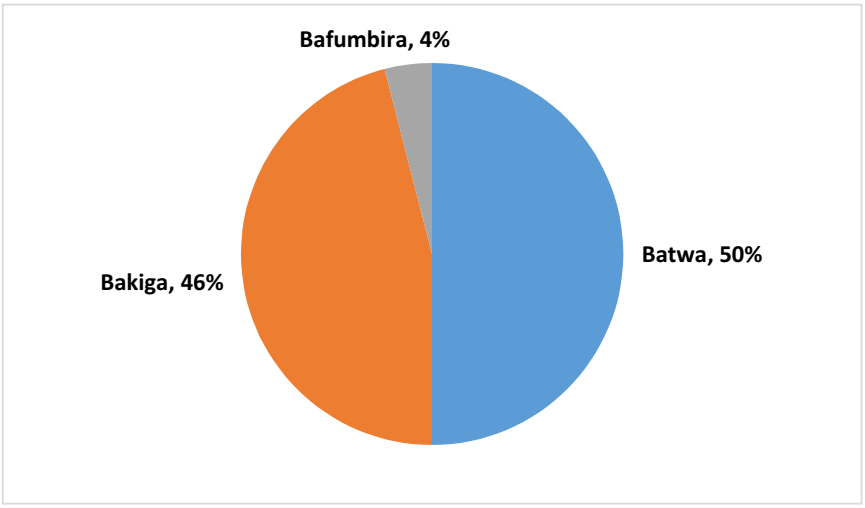

Figure 2: Ranking of bamboo as a primary income generating source among the different ethnic groups

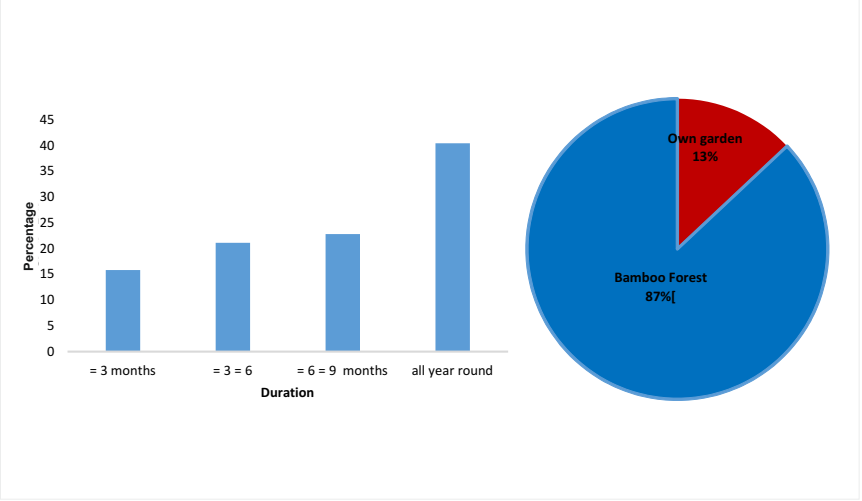

Figure 3: Duration of bamboo collection and sources of collection.

Majority (40%) of the respondents collect bamboo all year-round while about 44% engage in bamboo collection for at least 6 months (Figure 3). About 87% of the respondents collect bamboo from the natural forest while 13% collect from their own garden. The main reasons given for not growing bamboo privately on-farm were; lack of adequate land and lack of access to bamboo germplasm. This is in line with a study by Bitariho and Mcneilage (2007) who found that 96% of the interviewed respondents in areas adjacent to Echuya had not planted bamboo in their homesteads. According to NEMA (2012), most people in rural areas of Uganda live directly off natural resources. Harvesting of NTFPs both for home consumption and sale is an essential activity of their livelihoods (Babulo *et al.,* 2009). The current situation – where communities mostly depend on national forests – is unsustainable and limits the amount of income they could generate from the bamboo trade. Efforts to promote bamboo propagation and growing on-farm are still limited in scope.

Gender participation in different bamboo activities

Gender involvement tends to vary in relation to different bamboo activities. Bamboo harvesting is mainly dominated by men followed by women but also assisted by children (Figure 4). The processing of bamboo into different products was still dominated by men. Marketing is done by both men and women although men still dominate. Women who belong to some social organizations such as groups usually market bamboo products through their social engagement in these groups. Males on the other hand sell their products directly in the markets.

Similar to our finding, FAO (2012) found out that the marketing of bamboo products and other NTFPs in Bangladesh is mainly carried out by men. The male dominance over females is also found in most sectors in Uganda and reflected in the country's low gender development index of 0.878 (UNDP 2016). Formal harvesting of bamboo from Echuya CFR is done on particular days of the month as permitted by NFA. Due to long distances involved in the transportation of bamboo from the forest, most household members get involved to maximize gain from the obtained permission. The participation of males is higher probably due to long distances involved but might also be attributable to the fact that women have other duties to perform in their households (Kabwe, 2016; Carr and Hartl, 2008). Women are not allowed to

participate in the production of some bamboo products such as bamboo baskets and trays as the sitting positions involved are generally not acceptable for women in the region. The dominance of men in the marketing activity is possibly because men are the bread winners in most of the African societies (Kabwe, 2016). Accordingly, they tend to control all income generating activities in the household (Kabwe, 2016; Carr and Hartl, 2008).

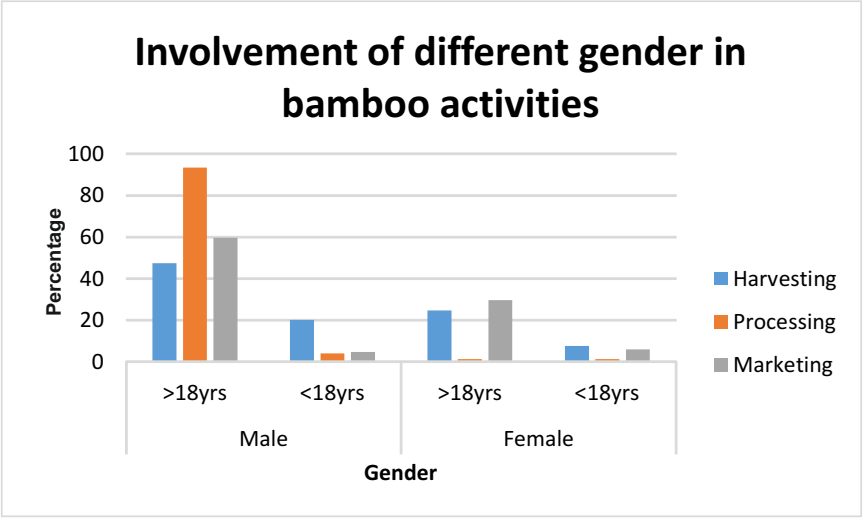

Figure 4: Gender participation in bamboo activities

Bamboo products and the main beneficiaries

Bamboo offers a variety of products for people. The main products identified in south western Uganda are baskets, beehives, winnowing trays, stakes, poles and firewood. These products mainly benefit a number of players in the local bamboo chain (Figure 5). Baskets are the most widely produced and utilized bamboo product in south western Uganda. They are mainly used by farmers during the harvesting of crops as well as post-harvest handling. Bamboo baskets are also used as measuring troughs in the local markets to sell Irish potatoes and other agricultural products. Bamboo baskets and winnowing trays are produced in different sizes (large, medium, small) to enhance usability. A few artisans produce beehives from bamboo to support apiary activities in the region. Focus group discussions revealed that bamboo hives are preferred because they are durable and cheap. Bamboo is also split and used as stakes for climbing crops especially beans. Bamboo stakes are preferred because they are more resistant to termites than eucalyptus ones. Bamboo poles are highly used in construction by local communities. Dry bamboo is also collected from the forest on particular days of the week and used as fuel wood by local communities.

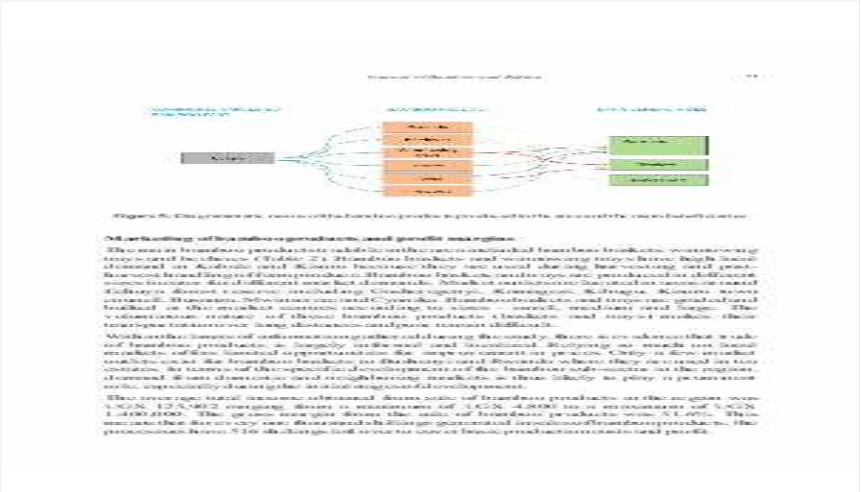

Figure 5: Diagrammatic nexus of the bamboo products produced in the area and the main beneficiaries

Marketing of bamboo products and profit margins

The main bamboo products tradable in the area included bamboo baskets, winnowing trays and beehives (Table 2). Bamboo baskets and winnowing trays have high local demand in Kabale and Kisoro because they are used during harvesting and post-harvest handling of farm produce. Bamboo baskets and trays are produced in different sizes to cater for different market demands. Market outlets are located in areas around Echuya forest reserve including Gasheregenyi, Kamagezi, Kibugu, Kisoro town council, Busanza, Mwinserere and Cyanika. Bamboo baskets and trays are graded and bulked at the market centres according to sizes – small, medium and large. The voluminous nature of these bamboo products (baskets and trays) makes their transportation over long distances and poor terrain difficult.

Within the limits of information gathered during the study, there is evidence that trade of bamboo products is largely informal and localized. Relying so much on local markets offers limited opportunities for improvement in prices. Only a few market outlets exist for bamboo baskets to Bushenyi and Rwanda where they are used in tea estates. In terms of the specific development of the bamboo sub-sector in the region, demand from domestic and neighboring markets is thus likely to play a prominent role, especially during the initial stages of development.

The average total income obtained from sale of bamboo products in the region was UGX 125,902 ranging from a minimum of UGX 4,800 to a maximum of UGX 1,400,000. The gross margin from the sale of bamboo products was 51.6%. This means that for every one thousand shillings generated in sales of bamboo products, the processors have 516 shillings left over to cover basic production costs and profit.

Table 2: Bamboo based products and their prices on the local market

Product	Production cost (UGX)		Selling price (UGX)	
	Farm gate	Market	Farm gate	Market
Baskets				
Small	1,125	50	2,250	3,650
Medium	1,125	50	2,250	3,800
Big	2,175	55	3,750	5,550
Trays				
Small	1,475	25	2,750	3,950
Medium	2,400	25	4,000	5,250
Big	3,650	32	5,500	6,750
Beehives	2,850	325	5,000	8,000

Main bamboo stakeholders in the study area

Interest in bamboo cuts across a wide range of stakeholders in the region (Table 3). The main interventions include involving local communities in the management of the bamboo forest, capacity building on propagation and product development.

Table 3: bamboo stakeholders and their roles in the study area

Stakeholder	Role
Local communities	These are the main beneficiary of bamboo resource in the area. Organized into Collaborative Forest Management groups with a mandate to control illegal exploitation of the bamboo resource
Uganda Industrial Research Institute	To develop high quality bamboo products for local and international markets
Institute of tropical forest conservation	Provides support and guidance on management of the bamboo forest
Nature Uganda	Build capacity of local communities about bamboo domestication and product development
United Organization for Batwa Development in Uganda (UOBDU)	The organization is a center for Batwa – an indigenous minority ethnic group which lived in Echuya forest but later evicted and resettled in adjacent areas. Their mandate is to make sure that the Batwa are not marginalized during the use of the bamboo resource in Echuya forest.
Uplift the Rural poor (URP)	Support bamboo domestication and product development in Kisoro.
National Forestry Authority	Ensure sustainable conservation of Echuya Central Forest Reserve through collaborative approaches with local communities

SWOT analysis of the bamboo sub-sector in the region

The bamboo sub-sector in the region has many strengths upon which future interventions can be tailored to harness opportunities available. In addition, there are some weaknesses and threats which need to be addressed to enhance the development of the sub-sector in the study area (Table 4).

Table 4: SWOT analysis of the bamboo sub-sector in the study area

Strength	Weakness
-Strong indigenous knowledge about bamboo	-Overdependence on the forest for bamboo raw materials
-Presence of collaborating organisations to support bamboo interventions	-Lack of advanced technologies for efficient processing of bamboo
	-Relatively inferior products
	-Limited research
	-Limited access to planting materials
Opportunities	**Threats**
-Diverse range of products	-Restricted access to the bamboo forest
-Growing demand of products	-Receding of the bamboo zone in the forest
-Reduced supply of wood	-Lack of policy framework for production, processing and marketing
-Growing demand for bamboo products	
-Increased awareness about bamboo nationally	

CONCLUSION

This study has shown that there are a number of bamboo products in the study area produced mainly based on the local knowledge. These products are socio-economically important to the livelihoods of the local people with some supplementing household income. The economic value of these products can be

enhanced through capacity building interventions on product development to improve their quality. There is need to establish market linkages to tap into a wider market for the benefits of the local people. The presence of a wide range of bamboo stakeholders should be a stepping stone to initiate bamboo development programmes that can generate employment for the local people. This would greatly contribute to the regional economy and enhance the capacity of the rural people to combat poverty.

ACKNOWLEDGEMENT

We would like to acknowledge funding from government of Uganda provided through the Agricultural Technology and Agribusiness Advisory Services (ATAAS). We would like to thank the NFA, Nature Uganda and Local Government staff of Kabale and Kisoro for their support during data collection. Our sincere gratitude goes to the local communities who unreservedly volunteered information. Special thanks to the Senior Research Technicians (George Niyibizi, Emilly Kamusiime, Bena Kabonesa and Samuel Ongerep) who worked tirelessly during data collection and entry.

REFERENCES

Babulo, B., Muys, B., Nega, F., Tollens, E., Nyssen, J., Deckers, J. and Mathijs, E., 2009. The economic contribution of forest resource use to rural livelihoods in Tigray, Northern Ethiopia. *Forest Policy and Economics*, 11(2), pp.109-117.

Bitariho, R. and McNeilage, A., 2008. Population structure of montane bamboo and causes of its decline in Echuya Central Forest Reserve, South West Uganda. *African Journal of Ecology*, *46*(3), pp.325-332.

Bitariho, R. and Mosango, M., 2005. Abundance, distribution, utilization and conservation of Sinarundinaria alpina in Bwindi and Mgahinga forest National Parks, South West Uganda. *Ethnobotany Research and Applications*, *3*, pp.191-200.

Buyinza, M., 2009. Biogeography and livelihood effects of edible bamboo shoots in Mt. Elgon National Park, Eastern Uganda. *Environmental Research Journal*, *3*(2), pp.35-41.

Bystriakova, N., Kapos, V. and Lysenko, I., 2004. *Bamboo biodiversity: Africa, Madagascar and the Americas* (No. 19). UNEP-WCMC/INBAR. http://www.unep-wcmc.org/resources/publications/UNEP_WCMC_bio_series/19.htm

Carr, M., and Hartl, M. 2008. Gender and non-timber forest products: promoting food security and economic empowerment. *International Fund for Agricultural Development,* United Kingdom.

Escamilla, E.Z. and Habert, G., 2014. Environmental impacts of bamboo-based construction materials representing global production diversity. *Journal of Cleaner Production*, 69, pp.117-127.

FAO, 2012. Gender stock taking in forestry department. http://www.fao.org/forestry/gender/91553/en/.

Hakeem, K.R., Ibrahim, S., Ibrahim, F.H. and Tombuloglu, H., 2015. Bamboo biomass: Various studies and potential applications for value-added products. In: Hakeem, K.R., Jawald, M., Alothman, O. (eds). *Agricultural Biomass Based Potential Materials* (pp. 231-243). Springer, Cham.

Kigomo, B.N., 1988. Distribution, cultivation and research status of bamboo in Eastern Africa. KEFRI ecological series, vol. 1. Kenyan Forestry Research Institute, Nairobi.

Lobovikov, M., Ball, L., Guardia, M. and Russo, L., 2007. *World bamboo resources: a thematic study prepared in the framework of the global forest resources assessment 2005* (No. 18). Food & Agriculture Organisation, Rome Italy.

Mekonnen, Z., Worku, A., Yohannes, T., Alebachew, M. and Kassa, H., 2014. Bamboo Resources in Ethiopia: Their value chain and contribution to livelihoods. *Ethnobotany Research and Applications*, *12*, pp.511-524.

Midmore, D.J., 2009. Bamboo in the global and Australian contexts. *silvicultural management of bamboo in the Philippines and Australia for shoots and timber*. Proceedings of a workshop held in Los Baños, the Philippines, 22–23 November 2006. ACIAR Proceedings, 129: pp.13-17.

NEMA, 2012. State of Environment Report for Uganda. National Environment Management Authority, Kampala, Uganda.

Patel, B., Gami, B. and Patel, P., 2017. Carbon Sequestration by Bamboo Farming on Marginal Land and Sustainable Use of Wood Waste for Bioenergy: Case Studies from Abellon Clean Energy. In: Paddy, K.K, Ramakantah, V., Chauhan, S.S., Kumar, A.A.N. (eds). *Wood is Good: current trends and future prospects in wood utilization* (pp. 451-467). Springer, Singapore.

Ssali, F. and Bitariho, R., 2013. Status and distribution of montane bamboo in Echuya central forest reserve, south western Uganda. Bamboo Report, Institute of Tropical Forest Conservation, Ruhija Kabale Uganda.

Uganda Bureau of Statistics (UBOS), 2016. The National Population and Housing Census 2014 – Main Report, Kampala, Uganda.

United Nations Development Programme (UNDP), 2016. Human Development Report 2016. http://hdr.undp.org/sites/default/files/2016_human_development_report.pdf

Van der lugt, P. and Lobovikov, M., 2008. Markets for bamboo products in the West. *Bois et forets des Tropiques*, (295), pp.81-90.

Yin, R.K., 2009. Case Study Research Design and Methods. Applied Social Research Methods Series, Volume 5. *SAGE Publications*, New Delhi, India.