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CREATING AWARENESS OF THE VALUE OF NON-TIMBER FOREST PRODUCTS TO RURAL COMMUNITIES AROUND MABIRA CENTRAL FOREST RESERVE, UGANDA

Patience Tugume[1*], Mukadasi Buyinza[2], and Esezah K. Kakudidi[1]

[1]Department of Plant Sciences, Microbiology and Biotechnology, Makerere University, P.O Box 7062, Kampala, Uganda. E-mails: patiebeys@gmail.com[*]; esezahk@gmail.com
[2]College of Agriculture and Environmental Sciences, Makerere University, P.O Box 7062, Kampala, Uganda. E-mail: buyinzamukadasi@gmail.com

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Abstract

Contribution of non-timber forest products (NTFPs) to rural livelihoods is vital but often ignored when drafting resource management policies. Information on the value of NTFPs for subsistence use and trade is often inadequate due to market failure. This potrays a wrong message that non-marketed products lack economic value and are not worth protecting. The study estimated the value of NTFPs from Mabira Central Forest Reserve used for subsistence and trade by adjacent communities. Data were collected through key informant interviews, questionnaire survey of 342 resource users and spot market analysis to establish the market value of used NTFPs. Mainly poor women and men aged below 61 years and with low education levels extracted NTFPs. The annual value of identified NTFPs was $ 860,470 of which $ 58,688 was attributed to subsistence use and $ 801,782 to cash income. NTFPs value varied significantly between products (F=1.67, df 16 p=0.05) and between villages (F=0.000, df 13, p<0.05) with charcoal offering the highest annual value ($ 327,686) and palm leaves – the lowest ($ 187). NTFPs from Mabira CFR have a high potential to enhance livelihoods of the poor, women and youth in the study area if sustainably harvested since availability of some plant species used for firewood and charcoal production were reported to be declining. These results indicate the need for urgent intervention measures for alternative sources of income and sustainable extraction of NTFPs to minimize pressure on the forest reserve.

Key words: Charcoal value, commercial value, subsistence consumption, valuation, wealth index, livelihoods.

Introduction

Forests play important roles in the livelihoods of rural people by providing employment, energy, nutritious foods and a wide range of goods and ecosystem services (FAO 2014). Forests have economic value and capacity of generating human welfare. Non-timber forest products (NTFPs) are significant goods from the forest and vital in improving livelihoods of a larger part of the world's population (Belcher and Schreckenberg 2007, Heubes et al. 2012). Over 1.2 billion rural people in the world depend on NTFPs to supplement their basic needs (Kristensen and Lykke 2003). In addition, some NTFPs are used in promotion of traditional and cultural val-

ues (Cavendish 2002). For a long time, Ugandans have harnessed firewood, timber, and poles, or used their derivatives for their energy needs, domestic comfort, security, or development. Of particular importance are the non-wood benefits from the forests, and the environmental values that contribute significantly to people's livelihoods, especially women, and yet are not reflected in the national accounting systems. In addition to subsistence consumption, trade in NTFPs has increasingly become a source of income for communities adjacent to forests. The income obtained from the sale of NTFPs makes a valuable contribution to domestic expenditure (Kristensen and Balslev 2003, Ros-Tonen and Wrersum 2000). Schaafsma et al. (2012) revealed that local people suffer economic loss if they are denied NTFPs collection. Since NTFPs play an important role in the livelihood of forest dwellers, their harvesting can act as an incentive for participatory forest management (Ros-Tonen and Wrersum 2000). According to Cocksedge (2001) the use of NTFPs could reduce the dependency of local people on timber whose extraction is more destructive. The total contribution of the forestry sector to Uganda's economy was estimated at $ 154.8 million (NEMA 2016). This is presumed too low because most of the NTFPs are collected, traded and consumed outside the cash economy and therefore not adequately captured in national statistics (Chidumayo 2013). Some studies in Uganda have identified and documented the NTFPs species (Asiimwe et al. 2014, Tabuti 2012), established commercialisation of wild foods and medicinal plants (Barirega et al. 2012), or management of tree diversity (Boffa et al. 2008) without estimating their economic contribution at local, regional or national levels. Failure to recognise the economic contribution of NTFPs to Gross Domestic Product (GDP) has led to their insufficient recognition in national planning for local livelihoods. Inadequate evidence on the economic significance of forests influences people's wrong perception about the usefulness of the resource resulting in poor management and consequently forest degradation. Awareness of NTFPs values will guide formulation of policies towards their access and utilisation in order to guard against overharvesting and eventual depletion of the resource (Tietenberg and Lewis 2012). Commercial extraction of NTFPs however, could reduce both the diversity and population of species in the forest. There is a need to maintain a balance between commercial collection and biodiversity conservation through identification of NTFPs collectors from Mabira Central Forest Reserve (CFR). It is against background that estimation of NTFPs values from Mabira CFR was guided by the following objectives: i) To identify the NTFPs from Mabira CFR consumed and traded by surrounding communities, ii) To establish the sociodemographic characteristics of NTFPs users, and iii) To estimate the value of NTFPs for subsistence and commercial use.

Materials and Methods

Study area

The choice of the study area was based on villages that heavily depend on Mabira CFR for NTFPs extraction as established from rapid rural appraisal (Tugume et al. 2016). The study was conducted in 14 out of 27 villages of Mabira (Fig. 1) that included: Dangala, Najjembe, Buwoola, Lugala, Naluvule, Nakalanga, Khonko, Bugabe, Ntunda, Kalagala, Bukuku, Nagojje, Lunya and Ssese.

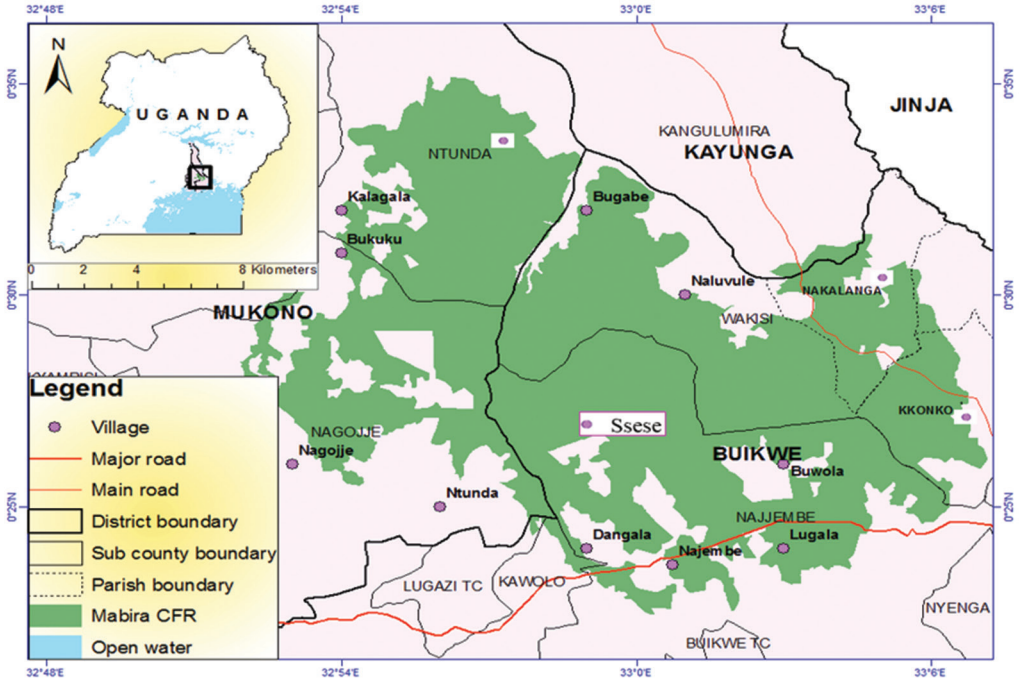

Fig. 1. Map of Mabira CFR showing study villages.

Note: Highlights sites where NTFPs user surveys were conducted and the administrative boundaries within the study area. Inserted smaller map of Uganda shows the location of Mabira CFR. The largest open water body indicated in the map of Uganda is Lake Victoria, for which the forest reserve acts as a water catchment.

The Central Forest Reserve (CFR) occupies an area of approximately 306 km^2 with an altitudinal range of 1070 – 1340 m above sea level (Moyini and Masiga 2006). It is situated between latitude 0°22´ and 0°35´ N and between longitude 32°56´ and 33°02´ E (Moyini and Masiga 2006). The reserve is characterised by numerous flat-topped hills and wide shallow valleys (Howard 2001). The soils are generally ferralitic sandy clay loams, with black waterlogged clays in the valley bottoms. The climate is tropical with two rainfall peaks from April to May and October to November and annual amounts ranging between 1250–1400 mm. Annual mean temperature range: minimum: 16–17 °C, maximum: 28–29 °C (Tugume et al. 2016).

There is pressure on the forest for subsistence use and commercial farming of sugar cane and tea resulting into conflicts among different stakeholders. The recent threat was the interest by the Ugandan government to convert a third of the forest for sugar cane growing in 2007 and later in 2011 amidst protests from conservationists and the general public. Over 90 % of households around the reserve satisfy their subsistence needs from the forest (MWLE 2002). The extensive use of forest resources is attributed to rapid population expansion in the 27 villages (235 people per km^2) leading to pressure on the land for agriculture and on the forest for extrac-

tion of both timber and non-timber forest products (Isabirye et al. 2010). Education and income levels of forest communities are low (Agea and Fungo 2009), conditions that increase dependence on the forest for NTFPs (Vedeld et al. 2007).

Data collection

Rapid Rural Appraisal (RRA) (Tugume et al. 2016) was conducted in each of the 27 villages to assess key economic activities present. Consequently, 14 villages that heavily depend on Mabira CFR for NTFPs extraction according to village leaders were selected for resource user survey. The target population was 1,110 resource users out of which 342 were selected for the study.

An introductory meeting was held in each of the selected villages where NTFPs users were introduced to the research team by the village Chairpersons. During the inception meeting, the objectives and significance of the study were discussed, lists of NTFPs collectors generated to form a sampling frame, and a check list of all NTFPs utilized by local people prepared. Prior to the actual survey, the questionnaire was tested among 20 random NTFP users to identify any ambiguous questions which were amended in the final copy used (Barribeau et al. 2012).

NTFPs users in each village were stratified according to NTFPs used/extracted/traded and the number of users in each NTFPs category were established. Stratified random sampling was used to select at least 10 % of resource users in different use categories per village (Roscoe 1975) and ′snowball′ sampling technique (De Caluwe 2011) was used to select the respondents. Semi structured questionnaires were then administered to the selected resource users in each category per village.

Questionnaires gathered data about quantities of NTFPs consumed or sold locally, time spent gathering NTFPs, season of collection, reason for collection, market price/price of close substitutes for untraded products and availability of the product. Other data collected were on education level of traders and household income from other sources. In addition respondents were asked to list all the capital assets they own. Traders were asked to report the costs associated with NTFPs trade/collection. Spot market analysis was done. Using a checklist randomly administered to NTFPs vendors, unit selling prices and quantities of different NTFPs were established. Key informant interviews with village local council leaders, NTFPs vendors and herbalists (traditional healers and medicinal plant sellers) were conducted to supplement data collected through resource user questionnaire survey.

Construction of a wealth index

A wealth index was calculated for each resource users' household (UBOS and Marco International Inc. 2007). The household assets and type of housing used to construct the index were scored as indicated in Table 1. A wealth index scale ranging from 0.5 to 65 was created by summing up scores for each of the housing characteristics and household possessions of the NTFPs users. Out of this, four wealth classes were formed depending on total scores for each users household as lowest (0.5–13), second (14–25), third (26–36) and highest (40–65). Such an asset index has proved reliable in Uganda (UBOS and Marco International Inc. 2007) and is highly comparable to both poverty rates and Gross Domestic Product (GDP)

Table 1. Scores of nature of household and assets used to calculate the wealth index.

Wealth indicator	Score			
	0.5	1	2	3
a) Nature of main house				
Walls		Plastic sheeting	Timber and mud	Bricks
Floor		Not cemented	Cemented	Tiles
Roofing		Thatch	Iron sheets	Tiles
Window frames		Wood	Metallic	
b) Household goods		Radio Bicycle	Television Motor cycle	Motor vehicle
c) Livestock	Chicken	Goat, pig	Cow	

per capita in other low income countries (Filmer and Priychett 1998). The lowest quintile comprised of households regarded as the poorest and the highest quintile comprised households that were wealthier.

Data analysis

Simple descriptive statistics such as means and percentages were used to present incomes and quantities of NTFPs and sociodemographic characteristics of respondents.

Market price valuation was used to determine the value of NTFPs (Godoy et al. 1993). This facilitates comparison with values beyond forest communities and provides an indirect estimate of a cost or benefit using surrogate market goods and commodities. The method has weaknesses of under/overestimating volumes harvested/sold for reasons of prestige or tax avoidance. In case of illegally traded products, there could be undisclosure by traders. These weaknesses were overcome using shadow prices to convert non market NTFPs' benefits to monetary terms for easy comparison with the value of marketed commodities. This valuation focused on product uses (output) rather than value of individual species, thus all the various uses were summed under the different use categories.

The net value of each product was obtained by subtracting the average costs incurred to obtain the product from its market value. This was multiplied by the average number of units sold or consumed per user per annum to get the net annual value of the resource. The value of each forest product per resource user was calculated using formulas (1–3) (Vedeld et al. 2007) and formula (4) (Scott 1998):

$$NV_p = MV - C, \quad (1)$$

$$NAV/\text{user/yr.} = NV_p \times \text{No of units/user/yr.}, \quad (2)$$

$$NAV_{village} = NAV/\text{user/yr.} \times \text{No of users/village}, \quad (3)$$

$$\text{Net value for all users in all villages} = \sum_{n=1}^{n=14} NAV_{village}, \quad (4)$$

where: n – number of villages, MV – market value (calculated by multiplying the quantity consumed/sold with the market price), C – total cost of extraction/processing/sale associated with a NTFP, NV_p – net monetary value for each product, NAV/user/yr is the net annual value of NTFPs for each user per annum, and $NAV_{village}$ is the total value of a given product in the whole village. The total cost of NTFP (C)

was obtained by multiplying the cost per unit by the quantity of the product extracted/processed/sold.

The costs of extraction/processing included labour cost which was determined by multiplying the number of hours used in NTFPs collection/processing revealed during the interviews with the value of agricultural labour in the area. Through discussions with respondents, a figure of approximately two dollars per hour was estimated as the wage for agricultural labour. This was used based on the assumption that a cash wage value intrinsically reflects the opportunity cost of using labour on a person's land. However, it should be noted that the opportunity cost of agricultural output varies with season. This study was conducted during the dry season when agricultural production is low leading to low labour cost. Another cost of extraction and trade was transport. Variation in the value of NTFPs was tested using ANOVA statistic.

Estimating the value of individual NTFPs

- Value of firewood = (Average quantity collected × No of times firewood is collected in a week × No of weeks in a year × price per unit) – Costs of extraction. Users average quantity of a bundle that comprised of five logs for subsistence use or retail and an elf truck for wholesalers.
- The value of thatching materials = No of bundles consumed per household per year × market price per bundle (Martin 1995). Value of construction poles = No of poles used/ sold × market price per pole. Each user provided an estimate of the number of poles/bundles of thatch used for repair or to construct a house in the year of study.
- The value of handicrafts = (No of products made per month × price × 12 months) – annual costs.
- The value of forest foods was obtained by multiplying the quantity by the shadow price based on market prices in the surrounding markets.
- For medicinal plants, the market price of the most commonly traded medicinal plant was used as a proxy for all. The recall method was used to estimate the quantity and value of medicinal plants collected or marketed. Value = quantity collected per month × 12 months × price.
- The value of charcoal was calculated based on the market price of charcoal in the surrounding markets. The unit of measurement for charcoal was a sack. Value = quantity used/sold per month × market price × 12 months.

Results and Discussion

Characteristics of respondents

The characteristics of respondents are recorded in Table 2. Both men and women were involved in NTFPs extraction and related activities with a clear distinction in the products preferred by each gender. Similar trends in NTFPs collection were reported in South and West Africa (Campbell and Luckert 2002, Shackleton et al. 2011). However, Sunderland et al. (2004) illustrated a dominant role by women in NTFPs marketing and sale in Africa. Within forest communities gender differences in forest use are common where collection of wild foods and firewood are often done by women and children. In the current study, women and the youth were mostly engaged in collection of firewood for domestic use, processing and selling of mats and baskets. The collection of firewood for household cooking was reported

as a common practice in Western Kenya (Kiplagat et al. 2008). The dominance of women in firewood collection is explained by the exclusive duty of cooking by women in households. Production of mats and baskets is mutually exclusive with other household chores performed by women explaining their dominance in the sale of these products. Conversely, men were involved in strenuous illegal activities like commercial extraction of firewood, charcoal burning, manufacture of racks, cupboards and stools. These require a lot of energy and the need to travel deep into the forest to harvest raw materials. In the current study men reported travelling deep into forest to obtain rattan and palm leaves. Travelling long distances was reported in the extraction of bamboo in India by Saha and Sundriyal (2012). Men are more willing to take on risk by engaging in illegal harvesting of firewood and charcoal compared to women. This corroborates the findings of Aiyeloja et al. (2012) in Nigeria and Luoga et al. (2000) in Tanzania.

A majority of respondents were below 61 years and thus physically active and energetic to engage in NTFPs collection and trade which involve walking long distances and carrying heavy loads as corroborated by findings of Balama et al. (2016). The collection of some products from Mabira CFR is restricted by National Forestry Authority (NFA). This selects against the elderly who lack the energy to run fast to dodge the NFA forest guards and so the elderly are less likely to go into the forest. Rural poverty increases the need for resources and local people's dependency on Mabira forest. However, the command-and-control approach used by NFA of restricting access to the forest has only escalated 'forest-people' conflicts. This approach has increased illegal harvesting of forest products in order to meet the needs of the community.

NTFPs users had low levels of education (Table 2). Low education level limits the employment opportunities of respondents increasing their heavy involvement in NTFPs related activities. Similar findings were reported by Adhikari et al. (2004) who argued that higher educational levels make firewood collection unprofitable due to high opportunity costs of labour. Illukpitiya and Yanagida (2010) further reported that education increases opportunities for off farm income generation rendering NTFP extraction unattractive. In addition to NTFPs extraction respondents engaged in agriculture, petty trade, informal and formal employment (Table 2). NTFPs extraction was simultaneously carried out with other activities by 97 % of the respondents while only 3 % entirely depended on NTFPs extraction for their livelihoods. Dominance of farming in the area is due to conditions favourable for agriculture which is likely to impact both positively and negatively on the forest reserve. For instance, residents of Buwoola cultivate *Catha edulis* (Vahl) Forssk. ex Endl, which is illegal but of high value and thus inflates the value of agriculture. Dependence on illegal plant species means that should enforcement be strengthened, then there is a likelihood of a shift to exploitation of other forest products. There was evidence of encroachment by agricultural activities on the forest reserve, which, if not controlled, may lead to degradation. Land ownership for agriculture was limited to few acres or none increasing chances of forest encroachment for crop growing and NTFPs extraction.

Table 2. Socio-economic/demographic characteristics of respondents.

Socioeconomic attribute	Response rate, %
Age, years	*N*=342
<18	14
18–30	18
31–60	51
Above 60	17
Sex	
Male	60
Female	40
Household head	
Child	40
Mother/widowed	16
Father	43
Grandparent	5
Education level	
Non formal	18
Primary	52
Ordinary level	26
Advanced level	2
Tertiary	2
Occupation	
None	20
Peasant farming	65
Wage labour	8
Salaried employment	2
Petty trade	5
Land Holding	
No land	12
1–3 acres	61
>3 acres	27
Wealth Quintile of NTFP users household	
Lowest	39
Second	41
Third	14
Highest	6

Note: *N* = number of respondents. Education levels are according to Ministry of Education and Sports in Uganda. Tertiary level comprises both Diploma and Bachelor's Degree. Wealth quintiles of households are listed in ascending order of wealth.

Wealth quintiles of resource users' households

A majority of resource users belonged to households in the lowest and second lowest wealth quintiles (Table 2) an indication that most NTFPs users are poor. This pattern of NTFP dependence was reported elsewhere (Arnold and Perez 2001, Belcher and Schreckenberg 2007). Low levels of wealth increase the chances of dependence on the forest resource. The poor often lack enough capital to engage in other economic undertakings which drives them into extraction of NTFPs that requires less capital investment. Restrictions on NTFPs extraction may impact negatively on the poor but favour wealthy individuals who possess more political influence and thus likely to benefit more from the forest. This would aggravate poverty levels and at the same time promote forest degradation by the rich.

The value of NTFPs collected by the local community from Mabira CFR

Several NTFPs and their secondary products were collected, processed and traded (Table 3). The use of similar NTFPs is a common feature in other communities adjacent to forests (Ngugi et al. 2012, Sher et al. 2011). It is evident from the

current study that Mabira CFR is a critical resource in supplying several NTFPs used for livelihood improvement to surrounding communities. The total annual value of NTFPs extracted from Mabira CFR amounted to $ 860,471, of which 93 % was attributed to commercial extraction and 3 % to subsistence use (Table 3). These results are consistent with findings by Saha and Sundriyal (2012) in which a high number of NTFPs were traded in local markets. However, our findings contradict those of Shepherd et al. 2012 in Uganda in which 28 % of the NTFP value was attributed to the cash sector and 72 % to the non-cash sector. This variance could be ascribed to the fact that the latter study looked at national figures yet the current study estimated values to the local economy. The importance of NTFPs as a source of non-cash income was also reported in Kiag'ombe households (Ngugi et al. 2012). Commercial extraction involves large volumes of NTFPs than subsistence use. The high proportion of commercial users in the current study corroborates findings of Belcher et al. (2005) who reported the use of high value NTFPs to obtain cash income.

Charcoal contributed the highest total annual value followed by firewood (Table 3). This could be attributed to high volumes sold and the escalating prices in the area. Other studies in Africa support this finding and report charcoal as the main source of energy and a major contributor of rural household income (Arnold et al. 2003, Angelsen and Wunder 2003). The high value of both charcoal and firewood is also attributed to their availability all year round. The value of charcoal was lower than that determined from Eastern Arc Mountains in Tanzania (Schaafsma et al. 2012). The variance is due to difference in methods used and the size of the study areas. The current study estimated the value of charcoal to communities adjacent to Mabira CFR, while Schaafsma et al. (2012) assessed charcoal value from 13 mountain blocks spreading from Kenya to Eastern, Central and Southern Tanzania. Despite the high charcoal and firewood values, users reported a decline in abundance of *Vepris nobilis* Del., *Holoptelea grandis* (Hutch. Mibr), *Celtis mildbraedii* Engl. and *Margaritaria discoidea* (Baill.) Webster commonly used in charcoal production. Such a decline in tree species is not unique to Mabira CFR but was reported in other regions (Tabuti 2012, Saha and Sundriyal 2012) due to unsustainable harvesting. Decline in abundance of commonly used species puts significant pressure on the forest to supply fuelwood for cooking and may eventually lead to forest degradation. This is likely to have a negative impact by reducing household incomes of users.

The NTFPs collected are used for nutrition, construction, energy demands, and primary health care among others. Other studies have shown the importance of NTFPs to surrounding communities (Adepoju and Salau 2007, Kristensen and Lykke 2003). The utilization of NTFPs is a clear manifestation of their contribution to improving rural livelihoods. This is attained as a direct saving through subsistence use and local trade to get cash income. The use NTFPs frees cash resources to acquire other household needs and accumulate the necessary asset base for more secure livelihood like education, start-up capital for other economic activities and purchase of essential goods.

Table 3. Annual value of NTFPs extracted by communities around Mabira CFR for subsistence and commercial purposes.

NTFPs	Subsistenceuse, USD	Commercial use, USD	Total value, USD	Value, %
Charcoal	9,419	318,263	327,682	38.1
Firewood	34,398	119,480	153,879	17.9
Medicinal plants	3,295	77,190	80,485	9.4
Mats		75,331	75,331	8.8
Construction materials	6,502	66,234	72,736	8.5
Mingling sticks		44,009	44,009	5.1
Baskets		40,055	40,055	4.7
Brooms		15,322	15,322	1.8
Skewers		10 240	10,240	1.2
Tool handles		9,007	9 007	1.0
Bark cloth		8,519	8,519	1.0
Fodder	3,972	2,323	6,295	0.7
Stools		6,232	6,232	0.7
Wild foods	1,102	1,391	2,493	0.3
Cupboards		2,012	2,012	0.2
Raffia		1,663	1,663	0.2
Baby cots		1,601	1,601	0.2
Racks		1,569	1,569	0.2
Winnowing trays		720	720	0.1
Rattan		433	433	0.1
Palm leaves		187	87	0.02
Sum	58,688	801,782	860,471	100

Note: Figures were converted at 1 USD – Shs 2,533 (BOU – Monetary policy statements) USD=United States Dollars. NTFPs include both raw materials and value added products.

The annual values of NTFPs utilized by Mabira CFR communities varied between villages (Table 4). The high value of Charcoal and firewood suggests that people around Mabira CFR depend heavily on the reserve for domestic energy needs. This is also true for households in other parts of Uganda where woody biomass meets approximately 92 % of the energy needs for household cooking (MWE 2013). A high annual value of charcoal was also reported in Zambia (Mulenga et al. 2011) and West Africa (Falconer 1990). The high values for firewood and charcoal are not surprising given that fuel wood and charcoal forms the most common source of cooking energy in rural and urban areas in Uganda respectively. The supply of electricity an alternative source of energy is still limited and not affordable by most households in the low and middle class income groups. The National forest plan 2011/12 – 2021/22 (MWE 2013) indicated that the nominal value of firewood and charcoal in both monetary and non-monetary terms has been on the increase attracting more individuals in their trade. Increased commercialization of charcoal and firewood is likely to further degrade the resource base on which the forest dwellers depend. The extraction of firewood and charcoal are destructive activities that may lead to loss of more forest cover. A study by Shepherd et al. (2012)

in Uganda revealed that firewood, building materials and wild edible plants were the most important contributors to household income. The high annual values of firewood and charcoal in Dangala and Bugabe respectively (Table 4) was due to increasing demand in the main towns of Kampala, Jinja and Mukono.

Wild foods contributed a low annual value (Table 4) since most users reported difficulty in finding any wild foods due to deforestation. Wild foods were harvested by the youth incidentally during firewood collection. The costs of wild food extraction exceeded the expected benefits due to long distances that had to be travelled to gather enough volumes that would make economic sense as similarly reported in Nigeria (Adedayo et al. 2010). The common foods collected were fruits, leafy vegetables and yams. A study in South Africa (Shackleton and Shackleton 2004) reported that more than 85 % of the rural people consumed wild spinaches, edible fruits and honey from the forest. Wild foods were mainly for home consumption due to minimal quantities that were available. A similar pattern of total dependence on *Oenanthe stolonifera* (Roxb.) and *Musa* sp was reported in Senapati District in North-eastern India (Pfoze et al. 2012). Though forest foods were scarce, income from other NTFPs provided economic accessibility to food. NTFPs income was reportedly used to meet household needs including buying food which appears to be a more important benefit of the forest for food security than direct collection of forest foods.

Table 4. Annual Values of NTFP extracted by local people in Villages of Mabira CFR.

Village	Firewood, USD	Charcoal USD	Medicinal plants, USD	Edible plants, USD	Construction materials, USD	Other NTFPs, USD
Dangala	84,068	4,373	28	220	3,060	3,661
Najjembe	6,261	6,641	500		5,136	67,887
Buwoola	2,168	460	19,249		3,649	13,180
Lugala	4,992	11,104	9,797		6,588	2,705
Naluvule	1,421	65,013	14,510		7,729	11,122
Nakalanga	1,356	12,140	219	942	3,747	22,058
Khonko	1,704	43,901	135	232	2,470	13,123
Bugabe	26,431	91,717	1,374	253	7,782	7,673
Ntunda	2,521	10,719		111	8,467	10,216
Kalagala	9,182	10,221	5,495	423	4,809	10,134
Bukuku	477	33,981	18,536	152	4,877	7,868
Nagojje	5,233	8,911	2,340		8,097	37,935
Lunya	4,912	26,218		161	4,923	13,361
Ssese	3,150	2,286	7,106		1,380	3,489
Total	153,879	327,686	79,288	2,494	72,713	224,412
Subsistence value and %	34,398 (22 %)	9,419 (3 %)	3,295 (4 %)	1,103 (44 %)	6,502 (9 %)	2,971 (2 %)
Commercial value and %	119,480 (78 %)	318,269 (97 %)	75,993 (96 %)	1,391 (56 %)	66,210 (91 %)	220,439 (98 %)

Note: USD = United States Dollars. Other NTFPs include; palm leaves, rattan, fodder, skewers, barkcloth and secondary products from NTFPs processing like; mats, baskets, brooms, tool handles, simple furniture, baby cots and winnowing trays.

The minimal value of medicinal plants could be attributed to low quantities collected for home use. Quantities of NTFPs extracted for subsistence consumption are likely to be less compared to quantities extracted for sale. In most cases herbal medicines are cheaper than western medicines particularly when access to traditional healers is easier. Some studies have showed that demand for traditional medicine is increasing in urban environments despite availability of western biomedicine (Mander et al. 2007, Nadembega et al. 2011) underscoring their importance. Most medicinal plants were sold in raw form except where occasional drying was done. Cakilcioglu and Turkoglu (2010) reported processing of medicinal plants by drying. However, it is important to recognise that selling unprocessed herbal medicines attracts low prices, which translates into low value to traders. This underscores the importance of value addition in maximizing returns from medicinal plants trade. Trade in medicinal plants was dominant in Bukuku, Buwoola, Kalagala, Naluvule, and Lugala where the activity was the main source of income for herbalists that extracted larger volumes for sale. Mabira forest acts as a source of construction materials for rural homes. Materials used include poles, tying materials, thatch grass and reeds. The high value of construction materials is attributed to the fact that most houses in the study area are constructed using these materials which are cheaper compared to modern alternatives like bricks and iron sheets. Poles in some cases were required for supporting television antennas especially in semi urban centres that have access to electricity.

A total analysis of NTFPs from all villages revealed that firewood, charcoal, mats, skewers, baskets and mingling sticks offered high value to users (Table 5) and could be targeted for enterprise development. The variation in the mean annual value of NTFPs extracted was significant (F=1.67, df 16, p<0.05).

Table 5. Mean annual values obtained from utilisation of NTFPs.

NTFPs	Mean annualvalue, USD/village	Minimum value, USD	Maximum value, USD
Firewood	10,991 ±5,884	477	84,067
Charcoal	23,406 ±7,177	460	91,717
Fodder	787 ±191	144	1,585
Medicinal plants	6,707 ±2,078	28	1,930
Wild foods	312 ±96	111	942
Mingling sticks & tool handles	4,401 ±1,340	183	12,045
Brooms	3,064 ±1,134	142	6,850
Rattan	217 ±83	133	300
Skewers	10,240 ±0		
Stools	2,077 ±552	1,026	2,611
Mats	5,797 ±2,362	144	31,800
Baskets	4,006 ±1,469	411	15,558
Construction materials	5,195 ±600	1,379	8,467

Note: Figures were converted at 1 USD = Shs 2,533 (BOU – Monetary Policy Statements), USD = United States Dollars.

The value of NTFPs varied between villages with users from Bugabe village obtaining the highest mean annual value (Table 6). This was mainly attributed to the high charcoal volumes traded. The mean annual value of NTFPs extracted by residents from different villages was statistically significant (F=0.000, df 13, p<0.05). This implies that there was disparity in the mean annual values of NTFP extracted or sold in the different villages. For instance the mean annual values of NTFP was high in Bugabe followed by Naluvule villages and lowest for Ssesse. This variation is attributed to many factors including production volumes, demand, price, level of processing, nature of product extracted and sold, magnitude of extraction, accessibility to the forest and availability of livelihood means other than NTFP extraction. High volumes of firewood and charcoal are extracted to meet increasing demand due to the fact that both are the main sources of cooking energy in rural and urban areas in Uganda. This results into high revenues.

Variation in NTFPs values was reported in other studies (Illukpitiya and Yanagida 2010, ADB 2000). Extraction should however be done with caution in case of some products like charcoal as it leads to forest degradation and loss of the preferred tree species.

Table 6. Annual values of NTFPs assessed from different villages.

Village	Resource users, No	Total annual value, USD	Mean annual value, USD/resource user
Dangala	23	95,409.58	4,148
Najjembe	42	86,425.03	2,058
Buwoola	26	38,706.09	1,489
Lugala	22	35,185.93	1,599
Naluvule	21	99,794.80	4,752
Nakalanga	23	40,462.42	1,759
Khonko	27	61,564.60	2,280
Bugabe	19	135,230.26	7,117
Ntunda	22	32,034.14	1,456
Kalagala	24	40,264.21	1,678
Bukuku	25	65,891.24	2,636
Nagojje	49	62,516.35	1,276
Lunya	25	49,574.87	1,983
Sesse	15	17,411.38	1,161
Sum		860,471	

Note: Figures were converted at 1 $ = Shs 2533 (BOU – Monetary Policy statements).

Variation in mean annual values is also attributed to level of NTFP processing or value addition. Villages that sold a lot of processed products presented with high annual mean values. Processing increases the cost of production which translates into higher prices directly increasing the value of such products. NTFP price differences and production volumes in the villages also contributed to variability in values. In villages where extraction of NTFP required travelling for long distances, the cost of extraction was high and this affected the value. In villages where extraction and trade in NTFP was the only means of livelihood, more time was dedicated to the

activity leading to extraction of large volumes and hence high revenues. However, this may threaten the existence of the NTFP species necessitating conservation measures. On the other hand villages where NTFP extraction and trade was a part time activity to supplement other income, the NTFP values were low. A similar scenario was reported in South Africa (Shackleton et al. 2002).

Conclusions

Mabira CFR is paramount in supplying local communities with firewood, charcoal, construction materials, wild foods and medicinal plants. NTFPs play an important role in rural livelihoods contributing $ 860,471 p.a. in both cash and non-cash income. This underscores the importance of Mabira CFR in poverty reduction to surrounding communities and at the same time indicates the economic loss NTFPs users would bear if NTFPs extraction was absent. The NTFPs value varied significantly between villages and products. Although charcoal had the highest annual value, its extraction threatens the continued existence of the forest reserve. Despite the presence of laws and regulations of accessing the forest reserve, there is continued extraction of NTFPs an indicator that households need such products. Variability in mean annual values of NTFP across villages points to the need for intervention measures for sustainable utilisation of the resource in villages that obtained high NTFP revenues. For instance on farm conservation of preferred charcoal and firewood species should be promoted in Bugabe and Naluvule in order to reduce their overexploitation. Furthermore for species that are reducing in availability, development of nursery and multiplication trials should be implemented in order to identify best production practices.

Meeting the actual needs of local people in the study area necessitates designing forest based initiatives/alternative NTFP sustainable livelihoods to improve household income and at the same time facilitate NTFPs conservation in order to obtain a win-win situation for all stakeholders. Such initiatives will be an incentive to divert the local people from NTFP extraction thus reducing the exploitation rates. The current study only valued NTFP of plant origin and so further studies on values of faunal species and other ecosystem services provided by Mabira CFR should be done. A similar study should be conducted in the rainy season to establish the availability of NTFP or challenges encountered in such a period.

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