Ethnobotany and Prioritization of Some Selected Tree Species in South-western Cameroon

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Research

Abstract

An ethnobotanical investigation was carried out in 12 villages in Manyu and Fako Divisions, South-western Cameroon to determine economic potentials and priorities of eight non-timber forest products (NTFPs) tree species and three tree crops. Gross farmer income in Manyu was found to be 30% from NTFPs and 70% from established tree crops, while in Fako it was 15% and 85% respectively. The yield of tree crops (160-1047 kg/farmer/year) was higher than NTFPs (0.3-273kg/farmer/year). Some 21 diseases were treated using 10 tree species. Farmers assigned highest priority for NTFPs to *Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Baill., *Ricinodendron heudelotii* (Baill.) Heckel, *Dacryodes edulis* (G. Don) H.J.Lam, *Irvingia wombolu* Vermoesen, *Cola lepidota* K. Schum. and *Garcinia kola* Heckel for their cultural and medicinal values implying potential need for their conservation.

Introduction

Indigenous knowledge has been pertinent in development of commercial products and sourcing of medical remedies. Recently, focus in ethnobotanical research has intensified on medicinal, cultural and commercial/livelihoods ethnobotany (Banjade & Paudel 2008, Focho *et al.* 2009, Hossan *et al.* 2010, Jiofac *et al.* 2009, Simbo 2010). Knowledge about the use of plants is higher within indigenous populations. Rapid urbanization in some hitherto ethnically homogenous rural areas has necessitated the documentation of knowledge of plants while the cultural/ethnic fabric is still fairly intact. On the other hand, urbanization is necessary for improved markets for Non-timber forest products (NTFPs) (Ndoye *et al.* 1997). Furthermore, to promote and improve species acceptable to local communities for other projects such as agroforestry, it is important to first establish the preference for selected species. Ayuk *et al.* (1999) found in such a study, that *Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Baill. was highly prioritized for domestication. Knowing the importance of NTFPs compared to other tree crops is useful for mapping agricultural sector policies but very little information on this exists, especially from studies in Cameroon.

NTFPs are increasingly evolving from mere livelihood safety nets with wild plants to necessary established plantations and medicinal species (Focho *et al.* 2009, Hossan *et al.* 2010, Jiofac *et al.* 2009) in rural communities in West and Central Africa as well as in other parts of the world. More often, research has focused on medicinal herbs, while woody species have received less attention, except established medicinal trees such as *Prunus africana* (Hook. f.) Kalkman for which studies have shifted to product development (Cunningham *et al.* 2002).

This study evaluated selected tree species as a source of medicines and livelihoods in Southwest Cameroon. Some of the studied communities are more than 50km from the nearest health center. The prioritization of the species

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based on both farmers' preferences and farm-gate prices could be used for integration of NTFPs into farming systems to improve on the farmer's yearly income. It further compared the NTFPs with established tree crops; cocoa (*Theobroma cacao* L.), sweet orange (*Citrus sinensis* L. Osbeck) and oil palm (*Elaeis guineensis* Jacq.) with respect to yield and income generation. Specifically, woody NTFPs were targeted as they are likely candidates for agroforestry establishment. It was hypothesized that although established agricultural crops like cocoa, sweet orange and oil palms are the main cash crops in the region, the woody NTFPs could contribute immensely in terms of income-generation, rural community health care, and socio-cultural rites. Therefore these NTFPs may be indispensable to the farmers' livelihoods.

Materials and methods

Study site

The study was carried out in Manyu and Fako Divisions of Southwest Cameroon (Figure 1). These Divisions differ in the level of urbanization, with Manyu Division still generally more rural and indigenous, while Fako Division is more urbanized and cosmopolitan. Manyu Division is between 5°10′33″ N and 4°43′25″ N latitudes and 10°9′48″ E and 10°2′38″ E longitudes. It has a surface area of 945,720.6 ha, and is a low plateau with undulating topography that ranges in altitude from 135 to 1000 m (Nkwatoh 2000). Fako Division lies in the coastal region between 4°28′30″N and 3°54′26″N latitudes, and 8°57′10″E and 9°30′49″ E longitudes. The land area is approximately 203,071.27 ha. It is mountainous, with the highest point at the summit of Mount Cameroon measuring about 4100 m (Suh *et al.* 2003).

The main economic activity of the people in the study sites is subsistence agriculture with emergent smallholder plantation schemes. Seven villages spread across three Sub-Divisions were selected for study in Manyu Division (Bakebe, Bachuo-Akagbe, Etoko, Okoyong, Bachuo-Ntai, Kembong & Ossing). Five villages were chosen for the study in Fako Division, spread across two Sub-Divisions (Ikata, Malende, Ekona, Bolifamba & Muea). The selection of study sites was based on population, farming practices, and accessibility. The villages represented replicates within the two main sites.

Ethnobotanical survey

The study commenced with an initial reconnaissance survey to identify potential study species and the target human population. Mixed methods were used in sampling. Purposive sampling techniques were used to select resident farmers with low to high produce output, and convenience sampling for the selection of study villages and the final respondents (Teddlie & Yu 2007). A total of 12 villages were selected; seven villages from Manyu Division and five from Fako Division. Subsequently, a participatory rural appraisal (PRA) method (Chambers 1994) was used to administer an average of 30 semi-structured questionnaires in each of the study villages, making a total of 360 questionnaires. This PRA method comprised direct administration of the questionnaires, and discussions with respondents. Each questionnaire contained 120 subquestions. In order to appropriately compare exploitation trends with other studies, demographic information including age groups, gender, academic level and marital status of respondents were obtained. The ethnomedicinal, food, agroforestry and other uses of the target woody NTFP species and established tree crops as well as their associated socio-economic data were evaluated. Concurrently, field evaluations were carried out to identify and match the species on-site to those in the inventory (Focho *et al.* 2010). Voucher specimens of the species were collected in triplicate, identified and crosschecked at the Limbe Botanical Garden Herbarium (SCA), treated and labelled. These were deposited at SCA and the University of Buea teaching herbarium. Only specific NTFP species identified during the initial reconnaissance survey were studied, and the respondents were strictly resident farmers. Of the 360 questionnaires administered, 304 were retained following elimination of incomplete and inconsistent responses, giving a response rate of 84%.

For the economic evaluation, the yield of the different species for both the on and off-seasons were registered per respondent and the farm gate prices recorded per kilogram of produce for species such as *T. cacao*. Other species such as *Irvingia* species, *Ricinodendron heudelotii* (Baill.) Heckel, and *Garcinia kola* Heckel are marketed in buckets and basins of known volume and the price per bucket/basin was recorded. The weight of the produce in these containers was measured and the price per kilogram was estimated. Farm gate prices were used because they represent the true value of the produce to the farmers. Ethnomedicinal information generated included the traditional names of the plants, illness treated and method of preparation/application. In describing how the ethnomedicines are prepared and administered the descriptions of the respondents were used, which give a clearer picture of the indigenous protocols.

The respondents were further asked to prioritize the species, first on the basis of farm gate prices of produce, and then on the basis of preference by ranking five of the woody NTFPs they would willingly cultivate/domesticate given the means, on a positive scale of 1 to 5. The first species was given a score of 5, and the least, a score of 1. At the end, the scores were pooled per species.

Data analysis

Data were tested for normality using the Kolmogorov-Smirnov test for normality. Data were found to be non-

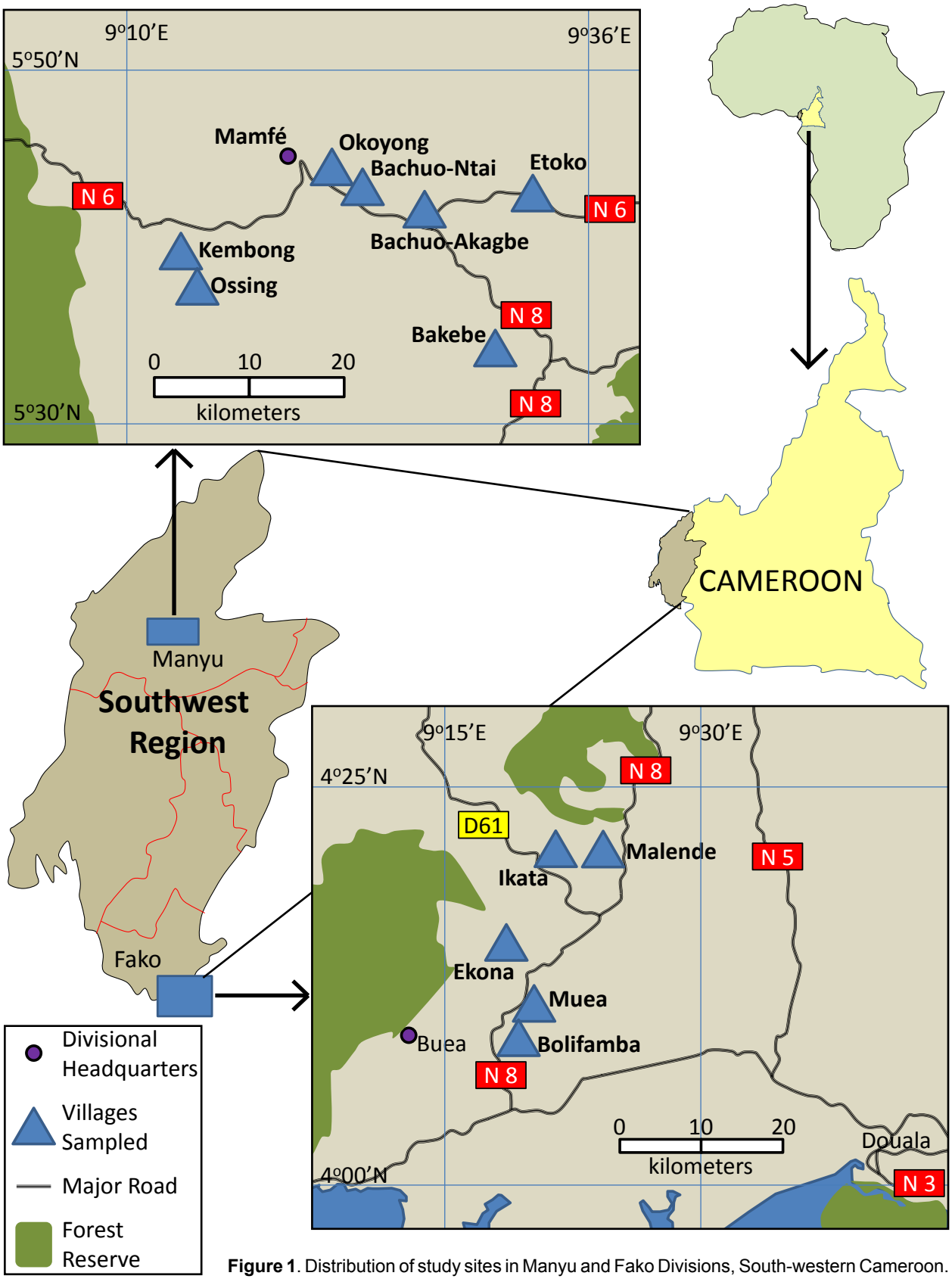

Figure 1. Distribution of study sites in Manyu and Fako Divisions, South-western Cameroon.

parametric at all acceptable α levels (0.01 and 0.05). Descriptive statistical analyses (means and standard errors) were subsequently conducted on the data to test for significant differences within sites. These analyses were carried out using the MINITAB Version 15 statistical package (Minitab 2007).

Data on medicinal uses of the different species was presented in tables, and Microsoft Excel 2007 (Excell 2007) was used to produce a composite plot of the prioritization of the species based on farm gate prices and farmers' qualitative preferences. In all analyses each village was treated as a replicate within the main site (Division).

Results

Study species

Table 1 shows species identified as important to the population in several aspects during the initial reconnaissance survey. There were eight NTFPs and three tree crops. Nine of the species were indigenous while two were exotic tree crops.

Demographic assessment of the sample

Demographic parameters of the farmers considered in this study, across the study sites included age, gender, education (literacy) levels, and marital status (Figure 2). The largest age group of respondents in Manyu Division was 45-60 years (26%) and in Fako Division, 25-35 years (30%). More males than females served as respondents in the two Divisions.

64% of the respondents in Manyu and 59.1% in Fako had at least the first school-leaving certificate. This is the basic academic qualification in the country which means that they can at least read and write. In both sites, there were significantly more married than single respondents (Figure 2).

Agroforestry and level of domestication of study species across sites

Figure 3 shows the level of dependence on planted domesticated species versus those found in forests. In Manyu Division, most farmers (96%) harvest *I. gabonensis* from their farms while *Trichoscypha abut* Engl. & V. Brehm is the species least used as a domesticate (16.8%). In Fako Division, the NTFP most domesticated is *Dacryodes edulis* (G. Don) H.J.Lam (77.3%) while *T. abut* and *Afrostyrax lepidophyllus* Mildbr. both occurred least in farms (4.3%). In the rural site (Manyu Division) there was a greater level of dependence on forests for produce; at the same time there were more planted farms of NTFP species than in the urban site (Fako Division) (Figure 3).

Economic evaluation and livelihood potential of the different species

Table 2 shows the mean annual yield and income per farmer for both study sites. Cocoa had the highest yield in both Manyu (959kg/farmer/year) and Fako (1047kg/farmer/year) Divisions. In Manyu cocoa yields were higher than all other species but in Fako, cocoa along with oil palm (856 kg/year) and sweet orange (694 kg/year) yields were significantly higher than those of all the other species.

Ethnomedicinal uses of study species

Most of the tree species studied had medicinal and cultural uses that complement their economic value. Some of the illnesses for which some of these species are used

Table 1. Species identified as important to populations in South-western Cameroon. Species status: Indigenous (I), Exotic (E).

Scientific name	Family	Common name	Category	Status
Citrus sinensis (L.) Osbeck	Rutaceae	Sweet orange	Tree crop	E
Dacryodes edulis (G. Don) H.J.Lam	Burseraceae	Plum	NTFPs species	I
Elaeis guineensis Jacq.	Arecaceae	Oil palm	Tree crop	I
Theobroma cacao L.	Malvaceae	Cocoa	Tree crop	E
Garcinia kola Heckel	Clusiaceae	Bitter cola	NTFPs species	I
Irvingia gabonensis (Aubry-Lecomte ex O'Rorke) Baill.	Irvingiaceae	Rainy season bush mango	NTFP species	I
Irvingia wombolu Vermoesen	Irvingiaceae	Dry season bush mango	NTFPs species	I
Ricinodendron heudelotii (Baill.) Heckel	Euphorbiaceae	**Njangsa**	NTFPs species	I
Afrostyrax lepidophyllus Mildbr.	Huaceae	Country onions	NTFPs species	I
Trichoscypha abut Engl. & V. Brehm	Anacardiaceae	**Okoyong** fruit	NTFPs species	I
Cola lepidota K. Schum.	Malvaceae	Monkey cola	NTFPs species	I

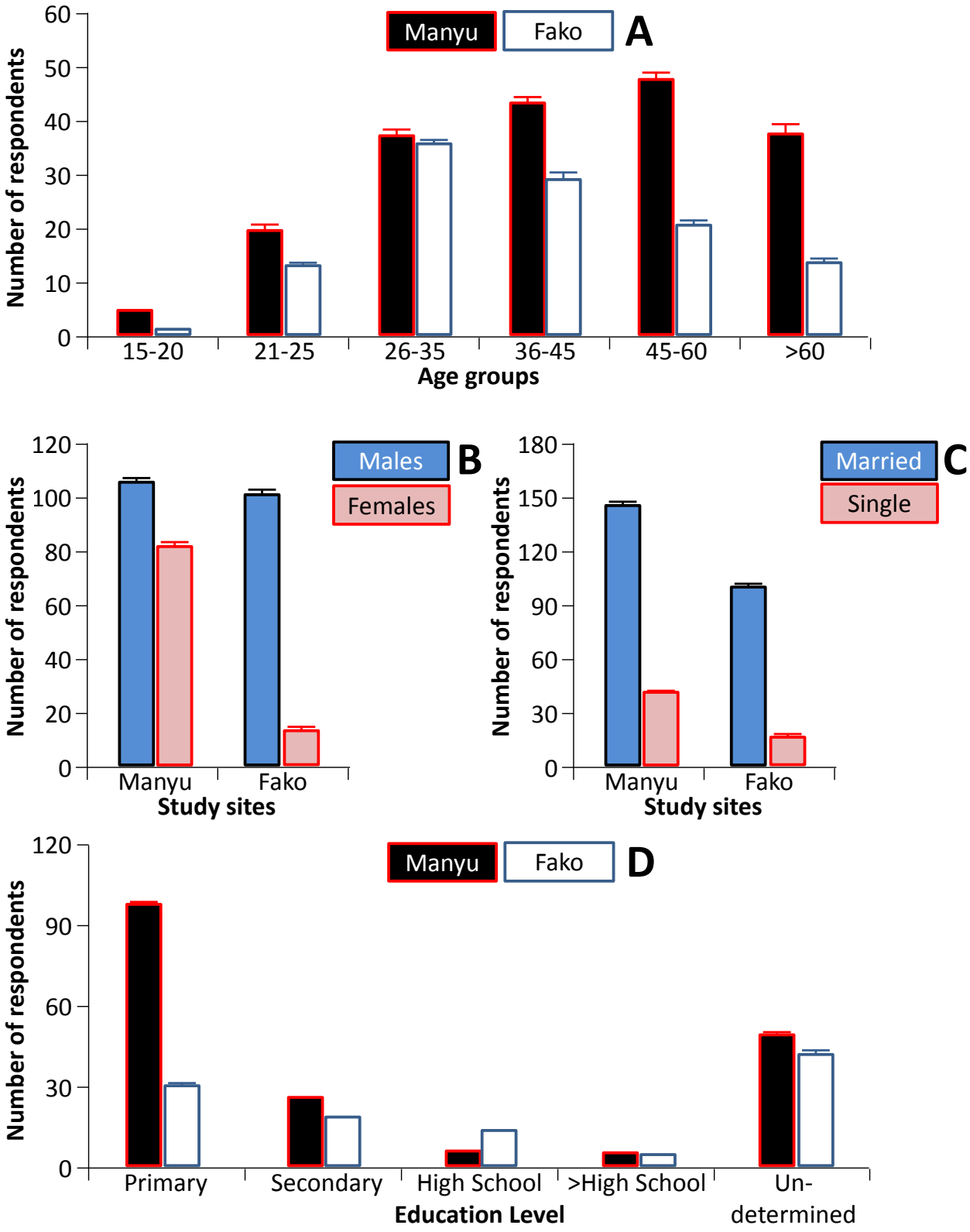

Figure 2. Demographic analysis of the target respondents in Manyu and Fako Divisions, Southwest Cameroon (bars = standard errors): **A**) Age distribution; **B**) Gender distribution; **C**) Marital status; and **D**) Education level.

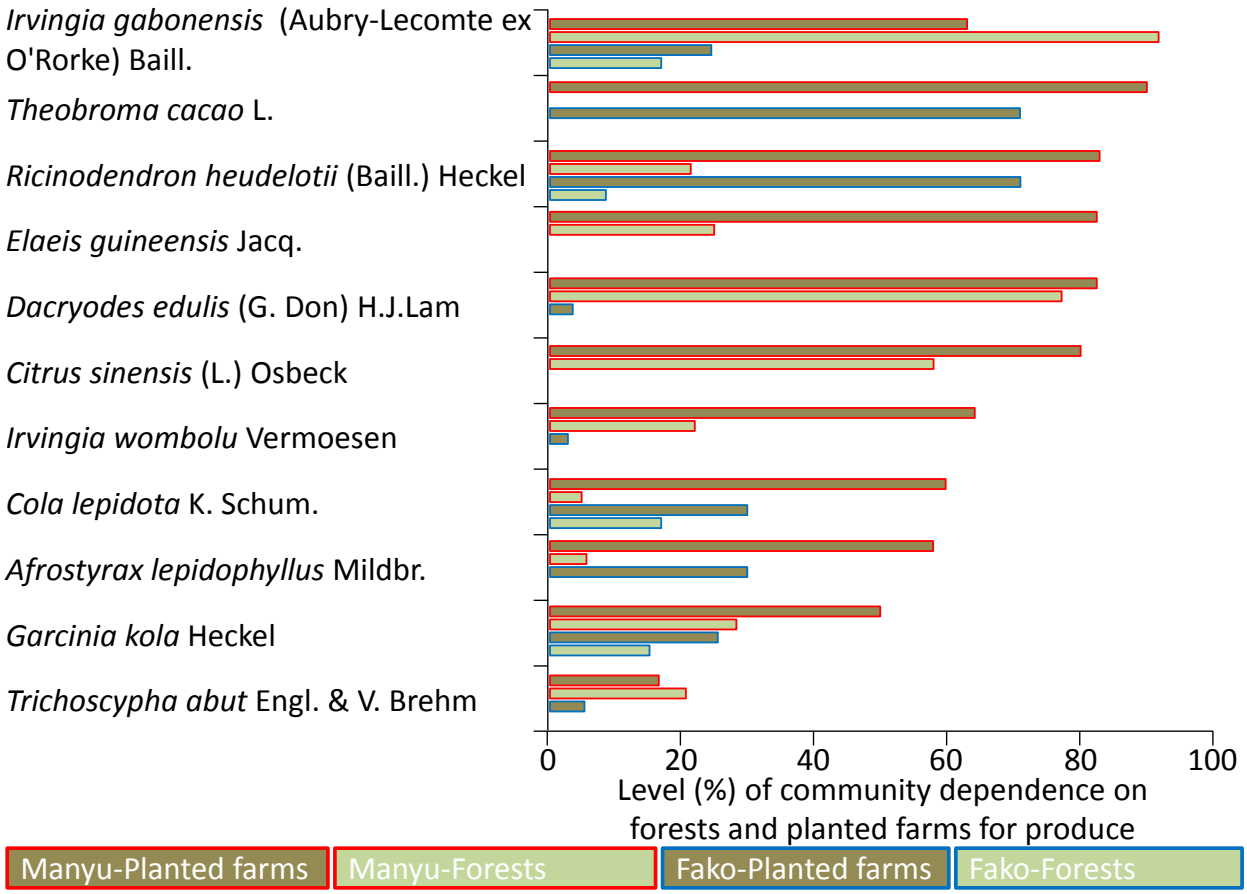

Figure 3. Level of domestication, as measured through community dependence on exploitation of forests and planted farms, for produce in Manyu (n=184) and Fako (n=115) Divisions, South-western Cameroon.

Table 2. Mean annual yield and income per farmer in two study sites in Southwestern Cameroon. Yield and income values presented as mean ± SE. Means with the same superscipt letter are not significantly different. †Extreme values excluded from analysis.

Species	Manyu Division (n=188)		Fako Division (n=116)	
	Yield (Kg/year)	Income (USD)	Yield (Kg/year)	Income (USD)
Irvingia gabonensis (Aubry-Lecomte ex O'Rorke) Baill.	86.37±7.82^{a}	189.36±17.15^{a}	40 ± 15^{a}	87.65±32.89^{a}
Afrostyrax lepidophyllus Mildbr.	11.61 ±2.95^{b}	74.22±14.47^{b}	0.3†	1.77†
Cola lepidota K. Schum.	40.1±24.5^{c}	53.79±28.65^{b}	28.1 ± 17.9^{b}	53.83±11.95^{a}
Irvingia wombolu Vermoesen	24.51 ±7.27^{c}	188±46.83^{a}	0.3†	1.75†
Elaeis guineensis Jacq.	160.9 ± 40^{d}	141.1±35.08^{a}	856 ± 554^{c}	750.79±485.98^{b}
Citrus sinensis (L.) Osbeck	591±133^{e}	155.59±34.87^{a}	694 ± 159^{c}	182.62±41.82^{c}
Garcinia kola Heckel	12.47±3.52^{b}	47.85±11.04^{b}	36.28 ± 7.19^{a}	119.32±23.63^{c}
Ricinodendron heudelotii (Baill.) Heckel	6.099±0.92^{f}	33.43±5.03^{b}	0.891 ± 0.78^{d}	12.21±9.72^{d}
Dacryodes edulis (G. Don) H.J.Lam	27.38 ± 7.2^{c}	24.51±5.05^{b}	273.3 ± 73.9^{e}	209.69±56.73^{c}
Theobroma cacao L.	959 ± 443^{e}	1050.76±485.16^{c}	1047 ± 298^{c}	1607.19±456.68^{b}
Trichoscypha abut Engl. & V. Brehm	6.78†	2.60†	6.6†	2.19†

as remedies in the study sites include impotence, whooping cough, frontal headache, mumps, and gastric ulcers (Table 3). The plants are used in these cases either as the main treatment or as ingredients in composite recipes. For the first time, a cocktail treatment for impotency comprising the central portion of young oil palm stem, palm wine, bitter cola bark and roots is reported.

Species prioritization

Results of species prioritization are presented in Figure 4, and illustrate that cocoa, sweet orange and oil palms were highly prioritized in spite of their low farm gate prices. With respect to the NTFPs, most of them scored higher than cocoa, sweet orange and oil palms on both indices used.

In Manyu Division, the order of preference of NTFPs only was *I. gabonensis*, *R. heudelotii*, *D. edulis*, *Irvingia wombolu* Vermoesen, and *Cola lepidota* K. Schum. respectively while in Fako Division, it was *D. edulis*, *C. lepidota*, *G. cola*, *I. gabonensis*, and *R. heudelotii* respectively.

Table 3. Uses of the plants for ethnomedicine, food and cultural activities in the study sites in Manyu and Fako Divisions, South-western Cameroon.

Scientific Names	Plant part used	Diseases treated	Preparation and administration	Food and cultural uses
Afrostyrax lepidophyllus Mildbr.	Bark	Side pain	Decoction used as an enema.	The seeds, leaves and bark are an important spice in most recipes.
	Endocarp	Asthma	Concoction of endocarp with *Ocimum canum* Sims.	
	Seeds	Abscess	Paste is rubbed into incisions on the abscess.	
		Appetite loss	Paste is mixed with water and used as a tonic.	
		Frontal headache	Seeds are roasted, and its paste rubbed into incisions made with a razor blade on the forehead.	
		Mumps	Paste is made from the seeds and applied on the mumps.	
		Spleen disorders	Decoction of paste in warm water and solution used as enema, 3 litres every 2 days until symptoms disappear.	
	Seeds & / or bark	Navel pain	Decoction of seeds and/ or bark. Used as enema every other day until symptoms disappear.	
Citrus sinensis (L.) Osbeck	Leaves	Malaria, Yellow fever, fevers	Steam bath of leaf concoction of citrus, pawpaw and mango.	The fruits are eaten as a snack.
Cola lepidota K. Schum.	Bark, Leaves	Cough, Whooping cough	a) Decoction used as enema. 1&1/2 litres repeated every 2 days. b) Infusion from fresh leaves used as enema.	Fruits are eaten as a snack, and are used to starve off hunger during other intensive farming season and harvesting/gathering activities that require long hours in the forests.
	Bark	Inactivity in infants	Decoction used as enema, every other day till symptoms disappear.	
		Malaria	Decoction used as enema, every other day till symptoms disappear.	
	Cotyledons	Skin fungi	Paste is applied topically.	
Dacryodes edulis (G. Don) H.J.Lam	Wood	Eye disorders	Suspension is made from wood charcoal and dropped into affected eyes. The wax is used as an accelerant, and also to 'activate' other traditional charms and amulets.	Fruits are eaten as a snack, and as a main accompaniment with staples like cassava/ plantains and for others it is a delicacy.

Scientific Names	Plant part used	Diseases treated	Preparation and administration	Food and cultural uses
Elaeis guineensis Jacq.	Whole juvenile plant	Inactivity in infants	Decoction is made from macerated young palm and used as an enema every 2 days for 2 weeks. Palm kernel oil is important in most traditional remedies.	Sap is tapped for palm wine, which in some cases is further distilled into **Afofo**. The nuts produce oil. Burning of the kernel is thought to weaken opposing charms and scare evil spirits and ghosts. Young fronds are used in various traditional ceremonies and dances, as well as in marking a hearse
E. guineensis & *Garcinia kola* Heckel	Young stem and sap from oil palm, bark and roots from bitter cola	Impotency	Concoction of the central part of the corm is scooped out, and it is mixed with the paste of the bark and roots of bitter cola. Fresh palm wine is added, strained and taken as a tonic at the rate of two glasses daily until symptoms disappear.	
G. kola	Bark	Spleen disorders	Decoction used as an enema.	Seeds are used during libation in marriage, childbirth and naming ceremonies, Seeds use as compliment with groundnut paste. It is also an aphrodisiac.
	Seeds	Constipation	Seeds are chewed whenever symptoms develop, until the constipation subsides.	
		Cough	Seeds are chewed whenever symptoms develop, until the cough subsides.	
		Gastric ulcers	Seeds (nuts) are chewed whenever pains develop, until symptoms disappear.	
Irvingia gabonensis (Aubry-Lecomte ex RO'Rorke) Baill.	Bark	Yellow fever	Decoction used as an enema.	Cotyledons are used as a soup thickener and a rare traditional cake. Dry shells are used as fuel wood in the rainy season when wood is mostly soggy.
	Endocarp	Frontal headache	Decoction of endocarp ground into paste and rubbed into incisions on the forehead whenever symptoms develop.	
	Roots & leaves	Malaria	Decoction of leaves and roots is boiled and used as an enema.	
Ricinodendron heudelotii (Baill.) Heckel	Bark	Anaemia	Decoction is taken orally as a blood tonic	The seeds are an indispensable spice in most traditional and national recipes. The traditional plantain dish of the Banyang people, as well as most fish- and meat-based soups must be prepared with a generous quantity of these seeds, to be of acceptable quality.
		Body pains	Bark is boiled and used as enema	
	Seeds	Abscess	Seeds are boiled, and its paste rubbed into incisions on the abscess	
Theobroma cacao L.	-	-	-	Mucilage from pod is used in gin production. Empty pods are burn and ash use as fertilizer and in local soap production. The fruits are eaten as a snack in both rural and urban areas.
Trichoscypha abut Engl. & V. Brehm	Fruits	Anemia	Fruits are eaten as a blood tonic.	Fruits eaten as snacks.

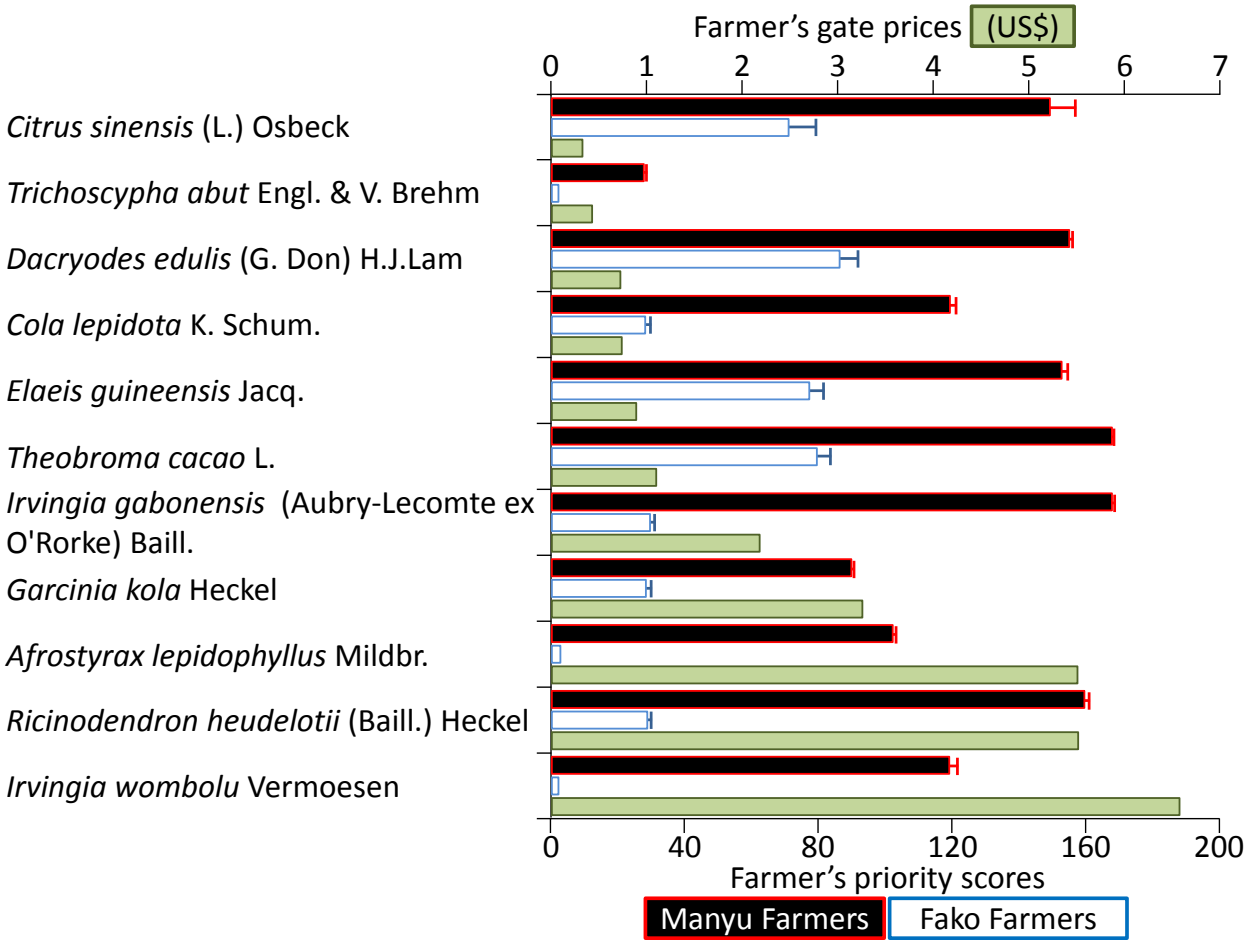

Figure 4. Species prioritization based on farm gate prices and farmers' qualitative preferences in Manyu and Fako Divisions, South-western Cameroon. 1US$ ≈ 456.1FCFA. Bars are standard errors.

Discussion

Demographic assessment of the sample

Demographic dynamics in the exploitation of NTFPs are important in establishing user trends in this socio-economic activity. Age is especially important in rural communities across West and Central Africa where it defines roles within the family. In the current study, the majority of the farmers were less than 60 years old. These results are consistent with that of Blay (2004) who found that chewing stick exploiters in Ghana were aged 30 to 39 years, and Defo (2004) who reported 85% of rattan exploiters in Yaoundé, Cameroon, were aged between 16 and 40 years. Exploitation of NTFPs was previously carried out by women but men have intensified NTFPs exploitation in order to ameliorate their incomes due to increasing cost of living and the increasing income-generating potential of NTFPs. These results are contrary to those of several authors (Nkem *et al.* 2010, Ndoye *et al.* 1997, Sunderland *et al.* 2004) who found that exploitation of NTFPs is a female dominated activity. On the other hand women are the sales agents as they generally have better knowledge of the market and negotiation skills. With men dominating in NTFPs exploitation women have carved a new niche in NTFPs marketing and purchasing directly from the farmers' homes, and are consequently more visible in the markets. This explains why 'Market-targeted' studies (Nkem *et al.* 2010, Ndoye *et al.* 1997, Sunderland *et al.* 2004) would arrive at contrary findings.

Agroforestry and levels of domestication

Besides the established cash crops, NTFPs are already being integrated into farming systems, with a higher diversity in Manyu Division where they play an increasingly important role in agro-economic activities. This integration is as a result of both auto-domestication (the process in which volunteer species are allowed to grow on farms during or following forest clearance without active farmer input in their initial establishment) and cultivated plantations (the purposeful planting and maintenance of NTFPs as the main crop in plantations). This would improve the resource base and consequently rural livelihoods enhance-

ment. Increased domestication would thus be significantly beneficial to these communities. These results are consistent with those of Van Dijk & Wiersum (1999) who suggested that enhanced forest-based livelihoods could be fulfilled by optimizing NTFP production in agroforest systems. Leakey & Simons (1998) had earlier stressed the importance of domestication of 'Cinderella species' on both livelihoods and the environment.

Economic evaluation and livelihood potential of the different species

The established tree crops are the main cash crops in the region but are expensive to maintain and this may greatly reduce their profitability. Cultivation of NTFPs on the other hand is currently considered as sub-agricultural and seasonal. Most of the NTFPs had negligible expenditure in their production and also have higher farm gate prices per kilogram than the established tree crops. The dominance of tree crops is as a result of higher production rates and well established markets (Ndoye *et al.* 1997, Ayuk *et al.* 1999) rather than higher economic potential. This is consistent with other findings on exploitation of NTFPs by Defo (2004) who reported that rattan contributed an average of 137,500 Franc Communauté Financière Africaine (FCFA) (US$302) to the income of households in Yaounde and its environs, as opposed to 87,000 FCFA (US$191) from cocoa sales. The market value of NTFPs depends on both national and international demand (Banjade & Paudel 2008, Leakey & Simons 1998, Ndoye *et al.* 1997). Species with a larger and ready market are expected to have a higher market value. Of the NTFPs most prioritized, species of *Irvingia*, *D. edulis*, *R. heudelotii* (Awono *et al.* 2002) and *G. cola* have established markets both nationally and internationally.

Ethnomedicinal uses of study species

Ethnomedicines play a significant role in the lives of most rural communities. This is due to their relatively low cost compared to clinical treatments in addition to the cultural values and low-income levels of the majority of the population in rural areas of Cameroon. NTFPs have achieved dominance in primary health care in most developing nations of west and central Africa (Adewusi 2004, Awono *et al.* 2002, Hossan *et al.* 2010). The results of some species in this study are similar to those in other countries in which some clinical trials have been carried out in various phases (Akinloye *et al.* 2000, Olamide *et al.* 2007 on *G. kola*). Evidence of medicinal compounds and uses has also been reported for *D. edulis*, *E. guineensis*, *Irvingia* species and *R. heudelotii* (Fondoun *et al.* 1999, Okwu & Nnamdi 2008, Oyen 2007). However, treatment of impotency in folklore usually employs a single plant or plant part like *G. kola* seeds. It is reported for the first time, that the use of a cocktail comprising young *E. guineensis* stem and sap (palm wine), with *G. kola* bark and roots is being used in the treatment of impotency. (The palm wine probably serves as the solvent.)

Species prioritization

Farmers' priority species are consistent with findings by Franzel *et al.* (1996). The current study however made use of two factors to shed more light on the drivers of farmers' priorities. In both sites, farmers' scores did not entirely reflect the farm gate prices, and indicate that medicinal and socio-cultural uses of these species are equally important. Bulk-production of tree crops and with a wider market also explain why these species were scored higher in the qualitative preference index than those with higher farm gate prices.

Conclusion

NTFPs contribute to primary health care and the income of a subsistence farming family. These species are part of livelihood safety nets as they are often in season when most of the main arable crops are off season. Farmers of this region may consider the following factors; medicinal, cultural uses, ease of establishment and income-generation potential in the selection of species for domestication which is an attribute for conservation of the species. For any potential pharmaceutical product development the target species are: *I. gabonensis*, *I. wombolu*, *R. heudelotii*, *D. edulis*, *A. lepidophyllus*, and *G. kola*. These species need to be conserved to reduce the pressure on forests within the communities.

Acknowledgement

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