



Impact of the exploitation of Non-Timber Forest Products on the socioeconomic sector in Kindu city and its surroundings (Maniema, DRC)

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ABSTRACT

This study aims at analyzing the social and economic impact the exploitation, use and the commerce of Non-Timber Forest Products in the habitats surrounding Kindu city, Nyoka locality, Bilundu and Muyengo villages in order to call on actors for responsible exploitation of these natural resources for their survival and to identify major constraints on the development of the NTFP sector in these areas. The methodology to collect collection was based on the ethnoecologic approach. We surveyed permanent operators and sellers in Kindu (Kindu city, Katako village, Shenge village, Lwama district), Bilundu village on Kibombo road, Nyoka and Muyengo villages on Kalima road. To get more information about socioeconomic aspects of the exploitation of NTFP of plant origin in the survey zone, we identified transformers and merchants in the four survey sites (at random at least 25% of household producers and sellers) for ten months, (between July 2018 and May 2019). Data collection consisted of interviews. The unit of sampling is operators and sellers' household. We sampled 697 individuals. The results show that:

➤ 48.4% forest operators in Kindu city exploit NTFP for home consumption and 28% prefer to sell. In Nyoka locality, 44.3% commercialize NTFP they exploit and 36.3% exploit them for both home and commerce consumption. In Bilundu village, 63% products are more destined to commerce and 21% exploit them home consumption. Operators in Muyengo sell 52% products, and consume 33% in their homes;

➤ In Kindu, 44% operators allocate their income to their children's education, 27% to their families' healthcare, and 21% to food needs. In Nyoka, 73% operators use their income to meet food needs in their households, 13% for their children's education and 11% for building. In Bilundu, 67.3% allocate their income to food in their homes, 22.2 % to their children's education. Likewise, in Muyengo village 77% operators allocate their income to food, and 10% to their children's education;

➤ 38% operators interviewed in Nyoka village said scarceness of some species impacts on the reduction of production of NTFP in their area, 31% point at progressive remoteness of the collection zone, 13% raise the issue of age to cover longer distances. In village Muyengo, 35% operators say there is decrease of these resources in the area because of progressive remoteness of collection zones, 33% complain about lack customers and 19% remark rarity of some species. In Bilundu village, progressive remoteness of the collection zones constitutes the first major reason of the decrease of production (54%), followed by rarity of some species (27%) and lack of transportation means towards the centers (12%). In Kindu, remoteness of the collection zones is the major cause of the decrease of production, followed by rarity of some plant species in the biotopes (21%) and lack of transportation means (12%).

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Introduction

The Democratic Republic of Congo is a vast country, located in the heart of Africa. It is mostly covered by the forest. To assure their subsistence, a large number of Congolese households resorts to agricultural activities and Non-Timber Forest Products (NTFP) collection (Debroux *et al.*, 2007).

These NTFP play an important role in the survival and the welfare of local populations, especially of the poor farming populations (Peter *et al.* in My Binh, 2009). In addition to local consumption, these products also sold on local, national and regional markets (Tabuna, 1999; Blazkova & Jenicek, 2006).

Unfortunately, real possibilities that these NTFP offer are unknown at the levels of local populations and socio-political decision-makers. On the one hand, local populations often ignore the economic, ecological and cultural values of NTFP collected in the forest and are swindled by wise tradesmen (case of *Prunus africana* collected by Pygmy in North and South Kivu, *Rauwolfia vomitoria* collected by local populations in Mongala district and in the surroundings of Kisangani city, crocodile's skins sold in Mankanza village, etc.). On the other hand, decision-makers do not understand the contribution of this sector to local, provincial or national economy, especially in improving food security of the populations (Toirambe, B, 2007).

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Markets of NTFP in DRC in general and in Maniema Province in particular, especially in Kindu city and its surroundings developed during the last decades, in part because of fast increase of the population.

In this way, this paper suggests to value the socioeconomic impact of the exploitation of main NTFP exploited, used and commercialized in Kindu city and its surroundings still less studied.

The general objective of the current survey is to point out social and economic impact of the exploitation of NTFP in the habitats surrounding Kindu city, Nyoka locality, Bilundu and Muyengo villages in order to call on actors for responsible exploitation of these natural resources for their survival.

Specific objectives of this study is:

1. To analyze the social and economic impact of the exploitation, use and commerce of NTFP in Kindu city and its surroundings;
2. To identify major constraints on the development of NTFP sector in Kindu city and its surroundings.

Study area

This survey was conducted in Kindu city and its surroundings, Kailo and Kibombo territories, in Maniema Province in the Democratic Republic of Congo. These parts of the province were chosen because of the relationship between the inhabitants and their forest ecosystems.

The study is focused on operators and consumers of NTFP and extends over four sites: Kindu city, Nyoka locality in Kailo territory (19 km away from Kindu), Bilundu village in Kibombo territory (37 km away from Kindu) and Muyengo village in Kailo territory (38 km away from Kindu).

Kindu city is located almost in the middle of the Democratic Republic of Congo. It is bounded by Kailo territory in the North; Kasongo, Kailo and Kibombo territories in the South; Kailo and Pangî territories in the East, Kailo and Kibombo territories in the West.

The topography of the city is the same as the one characterizing the extremity of the Congolese central basin, very little accident with the soil varying between sandy-clay type and clay-sandy type. This region has an agricultural soil that permits growing all sorts of cultures either subsistence or cash farming (Yuma, 2016).

According to city weather service report, Maniema Province is characterized by a hot and humid climate the equatorial type in the North, Sudanese type in the South while going through a transition zone in the center. The average temperature is about 27° C and rainfall amounts to 1650 mm.

The climate is characterized by a rainy season that intervenes two times per year from August to December and from January to mid-May; a dry season that does not exceed 4 months from mid-May to mid-August with fog in the morning and patchy fine rainfall. Season A normally extends from mid-September to January. Season B extends from February to May. (RVA/Mn, 2018).

The primary vegetation of this city was destroyed a long time ago. It included valuable species such as *Militia excelsa*, *Entadrophragma borea* and more others that have currently given way to gramineous plants, vegetables, bushes and shrubs, among wich *Musanga cecropioides*, *Eupatorium odoratum*, *Hyparrhenia sp*, *Pueraria javanica*, *Elaeis sp...*

Hydrography of the city is essentially made of the Congo River and its tributaries on both banks of the River, namely: Kindu, Kange, Mikonde, Luambondo, Muchondo, Mangobo, Kamikunga and Musubu on the right, and Mikelenge, Luandoko, Makopo, and channels on the left. (Yuma, 2016).

Method

Collection of the data

We used the ethnoecological approach to collect data in the field. We surveyed on Non-Timber Forest Products in Kindu and its surroundings. The survey consisted on interviewing permanent operators in Kindu city, Katako village, Shenge village, Lwama district, Bilundu village on Kibombo road, Nyoka and the Muyengo villages on Kalima road. We sampled 25% households at random for the interview. The sampling unit is operators' and consumers' household in the survey sites.

Data analysis and treatment

This analysis enabled us to get differences that were converted into percentages (%). Other tests were applied for more precision.

We used R and Excel softwares to draw some graphics and histograms and fill in some tables to show results on some variables in our database.

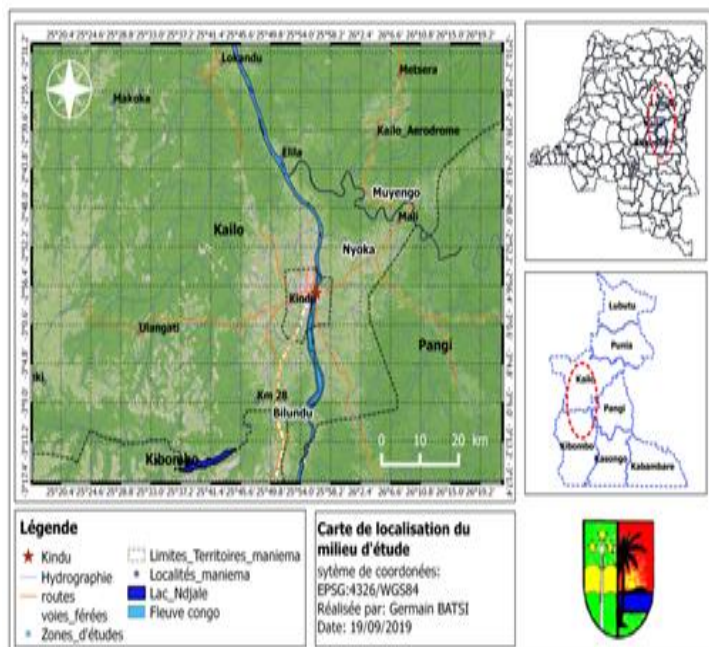


Figure 1. Localization of the study area

Table 1. The most practiced activities in Kindu and its surroundings

ENTITIES	ACTIVITIES									
	COMMERCE AND SMALL SCALE ACTIVITIES		FOREST EXPLOITATION		PUBLIC FUNCTION		FARMING		TOTAL	
	F.O	%	F.O	%	F.O	%	F.O	%	F.O	%
KINDU	82	35,1	43	18,4	36	15,4	72	30,9	233	100
NYOKA	8	4	76	41	4	2	99	53	187	100
BILUNDU	12	8	43	28	3	2	95	62	153	100
MUYENGO	5	4	45	36,2	3	2,4	71	57,2	124	100
Σ	107		207		46		337		697	
%	15		30		7		48			100

F.O : Frequency Observed

Results

Non-Timber Forest Products play a very important socioeconomic role. With regard to the economic crisis that DRC is undergoing, most of its population is getting more and more dependent of these products for food, medicine, building, etc. Through various informal channels, these products offer job opportunities and generate income to many exploiting and commercializing households (Toirambe, 2007).

The most practiced activity in our study area

Table 1 illustrates the most practiced activity in the four survey sites.

From this table, it is evident that the most practiced activities in Kindu are trade and small scale activities (35,1%), farming (30,9%) and forest exploitation (18,9%); farming (53%), and small scale activities (41%) in Nyoka locality; farming (62%) and small scale activities (28%) in Bilundu village; farming (57,2%) and small scale activities (36,2%) . in Muyengo village.

The final destination of the products

Most poor rural and urban populations resort to NTFP for food, medicine (home use) and commerce. The main final destinations of the products are shown in Figure 2 below.

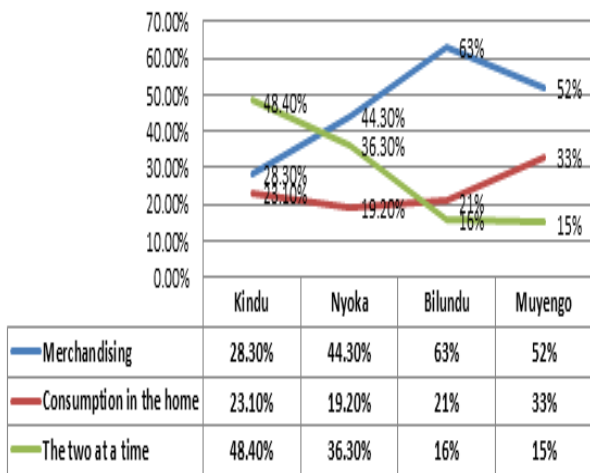


Figure 2. The final destinations of the habitats in Kindu.

48.4% forest operators of Kindu city exploit NTFP for home consumption and commerce while 28% only sell them. In Nyoka locality, 44.3% commercialize NTFP they exploit and 36.3% exploit them for both home consumption and commerce. In Bilundu village, products are more commercialized (63%) than used for home consumption (21%). (52%) operators in Muyengo commercialize NTFP and 33% consume them in their homes.

NTFP sales location

Figure 3 gives information NTFP sales location in our survey area.

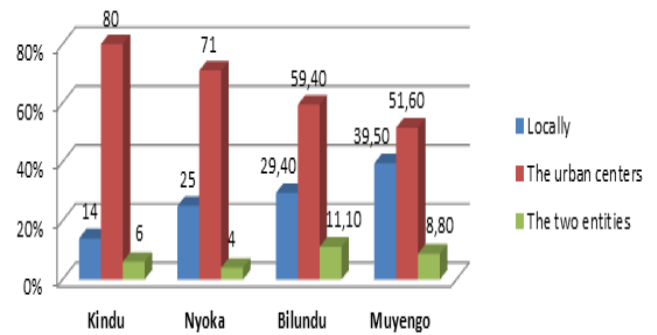


Figure 3. NTFP sales location in the habitats surrounding Kindu city, Nyoka locality and Bilundu and Muyengo villages.

Figure 3 shows that operators prefer to sell their products in urban centers: 80% in Kindu, 71% in Nyoka, 59.4% in Bilundu and 51.6% in Muyengo village. Other operators sell their products locally: 14% in Kindu, 25% in Nyoka, 29.4% in Bilundu and 39.5% in Muyengo. A third and least represented category of operators sell their products in both urban centers and locally less represented.

Means of transportation towards centers of consumption

Figure 4 provides information about means of transportation used to evacuate NTFP.

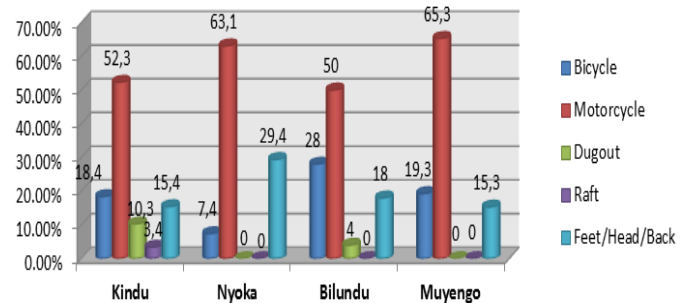


Figure 4. Means of transportation towards centers of consumption

This histogram shows that forest operators use mostly motorbikes to evacuate of their products 52.3% in Kindu, 63.1% in Nyoka, 50% Bilundu and 65.3% Muyengo; 18.4% operators use bicycles in Kindu, walk to the centers of consumption, 15.4% use some pirogues, 10.3% use bamboo rafts. In Nyoka locality, 29.4% walk to evacuate their products, and 7.4% use bicycles. In Bilundu, 28% use bicycles and 18% walk to evacuate their products. While in Muyengo, 19.3% use bicycles and 15.3% walk to centers of consumption.

Investment with the income from NTFP

Figure 5 below presents how the income from NTFP is affected by operators.

Table 2. Gender implied in the exploitation of NTFP

OFPWW	OPERATORS' SEX					
	MEN		WOMEN		TOTAL	
	Occurrences	Rates %	Occurrences	Rates %	Occurrences	Rates %
WFP	79	40	126	60	205	29
PP	26	23	102	77	128	18
PB	105	84	24	16	129	19
MP	26	32	64	68	90	13
TP	35	67	22	33	57	8
PMWA	31	38	57	62	88	13
TOTAL	302	43	395	57	697	100

WFP: Wild Food Plants. PP: Packing plants. PB: Plants for building. MP: Medicinal plants. TP: Textile Plants. 6. PMWA: Plants for making works of Art.

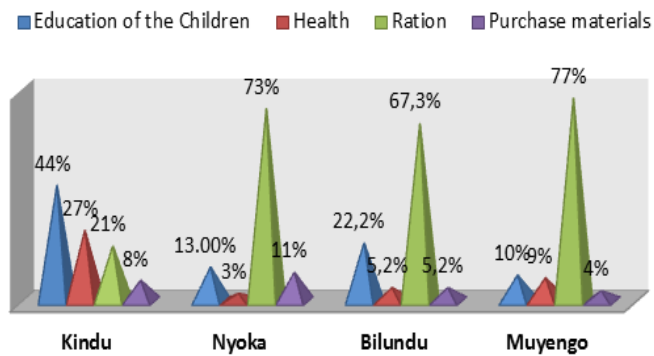


Figure 5. Investment with the income from NTFP

Figure 5 reveals that in Kindu 44% operators affect their income to their children's education, 27% to family medical

needs, 21% to home food needs; 73% to food needs, 13% to education and 11% to construction materials in Nyoka; 67,3% to food, 22,2% to education in Bilundu; 77% to food, and 10% to education in Bilundu.

Gender implied in the exploitation of NTFP

Table 2 shows the more implied gender in the exploitation of NTFP.

From this figure, it appears that women are more implied in the exploitation of several NTFP in our survey area. 60% women exploit NTFP versus 40% men; 77% women exploit packing plants versus 23% men; 68% women exploit medicinal plants 32% men; and 62% women exploit plants used for making works of art versus 38% men.

On the contrary, 84% men are implied in the exploitation of plants used for building versus 16% women, and 67% versus 23% in the exploitation of textile plants.

Table 3. Analysis of commercial profitability of *Amaranthus Viridus*

<i>Amaranthus Viridus</i>										
Walked Kindu										
N°	Bundle/Basket	PC (CF)	T. PC	Bundle/Basket	P.C/P (CF)	Cost	Gain	Selling Price	Raw margin	CP (%)
1	40	230	9200	1	500	1200	10400	20000	9600	92,3
2	40	300	12000	1	500	1000	13000	20000	7000	53,8
3	40	300	12000	1	500	1000	13000	20000	7000	53,8
4	40	300	12000	1	500	1200	13200	20000	6800	51,5
5	40	300	12000	1	500	1200	13200	20000	6800	51,5
6	40	230	9200	1	500	1200	10400	20000	9600	92,3
7	40	300	12000	1	500	1200	13200	20000	6800	51,5
8	40	300	12000	1	500	1200	13200	20000	6800	51,5
9	40	200	8000	1	400	1200	9200	16000	6800	73,9
10	40	200	8000	1	400	1200	9200	16000	6800	73,9
11	40	150	6000	1	350	1200	7200	14000	6800	94,4
12	40	250	10000	1	500	1200	11200	20000	8800	78,5
13	40	250	10000	1	500	1200	11200	20000	8800	78,5
14	40	250	10000	1	500	1000	11000	20000	9000	81,8
15	40	150	6000	1	350	1000	7000	14000	7000	100
16	40	150	6000	1	400	1200	7200	16000	8800	122,2
17	40	300	12000	1	500	1200	13200	20000	6800	51,5
18	40	300	12000	1	500	1200	13200	20000	6800	51,5
19	40	150	6000	1	350	1200	7200	14000	6800	94,4
20	40	300	12000	1	500	1200	13200	20000	6800	51,5
21	40	300	12000	1	500	1200	13200	20000	6800	51,5
22	40	300	12000	1	500	1200	13200	20000	6800	51,5
23	40	300	12000	1	500	1200	13200	20000	6800	51,5
24	40	300	12000	1	500	1200	13200	20000	6800	51,5
25	40	300	12000	1	500	1200	13200	20000	6800	51,5
26	40	300	12000	1	500	1200	13200	20000	6800	51,5
27	40	300	12000	1	500	1200	13200	20000	6800	51,5
28	40	300	12000	1	500	1200	13200	20000	6800	51,5
29	40	300	12000	1	500	1200	13200	20000	6800	51,5
30	40	300	12000	1	500	1300	13300	20000	6700	50,3
31	40	300	12000	1	500	1300	13300	20000	6700	50,3
32	40	250	10000	1	400	1300	11300	16000	4700	41,5
33	40	250	10000	1	400	1200	11200	16000	4800	42,8
34	40	300	12000	1	400	1200	13200	16000	2800	21,2
35	40	300	12000	1	500	1200	13200	20000	6800	51,5
36	40	300	12000	1	500	1200	13200	20000	6800	51,5
37	40	300	12000	1	500	1200	13200	20000	6800	51,5
38	40	300	12000	1	400	1200	13200	16000	2800	21,2
39	40	400	16000	1	600	1200	17200	24000	6800	39,5
40	40	300	12000	1	500	1200	13200	20000	6800	51,5
41	40	300	12000	1	500	1200	13200	20000	6800	51,5
42	40	200	8000	1	400	1200	9200	16000	6800	73,9
43	40	200	8000	1	400	1200	9200	16000	6800	73,9
44	40	200	8000	1	400	1200	9200	16000	6800	73,9
Total	1760	11810	472400	44	20650	52300	524700	826000	301300	57,42
Average	40	268	10736,36	1	469,32	1188,64	11925	18772,73	6847,73	60,45
Gap Marks	0	54,64	2185,69	0	56,26	65,47	2194,83	2250,21	1302,68	20,39
Coefficient of variation	0	20,36	20,36	0	11,99	5,51	18,40	11,99	19,02	35,51

PP: Purchase Price; TPP: Total Purchase Price; G: Gain; CP: Commercial Profitability

Cost = Transportation + Taxes, PCB = Cost + TSP, Selling Price = PP (Fc) x Number of bundle basket,

Raw margin = Selling Price - PCB, CP= Raw margin / PCB x 100, CF = Congolese Francs

Analysis of commercial profitability of the three Other Forest Products that the Wood of Work (OFPWW) the more exploited

The calculation of the total returns and the daily beneficiary margins achieved by the sale of the Other Forest Non-Timber Forest Products permits to situate the role of this sector in the process of development, to estimate its contribution to household income for the realization of food security. So, we analyzed commercial profitability three NTFP, namely *Amaranthus viridis*, *Megaphrynium brachystachyum* and *Eremospatha haulleveliana* sold in Kindu city.

Amaranthus viridis

We present Table 3 the calculation of the total gain from selling *Amaranthus viridis* on different markets in Kindu city.

Amaranthus viridis is sold in a basket of 40 bundles. After calculation of the revenues, the average of purchase price per basket is 10,736.36 CF. The price in detail of a bundle of *Amaranthus viridis* is on average 469.32 CF with 6,847.73 CF as daily average raw margin and 60.45% as average gain. The daily average cost (transportation, taxes) is 1,188.64 CF with 11,925 CF as gain. Sellers in Kindu have a gain superior to 50%, that is, 60.45% on average. This situation results from the location of markets in the city and the population's food preferences.



Photo Pierre



Photo Pierre

Figure 6. On the left, *Amaranthus viridis* on a stall and on the right, a bundle of *Amaranthus viridis* at Kindu central market

Megaphrynium brachystachyum

Table 4 shows calculation of gain from *Megaphrynium sold brachystachyum* at Kindu markets as a packing plant. It reveals that *Megaphrynium brachystachyum* is sold by a bundle of 140 leaves. After calculation of the revenues, we found that the average purchase price of a bundle is 1,426.42 CF. The selling price in detail of a bundle containing four leaves is on average 199.06 CF. The daily average cost (transportation, taxes) is 2,630.19 CF with 4,056.60 as daily gain. Post-sale, the daily middle raw margin is 2,343.21 CF and the average gain is 59.32%.



Photo Pierre



Photo Pierre

Figure 7. *Megaphrynium brachystachyum* at Makengele market in Kindu

Eremospatha haulleveliana

Table 5 presents the calculation of gain at Kindu markets of *Eremospatha haulleveliana* used for making works of art and for building.

Eremospatha haulleveliana is sold by a bundle of 165 threads. After calculation of the revenues, the average purchase price of a wholesale bundle is 2,477.21 CF. The retail selling price of a 15 thread bundle is on average 475.74 CF. The daily average cost (transportation, taxes) is 930.88 CF with 3,349.26 CF as daily gain. The daily average raw margin is 1,883.82 CF and 57.18CF as average gain.

Table 4. Rentability of *Megaphrynium brachystachyum*

<i>Megaphrynium brachystachyum</i>										
Kindu markets										
N°	Number of leaves/ wholesale bundle	Purchase Price (CF)	Number of leaves/ retail bundle	Retail selling price	Number of bundle in detail	Cost	PCB	Selling price	Raw margin	C.P (%)
1	140	1500	4	200	35	2500	4000	7000	3000	75
2	140	1300	4	200	35	2500	3800	7000	3200	84,2
3	140	1300	4	200	35	2200	3500	7000	3500	100
4	140	1300	5	200	28	2200	3500	5600	2100	60
5	140	1500	4	200	35	2500	4000	7000	3000	75
6	140	1400	4	200	35	2500	3900	7000	3100	79,48
7	140	1300	4	200	35	2200	3500	7000	3500	100
8	140	1500	5	200	28	2200	3700	5600	1900	51,3
9	140	1500	4	200	35	2500	4000	7000	3000	75
10	140	1500	4	200	35	2500	4000	7000	3000	75
11	140	1500	4	200	35	2200	3700	7000	3300	89,18
12	140	1500	4	200	35	2300	3800	7000	3200	84,21
13	140	1500	4	200	35	2500	4000	7000	3000	75
14	140	1300	4	200	35	2500	3800	7000	3200	84,21
15	140	1200	6	200	23,3	2300	3500	4660	1160	33, 14
16	140	1500	6	200	23,3	2300	3800	4660	860	22,63
17	140	1500	6	200	23,3	2200	3700	4660	960	25,94
18	140	1500	4	200	35	2200	3700	7000	3300	89,18
19	140	1500	4	200	35	2300	3800	7000	3200	84,21
20	140	1300	4	200	35	2500	3800	7000	3200	84,21
21	140	1500	4	200	35	2500	4000	7000	3000	75
22	140	1500	4	200	35	3500	5000	7000	2000	40
23	140	1500	4	200	35	3500	5000	7000	2000	40
24	140	1500	4	200	35	2200	3700	7000	3300	89,18
25	140	1200	5	200	28	3200	4400	5600	1200	27,27
26	140	1500	4	200	35	3200	4700	7000	2300	48,93
27	140	1500	4	200	35	3200	4700	7000	2300	48,93
28	140	1500	4	200	35	3200	4700	7000	2300	48,93
29	140	1500	5	200	28	3000	4500	5600	1100	24,44
30	140	1500	4	200	35	3200	4700	7000	2300	48,93
31	140	1500	4	200	35	3500	5000	7000	2000	40
32	140	1500	3	150	46,6	3200	4700	6990	2290	48,72
33	140	1500	4	200	35	2200	3700	7000	3300	89,18
34	140	1200	6	200	23,3	2200	3400	4660	1260	37
35	140	1350	6	200	23,3	2200	3550	4660	1110	31,26
36	140	1500	4	200	35	2200	3700	7000	3300	89,18
37	140	1500	4	200	35	2200	3700	7000	3300	89,18
38	140	1500	4	200	35	3200	4700	7000	2300	48,93
39	140	1500	4	200	35	3500	5000	7000	2000	40
40	140	1300	4	200	35	3200	4500	7000	2500	55,55
41	140	1500	4	200	35	3200	4700	7000	2300	48,93
42	140	1500	4	200	35	3500	5000	7000	2000	40
43	140	1200	5	200	28	3200	4400	5600	1200	27,27
44	140	1500	4	200	35	3500	5000	7000	2000	40
45	140	1500	6	200	23,3	2300	3800	4660	860	22,63
46	140	1200	6	200	23,3	2200	3400	4660	1260	37
47	140	1300	5	200	28	2200	3500	5600	2100	60
48	140	1350	6	200	23,3	2200	3550	4660	1110	31,26
49	140	1500	4	200	35	2500	4000	7000	3000	75
50	140	1400	4	200	35	2500	3900	7000	3100	79,48
51	140	1500	4	200	35	2200	3700	7000	3300	89,18
52	140	1200	6	200	23,3	2200	3400	4660	1260	37
53	140	1500	6	200	23,3	2300	3800	4660	860	22,63
Total	7420	75600	237	10550	1707,6	139400	215000	339190	124190	57,76
Average	140	1426,42	4,5	199,06	32,22	2630,19	4056,60	6399,81	2343,21	59,32
Gap Marks	0	110,77	0,82	6,87	5,17	482,62	518,23	954,99	861,73	24,15
Coefficient of variation	0	7,765	18,40	3,45	16,03	18,35	12,77	14,92	36,78	41,81

PCB: Price of Comes Back; **CP:** Commercial Profitability

Number of bundle in detail = Number of leaves / Wholesale bundle

Number of leaves / Retail selling/bundle

Purchase Cost = PC(CF) X Number of retail bundles

Table V. Economic profitability of *Eremospatha haulleveliana*

<i>Eremospatha haulleveliana</i>										
<i>Kindu markets</i>										
N°	Number of threads / Wholesale bundle	Purchase Price (CF)	Number of threads/ Retail bundle	Number of retail bundles	Retail selling price	Cost	Gain	Selling price	Raw margin	E.P (%)
1	165	2500	15	11	500	1000	3500	5500	2000	57,14
2	165	2500	15	11	500	500	3000	5500	2500	83,33
3	165	2500	15	11	500	500	3000	5500	2500	83,33
4	165	3000	15	11	500	500	3500	5500	2000	57,14
5	165	3000	15	11	500	1200	4200	5500	1300	30,95
6	165	2000	15	11	400	1000	3000	4400	1400	46,66
7	165	2500	15	11	400	500	3000	4400	1400	46,66
8	165	2000	15	11	400	500	2500	4400	1900	76
9	165	3000	15	11	500	500	3500	5500	2000	57,14
10	165	3000	15	11	500	500	3500	5500	2000	57,14
11	165	3000	15	11	500	500	3500	5500	2000	57,14
12	165	3000	15	11	500	500	3500	5500	2000	57,14
13	165	3000	15	11	500	500	3500	5500	2000	57,14
14	165	2500	15	11	500	500	3000	5500	2500	83,33
15	165	2300	15	11	400	500	2800	4400	1600	57,14
16	165	2500	15	11	500	1000	3500	5500	2000	57,14
17	165	2300	15	11	500	1000	3300	5500	2200	66,66
18	165	2300	15	11	500	1200	3500	5500	2000	57,14
19	165	2000	15	11	500	1000	3000	5500	2500	83,33
20	165	2200	15	11	500	1000	3200	5500	2300	71,87
21	165	2500	15	11	500	1000	3500	5500	2000	57,14
22	165	3000	15	11	500	500	3500	5500	2000	57,14
23	165	2000	15	11	400	1000	3000	4400	1400	46,66
24	165	2000	15	11	400	1000	3000	4400	1400	46,66
25	165	2000	15	11	450	1000	3000	4950	1950	65
26	165	2000	15	11	400	1000	3000	4400	1400	46,66
27	165	2000	15	11	400	1000	3000	4400	1400	46,66
28	165	3000	15	11	400	1000	3000	4400	1400	46,66
29	165	2300	15	11	500	1000	3300	5500	2200	66,66
30	165	2300	15	11	500	1000	3300	5500	2200	66,66
31	165	3000	15	11	500	1200	4200	5500	1300	30,95
32	165	3000	15	11	500	1200	4200	5500	1300	30,95
33	165	2250	15	11	500	1000	3250	5500	2250	69,23
34	165	2500	15	11	500	1000	3500	5500	2000	57,14
35	165	2500	15	11	500	1000	3500	5500	2000	57,14
36	165	2250	15	11	500	1000	3250	5500	2250	69,23
37	165	2500	15	11	500	1000	3500	5500	2000	57,14
38	165	2350	15	11	500	1000	3350	5500	2150	64,17
39	165	2000	15	11	450	1000	3000	4950	1950	65
40	165	2450	15	11	500	1000	3450	5500	2050	59,42
41	165	2000	15	11	400	1000	3000	4400	1400	46,66
42	165	2000	15	11	400	1000	3000	4400	1400	46,66
43	165	2350	15	11	500	1000	3350	5500	2150	64,17
44	165	2450	15	11	500	1000	3450	5500	2050	59,42
45	165	2250	15	11	500	1000	3250	5500	2250	69,23
46	165	2500	15	11	500	1000	3500	5500	2000	57,14
47	165	3000	15	11	500	1200	4200	5500	1300	30,95
48	165	2000	15	11	450	1000	3000	4950	1950	65
49	165	3000	15	11	500	1200	4200	5500	1300	30,95
50	165	2500	15	11	500	1000	3500	5500	2000	57,14
51	165	3000	15	11	400	1000	3000	4400	1400	46,66
52	165	2450	15	11	500	1000	3450	5500	2050	59,42
53	165	2000	15	11	450	1000	3000	4950	1950	65
54	165	2350	15	11	500	1000	3350	5500	2150	64,17
55	165	2350	15	11	500	1000	3350	5500	2150	64,17
57	165	3000	15	11	400	1000	3000	4400	1400	46,66
58	165	2250	15	11	500	1000	3250	5500	2250	69,23
59	165	3000	15	11	500	1200	4200	5500	1300	30,95
60	165	2000	15	11	450	1000	3000	4950	1950	65
61	165	2200	15	11	500	1000	3200	5500	2300	71,87
62	165	3000	15	11	500	1200	4200	5500	1300	30,95

63	165	2200	15	11	500	1000	3200	5500	2300	71,87
64	165	2450	15	11	500	1000	3450	5500	2050	59,42
65	165	2250	15	11	500	1000	3250	5500	2250	69,23
66	165	3000	15	11	400	1000	3000	4400	1400	46,66
67	165	2450	15	11	500	1000	3450	5500	2050	59,42
68	165	3000	15	11	500	1200	4200	5500	1300	30,95
69	165	2450	15	11	500	1000	3450	5500	2050	59,42
Total	11220	168450	1020	748	32350	63300	227750	355850	128100	56,24
Average	165	2477,21	15	11	475,74	930,88	3349,26	5233,09	1883,82	57,18
Gap Marks	0	368,58	0	0	40,97	221,43	384,83	450,67	372,81	13,44
Coefficient of variation	0	14,88	0	0	8,61	23,79	11,49	8,61	19,79	23,90

E.P. Economic profitability

Number of retail bundles = $\frac{\text{Number of threads/wholesale bundle}}{\text{Number of threads/Retail bundle}}$



Photo Pierre



Photo Pierre

Figure 8. Thread of *Eremospatha haullevilleana* Causal factors of NTFP production decrease

In the field, operators affirm NTFP production decrease as compared to previous years. The results on the major constraints preventing the development of NTFP sector in Kindu city and its surroundings are presented in Figure 9 below.

Figure 9 shows that 38% NTFP operators in Nyoka village say scarceness of some species is the cause of the reduction of NTFP production, for 31% progressive remoteness of the collection zone, for 13% operators age to walk long distances. In Muyengo village, 35% operators say there is decrease of these resources in the area, caused by progressive remoteness of the collection zones, for 33% operators lack of customs, and 19% operators scarceness of some species. Progressive remoteness (54%) of the NTFP collection zones constitutes the first reason of the production decrease in Bilundu village, followed by rarity of some species (27%), and lack of transportation means towards consumption centers (12%). In Kindu, remoteness of the

collection zones causes production decrease, followed scarceness of some plant species (21%) and lack of transportation means (12%).

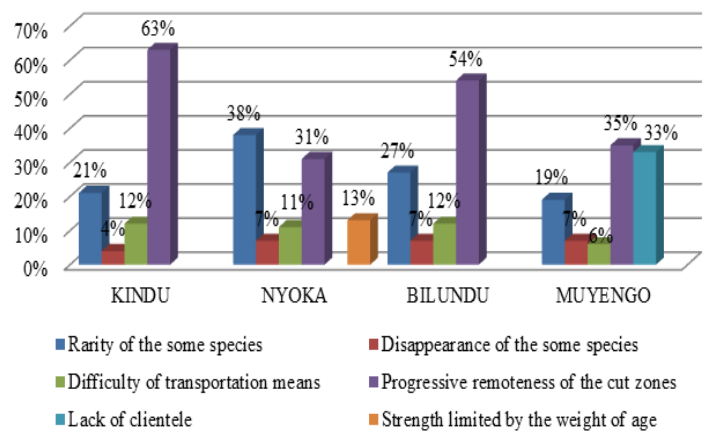


Figure 9. Reasons for the decrease of production of NTFP in Kindu city and its surroundings

Discussion

Economic profitability of NTFP

The analysis of the total income from NTFP in RDC proves to the importance of the sector and its contribution to food security in different regions of the country.

Eremospatha haullevilleana is sold wholesale at Kindu markets by bundle of 165 threads. After calculation of the revenues, we found that the average purchase price a bundle sold wholesale is 2,477.1 CF per day. The detail selling price a bundle of 15 threads is on average 475.74 CF. The daily average costs (transportation, taxes) is 930.88 CF with 3,349.26 CF as daily gain. The daily average raw margin is 1,883.82 CF and 57.18CF as average gain.

Daily verage raw margin is 1,883.82 CF, that is 1.14 US\$ /bundle/day at the rate of 1,650 CF for 1 US\$, and an average commercial profitability is 57.18%. In Kisangani, Biye (2009), found that the economic profitability of the income of households of rattan cutter-sellers is on average superior to 60%, as compared to cutter-transformers' daily income of 12.5 US\$, a train-carrier's 37.9 US\$, a bicycle-carrier's 17,05 \$US per day, a truck-carrier's 8.9 \$US. These income rates seem to beyond the poverty line, that is, 1 US\$ for middle class Congolese whose average daily income was valued less than one American dollar in 2005 in UNDP (2005) report and BILOSO (2008).

Amanranthus viridis is sold Kindu in a basket containing 40 bundles. After calculation of returns, we found that the average purchase price per basket is 10,736.36 CF. The daily average cost (transportation, taxes) is 1,188.64 CF with a gain of 11,925 CF per day. The price in detail of a bundle of

Amaranthus viridis is on average 469.32 CF with a daily average raw margin of 6,847.73 CF, that is 4.5 US\$ per day (1 US\$ equals 1,600 CF for 40 bundles and an average commercial profitability of 60.45%. We also found that sellers of *Amaranthus viridis* in Kindu have a profitability superior to 50% that is an average of 60.45%.

Megaphrynium brachystachyum is sold in Kindu by bundles containing 140 leaves. After calculation of the returns, we found that the average wholesale purchase price of a bundle is 1,426.42 CF. The selling price in detail of a four leaf bundle is on average 199.06 CF. The daily average cost (transportation, repeated taxes) is 2,630.19 CF with a gain of 4,056.60 CF per day. After sales, it appears that the daily average raw margin is 2,343.21 CF, that is 1.42 US\$ per day (1 US\$ equals 1650 CF) for a retailer and an average commercial profitability of 59.32%.

In urbano-farming municipalities in Kinshasa, Biloso and Lejoly (2006) note that the contribution of the commerce of *Gnetum africanum* leaves to the monthly income of the household is the incontestable leader with an average income 275 US\$, followed by *Pteridium Centrali-africanum* with 166.70 US\$ per month and by household, *Dracaena camerooniana* leaves (75.55 US\$), *Dioscorea praehensilis* tubers (71 US\$), and *Psophocarpus scandens* leaves (58.75 US\$). Toirambe (2002b), in a recent survey found that in Kinshasa nearly 1,069 people, mostly women (98%), sell *Gnetum sp* leaves in eleven prospected markets. This commercial activity generates an income (about 132.93 US\$/month) that is beyond the Congolese GNP (114 US\$/year/inhabitant) and clearly superior to civil service monthly salary (70 US\$/month for a Director).

In two markets in Mbandaka (Central and Wendji Secli markets), Ndoye and Awono (2005) valued for twelve months *Gnetum sp* leaf sales for a volume of 47,200 kg to 21,904 US\$; *Maranthaceae* leaf sales of 145,015 kg for a value of 3,446 US\$; palm wine 105,554 liters sales for 13,054 US\$.

These results oppose Liengola's (2001) that showed that in Kisangani commerce of NTFP is not profitable enough, with except *Gnetum africanum*. *Eremospatha haulleveliana* threads sold in large quantity in Kindu city, proving that it is very profitable to sellers.

Gender implied in the exploitation of NTFP

This study indicates that in Kindu city and its surroundings, women are more implied in the exploitation of several Non-Timber Forest Products in our survey sites. For the Wild Food Plants, women represent 60% and men, 40%. For packing plants, women exploit more (77%) than men (23%). For medicinal plants, women represent 68% of operators versus men 32%. Women are also numerous to exploit plants used for making works of art, that is 62% versus 38% for men.

Georges N'gasse (2010) published similar result that the Central Africa's society, based on a patriarchal régime, constitutes a constraint to the improvement of the production for woman's implication in the process of production and acquisition factors of NTFP production products, but, anyway, woman collect NTFP the more.

It should be noted that, that woman intervenes to more than 60% in production activities of production in African communities, while she undergoes a statute of inferiority that does not enable her to possess and to control many production factors.

Conclusion

This survey on the impact of the exploitation of Non-Timber Forest Products work in the socioeconomic sector of

Kindu city and its surroundings (Maniema, DR. Congo) permitted to get information on the impact of exploitation of these resources on the social and economic life of the forest operators of our survey area.

The main objective of this study is to find out the social and economic impact of the exploitation of NTFP in this region to call on actors for responsible exploitation of these natural resources for their survival.

We found the following results:

- 48.4% forest operators in Kindu city exploit NTFP more for both home consumption and commerce to the faith and 28% for selling only; 44.3% exploit them for home consumption and commerce and sell them in Nyoka locality; 63% commercialize and 21% exploit them for hom consumption in Bilundu village; 52% commercialize and 33% consume them in their homes in Muyengo.

- In Kindu, 44% NTFP operators affect their income to their children's education, 27% to sanitary needs of their families, 21% to food needs. In Nyoka, 73% of operators use their income to satisfy food needs, 13% to their children's education and 11% to purchase construction materials. In Bilundu, 67.3% affect their income to food, 22.2% to their children's education. Likewise, in Muyengo village, 77% forest operators affect their incomes to food of their homes, 10% to their children's education;

Amaranthus viridis is sold in Kindu in a basket of 40 packets. After calculation of the revenues, we found that the average purchase price by basin is 1,0736.36 CF. The price in detail of a packet of *Amaranthus viridis* is on average 469.32 CF with a daily average raw margin of 6,847.73 CF and an average commercial profitability of 60.45%. The daily average cost (transportation, taxes) is 1,188.64 CF with a daily gain of 11,925 CF. The observation reveals that sellers in Kindu city have a profitability >50%, that is 60.45% at average.

Megaphrynium brachystachyum is sold in Kindu markets by packet of 140 leaves. After calculation of the revenues, we found that the average wholesales purchase price of a packet is 1,426.42 CF. The selling price in detail of a packet of four leaves is on average 199.06 CF. The daily average cost (transportation, taxes) is 2,630.19 CF with a daily gain of 4,056.60 CF. After sale, it appears that the daily average raw margin is 2,343.21 CF and an average commercial profitability of 59.32%.

Eremospatha haulleveliana I sold wholesales in Kindu markets by packets of 165 sons. After the calculation of the revenues, we found the average purchase price of a packet is 2,477.21 CF. The selling price in detail of a packet of fifteen (15) threads is on average 475.74 CF. The daily average cost (transportation, taxes) is 930.88 CF with a daily gain of 3,349.26 CF and a daily average raw margin of 1,883.82 CF and an average commercial profitability of 57.18%.

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