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CONTRIBUTION OF NON-TIMBER FOREST PRODUCTS TO THE INCOME AND HOUSEHOLD FOOD SECURITY IN THE SANAGA-MARITIME DIVISION, LITTORAL REGION, CAMEROON

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ABSTRACT: *Cameroon's tropical forests possess many resources, including Non-Timber Forest Products (NTFPs). The present research therefore aims to highlight the contribution of NTFPs to household income and food security in the Sanaga-Maritime Division where the destruction of this resource has been observed for the benefit of oil palm production. Specifically, the aim is to identify the different NTFPs exploited in the sub-divisions of Dizangue, Ngwei and Pouma; - to estimate the contribution of NTFPs to household income; - to analyze the contribution of NTFPs to household food security and to identify the constraints related to the exploitation of NTFPs in these localities. Data were collected using a semi-structured questionnaires administered to the different categories of NTFP household users. A total of 104 households were interviewed, including 90 operators, 02 traders and 12 consumers. The SPSS 14.0 software and the Excel spreadsheet was used to analyze the data collected. Descriptive statistics as well as econometric logistic regression model combined with the Access Scale tool determining household food insecurity was used to realise the objectives of the study. The results show that the most exploited NTFPs were the leaves of Gnetum africanum, the fruits of Dacryodes edulis and Irvingia gabonensis. Therefore, agriculture remains the main source of income for the households surveyed (32%). However, NTFPs harvested contribute 19.5% of household income. The logistic regression model demonstrated that the consumption of NTFPs from picking, although not significant, positively influenced food security of surveyed households. Factors such as income and household size significantly affect food security. Despite the fact that users of NTFP faced some constraints, some of them still put in place strategies to ensure the sustainability of those resources.*

KEY WORDS: non-timber forest products, income, food security, household

INTRODUCTION

Forests in the Congo basin provide two types of resources namely timber and non-timber forest products (NTFPs). Although the former have been exploited for the most part since the arrival of Europeans, NTFPs have been exploited for decades by the local inhabitants of whom 30 million people depend directly on them. (Tabuna et *al.,* 2007). In Cameroon, forests occupy 20 million hectares (Ruppel and Schilchting, 2018) and 48% of the country's surface area (FAO, 2015). The tropical forest zone includes the degraded forests of the Centre and Littoral regions, the humid dense forests of the South West and East regions. These tropical forests are very diverse and represent 60% of Cameroon's biodiversity (Yogo, 2018). According to Tchatat et *al.* (2002), in South Cameroon, nearly 500 species of plants and 280 animal species have been identified for 1,200 different uses. In general, the Cameroonian forest produces more than 1,044,782 tons (leaves, bark, seeds, etc.) of NTFPs per year according to the statistics of the Interministerial Commission on NTFPs. It is already widely known that these products

complement household agricultural production by providing them with essential nutritional products, medicinal products, fodder, straw, etc. They are suppliers of relief food during the lean season or provide an emergency food safety net against seasonal hazards and in case of urgent need for households (Mukerji, 1995). However, there is a paradox about these products: despite their importance and their daily use, there is very little information on their ecological and socio-economic value, which hinders monitoring, regulation and management. Their value chains are largely informal and do not appear in statistics and policies (Ingram et *al.,* 2010). Consequently, it is difficult to assess their contribution to the standard of living of the population. By precisely defining and prioritizing those most important for trade and domestic use, it is possible to obtain a rough estimate (Ingram et *al.,* 2010).

The share of non-timber forest products in household consumption and illicit trade is often overlooked by policymakers, especially when it comes to products that are more important for the poor or marginalized groups. As a result, these resources can be ignored in the formal planning of land use and in the investment of large-scale projects. In addition, there is a lack of information to assess the contribution of NTFPs to household income and food security. Thus, the absence of official programs for the management and promotion of these products is one of the obstacles to the prosperity of the NTFP sector and the improvement of the standard of living of the population (Ba et *al.,* 2006).

This study is therefore aimed at overcoming this lack of data in the Sanaga-Maritime division especially as the socio-economic and ecological assessment of NTFPs should allow the formulation of recommendations for their sustainable management. It should also enable their integration into general forest management plans, with a view to sustainable exploitation of forest resources and many other services (Guédjé and Delis, 2003).

The Sanaga-Maritime division is an important oil palm production basin. Since the 2000s, 20% of its forests have already been destroyed. Palm groves are created indifferently in virgin and secondary forests and fallows left by food crops. Many plant species disappear and the natural habitat of wildlife is destroyed (Tchindjang et *al.,* 2016). Is it therefore logical to ask whether the destruction of forest ecosystems for the benefit of oil palm has led to a lack of interest in forest products in general and NTFPs in particular by households in the locality. Do NTFPs contribute to household income and food security in the Sanaga-Maritime division in the Littoral region of Cameroon? Thus, the objective of this study is to identify the NTFPs exploited in the Sanaga-Maritime division, estimate the contribution of NTFPs to the income of the household, analyse the contribution of NTFPs to the food security of the household and identify the constraints faced by the users of NTFPs.

MATERIAL AND METHODS

Study population, a unit of analysis and sampling technique

The study population is made up of all the households users of NTFPs. In fact, the users of NTFPs are the exploitants, traders and consumers of these products. The multistage stratified random sampling procedure was used which involved the following: in stage one, there was a purposively selection of the Sanaga-Maritime division out of a total of four divisions (Moungo, Nkam, Sanaga-Maritime and Wouri) that comprise the Littoral Region of Cameroon. In fact, this division is rich in ecosystems with high conservation value. Rainforests with rich plant and

animal biodiversity occupy a large part of the area. Likewise, this division is one of the main palm oil growing basins in Cameroon. Thus, the increase in cultivated areas is at the expense of forest ecosystems. Since 1975, Sanaga-Maritime has lost more than 20% of its original forests in favor of agriculture in general and oil palm in particular (Tchinsang et *al.*, 2016). Given these realities, it is possible that the population of the division do not give much importance to products from forests especially as oil palm cultivation is an important source of income. Tchinsang et *al.*, (2016) show in their study that populations can acquire up to 150,000 FCFA per month through the marketing of oil palm products.

In stage two, three sub-divisions include Ngwei, Pouma and Dizangue were purposively selected from the previously chosen division. In fact, the councils of Ngwei and Pouma have been designated to carry out this study because they are part of areas with Edéa I which have lost most of their forests to the benefit of elaeiculture and agriculture (Tchinsang et *al.*, 2016). The locality of Dizangue was chosen to conduct this study because of the presence of a company producing palm oil SAFACAM (*Société Africaine Forestière et Agricole du Cameroun)*. It is therefore useful to assess whether the predominance of oil palm in these areas did not prevent households from exploiting NTFPs. In stage three, three villages were randomly selected from each of the subdivisions initially selected. This brought the total number of villages to three (03) namely: Makondo 1, Koungue and Hegba Pouma respectively found in Ngwei, Dizangue and Pouma. In stage four, 104 households were randomly selected from the three villages : 44 from Makondo 1, 32 from Hebga Pouma and 28 from Koungue Thus, the sample were made up of 90 exploitants, 02 traders and 12 consummers of NTFPs. These ratios were randomly obtained on the basis of households who were available to participate in the interviews in each locality. The unit of analysis was the household of the said localities in the Littoral Region of Cameroon.

Validity and reliability of survey instrument

The instrument used in this study consisted of a list of questions developed following an extensive review of the literature. They were three types of questionnaires for the exploitants, traders and consumers household. Each of the questionnaires was carefully phrased to ensure consistency of inquiry. The researchers issued the questionnaire to an odd numbered committee of experts for possible clarity, relatedness, and evaluation (for validity). The questionnaire consisted of five subheadings with a varied number of items under each subheading. The questionnaire was pre-tested with 10 randomly selected household of the population to discern the extent to which the instrument was understandable.

Data collection and analysis

Data were obtained only from primary source. The data were collected using a set of structured and pre-tested questionnaires, which were administered to the households from each of the councils (Ngwei, Dizangue and Pouma). Combinations of both open and close-ended questions were used. The technique of data collection was reactive. The questionnaire provided information on personal and socio-economic characteristics of the respondents of the household. It also made it possible to determine the different non-timber forest products used in the sub-division of Dizangue, Ngwei and Pouma. This questionnaire made it possible to determine the contribution of NTFPs to household income and food security in surveyed areas. And finally, it shed light on the various elements that represent obstacles to the exploitation of NTFPs in the study areas. It should also be mentioned that the questionnaires classify

households that take part in the collection of NTFPs, those who market them and those who consume them. The data collected were subjected to descriptive and inferential statistics.

METHOD OF DATA ANALYSIS

The data were analyzed with the aid of SPSS version 14, using frequency and percentage. Data collected from the sample household population was analyzed both qualitatively and quantitatively. The constraints faced by the users of NTFPs were analyzed with the help of descriptive statistical tools such as frequency tables and percentages. The different NTFPs exploited in the study areas are presented in a table where one can find the total citation for usage of each product. The estimation of the contribution of NTFPs to household income was analyzed with the help of descriptive statistics with the aid of histogram.

Finally, the contribution of NTFPs to the food security of the household was analysed with the use of the Access Scale tool determining household food insecurity and inferential statistical tools viz., binary logistic regression model. The logit model is more convenient because the dependent variable is qualitative in nature, the explanatory variables are all qualitative variables, and the sample size is low (N=104) (Gujarati, 1995). The Access Scale tool determining household food insecurity is a set of nine questions which help to assess the level of food security in a household. It is used to calculate the Food insecurity score felt for the household during the past month and it is done by a simple addition of points, the answers to questions falling into four levels: never (0 point); rarely (1 point): one to two times in the last four weeks; sometimes (2 points): three to ten times in the last four weeks; often (3 points): more than ten times in the last four weeks. The sum of the response scores can range from "0", indicating a state of "food security" (defined as a "lack of food insecurity"), to "27", synonymous with "severe food insecurity" (Coates et *al.*, 2007). In this study, a household with a score of less than 13 was considered in a situation of food safety but those after 14 were in a situation of food insecurity.

In the study, the logit model is used to predict the probability of the occurrence of the event, that is, the natural log of the odds ratio of having made one or the other decision (Food security or Food insecurity). By denoting P as the probability of making such decision from the predictors X_1 to X_6, the mathematical formulation of the logit model used in this study is expressed in equation (1) such as:

$$\mathbf{Y = Logit\ (P) = Log\ (P/1\text{-}P) = a + b_1 X_1 + b_2 X_2 + \ldots\ldots\ldots + b_6 X_6} \qquad \ldots\ldots\ldots\ldots\ \mathbf{(1)}$$

Where: P: is the predicted probability of the occurrence of event (Food security); 1-P: is the predicted probability of non-occurrence of event (Food insecurity); Y: situation of food security of the household (coded as 1 = Food security, 0 = Food insecurity); X_1: consumption of local fish during the four last week before the survey (coded as 1 = Yes, 0 = No); X_2: consumption of local meat during the last four weeks before the survey (coded as 1 = Yes, 0 = No); X_3: consumption of picking NTFPs during the last four weeks before the survey (coded as: 1 = Yes ; 0 = No); X_4: consumption of bushmeat during the last four weeks before the survey (coded as 1 = Yes; 0 = No); X_5: Revenue of the household (continue); X_6: Size of the household (continue).

The exponentials Exp(B) of the slope coefficients β_k associated to the explanatory variables are interpreted as the Odds Ratio (OR) of the occurrence of the event (situation of food security)

for each increase in the predictor. A positive βk coefficient generally displays an OR greater than one (OR>1) whereas a negative βk coefficient usually indicates an OR lower than one (OR<1). Usually, the expression 1/Exp (B) designates the inverse OR which is computed in order to facilitate the interpretation of the variables with negative coefficients (Gujarati, 1995).

RESUTLS AND DISCUSSION

After the analysis of the collected data, the following results were obtained.

Main Non Timber Forest Products used by the households

The respondents were asked to list the main NTFPs they exploited during the month of May 2019. The results are presented in Table 1.

Table1: Main Non Timber Forest Products exploited by the households users

Forest product	Part used	Total citation	Usage
Exploitants			
Gnetum africanum	Leaves	39	Food
Dacryodes edulis	Fruits	22	Food
Irvingia gabonensis	Fruits	15	Food
Elaeis guineensis	Elaborate sap	5	Drink
Coulas edulis	Bark /Fruit	3	Food/Medicinal
Bambusa vulgaris	Sterm	3	Building material
Raphia farinifera	Sterm	1	Building material
Cola acuminata	Fruits	9	Food
Prunus cerasus	Fruits	1	Food
Pleurotidae spp.	//	4	Food
Afrostyrax lepidophyllus	bark/fruit	6	Food
Aframomum sp.	Seed	1	Food
Larvae of June beetles	//	3	Food
Garcinia cola	Fruits	9	Food
Megaphrynium macrostachyum	Leaves	1	Packaging
Actina spp.		1	Food
Fishs	//	37	Food
Bushmeat	//	19	Food
Traders			
Cola acuminata	Fruits	1	Food
Garcinia cola	Fruits	1	Food
Elaeis guineensis	Elaborate sap	1	Drink
Consumers			
Dacryodes edulis	Fruits	8	Food
Gnetum africanum	Leaves	4	Food
Garcinia cola	Fruits	2	Food
Bushmeat	//	2	Food
Fishs	//	3	Food

Table 1 shows that the majority of exploiting households interviewed are involved in the collection of leaves / fruits / seeds of *Gnetum africanum*, *Dacryodes edulis*, *Irvingia gabonensis*, *Cola acuminata*, *Afrostyrax lepidophyllus*, *Prunus cerasus*, *Aframomum* sp. *Garcinia cola*, *Coula edulis* and *Megaphrynium macrostachyum*. Sampling of palm wine, snails (*Actina* spp.) , mushrooms *(Pleurotidae* spp.) and larvae of June beetles is also taking place as well as the removal of building materials such as *Bambusa vulgaris* and *Raphia farinifera*. These findings are in line with those obtained by Lescuyer (2010) who stated that the collection of NTFPs remains a very widely practiced activity in forest area, which indicates the maintenance in these societies of a strong relationship between the ecosystem and the population. However, his finding on the economic importance of non-timber forest products in some villages in southern Cameroon is not similar to the finding of this study as the leaves of *Gnetum africanum* appear as a very popular NTFP in the Sanaga-Maritime division but were not among the main NTFPs exploited in southern Cameroon villages.

Hunting and fishing are also activities practiced by households in the Sanaga-Maritime division, as is generally the case for households living in the forest area of the Congo Basin, as stated by Loubelo (2012). The traders surveyed are involved in the marketing of palm wine, *Garcinia cola* fruit and *Cola acuminata*, which are NTFPs highly prized by men. Consumers revealed that the fruits of *Dacryodes edulis*, *Gnetum africanum* leaves, *Garcinia cola* fruits, bushmeat and freshwater fish were among the main NTFPs consumed in the last four weeks before 'investigation.

Contribution of the Non-Timber Forest Product to the income of the exploiting households

Before assessing the contribution of NTFPs to household income, it is advisable to present the average income generated by the sales of NTFPs. It should be noted that not all exploited NTFPs are marketed. The figure 1 highlights the average monthly income (in FCFA) from the commercialization of NTFPs during May 2019.

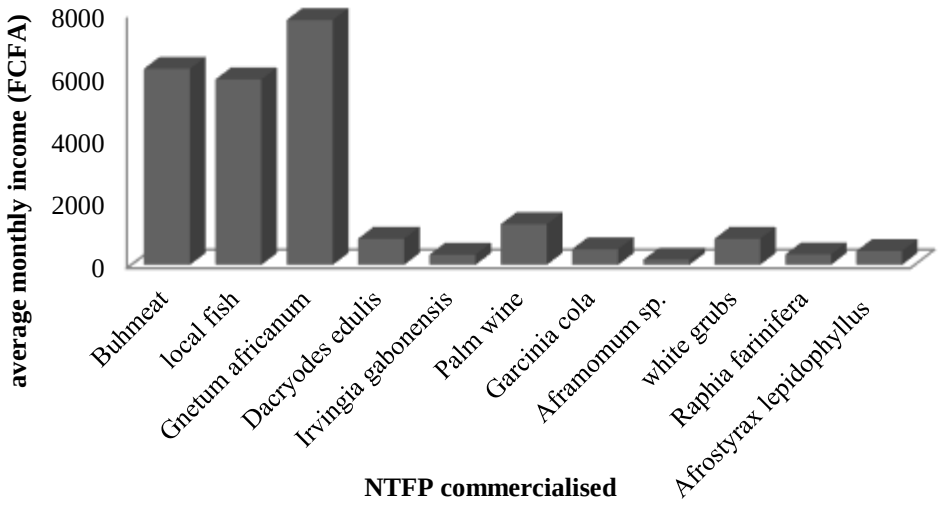

Figure1: Average monthly income generate by the sale of NTFPs (1US$= 500FCFA)

Figure 1 shows that the sale of *Gnetum africanum* leaves generates the most income for farm households with an average monthly income of 8, 000FCFA. This result corroborates with the work of Ndoye et *al.* (2007), who show that in the Equator province of the Democratic Republic of Congo, the edible leaves of *Gnetum africanum* are the NTFPs that provide the highest gains. The average monthly income from hunting and fishing is 7,000 FCFA and 6,000 FCFA respectively. These results can be explained by the fact that prices of bushmeat and freshwater fish are relatively high because supply is generally lower than demand. Thus, the farmers who exploit them earn a lot of profit. Other NTFPs harvested as the fruits of *Dacryodes edulis, Irvingia gabonensis, Garcinia cola, Aframomum* sp. and *Afrostyrax lepidophyllu*s produce a monthly income of less than 1,000 FCFA. Palm wine also generates a monthly average income of about 1,000 FCFA. The marketing of June beetle larvae and *Raphia farinifera* generates only an average monthly income of 1,000 FCFA because these products were actually not available during the survey due to seasonality of production.

NTFP exploiting households do not engage in this activity alone. They are usually involved in other economic activities such as agriculture (crop production only), livestock rearing, trade, crafts and are sometimes employees who receive a salary at the end of each month. Table 2 shows the contribution of each economic activity to the monthly household income.

Table 2: Contribution of each economic activity to the total income of the household

Activity	**Average monthly income (FCFA)**	**Percentage**
Agriculture (crop production)	20, 694	32.0
Livestock rearing	1,483	2.0
Trade	6,788	11.0
Wage	9,588	15.0
Handicraftsman	1,005	1.6
Hunting	6,272	9.7
NTFP picking	12,563	19.5
Fishing	5,933	9.2
Total	64,326	100.0

(1US$= 500FCFA**)**

Results in table 2 show that agriculture remains the main economic activity of households, contributing 32% of total household income. The different NTFPs harvested also contribute significantly (19.5%) to the average monthly household income. The wage is also an important source of income (15%) for NTFP farmers in the Sanaga-Maritime division. Trade of various other products also allows NTFP farmers to earn a little more money (11%). Hunting and fishing are activities that allow households, among other things, to earn additional income. They contribute respectively 9.7% and 9.2% to the average monthly household income. Livestock and handicraftsman are marginalized activities in the division and contribute respectively to 2% and 1.6% of the household's monthly income. These results do not corroborate with those obtained by Lescuyer (2010) who in his study in some villages of South Cameroon revealed that the income from the collection of NTFPs contribute slightly to the overall income of the household. This low contribution of NTFPs to income can be explained by the fact that the populations of these localities consume NTFPs more than they market them.

Contribution of Non Timber Forest Product to food security of the households

Household food security was assessed using the Household Food Insecurity Access Scale tool .This food security measure help to identify households that are food secure and those who are food insecure. Table 3 presents the estimation of the parameters of the model. The Logit model is used in this study to determine the factors that influence a household's food security. The results show that Chi-square in the Omnibus test is significant at 1% because $X^2 = 90.427$ and sig = 0.000. This shows that there is a significant relationship between the dependent variable and the independent variables. In addition, the prediction percentage of the model is reasonably good (96.2%). The Nagelkerke R^2 is 0.860, which indicates that the independent variables predict the dependent variable at 86%.

Table3: Estimation of the parameter of the regression logistic model (N=104)

Independent variables	**B**	**Sig**	**Exp(β)**	**1/ Exp(β)**
Consumption of local fish (1/0)	-1.322	.389	.267	3 .74
Consumption of local meat (1/0)	.644	.609	1.904	//
Consumption of picking NWFPs (1/0)	.396	.783	1.485	//
Consumption of bushmeat (1/0)	-2.316	.119	.099	10.10
Revenue of the household	5.605	.000***	271.830	//
Size of the household	-5.931	.000***	.003	333.33

These results show that the consumption of products from local fishing and hunting has a negative influence on household food security. Those who consumed freshwater fish and bushmeat respectively were 3.74 and 10.10 times less likely to be food secure. This result can be explained by the fact that the measure of food safety used does not take into account the nutrient intake of food but rather takes into account the preferences and quantity and diversity of food consumed by the household. . Thus, it may happen that the households that consumed these products did not consume enough of these animal proteins because of their scarcity or because of their high price. In addition, a report from the Central African Forests Commission (2010) also shows that the richest households in Gabon and therefore in a situation of food security consume less bushmeat than the poorest households for whom this meat is the main source of protein. Although the coefficient of the variable "consumption of picking NTFPs" variable is insignificant, the model shows that households consuming NTFPs harvested positively influence food security. In fact, the people consuming the NTFPs from the harvest are 1.485 times more likely to be in a situation of food security.

This result can be explained by the fact that the NTFPs from the picking were abundantly found on the household menu of households during the last four weeks preceding the survey. The coefficient of the "local livestock products" variable, although insignificant, shows that households that consume local livestock products have a higher probability of being in a food security situation. The variables size and household income are significant at 1%. Thus, when household income is high, people are much more likely to be food secure because they are able to eat their fill and according to their preference. Household size negatively influences household food security. In fact, when household size is high, household members are less likely to eat as much as they like.

Constraints faced by the users of Non Timber Forest Products
The obstacles are the difficulties encountered during the execution of an activity. Table 9 presents the main obstacles raised by the different categories of households using NTFPs surveyed in the Sanaga-Maritime division.

Table 4: Different constraints faced by NTFPs users

Categories	**Frequency**	**Percentage**
Exploitant	N= 90	
Lack of technical and institutional support	6	7
Difficulty in taking the resource	36	40
Conflicts with other operators	30	33
Difficult transportation	18	20
Traders	N=2	
Seasonality of the product	1	50
Fluctuation of buyers	1	50
Consumers	N=12	
High cost	8	67
Scarcity of some NTFPs	4	33

Several constraints are mentioned by the NTFP farmers in the division of Sanaga-Maritime. Table 3 shows that 40% surveyed farmers have difficulties in harvesting the resource. 33% mention conflicts with other operators, 20% say that transport is difficult and only 7% report a lack of technical and institutional support. Exploitants of NTFPs have great difficulty in harvesting because they are in hard-to-reach areas and are often stung by insects. Moreover, with the pressure being put on these resources, it turns out that farmers are often in conflict because everyone wants to take the resource at the expense of the other. Transport difficulties were much more evoked by hunters who say that when the hunt has been good, they have great difficulty transporting the meat.

Like farmers, NTFP traders faced difficulties. In fact, half (50%) of traders note that the non-timber forest products they market are seasonal, which leads them to go to other localities to buy them at the time of the shortage in their area. In addition, the other half of surveyed traders evokes the fluctuation of the customers. In fact, there are times of high numbers of customers and periods of shortage which often causes a shortfall.

Barriers related to NTFP consumer are also presented in Table 3. The majority of consumers (67%) complain about the high price of NTFPs and their scarcity in the market (33%). This is especially the case of game that is increasingly rare in the market and even if consumers see it, it is not always affordable. In order to maintain the sustainability of the species, it is increasingly recommended to take measures to preserve the environment. Table 5 presents the precautions taken by NTFP operators to ensure their sustainability.

Table 5: Different measures taken by NTFP operators to ensure their sustainability.

Activity	**Frequency**	**Percentage**
Fishing		
Do not take the small ones	27	73
None	10	27
Hunting		
Do not take pups and pregnant females	2	11
None	17	89
Picking		
Do not uproot the plant (case of *Gnetum africanum)*	43	68
Domestication of some NTFPs	15	24
None	5	8

The large majority of fishermen (73%) say that they do not harvest smaller fishes because they are not highly appreciated by consumers and also because they want to allow them to reach maturity. However, 27% of the fishermen surveyed say that they are not taking any measures to ensure the sustainability of fishing in their area.

Most hunters surveyed (89%) stated that they do not take any action to ensure the sustainability of wildlife species. This can be explained by the fact that wildlife species are in full extinction and when by chance they catch a few they tend not to worry about their sustainability.

Farmers responsible for collecting NTFPs in general and those of *Gnetum africanum* in particular (68%) claim that they pick the leaves so that the plant can regenerate. 24% of surveyed farmers say that they have domesticated some NTFPs in order to avoid their disappearance it is especially the case of *Dacryodes edulis* which is found in practically all the homesteads. Finally, only 8% of farmers say they are taking no action to ensure the sustainability of NTFPs.

CONCLUSION

In conclusion, these results show that NTFPs in the Sanaga-Maritime division are relatively important for households despite the fact that oil palm production, the main destroyer of forests is widespread. The income generated by the marketing of certain NTFPs (such as *Gnetum africanum* leaves) is quite important and is thus useful for rounding off the end of the month. In addition, households are able to meet their food needs thanks to NTFPs, mainly from harvesting. Despite difficulties in harvesting these forest resources, some farmers are implementing strategies to ensure their sustainability.

In view of these results, the recommendations are aimed at rural populations and public authorities. To the attention of the harvesting households of NTFPs it is recommended to domesticate *Gnetum africanum* because this speculation is under strong pressure and if nothing is done it may disappear. For the public authorities, it is necessary to put in place strategies to increase the value of NTFPs with a strong contribution to household income.

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