



The Challenges and Management Strategies of Non-Timber Forest Products for Sustainability in Nguti Sub Division, South West Region, Cameroon

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Authors' contributions

This work was carried out in collaboration among all authors. Authors NNTB, RNMN and NF designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors NNTB and NF participated in data collection and analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

Nguti is one of the three Sub-divisions in Kupe Muanenguba Division of the South West Region of Cameroon. This Sub-division is endowed with great potentials and diversity in Non-Timber Forest Products (NTFPs) resulting from the eco-floristic composition within the sub-division. The objective of this study is to investigate the challenges that are plaguing the exploitation of NTFPs and present management options for sustainability. Secondary data were collected from published and unpublished sources whereas primary data tools included questionnaires, interviews and participant observations. Findings showed that Nguti Sub-division has endowed with enormous forest entities and rich in several NTFPs ranging from nuts, seeds, barks, leaves, trees and roots

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as well as several species of bush meat. Five major challenges viz. transformation and storage, government policies and customary regulations, depletion and scarcity of resources, deforestation and poaching as well as population pressure and agricultural activities were observed which attributed in reducing quantity and quality of these resources. For sustainable harvesting and management of these resources, cottage industry must be developed and promoted along with cultivation or domestication of these NTFPs, market chain should be monitored and certain government policies should be framed to regularize harvest and methods of extraction. Controlling of deforestation, poaching, agricultural activities and generating new alternative sources of income will certainly reduce the pressure meted on the available resources in the forest.

Keywords: Non-timber forest products; challenges; management strategies; sustainability; Nguti sub-division; Cameroon.

1. INTRODUCTION

Globally, forested areas are endowed with many Non-Timber Forest Products (NTFPs). According to the Food and Agricultural Organisation [1], these are “goods consisting of biological origin other than wood, derived from forests, other wooded land and trees outside forest”. The NTFPs offers great opportunities to forest based communities though attention towards this has been minimal over the years [2]. Harvesters represent a wide swath of the population, across generations, cultural groups, and sectors of the society [3,4]. These NTFPs have important economic, social, cultural, religious and ecological values especially in Africa and Asia. These are considered a safety net that fills the gaps due to shortfall in agricultural production or other forms of emergencies [5]. Different forest types provide a wide range of forest products (fruits, nuts, seeds, leaves and roots) which are key livelihood components to the local people [6]. According to the Millennium Ecosystem Assessment Report of 2005, there are more than 150 NTFPs traded internationally [7]. Recent estimates of the total value of NTFPs in Europe amount to 2.27 billion Euro while that of India is 40 per cent of official forest revenues and 55 per cent of forest based employment [8]. NTFPs traders from the Democratic Republic of Congo earned between USD 16 and 160 per week while producers earned about 50-70% of that amount per week [5]. In Nigeria 80 per cent of income is derived from NTFPs [9] while in Cameroon, the value added is estimated at 13 million USD by involving at least 283,000 people [10]. Nguti Sub-division is endowed with great potential and diversity in NTFPs resulting from the diversity in the eco-floristic composition within the sub-division [11]. The NTFPs sector in Nguti employed up to 80 per cent of the population coupled with the near absence of economic

opportunities. In spite of these roles, a major challenge persists in the accurate evaluation of NTFPs as a revenue component for the livelihoods of indigenous people [12]. According to the World Bank [13], biodiversity provides two main challenges for natural resource management firstly, most of its benefits continue to be considered as economic externalities and secondly, benefits tend to accrue over the long term. The importance of NTFPs in rural household income is not well known due to the absence of a systematic and rigorous data collection system at the national level in many developing countries [7].

As indicated by Agrawal et al. [14], the NTFPs-based activities, if prioritized by the government and other stakeholders can be used to enhance the socio-economic wellbeing of communities living in and around forestlands. The production systems, management and value chains of NTFPs are framed within complex socio-ecological and socio-economic contexts at multiples scales, facing important challenges and opportunities that deserve attention to further understand the role of NTFPs in human wellbeing and bio-economics [3,5,15]. This is to ensure that their full potentials can be unlocked from the local to the global level in a changing world. Given the importance, these products offer to several people in the world and the inhabitants of Nguti in particular, there is dire need to manage the resources for sustainability.

Nguti Sub-division is endowed with enormous potential and diversity in NTFPs resulting from the multifariousness in the eco-floristic composition within the sub-division [11]. These forest types provide a wide range of forest products which are key livelihood components to the local people. But in recent years, the volume and variety of the products has recorded a

decline resulting from several factors. Inadequate information on the quantity and quality of the available NTFPs has created lapses on how to evaluate the degree of exploitation and change over time and the available information is not transmitted to those who are actually engaged in the exploitation of forests products. Also, exploiters have very limited access to technology and as such, it is likely that they will end up selling the products in a relatively raw state to an intermediary. Again, women are monopolizing the exploitation and commercialization of NTFPs but are excluded during community participation process, and are never part of the patriarchal decision based structures. Education and sensitization programmes on environmental protection that focus exclusively on hunters are doomed to fail because it is tilted towards only male hunters meanwhile women are spotted around Nguti and Manyemen who deal with hunted bush meat. It is against these loop holes that this study has as objective to investigate the exploitation challenges and management strategies of NTFPs for sustainability in Nguti Sub-Division. Keeping this in view, the present study was conducted.

2. MATERIALS AND METHODS

2.1 The Study Area

This study was undertaken in Nguti Sub-division found in Kupe Muanenguba Division of the South West Region of Cameroon (Map 1) having geographical area of 1444 km² with latitude 5° 15" N and longitude 9° 30" 00 [16]. The climate of Nguti Sub-division is generally of the equatorial domain with the Cameroon montane type bearing two main seasons as: short dry season of about four months (November to February) and long rainy season (March to October). Generally, the climate is wet with an average temperature of 25 to 35°C and relative humidity of above 75 per cent [17]. These climatic conditions are suitable for the dense nature of the forest which fosters the growth of NTFPs. The area is characterized by hills, steep slopes, deep valleys, low lands, rugged and undulating surfaces with an elevation of 1367 m above sea level especially in the Mbo hinterlands [17]. Being the biggest Sub-division in Kupe Muanenguba Division, Nguti has several forest

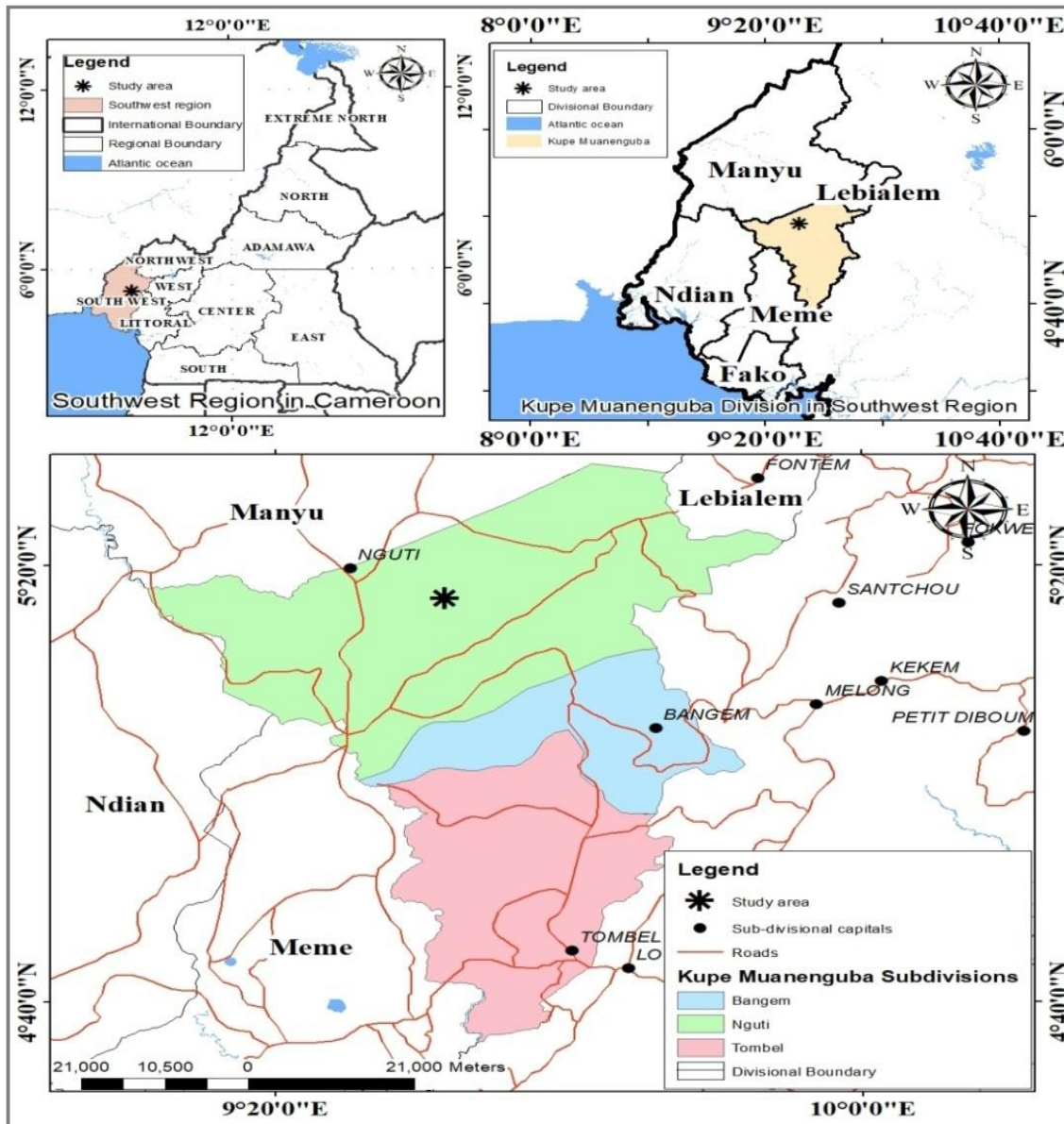
entities that have been divided into Forest Reserves and Community Forests. The Forest Reserves include the Banyang Mbo Wildlife Sanctuary (surface area 69,147 hectares), the Bakossi National Park (surface area 29, 320 hectares), the FMU 11- 007A (surface area 9,048 hectares) and the Forest Management Unit 11-007B (surface area 27,065 hectares) [18]. The Community Forests includes MbACOF (surface area 3,070 hectares), the Nloa River Management Common Initiative Group (NLORMAC-CIG (surface area 4,721 hectares) and the Rural Environment and Poverty Alleviation (REPACCIG (surface area 5,178 hectares). In all, these entities occupy about 45% of the total surface area in the municipality [19].

2.2 Methodology

A survey was conducted and twenty villages were selected through stratified random sampling technique. Secondary data was procured from published and unpublished materials obtained from the University of Buea and Nguti Council libraries, various Delegations and Organizations in Nguti as well as internet materials. The cyber tracker was used in protected areas like the Banyang Mbo Wildlife Sanctuary to identify patches of deforestation, agricultural and poaching activities. Primary data was collected through pre-tested questionnaires, interviews and focused group discussions. In total 200 responses (questionnaires) were recorded from the sampled villages. The data obtained were analysed both qualitatively and quantitatively by using Statistical Package for Social Sciences (SPSS version 16.0). The Activity Index formula was used thus:

Activity Index= Respondent population for each activity x Number of Activities / Total respondent population for all the activity.

Concerning the decision rule, the value ranges from =1, <1, >1. Where <1 implies less impact of the activity to foster resource development, =1 implies that the impact of the activity is sufficient to degrade the resource but gives the possibility for the resource to easily gain resilience, >1 implies that the impact of the activity on resource depletion is high such that the resilience of the resource is not guaranteed if not difficult.



Map 1. Location of Nguti Sub-division in Kupe Muanenguba Division
 Source: Adapted from the Administrative map of Cameroon, NIC (2011)

3. RESULTS AND DISCUSSION

The results for this study were discussed based on the following sub themes; spatial distribution of NTFPs, challenges and management strategies of NTFPs for sustainability.

3.1 Spatial Distribution of NTFPs in Nguti Sub-Division

The availability of NTFPs is very unevenly spread across the sampled villages as seen on Map 2.

It was observed that a majority of the species were found growing in the forest (wild) along with other forest species. These species are rarely cultivated, but may exist as deliberately protected stands either on farmlands or in the wild. No major regional variation was observed in terms of the distribution of the major NTFPs identified. Less than 5 per cent of the sample households believed that the resources are still very abundant, while over 70 per cent thought that the resources are still averagely abundant. Among all the identified NTFPs, only bush mango (*Irvingia*

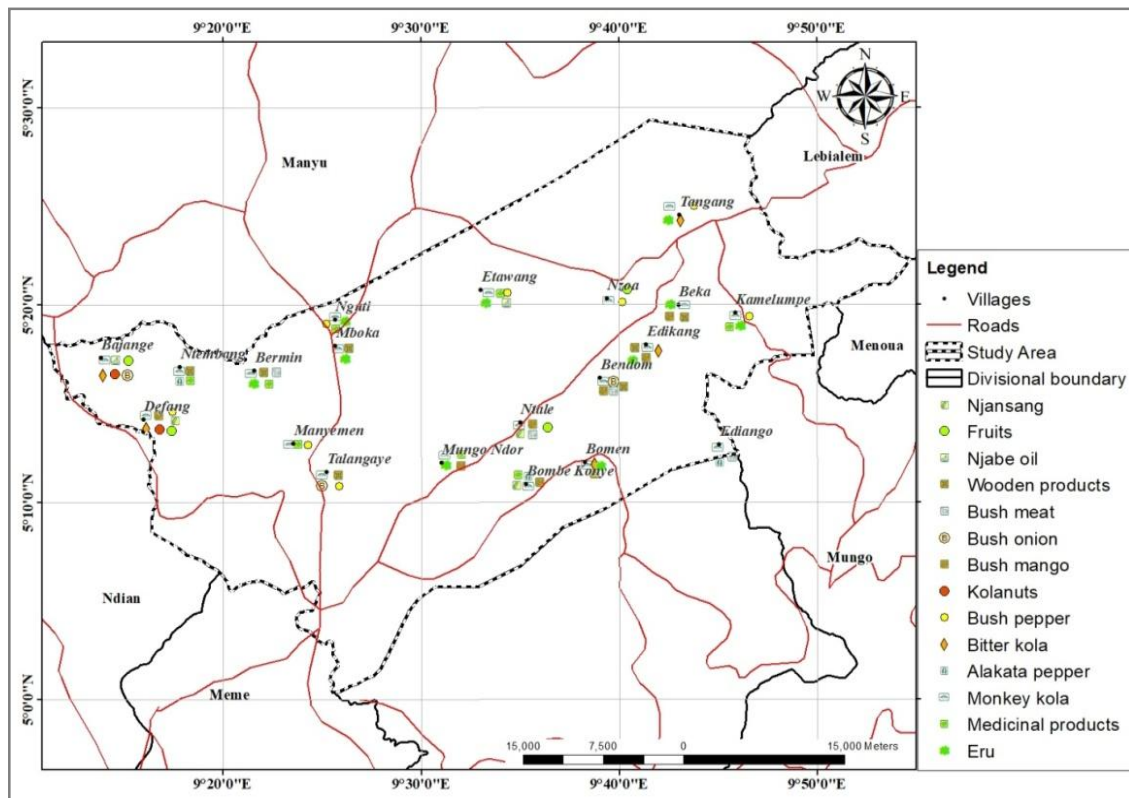
gabonensis and *Irvingia wombolu*) and njansang (*Ricinodendron heudelotii*) fruits were rated as averagely abundant still, by 25 per cent of the respondents. These two wild fruits do not seem to be threatened compared to the other NTFPs that are harvested by cutting down either parts or the whole plant like eru, bush pepper and cane. Njansang and bush mango trees are more common in the forest and their distribution points to unsustainable environmental conditions for the propagation of the species. The abundance of rattans in farmlands could be explained by the fact that deforestation is a serious issue taking place in Nguți Sub-division rendering forest conditions conducive for natural regeneration of rattan species.

NTFPs with common domestic uses like eru (*Gnetum africana* and *Gnetum bucholzianum*), bush pepper (*Piper guineensis*) and bush onions (*Afrostryax kamerunensis*) which are commonly preferred vegetable and soup condiments are sparsely distributed in the forest and farmlands. This is due to high demand and constant competition for collection among the sampled households.

3.2 Challenges in the Exploitation of NTFPs in Nguți Sub-Division

The inhabitants of Ngu Sub-division are faced with several challenges plaguing the exploitation of NTFPs at collection sites. Five major problems were identified by 95% of the population who agreed to be facing problems nowadays. These problems are illustrated on Fig. 1 with varied intensities.

It is evident from Fig. 1 that transformation and storage (30%) emerged as the major challenge, followed by government policy and customary regulations (25%), depletion and scarcity of resources (20%), deforestation and poaching (15%) and population increase and agricultural activities (10%) accounted the least. It was noticed that these challenges are interwoven as population increase contributes to depletion and scarcity of resources, deforestation and poaching emanate from poor method of harvesting and inadequate government policies employed both in the domestication, transformation and marketing of exploited NTFPs. The major challenges are explained in Fig. 1.



Map 2. Spatial distribution of NTFPs across sampled villages

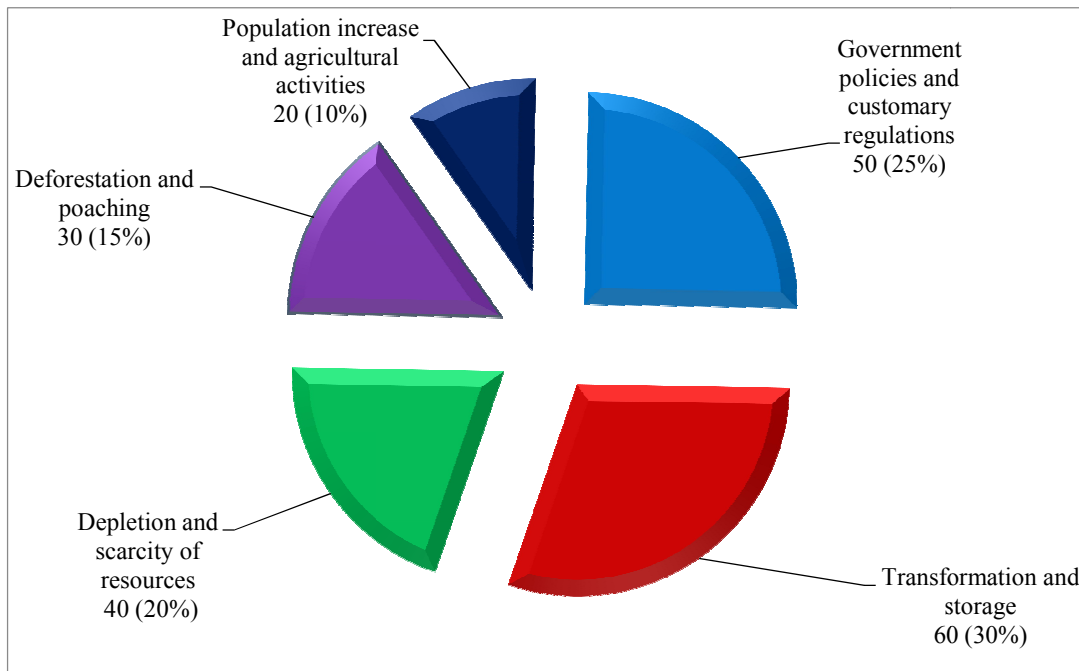


Fig. 1. Major challenges in the exploitation and management of NTFPs

3.2.1 Transformation and storage

Producers process some NTFPs like bush mango, fresh either because they want to add value or earn fast money. The freshly cracked bush mangoes are difficult to preserve as they are highly perishable. There is no drying facilities or technology available. Furthermore, the harvesters or collectors spend long hours or several days in the forest during harvesting, thus making the process very tedious, cumbersome and time consuming. It was found that the commercialization of NTFPs became difficult because the products are harvested far away from markets and processing facilities. Getting the products to city markets implied high transport costs, and due to their perishable nature, wild fruits and vegetables are often spoiled by the time they reach the markets. Over 90% of the NTFPs are transported out of the villages in raw form and exploiters have little or no involvement in value addition, such as drying, grading, packaging or proper weighing. Lack of proper storage facilities allows for low quality of the product, which in turn amounts to low returns.

3.2.2 Government policy

Government arrangements are present in the form of customary regulations which have some weak influence on the chain and livelihoods, in

contrast to the significant impact of market-based arrangements. *Gnetum africanum* was declared as an endangered species in Cameroon due to its declining quantities and a ban was considered, though never implemented in 1999 [20]. Since 2005, eru has been listed as a special forestry product for which annual quotas are set and permits for transportation are needed. Monitoring the use of permits to exploit NTFPs was difficult given that about 80 per cent of permits over the period were either for all regions or did not specify a region. As requested by the 1994 Forestry Law on special products, no population surveys were reported to have ever taken place on eru.

It was observed that traders in Nguti have to pay a higher amount on an average 25 per cent of trader and exporters cost even possessing a permit. It was also noticed that permits are granted to traders rather than actual harvesters who harvest in a grey area of the law as customary user rights allow harvesting but not selling. Awareness status presented in Fig. 2, where out of the 140 harvesters, 70 per cent were found unaware of their user rights under the 1994 Forest Law of the state. Twenty per cent of the respondents believed that forests belong to them and can be freely exploited for commercial use whereas 10 per cent remained neutral concerning their opinion towards policy

regulations. The regulatory system works in contrary to its objectives, thus, inadequately monitoring and controlling trade, inefficiently collecting government revenues and allowing ample opportunities for corruption. The difficult, non-transparent and inefficient permit system does not protect a species that is near to be threatened.

The lack of knowledge about the abundance and quantity of the different NTFPs and lack of control at major markets and border crossings have accentuated unsustainable management strategies to ensure income generation from the exploitation and commercialization of NTFPs. There is a lack of proper documentation of the records, as there is no control over the trade of any product. In the words of an eco-guard from the Banyang Mbo Wildlife Sanctuary, “*staffing of the forest department is insufficient, especially at the lower level, to effectively monitor the situation on the ground*”. It was also realized that low incomes derived from the sale of selected NTFPs in Nguti Sub-division were due to price fluctuation, poor communication and poor quality of the available products.

3.2.3 Customary regulations affecting NTFPs in Nguti sub-division

The policy and regulations affecting the exploitation of NTFPs in Cameroon are primarily determined and influenced by the National Forestry Law No 94/01 of January 1994 which specifies forestry, wildlife and fisheries regulations [21]. With reference to the limitations of the 1994 Forestry Law, it is noted that in an

effort of the law to address the lack of community benefits of forest resource exploitation, there is still heavy emphasis on timber while NTFPs are not fully incorporated into the Forestry Code as pointed out by some collectors in Nguti Sub-division. As reported by an informant in Nguti, “only very high value NTFPs like *Prunus africana* are mentioned in terms of control and there exist little or no provision for the collection of revenues from either the issue of permits or the substantial trade in several NTFPs despite the establishment of a Department within Ministry of Forestry and Wildlife (MINFOF) which is purely responsible for NTFPs”. A major constraint on the implementation of policies and regulations pertaining to NTFPs is the conflict which arises between customs and forestry department revenue collectors at border crossing points where NTFPs are transported.

3.2.4 Depletion and scarcity of resources

Depletion and scarcity of resources accounted for 20 per cent as a challenge towards NTFPs collection resulting from poor harvesting methods. The general scarcity of eru, njansang, bush mango and bitter kola (*Gracinia kola*) are explained by the pressure of the communities on the few available individual trees especially in the forest and farmlands. For NTFPs harvested through seeds like bush mango, as much time has been spent in the forest to collect every available seed which in turn badly affected natural regeneration. Due to deforestation, the population has to trek long distances to harvest these products.

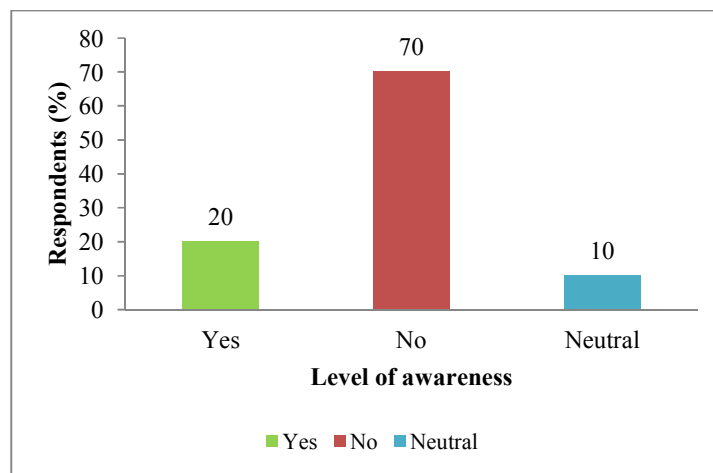


Fig. 2. Awareness status on policies governing NTFPs exploitation

Source: Field work, 2018

It was observed that, for NTFPs whose barks and leaves are the products, harvesting has turn to be destructive. The main reason for the scarcity of some NTFPs seed in a forest area is heavy harvesting or even seeds produced then germination is badly affected by soil and weather conditions, and at maturity faulty harvesting methods. The results are in line with the work of Mgbe (2018) [22] who reported that environmental factors in the Takamanda Forest Reserve in Manyu are responsible for NTFPs depletion.

As a challenge, the influence of seasonality was observed as the key factor influencing the productivity and availability of NTFPs in Nguti as they have their seasons of availability and scarcity. The wet season, however, is the potential period when majority of the NTFPs are harvested but considering the poor and rudimentary methods of preservation and storage facilities, enormous quantity of the output is consumed immediately or sold at cheaper rates to prevent damage and losses.

3.2.5 Deforestation and poaching

Mass deforestation as a general challenge towards managing forest and its products is a major problem affecting the availability of NTFPs. Timber tree species such as Maobi or Njabe (*Baillonella toxisperma*) used both as timber and NTFPs harvesting and njabe oil extracted from it is also highly priced for timber. About 60 per cent of the respondents agreed to the fact that deforestation for the extension of farmlands (Plate 1 A) and by companies (Plate 1 B) such as Sith Global Sustainable Oils Limited (SG-SOC) agro-industrial plantation and Wijma timber saw

company contributed to scarcity of NTFPs product.

During felling species that occur in very low densities or climb on tree trunks like bush pepper are greatly affected like bush mango if not carried out with care. It was observed that Talangaye, Tangang and Bendom villages witnessed massive deforestation activities. However, the elimination of species providing both timber and NTFPs was perceived as the most severe and this situation ties with the ideas of Van Dijk [23] where he pointed out that deforestation too was a major cause of forest resource depletion in the South Region of Cameroon.

3.2.6 Population increase and agricultural activities

Increasing population density coupled with urban – rural migration, insufficient control mechanisms and the demand for more land for agricultural activities was reported by the conservator as a serious threat towards the management of protected areas like the Banyang Mbo Wildlife Sanctuary and the proposed Nguti Council forest area. The combined impact of land use changes and unsustainable harvesting techniques is that, eru is becoming scarcer in Nguti Sub-division as 80 per cent of respondents perceived that foraging distances have increased in the past five years as well as shrinking of forest entities, attributed to clearance for farms, plantations and logging. According to one of the respondents, “Most farmers in the area have placed their hope in shifting cultivation practice through which vast forest resources have been ravaged in the past years and it is still visible till date”.



Plate 1. (A and B) Impact of deforestation on the regeneration of NTFPs

Poor farming practices have not only increased rural vulnerability to accessing basic livelihood materials but have orchestrated environmental problems like landslides in Njongo and soil erosion along major hillsides. As many families increasingly get constrained to obtain higher yields for the home and market, they tend to expand their grip on land and other resources for exploitation. Unfortunately, this has triggered a succession of resource and environmental problems which further pin down agricultural productivity in most parts in Nguti Sub-division.

Occupational distribution of the respondents was obtained from which the activity index was calculated as shown in Table 1.

It was perceived from Table 1 that civil servant, hunting and fishing as well as trade have an index of less than 1 implied that their impact on the degradation of the forest resource base is minimal such that degraded resources can easily regenerate and gain resilience. Farming, NTFPs and lumbering have indexes above one indicated that a greater impact was on the resources when these activities were carried out. Notwithstanding, agriculture still has a higher activity index more than lumbering and NTFPs

exploitation showed that the activity affects the availability of NTFPs exercised through bush burning, shifting cultivation and massive destruction in search of more farmlands. It was evident from this analysis that agricultural activities, lumbering and excessive exploitation of NTFPs are responsible for forest resource degradation in Nguti Sub-division.

3.3 Strategies to Ensure Biodiversity Conservation and Sustainable Exploitation of Non-Timber Forest Products

The challenges narrated by the respondents, some strategies as shown on Fig. 3 are necessary to be put in place to manage forest resources and ensure their sustainability. Some of the major strategies pointed out by the exploiters are as: domestication of NTFPs (30%), development of the cottage industry (20%), monitoring the market chains (20%), management of deforestation and poaching rates (15%), evaluate harvesting methods (10%), improve agricultural systems and encourage alternative sources of income (5%).

Table 1. Occupational distribution of respondents

Occupational structure	Farming	Lumbering	Civil servant	NTFPs collector	Hunting and fishing	Trade
Total	60	40	10	50	10	30
Percentage	30	20	5	25	5	15
Activity index	1.8	1.2	0.3	1.5	0.3	0.9

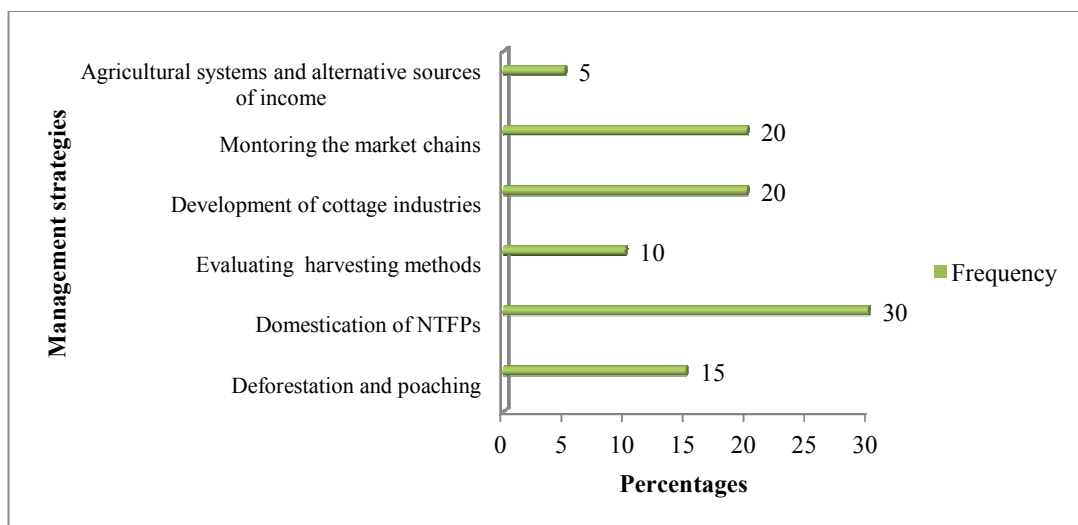


Fig. 3. Management strategies for forest resource sustainability

These strategies are elaborated in the paragraphs that follow.

3.3.1 Supporting local communities to domesticate and exploit NTFPs

To realize community-based NTFPs production, emphasis should be on the improvement of the expertise of local people. Initiative groups like Rural Environment and Poverty Alleviation Community Initiative Group (REPACCIG) and Nloa River Management Common Initiative Group (NLORMAC-CIG) can certainly play a role in supporting rural communities to set up forest based enterprises, but should only actually assist them when local skills fall short. If designing management plans is the objective, an inventory should be made of the current forestry management systems used by local communities.

Baseline ecological data on rainfall, temperature, soil type, forest cover and vegetation type must be collected for the habitats of NTFPs. Different harvesting regimes should be tested to verify their sustainability. Management plans considering ecological, social and economic concerns need to be established for forests that yield important NTFPs. It is also important to check whether certain plant species are protected under national or international law, before stimulating their extraction.

Domestication should be based on ex-situ and in-situ conservation. To relieve the pressure on certain wild populations, it is worthwhile trying to cultivate rare and valuable NTFPs. Domestication should focus on high yielding seedlings as it reduces pressure on wild resources as well as ensures continuous supply of NTFPs to increase the productivity and carbon sequestration per unit square meter of the earth's land. Conservation of some species in their natural environments (in-situ) requires that extracting products from wild populations will no longer be necessary. In line with this, botanical gardens should be created in Nguti that will play an important role in supporting communities with the domestication of wild plants and trees, thus contributing to forest conservation. Although valuable for their genetic traits, wild populations in their original environment might lose their importance to local people and run the risk of being felled for timber or got rid of to make space for agriculture. A further intensification of NTFPs management and an increase of production should be a feasible option and should be

supported by enrichment planting and the development of more productive and adapted varieties by domestication. This means that in all stages of forest management planning, attention should also be given to the NTFPs exploitation and resource management in cultivated areas.

3.3.2 Monitoring the market chains

The exploitation of NTFPs is laborious and time consuming and does not lead to a corresponding increase in commercial value because of the non-existence of the trading supply chain. Producers and traders of NTFPs who are most often women are flexible and vulnerable to external shocks such as price fluctuations. There is, therefore, need for a well-structured organization to facilitate the negotiation of prices and define trade rules so that this vulnerable sector of the population should benefit or obtain satisfaction from the existing or future market chains for NTFPs. Because the market chains of many NTFPs are seldom monitored, the social and economic importance of these products is often under-estimated. To improve the marketing of NTFPs and to enhance the benefits to local communities, market research must be done to understand trade channels and to encourage alternative channels if need be. Dissemination of market information to local communities to ensure that fair prices are paid to the collectors should be done, the formation of cooperatives of collectors and processors of NTFPs should also be encouraged as they are likely to better counter balance the power of buyers than individuals. It was also noted that 36 associations were engaged in the management of cash crops, food crop, piggery, cattle rearing but unfortunately, none was dedicated specifically for the management and control of NTFPs.

3.3.3 Promote the development of cottage industries

Small cottage industries need to be established near productive forests as the NTFPs are harvested far away from their markets and processing place. Exploiters will be responsible for exploiting and processing their products that can be stored for longer periods to earn an increased market price. Drying, grinding, freezing, canning, and oil extraction will also increase the product's price and the villager's share of its value. For instance, njansang seeds and the husks can be used for making njansang oil which can be used as a margarine or cooking oil. Employment opportunities through the

industry will be available and consequently reduce the pressure on the harvesting of NTFPs as individuals will now have diversified income sources. The creation of marketing cooperatives and the development of a good marketing information system are vital for increasing the value of NTFPs to the local communities. Action to protect, research and sustainably exploit these species is urgently needed as these underutilized plants are not generally cultivated and are even less commonly studied. It is for this reason that these unfamiliar plant species must be properly identified and information on their habitats, culture, value addition, marketing and uses must be disseminated.

At present most species are used in small quantities either singly or in combination but more information is needed to determine how to process, preserve and store these materials. At the community level, increased income opportunities through the marketing of NTFPs can provide stimulus to conservation and sound forest management by the indigenous people.

3.3.4 Deforestation management and reduction of poaching rates

In natural forests with or without a timber production function, the focus should be on sustaining the long-term NTFPs production and exploitation. With regard to logging, special attention should be given to avoid or minimize the possible damage of NTFPs species. This

requires a careful integration in planning during logging operations, but especially in pre-and post-harvesting actions such as the identification of locally important NTFPs resources and the consequences for forest resource inventories and monitoring. Moreover, some mechanism for community involvement at the stage of elaboration, approval, management planning and for compensation of the loss or damage to NTFPS species should be developed as revealed by the respondents. If extractors, harvest wild plants from forests where they have no formal ownership or user rights, they will take little responsibility for the management of the resource to ensure a sustainable harvest.

In Nguti Sub-division a village forest management committee system known as the cluster platform linkage has existed wherein the cluster facilitator works together with those in charge of managing natural resources through the Program for Sustainable Management of Natural Resources (PSMNR) and the Village Forest Management Committee (VFMC) as illustrated on Fig. 4. The role of the cluster facilitator is aimed at communicating information from PSMNR members to the VFMC and vice versa, animation, planning and reporting activities put in place for sustainable exploitation of resources both from VFMC and PSMNR, assistance and follow up all the activities considered for the year.

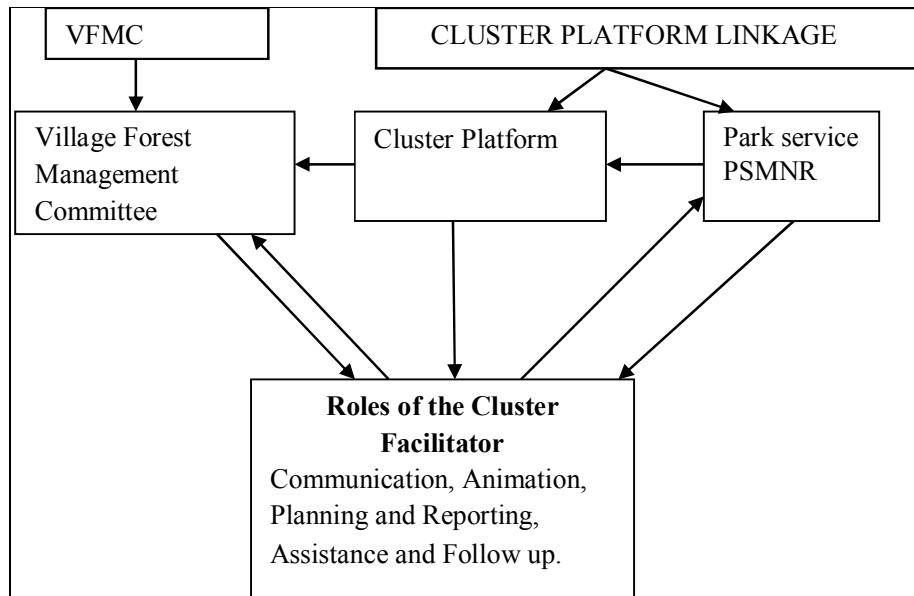


Fig. 4. Structure of village forest management committee in Nguti

The distance required for hunting of bush meat in the community is already a pointer to the whole community that something wrong is beginning to happen and as such the repositioning of eco-guards within areas of high intensity of hunting like Bendom and Bajange villages is the only remedy for the moment. Hunting levels can be controlled and managed through bio-monitoring of some mammal species and regular bush meat markets monitoring should provide a clearer picture of hunting activities in Nguti and the impact on targeted animal populations. Bio-monitoring should be done wherein devices are placed into animals and then can be read using geographic information software to track their migration and hunting of endangered species. As women are involved in the hunting process, both men and women hunters should be considered as important stakeholders at equal footing and incorporate women in the fight against poaching.

3.3.5 Evaluating harvesting methods for sustainability

To identify sustainable harvest levels, it is essential that basic information is available about those doing the actual harvesting, what quantities are taken out from the forest, how the product is processed, how it is marketed and who profits from the trade. Sustainable harvesting methods should include systems in which part of the bark is removed on only one side of the tree, a limited quantity of fruits or seeds are collected and the rest left to ensure regeneration.

Given that sustained harvest depends much on the part of the plant harvested, collecting leaves, roots, flowers, fruits, resin or a piece of bark might slow down its growth, but will not kill the plant. Harvesting the entire plant, digging out the roots, cutting the trunk or removing the whole bark is much more destructive. It is advisable that harvesters should climb the trees instead of cutting them down to harvest fruits or leaves, sufficient adult individuals of a plant should be left in the forest to ensure regeneration and care should be taken not to destroy seedlings. Harvesting should be concentrated in certain months, leaving the plants to recover during the remainder of the year. Exploitation of NTFPs producing species like Maobi or Njabe (*Baillonella toxisperma*) tree should be discouraged as a means of protecting seed trees. For a sustainable harvest of medicinal products, the bark should be removed only on two opposing sides of the trunk and the

interval between successive partial cuttings should be at least 4-5 years for the plant to recover from shock.

3.3.6 Framework for domestication of NTFPs

With regards to the challenges identified during the research, domestication of NTFPs both as a challenge and a strategy for sustaining biodiversity for sustainable livelihoods called the attention of the researcher to develop a framework for analysis. The conceptual model as shown on Fig. 5 examines factors that may affect NTFPs exploiters decision on domestication of NTFPs especially rare products like eru, bush pepper, snails and *Prunus africana* and explains why incentive-driven policies may add an additional impetus for NTFPs domestication). At the centre of the framework is the outcome that is the rational-strategic decision of exploiters to plant economic fruit bearing trees based on the highest expected individual benefits and lowest cost.

The model depicts that the decision to engage into domestication of NTFPs is influenced by several factors be it internal or external to the household. Within the household, the age of the household head, the number of active exploiters, level of education of the exploiter and amount of land owned are reported to influence the decision to domesticate NTFPs. Factors external to the household that may trigger domestication of NTFPs decisions includes market opportunities for the products, ecological and technical factors and the opportunity cost of domestication of NTFPs. The exploiters of NTFPs would engage into domestication of NTFPs if the opportunity cost of forgone benefits on the land used were lower than the benefits derived from NTFPs products.

Given that the activities involved in the exploitation of NTFPs are conditioned by a set of rules and regulations (institutions), the decision of the rational exploiter to domesticate NTFPs on available piece of land is not only influenced by the highest expected utility, but also by what is possible within a given institutional environment. This comprises government policies and a conducive legal framework (both formal and informal). The policy and legal framework here include the whole set of political strategy or vision and regulations that establish the basis of production, transformation, packaging, exchange and distribution of NTFPs in Cameroon.

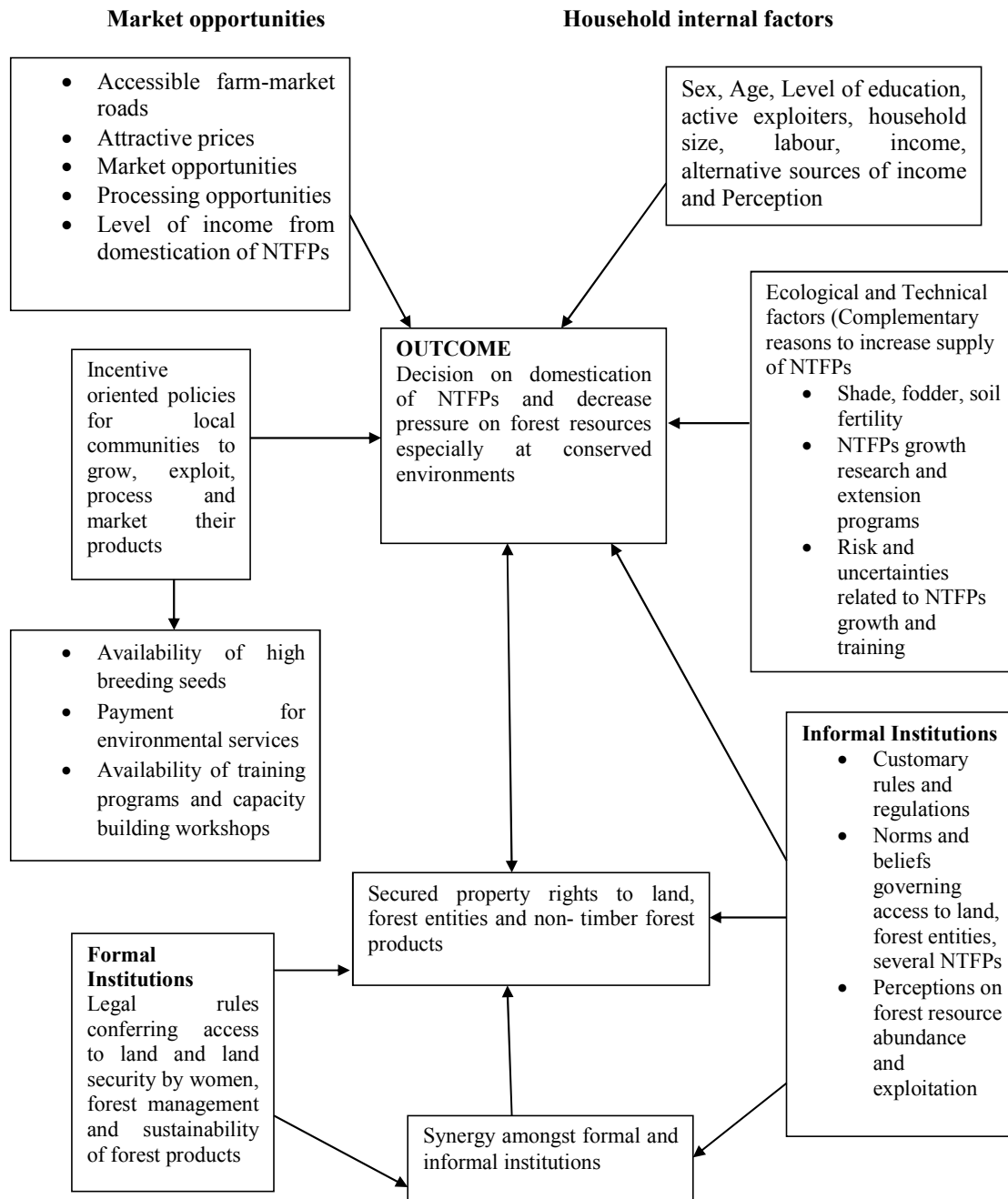


Fig. 5. Framework for the domestication of NTFPs

As illustrated in Fig. 4, the household's internal factors, ecological and technical factors, and incentive-oriented policies act directly while those related to formal and informal rules and regulations may work both directly and indirectly. Direct incentive-oriented policies may include provision of seeds of high yielding varieties, improving the quality of NTFPs, renewing aging

NTFPs trees through domestication, training sessions on processing and marketing NTFPs, skills provision for paper making, oil production and paying for environmental services may encourage exploiters to engage into the growth and domestication of NTFPs. Such incentives are very important because without incentive-oriented policies, a rational exploiter with a

particular plot size will engage either into NTFPs exploitation from protected areas or if engaged into the domestication process, he will do that to meet his personal, economic, cultural and ecological needs. This rational decision will take into consideration the potential alternative benefits from planting other types of plants to meet other economic and social needs. Thus, NTFPs exploiters would engage upon the growth and domestication of NTFPs in a sustainable manner if the marginal benefits from doing so exceed marginal costs. These incentive-oriented policies are expected to increase the competitiveness of indigenous fruit trees with regards to other wild plants species.

The rational exploiters' choice is constrained by policies and regulations governing the forestry sector and its derivatives meaning that, depending on the way the policies and regulations are drafted, they may provide any combination of incentives, disincentives, sanctions or information to promote contrary behaviours. These institutions in this study both formal and informal must collaborate to provide legislation and regulations that influence exploiters' decisions to domesticate and grow NTFPs through their control on exploiters' perceived property rights to land, forests and its products. In the absence of clear property rights with regards to access to land and NTFPs, the exploiters will not take advantage of market opportunities.

Also, in the absence of an adequate policy framework, transaction risks and costs will be high and may further reduce exploiters and traders' motivation to domesticate and market NTFPs. This means that if property rights to forests and its products are supportive, they may also contribute to making on-farm domestication of NTFPs more competitive, thus increasing their economic benefits.

On the other hand, poorly defined rights may serve as a disincentive to on-farm NTFPs domestication, thereby reducing the decision on the domestication of NTFPs which in turn will reduce the abundance of NTFPs and consequently a fall in economic benefits and livelihood opportunities.

4. CONCLUSION

Nguti Sub-division is endowed with several forest entities rich in several Non-Timber Forest Products ranging from nuts, seeds, barks,

leaves, trees and roots as well as several species of bush meat. Around 80 per cent of the inhabitants depend on the resources for their livelihood sustainability. This relative dependence is coupled with meager opportunities of alternative income resulting from low level of educational attainment of the population involved. The challenges of NTFPs in Nguti were recorded as government policies and regulations, poor transformation and storage facilities, depletion and scarcity of resources, deforestation and poaching as well as population growth and agricultural activities. Some of the prominent strategies that can be implemented to manage NTFPs for sustainability includes; domestication of NTFPs, development of the cottage industry, monitoring the market chain and regulating government policies, managing deforestation and poaching, improving upon the agricultural systems and provision of alternative sources of income. In order to ensure sustainable exploitation and management of NTFPs, the strategies identified and explained must be flexible, implemented effectively and also monitored. Monitoring and evaluating the progress of the strategies to manage NTFPs, will enable all stakeholders involved to appreciate and amend the strategies or better still adopt other measures that can ensure the sustainable management of NTFPs in Nguti Sub-division and the world at large.

5. RECOMMENDATIONS

On the basis of the findings of this study, a number of recommendations are hereby postulated that if strategies properly implemented, it will address the challenges to a greater extent and ensure the sustainability of the products.

At the local level, farmers should be advised by the village forest management committee members to do selective felling when opening new farms and to assemble the destroyed biomass in heaps before burning. Where this cannot be totally avoided, any land area affected by fire should be replaced by practicing agro-forestry activities.

At the level of the Nguti council, the ecotourism sector should also be developed and promoted as the sector will employ many youths and reduce pressure on the available resources in the locality.

Capacity building programmes should be organized by Non-Governmental Organizations

and Civil Society Organizations wherein the community will acquire technical trainings, processing, financial supports, storage facilities and knowledge on legal requirements. This will help to improve the bargaining power of the exploiters.

In addition to this, the government of Cameroon and policy makers should be greatly involved in the management of NTFPs in Nguti. Reiterating the management adage “you cannot manage what you cannot measure”, a resource survey should be carried out by the Ministry of Scientific Research, IRAD Ekona, Ministry of Forestry and Wildlife (MINFOF), Ministry of Environment, Nature Protection and Sustainable Development (MINEPDED) and several environmental Non-Governmental Organizations like German International Cooperation (GIZ) on the existing growing stock and the productivity of NTFPs per unit of time and area, the quantity of sustainable yield that can be prescribed for harvesting, the specific sustainable harvesting techniques in terms of seasons, methods and tools are appropriate for each of the different NTFPs available at production sites.

These recommendations are addressed to the local population, Nguti council, NGOs and civil organizations, Cameroon government and policy makers.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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