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Assessment of livelihood activities for conservation management in the Deng Deng National Park-Belabo Council Forest Conservation Corridor, East Region of Cameroon

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Abstract

Many local communities in Cameroon especially around protected areas survive through the exploitation of natural resources in the wild. This study was set out to assess the different livelihood activities carried out in communities located in the corridor between the Deng Deng National Park and the Belabo Council Forest. This assessment was a giant step towards the planning for effective conservation of biodiversity in the corridor. To achieve this, a household survey was conducted using the simple random sampling technique where each household was given equal opportunity of being chosen to take part in the survey. Surveys on hunting and Non-Timber Forest Products (NTFP) were conducted. During these surveys a total of 440 questionnaires were administered in 11 villages. The results revealed that agriculture, hunting and the collection or harvesting of Non-Timber Forest Products (NTFPs) were the major livelihood activities carried out by the local population. Most respondents (51%) farm sizes were between 0.5 to 3 hectares and crops cultivated were; cocoyams, plantains, potatoes, cassava, groundnut and maize. A total of 69% of the population were engaged in the collection and harvesting of NTFPs such as njansang (*Ricinodendron heudeloti*), bush mango (*Irvingia gabonensis*), bitter cola (*Garcinia kola*), colanut (*Cola nitida*). A majority of respondents (97%) collected the NTFPs for consumption and sale. It was shown that 53% of the collector earned at least 100,000XAF to 200,000XAF per year. With respect to hunting, a majority of respondents (87%) hunt for sale and consumption while 11% hunt just for sale. The studied communities depend highly on the forest and this has led to loss of biodiversity through habitat loss and fragmentation. Thus, adequate conservation management strategies are very instrumental for the improvement of biodiversity and livelihood in the corridor.

Keywords: Conservation; Livelihood; Management; Non timber forest products

1. Introduction

Livelihood's survivals are (ways of making a living) the various activities and resources that allow people to live. Different people have different lifestyles and ways of meeting their needs. Similarly, households perform various activities to gain and maintain their livelihoods. These activities depend on the availability of assets, resources, labour, skills, education, social capital, seasonality, agro-climate/agro-ecology, and gender [1, 2, 3, 4]. These livelihood strategies are the range and combination of activities and choices that people make in order to achieve their livelihood goals. Dependent on their resource base and their understanding of the options available, different categories of households develop and pursue different livelihood strategies. These strategies include short-term considerations such as ways of coping with shocks and managing risk. These strategies can be positive, helping households become more

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resilient, or negative when they result in the further erosion and decrease of the asset base. Few studies have considered differences in forest dependence among households as they assumed homogenous local conditions [5,6] and similar opportunities in resource portfolio across households [7,8].

Millions of people around the world depend on forest products and services for their daily income [9]. The importance of these timber and non-timber forest products to people's livelihoods and wellbeing has been documented for various tropical regions [10]. Some scholars argued that forests in addition to providing a source of income to rural households also provide a safety net for people in times of scarcity or emergency [11, 12]. Therefore, stimulating incomes from forest has been perceived as a possible strategy to improve incomes among rural communities [13].

Studies in Nepal showed that community forestry program contributed to improvement of the livelihoods of rural people in three main ways: (i) by increasing the resources, (ii) by reforming the organizations, agencies and policies, and (iii) by facilitating the social changes [14]. Forest condition, composition of user groups, decision making, access to resources, and distribution of benefits are some of the specific components of community forestry that affect the people's livelihoods [15]. The concept behind is that people's access to the forest and their involvement in decision making directly affects distribution of goods and benefits and, therefore, their livelihoods.

Many countries in the Congo Basin of Sub Saharan Africa (SSA) (including Cameroon) have secured significant proportions of their forest land surface for conservation. Since 1970, the total area coverage of conservation sites in SSA increased nearly twofold. Cameroon, called "Africa in miniature" has over 30 protected areas, including wildlife sanctuaries, national parks and forest reserves, which span across the country covering over 4.4 million hectares. These forests are directly or indirectly pressurized by timber exploitation and the expansion of plantations. In addition, the activities of poor resource-dependent communities around conservation sites as they strive to secure a livelihood [16].

Cameroon is 'Africa in miniature' and its forest have provided different livelihood options such as food, medicine, shelter, cultural to economic pursuits. Its forest is known to be very dense and lush. It covers about 47% of the national territory (22 million hectares) and it is characterized by a great variety of flora and fauna. It is ranked among the five African countries which are the most naturally diversified. Her forest ecosystems have multiple functions and are therefore of great significance for the well-being of people especially forest dwellers [17].

Both absolute and relative income from forest resources vary among households within a given community, and is often related to total household income [18]. [19,20] opined that the poorest forest dwellers tend to have a higher forest dependence, but their absolute income from forest resources is lower than that of people with a lower forest dependence. However, single livelihood sources have proven over the years to be insufficient to emancipate the rural poor from their poverty trap requiring the adoption of multiple options. Consequently, rural households rely on a range of natural-resources.

People who live in a forest environment and who practice hunting, gathering and shifting cultivation are likely to draw heavily on that forest and its outputs. In addition to providing a wealth of material outputs of subsistence or commercial value, and the basis for rotational agriculture systems that depend on the ability of bush fallow to revive the productivity of the land, the forest constitutes an integral part of the social and cultural framework of those living within it [21]. For some, the main importance of the forest is that the energy released by the conversion of forest to farm and bush is a major source of power in society [22]. It is in this line that this study was carried out to assess the livelihood activities for conservation management of the Deng Deng-Belabo Council Forest conservation corridor.

2. Material and methods

2.1. Location of the study area

The Deng Deng-Belabo Conservation Corridor is located in the East Region of Cameroon. This region occupies the South-Eastern portion of the country and is the largest in terms of surface area. It is however, the most sparsely populated region in the country with a density of about 7 persons per square km [23]. It covers an area of 109,002 km² [24] and bordered by Adamawa Region to the North, Center and South Regions to the West, Central African Republic to the East and Congo Brazaville to the South. This study was conducted in communities that derive their livelihood from two proposed Community Forest Reserves (CFRs) in the corridor. These community forest measure the size of 5,000 ha for community forest one (KEBO) and 4,588ha for Community Forest two (KEPOL). KEBO is located between latitude 5°0'06.09" - 5°05'55.17" North of the Equator and longitudes 13°19'44.60"-13°27'07.73"East of the Greenwich Meridian while KEPOL is located between latitudes 5°07'06.14"-5°12'57.47"North of the Equator and longitudes 13°28'46.32"-13°33'07.45"East of the Greenwich meridian.

2.2. Climate and Topography

The biophysical environment of Deng Deng National Park is described by its characteristics climate, relief, vegetation types and hydrology. Annual rainfall in the park ranged from 1500 mm to 1600 mm. The park area features a typical equatorial and humid climate [25] defined by the rainfall regime in this area. Seasonal pattern in the park area is characterized by distinct but unequal dry and wet season periods. The area consists largely of flat and gently undulating terrain. Elevation within the park varies from 100m in the south to 920m above sea level in the north. Availability of water in the park is highly influenced by climatic variability and precipitation. Rivers and streams in the park are fed by rainfall and seasonal runoff during the raining season but experience drop in level, decrease in surface area or go dry during the dry season. The map of the study site is presented in figure 1

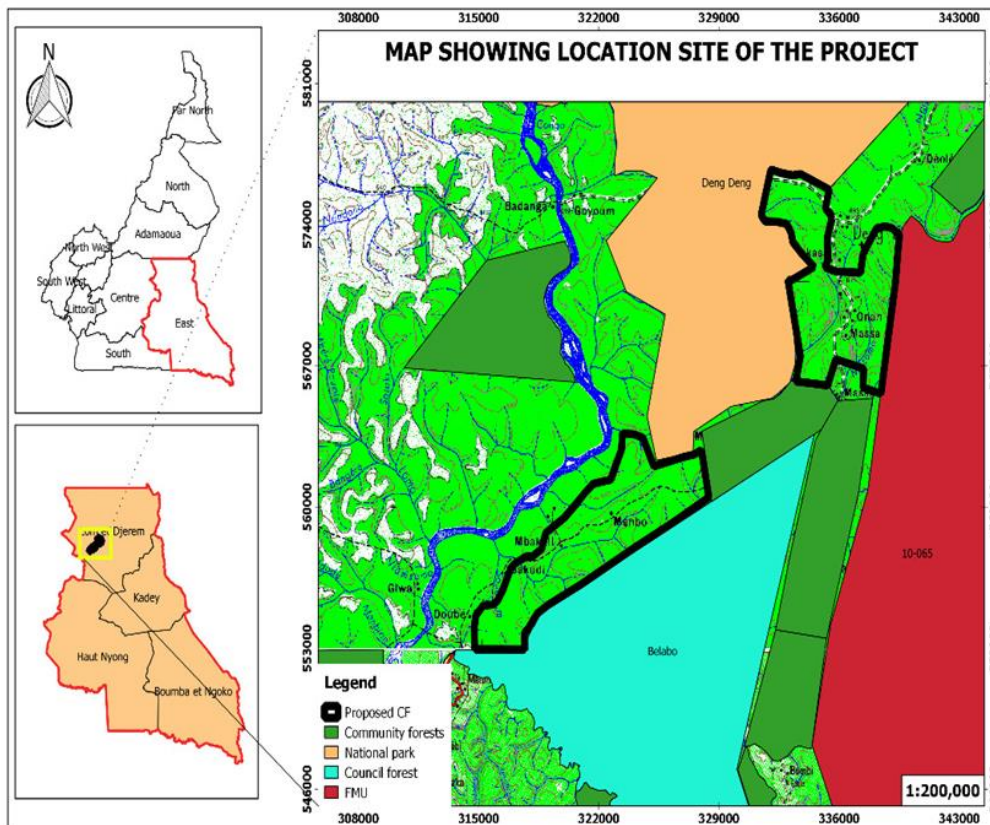


Figure 1 Location map of the study area

The corridor is made up of 11 small communities namely Deng Deng, Kambocassi, Hona, Mansa, Mbaki village, Mbaki 2, Satando, Mbambo, Sakoudi, Tamtsek and Biombe with a total population of about 6,264 persons. They have as major economic activities farming, hunting and the harvesting of Non-Timber Forest Products.

2.3. Sampling and questionnaire administration

Questionnaires were designed in English and translated in to French for easy comprehension during administration. A total of 213 questionnaires for the household survey were administered and each respondent was chosen from a randomly selected household where the household heads answered the questions. For the hunting and NTFPs survey, questionnaires were administered using the stratified sampling technique where only those involve in hunting and NTFPs were selected to take part in the survey. With regards to hunting and NTFPs survey, 83 and 144 questionnaires were administered respectively. Each questionnaire was made up of close ended and open-ended questions which helped to capture the social and economic activities carried out by the villagers. The distribution of the questionnaires administered is presented in table 1.

Table 1 Distribution of administered questionnaires

Names of villages	Household survey	Hunting survey	NTFPs survey
Deng Deng	30	15	18
Kambocassi	21	25	18
Hona	20	13	14
Mansa	25	4	14
Mbaki Bruce	11	10	8
Mbaki 2	20	1	10
Satando	18	4	11
Mbambo	20	8	19
Sakoudi	16	3	10
Tamstek	14	5	10
Biombe	19	5	12
Total	213	83	144

The research made use of a community field guide in each of the communities who could read, understand French and helped interpret some of the questions in their mother tongue to help the interviewees to better understand the questions.

2.4. Data Analysis

After the administration of questionnaires, the questionnaires were cleaned, sorted, coded, inputted and analyzed using the Statistical Package for Social Sciences (SPSS version 16).

3. Results and discussion

3.1. Characterization of the population of the study area

The population living in these communities are distributed across different age groups (figure 2). The highest proportion of the population was made up of youths between the ages of 25 and 40 years (51%). This means that their impacts on biodiversity is very significant since they are the most active group who derive their living directly from the forest either through hunting, farming, collection of NTFPs or exploitation of medicinal plants. The results of the household survey showed that 73% of respondents were male while 27% of them were female.

A majority of the population have just primary education (59%) while 37% attended secondary school with very few of them obtaining the Ordinary Level Certificate. Only 4% of the population sampled had Advanced level certificate. The low level of education among the sampled population could be due to the fact the long distance between other villages and Deng Deng (which is the lone village that has secondary schools) discourages many of the student from going to school especially when they fail their exams. The low level of education goes a long way to affect conservation in the area; most of them are involved in farming and hunting activities. Children who drop out of school join their parents in the farming and hunting activities. Most (61%) households were large; with 6 or more people per household (Figure 2). Large families are more likely to face lower per capita land availability and high dependency ratios for food requirements [26]. They may thus rely on forest resources around them because of the available family labor that can be utilized for NTFPs collection. [27] Hypothesized that household size is positively related to NTFPs collection and utilization. Thus large households exert a lot of pressure on the forest so as to meet up with their livelihood supplies.

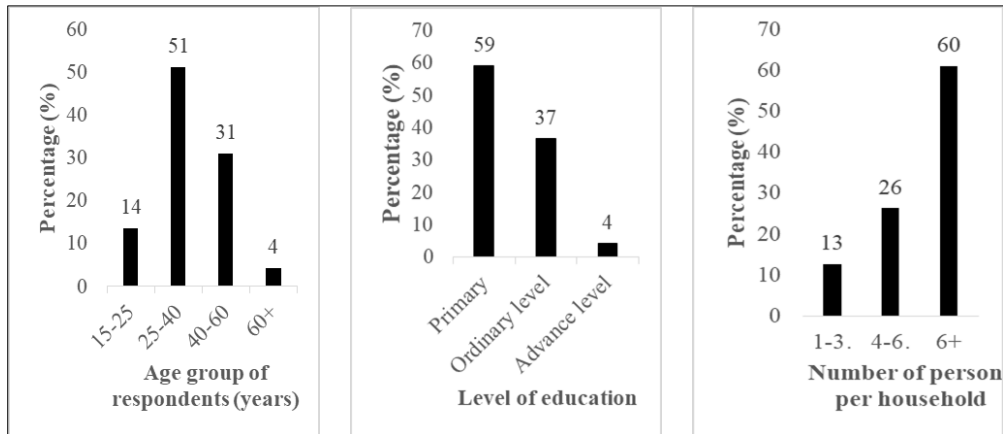


Figure 2 Characteristics of the studied population

3.2. Livelihood Activities

3.2.1. Agriculture

Farm sizes in the study area were generally small with a majority (61%) having farms less than 3ha (Table 2). Farm size plays an important role in crop production as it influences the quantity and availability of food in the household at any point in time. Households with limited farmland may not be able to produce adequate food for their families, hence, rely heavily on forest resources around them as their safety net, to complement food shortage [28]. The results of the study revealed that respondents had multiple farms with a majority (65%) having between 1 and 2 different farms. Very few respondents had large farms (3%) or more than 5 (4%) different farms. The respondents planted many different crops in their farms that ranged from cash to food crops. The main crops cultivated were cocoa, plantains, cassava, banana, maize, potato, cocoyam and ground nuts. The food crops were either sold or consumed by the members of the household.

Table 2 Farm sizes and number of farms of respondents

Farm size (Ha)	Percentage of respondents	Number of farms	Percentage of respondents
0.5 -3	61	1- 2	65
3.5-7	35	3-5	30
7.5 -10	3	>5	4

When farmers own large number of hectares of farms in the forest it leads to deforestation, fragmentation and habitat loss. They believe that owning many hectares leads to greater yields. [29] Contradicted this assertion by saying that most future gains in agricultural productivity will have to come from improved efficiency on existing agricultural lands and not expansion which will go a long way to improve on conservation practices.

3.3. Collection of Non-Timber Forest Products.

Different types of NTFPs were collected by respondents namely; njansang (*Ricinodendron heudeloti*), bush mango (*Iringianga bonensis*), bitter cola (*Garcinia kola*), colanut (*Cola nitida*), black pepper (*Piper nigrum*), bepe (*Monodorum risticum*). Most (67%) of these NTFPs were collected during their various production seasons. The NTFPs were collected for sale and household consumption.

The yearly income from individuals generated from the sale of their products was greater than 50000XAF. Most respondents (53%) earned between 100 and 200 thousand XAF (figure 3). Income from sale of NTFPs was used to pay children school fees and cater for other expenses. Our findings agree with other studies about the important role of NTFPs in providing household food security and income in forest areas [30]

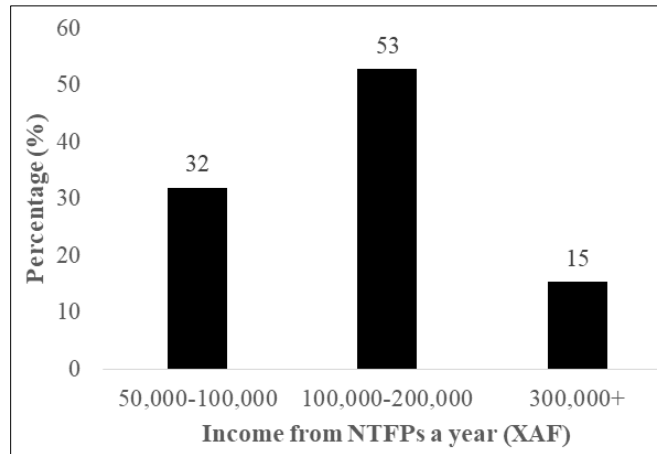


Figure 3 Yearly income from NTFPs per respondent

The harvesting of these NTFPs is done in an unsustainable manner which goes a long way to affect conservation management. This was confirmed by a study carried out by [31] who concluded that long-term harvesting of NTFPs leads to forest and resource depletion there by affecting conservation of forest resources.

Many NTFPs are harvested for commercialization. The extension of the market system to more remote areas has increased both the demand and the opportunity for increased cash incomes as many urban buyers leave towns to villages to buy directly from the collectors at cheaper rates to sell at high prices. Still, the majority of these products are sold in large quantities and for relatively low prices. These communities lack basic infrastructure and market access, the collection of NTFPs provides considerable subsistence support to their livelihoods through the provision of food, medicines, and plants and animals of cultural importance. According to [32], when these products are sold, they provide direct, and often the only means of access to the cash to these community people. The findings agree with [33] who suggested that NTFPs play an important role in supporting livelihoods.

3.4. Hunting Activities

Hunting was found to be a major activity for the respondents with 87 % of the sampled population hunting for sale and household consumption. These results are similar to that of [34] who confirmed that bush meat is an indirect source of food in that the sale of meat probably facilitates the purchase of food. Indirectly Hunting was carried out both in protected areas and in buffer zones (figure 4). 89% of the respondents generated between 100,000 and 500 000 XAF from the sale of bush meat yearly while the rest generated between 500,000 and 1,000,000 XAF.



Figure 4 Areas where hunting is carried out

These communities consider hunting as one of their main activities which remain a local or artisanal activity carried out by many for livelihood survival. These results corroborate that of [35], who found that hunting bush meat remains a

largely artisanal occupation in Central Africa. Bush meat is often the only available source of protein [36]. They opined that many people who were born and raised in or near the forest, bush meat was the primary source of protein and also a tradition of their ethnic groups.

4. Conclusion

The results of this study reviewed that communities around the forest area rely on the forest for their livelihood. In the study area, a majority of the people are engaged in farming, hunting and the harvesting of NTFPs. Most rural poor people maintain diversified livelihood strategies because they cannot obtain sufficient income from any single strategy to survive and to reduce risk. These surveys demonstrated that the rural poor tend to be disproportionately dependent on forest resources in the sense that a higher proportion of their total income came from forest resources.

A great portion of the forest is lost to agriculture: burning of grassland by farmers during slash and burn damages gorilla habitats when fire burn out of control and enter the forest. Uncontrolled harvesting and exceptionally high prices of Non-Timber Forest Products may cause overharvesting, leading to forest degradation since some of the trees might need to be completely cut down for harvesting to be done. To reduce pressure on biodiversity caused by anthropogenic activities, other sustainable livelihood options should be provided to communities such as agroforestry, bee keeping, transformation and domestication of Non-Timber Forest Product. Fish farming should also be introduced to reduce reliance on bush meat hunting for proteins.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no competing interests.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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