The contribution of community forestry on livelihood improvement and environmental protection in Cameroon

Abstract

The sustainable management of community forests in Cameroon is a success story for the achievement of Community-Based natural Resources Management (CBNRM). This approach empowers local communities to take the lead on natural resources management, giving them a sense of responsibility and ownership. This study was carried out in three community forest (Woteva, Bakingili and Bimbia-Bonadikombo community forests) in Fako Division, South West Region of Cameroon. The Bimbia-Bonadikombo community forest was created in the year 2002 and is located in Limbe III, Limbe I and Tiko subdivions. In this study, 135 (45.8%) of the 295 respondents were from Bimbia-Bonadikombo, 109 (36.9%) from Bakingili and 51 (17.3%) from Woteva. From this total, 155 (52.5%) were female and the rest (140 or 47.5%) were male. The improved adoption of sustainable exploitation can be explained by the numerous sensitization and training workshops and field demonstration carried out by the Ministry of Forestry and Wildlife through the Programme for the Sustainable Management of Natural Resources-Southwest (PSMNR-SW), as well as Mount Cameroon prunus africana Association (MOCAP).

Keywords: Environmental protection, Cameroon, natural resources management, community forestry

1. Introduction

Community-based natural resources management (CBNRM), especially community forestry has been considered in recent times as an important strategy to help local populations conserve forests and improve their livelihoods (Angu 2006; Berkes 2004; Bray et al, 2005; Brown, 1999; Carig 2012). Since its emergence in the 1970s, community forestry (CF) has grown tremendously with communally managed forests being the main source of livelihood for more than 1.2 billion people (Agrawal et al. 2008). The approach of CF has promoted a greater involvement of rural communities in the management and utilization of their natural resources (Acharya 2000; Maryudi et al. 2012). It is considered by many people as the policy strategy for achieving livelihood improvement, forest resource conservation and natural resource management devolution (Adams 2001; Adhikari 2007; Carney 1998; Gilmour 2016). Many developing countries experimented and adopted the CBNRM approach.

Cameroon, considered as one of the nations to take the lead on CF in Africa, introduced forestry decentralization reforms in the early 1990s (Fondufe et al. 2016; Ekoko 2000; Nkenfack et al. 2009). As host to a substantial proportion of Cameroon's tropical and mangrove forest, the South West

Region contains several community forests spread across the different divisions in the region. Fako Division alone host four community forest, namely; Woteva community forest, Bimbia-bonadikombo community forest , Etinde community forest and Bakingili commumity forest. Over two decades after the enactment of the concept of community forestry in Cameroon, there is still a heated debate about whether community forestry is an ideal strategy for sustainable forest management and poverty reduction (Karsenty and Vermeulen 2016; Shabaz 2007; Tieguhong 2016).

Though community forestry in the South West Region and other parts of Cameroon have been the subject of many researches, very few of these efforts have addressed questions related to the contribution of this forest management model to the livelihoods of forest dependent communities, biodiversity conservation and natural resources management devolution, thus giving the basis for this research work.

Decades after the implementation of this forest management model in the Fako Division, controversies about its effectives still exist. Questions related to the extent, patterns and socio-demographic determinants of community forest use and the extent to which people depend on forest resources for household consumption and income have remained largely unanswered. Grey spots still exist in current literature on the contribution of community forestry to the livelihood parameters of income, employment and infrastructures development in the study area.

2. Materials and methods

2.1 Site description

This study was carried out in three community forest (Woteva, Bakingili and Bimbia-Bonadikombo community forests) in Fako Division, South West Region of Cameroon. The Bimbia-Bonadikombo community forest was created in the year 2002 and is located in Limbe III, Limbe I and Tiko subdivions. It covers a surface area of 3,735 hectares and serves the following villages: Bonangombe, Bonabile, Lifanda, Dikolo, Mbonjo, Mabeta, Bonadikombo, Ombe native (Moliwe hills) and Bamukong. Woteva community forest is located in Buea subdivision. It was created in the year 2011, covering a surface area of 1,865 hectares and primarily serves the Woteva village. Other villages that depend on its fauna and flora resources include Bonakanda, Bova 1 &2, Wonjia, and Ekona Lelu. The Bakingili community forest was created in the year 2010. It is located in West Coast subdivision and covers an area of 922 hectares. It primarily serves the Bakingili village.

2.2 Sample and sampling intensity

The study population consisted of residents aged 15 years and above living in villages or settlements adjacent to the selected community forests under study. A total of 295 respondents from the various localities were selected for the study and their distribution according to community forests and villages/settlements is represented in table 1 below. The number of villages hosting the community forest and size/population of the village determined the number of questionnaires that were distributed for the community forest and village. Thus, community forests hosted by more villages and larger villages received more questionnaires.

Table 1: Distribution of respondents per community forest and village

Community Forest	Village/Settlement	No. of respondents	% of respondents

Bakingili	Bakingili	73	24.75
	Wete-Wete	36	12.20
Woteva	Woteva	51	17.29
Bimbia-Bonadikombo	Bonagombe/Bonabile	24	8.14
	Bonadikombo	34	11.53
	Lifanda Congo	22	7.46
	Upper Mawon	19	6.44
	Ombe Native	20	6.78
	Bamukom	16	5.42
Total		295	100

2.3 Data collection

Primary data was obtained from a structured questionnaire containing close-ended questions on the respondent's socio-demographic characteristics, use of and dependence on forest resources and perceptions of the contribution of community forestry to selected livelihood, conservation and governance parameters. A total of 300 questionnaires were administered. At the end of the exercise, 5 were rejected for incomplete or imprecise answers. Furthermore, key informant interviews using an interview guide were conducted with influential and knowledgeable members of the community. A total of 10 key informant interviews were conducted with heads of the village traditional councils, heads of user's groups and other influential community members. Finally, nonparticipant observations and field visits were made by the researcher to collect relatively objective first-hand information on the state of community infrastructure development, forest stands and regeneration activities. During this exercise, field notes were taken.

Secondary data was obtained through desktop review of community forest simple management plans, books, journal articles, published and unpublished thesis, magazine articles, web sites publications etc.

2.4 Sampling technique

A multi-staged sampling procedure was employed to select respondents for the study. In the first stage, three out of the four community forest in the Fako Division were randomly selected. The chosen community forests were Bakingili community forest, Bimbia-Bonadikombo community forest and Woteva community forest. In the second stage, nine (9) out of the sixteen (16) villages and settlements/bordering the chosen community forest were purposefully selected based on their proximity to the forests and geographical accessibility. These include, Bakingili, Wete-Wete camp, Woteva, Bonagombe/bonabile, Bonadikombo (Mile 4), Upper Mawon, Lifanda congo, Ombe Native and Bamukom. In the final stage, simple random sampling was used to select respondents from Bakingili, Wete-Wete, Woteva, Bonagombe/Bonabile, Ombe Native and Bamukon based on a prior developed household list while in Upper Mawon, Lifanda Congo and Bonadikombo (Mile 4), convenient or availability sampling technique was employed.

2.5 Data analysis

The quantitative data obtained from the questionnaire survey was analysed using exploratory statistics (Boxplots, Kolmogorov-Sminov and shapiro-Wilk), descriptive statistics (frequency, percentages, mean, standard deviation, standard error mean, charts and tables) and inferential statistics (Chi square, pearson's correlation coefficients, binary logistic regression coefficients and paired sample t-test). The pearson's chi square, Pearson's correlation, binary logistic regression and paired sample t-test procedures were employed as test of association, measure of strength/direction of association, test of prediction and test of variation. The data was analysed using IBM statistical package for social sciences version 20. Charts and tables were developed to enhance illustration using Microsoft office 2013. The qualitative data obtained from the key informant interviews were collated for similarities and differences in response to key questions.

3. Results and Discussions

3.1 Socio-demographic characteristics of respondents

In this study, 135 (45.8%) of the 295 respondents were from Bimbia-Bonadikombo, 109 (36.9%) from Bakingili and 51 (17.3%) from Woteva. From this total, 155 (52.5%) were female and the rest (140 or 47.5%) were male. This female dominance reflects the higher population of females over males in the area, as is generally the case with Cameroon. The majority (68.5%) of the respondents were below the ages of 45 years, indicative of a youthful and productive population. The population is literate, since more than three quarter (75.3%) of the respondents had some form of formal education. Close to half (48.1%) of the respondents were into agriculture and forest-related activities, thus indicating high pressure on forest and environmental resources. The rich volcanic soils and abundant forest resources in the area lends itself to these livelihood activities. A majority (51.5%) of the respondents were in the lowest income category, indicative of a relatively poor population. More than half (63.1%) of the respondents have lived in the area for more than 11 years, signifying that they are knowledgeable about the trends in livelihoods, conservation, and governance in the area. Most of the respondents were non-indigenes indicating the heterogenous nature of the population, and justifying an influx of migrants to the area.

3.2 The extent, patterns and socio-demographic determinants of community forest use and dependence

3.2.1 Extent of community forest use

In this study, a higher percentage of the respondents (60.7%) use the community forest for livelihood activities while the rest do not use the community forest. This is in line with the findings of Beauchamp and Ingram (2011) who reported a high use of community forest in the Melombo and Akomnyada II localities in the Eastern region of Cameroon by the local communities. This high use of the forest by the community can be linked to limited forest alternative livelihoods and low level of skills and academic qualification among some of the residents (particularly in Woteva) for other form of employment. This can also be justified by the dominance of the active age group in the area. At the 95% confidence interval, forest use differed significantly across locations ($p=0,00$; $x^2=34,15$; $df=2$) probably due to the variations in the characteristics of the population structure. Forest use was higher (82.4%) in Woteva, followed by Bakingili (71.5%), and lowest (43%) in Bimbia-Bonadikombo. The relative differences in livelihood opportunities present in the different localities account for this difference in forest use. In Wateva where forest use was highest, farm and forest related activities

constitute the major livelihood activities of the people. In Bakingili, forest use was relatively moderate since in addition to farming and forest related activities, a significant proportion of the residents are involved in artisanal fishing and trade. Increased opportunities for fishing, farming, small trading and other paid employment in the urban localities of Limbe, account for the relatively low level of forest use in Bimbia-Bonadikombo. Akoa (2007) observed similar differences across several community forests in Cameroon. In addition, forest use significantly varied across the socio-demographic characteristic of gender (p=0.00, age group (p=0.00), level of education (p=0.00), primary occupation (p=0.00), level of income (p=0.00) and longevity in the area (p=0.00).

3.2.2 Patterns of Community Forest use

Among the 179 respondents who use the forest, 160 (89.4%) use the forest for fuelwood collection, 46 (25.7%) for timber exploitation, 71 (40%) for farming, 74 (41.3%) for non-timber forest products (NTFPs) harvesting, while the rest reported using the forest for cultural rites and ceremonies (3.9%), recreation (3.4%) and research (1.1%).

The high use of the forests for fuel wood collection in the selected community forest is in line with the works of Akoa (2007). Like in most developing countries where fuel wood constitutes the dominant source of energy (FAO, 2010), fuel wood is extensively used in the study area for household cooking, heating and fish smoking. Contrary to other timber and non-timber forest products, there are limited restrictions on the collection of fuel wood for household consumption from the selected CFs. Also, fuel wood is extensively harvested for charcoal production in Bimbia-Bonadikombo and Bakingili for sale in the city of Limbe. Typical species of trees used for fuelwood and production of charcoal are mango wood (*Desbordesia glaucescens*) and matanda (*Uapaga guinensis*). **NTFPs** harvesting constituted another major form of community forest use. Abanda and Nzino (2014) reported similar patterns in Cameroon respectively. The most reported types of NTFPs were spices and condiments (22.2%), medicinal plants (21.2%), forest fruits and nuts (19.8%), canes and bamboos (13.7%), leaves and fodders (4.7%) and honey (2.8%). Game or bush meat (15.5%) was hunted/collected (figure 1).

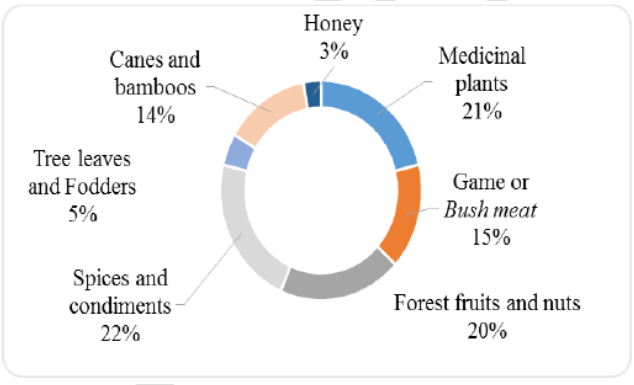

Figure 1: Non-timber forest products exploited in Bakingili, Woteva and Bimbia-Bonadikombo Community Forests

In the study area, NTFPs are used extensively as food, medicine, livestock feed, household construction material, etc. NTFPs like bush mangoes (*Irvingia gabonensis*), Eru (*Gnetum africamum*), Njangsang (*Ricinodendron heudelotti spp*), bush pepper, bush onions, alligator pepper (*Aframumun spp*), etc. are important parts of the local diets. NTFPs used for medicinal purposes include pygium (*Prunus africana*), yellow stick (*Garcinia manni*), bitter cola (*Garcinia cola*), cola (*Cola acuminate*), and milk stick (*Alstonia boonai*). Other NTFPs of importance are rattan (*Lacosperma spp*), ngogo leaf

(*Megaphrynium macrostach*), bamboos. Another major use of the community forest was subsistence and smallholder farming. The use of community forest for agricultural purposes have also been observed in the Etinde community forest and Muaku Community forest (Pers. Comm.). In most of the selected community forests, there are forest management units allocated for farming purpose. **T**he forests were also used for bush meat hunting. The community forests are host to species such as antelope, and rat, viper, pangolin, squirrel, Mona Monkey, brush tail porcupine which are valuable sources of protein for most household. Even though most of the Community Forest have a limited quantity of commercial timber, available timber species like mahogany (*Ethandophama spp)* Iroko, Isaka, small leaf, tiger wood etc. were exploited and generally used for house construction or transported for sales to neighboring towns. **T**he presence of touristic sites in the community forest such as the German graves and lava craters in Woteva, the slave port in Bimbia and lava flow traces of 1999 in Bakingili make the community forests important destinations for tourist. Given that most of these community forest fall within the Mt Cameroon biodiversity hotspots, they are also used for scientific research.

No statistically significant variations in the use of the community forests for fuel wood collection ($p=0,807$; $x^2=0,429$; $df=2$), NTFPs harvesting ($p=0,115$; $x^2=4,326$; $df=2$), farming ($p=0,312$; $x^2=2,330$; $df=2$) and timber exploitation ($p=0,861$; $x^2=0,300$; $df=2$), were observed across the selected localities (figure 2). This therefore indicates that forest use patterns for major forest resources does not vary significantly across the community forests.

3.3 Contribution of community forestry to livelihood/income

17.9% of the respondents reported an increase in community members income under community forestry, 12.3% perceived a decrease, 53.9% perceived no change while 15.9% did not know. The results show that community forestry has influenced no significant change in the income of community members. This is in conformity with the works of Minang et al. (2007) who reported that forest management devolution has not contributed significantly in improving basic assets and means at the household level in the Bimbia-Bonadikombo area and in four selected areas in Cameroon (i.e. lomie/Dja, Ocean, Mt Cameroon and Mount Oku) respectively. This can be due to the fact that most of the community forest entrusted to communities in this area by the state were highly degraded with little or no commercially exploitable quantity of timber and non-timber forest products. Also, most of the community forest have focused on regeneration rather than on income generation, and on the other hand, they have not had reliable economic operators to exploit the little available commercial timber for income generation. Thus, illegal timber exploitation which is beneficiary only to a handful of people is what obtains in the area. At the 95% level of confidence, respondents' perception of the effect of community forestry on income did not differ across locations ($p=0,152$; $x^2=9,412$; $df=6$; $r=0,007$). The fact that all the community forests have similar resources and challenges account for the similarities in the impact on income.

3.4 Contribution of community forestry to forest resources conservation

3.4.1 Contribution of community forestry to forest stand

34.9% of the respondents reported that forest stands have witnessed a minor increase with community forestry, 14.2% reported a major increase, 22% reported a major decline, 21% reported a minor decline while the rest, 6.8% reported no change. This indicates that forest stands have increased in the context of community forestry. This is similar with the findings of Lupala et al. (2015) who recorded increased miombo woodland forest covers and stands in areas of participatory forest management in

the Iranga region in Tanzania. However, illegal timber exploitation turns to affect forest stands. At the 0.05 significance level, significant differences on changes in forest stands were found with location ($p=0.019$; $x^2=18.271$; $df=8$; $r=0.114$). This is related to the variation in anthropogenic activities from one community forest to the other. Decline in forest covers and stands were above average (60%) in Bimbia-bonadikombo, below average (32.3%) in Bakingili and low (7.7%) in Woteva. Decrease in forest stands were highest in Bimbia-bonadikombo CF because this forest is subjected to higher pressures from the surrounding population than in Bakingili and Woteva. Also, the size of the forest makes regular patrol and surveillance to check illegal forest exploitation difficult.

3.4.2 Contribution of Community forestry to Wildlife

40% of the respondents reported an increase in the incidence of wildlife sightings, sounds and traces with community forestry, 39.4% reported a decrease, 12.8% reported no change while 6.8% did not know. An increase in the incidence of wildlife sightings, sounds and traces reported indicate that community forestry has contributed to some extent to wildlife conservation. This is in line with the findings of Anup (2016) who reported that wild animals such as leopard, porcupine, monkey and birds were increased in the forest in areas were community forestry is practice in Nepal. According to Mr. Elive who is head of the Bakingili Village Forest Management Committee and forest management officer of the Bakingili community forest, sightings, traces and sounds of some endangered species such elephants and chimpanzees have increased with presently higher levels of human-wildlife conflicts. At the 95% level of confidence, significant difference in the incidence of wildlife sightings, sounds and traces was found with location ($p=0,00$); $x^2=36,243$; $df=6$; $r=0,08$). The relatively more disturbed Bimbia-Bonadikombo community forest experienced lower wildlife sightings, traces and sounds, compared to the more stable Woteva and Bakingili community forest, benefiting from more surveillance.

3.4.3 Contribution of Community Forestry to Environmental Awareness

67.8% of the respondents reported an increase in environmental knowledge and awareness of the importance of forest resources conservation with the advent of community forestry. On the other hand, 12.8% reported no change, 10.8% reported a decrease while the rest, 8.6% did not know. This clearly indicated that community forestry has greatly increased environmental awareness and community members` understanding of the importance of the sustainable use of the forest and its related resources. Similar arguments have been advanced by Anup (2016).

3.4.4 Contribution of community forestry to the adoption of sustainable exploitation practices

In this study, 60% of the respondents reported that forest resource users have adopted sustainable resource exploitation and farming practices with the advent of community forest. However, 30% reported that sustainable resource exploitation and improved farming practices have not been adopted while 10% did not know. The results showed that sustainable forest resource exploitation practices have been adopted in the area since the introduction of community forestry. This finding is in line with that Eben (2014) who noted an improvement in the methods used in the exploitation on non-timber forests products (*Prunus africana* in particularly) in the study area. The improved adoption of sustainable exploitation can be explained by the numerous sensitization and training workshops and field demonstration carried out by the Ministry of Forestry and Wildlife through the Programme for the Sustainable Management of Natural Resources-Southwest (PSMNR-SW), as well as Mount Cameroon prunus africana Association (MOCAP). Of the 178 respondents who reported the adoption of sustainable practices, agroforestry (71%), collection of dead branches only (32.1%), sectional

harvesting (32.6%), picking only of fallen fruits (48.1%), selective hunting (38.2%), and cut-and-replant (40.9%) were reported as the most adopted sustainable practices for farming, fuel wood collection, medicinal plants harvesting, forest fruits collection, wildlife hunting and timber exploitation respectively.

Adoption of sustainable practices was high (77.1%) in Bakingili, above average in Woteva (66.6%) and low (43%) in Bimbia-Bonadikombo. The adoption of sustainable practices were highest in Bakingili and Woteva because they are small and closely knit communities that permit reinforcement of good practices among community members as compared to the large and peri-urban nature of Bimbia-Bonadikombo. The support of PSMNR (technical and financial) to the management of these two community forests also contributes to increase use of sustainable practices.

3.4.5 Contribution of Community forestry to forest regeneration

In the study area, 63.4% of the respondents reported that regeneration (afforestation and reforestation) have been carried out with the advent of community forest. On the other hand, 26.4% of the respondents reported no such activities while the rest 10.2% did not know. In the year 2014, over 20 000 endangered trees were planted by MINFOF with support from the Environmental and rural Development Foundation (ERuDeF) via its program for the conservation of Threatened trees in the Bakingili and Woteva CFs. Also, in the years 2020 to 2021, over 30,000 trees were planted in Bakingili community forest and along the boundaries of the Mount Cameroon National Park. In Bimbia-bonadikombo, a highly-used practice is cut-and-replant whereby forest users are obliged to plant and tag two trees for every one they fell. Also, tree nursery development has been carried out extensively in the area with the assistance of national forestry development agency (ANAFOR). At the 95% level of confidence, respondent's perception of regeneration activities did not vary significantly among location ($p=0,509$; $x^2=3,299$; $df=4$). These activities can be explained by the fact that reforestation and afforestation has been a major preoccupation and activity of the selected community forest management organizations.

Conclusion

The sustainable management of community forests in Cameroon is a success story for the achievement of Community-Based natural Resources Management (CBNRM). This approach empowers local communities to take the lead on natural resources management, giving them a sense of responsibility and ownership (Agrawal 2007). As a result, local communities derive environmental benefits from the protection of biodiversity, as well as livelihood improvement of the population via sustainable exploitation of forest resources. However, it is important for technical services and other relevant stakeholders to provide adequate support to accompany communities in CMNRM so that the concept remains part and parcel of the communities, and fully adopted by them.

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