Journal of Food Security, 2021, Vol. 9, No. 2, 56-61
Available online at http://pubs.sciepub.com/jfs/9/2/3
Published by Science and Education Publishing
DOI:10.12691/jfs-9-2-3

Analysis of Small Scale Farmers Households Food Security in the Mount Bamboutos Ecosystem

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Received February 21, 2021; Revised April 01, 2021; Accepted April 09, 2021

Abstract The Mount Bamboutos ecosystem constitutes part of the area with the second highest level of food insecurity in Cameroon. In order to check the diminishing biodiversity, there is an urgent need to develop a 25-year plan for the management of the Mount Bamboutos ecosystem biodiversity. This study seeks to examine the food security status of smallholder farming households, factors affecting household food security and coping strategies in case of food shortages. Households were selected through a simple random process from 11 villages around Mount Bamboutos and questionnaires administered to 261 household heads. The socio economic characteristics of the households were analysed. The main sources of income for farmers in the study area were crop production and animal production. The Household Food (In) Security Access Scale (HFIAS) was used to measure household food security. Forty five percent of the sampled households were food secure. Access to irrigation facility by household was positive and highly significantly ($P<0.01$) influenced household food security as well as the duration of household head in the village. The main coping strategies in case of food shortages used by the farmers were; eating same food and skipping meals. As a recommendation, irrigation facilities and training opportunities should be provided to smallholder farmers in the study area to ensure better crop production for food security.

Keywords: *coping strategies, food security, irrigation, smallholder households, mount Bamboutos*

Cite This Article: Louis Nkembi, Deh Nji Herman, Tankou Christopher Mubeteneh, and Njukeng Jetro Nkengafac, "Analysis of Small Scale Farmers Households Food Security in the Mount Bamboutos Ecosystem." *Journal of Food Security*, vol. 9, no. 2 (2021): 56-61. doi: 10.12691/jfs-9-2-3.

1. Introduction

Food insecurity and poverty are crucial and persistent problems facing the world. The number of people who are food insecure and malnourished over the world has been on increase since 2014, reaching an estimated 815 million in 2016 [1]. A report from the Food and Agricultural Organisation (FAO), World Food Programme (WFP) and the International Fund for Agricultural Development [2] indicated that around 1.4 billion live below USD 1.25 per day with majority of them living in rural areas of Sub Saharan Africa who depend on agriculture as main source of livelihood. A majority of the food insecure people in the world are rural small farmers who live in the developing countries [3] and achieving food security remains challenging in many rural areas of Sub-Saharan Africa [1].

Food security is a situation that exists when all people at all times have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life [4]. Three pillars have been used to explain food security: availability, accessibility and utilization. Availability refers to the physical presence of a large quantity of food, utilization means sufficiency in both quantity and quality of food and sustainability implies access at all times and not losing such access [5]. On the other hand, food insecurity refers to condition in which people lack basic food intake to provide them with energy and nutrients for fully productive lives [6]. Common causes of food insecurity in Africa include; drought and extreme weather events, pests, livestock diseases and other agricultural problems, climate change, military conflicts, corruption and political instability [7,8]. Malnourished people are more susceptible to disease and less able to work or produce food [9] hence the direct linkage between food insecurity and poverty.

Cameroon is endowed with rich resources and varied agro ecological zones capable of producing enough essential food commodities to feed its growing population. Agriculture remains one of the most important sectors of the Cameroonian economy; contributing about 30% of the total annual GDP [10]. Despite the huge potentials, food production in Cameroon is still largely in the hands of smallholder farmers who constitute about 70% of the farming population [11]. Their cultivation practices are

characterized by the use of basic tools, small farm sizes, low capital inputs, high labor inputs, limited control of pests and diseases and low yields [12]. Producing food under such constrained conditions is a big challenge coupled with effects of climate change [13]. Cameroon has great potentials for agricultural production to feed its over 23 million people and more. Cameroon was considered as self-sufficient in agricultural production and until the late 80s. Since the early 90s, Cameroon began spending billions of francs CFA to import large quantities of food items despite the fact that improving and relying on national products has large comparative advantage [10].

About 16% of households in Cameroon are food insecure which is approximately 3.9 million people. Out of this number about 211,000 people are severely food insecure; having limited or no access to sufficient, nutritious food that is required to live healthy life [14]. A higher percentage of households in rural areas are more food insecure than those in urban centers. At the regional level, the Far North has the highest prevalence of food insecure households (33.6%), followed by North West (18.1%) and West (18%) regions. The North West and West regions constitute part of the Mount Bamboutos ecosystem. The study area constitutes the second most food insecure part of the country [14]. It is therefore important to carry out a focused study to get more information on food security in the study area. This study was designed to answer the following questions: i) what are the socio-economic characteristics of respondents in the study area?, ii) what is the food security status of respondents in the study area?, (iii) what are the determinants of food security among respondents in the study area and iv) what are the coping strategies to food insecurity among respondents in the study area?. The results of this study are expected to provide useful information both for policy makers and researchers who are working to develop a 25-year plan for the management of the Mount Bamboutos ecosystem biodiversity. Moreover, food security analysis at household could facilitate identification of the most appropriate strategies that could be taken.

2. Methodology

2.1. Study Area

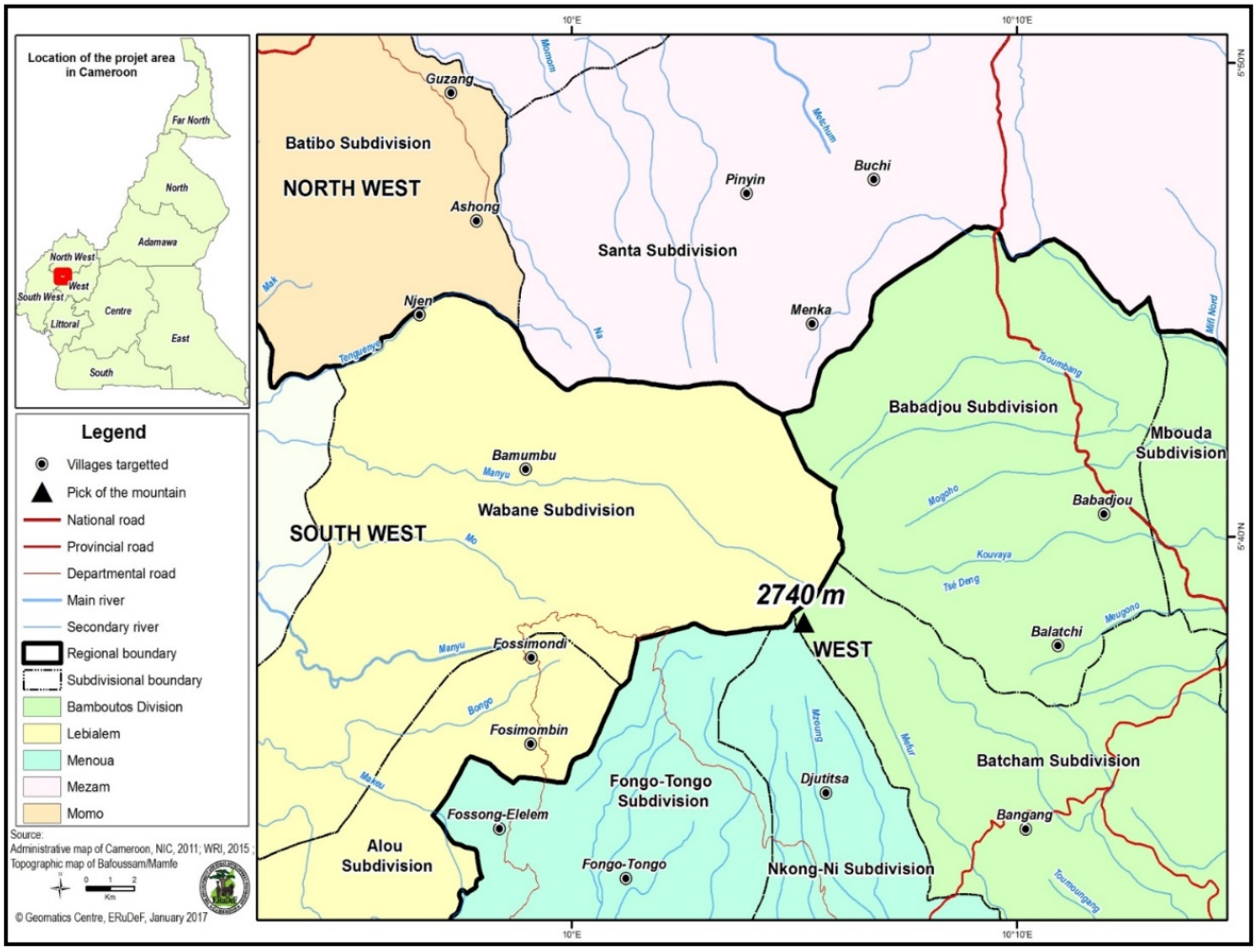

Figure 1. Location of villages where questionnaires were administered

Figure 1 presents the map of the study area with the targeted villages. Mount Bamboutos is the third largest volcano (800 km^2) of the Cameroon Line after Mounts Cameroon and Manengouba. This massif is situated between longitudes 09°57'E and 10°15'E and latitudes 05 °27'N and 05 °48'N. It forms part of the Cameroon Highlands Forest eco-region. It runs South-West to North-East through Western Cameroon and adjacent South-East Nigeria. It spans three regions (West, South-West and North-West), 5 districts (Bamboutos, Menoua, Mezam, Momo and Lebialem) and 08 sub districts across the mountain. This area has a population estimated at 81,257 inhabitants with an average density of 400 inhabitants / km^2 distributed in 56 communities. However, in the context of this project, only 14 communities (upstream) directly linked to the mount Bamboutos ecosystem are considered, with a population of over 30000 people. The soils are characterized by low bulk density (0.73g/cm3) and a loamy texture. The low bulk density is indicative of the andosolic nature of these soils [15]. It might be due to more ground biomass input in the form of leaf [16]. High fine particles (silt + clay) content might be due to the absence of translocation of finer particles from the surface horizons. The structural stability index is high, indicating a stable structure [17].

The NE slope of Mount Bamboutos is characterized by wet, humid and cool climate with periodic moisture regime (1700 to 1800 mm annual rainfall) and isothermic conditions (15˚C to 18°C mean annual temperature). The rainy season stretches from March to October and the drying season from November to February.

Mean maximum temperature is between 20-22°C; mean minimum 13-14°C. November has the lowest mean minimum temperature and December the highest mean maximum. Temperature inversions at night in narrow valleys which suffer from poor air drainage leads to some ground frost, mainly in January or February. Rainfall varies from 1780 – 2290mm per year. Most rain falls between July and September. Generally January and February have the lowest relative humidity (average 45 - 52 %). The monthly average humidity exceeds 80% in July and August. During the rainy season, mist and low cloud occur frequently. The Mount Bamboutos area is part the western Highlands of Cameroon with an altitudinal range of slightly below 1000m to 2740m at the summit of Mt Bamboutos. The vegetation map of Cameroon by Letouzey in 1985 [18] classifies;

- the submontane forest that ranges from 800m to 1900 – 2000m of altitude,
- the montane forest 1900 – 2000m and above. However, the MBI area also carry vast derived grassland and woodlands as described by Hawkins and Brunt, 1965 [19].

The weather conditions of the area favours crop production and animal rearing which are the main activities of the small scale farmers of this area.

2.2. Source of the Data

The study collected qualitative and quantitative data pertaining to social, demographic and economic aspects of households. A structured questionnaire was used to collect data through a household survey from 11 villages in the Mt Bamboutos landscape. The survey covered a total of 261 randomly selected households.

2.3. Data collection

For this study, respondents were the primary data sources. A structured survey questionnaire was designed and pre-tested to collect the primary data. The household heads were the main respondents for this study because they had a mastery of the information needed and will provide the information with minimal errors. Both qualitative and quantitative data were collected simultaneously during the questionnaire administration. Qualitative and quantitative data were collected to enable a better interpretation of data analysis results. Information sort from the heads of selected households was related to the socio-economic characteristics of households, household food security status, and coping strategies against food shortages.

2.4. Data Analysis

Survey data were first sorted out, edited and coded, organized and keyed into the SPSS software package version 6. Descriptive statistics (frequency, percentages, means), household food insecurity access scale (HFIAS) and logit model were used to analysed the data. The household food insecurity access scale (HFIAS) [20] consists of nine questions divided into two main categories. These `occurrence questions` indicate the prevalence of particular food insecurity condition over the time specified and frequency of occurrence questions that determines how often the condition occurred. Only respondents who answered all the nine questions were included in food security assessment and the specified time was 12 months for this study. Using the scale score [20], households were categorized into 4: severely, moderately, mildly food insecure and food secure households [21]. The higher the score, the more the household is food insecure and vice versa.

3. Results and Discussion

3.1. Socio Economic Situation of Households

Table 1 below indicates that 69% of household heads were men while 31% were women. A majority of respondents (45%) were age between 36 and 55 years and 25% were age between 16 and 35 years. These age groups are referred to as productive age group [3], an indication that the respondents are still very active to engage in agricultural production that will contribute to their households' food security [22]. At the active age, household heads adopt innovations that positively affect their farm productivity and consequently income [23], [24]. The average age of respondents was 46 years. Most respondents were literate with 49 % having at least primary school education and just 16% were illiterates. The literacy rate is key determinant in every aspect of agricultural production and food security Sana et al., 2015 [25]. Most respondents (80%) had lived in the village for more than 15 years. Average household size was 8 persons

with 26% of households having household sizes greater than 10. Training is a very important component of effective crop and animal production. For this study, 79 % of the respondents had undergone training in various aspects of crop and animal production. The main source of income for farmers in the study area was crop production where 98% of respondents attested as their first main source of income. The second main source was animal production.

Table 1. Demographic and socioeconomic characteristics of Households

Variable	Description/range	Frequency	Percentage
Sex of household head	Male	180	69
	Female	81	31
Age	16 -35	74	28
	36-55	117	45
	56-75	66	25
	>75	4	2
Education level	Illiterate	42	16
	primary school	127	49
	secondary school	61	23
	high school	26	10
	university	3	1
	Degree holder	2	1
Duration in village (years)	1-15	51	20
	16-30	83	32
	31-45	55	21
	46-65	59	23
	>65	9	4
House hold size	1 – 5	93	35.6
	6 -9	98	37.5
	10 - 13	42	16
	14 and above	28	10
Training received	Yes	200	79
	No	54	21
First main source of income	crop production	256	98
Second main source of income	Livestock rearing	103	40

3.2. Household Food Security Situation in the Study Area

The household food (in) security access scale was used to measure household food security. Based on the experience, anxiety, and uncertainty about food supply, limited variety of food and insufficient food intake, households were classified as food secure, mildly food insecure, moderately food insecure and severely food insecure.

Food secure households are those which experience none of the food insecurity conditions described in the scale in this case the HFIAS score is 0. Or just experiences `worry`, but in rare occasions. The results in Figure 2 below shows that 45% of the sampled households were food secure. Of the sampled households, 14% were mildly food insecure. These are households which worry about the inadequacy of food in the household, and tend to consume the same type of food most of the time. They do not get food of their preference, eat a limited variety of food and most often what is available [3]. Food insecure households formed the second largest category with 24% of the sampled households being food insecure. These are households who experience inadequate food intake due to lack of resources that enable them to command or produce food they need to maintain an acceptable level of consumption. They result to skipping meals, eating less and doing activities that they don`t prefer in order to get food, for example, begging or sending children to go out to work in order to get food on their tables.

The maximum HFIAS score was 12 and the minimum was 0. Average HFIAS was 3.5. Higher HFIAS score indicates the increased level of food insecurity while a lower score represents a lesser degree of food insecurity situation.

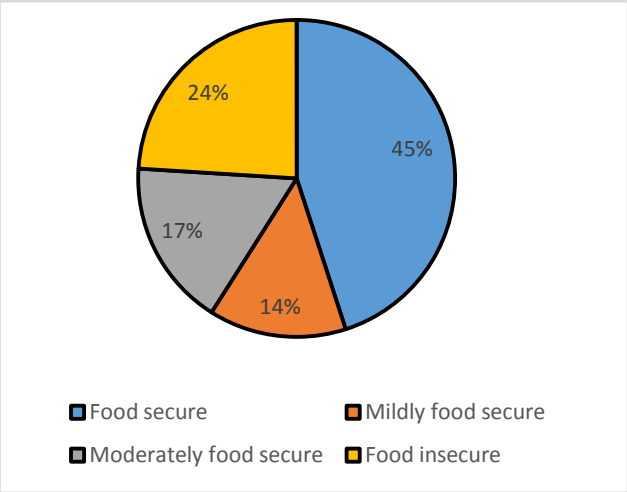

Figure 2. Food security situation in the study area

3.3. Factors Affecting Household Food Security in the Study Area

The results in Table 2 show that the coefficient of access to irrigation facility by household was positive and highly significantly ($P<0.01$) influencing food security in the study area. The coefficient of household size although not significant was negatively influencing food security in the study area. These results imply that the more farmers have irrigated farms, the more their chances of being food secure [26]. This is logical because, when farmers have irrigation facilities, they can enhance crop production through water stress mitigation and reduction in risks of crop failures thus ensuring household food security. Irrigation is an important crop cultivation technique that determines crop yields in small holder farming systems [27]. Results of this study show that the longer farmers stay in the village the more they are food secure. This is shown by the positive significant coefficient of duration in the village and food security ($P<0.05$). This could be attributed to the fact that the more people stay in the village, the more they can own land and plant perennial crops that will produce over longer periods. Although the coefficient was not significant, the household size had a negative impact on household food security in the study area. This is obvious because having enough food to feed a large household is not easy especially if most of them are too young or very old and unproductive [28]. In this

study, training referred to short term training on different aspects of crop and animal production. Surprisingly, having received training had a positive but non-significant effect on food security. This suggests that training needs to be continuous and not just periodic for its effects to be significant. This is linked to regular extension services where farmers are continuously trained and mentored by extension agents.

3.4. Coping Strategies

A number of coping strategies in case of food shortage was adopted by the farmers; eating same food, skipping meals, eating less per meal and doing things that that they don`t prefer such as sending children to go out to work in order to get food (Table 3). The frequently used strategy was reducing the quantity of food eaten, as 48% of the households used it. This implies that when households are faced with food shortages, the immediate strategy they adopt is to reduce the quantity of food eaten. As the food insecurity continues, other strategies which are more severe are used and in extreme cases, a strategy such as `doing things they don`t prefer' such as 'sending children to beg' are used. This was the least used strategy implying that extreme cases of food insecurity were not so many. Urban households in Abuja Nigeria [29], farming households in Forest Belt of the Central Region of Ghana [30] and smallholder farming households in Borno State, Nigeria [31] used reduction of quantity of meals as a coping strategy during food shortages.

Table 2. Results of logistic regression showing factors affecting household food security

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Gender	.175	.395	.195	1	.659	1.191	.549	2.585
Age	-.027	.019	2.045	1	.153	.974	.939	1.010
Duration_village	.026	.013	4.416	1	.036	1.027	1.002	1.052
Total_household	-.048	.036	1.697	1	.193	.954	.888	1.024
Raising_livestock(1)	-.158	.423	.140	1	.709	.854	.373	1.957
Irrigation_present(1)	1.157	.419	7.617	1	.006	3.180	1.398	7.231
Previous_training	.467	.462	1.018	1	.313	1.595	.644	3.947
Constant	-.233	.950	.060	1	.806	.792		

a. Variable(s) entered on step 1: Genre, Age, Duration in village, Total household, Raising livestock, Irrigation present, Previous training.

Table 3. Coping strategies used by households in the study area.

Coping strategy	Frequency	Percentage
Eating same food	45	28
Skipping meals	54	34
Reduction in quantity of meals	77	48
Begging or sending children to work to get food	35	22

4. Conclusions

The smallholder farmers in the Mount Bamboutos ecosystem were mostly men and were literate. Crop and animal production were the main sources of the livelihoods for these farmers. Out of the sampled households, 55 % were food insecure. The main factors affecting household food security in the study area are access to irrigation facility and duration of household head in the village. The first coping strategy adopted by respondents during food shortage is reduction in quantity of meals. The results of this study show that intervention strategies for food security should involve amelioration of crop production techniques such as building of irrigation facilities. More so political/social stability is very necessary where farmers will stay long in their villages without being displaced. Continuous training of farmers is equally very important for sustainable crop production for food security.

Acknowledgements

We acknowledge the financial support of the Darwin Initiative and TreeSisters. We also acknowledge the technical support of the International Tree Foundation (ITF) to this project. We are grateful to the smallholder farmers round Mount Bamboutos for their collaboration.

Statement of Competing Interests

The authors declare no competing interests.

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