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Abstract

Climate change is a threat to the livelihood and development of most African countries because it brings about decrease in agricultural production and drop in farm revenue. The negative effects are felt by a majority of resource limited persons resident in rural areas whose livelihoods depend entirely on agriculture. This study investigates the impact of climate change on crop production and development of Muyuka subdivision. Simple random sampling technique was used to select 30 farmers from each of the five communities (Mautu, Owe, Bafia, Ikata and Muyenge). Data collected on social characteristics of the respondents, impact of climate change on production and development were aged 40-49 years, had attained primary education, had been farming for 10-14 years and 25 years and above and were farming for both subsistence and commercial purposes. Farmers had been negatively affected by climate change as it brought about drop in yields of crops like plantain, cocoyam, maize and cocoa which are commonly grown in this subdivision. Climate change affected farmers most was increase sunshine intensity which caused drying of plants and ripening of cocoa pods before maturity. Adaptation is therefore necessary to reduce impact and ensure livelihood of farmers.

Keywords

Cameroon, Climate Change, Development, Impact, Livelihood, Poverty

1. Introduction

Climate change manifesting itself through temperature increases, rainfall reduction, new/increase pests and diseases incidence, drought and flood affects agricultural production and food security particularly in sub-Saharan Africa [1]. Reduction in rainfall reduces the availability of water for agriculture especially in Africa where agriculture is mostly rain-fed. Too much rainfall causes disease infestation in crops while too little can be detrimental to crop yield at crucial growing stage [2]. Increase in temperature brings about drying of crops and is also a favorable condition for the emergence of pests and diseases which attack crops and reduce yields. Climate change is a threat to the livelihood and development of most African countries because it brings about decrease in agricultural production and drop in farm revenue. The negative effects are felt by a majority of resource limited persons resident in rural areas whose livelihoods depend entirely on agriculture. Changes in climate will bring about drop in farm revenues and food insecurity because climate has direct impact on soil fertility, response of input and labor. Temperature increase in tropical regions will adversely affect the production of crops like rice, wheat, corn, beans and potatoes, which are major food crops for many people in

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Africa [3].Low rainfall and increased temperature recorded in 1997 in Northern Cameroon brought about starvation, malnutrition and poverty [2]. According to [4], the decline in yield in rain-fed agriculture could be as much as 50% and this will greatly threaten the achievement of the millennium development goal 1 (eradicate extreme poverty and hunger). The threats of climate change are more severe in developing countries because many low-income countries are located in tropical and subtropical regions which are particularly vulnerable to rising temperatures, and in semi-desert zones, which are threatened by decreasing water availability [5]. Agricultural yields will decrease and prices of food stuffs will increase causing food consumption to decrease in developing countries [6]. The impact of climate change on Africa is going to be the "Tiko drink-kumba drunk" syndrome as African countries which contribute so little to climate change will suffer most due to their limited capacity to adapt. Africa is said to be the most vulnerable continent to climate change since the continent is already exposed to food insecurity and poverty. Climate change has detrimental as well as beneficial consequences on agricultural production depending on the region. Increase temperature of 1- 3 °C benefits crop and pasture yields and lengthen growing season in temperate regions. However, warming above 3 °C is expected to have negative effects on production in all regions [4]. More rainfall increase the availability of water for agriculture in drought zones while increase concentration of CO_2 in the atmosphere will increase CO_2 fertilization and bring about increase in yields of some crops especially weeds.

Climate change affects rural development through droughts and floods causing migration to different areas for shelter which may result to conflict between social groups. Climate change imposes constrains to development especially among smallholder farmers whose livelihood depend on rain-fed agriculture [4]. The objectives of the study were to understand the social characteristics of farmers of Muyuka sub-division, investigate the impact of climate change on agricultural production and development and finally to identify the climatic event that had affected farmers most.

2. Methodology



Figure 1. The divisions of the Southwest region of Cameroon. Source: [7]

This study was carried out in Muyuka sub-division found in the Southwest region of Cameroon situated between latitude4°, 29' N, longitude 9°, 42' E and covering a total surface area of about 545.21km² [8]. The rainy season runs from mid March to October and dry season from November to mid March. Found at the foot of mount Cameroon, the rich volcanic soil has attracted many people into the communities of Mautu, Owe, Bafia, Ikata and Muyenge to practice farming. Thirty (30) farmers aged 20 and above and members of

Figure 2. Sketch map of Muyuka sub-division. Source: [8]

Common Initiative Groups (CIG) were randomly chosen from each of the five communities (Mautu, Owe, Bafia, Ikata and Muyenge). Data were collected by use of structured questionnaire on social characteristics of the respondents, impact of climate change on production and development and on the climatic event that had affected farmers most. Responses were analyzed using descriptive statistics (frequency counts, percentages, charts and tables).

3. Results and Discussion

3.1. Socio-Economic Characteristics of Respondents

The socio-economic characteristics of farmers are presented on table 1. Majority of the respondents (35.30%) were of the age group 40-49 years implying they were young and energetic. Most of the respondents (61.30%) were married and therefore had much responsibility on their shoulders and were expected to take farming seriously. Table 1 further showed that 24% of the respondents had informal education, 52.7% had primary, 14.7% had secondary, 8% had high school and 0.70% had tertiary. A low level of education is generally observed amongst farmers and this could affect their adaptation to climate change. Reference [9] noted that education is expected to influence the perception of farmers on climate change and enhance adaptation of innovation among farmers. Majority of the farmers (88.60%) had household size of 1-10 members implying there were many mouths to feed and decrease in crop yields might lead to hunger and starvation. Majority of the farmers had farming experience of 10-14 years (27.30%) and 25 years and more (26%). This further goes to confirm that farming is one of the economic activities in the area and most of the farmers have been farming long enough to have experienced changes in climate. As further shown on table 1, most of the farmers (62.00%) were landlords. Land just like capital and labour is an important factor of production and the impact of climate change will be more on tenants who depend solely on the productivity of the farm they are renting to feed their families and sell excess to generate income to pay the rents of the farm and take care of other basic needs. Majority of the respondents (94.70%) practiced farming for both subsistence and commercial purposes implying that they depend on their farms for subsistence and income cultivating both food and cash crops sometimes in a mixed system. Most of the farmers (80.70%) depend solely on agriculture as source of income. Agriculture remains the backbone of rural communities and is pivotal for their development. Anything that affects agriculture affects their livelihood.

3.2. Impact of Climate Change on Agricultural Production and Development

When asked the question whether climate change had affected them, all the farmers were affirmative that climate change had adversely affected their livelihood (table 2).These results confirm that climate change is a great threat to the livelihood of farmers and adaptation is necessary since agriculture is the main source of food and revenue. Impact of climate change on crop production is presented on table 3. As shown the table, 78.80% of farmers cultivating plantain noticed a decrease in plantain yields and 43.20% of those who cultivate cassava noticed decrease in yields. In the same way 93.30% of farmers cultivating cocoyam realized decrease in yields just like 93.10% of those cultivating egusi observed decrease in their yields. Amongst those farmers cultivating maize, 88.50% said they had observed decrease in yields too. Generally, there is an observed decline in food crops due to low rainfall, temperature increase, increase sunshine intensity and increase prevalence of pests and diseases except for cassava yields where 42.00% of farmers noticed that it had remained unchanged. The results obtained are similar to [10] who noted that farmers in Ghana observed decline in maize and cocoyam yields as a result of increasing temperature, rainfall reduction and increasing occurrences of pests and diseases. Significant decrease in the yields of stable food crops like plantain, cocoyam and maize will greatly affect food security and the livelihood of farmers given that they greatly rely on the productivity of these crops for their sustenance and income. Hunger and malnutrition will be experienced as a result of poor yields thereby making these communities more vulnerable to climate change. The fact that cassava yields has not been greatly affected like other crops (maize, cocoyam, plantain etc.) might mean that cassava is not very sensitive to climate change like other crops. This is likely because cassava has the ability to withstand poor environmental conditions such as low rainfall and infertile soil making it to survive even when other crops fail. According to [11] cassava is a Rambo food crop because it still survives despite all that the climate throws at it. Cassava's survival is due to the fact that the crop is drought resistant, resists high temperature, can deal with low rainfall and is not highly susceptible to pests and diseases like other crops [11]. Furthermore, 87.8% of farmers cultivating cocoa perceived a decrease in cocoa yields while 6.10% said yields had increased and another 6.10% noticed that yields had remained same. Sensitivity of cocoa to sunshine and rainfall makes it vulnerable to climate change. Studies carried out by [12] in Nigeria showed that decrease in yield of cocoa was due to high susceptibility of cocoa plant to drought conditions often associated with increase temperature and decrease in rainfall amount. Prolong dry season increases mortality of cocoa seedlings and water deficit in mature cocoa plant results in low yields. Increase temperature favors pests like capsid which attack the cocoa beans and make them lose weight while rainfall variability favours the black pod disease which affects ripening of the cocoa pod. Concerning palms production, 24.30% of the farmers cultivating palms were of the opinion that palms yields had increased, 35.10% noticed decrease and 40.50% said unchange.

Analysis of the impact of climate change on development is presented on figure 3.As shown on the figure, majority of the farmers (60.00%) were of the view that climate change had entrained poverty into the community. Farming is the principal activity in these communities and farmers depend on farm output for income. Similarly [2] reported that increase temperature and decrease in precipitation would cause revenues from agricultural products in Cameroon to drop. To 23.20% of the respondents climate change has brought hunger into the community as crops no longer produce well and farming being the main source of sustenance makes most families to live in hunger. Hunger currently affects about half of African's population and is expected to worsen if the current trends are not halted or reversed [13]. Another 9.30% of the farmers reported that climate change has increased cases of school dropout as much money is not made from sales making it difficult for parents to acquire school requirements and pay school fees for their children. This is in line with [4] that climate change will affect achievement of millennium development goal 2 (Achieve universal primary education). Some 4.20% of respondents think hunger and poverty expose people to illnesses and social vices like stealing of produce from others farms while 3.30 % of respondents were of the view that climate change has brought about deterioration of living standards because the poor yields and low income made from sales cannot permit farmers to feed well, construct houses and acquire other facilities to ameliorate their standard of living.



Figure 3. Impact of climate change on development.

Table 1. Socio-economic characteristics of respondents.

Social characteristics	Frequency	Percentage
Gender		
Male	75	50
Female	75	50
Age		
20-29	24	16
30-39	27	18
40-49	53	35.3
>50	46	30.7
Marital status		
Single	32	21.3
Married	92	61.3
Divorced	8	5.3
Widow/widower	18	12
Level of education		
No formal education	36	24
Primary	79	52.7
Secondary	22	14.7
High school	12	8
Tertiary	1	0.6
Household size	1	0.0
1-5	62	41.3
6-10	71	47.3

$\begin{array}{ccccccccc} 11-15 & 12 & 8 \\ >15 & 5 & 3.3 \\ \end{array} \\ \begin{array}{ccccccccccccccccccccccccccccccccccc$	Social characteristics	Frequency	Percentage
>1553.3Years in farming<5	11-15	12	8
Years in farming <5	>15	5	3.3
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Years in farming		
	<5	15	10
	5-9	20	13.3
15-19 8 5.3 20-24 27 18 Land tenure system 18 Landlord 93 62 Tenant 28 18.7 Both 29 19.3 Purpose of farming 1 0.6 Commercial 7 4.7 Both 142 94.7	10-14	41	27.3
20-242718Land tenure systemIandlord9362Tenant2818.7Both2919.3Purpose of farmingIandlordIandlordSubsistence10.6Commercial74.7Both14294.7	15-19	8	5.3
Land tenure systemLandlord9362Tenant2818.7Both2919.3Purpose of farming0.6Commercial74.7Both14294.7Source of income142	20-24	27	18
Landlord9362Tenant2818.7Both2919.3Purpose of farming0.6Commercial74.7Both14294.7Source of income142	Land tenure system		
Tenant2818.7Both2919.3Purpose of farming0.6Subsistence10.6Commercial74.7Both14294.7Source of income142	Landlord	93	62
Both2919.3Purpose of farming0.6Subsistence1Commercial7A.7Both142Source of income	Tenant	28	18.7
Purpose of farming Subsistence 1 0.6 Commercial 7 4.7 Both 142 94.7 Source of income	Both	29	19.3
Subsistence10.6Commercial74.7Both14294.7Source of income14294.7	Purpose of farming		
Commercial74.7Both14294.7Source of income142	Subsistence	1	0.6
Both 142 94.7 Source of income	Commercial	7	4.7
Source of income	Both	142	04.7
	Source of income	142	94.7
Agriculture 121 80.7	Agriculture	121	80.7
Commerce 0 0	Commerce	0	0
Both 29 19.3	Both	29	19.3

Field survey 2012

Table 2. Farmers affected by climate change.

Affected by climate change	Frequency	Percentage
Yes	150	100

Field survey 2012

Table 3. Impact of climate change on crop production.

Production	Trend of production	Frequency of farmers	Percentage of farmers
Plantain	Increased	13	9.80
	Decreased	104	78.80
	Unchange	15	11.40
Cassava	Increased	13	14.80
	Decreased	38	43.20
	Unchange	37	42.00
Cocoyam	Increased	5	3.70
	Decreased	125	93.30
	Unchange	4	3.00
Egusi	Increased	2	2.80
	Decreased	67	93.10
	Unchange	3	4.20
Maize	Increased	6	7.70
	Decreased	69	88.50
	Unchange	3	3.80
Cocoa	Increased	8	6.10
	Decreased	115	87.80
	Unchange	8	6.10
Palms	Increased	9	24.30
	Decreased	13	35.10
	Unchange	15	40.50

Field survey 2012

3.3. Climatic Event which Affected Farmers Most

Farmers were interrogated on climatic event which affected them most and results presented on figure 4 show that majority of farmers (46.5%) had been negatively affected by intense sunshine (drought). Too much sunshine dries up plants before they are matured making farmers to plant same piece of land more than once thereby increasing the work load especially for women who already have much on their hands. Ripening of cocoa pods before maturity has been observed as a result of increase sunshine intensity. Agriculture in Africa and Cameroon in particular is mostly rain-fed and low rainfall reduces the availability of water needed by plants. Farmers equally depend on rain water to spray their farms and low rainfall in recent years has rendered this task difficult and it is for these reasons that 21.3% of farmers said low rainfall had affected them most. Another 13.1% of farmers said increase temperature had affected them most because it comes along with diseases like malaria which reduce labour productivity and in turn affects yields. This increase in temperature is also a favorable condition for emergence of pests and diseases which 19.1% of farmers said had affected them most since they attack food and cash crops making them not to produce well.



Figure 4. Climatic events which affected farmers most.

4. Conclusion

Climate change is a serious threat to the livelihood of farmers bringing about drop in yields of plantain, cocoyam, egusi, maize and cocoa which are the main sources of food and revenue in Muyuka Sub-division. Cassava and palms are not very sensitive to climate change. The impacts of climate change on development have been poverty, hunger, school dropout, stealing and deterioration of living standards resulting from drop in crop yields. Climatic event which affected farmers most in the study area was intense sunshine because it caused drying of crops before they were matured making farmers to plant the same piece of land over again. Since agriculture is the main source of food and income for these communities, adaptation of the agricultural sector is necessary to reduce vulnerability of these communities and ensure their livelihood. Based on these results it is therefore recommended that crops such as cassava and palms which are less sensitive to climate change should be cultivated.

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