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Climate Change Situation in Zamfara State: Farmers' Awareness and Agricultural Implications

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Abstract
Farmers' awareness on climate change and the agricultural implications in five local governments of Zamfara state were carefully investigated. The research methodology utilized a Rapid Rural Appraisal approach to interview the farmers on the basis of targeted and influential factors such as awareness, mitigation and adaptation strategies and the sources of information on climate change. A batch of 300 local farmers was interviewed in each of the five local governments. The outcome of the study revealed to a high degree that while the farmers are aware of the climate change and its agricultural consequences, the different options utilized for the handling of its challenges are crude (i.e. low grade) with great perception that adaptation strategies are likely to be more effective for the region.
Keywords: Climate change; implications; knowledge; farmers; handling.

1.0 Introduction

According to IPCC (1-5), climate change is the observable change (often using statistical means) in the state of climates over long periods of time identified or occasioned by the variability of its properties. While time it takes for the changes to become noticeable is important,the level of deviation from the normal and its impacts on the ecology are most paramount. Climate change is the end product of a changing climate (2-6). Studies have shown that global or regional climate was never static and that one of the inherent properties of climate is variability. For example, over geological time, global temperatures have usually varied from glacial through cold, moderate and warm (3-8).

Human beings are the most important members of ecosystems and environment (consisting of all factors – social, physical, and cultural) and its surroundings exist to support their development and activities (4-10). However, in the quest for development and comfortable life, man's activities such as exploitation of resources, sustenance and creation of wealth-proving detrimental to the environment. While man is fast becoming the main problem in all of global warming and environmental issues, the solution also lies in his hands (4).

Climate change increases average global temperature with subsequent attendant effects on human life and the natural environment part of which include rising sea levels, changes in climate patterns, change in the amount and pattern of precipitation, and more severe weather including stronger tropical storms, droughts, and heat waves especially in the subtropical desert regions (3, 11-15). In Sub-Saharan Africa, there had been persistent drought and desertification in recent years, and all indicators point to the trend continuing (4, 16-18).

However, there are considerable efforts by governments and researchers to device ways of either mitigating or adapt to the effects of climate change (5, 19, 20). Parts of the mitigation strategies include reduction in greenhouse emissions, reduction of deforestation; increase in afforestation; modification of agricultural practices to reduce emissions of greenhouse gases and build up soil carbon as contained in the Paris agreement (1, 3, 20-25). As for adaptation, the key strategies employed by the stakeholders include changing the cropping patterns; stopping further development on wetlands, flood plains, and close to sea level; developing crops that are resistant to drought (26-32).

Studies have established that developing countries such as Nigeria are the least, or in some cases not prepared for the impact of sustained climate change (6, 20-25). Nigeria has been relatively lucky not to have experienced major climate-change-induced natural disasters, the effect of climate change is evidenced by rise in sea level and erosion along the nation's coastline; the weather pattern is no longer distinct in the country, we have witnessed very hot weather conditions and high precipitations leading to flooding which ruined crops in parts of the country creating food scarcity, the latest being Jigawa State; gully erosion has sacked many communities especially in Edo and Anambra States; as a result of persistent drought, the Lake Chad has almost dried up, while there had been persistent desert encroachment in the north.

1.1 Study Objectives

With 'Farming is our Pride' as the state's slogan, Zamfara is largely an agrarian state with the overwhelming majority of its people engaged in one form of farming practice or the other. However, there agricultural output has not been impressive recently. With increasing threat of desertification, reduced precipitation levels and increasing average ambient temperature, there is an urgent need to study the farmers' awareness and response to the changing environmental conditions. The primary aim of this paper therefore is to study the implications of climate change on agricultural practices in the state.

2.0 Materials and Methods

2.1 Description of the Study Area

Figure 1 below illustrates the map of Zamfara state Nigeria showing the selected Local Government areas considered for the research. Geographical information revealed the region to enjoy a tropical type climate. Agricultural activities are the major economic activities of the inhabitants in the state. Zamfara state share borders with Katsina, Niger and Sokoto with relatively similar climate and single rainfall maxima pattern encountered in most northern states of Nigeria. Farmers in the selected study areas are specifically involved in cultivation of food crops like rice, sorghum, millet, cassava, etc. with few cases of cotton and sugarcane production.

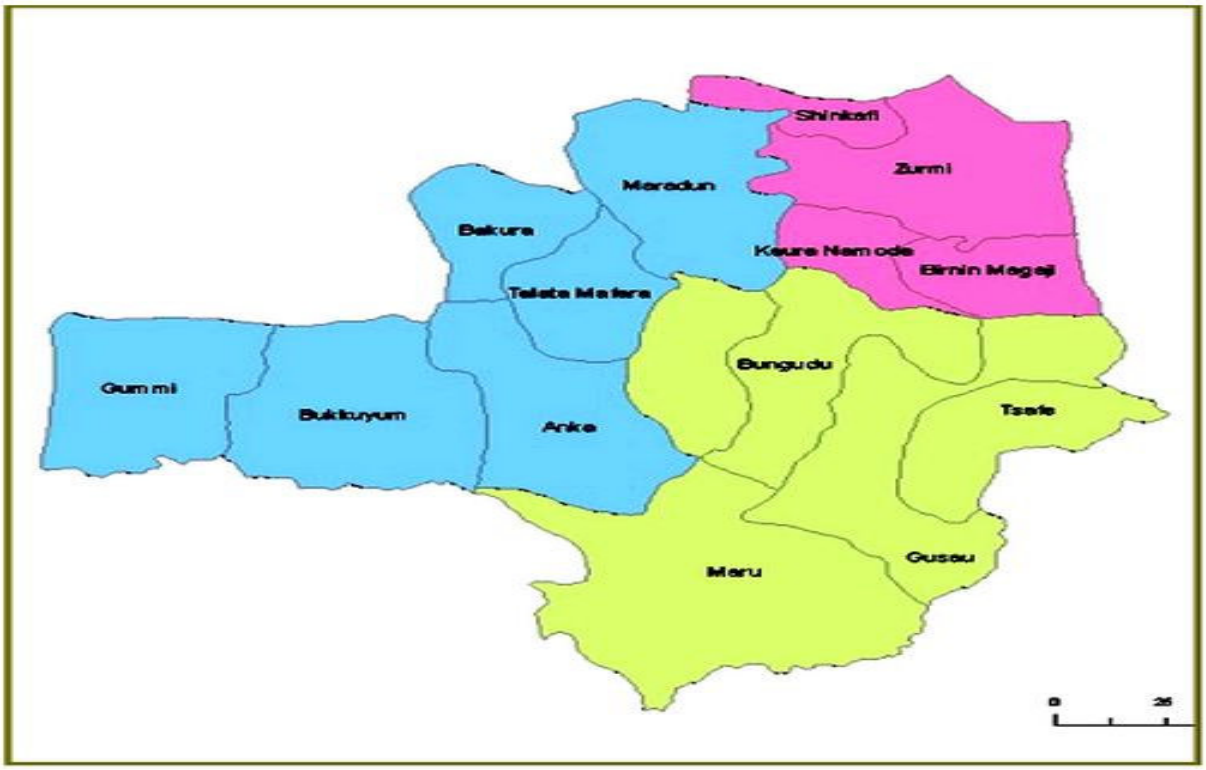

Figure 1. Geographical map of the study area (Zamfara State).

2.2 Research Methodology

Batch of 300 farmers across five (5) local government areas of Zamfara state were interviewed by issuing out systematically-designed questionnaires. The selection of interviewees was done using a multistage random sampling technique. Rapid Rural Appraisal involving transect-walks, identification and inspection of farmlands was used to encourage the respondents to describe their relationships with their natural resources, particularly the indigenous adaptive measures.

The interview schedule was divided into five (5) sections (A-E). Sections B-E, however, had more relevance to the main aim of the research. Section B determined rural households' climate change awareness. Respondents were asked to indicate the extent to which variables such as high/low rainfall, floods, food insecurity and hunger, extinction of animal and planting species, desertification etc represented their level of climate change awareness. Section E looked at the effective indigenous, emerging technologies and innovations adopted by the farmers to mitigate the negative effects of climate change in their neighborhoods.

3.0 Results and Discussion

All the respondents are engaged in Subsistence farming which is explained by the observation that nearly all the farmers are married with Bungudu (70%) having the lowest percentage of married respondents. Also, the dominant commodities being cultivated are food crops such as sorghum, millet, maize and rice.

3.1 Awareness to Climate Change

The results shown in Table 1 indicated that there is a general but poor level of awareness to climate change. Kaura Namoda while having the highest people (20% of the respondents) having excellent awareness, also has, alongside Zurmi and Maru, the highest respondents (50%) each with poor level of awareness. Bungudu (with 18% of the respondents having excellent awareness, second only to Kaura and 21% having poor awareness, the

lowest of all the respondents in the five local governments) is the local government with the most adequate knowledge of climate change and its effects.

Table 1: Showing the level of awareness to climate change.

	Local Government (%)				
	Tsafe	**Zurmi**	**K/Namoda**	**Bungudu**	**Maru**
Excellent:	-	10	20	18	10
Very Good:	13	05	05	12	07
Good:	20	15	05	14	18
Fair:	30	20	20	35	15
Poor:	37	50	50	21	50
Total	**100**	**100**	**100**	**100**	**100**

3.2 Source of Information on Climate Change

There are no respondents who reported sourcing their information on climate change from the politicians (as shown in Table 2) in all the five local governments. This is particularly worrisome as Zamfara is classified as one of the frontline states that are vulnerable to desertification (NASPA, 2012). While most of the respondents reported mass media (radio and TV) as their primary source of information (Zurmi with 50% having the highest and Bungudu with 34% having the lowest). Tsafe has the lowest number of respondents (0%) who sourced their information from extension workers but the highest respondents (20%) whose sources are friends and colleagues.

Table 2: Indicating the source of information on climate change.

	Local Government (%)				
Source	**Tsafe**	**Zurmi**	**K/Namoda**	**Bungudu**	**Maru**
Extension workers:	30	25	35	15	16
Friends:	20	10	10	13	08
Cooperatives:	-	05	10	20	22
Radio/TV:	40	50	42	34	49
Internal:	10	10	03	18	05
Politicians:	-	-	-	-	-
Total	**100**	**100**	**100**	**100**	**100**

3.3 Adaptive Measures

Due to general, even if poor knowledge of climate change, farmers in the five local governments have taken some measures that will help them to adapt to the effects of the observed changes in climatic conditions. Table 3 showed that some of the measures taken include planting of cover cropping, mixed farming practices and use of crop varieties with short harvesting period. Respondents in Zurmi (45% and 30% respectively) employ the use of cover cropping and crop varieties that are well acclimatized to the climate conditions more than the other local governments. Tsafe (30%) which closely follows Zurmi in the use of cover cropping use pet resistant crops and mixed farming practice (15%) more than the others.

Table 3: Showing the adaptive measures employed by the respondents.

	Local Government (%)				
Measures	**Tsafe**	**Zurmi**	**K/Namoda**	**Bungudu**	**Maru**
Planting Cover Crops	30	45	18	20	28
Planting Pest Resistance Crops	32	05	30	15	22
Mixed Farming Practice	15	-	10	15	05
Use of crop Varieties that are well acclimatized:	18	30	02	20	35
Use of Crops that are harvested in short period:	05	20	40	30	10
Total	**100**	**100**	**100**	**100**	**100**

3.4 Mitigative Measures

Respondents from Tsafe local government (as shown in Table 4) with 40% employ Afforestation as a measure of mitigation effect the least but use contour bounds (30%) the most. Farmers in Kaura (about 79%) significantly employ afforestation. Zurmi, a rural community, drain wetlands for crop production (38%) more than the remaining local governments.

Table 4: Mitigation Measures
Local Government (%)

Measures	Tsafe	Zurmi	K/Namoda	Bungudu	Maru
Reforestation/Afforestation:	40	42	79	60	72
Making Contour bounds around farmlands:	30	20	10	30	18
Draining of wetlands for crops production:	30	38	11	10	10
Total	**100**	**100**	**100**	**100**	**100**

4.0 Conclusion

The awareness of farmers on the phenomenon of climate change in Zamfara state was established. The menace has affected agricultural output from the area over the years. While there is a generally poor appreciation of the deep impacts of climate change, the farmers have nevertheless developed strategies to protect their produce from its effects (mitigation). There were also handling parameters which include the use of acclimatized seedlings; cover cropping, mixed farming and using crops with short harvesting period. For mitigation, the respondents utilize reforestation/afforestation and use of contour bounds. Clearly, while the degree of awareness is high, the perception of the farmers on the menace of climate change is poor as there are no programs in place that will help them understand and device improved methods of handling climate change problems and associated consequences.

4.1 Recommendations

1. Government should devise new campaign strategies to improve climate change awareness.
2. Inclusion of climate change in syllabus of secondary and post-secondary institutions will be helpful in handling the problems.
3. Adoption of modern strategies by farmers is hereby encouraged. This will however require an unconditional government subsidy on equipments and agricultural/farm inputs.

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