



## Farmers' Perception of the Influence of Climate Change on Agricultural Production in Gombe State, Nigeria

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### ABSTRACT

The purpose of the study was to find out Farmers perception of the influence of Climate Change on Agricultural Production in Gombe State. Four research questions were formulated. The study adopted the descriptive survey design. The area of the study was Gombe State. The population from which the farmers were sampled was 438 registered farmers while the sample size was 131 respondents selected using simple random sampling technique. The instrument for data collection was a questionnaire. The data collected were analyzed using mean and standard deviation. Findings of the study revealed that from the perspective of the respondents, deforestation, bush burning and burning of fossil fuels like coal were the major causes of climate change. The finding also revealed that flooding resulting from climate change destroyed plants, animal species and spread diseases. Improving afforestation, avoidance of bush burning and avoidance of deforestation were identified as the strategies needed to mitigate the effects of climate change. The study recommended that Extension Agents should discourage farmers from deforestation and bush burning by embarking on effective campaign on the causes and consequences of climate change. Agricultural Extension agents should educate the farmers and general public on the danger of flooding as it affects agricultural production, adopt the use of improved varieties of crop plants that are resistance to drought, weeds, pests and diseases. Government should embark on awareness campaign on climate change and strategies for mitigation of climate change.

**Keywords:** Farmers perception, Influence, Climate Change, Agricultural Production.

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### INTRODUCTION

Climate change is one of the most serious environmental threats facing mankind worldwide. It affects agriculture in several ways, including its direct impact on food production. The Intergovernmental Panel on Climate Change IPCC, (2014) which built on the Fourth Assessment Report published in 2007, defined climate change as a change in a state of climate that can be identified by using statistical test or by change in the mean and or the variability of its properties that persist for an extended period of time or longer. According to Ibrahim, David, and Okpanachi (2010), climate change can be regarded as changes in the atmospheric condition of the earth surface which is brought about by emissions of certain gases due to natural occurrences and human activities. It is the shift in weather variations or patterns involving overall and unprecedented changes in weather patterns, which may include

unusual changes in rain, yield, precipitation, temperature, density or cloud look (Patrick, 2012). According to Ali, (2011) climate change has the potential of affecting all natural and human systems and may be a threat to human development and survival socially, politically and economically. He further stated that many systems are tied to climate, such that a change in climate can affect many related aspects. These include where and how people, plants and animals live, such as food production, availability and use of water, and health risks and it is becoming an environmental, social and economic challenge on a global scale.

The African continent is believed to have contributed very little to anthropogenic climate change, but the impact on Africa is believed to be very high. This is attributed to the continent's low adaptive and mitigation capacity, over-dependence on agricultural sector and existence of many other stressors. The negative consequences of climate change in Africa are already happening as indicated by frequent floods, droughts and shift in marginal agricultural systems (Challinor *et al.*, 2014). Climate change poses a serious risk to poverty reduction and threatens to undo achievements of decades of development efforts (IPCC, 2010). Josphine and Amaechi (2014) also observed that the adverse effects of climate change are already evident with natural disasters becoming more frequent and more devastating and developing countries becoming more vulnerable. While climate change is a global phenomenon, its negative impacts are more severely felt by poor people and poor countries. The poor are more vulnerable because of their high dependence on natural resources, and because of their limited capacity to cope with climate variability and extremes (IPCC, 2010).

In 21<sup>st</sup> century, climate change is posing the greatest threat to food security particularly in many of the poor, agriculture-based countries of sub-Saharan Africa (SSA) with their low capacity to effectively cope with it. Nellemann, Mac Derette, Mandas, Eickhout, Svihus, Prins and Kaltenborn (2009) reported that climate change affects the biodiversity, food security, water availability, and productivity levels in Africa.

Bruckner (2012) said African continent is one of the most vulnerable continents due to its high exposure and low mitigation and adaptive capacity. The vulnerability of the African continent is only due to low level of economic development that makes less and low capacity to adapt the impacts of climate changes. He further stated that in developing countries, risks are higher in agriculture than any other sector. This is attributed to the fact that -climate change affects the two most important direct agricultural inputs, precipitation and temperature. African countries are more affected by climate change because of their reliance on agriculture as well as their lower financial, technical, and institutional capacity to adapt (Rose, 2015). Climate change also indirectly affects agriculture by influencing emergence and distribution of crop pests and livestock diseases, exacerbating the frequency and distribution of adverse weather condition, reducing water supply and irrigation.

Nigeria is one of the Sub Saharan African countries where agriculture is important. Due to the significance of agriculture to man and industries, many people engage in agricultural production. Nigeria's economy is therefore predominantly agrarian and the exploitation of natural resources remains the driving force for the country's economic development. Nigeria's agriculture therefore depends highly on climate because temperature, sunlight, water, relative humidity are the main drivers of agricultural productivity (Akinnub *et al.*, 2012). Climate change is also predicted to have adverse effect on the agricultural sector of the poorer parts of the world especially Sub Saharan African which Nigeria is inclusive. Most of agricultural activities in that part of the world are low technology based and therefore heavily susceptible to environmental factors due to poor knowledge about climate change

implication. There are two dimensions to the issue of climate change in Nigeria. The first, already acknowledged by households and communities across Nigeria, and reported by the Nigerian Meteorological Agency (NIMET) (2008), is changes that have already been observed in climate parameters such as temperature, rainfall and extreme weather events. The second deals with changes that are to be expected in the future.

Recently, issues of climate variability and change have been on the front burner of society's environmental discourse the world over. This is because of the precarious state of the global environment which is now possessed by eminent unpredictable weather conditions resulting in climate variability and change, yet there may be deficiency especially in areas where dissemination of information is a problem. This has become critical because climate change will significantly affect agricultural production such as livestock keeping, fishing and forest-dependent people, particularly in areas with persistent soil and water scarcity, high exposure to floods, droughts, which increases poverty and hunger (Mark *et al*, 2013).

In most studies, Farmers level of understanding of climate change seems to be low regarding their experiences in change and length of seasons, incidence of environmental hazards such as flood, droughts, and crop failures, long term shift in wind speed, change in rainfall intensity and uncertainty of rain (Mama and Osinem, 2007).

Rahman (2008) reported that perception of climate change as a threat across the world has been increasing over the years, thanks to the severity and increased frequency of climate change impacts. UNDP (2007) said but it is still not considered a priority environmental issue especially in the developed countries. According to Pew Research Centre (2013) various studies show that people in developing countries are more likely to perceive climate change as a threat that may affects the whole communities and human endeavor. Contrary results were, however, reported by Peterman *et al* (2009) states that climate change is more likely to be perceived as a serious problem in the developed world than in developing countries, despite developing countries being the most vulnerable to climate change impacts. Society is today presented with climate change challenges.

Climate change is a major and perhaps the most critical of all the environmental challenges which confront societies in the present century. Strong scientific evidence indicates that drifting climate change and variability pose a serious environmental concern for agricultural production today than ever before (IPCC, 2010). Nwankwo and Unachukwu (2012) indicated that farmers need to be educated on causes and effects of climate change. Boon (2010) and Ekpoh and Ekpoh (2011), reported that farmers have poor knowledge and understanding of climate change. Vujovic (2013) also reported that only few farmers had deep scientific knowledge and understanding of climate change risks. There is much scientific evidence on the phenomenon of climate change globally but little researches have been dedicated to understanding of farmers' perception of the causes, effect and mitigation of climate change in Gombe State. There is a need for the understanding of the concept of climate change by farmers so that they will have basic idea in dealing with and managing the issue of climate change.

## METHODOLOGY

Design of the study is descriptive survey research design. The area of the study is Gombe State, located in the north-east of Nigeria at the Latitude of 10°15'00" N and Longitude of 11°10'00" E and has a boundary with four states namely Bauchi state from the west,

Adamawa State from the south, Borno State from the east and Yobe State from the north. The area is about 18,768 square kilometers. The climate of Gombe is warm to hot and humid, while the average daily temperature is about 26°C/79°F and it cools down at night to about 16°C/61°F. The altitude in Gombe is varied, from 767 to 1,606M (2,516-5,269ft) (Rahman, 2008).

The population of the study area consists of 438 registered farmers. Simple random sampling technique was used in selecting 30% (131) of the respondents, using table of selecting sample (Krejcie and Morgan, 1970). The instrument for data collection was a structured questionnaire. The instrument posed questions on demographic characteristics, effects of climate change on agricultural production, and mitigation strategies of climate change. Validity of the instrument was determined by three experts from Faculty of Agriculture, Abubakar Tafawa Balewa University, Bauchi. Their suggestions, observations and corrections were used to improve the Instrument. Reliability of the instrument was determined using split half method to obtain a Cronbach Alpha coefficient of 0.86. The data was collected by administering the instrument to the respondents and analyzed using descriptive statistics of means and standard deviation.

## RESULTS AND DISCUSSION

### Farmers' perception of the causes of climate change in Gombe State

In Table 1, the results showed the mean responses and standard deviation of the farmers' perception on the causes of climate change in Gombe State.

**Table 1:** Farmers' perception of the causes of climate change

S/No.	Statement	N	Mean	Std. Dev.	Decision
1.	Deforestation is one of the major causes of climate change	130	3.59	0.62	Agreed
2.	Bush burning is a factor that causes climate change	130	3.32	0.72	Agreed
3.	Erupting volcanoes which releases gasses in the atmosphere causes climate change'	130	3.20	0.74	Agreed
4.	Burning of fossil fuel like coal increase the level of carbon dioxide causes climate change	130	3.33	0.80	Agreed
5.	Emissions from combustion engines such as cars, heavy trucks, generators and other related engines causes climate change	130	3.26	0.71	Agreed
6.	Industrial activities are also major causes of climate change.	130	3.20	0.79	Agreed
7.	Urbanization is a factor that causes climate change	130	2.82	0.88	Agreed
8.	Gas flaring and leakage from oil companies causes climate change	130	3.08	0.82	Agreed
9.	Excessive use of chemicals on the farm causes climate change	130	2.86	0.83	Agreed
10.	Rise in demand for energy due to high population causes climate change	130	2.61	1.03	Agreed
	<b>Grand Mean</b>		3.17		

The result reveals that the farmers perceived all the ten (10) items as the causes of climate change in Gombe State with a grand mean of (3.17) The table also indicates that, the standard deviation ranged between 0.62 – 1.03, which showed that each of the values was below 1.96. This indicates that the responses were not too far from the mean. This implies that the respondents have the same perception on causes of climate change in Gombe state.

The findings of the study reveal that farmers perceived deforestation, bush burning and burning of fossil fuels like coal as the major causes of climate change. This finding is in line with that of Eze *et al.* (2014) and Okoroh (2011) who reported that bush burning, cutting down of trees, use of power generators, gas flaring from oil companies and burning of fossil fuels from vehicles, gases released from industries; excessive use of chemicals and crude oil spillage contribute to climate change. Umunakwe (2011) also reported that the causes of climate change include gas flaring, and natural phenomenon. Furthermore, IPCC (2007) reported that the main cause of the current global warming trend is human's increase of the GHG in the atmosphere, which blocks heat from escaping to the space. Over the past centuries, the amount of GHG in the atmosphere has been relatively stable until its concentrations began to increase, due to the rising demand for energy caused by industrialization, high population, changing land use, bush burning and human settlement patterns (IPCC, 2011), which have resulted to climate change, it also added that the earth's climate has changed throughout history but the current warming trend is of particular significance because most of it is human-induced and occurring at an unmatched rate for the past centuries . In its recently released of the Fourth Assessment Report of IPCC group of 1,300 independent scientific experts from countries all over the world under the auspices of the United Nations, concluded that there is more than 90% probability that human activities over the past centuries have warmed planet earth (IPCC, 2007).

### Farmers' perception of the effect of climate change on Crop production in Gombe State

Results in Table 2 show the mean responses and standard deviation of farmers' perception of the effect of climate change on Crop production.

**Table 2:** Farmers 'perception of the effect of climate change on crop production in Gombe State

S/N	Statement	N	Mean	Std. Dev.	Decision
1.	Crop failure and poor harvest is a result of climate change	130	3.01	0.86	Agreed
2.	Climate change leads to high cost of agricultural production	130	2.96	0.87	Agreed
3.	Plant growth and development is affected by climate change	130	3.04	0.82	Agreed
4.	Flooding resulting from climate change can destroyed plants	130	3.33	0.75	Agreed
5.	Variation in rain pattern as a result of climate change can affects productivity	130	3.36	0.69	Agreed
6.	Climate change can affect agricultural land through soil degradation	130	3.26	0.64	Agreed
7.	Climate change leads to drought and result in food insecurity	130	3.14	0.92	Agreed
8.	Climate change leads to instability of rainfall and in return affects the anatomical and physiological functions of crop plants	130	3.06	0.92	Agreed
9.	Climate change displaces farming family, lead to migration thereby reducing crop productivity	130	3.12	0.79	Agreed
10.	Water pollution as a result of climate change lead to shortage of fresh water which in turn spreads pests and diseases that attack crop plants	130	3.23	0.76	Agreed

**Source:**

The findings on Agricultural production reveals that the farmers perceived all the items in Table 2 as the effect of climate change on crop production with a grand mean of 3.15. The table also indicates that the standard deviation values ranged from 0.64 – 0.92 which showed that each of the value was below 1.96. This indicates that the responses were not too far from the mean.

The finding also revealed that farmers perceived that flooding and variation in rain pattern resulting from climate change destroyed plants and affects their productivity. This is due to the rising demand for energy caused by industrialization, changing land use, and bush burning may result in flooding. Khanal (2009) reported that agriculture is highly sensitive to climate variability and weather extremes, such as droughts, floods and severe storms. While food production may benefit from a warmer climate, the increased potential for droughts, floods and heat waves will pose challenges for agriculture, thereby affecting farming activities. Audu *et al*, (2010) also reported that climate change has altered the natural hydrological calendar to the extent that the life cycle of most insect pests which were controlled or disrupted with the onset of rainfall which is now inconsistency has resulted in the strengthening of the lifespan of those biological pests and further destruction of forest and agricultural crops.

#### Farmers' perception of the effect of climate change on animal production in Gombe State

Results in Table 3 shows the mean responses and standard deviation of the farmers' perception on the effect of climate change on animal production.

**Table 3:** Farmers' perception of the effect of climate change on animal production in Gombe State

S/No.	Statement	N	Mean	Std. Dev.	Decision
1.	Heat stress as a result of climate change, decreases milk production in animals.	130	3.23	0.77	Agreed
2.	Climate change leads to increased cost of animal production	130	2.86	0.81	Agreed
3.	Animal growth and development is affected by climate change	130	3.03	0.85	Agreed
4.	Flooding as a result of climate change destroyed animals and spread diseases	130	3.32	0.74	Agreed
5.	Climate change affects animal biodiversity e.g. genes, species, and breeds.	130	3.06	0.75	Agreed
6.	Heat stress as a result of climate change decreases feed intake in farm animals	130	2.98	0.84	Agreed
7.	Temperature increases due to climate change could accelerate the growth of parasites in farm animals	130	3.00	0.84	Agreed
8.	Drought or flooding caused by climate change affects the growth and development of feed crops and grazing system	130	3.15	0.77	Agreed
9.	High temperature as a result of climate change affects animal reproduction	130	3.15	0.83	Agreed
10.	Water pollution as a result of climate change leads to shortage of fresh water for animals' intake	130	3.18	0.78	Agreed

**Source:**

The result reveals that the farmers perceived that all the items in Table 3 are the effect of climate change on animal production with a grand mean of 3.10. The table also indicates that the standard deviation ranged between 0.75 – 0.85 which showed that each of the value was below 1.96. This indicates that the responses were not too far from the mean.

The finding of the study further reveals that farmers perceived that flooding and heat stress due to climate change destroyed animal species, spread diseases, decreases milk, meat and eggs production in animal husbandry. The implication of this is that, climate change may induce flooding and shifts in diseases spreading, outbreaks of severe disease, or even introduce new diseases, which may affect livestock that are not usually exposed to environmental conditions. The finding is in agreement with that of Ayinde, Muchie and Olatunji (2011) found that climate change can also affect the quantity and quality of feed stuffs such as pasture, forage and grain and also the severity and distribution of livestock diseases and parasite in agricultural sector. Livestock products are an important agricultural commodity for global food security because they provide 17% of global kilocalorie consumption and 33% of global protein consumption. Henry *et al.*, (2012) reported that potential impacts on live-stock include changes in production and quality of feed crop and forage. These impacts are primarily due to an increase in temperature and atmospheric carbon dioxide (CO<sub>2</sub>) concentration, precipitation variation, and a combination of these factors.

### Strategies to mitigate the effects of climate change on Agricultural Production in Gombe State

Table 4 shows the strategies needed for mitigating the effects of climate change on agricultural practices.

**Table 4:** Strategies for mitigating the effects of climate change on Agricultural Production in Gombe State.

S/No.	Statement	N	Mean	Std. Dev.	Decision
1.	Avoidance of bush burning	130	3.34	0.77	Agreed
2.	Avoidance of deforestation	130	3.34	0.86	Agreed
3.	Adoption of appropriate tillage practices in growing crops	130	3.01	0.81	Agreed
4.	Bio-Energy use reduces climate change effects	130	3.03	0.82	Agreed
5.	Reduction in the use of generators and heavy engines mitigate climate change effects.	130	3.20	0.76	Agreed
6.	Construction of wide drainage channels for flood control is part of climate change mitigation.	130	3.03	0.83	Agreed
7.	Improving afforestation can reduce the effect of climate change	130	3.53	0.68	Agreed
8.	Adjusting animal diets can also be used as a mitigation measure	130	2.83	0.84	Agreed
9.	Planting of crops and breeding animals according to local climate conditions	130	3.03	0.84	Agreed
10.	Use of stress resistance breeds of animals and varieties of crops can mitigate the effects of climate change	130	3.06	0.75	Agreed

#### Source:

The result reveals that the farmers perceived all the items in Table 6 as the strategies for mitigating the effects of climate change on Agricultural Production with a grand mean of

3.14. The table also indicates that the standard deviations ranged between 0.68 – 0.86 which showed that each of the value was below 1.96. This indicates that the responses were not too far from the mean.

The findings reveal that farmers perceived improving afforestation, avoidance of bush burning and deforestation as the strategies for mitigating the effects of climate change on agricultural practices. Climate change mitigation involves measures that reduce the amount of the factors that increase the effects of climate change on Agricultural Production which includes afforestation, bush burning, and land clearance. This finding is in consistent with Gerber *et al* (2013) who noted that climate change is a complex phenomenon which became a global issue from the mid to late 20th century on-wards. Climate change is a change in global or regional climate patterns which is attributed to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels. Also, Bernard (2012) noted that climate change as a short-term or long-term alteration of the statistical properties of a climate system. Such a change can be temporary or permanent, regional or global. Global climate change occurs as a result of the accumulation of emitted GHGs to levels that the atmosphere is warmed up. The major causes of this warming to the rising stocks of GHGs in the atmosphere including carbon dioxide (CO<sub>2</sub>), me-thane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), chloro and fluoro-carbons and a number of other gases that arise from industrial processes. Agriculture depends largely on environment and any prolonged fluctuations in average weather can affect its productivity. To address climate change and promote sustainability in agriculture, tangible progress on implementation of strategies for mitigation and adoption of the agricultural sector need to be harnessed and pursued.

## CONCLUSION AND RECOMMENDATIONS

It was concluded from the study that most of the farmers in the study area perceived deforestation, bush burning, erupting volcanoes, emissions from combustion engines, industrial activities, gas flaring, rise in demand for energy and burning of fossil fuel like coal as the major causes of climate change. Farmers perceived flooding, crop failure, plant growth, agricultural land, drought, instability of rainfall, shortage of fresh water, displacement of farming family and variation in rain pattern as the major effects of climate change on crop production while animal growth and development, destruction of animals, spread of diseases, animal biodiversity, growth of parasites, feed crops and grazing system, shortage of fresh water, animal reproduction and heat stress as the major effects of climate change on animal production. It was clear from this study that farmers perceived improving afforestation, appropriate tillage practices, bio-energy use, reduction of generators use, construction of wide drainage, use of resistance breeds, avoidance of bush burning and deforestation as the strategies for mitigating the effects and causes of climate change on agricultural practices.

Based on the findings of the study, the following recommendations were made: -

1. Extension Agents should emphasize campaign to discourage deforestation and bush burning to reduce the consequences of climate change.
2. Extension Agents should educate the farmers on the danger of flooding as it affects agricultural production as well as advice government to take proactive measures such as construction of drainages.



3. Extension Agents should educate farmers to adopt improved varieties of crop that are resistant to drought, heat stress, weeds, pests and diseases.
4. Extension Agents should embark on climate change awareness campaign and mitigation strategies against climate change.

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