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ANALYSIS OF CLIMATE CHANGE EFFECTS AMONG RICE FARMERS IN BENUE STA' NIGERIA

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ABSTRACT

The study was carried out in Benue state, Nigeria to analyze climate change effects among rice farmers. Questionnaire/interview schedule was used to collect data from a sample of 90 respondents in the study area. Data were analyzed using frequency distribution, percentage, mean score and standard deviation. Findings of the study revealed that majority (82.2%) of the respondents were males; married (96.7%) with a mean age of about 44 years. Major perceived causes of climate change were use of generators which produce fumes (M=2.16), continuous cropping (M=2.11), human activities (tillage) (M=1.94), use of inorganic manure (M=1.92), burning of fire wood (M=1.94), bush burning (M=1.82), deforestation (M=1.80), increase in population which leads to loose of farmland (M=1.80), land degradation due to soil erosion (M=1.60), over grazing of farmland by livestock (M=1.66), and burning of fossil fuel by industries and automobile (M=1.50), among others. Results also indicate that unemployment (M=1.74), desertification (M=1.68), loss of farmland to flood and erosion (M=1.64), increase vulnerability to soil erosion (M=1.56), increase in pests and diseases infestation in rice farms (M=1.52), increase in growth of weeds (M=1.56), easy loss of water from the soil (M=1.48), reduces soil fertility (M=1.42), causes stunted growth in rice crops (M=1.42), among others were perceived effects of climate change in rice production. Human activities such as deforestation, overgrazing of farmland by livestock, use of inorganic manure, etc. should be discouraged in order to cushion the effects of climate change as well as increasing productivity among rice farmers.

Keywords: Climate change, Effects, Causes, Vulnerability, Rice farmers, Nigeria.

Contribution/ Originality

This study contributes in the existing literature by indicating effects of climate change which has been a source of concern that poses serious environmental threat to mankind. Climate change has been a major challenge for stakeholders in agricultural production resulting in poor yields of crops and loss of revenue for farmers.

1. INTRODUCTION

According to climate change is perhaps the most serious environmental threat facing mankind worldwide. It affects agriculture in several ways, one of which is its direct impact on food production. Climate is the primary determinant of agricultural productivity. Given the fundamental role of agriculture in human welfare, concern has been expressed by federal agencies and others regarding the potential effects and/or consequences of climate change on agricultural productivity. Climate change affects crop and livestock production, input supplies and other components of agricultural systems.

Agriculture in Nigeria is mostly rain-fed, and any change in climate is bound to affect its productivity and other socio-economic activities generally. The issue of climate change has become more threatening, not only to the

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sustainable development of socio-economic and agricultural activities of any nation but also to the totality of human existence [1]. Furthermore, the effect of climate change implies that the local climate variability which people have previously experienced and adapted is changing and this change is observed in a relatively great speed.

According to Kuta [2] local farmers are seriously concerned about weather variations because of the impact on food security, availability, stability, accessibility and utilization. The change in weather affects livestock, forestry, fisheries and decreases plant species including rice which is the world's most important crop for ensuring food security [3].

Climate change is defined as any change in global temperature and precipitation over a time due to natural variability or as a result of human activity [4]. Climate change is a long-term change in the statistical distribution of weather pattern over periods ranging from decades to millions of years. It may be a change in average weather condition or the statistical distribution of weather events.

Despite efforts made by the federal government of Nigeria to ensure that there is adequate supply of food in the country to tackle food insecurity through enacting of various agricultural programs, there is still acute shortage of food among the populace. This is as a result of climate change which leads to reduction in crop yield and quality, destruction of farmland by flood, high incidence of weeds, increase in pests and diseases, drought as well as decrease in soil fertility [5].

The impact of climate change on agriculture in Nigeria is an adverse one. Droughts, floods and storms affect agriculture in the north, middle belt and in the southern part of the country [6]. Changes in rainfall in terms of late arrival, early departure and low amount of rainfall result in poor harvest of crops which consequently affect the income of the people and the nation in general. Drought affects the volume of water in the rivers and lakes, used for irrigation and fishing activities [7]. According to the Federal Government of Nigeria (FGN) [8] in the past thirty years, over 90% of the Lake Chad water has been lost to drought. This has affected the farming and fishing activities on the Lake.

In Southern part of Nigeria, the impact of climate change on agriculture is seen on the effects of gully erosion on land use. A large portion of arable land is lost due to gully erosion in Anambra, Enugu, Ebonyi and Kogi States. Sometimes, effects of the erosion are in form of leaching, where agricultural lands are devastated, leaving the land to be unproductive, resulting in poor harvest. It is on record that years of drought in Nigeria are years of invasion of locusts and pests on tender farm crops with the attendant hunger on the citizens. Floods destroy farm crops close to river banks resulting in poor harvests and the destruction of bridges, blocks roads to markets and farm. About 70% of Nigerians depend on agriculture for their livelihood and any decrease in agricultural production is dangerous not only on an individual but on other sectors of the economy [8]. In some places, floods and drought could become more frequent and more severe, while local changes in temperature, precipitation and soil moisture could severely influence many areas important to human life such as natural ecosystems, agriculture and food supplies, human health, forestry, water resources, energy and transportation [9].

Agriculture is most sensitive to global warming of climate change and its effects leads to stunted growth of crops; easy spread of pests; diseases attack on crops, livestock and fish; drying of seedlings after germination and transplanting; low yield of crops and/or crop failure; low quality of farm produce; fall in farm revenues/incomes (economic losses); isolated location of farms; small farm size; low level of technology adoption; reduced supply of raw materials for agro-based industries; impact on water resources; late fruiting of fruit trees [10].

Human activities have been identified as the major causes of climate change in Nigeria [11]. The oil and gas sectors in the Niger Delta and offshore through gas flaring, deforestation through tree cutting for fuel wood and timber, expanding slash and burn agriculture as well as developmental projects, gas emission from cars, trucks and generators have been identified as contributing to climate change [12]. Other causes are population explosion, depletion of natural resources indiscriminate exploitation of renewable and non-renewable resources and environmental pollution (introduction of harmful substances into the environment) Ajah [13]. Popoola [14]

identified growth in human population, increased consumption of earth's resources, enhanced technology, economic advances and changes in organization of human societies as drivers responsible for climate change.

This raises these pertinent questions. What are socio-economic characteristics of the rice farmers? What are perceived causes of climate change? What are effects of climate change on rice production?

Specifically, the study sought to:

1. Describe socio-economic characteristics of the respondents;
2. Ascertain perceived causes of climate change by the respondents; and
3. Ascertain perceived effects of climate change by the respondents.

2. METHODOLOGY

This study was carried out in Benue State, Nigeria. Benue State has a land mass of about 33,955 square kilometers with a population of 4, 219244 people [15]. The population for the study consist all rice farmers in the study area. Zone C was selected out of the three zones in the state because of proximity and due to the fact that rice is one of the major crops grown in the area. Zone C is made up of nine (9) blocks; two out of the nine blocks were selected for the study. Also, two (2) circles were selected randomly from each of the blocks. In Agatu block, Obagagi and Aila circles were selected using simple random sampling technique. Obagaji had a total population of 200 rice farmers, and Aila has 150, while in Apa block, Edikwu and Adijah circles were also selected using simple random sampling technique. Edikwu had a total population of 100 rice farmers, while Adija had a total of 50 rice farmers. Due to the enormity of the population not all the respondents were selected for the study. In Obagaji, 36 rice farmers were selected, 27 rice farmers were selected in Aila, while in Edikwu and Adija, 18 and 9 rice farmers were selected, respectively using 18% of the population, giving a total sample size of 90 respondents used for the study.

Data were collected using questionnaire which was divided into three (3) sections (A to C) based on the specific objectives of the study. Section A sought information on socio-economic characteristic of the respondents. Section B focused on perceived causes of climate change, while section C centered on perceived effects of climate change on rice production. Data obtained for the study were analyzed using descriptive statistics such as frequency distribution, percentage, mean score and standard deviation

3. RESULTS AND DISCUSSION

3.1. Socio-Economic Characteristics of the Respondents

3.1.1. Sex

Table 1 shows that majority (82.2%) of the respondents were males, while the remaining 17.8% were females. This implies that more males were involved in rice production than females in the study area. The finding is in agreement with FAO [16, 17] who found that agricultural production is a male dominated profession in the third world countries. This is not surprising as rice production in the study area is dominated by males.

3.1.2. Age (Years)

Data in Table 1 show that 40.0% of the respondents were between the ages of 31 and 40, while 40.0% were also aged 41 and 50 years with a mean age of 43.7 years. This indicates that rice farming was dominated by able-bodied young men with capacity and experience to cope with the stressful nature of production.

3.2. Marital Status

Result in Table 1 show that majority (96.7%) of the respondents were married, while 2.2% were single. It shows that a greater percentage of the respondents were married, having members of their families hence greater involvement in rice production in order to feed members of their families.

3.3. Educational Qualification (Years)

Entries in Table 1 show that 50.0% of the respondents had primary school education, 32.2% had secondary education, while about 12% had no formal education, among others. This implies that a good number of the respondents were literate in order to cope with climate change effects. This is similar results with Maddison [18] who stated that better education can help in improving awareness of potential benefits and willingness to participate in local natural resources management and conservation activities. Educated and experienced farmers are expected to have more knowledge and information about climate change and agronomic practices that they can use to respond to climate change effects.

3.4. Farm Size (Hectares)

About 58% of the respondents had a farm size of between 2 and 4ha, while 21.2% had a farm size of 5-7ha, among others (Table 1). This implies that rice production is relatively practiced on a large scale in order to be economically stronger and improve the standard of living of the respondents. This is in contrast with Nwalieji [19] who stated that rice is produced under uplands, swamps and irrigated low lands and is dominated by small-scale farmers who cultivate small hectares of land between 1-2 hectares.

3.5. Contact with Extension Agents

Data in Table 1 also show that majority (68.9%) of the respondents had extension contacts, while 31.1% of the respondents did not have extension contacts. This implies that majority of the respondents obtain information on agricultural information from extension agents. This is in agreement with a study carried out by Kandlinkar and Risbey [20] which stated that availability of agricultural information on climate change helps farmers to cope with changes in climate.

3.6. Farming Experience (Years)

Entries in Table 1 show that 42.2% of the respondents had farming experience of less or equal to 10 years, about 26% had a farming experience of between 11 and 20years, while 21.1% of the respondents also had a farming experience of 21-30years. This indicates that the respondents had been involved in rice production for a long period of time. The long period of involvement in rice production will enable them to adapt to changes in climate.

3.7. Household Size (Numbers)

Data in Table 1 revealed that 41.1% of the respondents had household size of between 6 and 10 persons, while 37.8% and 12.2% had a household size of 11-15 persons and 16-20 persons, respectively. The mean household size was about 10 persons. This implies that the respondents had relatively large household size which could provide source of farm labour for rice production. This finding agrees with Ajani and Igbokwe [21] who stated that large household size enables farmers to take up labour intensive adaptation measures of climate change.

3.8. Primary Occupation

Majority (63.3%) of the respondents had farming as their primary occupation, while 20% and 11.1% were involved in trading and civil service, respectively (Table 1). This implies that the study area is agrarian community, engaging in farming as a major occupation.

3.9. Annual Income (Naira)

Findings in Table 1 revealed that 57.8% of the respondents had annual income of more than ₦70,000, while 21.1% and 15.6% had annual income of 60,000-69,999 and 40,000-59,999, respectively. The mean annual income of the respondents was about ₦51999.4. This implies that the respondents earned reasonable amount of money from

rice production. This is in contrast with the general characteristics of traditional farming system practiced in the rural areas where returns from farming are low due to low investment by subsistence farmers.

3.10. Membership of Formal Organization

Data in Table 1 show that majority (92.2%) of the respondents belonged to one formal organization or the other, while 7.8% of the respondents did not belong to any formal organization. About 48% of the respondents belonged to cooperative society, 44.4% belonged to farmers association, while 7.8% of the respondents were members of thrift *(Bam)*. This implies that the respondents were members of formal organization which will enable them to obtain information on adaptation strategies to climate change. This will also boost their activities on rice production since they can easily have access to credit facilities provided by the government for increased production.

Table-1. Distribution of respondents according to socio-economic characteristics (N=90)

Socio-economic characteristics	Frequency	Percentage
Sex		
Male	74	82.2
Female	16	17.8
Total	90	100
Age (years)		
21-30	5	5.6
31-40	36	40.0
41-50	36	40.0
51-60	9	10.0
Above 60	4	4.4
Total	90	100
Marital status		
Single	2	2.2
Married	87	96.7
Widow	1	1.1
Total	90	100
Educational qualification (years)		
No formal educational	11	12.2
Primary education	45	50.0
Secondary education	29	32.2
Tertiary education	5	5.6
Total	90	100
Farm size (hectares)		
2-4	52	57.8
5-7	19	21.1
8-10	8	8.9
Above 10	11	12.2
Total	90	100
Farming experience (years)		
<10	38	42.2
11-20	23	25.6
21-30	19	21.1
31-40	5	5.6
Above 40	5	5.6
Total	90	100
		Continue
Household size (numbers)		
1-5	7	7.8
6-10	37	41.1
11-15	34	37.8
16-20	11	12.2

Above 20	1	1.1
Total	90	100
Primary occupation		
Civil service	10	11.1
Farming	57	63.3
Trading	18	20.2
Teaching	4	4.4
Total	90	100
Annual income (naira)		
<20,000	0	0
20,000 – 39,999	5	5.6
40,000 – 59,999	14	15.6
60,000 – 69,999	19	21.1
Above 70,000	52	57.8
Total	90	100
Membership of formal organization		
Yes	83	92.2
No	7	7.8
Total	90	100
Types of formal organization		
Cooperative society	43	47.8
Farmers association	40	44.4
Thrift *(Bam)*	7	7.8
Total	90	100
Contact with extension agents		
Yes	62	68.9
No	28	31.1
Total	90	100
Number of extension contact		
1-5	76	84.4
6-10	13	14.4
Above 10	1	1.1
Total	90	100

Source: Field survey, 2015

Table-2. Distribution of respondents according to perceived causes of climate change

Causes of climate change	Mean score (M)	Standard deviation (SD)
Bush burning	1.82	0.943
Human activities such as Tillage	1.94	0.952
Deforestation	1.80	0.767
High temperature	1.46	0.795
Global increase in carbon(iv)oxide concentration	1.43	0.671
Burning of fossil fuels by industrial and automobiles	1.50	0.640
Land degradation due to soil erosion	1.60	0.715
Building up of green house gases in the atmosphere	1.27	0.492
Increase in release of methane (CH_4), Nitrous oxide and Ozone (O_3)	1.32	0.633
Use of inorganic manure	1.92	0.810
Continuous cropping	2.11	0.813
Increase in population which leads to loss of farm land	1.80	0.901
Use of generators which produce fumes	2.16	2.258
Burning of fire wood for cooking	1.94	0.826
Over grazing of farmland by livestock	1.66	0.876

Source: Field survey, 2015

3.11. Perceived Causes of Climate Change

Use of generators which produce fumes (M=2.16), continuous cropping (M=2.11), human activities (tillage) (M=1.94), use of inorganic manure (M=1.92), burning of fire wood (M=1.94), bush burning (M=1.82), deforestation (M=1.80), increase in population which leads to loose of farmland (M=1.80), land degradation due to soil erosion (M=1.60), over grazing of farmland by livestock (M=1.66), and burning of fossil fuel by industries and automobile (M=1.50) were perceived by the respondents as major causes of climate change (Table 2). Others include high temperature, (M=1.46) global rise in CO_2 concentration, (M=1.43) build up of green house gases in the atmosphere, increase in release of Methane (CH_4) Nitrous oxide and Ozone (O_3), (M=1.32), among others. The finding agrees with Intercontinental Panel on Climate Change (IPCC) [4] who observed that human activities are very likely the causes of global warming.

3.12. Perceived Effects of Climate Change

Perceived effects of climate change as indicated by the respondents include unemployment (M=1.74), desertification (M=1.68), loss of farmland to flood and erosion (M=1.64), increase vulnerability to soil erosion (M=1.56), increase in pests and diseases infestation in rice farms (M=1.52), increase in growth of weeds (M=1.56), easy loss of water from the soil (M=1.48), reduces soil fertility (M=1.42), causes stunted growth in rice crops (M=1.42), increase in prices of rice (M=1.38), low yield in rice production (M=1.41), increase in hunger/famine among family members (M= 1.30) and reduction in supply of raw materials to agro-allied industries (M= 1.29), among others (Table 3). The finding is in line with Zhu [22] who stated that climate change has both positive and negative effects on farming, but there could be a more negative influence in the long run which may lead to food insecurity.

Table-3. Distribution of respondents according to perceived effects of climate change on rice production

Perceived effects of climate change	Mean score (M)	Standard deviation (SD)
Reduces soil fertility	1.42	0.719
Low yield in rice production	1.41	0.685
Reduction in farm income/revenue	1.32	0.667
Increase hunger/famine among family members	1.30	0.678
Leads to food insecurity in household	1.40	0.667
Desertification	1.68	0.493
Increase vulnerability to soil erosion	1.56	0.582
Increase in pest and disease infestation in rice farms	1.52	0.64
Unemployment	1.74	0.758
Causes stunted growth in rice crops	1.42	0.636
Increase in prices of rice	1.38	0.605
Loss of farmland to flood and erosion	1.64	0.605
Increase in growth of weeds	1.56	0.601
Reduction in supply of raw materials to agro-allied industries	1.29	0.525
Easy loss of water from the soil	1.48	0.524

Source: Field survey, 2015

4. CONCLUSION AND RECOMMENDATIONS

Majority of the respondents were males, middle aged, having large household size and long period of farming experience. Major causes of climate change were deforestation, bush burning, human activities such as tillage, burning of firewood for cooking, overgrazing of farmland by livestock, use of inorganic manure and increase in population which leads to loss of farm land. Desertification, increase vulnerability to soil erosion, unemployment, increase in pests and disease infestation in rice and increase in growth of weeds, among others were perceived effects of climate change on rice production.

Human activities such as deforestation, overgrazing of farmland by livestock and use of inorganic manure, among others should be discouraged in order to cushion the effects of climate change as well as increasing productivity among rice farmers. Efforts should be geared towards cushioning the effects of climate change on rice production by the stakeholders such as the government, extension agencies, research institutions, climatological/metrological institutes, disaster management agencies, higher institutions, local farmers and other stakeholders by giving out first hand information on weather forecast so that rice farmers will know the right and best time to plant and harvest crops.

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