

PERCEPTION OF CLIMATE CHANGE BY SMALLHOLDER MAIZE FARMERS IN GOMBE STATE , NIGERIA.

Abstracts

This study assessed the awareness and impact of climate change by smallholder maize farmers in Gombe state. Both primary and secondary sources of data were used. list of registered farmers was obtained from Gombe State Agricultural Development Programme(GSADP).The primary data were collected through the use of interview schedules. Descriptive statistics were used for the analysis. The result reveals that Most (43.2%) of the respondent were between ages 40-49, ~~(87.5%)~~ were male, ~~(84.3%)~~ were married,~~(65.7%)~~ had 30-35 years of farming experience and only ~~(38.8%)~~ belong to farmers association . Majority (85.6 %) of the farmers were fully aware about the changing climate and majority and ~~(57.3%)~~ of the farmers obtained their information about climate change through radio because it is the most available and reliable means of communication to the farmers and length of farming experience influenced awareness of changing climate. About ~~(62.9%)~~ of the respondent reported that decrease in rainfall reduce crop yield, ~~(59.4%)~~ said increase in temperature damage their crops and ~~(50%)~~ said increase in wind speed breaks their plants. The impact observed on farm were flood, soil erosion, prolong dry spell and reduced crop yield were rated high based on likert scale. The study recommends that extension works and community groups should enlighten the farmers on the impact of changing climate and farmers are advice to come up with early warning system on how to cope with the changing climate.

Key words: Smallholder, Farmers, climate change, Agro-Ecology, Gombe State.

Introduction

Climate change awareness involves creating knowledge, understanding, values, attitude, skills and abilities among individuals and social groups towards the issues of climate change for attaining a better environment. Awareness about climate change will go a long way in solving most of the problem attached to it. Most of the campaigns about climate change were not addressing the target population that was why its impact was not meeting it set objectives. A survey conducted by (United Nation Development Program, [UNDP], (2010) noted that climate change awareness was highest at the federal level, these dropped sharply at the state and local government levels, where real action is needed. According to Akponikpe, Johnston & Agbossou, (2010), farmers are aware of the differences between the past climate and the present climate

36 according to the change in climate variables (rainfall pattern, temperature, sunshine and wind),
37 but not with the name climate change.

38 Climate change had caused a shift in the seasonal variability of weather and climate and thus a
39 shift in the normal timing and length of wet and dry seasons and increase in the seasonal
40 fluctuation of the water bodies. Rainfall variability refers to variations in the mean state and
41 other statistics (such as standard deviations and the occurrence of extremes) of rainfall on all
42 spatial and temporal scales beyond that of individual precipitation events (Odjugo, 2010).

43 In Nigeria, changing rainfall patterns have been observed by (Nnaji, 2001) and (Odjugo, 2010)
44 which is observed decline in rainfall intensity in Nigeria. There are observable reductions in
45 precipitation in northern parts of Nigeria, (Boko *et al.*, 2007). The most significant climatic
46 variation in the north eastern region of Nigeria since 1960s had been the persistent decline in
47 rainfall which had reduced agricultural productivity in the region, (Ayuba, Maryah & Gwary
48 2007). Farmers in Gombe state had observed changes in rainfall trends and number of rainy days
49 which are attributed to climate change (Msheliza & Bello, 2016).

50 Agriculture in Nigeria is adversely impacted by increased variability in the timing and amount of
51 rainfall, Water deficits depress crop and livestock production and hence affect food security,
52 reduction of arable lands, while the sea incursion is reducing the arable land of the coastal plain,
53 the desert encroachment with its associated sand dune is depriving farmers of their agricultural
54 farmlands and grazing rangelands, (BNRCC, 2010).

55 In Nigeria, some areas like the Niger Delta regions receive more rainfall, while some areas in the
56 Northern regions are receiving less rainfall, the length of the growing seasons are changing,
57 ecological zones are shifting and rainfall is becoming more unpredictable and unreliable (Brett,
58 2009). Maize farmers in Gombe state are finding it difficult to produce the quantity they use
59 to produce due to constant changes in the behaviors of the climatic variables which resulted to the

60 loosing of livelihood by many farmers. It is based on this background that this study seek to
61 assess farmers awareness about climate change and it impact on their farm production with the
62 following objectives:

- 63 i. Identify the socio-economic characteristics of the respondents;
- 64 ii. Assess the awareness of farmers on the changes in climatic variables;
- 65 iii. Determine the impact of climate change in the study area

66 **Methodology**

67 Gombe State is located between Latitude. 9°30' and 12° N and Longitude. 8°45' and 11°45'E. It
68 is shares boundaries with Yobe state to the north, Borno and Adamawa states to the east, Bauchi
69 state to the west and Taraba State to the south. The data used for this study were from primary
70 and secondary sources. The primary data were collected through the use of interview schedule.
71 List of registered farmers from Village Extension Area (VEA) of Gombe State Agricultural
72 Development Program (GSADP) was used to select the number of the farming family in each
73 community for the interview. Maize crop yield data from GSADP and rainfall totals from Upper
74 Benue River Basin Development Authority (UBRBDA) Dadinkowa station. Three Local
75 Government Area (LGA) was systematically selected based on the three Agro- climatic zones of
76 the state.
77 Stratified, random and purposive sampling technique was employed to administer the
78 questionnaire to those that have been farming for the period of thirty (30) years and above because
79 of their experience. According to National Conservation Foundation (NCF, 2008) Gombe state
80 was divided in to three agro-ecological zone namely Southern Guinea Savanna (SGS), Northern
81 Guinea Savanna (NGS) and Sudan Savanna (SS) where one LGA was selected from each agro-
82 ecological zone. Billiri LGA was selected from (SGS), Kwami LGA from (NGS) and Nafada
83 LGA from Sudan Savanna (SS). Krejcie and Morgan (1970) table of sampling sampling

84 population was used where 384 was determined as the sample size. Cochran (1977) formula for
 85 the determination and distribution of sample size was used, the formula is as follows:

86
$$N = \frac{Nh \times n}{P}$$

87 Where Nh = Population

88 N = Sample size

89 n = Total number of respondents

90 P = Total population of the selected communities within the study area.

91 Three hundred and eight four (384) questionnaires was randomly distributed among those that had
 92 been farming for thirty (30) years and above. But only two hundred and forty nine (249)
 93 questionnaires were returned from the respondents therefore, only the returned questionnaires were
 94 used for the study (Table 1).

95 **Table 1: Sampling Frame for the Study**

LGA	Selected VEA	Number of Registered Farmers	Determine Sample Size	Sample Size
Billiri	Sansani	1069	33	21
	Todi	1807	55	36
Kwami	Malleri	2074	64	41
	Kwami	3621	110	72
Nafada	Jigawa	2422	74	48
	Nafada	1561	48	31
Total		12554	384	249

96 **Source:** Gombe State Agricultural Development Program (GSADP, 2015).

97 Data Analysis

98 Both qualitative and quantitative technique (mixed method) was used for this analysis where
 99 descriptive statistics was used to analyze the socio – economic status of the respondents and their
 100 awareness while Likert type scale was used to analyze the impact on farm, the Likert type
 101 measuring instrument is represented by the formula:

102
$$\bar{X} = \frac{\sum fx}{\sum f} \dots\dots\dots(1)$$

103 Where $\bar{X}$ = mean score

104 $\sum$ = Summation Sign

105 F = Frequency

Three (3) different scaling statements were used namely; high (3), moderate (2) and low (1). The mean of the scaling statement was 2 which is the weight mean of the weight mean of the statement. Decision Rule: Any mean value greater or equal to 2 is high; any mean value less than 2 is low.

$$\frac{3+2+1}{3} = \frac{6}{3} = 2$$

Statistical package for social sciences (SPSS) (version 19) was used for data analyses.

RESULTS AND DISCUSSION

Socio Characteristics of the Respondent

Respondents studied varied based on their age, sex, marital status and formal educational exposure. The distribution of the farmers based on the demographic characteristics of age, sex, marital status and formal educational exposure is presented in (Table 2).

One hundred and eighty four (108) of the respondents studied who constituted (43.2%) of the study population were from age group of 40-49 while respondents who were of the ages 70 and above constitute only (2.8%) of the study population this implies that majority of the farmers were from the productive age. About (87.6%) of the respondent were male while (12.4%) were females and majority of the respondents studied (84.3%) were married. This results is in line with findings of Anyoha et al (2013) who reported more male farmers (60%) than female famers (40%) in Umuahia South.

130 **Table 2: Characteristics of the Respondents n = (249)**

Characteristics	Frequency	Percentage %
Age (Years)		
40-49	108	43.2
50-59	76	30.4
60-69	58	23.2
70+	7	2.8
Sex		
Male	218	87.5
Female	31	12.4
Marital Status		
Married	210	84.3
Widowed	26	10.4
Single	13	5.2
Educational		
Non Formal Education	120	48
Primary	63	25.3
Secondary	42	16.8
Tertiary	24	9.6
Number of Farm Land		
1	102	40.9
2	113	45.4
3-5	34	13.6
Farming Experience (Years)		
30- 35	164	65.7
36 -40	62	24.8
40 +	23	9.2
Farmers Clubs		
Belong	97	38.8
Not Belong	152	61.2
Access to Extension Service		
Access	213	85.3
Not Access	36	14.7
Total	249	100

131 **Source:** Fieldwork 2016

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137 Educational Qualification of the Respondents

138 Based on Respondent educational exposure, ~~(48.2%)~~ were not exposed to formal education and
139 ~~(25.3%)~~ had primary education. Those who had secondary and tertiary educational exposure
140 constitute ~~(16.8%)~~ and ~~(9.6%)~~ respectively. This is an indication that almost half of the
141 respondents were educated and educated respondents tend to be aware about climate change,
142 more efficient in production and ready to accept new strategies when compared with the other
143 half respondents that were illiterates who rely on their experience (Table 2.). ~~This~~ result is in
144 agreement with the findings of Anyoha (2013) who reported that education influence awareness
145 of farmers and Ofuoku (2011) reported that formal education is expected to influence their
146 perception.

147 Number of Farmlands, Farming Experience, Farmers Club and Extension services

148 The respondents studied had farmlands but did not have regular shapes and sizes only the
149 numbers of farm holdings were used. About ~~(40.9%)~~ of the respondent owned one (1) farmland,
150 ~~(45.4%)~~ owned two (2) farmlands and only ~~(13.6%)~~ owned (3-5) farmlands, by implication
151 majority of the respondents had two (2) farm land. Years of farming experience equipped
152 respondents with adaptation strategies to cope with different climatic conditions in their
153 production. About ~~(65.7%)~~ of the respondents had (30-35) years of farming experience, while
154 ~~(9.2%)~~ had over 40 years of farming experience, therefore years of farming experience does not
155 influence awareness of climate change. About ~~(38.8%)~~ of the respondent belong to Farmers
156 Association while ~~(61.2%)~~ of the respondents did not belong to farmers club, this results
157 contradicts the findings of Anyoha *et al* (2013) who reported majority of the farmers belong to
158 farmers organization.

Comment [DDCC1]: Make it clear.

Comment [DDCC2]: Is it logical?

160 Results of respondent patronize extension services where (85.6 %) experience extension service
161 while farmers whom did not patronize the extension services constituted (14.4%). Since majority
162 of the respondent access extension service therefore adaptation to climate change among
163 respondents will not be a challenge.

164

165 **Awareness and Source of information about Climate Change**

166 Awareness about changes in climatic variables is important in coping or adapting to climate
167 change. Awareness of climate change is the first step in mitigating the impact of climate change
168 through adaptation. Rising awareness is an important component in building capacity of the
169 population in combating the menace of climate change, because adaptation may not be possible
170 without effective awareness.

171 Majority of the respondents who constitute ~~(85.6 %)~~ (Table 3) were aware that the climate is
172 changing. Only thirty six (36) who constitute ~~(14.4%)~~ were not aware, which implies that
173 majority of the farmers were aware of climate change, because of their level of awareness it will
174 be easy for them to identify effect of climate change in their farming system, this result concord
175 with the findings of (Anyoha *et al.*, 2013) who reported that majority of the farmers in Umuahia
176 South were aware of climate change and (Adebayo *et al.*, 2012) reported that Majority of the
177 farmers in Adamawa state are aware of climate change and submitted that climate change has
178 affected their farming activities in recent years.

179 Respondents obtained information about climate change from various sources, namely: radio,
180 television, newspapers, extension services, research institute, co-operative, fellow respondents
181 and religion gathering. One hundred and forty three (143) who constitute ~~(57.3%)~~ of the farmers
182 obtained information about climate change through radio while two (2) constitute ~~(0.8%)~~ of the
183 respondents obtained their information from co – operative societies, (Table 3) presents the

184 details of the findings of the major sources of climate change awareness; this implies that radio
 185 played an important role in creating awareness about climate change which is in line with the
 186 finding of (Bryan *et al.*, (2011) who reported that radio is the fastest means of reaching all
 187 farmers than any other means of communication. Since it is easy to communicate to farmers
 188 through radio, adaptation strategies can also be communicated to them through radio.

189 **Table 3 Awareness and Source of information about Climate Change**

Variables	Frequency	Percentage1%
Awareness of Climate Change		
Aware	213	85.5
Not Aware	36	14.5
Source of Information about Climate Change		
Radio	143	57.1
Television	5	2
News Paper	6	2.4
Extension Service	27	10.8
Research Institute	7	2.8
Co –Operative	2	0.8
Fellow Farmers	47	18.8
Religion Gathering	12	4.8
Total	249	100

191 **Source:** Fieldwork 2016

192
 193 **Observed Impact of Climate Change by Farmers**

194 Majority (62.9%) of the respondents reported that reduction in rainfall have reduce their crop
 195 yield while only (11.6%) said it reduces grass for their animals. About (59.4%) of the
 196 respondents reported that increase in temperature is responsible for damaging farm produces
 197 while (32.4%) reported that it wilter their crops, only (8.0%) reported that it kills their
 198 livestock's. These results agree with the finding of Farauta *et al.* (2011) who reported that high
 199 temperature reduce crop yield in the northern Nigeria. From these results it is evident that
 200 climate change have affected agriculture in the studied areas as presented on (Table 5).

201

About half (50.2%) of the respondents reported that wind speed breaks their plants while (18.0%) of the respondent reported that top soil erosion affects their farms as a result of increased wind speed. This implies that change in wind speed had a negative impact on farms because it affects the direct means of livelihood of the respondents.

Table 5 : Observed Impact of Climate Change by Farmers n= 249

Variables	Frequency	Percentage %
Effect of low Rainfall on Farm		
Reduce crop yield	157	62.9
Reduce water for livestock	63	25.2
Reduce grass/ biomass	29	11.6
Effect of high Temperture on Farm		
Wilting of crop	81	32.4
Damage farm produce	148	59.4
Death of livestock	20	8.0
Effect of wind		
Breaking of plants	125	50.2
Blowing off the flowers	79	31.7
Top soil Erosion	45	18
Total	249	100

Source: Fieldwork, 2016

Impact of Climate Change on Farm

The most common impact of climate change observed in the studied areas was presented on (Table.6) where Floods, prolonged dry spells, incidence of pest and disease outbreak, poor yield, erosion (Plate 1) this result was not in agreement with the findings of (Anyoha *et al*, (2012) who reported that flood and erosion were rated low while increase cost of production were rated high while severe wind storm, increase rate of weed infestation and decrease soil fertility were rated low as it was determined by the scale. The number of high impacts were higher than the low impacts as it is from the decision rule, therefore this results means that it affect the livelihood of the farmers.



Source: Fieldwork, 2016

Plate 1: Gully Erosion on a maize farm in Billiri

Table 6: Impact of Climate Change on Farm

Variables	High	Moderate	Low	Mean	Decision
Floods	178	60	11	2.6	High
Prolonged dry spells	127	98	24	2.4	High
Severe wind storm	62	112	75	1.9	Low
Incidence of pest and disease	73	147	29	2.1	High
Incidence of weed infestation	43	89	117	1.7	Low
Decrease in soil fertility	43	137	69	1.8	Low
Poor yield	50	142	57	2.0	High
Increased cost of production	114	101	34	2.3	High
Erosion	199	31	19	2.7	High

Source: Fieldwork, 2016

Conclusion

In conclusion, about (43.2%) of the respondent were between ages 40 -49, (87.6%) were male and (84.3%) were married. Majority of the respondent (48.2%) were not exposed to formal education and (45.4%) owned two (2) farmlands. The farmers were fully aware of the changes in climatic variables and awareness may be key to adaptation. Base on crosstabing results length of farming experience and formal education does not influence awareness of climate change. Climate change has a negative impact on the livelihood of the respondents such as crop failure, wilting of crops, damaging their crops, killing their animals as a result of increase in

temperature while decreasing rainfall manifest through food shortage increase, starvation and many of the respondent lost their basic means of livelihood due to the menace of climate change.

Recommendation

The study came up with following recommendations inorder to create room for adaptation to climate change in the state:

- i. Extension works and community groups should educate farmers with information on Climate Change and its impact.
- ii. Farmers are advice to come up with early warning system on how to handle issue regarding the changing climate in their faming activites.
- iii. Farmers are encougrage to practice irrigation inorder for them to subpliment their livelihood when rain fed agriculture fails.

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