

Climate Change and Adaptation Strategies of Arable Crop Farmers In Abia State, Nigeria.

¹Jackson, S.O; ²Weli V.E & ²Chukwu-Okeah, G.O

¹Center for Disaster Risk and Development Studies, University of Port Harcourt

²Department of Geography and Environmental Management, University of Port Harcourt

*Corresponding author

*Weli V E, Department of Geography and Environmental Management, University of Port Harcourt Nigeria.

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Abstract

This study was set up to examine climate change and adaptation strategies of arable crop farmers in Abia State. The study adopted the cross-sectional research design with a sample population of 392 farmers across the seventeen Local Government Areas of Abia State. Chi Square statistics was used to test the study hypothesis. The study revealed that Climate change impact on arable crops is affecting farmer's economy in Abia State. Evidences of climate change in the area, could be seen in the form of increase in temperature, change in rainfall pattern and intensity which has brought about a change in planting seasons, the study further revealed that The techniques/strategies adopted by arable crop famers in Abia State include cultivation of early maturing breeds of arable crop, crop diversification, changes in time of farm operation, change of farm location, rain water harvesting, diversification of income-generating activities and planting of drought-resistant varieties. The most predominant adaptation strategies practiced by arable crop farmers in Abia State are cultivation of early maturing breeds of arable crops, crop diversification and changes in time of farm operation and that there was seasonal variation in the choice of adaptation strategy adopted by farmers. The study however recommends that climate change impacts on arable crops as such agricultural activities that enhance climate change such as bush burning, total forest clearing should be discouraged. There is a need to adopt agro based environmental friendly techniques in crop production such as alley farming and that farmers should be encouraged to adopt the identified effective adaptation technique that are practicable for their location.

Keywords: Climate, Climate Change, Adaptation, strategies, Arable crops, Farmers.

Introduction

Agriculture globally have been identified as a major source of human existence as it provides food on which man depends to live, this situation however is not different in Nigeria and in Abia State to be specific. Agriculture has been viewed by several scholars to be influenced by the ever changing climates which also affect its turn out and the achievement of food security by different nations and people globally. The achievements of food security by any nation and Government have been in the front burner of national issues but it is quite unfortunate that this in most nations have never been near to achieving.

Although reports have suggested that with the increase in global population and the adoption of technologies that affects the environment negatively, our world is beginning to receive a reprisal attack from environmental components leading to the creation of environmental extremes in terms of rainfall and temperature which

have been proofed to have increased excessively leading to a drastic change in the global climatic conditions. These conditions have in turn affected agriculture to a very large extent as it has brought about a drop in the crop yield especially in developing nations who are technologically backward and lack the supportive capacity to turn things around by adopting agro based technology that enhances crop yield amidst the global climate change.

Some scholars have it on good account that the rise in temperature and the uneven as well as abnormal rainfall distribution greatly affects crop production everywhere in the world [1]. These adjustments in climate and weather conditions are probably going to influence the food security of developing nations that is already experiencing hunger due to an ever growing population associated with an unreliable and undesirable food sources [2]. The increase in the heating process of climate and weather frameworks can bring about exceptionally changes in the event of extraordinary

weather conditions such as an increase in temperature and a lopsided precipitation designs [3]. These outrageous occasions happen because of move in their appropriation, or to change looking like circulation. Different investigations propose that a move in mean records for much the change in watched temperature limits [4]. Correlations of different examinations demonstrated that both every day greatest (Tmax) and least (Tmin) temperatures have moved toward higher qualities in all locales. These move in temperatures and precipitation fundamentally influenced the cropping designs, crop yields and phenology [5]. Have it on good account that the survival, growth and development of crop is determined by the temperature surrounding the plant and that each crop species has a specific temperature range represented by a minimum, maximum, and optimum on which it can survive. According to the Intergovernmental Panel for Climate Change the expected changes in temperature over the next 30–50 years are predicted to be in the range of 2–3°C. Temperature dynamics and its occurrences are predicted to be on the increase with more devastating outcome, increase in its frequencies and longtime existence over what it is presently [6-8]. Extreme temperature events may have short-term durations of a few days with temperature increases of over 5°C above the normal temperatures [9]. These extreme weather events as there occur would have the most dramatic impact on plant pro-

ductivity which will also affect human existence since food supply has a direct relation to human survival on earth.

From the above descriptions, it is obvious that the situation in Abia State Nigeria is not farfetched. The ravaging effects of climate change on crop production in Abia State Nigeria have been on the increase with very minimal attention given, hence inadequacy of food supplies have taken the center stage with starvation and hunger lurking in the State without any identifiable means to end this ravaging menace, therefore this study having identified the challenges and gaps in the literature of arable agriculture as it relates to climate change is poised to ascertain effective and workable adaptation strategies to cushion these effects and further improve crop production in the area amidst climate change.

Materials and Methods

The study area is Abia State, Nigeria. Abia State lies between latitude 500'0"N and 600'0"N and longitude 700'0"E and 80'0"E (Figure 3.1). The aborigines of the town are the Ngwa people and they are mostly Christians (Chigbu, 2011) as cited [10]. The State is statutorily divided into 3 senatorial zones and has 17 Local Government Areas (LGAs). The capital is Umuahia and the major commercial city is Aba.

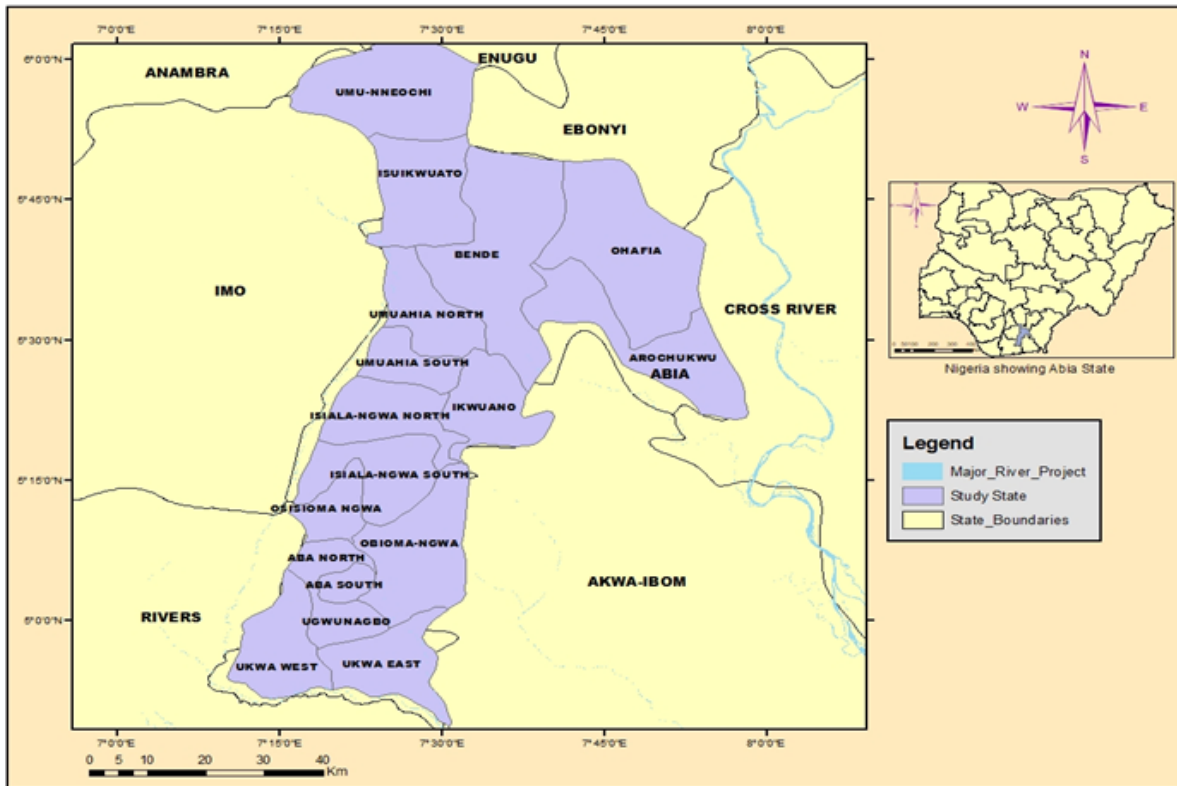


Figure 1: Study Area

It's also the 5th most industrialized state in the country, and has the 4th highest index of human development in the country (Nwoko, 2013) as cited in Jackson (2021). The study adopted the cross sectional research design; using the survey research method, the study was carried out in the 17 seventeen Local Government Ar-

reas of Abia State, with a farmer's population of 18697 which was subjected to Taro Yamane formula for sample size determination. Using the Taro Yamane formula, the study population was 392. Questionnaire was used as the instrument for data collection, this was distributed to 392 respondents using simple random sampling

technique. Although from the 392 copies of questionnaire distributed, a total of 374 copies were returned filled and adequate for analysis. The chi Square statistical tool was used to test the stated study hypothesis which states that there is no statistically

significant impact of climate change on arable crops in Abia State. Conclusively data generated from the study were analyzed using descriptive statistics.

Results and Discussion

Table 1: Respondents Perception of the Impact of Climate Change on Arable Crops Production in Abia State.

S/N	Questionnaire Item	Strongly Agree	Agree	Disagree	Strongly Disagree
1	There have been evidence of climate change in your area	214 (57.2%)	157 (41.9%)	3 (0.80%)	0 (0%)
2	Climate change in the area is seen in the form of high temperature	236 (63.1)	119 (31.8%)	18 (4.8%)	1 (0.27%)
3	Rainfall pattern and intensity has also changed in the area.	188 (50.3%)	179 (47.8%)	7 (1.9%)	0 (0%)
4	Climate change is affecting crop yield	203 (54.2%)	165 (44.1%)	6 (1.60%)	0 (0%)
5	Reduction in arable crop yield is associated with climate change	190 (50.8%)	166 (44.4%)	18 (4.8%)	0 (0%)
6	Farmers economy is affected due to climate change	161 (43.0%)	118 (31.6%)	16 (4.3%)	0 (0%)
7	Planting seasons has changed in recent times in the area	189 (50.5%)	157 (41.9%)	8 (2.1%)	8 (2.1%)

Source: Field Survey, 2021

Table 1 above, shows the respondents response to evidence of climate change in their locality. The table shows that in response to questionnaire item 1 214 respondents representing (57.2%) of the study population strongly agreed that there have been evidence of climate change in their locality, 157 respondents representing (41.9%) of the study population agreed, 3 respondents representing (0.80%) of the study population strongly disagreed none disagreed. This concludes that good number of the respondents agrees that they have been evidence of climate change in their localities.

The table also in line with questionnaire item 2, shows that 236 respondents representing (63.1%) of the study population strongly agreed that climate change in the area is seen in the form of high temperature, 119 respondents representing (31.8%) of the study population agreed, 18 respondents representing (4.8%) of the study population strongly disagreed and 1 respondent representing (0.27%) disagreed. This concludes that climate change in the area is seen in the form of high temperature.

The table shows that in line with questionnaire item 3 that 188 respondents representing (50.3%) of the study population strongly agreed that rainfall pattern and intensity has also changed in the area, 179 respondents representing (47.8%) of the study population agreed, 7 respondents representing (1.9%) of the study population strongly disagreed and non-disagreed. This however concludes that rainfall pattern and intensity has also changed in the area. The table in line with questionnaire item 4 shows that 203 respondents representing (54.2%) of the study population strongly agreed that climate change is affecting crop yield, 165 respondents representing (44.1%) of the study population agreed, 6 respondents rep-

resenting (1.60%) of the study population strongly disagreed and none disagreed. This however concludes that climate change in the area is affecting crop yield.

The table also examines if reduction in arable crops yield is associated with climate change in Abia State. From the table it is observed that 190 respondents representing (50.8%) of the study population strongly agreed that reduction in arable crops yield is associated with climate change in Abia State, 166 respondents representing (44.4%) of the study population agreed, 18 respondents representing (4.8%) of the study population disagreed while none strongly disagreed.

Questionnaire Item 6 as observed showed the response of the farmers to agreeing or disagreeing to their economy been affected due to climate change, from the response 161 respondents representing (43.0%) of the study population strongly agreed that their economy been affected due to climate change, 118 respondents representing (31.6%) of the study population agreed, 16 respondents representing (4.3%) of the study population disagreed and none strongly disagreed. This shows that farmers economy is been affected due to climate change in Abia State. On the issue of change in planting seasons in recent times in Abia State, as observed in questionnaire item 7, 189 respondents representing (50.5%) of the study population strongly agreed that there is a change in planting seasons in recent times in Abia State, 157 respondents representing (41.9%) of the study population agreed, 15 respondents representing (4.0%) disagreed while 8 respondents representing (2.1%) of the study population strongly disagreed. This however implies that there is a change in planting seasons in recent times in Abia State.

Table 2: Knowledge of adaptation strategies adopted by arable crop farmers in Abia State.

S/N	Questionnaire Item	Yes	%	No	%
1	Are there techniques as a farmer that you have applied to maintain your farms amidst climate change?	260	69.5	114	30.5
2	Have the technique helped in any way to reduce farm produce loss?	271	74.5	103	25.5
3	Do you know that these techniques are knows as adaptation strategies?	225	60.1	149	39.9

Source: Field Survey, 2021

Table 2 shows the knowledge of adaptation strategies adopted by arable farmers in Abia State. From the table. it is observed that 260 of the respondents representing (69.5%) of the study population agrees that there are techniques as farmers that they have applied to maintain their farms amidst climate change while 114 respondents representing (30.5%) of the study population said no. With respect questionnaire item 2, 271 respondents representing (74.5%) of the study population agrees that that the strategies they have adopted

have helped to reduce farm produce loss while 103 respondents representing (25.5%) of the study population did not agree. In line with questionnaire item 3, 225 respondents representing (60.1%) of the study population agrees that the techniques that have adopted to cushion the effects of climate change are known as adaptation techniques while 149 respondents representing (39.9%) of the study population said they do not know.

Table 3: Adaptation strategies adopted by arable crops farmers in Abia State.

Adaptation Strategies	Rain water harvesting	Planting of drought-resistant varieties	Crop diversification (intercropping)	Change of farm location	Changes in time of farm operation	Cultivation of early maturing breed of Arable crops	Diversification of income-generating activities
Response	231	119	342	317	323	365	212
Percentage%	61.8	31.8	91.4	84.8	86.4	97.6	56.7
Ranking	5	7	2	4	3	1	6

Source: Field Survey, 2021

Table 3 shows the adaptation strategies adopted by arable crops farmers in Abia State. From the table it is observed that 231 respondents representing (61.8%) of the study population independently adopted rain water harvesting as adaptation strategy, 119 respondents representing (31.8%) of the study population adopted planting of drought-resistant varieties, 342 respondents representing (91.4%) of the study population adopted crop diversification (intercropping), 317 respondents representing (84.8%) of the study population adopted change of farm location, 323 respondents representing (86.4%) of the study population adopted changes in time of farm operation, 365 respondents representing (97.6%) of the study population adopted cultivation of early maturing breed of arable crops.

and 212 respondents representing (56.7%) of the study population adopted diversification of income-generating activities as their adaptation strategy. From the table, it is also observed that in the ranking cultivation of early maturing breeds of arable crops ranked first, crop diversification ranked second, changes in time of farm operation ranked third, change of farm location, ranked fourth, rain water harvesting fifth, access to diversification of income-generating activities as their adaptation strategy ranked sixth while Planting of drought-resistant varieties ranked seventh. However, it is observed that the most predominant adaptation strategies practiced by arable crop farmers in Abia State are cultivation of early maturing breeds of arable crops, crop diversification and changes in time of farm operation.

Table 4: Adaptation strategies adopted in the dry Season by arable crops farmers in Abia State

Adaptation Strategies	Rain water harvesting	Planting of drought-resistant varieties	Crop diversification (intercropping)
Frequency			
Response	16	201	157
Percentage%	4.3	53.7	41.9

Source: Field Survey, 2021

Table 4 shows the adaptation strategies adopted by arable crop farmers in the dry Season in Abia State. From the table it is observed that 16 respondents representing (4.3%) of the study population adopted rain water harvesting during the dry season, 201 respondents representing (53.7%) of the study population adopted

planting of drought resistant varieties while 157 respondents representing (41.9%) of the study population adopted inter cropping. From the table it is observed that planting of drought resistant varieties is the most adopted adaptation strategy in the dry season by arable farmers in Abia State.

Table 5: Adaptation strategies adopted in the Wet Season by arable crops farmers in Abia State

Adaptation Strategies	Diversification of income-generating activities	Changes in time of farm operation	Change of farm location	Cultivation of early maturing breed of Arable crops	Cultivation of early maturing breed of Arable crops
Frequency					
Response	19	42	23	269	21
Percentage%	5.1	11.2	6.1	71.9	5.6

Source: Field Survey, 2021

Table 5 shows the adaptation strategies adopted by arable crop farmers in the wet Season in Abia State. From the table it is observed that 19 respondents representing (5.1%) of the study population adopted diversification of income generating activities, 42 respondents representing (11.2%) of the study population adopted Changes in time of farm operation, 23 respondents representing (6.1%) of the study population adopted the change of farm loca-

tion, 269 respondents representing (71.9%) of the study population adopted the cultivation of early maturing breed of arable crops while 12 respondents representing (5.6%) of the study population adopted the use of crop diversification. From the table it is observed that the cultivation of early maturing breed of arable crops is the most adopted adaptation strategy in wet season by arable farmers in Abia State.

Table 6: Source of information about adopted Adaptation Strategy

Response	Frequency	Percentage (%)
Colleague	10	2.67
Farmers Organization	41	10.9
Government Training	51	13.6
Local Knowledge	206	55.1
Total	373	100

Source: Field Survey, 2021

Table 6 displays the source of respondent's information about adopted adaptation strategy. From the table it is observed that 10 respondents representing (2.67%) of the study population stated that they got information about the adopted adaptation strategy through their colleagues, 41 respondents representing (10.9%) of the study consented to farmer's organization as their source of adopted adaptation strategy, 51 respondents representing (13.6%) of the study population identified government training as their source of information while 206 respondents representing (55.1%) of the study

population stated that their source of information with respect to the adopted adaptation strategy is through local knowledge. This however explains that the most predominant source of information on adopted adaptation strategy by arable crop farmers is through local knowledge.

Hypothesis Testing.

1. There is no statistically significant impact of climate change on arable crops in Abia State.

Table 7: Chi – Square Statistics Result for Impact of Climate Change on Arable Crops in Abia State.

Strongly Agree		Agree		Disagree		Strongly Disagree	
O	E	O	E	O	E	O	E
214	200.1	157	155.9	3	14.7	0	3.2
236	200.1	119	155.9	18	14.7	1	3.2
188	200.1	179	155.9	7	14.7	0	3.2
203	200.1	165	155.9	6	14.7	0	3.2
190	200.1	166	155.9	18	14.7	0	3.2
181	200.1	148	155.9	36	14.7	9	3.2
189	200.1	157	155.9	15	14.7	13	3.2

Source: Researchers Computation (2021)

$$\begin{aligned}
 Df &= (R-1) (C-1) \\
 &= (2-1) (7-1) \\
 &= 1 \times 6 \\
 &= 6
 \end{aligned}$$

The calculated Chi-Square statistics value is 119.59 (See Appendices 11). For 6 degrees of freedom the critical Chi-Square statistics value at 95% significance level is 12.5916. Since the Chi-Square statistics calculated value of 119.59 is greater than the Chi-Square statistics table value of 12.5916 at 95% significance level, we therefore accept the alternate hypothesis which states that there is a statistically significant impact of climate change on arable crops and reject the null hypothesis of no statistically significant impact.

Conclusion and Recommendations

The study concluded that t climate change impact on arable crops is affecting farmer’s economy in Abia State with its evidences noticed by increase in temperature, change in rainfall pattern and intensity which has brought about a change in planting seasons. However, the findings of this study are as follows;

1. The techniques/strategies adopted by arable crop famers in Abia State include cultivation of early maturing breeds of arable crop, crop diversification, changes in time of farm operation, change of farm location, rain water harvesting, diversification of income-generating activities and planting of drought-resistant varieties.
2. The most predominant adaptation strategies practiced by arable crop farmers in Abia State are cultivation of early maturing breeds of arable crops, crop diversification and changes in time of farm operation.
3. The study also showed that there was seasonal variation in the choice of adaptation strategy adopted by farmers.
4. The adopted strategy has enhanced production capacity after the notice of climate change and that the adaptation strategy they adopted was effective.
5. Statistically the study revealed that there is a statistically significant impact of climate change on arable crops.

The study hence recommends the following;

1. Climate change impacts on arable crops as such agricultural activities that enhance climate change such as bush burning, total forest clearing should be discouraged.

2. There is a need to adopt agro based environmental friendly techniques in crop production such as alley farming.
3. The farmers should be encouraged to adopt the identified effective adaptation technique that are practicable for their location such as cultivation of early maturing breeds of arable crops, crop diversification and changes in time of farm operation.
4. There is need for extension services, trainings and enlightenment programme to arable crop farmers in particular, to enhance their knowledge with modern climate change adaptation strategies and techniques which will enhance production and economic capacity of the farmers.

References

1. Lobell D B, Field C B (2011) California perennial crops in a changing climate. *Climatic Change*.109: 317-333.
2. Lobell D B, Schlenker W, Costa- Roberts J (2011) Climate trends and global crop production since 1980. *Science*. 29: 616-620.
3. Ahmed I, Rahman M.H, Ahmed S, Hussain J, Ullah A, et al. (2018) Assessing the impact of climate variability on maize using simulation modeling under semi-arid environment of unjab, Pakistan. *Environmental Science and Pollution Research*. 25: 28413-28430.
4. Lewis S.C and King, A.D (2017) Evolution of mean, variance and extremes in 21st century temperatures. *Weather and Climate Extremes*. 15: 1-10.
5. Ahmad I, Wajid S A, Ahmad A, Cheema M J M, Judge J, et al. (2018) Assessing the impact of thermo-temporal changes on the productivity of spring maize under semi-arid environment. *International Journal of Agriculture and Biology*. 20: 2203-2210.
6. Chen C, Pang Y, Pan X, Zhang L (2015) Impacts of climate change on cotton yield in China from 1961 to 2010 based on provincial data. *Journal of Meteorological Research*.29: 515-524.
7. IPCC. Climate Change (2007) The Physical Science Basis: Working Group I Contribution to the Fourth Assessment Report of the IPCC. Vol. 4. United Kingdom: Cambridge University Press; 2007.
8. Amouzou K A, Naab J B, Lamers J PA, Borgemeister C, Becker M, et al. (2018) CROPGRO-cotton model for determining

-
- climate change impacts on yield, water-and N-use efficiencies of cotton in the dry savanna of West Africa. *Agricultural Systems*; 165: 85-96.
9. Rahman M H (2018) Multi-model projections of future climate and climate change impacts uncertainty assessment for cotton production in Pakistan. *Agricultural and Forest Meteorology*. 253: 94-113.
10. Jackson S O (2021) Vulnerability of Arable crops to Climate Change and Adaptation Strategies in Abia State. A PhD Thesis Seminar Presented to the Faculty of Social Sciences University of Port Harcourt.

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