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Climate (Rainfall) changes awareness assessments of food crop farmers in parts of South-Eastern, Nigeria

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Abstract
The study broadly examined the level of understanding or awareness of the changing nature of the annual rainfall regime, as a precondition for informed response action by peasant farmers in the study area. The study methods consisted of the identification of the estimated six thousand (6,000) study population across three states in South Eastern Nigeria namely; Abia, Akwa Ibom and Cross River. A sample of one thousand five hundred (1,500) farming households of fifty (50) years and above in age at least half of which in farm business, was drawn across study area with the multi-stage probability sampling design. A wells structured close and open-ended measurement instrument consisting mainly Likert-type questionnaire items to measure the respondents knowledge of sets of rainfall change stresssors and/or stimuli was administered equally, among the sixty farming communities selected. Finally twenty-five (25) farming households were randomly served from each of the farming communities making up the sampling seize. The five response stressors are the change in quantity (amount), change in duration, change in frequency, change in intensity and the change in geographical spread. Descriptive statistics comprising the calculation of the mean, percentages and rankings as well as the non-parametric chi-square confirmatory goodness of fit tests are utilized in the analyses of the data and statistical testing for objective conclusions.

Keywords: climate changes, awareness assessments, food crop farmers, south-eastern

Introduction
The climate change pandemic is on the 'prowl' with its immediate and long-term implications. It can only be checkmated through effective dissemination of research findings and education. It may also be safe to generalize that almost every key aspect of human endeavours are directly or indirectly influenced by the weather and climate system. Indeed, the global food crises in sub-Sahara Africa and elsewhere including the more recent shortages in rice supplies from producing nations in S/E Asia leading to high prices of the commodity have been linked with attempts at averting the global warming problem. Padi rice fields in South-east Asia and South America are rather being experimented with sugar cane plantations for biofuels production believed to be more environmental friendly. (World Bank, 2002) [33].

However, Sub-Sahara and Tropical Africa is faced with greatest risk from this pandemic through desert encroachments, biodiversity loss and extinction with shrinking water bodies and lakes (NIMET 2008) [17]. The awareness level and capacity to respond to this pandemic is about the lowest the world over (WMO, 1988) [32]. There cannot be an exaggeration of the fact that effective response is a direct function of the level of awareness or understanding and ability to respond to the problem. It is posited, in this study therefore, that the seeming low adaptive responses to the problems associated with the changing annual rainfall regime in the study area is, among other factors, due to the seeming lack of knowledge and skills of the problem by the peasants. As a result, materials, energy and time are spent "chasing shadows", a complete reversal with the awareness creation campaigns for the HIV/AIDS, pandemic. Why does the government not attempt to "nip in the bud" by creating the needed awareness. Whereas planned responses based on efficient awareness creation and education are most effective leading to 15 to 25% increase in farm output in India, (Barry *et al.,* 2000) reactive or autonomous responses do not guarantee increased food production. Autonomous response is individualistic and barely equips the operator with partial or incomplete facts and knowledge leading to the 'clairvoyant farmer concept' or trajectory – believing erroneously that are necessary steps are taken to contain climate change issue(s) (Fussel *et al.,* 2000).

A change in annual rainfall regime over time involves the change and or – variations in either of the stimuli or stressors. Such may involve the change in the following; the change in the amount, change in the duration, change in the intensity, change in the frequency and the change in the spread (Glantz, 1988; IPCC, 1991a, Afanideh, 2006; Liverman, 1986; Rosenberg, 1992) [3, 24]. Excepting the Humid Tropical sample location of Calabar with an increasing but insignificant annual trend (Afangieh, 2006) [3], the two remaining sample locations are relatively more hinterland. Trend analysis of the region's annual rainfall rather indicated a negative or declining trend as compiled and published by (NIMET, 2007, Afangideh, 2005; 2006) [17, 4]. The researcher is desirous therefore to establish the awareness level of the respondent farmers to this evolving scenario and the most impacting climate change stressor(s). Viable response options may not be quite possible without their initial determination. It is envisaged.

Research Aims and Objectives

The overall aim of this research is to establish the level of awareness of food crop farmers to the global problem of climate change in the sub-region. Towards the attainment of the aim are the following objectives;

a) To determine the level of awareness of the respondent farmers to the changing annual rainfall regime vis a vis change in quantity, duration etc.
b) To also find out the most impacting change stressor from point of view of the respondents;
c) Proffer solutions to enhance efficient and effective information management and education in climate change.

Scope and Limitation of the Study

The scope of this research is limited to the determination of the level of awareness of rainfall changes by croppers being one of the most vulnerable sectors to the ecological pandemic of climate change. It is purely a survey research intent on simple analysis of responses to objectively assess the awareness level of respondents to the problems. Rainfall information are not utilized as such facts have already been established by both the author and others. Besides, the lack and difficulty in getting data and reliability of climate information, particularly in Africa, are known. The change indices are therefore difficult to determine from the above limitations.

Conceptual and Theoretical Frameworks

Two concepts are considered vital understanding the basis for the study. The anthropogenic climate change concepts, states briefly that climate has changed and is currently changing because of a wide range of natural factors which operate over a variety of time scale. Nonetheless with the increasing human population and the rising levels of technology, urbanization and agricultural expansion to feed the fast growing global population etc, it is now apparent, over the last century, that man has become a significant factor in the change (WMO, 1970; UNEP, 1985). The resulting increasing terrestrial temperatures, from the emissions of greenhouse gases are leading to extremities in average summer rains and flooding in the Temperate world while the Tropics face the southwards encroachment of the deserts biodiversity loss and extinction, sea level rises, and flooding and erosion in coastal regions etc. the changes in the mean rainfall regime of the study area, is believed therefore to be more the direct result of the global warming phenomenon or the climate change pandemic.

Wermers Organisms Development Theory

The first comprehensive but empirically derived theory of the cognition of space in man-using the child was propounded by Wermer in 1957. Wermer sees cognitive development as preceding through three distinctive developmental progressions namely; progressive self-object differentiation, progressive constructivism and constructive perspectivism (Ebong and Bassey, 2004; Bell *et al.,* 1996) [6]. The progressive self-object differentiation is a stage during which the man cannot differentiate self from his environment, being passive and just learning. With our peculiar case study the farmers may be confronted by the problem but being more or less ignorant are only learning to understand what or the nature of the problem.

At the progressive constructivism stage, the child becomes increasingly active to construct the image of the world around him, the farmer gradually gets to understand the issues involved as he continues with his farming. He learns more through time with higher expectation having learnt to isolate and understand the issues or come to realize that self and environment are different dependent entities. The phase constructive perspectivism sees the children image of the world as a fusion of both his thoughts and others. He has come to appreciate the complexity and multi nature or perspectivism and dynamism of the world through learning with repeated observations. This three developmental or learning levels are sensori-motor, perceptual and contemplative corresponding to the three progressions. The respondent peasant farming population in the area, in order to be aware of the change in the (rainfall) climatic regime of their operational environment must be made to realize the variations and changes mean weather or climate of their business environment. Following the model, the child is taught to understand and/or learn but the peasants in the study are left alone. Without the full involvement of governments in awareness creation, education and dissemination of research findings the process is incomplete and the expected actions may be late for a timely "stitch".

Study Area

The study is conducted across three states namely Akwa Ibom, Cross River and Abia. Studies on the agro-ecological zones sculptured from the ADP of the Federation. Fig. 1. Climatic patterns in the states are nearly similar for Akwa Ibom, Abia and about a half of southern Cross River State being of the Humid Tropical type. The remaining half of the later, is within the Guinea Savanna climatic zonation, Aw (Koppen Zonation), the annual precipitation averages are 285mm, 2558.3mm and 2403mm while the extremes are 3992.5mm; 2110.0mm; 3825.4mm; 1599.4mm; and 34017.7; 1601.7 respectively for Calabar, Uyo and Umuahia.

The vegetation and soil can be classified into the mangrove swamp, and the rainforest while the guinea savanna and montane are specifically found in northern Cross River. Abia, Akwa Ibom and Southern Cross River State soils are underlain by the Benin formation consisting predominantly of fluvial and lacustrine deposits which were formed from the Oligocene to recent times. The sediments are mainly loose unconsolidated and semi-coordinated sands intercoated with silt, clays and shales with some organic matters. The basement complex rocks to the north of Cross River State include the magnetities, quatzites, granites, qnesses, schisti and basalt. The resulting soil types also show very strong influence of the underlying geologic parent materials.

Farming is the major occupation of the people while fishing and hunting are secondary. Major food crops include cassava, rice, maize, yam, water yam, melon etc. vegetables grown extensively include fluted pumpkin, bitter leaf, waterleaf, okra, pepper, melon, afang (*Metum africanum*). Besides, it is also rich in cash crops such as oil palm, rubber, cocoa, kolanut, plantain, banana and pineapple.

Population of Study

This study is conducted with an estimated populated of six thousand (6,000) respondents drawn from the twelve (12)

Agro ecological zones of the area. Five hundred (500) respondent farmers are thus drawn from each of the ecological zones. There are however about 291, 131: 342, 131 and 210, 236 farming families in Cross River state, Akwa Ibom and Abia States respectively (CRADP, 2001; AKADEP, 2002 A-DEP, 2000).

Sample of Study

The need for sampling in this study results from the desire to obtain external validity and also to eliminate problems associated with most research such as population size, cost in terms of finance and time, greater speed and accuracy and accessibility to the population. Out of Six Thousand (6,000) staple crop farmers, three thousand (3,000) respondents are drawn from the zones with two hundred and fifty (250) respondents sampled from each of the six purposively selected, zones giving thus a thousand five hundred (1,500) sample of study. This sample (1,500) represents 25% of the total estimated population for which Pell (1982) have argued that this proportion is a reasonable percentage and number for research work.

Table 1: Sample Agro-Ecological Zones and Respondents

Agro-Eco-zones	No. of Respondents
Ohafia	250
Umuahia	250
Abak	250
Oron	250
Ogoja	250
Calabar	250
Total	1,500

Source: Field Survey, 2006.

Sampling Design

The sampling procedure that is adopted for this study is the multi-stage sampling technique for reasons already stated. A purposive sampling of two agricultural zones in each state leads to yet another sampling of two Local Government Areas each thus giving a total of twelve Local Government Areas in all. Five farming communities were again purposively selected from each of the selected Local Government Areas for random sampling. From the sixty (60) farming communities so sampled, twenty-five (25) farming households are randomly drawn to give the sample size of a thousand five hundred respondents. An enumeration of farming households is carefully conducted from where twenty-five respondent households are randomly sampled in each of the farming communities.

Table 2: Field Questionnaire Pre-processing

LGAs	Administered	Loss	Returned	Rejected	Used	Response
Ohafia	125	12	113	8	105	84.00
Arochukwu	125	17	108	6	102	81.60
Umuahia	125	4	121	14	107	85.60
Ngwa N.	125	24	101	-	101	80.80
Ukanafun	125	11	114	2	112	89.60
Oron	125	2	123	4	119	95.20
Okobo	125	23	102	6	96	76.80
Ogoja	125	14	111	-	111	86.40
Obanliku	125	5	120	11	109	87.40
Akpabuyo	125	17	108	5	103	82.40
Akamkpa	125	2	123	7	116	92.80
Total	1,500		1,342	63	1,279	85,28

Note: a dash (-) means none-rejected. Average response rate = 85.28%
Source: Field Survey (2006).

Instrumentation

This study utilizes the questionnaire, unstructured interview and participant observation method to collect data. Such structured questionnaire sought the respondents' opinion / knowledge of the nature of the annual rainfall regime in the study locations. The questionnaire involve the close and open-ended format and is structured in a manner to cover all the variables under investigation. The face-to-face methods are used to administer the questionnaire. This method is appropriate because apart from ensuring a high response rate, the possibility of misinterpretation of the questions by the respondent is eliminated as either the researcher or his trained field assistants are available to explain what the respondents do not understand. Besides, it ensures accurate sampling and collection of relevant data from the respondents. The Likert-type response categories are preferred because the format, apart from the ease of analysis increases comparability of responses in the respective agro-ecological zones of study.

Validation of the Instrument

The questionnaire is tested using a pilot study technique where questionnaire are administered to 150 respondents in the twelve agro-ecological zones representing 10% of the respondents for their response. The essence of this pilot study, however, is to test 'how it will work' and 'how it can be improved upon or modified' for more proficiency. After the exercise, some modifications are made through experts counselling leading to the restructure of some questionnaire

items. The results of the pilot study indicate that the respondents understood the contents of the questionnaire.

Hypothesis

H_0: Awareness level of climate change issues by the respondents farmers is not significant.

H_1: The awareness level of the changing rainfall pattern by the respondent farmers is significant.

Procedure for Data Analysis

1. Statistical analysis involves the utilization of both descriptive and inferential techniques. The descriptive analysis consists of determining the mean responses, frequencies and rankings. Conclusions in support of the research-hypothesis require use of the chi-square (contingency test) at 95% confidence level. The statistical notation for the chi-square test statistic is given as:

   Chi-squared (x2) = $\sum_{1=1}^{n} \frac{(O-E)^2}{E}$

Where,

O = Observed frequency

E = Expected Frequency

N = Number of Category. It is used in this study to evaluate the appropriateness of the positive responses to the issue from a theoretical basis.

Findings

Rainfall change Awareness Assessment of farmers in South-Eastern, Nigeria. The assessment of the level of awareness of the changing annual rainfall regime by croppers, as an indirect measure of the impact and response to the problem is the major focus of the study. The key rainfall change indices, whose variability and change are considered critical to farm business, include the change in the annual total, the change in duration, change in the intensity, change in the geographical spread and the

change in the frequency of occurrence (Elkin, 1997; Trenberth *et al.,* 2005). Barry *et al.* (2002) have termed the above as the change "response stimuli" or the "stressors" which climate-sensitive system's operators like the agricultural and water resources sectors etc. must be adapted to for sustainability. The operator's level of awareness is considered a major input variable in adaptive response strategy for sustainability.

Awareness ratings of the stressors above are 'increasing', 'Decreasing', Stagnating' and 'No consistency'. The respondents are to indicate their agreements or disagreements with the ratings above by ticking that which agrees best or explains the situation as felt or experienced by them. To facilitate the analysis, therefore. 'Decreasing' and 'stagnating' responses are regarded as 'yes' while 'no' stands for 'increasing and 'not consistent' responses. Descriptive statistics, rankings are utilized in the discussions. The inferential non-parametric chi-square test statistic is finally used for hypothesis testing, generalization, and conclusions. The analyses of field responses are however summarized state by state in Table 3 below. Preceding the sets of questions that.

Table 3: rainfall change stressors awareness assessment for Akwa Ibom state

Response stimulus	Awareness Level	
	Yes (%)	No (%)
Change in annual total	225(54%)	197 (49%)
Change in intensity	250 (60%)	190 (46%)
Change in duration	260 (62%)	165 (40%)
Change in spread	199 (49.9%)	216 (52.1%)
Change in frequency	240 (57.9%)	175 (57.1%)

Table 4: rainfall change stressors awareness assessment for Abia state.

Response stimuli	Awareness Level	
	Yes (%)	No (%)
Change in annual total	220(51.7%)	201 (47%)
Change in intensity	210 (49.1%)	211 (51.1%)
Change in duration	252 (58%)	169 (41.9%)
Change in spread	197 (46.7%)	224 (53.3%)
Change in frequency	260 (61.7%)	160 (38.3%)

Table 5: Rainfall change stressors awareness assessment for cross river state

Response stimuli	Awareness Level	
	Yes (%)	No (%)
Change in annual total	250(57%)	175 (43%)
Change in intensity	246 (56%)	186 (43.7%)
Change in duration	260 (59.6%)	176 (40.4%)
Change in spread	235 (53.4%)	201 (46.66%)
Change in frequency	239 (55%)	195 (45.1%)

Table 6: Composite rainfall change stressors awareness assessment

Response stimulus	Awareness Level	
	Yes (%)	No (%)
Change in annual total	678 (52.7%)	601 (47.3%)
Change in intensity	683 (53.3%)	596 (46.7%)
Change in duration	762 (59.2%)	517 (40.8%)
Change in spread	631 (49.3%)	640 (50.7%)
Change in frequency	7346 (57.8%)	540 (42.4%)

Source: Field data analysis, 2006.

Led to the presentations above has been the surprising initial response regarding the main issue of the study. The high positive nominal response, with the Cross River State respondents in the lead, on whether or not the annual rainfall regime is posing a problem to farming was a pleasant surprise to the team. On further analysis the average 'yes' response was 61.4% across. This further led to the study team's wish to further establish the major stressors.

The level of the farmer's knowledge of the changing nature of the manual rainfall regime due to the issue of global warming

from our simple analysis is considered low. The average positive and negative responses regarding the change response stimuli or stressors are 53.46% and 45.48% respectively (Table 6). Declines in the annual duration and frequency seem the more acknowledged with percentage scores of 59.2% and 57.8% respectively.

On a state by state basis, however, (Tables 3. 4, 5) the positive (yes) responses in support of the main issues are 54.24%, 53.42% and 55.8% for Akwa Ibom, Abia and Cross River respectively. On individual states levels, the change stressor(s) with the highest awareness in the area consist of the change in the duration (60%) for Akwa Ibom while it is (58%) for Abia State, it is the change in duration for Cross River (59%). The second noticeable rainfall change stressor are the change in frequency 57.9% (Akwa Ibom); 57.70 (Abia) and annual total 60% (Cross River) the apparently higher awareness rating for Cross River farmers from the presentations above is clearly understood as the only study state with the likely risk of climate change problems, due to its north-south orientation or the continental effect. Moisture from seasonal rains is the most critical factor in farm operations. Abia and Akwa Ibom farmers even with the statistically established declining trend in the annual regime (Afangidehand Ekanem, 2006) seem not to be under stress, hence the low awareness ratings from analysis. Being within the Humid Tropics, occasional floodings of farmlands and erosion are the predominant climate change problems of these states.

To indeed generalized whether the average 'yes' responses from the study is significant and in accordance with theoretical expectations utilizing the non-parametric chi-square test at 95% confidence level and n-1=4 degree of freedom, is negative ($X^2_c < X^2_t = 5.991 < 9.488$). The acceptance of the null hypothesis implies that the farmers are not well aware of the issues as their response is below the theoretical minimum expected. The initial nominal affirmation of the issue cannot be relied upon therefore as it might have been an over exaggeration or a mere chorusing effect.

Discussion of Findings

Results of the initial nominal response affirming the issue of rainfall change as well as the test of hypothesis points to a rather low hence insignificant level of awareness to the problem by the respondent farmers. The response strategies are therefore low or non-existent by extension. Afangideh and Ekanem (2005) [4] did establish a statistically significant decline in the annual rainfall regime for Uyo, Akwa Ibom State one of the sample states. The same conclusion can easily be drawn also for Umahia, Abia States and much more so for Cross River State. The 2008 edition of the Nigerian Meteorological Bulletin have shown and concluded that the climate change problems are here with us in apparent support of the research findings and conclusion above. The truth however is that the operators of one of the most sensitive and vulnerable sector to the risk posed by climate change are unaware and cannot therefore be held responsible for farm practices that enhance global warming e.g. application of chemical fertilizers, bush clearings and burning etc. their apparent inactivity may be because they are not at any serious risk as the impacts are equally minimal or non-existent at all. Secondly, as peasants and illiterates, they are indeed ignorant of the issues and thereby acting the 'dumb farmer' that lacks the ability of responding to changes around him. But quietly bearing the pains through poor harvest with the hope of external or divine intervention (Fusssel and Kelvin, 20002; Smith and Pilofosova, 2001; Kane and Yohe 2000) [11].

The average awareness ratio of 53.7% (Table 6) from analysis is low and insignificant. This awareness level seems lower than their counterparts elsewhere in the world. A major reason for this may be the complete non-sensitization of the populace in general and climate-sensitive sectors of the economy in particular on the potentially impending catastrophe by the governments (local, state and federal). "A stitch in time serves nine' is an adage that is worth borrowing here. In the Carribean for instance, the Carribean planning for Adaptation to Climate Change (CPACC) had the plan to build the capacity to reduce the vulnerability to climate change. The CPACC adopted an institutional strengthening approach through a monitoring, communication, training and information dissemination programme to provide guidance to country-level manager (King and Clarke, 2000) [14]. In the Magherb region, another UNDP/GEP funded initiative 'capacity building of the Maghreb countries in Climate change', focused on building structures to manage climate change sustainably to prepare adaptation strategies at the local level and to engage the private sector to see how it can reduce its contribution to greenhouse gas emissions. (UNDP/GEF/RAB/94/931 Project, 2002). Also, the Pacific Islands Climate Change Assistance Programme (PICCAP) follows a community development approach to develop a mitigative as well as adaptive capacity wherein individual communities and sectors are being empowered to reduce their vulnerability and focus on building resilience to their community.

The Nigerian governments can do more to sensitive its citizenry early enough to the evolving climate change pandemic as 'a stitch in time' to avoid future multiple and complex food and water crises etc. with response being certainly a direct function of the awareness level, education and impacts, etc. the adaptive responses of the farmers are low often in the dumb and / or clairvoyant farmer trajectories (Fussel and Klein, 2002). Effective and efficient adaptive responses and capacity depend upon the level of information available to the farmer, government policies, education, income, skill, willingness and ability to access modern technology (Adger, 2003; Obriovdan *et al.*, 1998; O'Riovdan and Jordan, 1999) [2, 16]. The entire farming population in the study is seemingly deficient in all of these for which the governments are hereby called upon the seriously address for sustainability.

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