

Adaptive Response Problems of Subsistence Farmers to Rainfall Changes in South-Eastern Nigeria.

[1*] A. I. Afangideh, [2]P.A. Akpan and [2]E.P. Udofia
[1] Department of Geography and Regional Planning, University of Calabar, PMB. 1115, Calabar, Nigeria.
[2] Department of Geography, University of Uyo, Akwa Ibom State, Nigeria.
*Corresponding Author: asuquoafang@yahoo.co.uk

Abstract
The multivariate (R-mode factor analysis) technique was utilized to determine the main adaptive response problems of subsistence farmers to the changing annual rainfall pattern in South-eastern Nigeria. A total of one thousand two hundred and seventy nine (1279) respondent farmers were randomly drawn from sixty (60) farming communities in Cross River, Abia and Akwa Ibom states, Nigeria, a six (6) dimensional solution from an initial fifteen (15) was arrived at accounting for almost 70% of the variations in the original problem matrix. These major problems include the lack of climate information, illiteracy, awareness problem, fertilizers and funding problems, poor agricultural and weather extension services, and difficulties in accessing official information. Non-governmental organisations and governments should be much more interested in climate change issues and act proactively to ameliorate the problem.
Key words: Rainfall change, R-mode factor analysis, subsistence farmers, adaptive response.

INTRODUCTION

Climate change has been experienced all over the world for the past few decades, and increasing temperatures will result in more adverse weather and climate variability (Amiri and Eslamian, 2010; Begum *et al.,* 2011). Reports on the adverse effects of climate change include changes in rainfall and temperature patterns, sea level rise, agriculture and food production, forestry and wildlife, water resources, drought frequency and desertification as well as human health (Afangideh et al., 2008; Amiri and Eslamian, 2010; Eneh, 2011; Shafik Elmallah, 2011). The risks associated with anthropogenic climate change call for a broad spectrum of policy responses to reduce the vulnerability of climate-sensitive systems (Fussel and Klien, 2002). The two fundamental response strategies distinguished in the climate change community are mitigation and adaptation. Whereas mitigation refers to limiting global climate change through reducing the emissions of greenhouse gases and enhancing their sinks, adaptation aims at moderating its adverse effects through a wide range of system-specific actions. Such may involve changes in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change (Smith and Pilifosova, 2001). Mitigation has traditionally received much greater attention than adaptation in the climate change community both from scientific and policy perspectives. Adaptive responses by the operators of climate-sensitive systems such as water resource, food and agricultural subsystems can either be reactive (autonomous) or planned (Smith and Pilofosova, 2001). It depends quite greatly on the adaptive capacity of the affected system, region or community to cope with the impacts, and risks of climate change. However, an adaptive response in the study areas is reactive searchingly following the ‘dumb and clairvoyant farmer’ trajectories (Fussel and Klein, 2002). The major reasons for the ineffective adaptive response strategies by the respondent food crop farmers are the major plank of this study. Primary food supplies such as vegetable, tubers, cereals and spices are the main food intakes and supplements for the rural and urban dwellers, and these must be sustained against hunger and income for the teeming dependents (Consumers) and producers (resource-poor farmers).
This study aimed at finding out the major problems confronting effective and efficient adaptive responses to the global warming climate change pandemic by subsistent food crop farmers in South-eastern Nigeria.

RESEARCH METHODOLOGY

Study Area

The study was conducted across three states namely Cross River, Abia and Akwa Ibom in the humid South-eastern Nigeria. The area is located between latitudes 4º 26[1] and 6º 55[1] North and Longitudes 7º and 9º 28[1] east. The average annual temperatures are in the range of 23.4 – 39.69 ºC and annual rainfall averages 1300 mm (**Udoidung** *et al*., 2007; Ukeh, 2008; Afangideh *et al*., 2010; Afangideh et al., 2012). The study area is bordered by the Atlantic Ocean to the south and the Republic of Cameroon to the east, the north and west are bordered by states in the Federal Republic of Nigeria (Fig. 1).

Study Population and study sample

The population of this study comprise all the 12 agro-ecological zones of the three states and the corresponding Local Government Areas (LGAs). Consequently, Food crop farmers in the 12 agro-ecological zones constituted the study population. The study was therefore conducted with about 6,000 respondents (500 from each zone). Out of the total study population of 6000 subsistence farmers, 3000 respondents were drawn from 6 agro-ecological zones at two per state. Hence, 250 respondents were sampled from each of the 6 zones making a total of 1,500 respondent farmers for the study.

Sampling Techniques, Instrumentation and Validation

The sampling procedure adopted for this study was the multi-stage design. A purposeful sampling (non-probability) of two agro-ecological zones were sampled for each state; Ohafia, Umuahia, Abak, Oron, Ogoja and Calabar. Two LGAs were then randomly chosen in each state giving a total of 12. In each LGA, 5 farming communities (FC0 were selected with the stratified random technique and thus giving a total of 60 FC. Twenty five (25) farming households (FH) were randomly selected per FC, with the sampling without replacement variant, to give 1500 respondents used for the study (Table 1). This stratified sampling was useful in the selection of sample because the population consisted of a number of sub-groups which ordinarily needed to be represented. The study utilized the questionnaire, unstructured interview and participant observation methods to collect the data. Such structured questionnaire sought the respondents' opinion, knowledge or suggestions on the problem of adaptive responses and the way forward. The face-to-face method was used to administer the questionnaire because apart from ensuring a high response rate, the possibility of misinterpretation was eliminated as either the researcher or the trained field assistant were available to explain what the respondents cannot understand. The questionnaire was also tested for validity using a pilot survey technique where 150 respondent farmers in the 12 agro-ecological zones were administered representing 10% of the respondents. Modifications were made after the exercise and some items in the questionnaire were re-structured. The result of the pilot study showed that the respondents understood the contents of the questionnaire.

Data Analysis

The multivariate grouping technique with factor analysis and additional hypothesis testing capability (Johnston, 1980) was used for analysing data. With this technique, a large number of original variables (X1, X2, X3, 4X, Xn) can be collapsed into new set of fewer variables (Z1, Z2, Z3 ...2) accounting for a significant portion of the variation in the original data set.

With the Q-model variant the data matrix columns containing 15 adaptive response problems from the 1279 responses in the present study were collapsed into major problem groupings. The essence of the technique was to create order or pattern from disorderly scenarios (Udofia, 2011). The barriers or problems to effective response strategies for which the major ones were to be sorted out include funding (X_1), cost of fertilizers (X_2), government policy (X_3), education (X_4), extension services (X_5), weather services (X_6), poor orientation(X_7), difficulties in assessing official information (X_8), weather related extension services (X_9), resistance of farmers (X_{10}), limited resources (X_{11}), institutional barriers (X_{12}), cost of adaptation (X_{13}), knowledge of fertilizers (X_{14}), poor skills (X_{14}).

RESULTS AND DISCUSSION

The result of preliminary investigation of the distribution of the constraints in terms of their means and standard deviations is presented in Table 2. Indicators or problems were homogenous (Table 2) with the mean values of 1 and above but <2, and standard deviation values of >0 but <1. The standard deviation can also be grouped into highly deviated (>0.7) which are 8 in number, and less deviated (<0.7), these are 7 in number.

The factor analysis procedure with varimax rotation and communalities applied to the data yielded a six-dimensional solution (Table 3). The communalities which can be regarded as indicators of the importance of the variations in the analysis range between 0.19 and 0.7, relative mix of the factors. The six factors that accounted for about 70% (69.98%) of the total variations are the composite indicators that defined the major constraints to effective responses by subsistence farmers in the studied area (Table 4).

In this study, factor 1 with 1.598 eigen value accounted for 20.93% of total variation and was the most important factor or dimension of the fifteen variable adaptive response constraints (Table 4). Two variables, the poor weather and climatic information (P7) and the gross unreliability in the weather information (P8) load positively and significantly on the dimension (Table 3). The resource poor farmers are always vested with local knowledge for yield enhancements. But where the additional sensitization is lacking or faulty, as was the case of the study area, the farmers have limited weather information (Afangideh et al 2012). Factor 2 (illiteracy and awareness problem) with 1.195 eigen value accounted for 15.65% of total variance, associated are three variables which load positively and negatively. The positive loaders were government policy (P4), education (P5) and the cost of adaptation. On the contrary, the lack of awareness and illiteracy coupled with ignorance of respondents in the study area created unfounded fears and complexes. However, nations with a different perception of the risk of climate change are adopting decision rules that encourage them to invest both in adaptation and mitigation technologies to ensure benefits are maximized. For instance, the Pacific Islands Climate Change Assistance Programme (PICCAP) has followed a community development approach to develop mitigative as well as adaptive capacity (IPCC, 1996).

Factor three with 0.739 eigen value accounted for 9.67% of the total variance in the variable problem space. Two variables namely funding (P1) and cost of fertilizers (P2) have positive loadings. Funding remains a major determinant of the success or otherwise in all human endeavours. This finding is in agreement with the submissions of Burton et al. (1998) and Kates (2001) that whatever is expressed as economic assets, capital resources, financial means, weather or poverty, the economic conditions of nations and groups clearly are determinants of adaptive capacity responses. Respondents in the study are characterised by limited resources recognized as major constraints to the adoption of efficient and effective measures (IPCC, 2001). This factor is considered an eloquent conformation of the above, and termed the funding and cost problem.

Factor four with 0.651 eigen value accounts for 8.52% of the total variance in the primary variable matrix. The most pronounced variable with a positive loading of 0.707(Table 3) was the poor agricultural extension services; while variable eleven specifically addressed the lack of weather extension services. Following this factor is poor agricultural and weather extension services problem. The poor state of agricultural weather extension service and the variable/complex nature of the average resource poor farmer to new ideas and innovation was a great problem of adaptation. The results showed that extension agents are not well informed on climate sciences adaptation and mitigation, hence the adoption of adaptive measures were constrained by priorities and institutional barriers (Bryant *et al.,* 2000; De Leo and Kreutzwiser, 2000).

Factor five with 0.611 eigen value accounted for 8% variation in the original variable space loading. The absence of workshops and demonstrations of new technologies by the different tiers of government and NGOs for this category of farmers on climate change and other related issues are serious set-backs. The sixth and the last major groupings of the problems of adaptation with 0.551 eigen value accounted for 7.21% of the variation in the original variables data matrix. The lone variable, difficulty in accessing official information is an issue that must be looked into seriously. The bureaucracy of governments must be redefined for exemptions on issues of public good such as climate change. Governments and other organisations could relax their operational standards with regards to problems that concern resource poor farming communities so as to encourage them benefit from specialized services and research findings.

CONCLUSION

The main problems and constraints to effective response strategies to the global climate change issues among resource poor crop farmers in south eastern Nigeria has been established. In descending order of magnitude the problems include the lack of climate information, illiteracy and awareness, fertilizer and funding, poor agricultural and weather extension services, and the difficulty in accessing official information. Governments should invest more on climate change and other environment-related issues and educate its peoples who are the ultimate beneficiaries and end-users for sustainability.

REFERENCES

Afangideh, A.I., F.I. Okpiliya and E.I. Eja, 2010. A preliminary investigation into the annual rainfall trend and patterns for selected yowns in parts of South-eastern Nigeria. J. Sustainable Dev., 3(3): 275-282.

Afangideh, A.I., P.A. Akpan, E.P. Udofia and D.A. Ukeh, 2012. Socio-Demographic determinant of response strategies by Resource-Poor farmers to climate change in South-Eastern Nigeria. J. Geography and Geology, 4: 33-40.

Afangideh, A.I., P.A. Akpan, F.I. Okpiliya, F. Ekanem and M. Abua, 2008. Climate (Rainfall) changes awareness assessment of food crop farmers in parts of South Eastern Nigeria. African Studies Review, 5(3).

Amiri, M.J. and S.S. Eslamian, 2010. Investigation of Climate change in Iran. J. Environ. Sci. Technol., 3(4): 208-216.

Begum, R.A., C. Siwar, R.D.Z.R.Z. Abidin, and J.J. Pereira, 2011. Vulnerability of climate change and hardcore poverty in Malaysia. J. Environ. Sci. Technol., 4: 112-117.Doi:10.3923/jest.2011.112.117

Burton, I., J.B. Smith and S. Lenhart, 1998. Adaptation to climate change: theory and assessment. In Handbook on methods for climate change, impact assessments and adaptation strategies. Amsterdam, UNEP.

Bryant, C.R., B. Smit, T.R. Johnson, J. Sinitheus and B. Singh, 2000. Adaptation. In Canadian Agriculture to climate variability change. Climate Change, 45(1): 181-201.

De Loe, R.C. and R. Kreutzwiser, 2000. Climate variability, climate change and water resource management in the Great lakes. Climate Change, 45(1): 163-179.

Eneh, O.C., 2011. Enhancing Africa’s environmental management: integrated pest management for minimization of Agricultural pesticides pollution. Res. J. Environ. Sci., 5(6): 521-529. DOI:10.3923/rjes.2011.521.529.

Fussel, H.M. and R.J.T. Klein, 2002. Assessing vulnerability and adaptation to climate change: An evolution of conceptual thinking. Paper presented at the UNDP Expert Group Meeting on ‘Integrating Disaster, Reduction and Adaptation to Climate Change’ Havana, Cuba.

IPCC, 1996. Climate change impact, adaptations and Mitigation. Cambridge, CUP.

IPCC, 2001. Climate Change 2001: Synthesis Report. Cambridge, CUP.

Kates, R.W., 2001. Cautionary Tales: Adaptation and the global poor. Climate Change 45: 1-17.

Shafik Elmallah, E., 2011. Regional climate interaction with the solar and geomagnetic activities. Res. J. Environ. Sci., 5(4): 316-328. DOI: 10.3923/rjes.2011.316.328.

Smith, B and O. Pilifosova, 2001. Adaptation to climate change in the context of sustainable development and equity. In: McCarthy et al. (eds). Climate Change 2001: Impacts, Adaptation and Vulnerability. Cambridge, CUP.

Udofia, E.P., 2011. Applied statistics with Multivariate Methods. Enugu, Immaculate Publ.

Udoidung, N.I.G., I.E. Braide, K.N. Opara and H.A. Adie, 2007. Perstans filariasis in rural communities of the lower Cross River basin Nigeria: parasitological observations. Int. J. Zool. Res., 3(4): 207-212. DOI=ijar.2007.202.212.

Ukeh, D.A., 2008. Bioactivities of essential oils of *Aframomum melegueta* and *Zingiber officinale* both (Zingiberaceae) against *Rhyzopertha dominica* (Fabricius). J. Entomol., 5(3): 193-199.DOI=je.2008.193.199.

Table 1. Sampling administration and collection of questionnaire.

LGAs	Number Administered	Number Returned	Number Rejected	Number Used	% Response
Ohafia	125	113	8	105	84
Arochukwu	125	108	6	102	81.6
Umuahia	125	121	14	107	85.6
Isiala Ngwa North	125	101	0	101	80.8
Abak	125	114	2	112	89.6
Ukanafun	125	123	4	119	95.2
Oron	125	102	6	96	76.8
Okobo	125	98	0	98	78.4
Ogoja	125	111	0	111	88.8
Obanliku	125	120	11	109	87.2
Akpabuyo	125	108	5	103	82.4
Akamkpa	125	12	7	116	92.8
Total	**1500**	**1342**	**63**	**1279**	**85.28**

Table 2. Descriptive statistical analysis of original data matrix

No. of problems	Mean	Standard deviation	No. of samples
P1	1.39	0.79	1279
P2	1.08	0.39	1279
P3	1.49	0.87	1279
P4	1.26	0.67	1279
P5	1.28	0.69	1279
P6	1.51	0.87	1279
P7	1.46	0.84	1279
P8	1.24	0.65	1279
P9	1.56	0.89	1279
P10	1.11	0.46	1279
P11	1.47	0.85	1279
P12	1.35	0.76	1279
P13	1.46	0.84	1279
P14	1.07	0.36	1279
P15	1.08	0.39	1279

Table 3. Rotated factor matrix

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
P1	0.26	0.379	0.48	0.145	-0.261	0.044
P2	0.027	0.042	-0.05	-0.347	-0.067	-0.038
P3	0.01	-0.06	0.921	0.243	0.019	-0.054
P4	-0.135	0.589	0.016	0.023	-0.147	-0.084
P5	-0.093	0.589	-0.078	0.081	0.127	-0.059
P6	0.184	0.373	-0.036	0.707	-0.255	-0.435
P7	0.864	-0.169	-0.008	0.158	-0.028	0.056
P8	0.599	-0.06	-0.148	0.119	0.173	0.086
P9	0.158	0.024	-0.049	0.236	0.937	-0.034
P10	0.649	0.027	0.051	-0.154	-0.049	0.333
P11	-0.065	-0.255	-0.196	0.325	0.68	0.862
P12	-0.509	-0.216	-0.265	0.23	-0.121	0.106
P13	-0.548	-0.664	-0.0229	0.049	-0.023	-0.091
P14	-0.029	0.011	-0.069	-0.217	-0.004	0.084
P15	-0.069	-0.024	-0.021	-0.303	-0.084	-0.07

Table 4. Dimensional Communality matrix

Variable	Communality	Factor	eigen value	% variance	Cummulative %
P1	0.334	1	1.598	20.93	20.93
P2	0.019	2	1.195	15.65	36.57
P3	0.685	3	0.739	9.67	46.24
P4	0.176	4	0.651	8.52	54.77
P5	0.19	5	0.611	8	62.79
P6	0.71	6	0.551	7.21	69.98
P7	0.565				
P8	0.184				
P9	0.773				
P10	0.029				
P11	0.694				
P12	0.39				
P13	0.57				
P14	0.077				
P15	0.016				

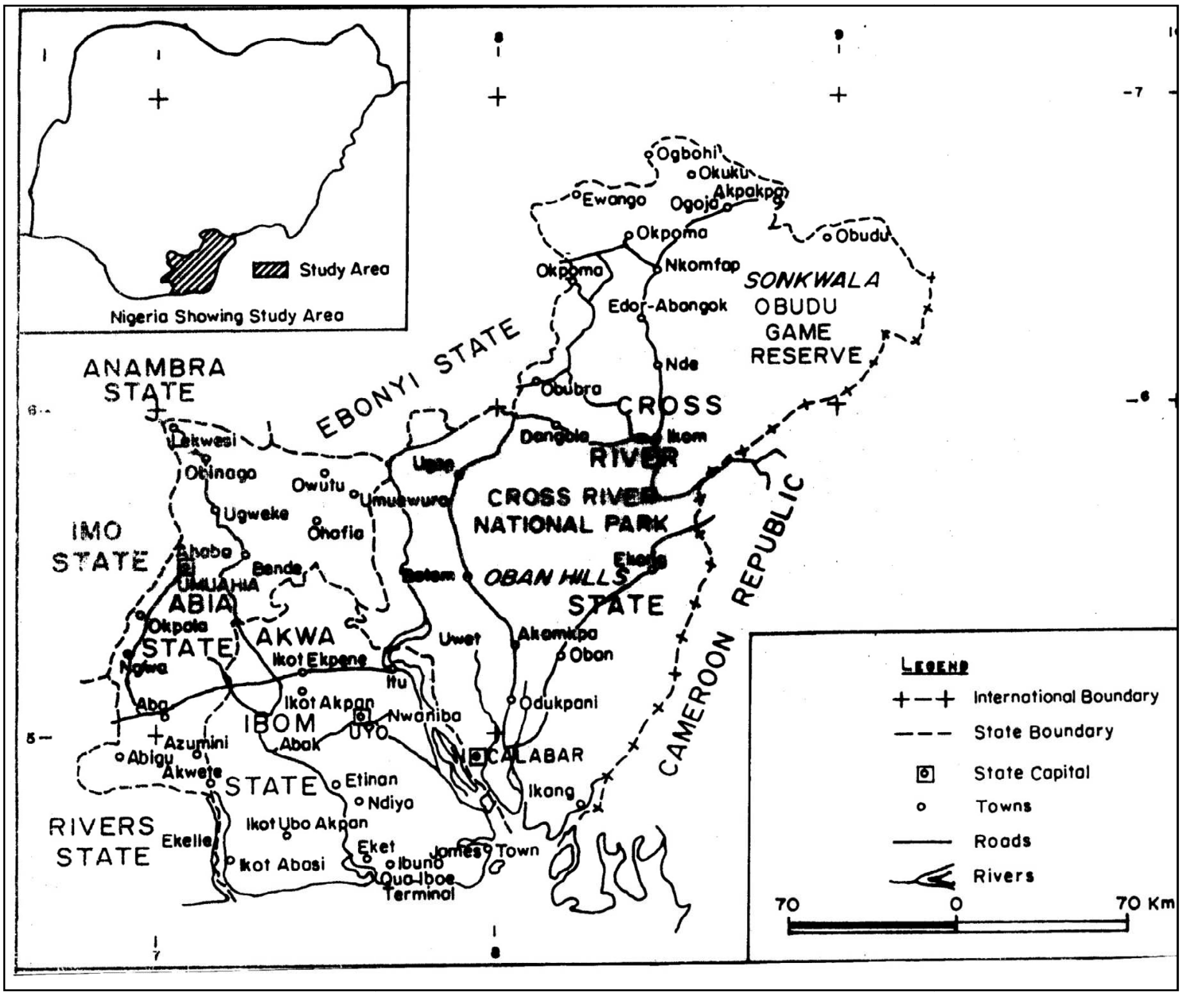

Fig. 1. Map of Nigeria showing study area.