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Altered climate and livelihood of farming families in Niger Delta region of Nigeria

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This study focused on how altered climate has affected the livelihood of the farmer and the farming families in Niger Delta region of Nigeria. The study adopted descriptive survey research design. This study had two research questions and two hypotheses. The population for the study was 246,807 made up of registered farmers. Proportionate stratified random sampling technique was used to select a sample size of 4,936 as respondents. Structured questionnaire was used to collect data. The instrument was face validated by three experts. Cronbach alpha method was used to determine the internal consistency of the questionnaire items which yielded a coefficient of 0.81. Mean, standard deviation, and t-test were used for data analysis. The findings of the study revealed that altered climate have adversely influenced the livelihood and living conditions of the farmer and the farming families in the area studied. Findings further revealed that the altered climate has led to increased poverty level and raised cost of production (input and labour cost), thus affecting farmers hitherto coordinated livelihood. Adoption of local adaptation approaches will help the farmers survive.

Key words: Farmer, flooding, sea level rise, rainfall, sustainable agriculture.

INTRODUCTION

The importance of agriculture to humans and the society have been continually lauded to include sources of revenue for governments at various levels and as a means of livelihood by providing employment for farmers, marketers, and processors of agricultural products. In Nigeria, agriculture engages over 70% of the labour force and contributes about 40% to Gross Domestic Product (GDP) (FMARD, 2012). It provides food for the teeming population, feed for animals and raw materials for various industries. However, it is one of the most climate sensitive economic sectors as a change in climate bears a direct effect on agriculture. Altered climate, generally termed climate change has been an international issue affecting various agricultural production processes, including the producers: the farmer and his families. Altered climate is the total or average variation of the atmosphere over a period of time, usually from decades to many years in a location which can be caused by processes internal to the earth, external forces from space or human activities (Lobell et al., 2008).

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Altered climate has often been referred to as the noticeable change in climate that persists for an extended period, typically decades or longer (IPCC, 2007). Ikehi and Zimoghen (2015) described altered climate as the variation in the statistical distribution of average weather conditions over a prolonged period of time leading to adverse effects on the farmer and the farming families in any region of the world, such as the Niger Delta region.

The Niger Delta region of Nigeria is densely populated and occupies about 12% of the total land mass of Nigeria with a land area of about 70,000 km² out of which 2,370 km^2 consist of rivers, creeks, and estuaries, while stagnant swamp covers about 8,600 km² (Ugolor, 2004). The region is divided into drier landward part where crop farming is the major agricultural activity and the seaward part (riverine and swampy area) which is characterized by extensive creeks and water bodies, where fishing and aquaculture replaces crop farming as the dominant aspect of the rural economy (Aweto, 2011). The economic activities of the communities in the region are either land-based or water-based to include collection and processing of palm fruits, crop, and animal farming, fishing and fish farming, forest resources utilization (such as game, raffia), general farming and trading of agricultural goods (Rosemary et al., 2012). The region is endowed with great potentials for high productive and profitable agricultural practice and occupies greater area of Nigeria's most fertile land suitable for the production of crops such as cassava, palm tree, rubber, yam, and many other crops while the availability of water bodies make feasible aquaculture like fish farming (Fapojuwo et al., 2012; Abisola, 2013). The major occupation in the region is farming thus an altered climate affects the farmer and his farming family.

The main effect of altered climate is the increasing average temperature which causes a variety of secondary effects (IPCC, 2007). The secondary effects include changes in patterns of precipitation affecting rainfall, rising sea levels, altered patterns of agriculture, increased extreme weather events, expansion of the range of tropical diseases, among others (IPCC, 2007; Ogundele, 2012; Ikehi et al., 2014). These secondary effects have affected the world in varying degree of impacts in different regions. As ecosystem is being affected, people especially the indigent who cannot cope with the drastic changes may have to migrate in search for fairer and better opportunities. Estimates of future "climate change migrants" range from 200 million to 1 billion by 2050 (Myers, 2005). Africa is one of the most vulnerable continents to face climate change, because of multiple existing stress and low adaptive capacity (Mimura et al., 2007). According to these authors, sea level rise is projected to worsen inundation, storm surge, erosion, and other coastal hazards in the continent and these effects would threaten vital infrastructure, settlements, and facilities that support the livelihood of isolated communities. In many African countries, other factors already threatening human health such as malaria may increase as altered climate conditions could favour the proliferation of carrier agents (Boko et al., 2007). As estimated, by 2020, between 75 and 250 million people are projected to be exposed to increased water stress and by 2050, between 350 and 600 million people in Africa are projected to experience increased water stress due to altered climate (Boko et al., 2007). Niger Delta like other deltas in the continent is recognized as being vulnerable to the effects of altered climate due to its low-lying area.

Flooding in the region (between July and October 2012) forced rivers to overflow their banks and submerged hundreds of thousands of acres of farmland (Hassan, 2012). Besides the destruction of buildings and lives, floods blocked transportation routes in the region. The cost of managing the land for cultivation, cure for disease and pest control in animal, crop, and fish production has been on the rise as a result of altered climate bearing direct effects on the social and economic wellbeing of farmers. The wellbeing of the farmer and his farming families is as important as the production process and the agricultural produce and climate change affects not just produces but also the farmer and the farming families as well as the environment they dwell. Leading to decline in performance, thus reduced yields. Sea level rise in the region could increase the emergence of health-related hazards for the farmer and his family.

Variation in temperature and humidity alters pest and disease movement and favours the risk of invasion. Frequent natural disasters like floods, ocean and storm surges damage sources of livelihood and also causes harm to farmland, post-harvest activities, life, and property (Uyigue and Agho, 2007; Idowu et al., 2011). Extreme storm events are likely to increase failure of floodplain protection as well as damage urban drainage and sewage systems (Apata, 2010). Increased heat causes discomfort for the farming family, while intense heat wave leads to electricity blackouts (Boko et al., 2007). Though some farming families in the region still engaged in farming, they work more with little in return. Their farming and fishing have been impaired in recent times by the deplorable state of the environment as a result of altered climate (Uyigue and Agho, 2007). According to the authors, due to the degradation of their immediate environment, the local farmer can no longer engage in sustainable production leading to low economic capacity of the already indigent farmer. The change in climate affects crops, livestock, forestry, and fishery in various ways invariably impacting on the livelihood of the farmer and his families. Many people in the Niger Delta whose source of livelihood once depended on natural sectors such as, farming and fishing are now changing their responsible means of livelihood. Change in the farming occupation will have adverse effects on agricultural sector in the region and the nation as a whole. Continued degradation of land and water as

a result of altered climate in the region will affect the major agricultural produce in the region, thus increasing hardship for the farmer and his family.

The farmers are complaining of drastic changes they could not comprehend as their previous knowledge could not serve them competently. Thus, it became imperative to empirically document the observations and plight in order to suggest suitable approaches to restore their hitherto productive livelihood. Further, it is also necessary to know if both male and female farmers have the same complain. This study thus poses the following research question and hypotheses.

Research question

1. What are the effects of altered climate on the farming profession in the Niger Delta region?
2. What are the effects of the altered climate on the living conditions of the farmer and the farming families in the Niger Delta region of Nigeria?

Hypotheses

H_{01}: There is no significant difference in the mean ratings of male and female farmers on the effects of altered climate on the farming profession in the Niger Delta region.

H_{02}: There is no significant difference in the mean ratings of male and female farmers on the effects of altered climate on the living conditions of the farmer and the farming families in the Niger Delta region of Nigeria

MATERIALS AND METHODS

The study adopted descriptive survey research design and was carried out in the Niger Delta region of Nigeria. The region located in the Southern part of Nigeria is made up of 9 states, namely, Abia, Akwa-Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo, and River. The population for the study was 246,807, made up of 67,551 and 179,256 registered farmers in Bayelsa and Delta states, respectively. Among the 9 Niger Delta states, Bayelsa and Delta were the most affected ones with natural disaster, such as flood submerging and destroying farmlands in 6 out of 8 and 18 out of 25 local government areas in the Bayelsa and Delta states, respectively (NEMA, 2012). The farmers in the sampled states were involved in the study, because they have experienced in providing firsthand information for answering the research questions. Proportionate random sampling technique was used to select 2% (4,936) of the farmers from each local government areas in both states. The instrument for data collection was a structured questionnaire developed from literature reviewed for the study. The questionnaire was divided into two sections, each section corresponding to the research questions of the study. Section 1 had twenty-one (21) items while section 2 had sixteen (16) items. Each item in the questionnaire had a four point response options of High Effect (HE), Moderate Effect (ME), Low Effect (LE), and No Effect (NE) (weighted 4, 3, 2, and 1, respectively). Three experts validated the instruments: one from Agricultural Development Programme (ADP) at Delta State Ministry of Agriculture and Natural Resources and two lecturers from the Department of Agricultural and Bioresources Education, University of Nigeria, Nsukka. The reliability of the questionnaire instrument was established using Cronbach alpha method and a co-efficient of 0.81 was obtained. To determine the reliability index, 54 copies of the questionnaire were pre-administered on both male and female farmers in Edo State. These farmers were not part of the studied population. The completed copies of questionnaire were retrieved and analyzed employing the Cronbach alpha method. The researchers with the help of 5 research assistances administered and collected the completed questionnaire. The respondents were contacted physically and the questionnaire was administered to both gender, randomly. Out of the 4,936 copies of the questionnaire administered, 3,728 copies (representing 76% of the total copies) were successfully retrieved and only 3,214 copies (about 65%) were duly completed and found useful for data analysis. The Statistical Product and Service Solutions (SPSS v 20.0) was employed for data analysis. The statistical tools used for data analysis were mean to answer research questions and standard deviation to validate the closeness of the respondents from the mean and from each other in their responses while a two-tailed t-test was used to test whether male and female farmers differed in their response, using a 0.05 level of significance. Decisions were made at mean criterion value point of 2.50. To arrive at 2.50 criterion value, the average of the mean weights was calculated. Items with mean values equal or greater than 2.50 were regarded as “Adverse Effect (AE)” while with mean values lower the value point were regarded as “Non Adverse Effect (NAE)” affecting the farming profession and farmer and the farming families in the Niger Delta region.

RESULTS

Data on Table 1 revealed that seventeen items (S/N. 2 and 6-21) as responded to by farmers were adverse effects (AE) of altered climate on farming profession in the study area as there means ranged from 2.52 to 3.39 which is higher than the criterion mean value of 2.50. The remaining four items (S/N 1, 3-5) were regarded as non adverse effects (NAE) on the farming profession in the region as their means were 1.17, 2.38, 2.40, and 2.41 all of which were lower than 2.50 criterion mean. The table also showed that the standard deviation (SD) of the 21 items ranged from 0.11 to 1.19; indicating that the respondents were close to the mean and to one another in their responses. Data on Table 1 revealed that there is no significant difference (S) in the opinions of male and female farmers in seven items (S/N 1-3, 5, 9, 13, and 15), and a non-significant (NS) difference in fourteen items (S/N. 4, 6-8, 14, 16-21). However, the cluster value indicated that the difference in their opinions is NS. The null hypothesis of no significant difference of the items with remark NS was upheld as *p*-value is greater than the *a*-value ($p \geq a$) at the t-calculated value of the items. At the cluster value, p=0.10 and t=0.56, while significant level =0.05. Thus, the null hypothesis (H_{01}) of no significant difference is not rejected, but upheld as $p \geq a$ (0.10 > 0.05).

In Table 2, data indicate that eleven items (S/N 2, 3, 5,

Table 1. Mean, standard deviation and t-test scores of respondents on the effects of altered climate on the farming profession in the Niger Delta region (N=3,214).

S/N	Effects on the farming profession	$\bar{X}$	SD	R	H_{01}		
					t	*Sig	R
1	Reduced water availability for irrigation	1.17	1.09	NAE	2.25	0.03	S
2	Damage of stored grain	2.52	1.11	AE	-3.92	0.00	S
3	Spread of plant and animal diseases	2.38	0.97	NAE	-5.73	0.00	S
4	Invasion of new plant and animal pests	2.40	1.19	NAE	1.34	0.05	NS
5	Invasion of new plant and/or animal diseases	2.41	0.97	NAE	6.09	0.00	S
6	Rapid spread of weeds and pest in the farm	2.55	1.00	AE	-8.14	0.08	NS
7	Increased difficulty level and cost in the control of weed and pest	2.87	1.12	AE	6.16	0.15	NS
8	Change in rainfall pattern affecting historical patterns of cultivation	2.54	1.08	AE	9.20	0.15	NS
9	Poorer germination and birth rate	3.26	0.71	AE	0.13	0.03	S
10	Diminished plant and animal yield	2.84	0.88	AE	1.01	0.20	NS
11	Reducing marketability of produce	3.38	0.72	AE	-1.07	0.18	NS
12	Stunting of animal and plant growth	3.00	0.71	AE	2.56	0.09	NS
13	Increasing death scorching rate in production	2.62	0.72	AE	-0.15	0.01	S
14	Flooding of farmland and animal houses	3.95	0.11	AE	0.51	0.16	NS
15	Altering nature of work done on the farm	2.75	0.97	AE	-6.92	0.03	S
16	Increasing difficulty of work done on the farm	2.84	0.88	AE	1.19	0.15	NS
17	Increased labour cost due work difficulty	3.38	0.72	AE	0.86	0.09	NS
18	Increasing labour hours on the farm due to altered and increased difficulty of work in the farm	3.00	0.71	AE	3.67	0.19	NS
19	Cost of production (input and labour cost)	3.39	0.76	AE	1.95	0.17	NS
20	Declining net profit from farming	2.94	0.92	AE	1.79	0.16	NS
21	Lowered farming business expansion opportunities due higher cost of production	2.53	0.55	AE	-0.98	0.08	NS
Cluster value		2.80	0.85	AE	0.56	0.10	NS

R: Remark; AE; adverse effect; NAE: non adverse effect; NS: non significant; S: significant. p = *Sig (2-tailed).

8, 9, and 11-16) had mean values within 2.53 and 3.95. These mean values are higher than the 2.50 criterion mean values; indicating that altered climate by the items adversely affect (AE) the farmer and the farming families in the Niger Delta region of Nigeria. The other five items (S/N 1, 4, 6, 7, and 10) had NAE on the farmer and the farming families in the region as their means were lower than 2.50 criterion mean. The table also showed that the SD of the 16 items ranged from 0.62 to 1.20; indicating that the respondents were close to the mean and to one another in their responses. Data in Table 2 revealed that there is no significant difference (S) in the opinions of male and female farmers in eight items (S/N 1-4, 6-8 and 10) and a NS difference in eight items (S/N. 5, 9, 11-16). However, the cluster value indicated that the difference in their opinions is NS. The null hypothesis of no significant difference of the items with remark NS was upheld as *p*-value is greater than the *a*-value ($p \geq a$) at the t-calculated value of the items. At the cluster value, p=0.10 and t=0.98, while significant level=0.05. Thus, the null hypothesis (H_{02}) of no significant difference is not rejected, but upheld as $p \geq a$ (0.10 > 0.05).

DISCUSSION

Niger Delta like most coastal low lying regions of

Table 2. Mean, standard deviation, and t-test scores of Respondents on the effects of the altered climate on the living conditions of the farmer and the farming families in the Niger Delta region of Nigeria (N=3,214).

S/N	Effects on the livelihood of the farmer and the farming families	$\bar{X}$	SD	Dec	H_{02}		
					t	*Sig	R
1	Drying up of ponds and streams	1.19	1.15	NAE	3.75	0.04	S
2	Pollution of clean water sources	3.42	0.89	AE	6.41	0.02	S
3	Risk of sickness	2.53	1.11	AE	-3.92	0.01	S
4	Spread of disease	2.38	0.97	NAE	-5.73	0.04	S
5	Damage to buildings	2.70	1.20	AE	1.34	0.20	NS
6	Damage to roads and bridges leading to homes	2.41	0.97	NAE	6.09	0.04	S
7	Roof damage by acid rain	2.15	1.00	NAE	-8.14	0.04	S
8	Drainage system damage	2.87	1.12	AE	6.16	0.02	S
9	Poverty level	3.51	1.15	AE	0.82	0.11	NS
10	Loss of live (mortality rate)	2.41	0.95	NAE	2.70	0.02	S
11	Hotter environment leading to heat stress	2.58	0.99	AE	4.59	0.17	NS
12	Flooding of houses and neighborhood	3.95	0.11	AE	0.51	0.16	NS
13	Displacement of farmers from their homes	3.51	0.62	AE	-0.93	0.20	NS
14	Food shortage due to poor produce	2.64	0.95	AE	0.59	0.16	NS
15	Increasing cost of living	2.89	1.06	AE	0.65	0.17	NS
16	Increasing loss of (inherited) lands due to high cost of land reclaiming	3.21	1.12	AE	0.81	0.18	NS
Cluster value		2.77	0.96	AE	0.98	0.10	NS

R: Remark; AE; adverse effect; NAE: non adverse effect; NS: non-significant; S: significant. p = *Sig (2-tailed).

the world is constantly faced with flooding of various degrees.

However, due to increased and varying extent of precipitation attributable to climate change, the occurrence of flooding has increased with rivers and oceans easily overflowing their banks. This was observed in the 2012 flooding that impacted negatively on agriculture in the region. Altered climate have resulted to more adverse effects affecting cultivation and general farming in the region. In Table 1, items such as “reducing marketability of produce”, “increased labour cost due work difficulty”, and “cost of production (input and labour cost)” had high mean values of 3.38, 3.38, and 3.39 respectively. Indications like this reveal that farmers could be spending more than usual. Reduced marketability means reduced sales of products or value of farm produces, while increased labour and other input costs results to increased cost of production. The scenario will definitely affect the economic viability of farming as a sustainable means of livelihood. The findings of this study as presented in Table 1 are in agreement with that of Uyigue and Agho (2007), Bhusal (2009), Miguel and Koohafkan (2010), and Ikehi et al. (2014) that stated that difficulty and cost of agricultural production will increase with decreasing returns to the farmer. The authors anticipated more problems (which are now occurring) in farming resulting from altered climate.

Increasing adverse on farming profession tends to directly impact on the livelihood of the farmer and the farming families. While most projected effects holds true, however, increase in mortality rate tied directly to altered climate in the region was not indicated by the respondents. This finding disagrees with Cruz et al. (2007) who stated that there will be increased death rate due to factors favoured by altered climate. Also, drying up of ponds and other sources of water in the region as projected does not hold true for the region as the

area is coastal and with abundance of water.

This view is supported by Uyigue and Agho (2007) that stated that increased precipitation will cause excess of water, even flooding and not drought. As stated, wet regions will receive more rain while dry regions will become even dried. However, the adverse effects of altered climate is bearing had on the farmer and his farming families as indicated by the response of the farmers in Table 2. In Table 2, “pollution of clean water sources”, “poverty level”, “flooding of houses and neighborhood”, and “displacement of farmers from their homes” had high mean values. The respondents are not far from reality. Overflowing of rivers and heavy runs offs could lead to redirection of polluted or mud water into clean streams used by rural farmers as source of clean water. With decreased sales and increased cost of production, returns tend to reduce leading to rising poverty level as reported by the farmers. Risen water level means flooding and destruction of routes and residences leading to farmers’ displacement. These findings are not at divergent with that of authors such as Boko et al. (2007), IPCC (2007), Wolfe (2007), Apata (2010), and Ikehi and Zimoghen (2015) who outlined the effects of altered climate on humans as mainly negative affecting livelihood and families in the world, especially in African countries.

Findings of the study revealed that significant difference does not exist between the mean responses of the male and female farmers on altered climate and responsible livelihood of farming families in Niger Delta region of Nigeria, as indicated by t-test for both hypotheses. Therefore, any observed difference is not a statistical difference, but a mere chance which could have resulted from sampling error.

CONCLUSIONS AND RECOMMENDATIONS

Findings of this study served as a premise for making the following conclusions: altered climate has become a threat to sustainability of farming as a profession in the Niger Delta region of Nigeria; flooding is a major threat to sustainable agriculture and livelihood in the region; poverty level is on the rise as a result of low net profit from agriculture caused by the adverse effects of altered climate in the region.

In recommendation, since most crop farmers in the region practice rain-fed agriculture, it is necessary for the government and other relevant authorities to constantly provide weather information such as rainfall distribution ahead of time to help the farmers plan. This could be done through the radio or through the extension agents. While government and organized interventions are necessary, the farmers could construct dykes and barriers as well as gutters around their building to redirect flood away from their homes and farmlands. With rising poverty level among the already indigent farmers, farm input purchase capacity of the farmers will be affected, directly affecting production. Farmers in the region can be encouraged by providing incentives and subsidizing inputs for them by federal and state government as well as other non-governmental organizations. This will go a long way in improving production and discourage migration when profit from farming profession continue to reduce or standard of living worsens due to altered climate in the region.

Conflict of interests

The authors have not declared any conflict of interests.

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