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Farmers' Notion of Climate Change and Response to Rainfall Variability in a Nigerian Coastal Settlement of Oron

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Abstract
The study investigated farmers' notion of climate change and their response to rainfall variability in Oron, a Coastal settlement in Akwa Ibom State of Nigeria. The specific objectives of the study is to determine farmer's notion of climate and their response to climate variability. The farmers' perception of climate change is necessary for preparedness and planning purposes in an agrarian community in order to boost farm productivity. Through the use of structured questionnaires, data for the study was obtained from 400 farmers' in 17 randomly sampled villages in Oron. The data was complemented by information obtained through focus group discussion, participatory rural appraisal, direct field observations and in-depth interviews of key informants. To aid the analysis, data on some climatic variables from 2003 to 2013 were obtained from the study area and analysed to show the behavior of annual precipitation, wet and dry seasons precipitation and to compare results with the farmers' notion of climate change. In the same vein, the number of drought years occurring in the study area was calculated using Shewale and Kumar (2005) method. The study reveals that (i) most of the farmers' were unaware of the concept of climate change, even though they have considerable knowledge of major changes taking place in their environment (ii) The farmers have general feeling of uncertainty about the best time to plant crops due to the unpredictability of rainfall and the difficulties in planning farming activities (iii) the number of extreme rain event per year in the study area does not appear to be increasing, indicating that farming has not become more vulnerable to such phenomena. All the farmers indicated the need for planting early maturing seed and changing the timing of planting, as a response strategies to mitigate the effect of climate variability in the study area. The study, thus concludes that unless urgent steps are taken to educate the farmers' about their notion of climate variability and the possible pathways to adaptation, the coastal settlement is vulnerable to food insecurity.
Keywords: Climate change; Farmers notion; Rainfall variability; Coastal settlement.

1.0. INTRODUCTION:

Climate change refers to changes in climate overtime, whether due to natural variability or as a result of human activity (McCarthy, 2001). Since the United Nations Framework Convention on Climate Change (UNFCC) in 1992, the issue of climate change has become a global issue. The UNFCC defines climate change as "***a change of climate which is attributed directly or indirectly to human activities that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods*** (UNFCC, 2007).

In most circumstances, climate change is used to refer to anthropogenic activities which lead to an increase in emissions of greenhouse gases thereby causing global warning (Amos, Akpan and Ogunjobi 2014) . Climate change manifests in variations in different climatic parameters such as cloud cover, precipitation, temperature ranges, sea levels and vapour pressure (Ministry of Environment of the Federal Republic of Nigeria (MoEFRN), 2003). These manifestations contribute to the rise in ocean level and affects many coastal countries (Garg, Skukla and Kapshe, 2007). Studies have estimated that between 1950 and 2000, the global sea level has increased by an average rate of 1.8-0.3 mmyr^{-}1 (Church, White, Coleman, Lambeck and Mitrovica, 2004); Also Meehl, Stocker, Collins and Friedlingstan (2007) estimated a rise in global mean sea level of between 0.18m and 0.59m from 1980-1999 to 2090-2099. This rise in sea level may lead to changes in shoreline migration, beach erosion, change in coastal flooding patterns etc (FitzG-erald, Fenster, Argow and Buynevich, 2008).

The variations in climate parameters arising from climate change can affect the different sectors of the economy such as agriculture, health, water resources, energy, etc. The main cause of climate change has been directly linked to anthropogenic activities. For instance, the increased industrialization in the advanced countries resulted to the introduction of large quantities, of greenhouse gases (GHGs), including Carbon (IV) oxide (Co_2), Methane (CH_2) and Nitrous Oxide (N_20) into the atmosphere. These GHGs are the primary causes of global warning. The global increases in Co_2 concentration are primarily due to fossil fuel use and land use changes, while those of C_4H and N_20 are primarily due to agricultural practices. Incidences of climate change include changes in soil moisture, soil quantity, crop resilience, timing/length of growing seasons, yield of crops and animals, atmospheric temperatures, weed insurgence, flooding, unprecedented droughts, sea level virus among others. There are projections of increases in rainfall in the humid regions of southern Nigeria where this study was carried out. Such increases are accompanied by increases in cloudiness and rainfall intensity particularly severe storms. Since farmers are the managers and ultimate users of a region's agro-biodiversity and resources, farmers' involvement in assessing climate change and its impacts is indeed very significant.

Studies such as Jianchu, ***et al***, (2007) have been carried out to enable a better understanding of climate change and its biophysical and social effect. Farmers' experiences and observation of climate change, including – increased temperatures, changing rainfall and wind patterns, as well as year by year phonological changes, and changes in vegetation structure and patterns are all critical in considering adaption to climate change (Sharma and Tsering, 2009). Integrating the "***Civil Science***" of farmers notions with ***"formal science"*** assessments in addressing climate change, impacts will provide the optimum tools to enable the development of climate resilient livelihoods (Jianehu, Shrestha, Vaidya, Erikson and Hewitt, 2007).

"Notion" is the process in which an individual is in full awareness of his environment. It is synonymous with perception. It involves the full interpretation of information received from the surrounding environment and transforming it into physiological awareness. In this sense, the individual is a part of the system being perceived, and certainly moves within it, rather than being a passive outside observer. Notion is built around how people sense, mentally process, and act on patterns they perceive in space and time.

Thus, people's knowledge, experiences, culture and other social factors are reflected in notion of a particular situation. Given that scientific study on climate change could be expensive and time consuming for rural people and their livelihoods, their notion or local knowledge should be considered in order to predict and prevent catastrophes and to respond to climate change . This varies with the individuals past experiences, observations and present attitudes, needs, values, modes, expectations and social circumstances (Chapagain, Subedi and Paudel, 2009 and Banjade, 2003). The significance of incorporating local peoples' notion or knowledge into climate change policies is that the palliative methods adopted to respond to climate change impacts depend on how climate change is perceived by the people. More than this, the response of the local people to measures aimed at reducing climate change impact depend on how they understand and relate these measures to their own context. In other words, climate variability must be seen and understood by the people. However, incorporating local and indigenous knowledge into climate change should not be substituted for modern scientific knowledge. Local or indigenous knowledge should be complementary, rather than compete with global knowledge systems (Nyong, Adesina and Elasha, 2007).

Against this background, this study assesses farmers notion of climate changes in conjunction with meteorological data as well as farmers response or adaptation strategies to rainfall variability impacts in a Nigerian Coastal Settlement of Oron.

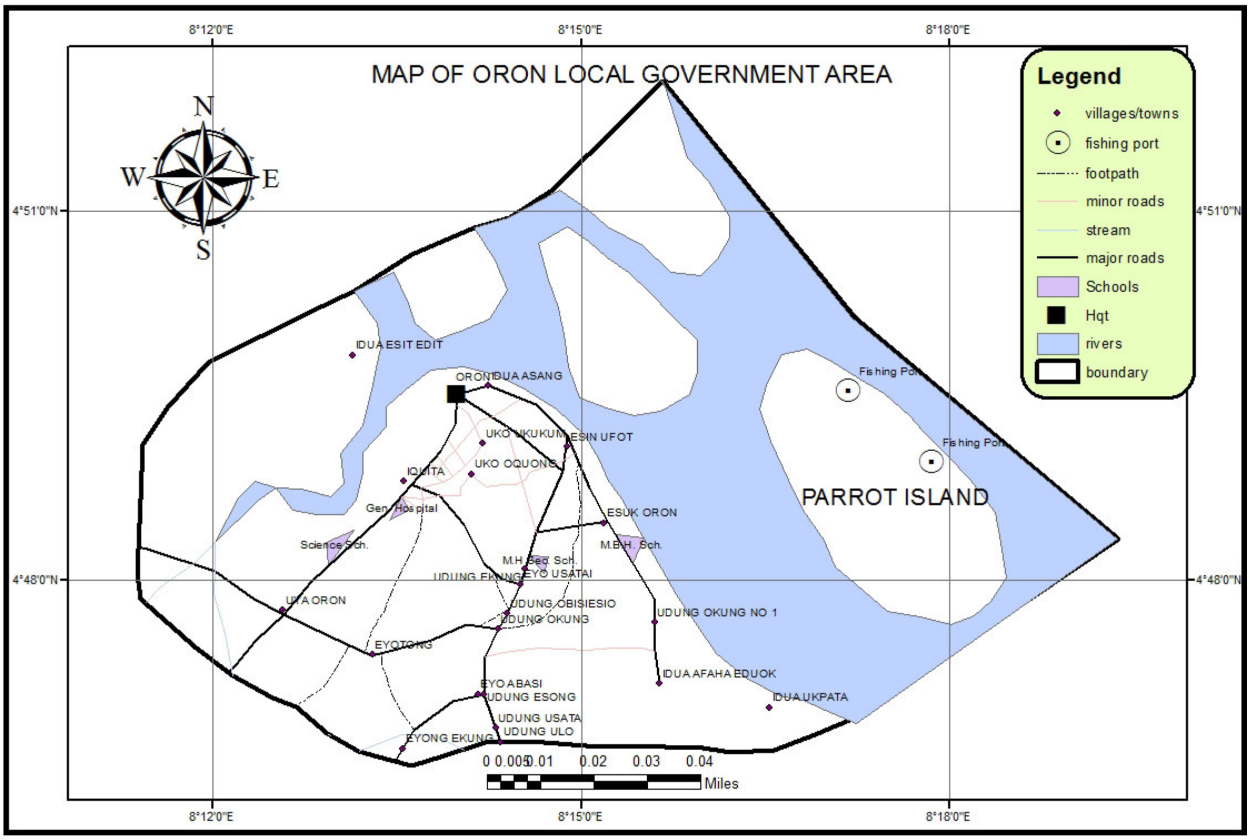
2.0. LITERATURE REVIEW

Literature on indigenous perception of climate change are well documented, these include Ayanwuyi and Nwabeze, (2012); Acquah, (2011); Devkota, Bajracharnya, Maraseric, Cockfield and Updahyay, (2011); Combest-Friendman, Christie and Miles, (2012); Haque, Yamamote, Malik and Sauer born, (2012); Aphunu and Nwabeze, (2012); Kpadoni, Adegbola and Tovignan, (2012); Baul, Ullah, Tiwari and McDonald (2013) and Tambo and Abdoulaye, (2013). These studies are significant in understanding different approaches that may be used in assessing peoples' notion to climate variability in local communities as well as their determinants. Central to the methodology employed by these scholars is the use of primary data on several variables among which are socio-economic characteristics of households such as age, sex, educational attainment, household income, occupation, etc. Also, notions or perceptions of change in climate parameters such as rainfall, temperature, storm frequency etc were collected using focus group discussions, questionnaires and oral interviews. The data obtained were analysed using descriptive statistics. Considerable number of these studies compared the perceptions to meteorological data on the respective variables to ascertain whether the perceptions or notions are in line with actual data (Devkota et al, 2011; Combest – Friedman et al, 2012 and Amos et al, 2014), while others examined the determinants of the perceptions using the socio-economic variables and other indicators of exposure to climate change vulnerability as explanatory variables – (Ayanwuyi et al, 2010; Aphunu and Nwabeze, 2012).

3.0. MATERIALS AND METHODS

3.1 The Study Area.

The study was carried out in Oron Local Government Area of Akwa Ibom State. The Local Government Area is located at appropriately between latitudes $4°46^1$-$4°52^1$ North and Longitudes $8°12^1$-$8°18^1$ East with a landmass of about 309.27km^2. Oron LGA is a coastal settlement that is located at the right bank estuary of the Cross River close to the Atlantic Ocean. It is both a river port with a ferry or packet station, linking Calabar and other rivers and coastal ports in the region and the Cameroun and Equatorial Guinea across the Exclusive Economic zone of Nigeria. It is a terminal point for roads linking important towns in the South south and South East Geo-Political zone – Aba-Uyo- Oron; Port Harcourt- Eket -Oron. Oron LGA is bounded by Okobo LGA in the North West by Urueoffong/Oruko Mbo and Udung Uko LGA in the South and South-West respectively. To the East and the South-East, it is bounded by the Cross River estuary, close to the Atlantic ocean.



The LGA is situated in the coastal areas of Akwa Ibom State with gentle rolling coastal plain sands typied by sedimentary basin formation of largely unconsolidated deposits. Rainfall is heavy and last about 10 months in the year. The LGA has two different seasons, namely; wet and dry seasons. The wet seasons last for about 10 – 11 months. The wet seasons start about February – March and last till mid – November. The raining seasons are also characterized by the little dry spell, which occurs about two weeks in August. The rate of development in the LGA is indeed very tremendous. Oron LGA is made up of four clans with 17 gazetted villages. The economy of the LGA is predominantly dominated by farming and fishing. Although the inhabitants are also engaged in petty trading and production, farming and fishing still remain the most important and primary occupation of the people as other activities are carried out on part time basis.

4.0. Data Collection Methods

Data were collected by means of informal and qualitative methods, principally through focus group discussions, participatory rural appraisal, in-depth interviews with key informants and direct observation approaches. These methods were adopted in preference to the formal and quantitative approach considering the cost, scope, structure, statistical analysis, and other advantages associated with them. For example, the structure of the traditional survey research is fixed or redesigned and formal as opposed to the flexible and informal structure of the PRA. Besides, the PRA method has built-in techniques of achieving a high degree of accuracy, especially, through triangulation, in addition to the advantage of the multidisciplinary composition of the investigating team and above all, the active participation of the community and on-the-spot analysis (Theis and Grady, 1991).

Focus group discussions (FGDs) were employed to bring together various households who are engaged in farming in the 17 villages that make up the study area. Each focus group consisted of 10 farmers drawn from each of the 17 villages. Effort was made to ensure that the focus group discussions were as representative as possible of farmers across the different farming systems practice in the study area. Particular attention was paid to gender representation and age differential in the focus groups. The focus group discussions was designed to collect data on farmers notions of climate change and their response or adaptation to rainfall variability as impacted on their livelihoods. Questions on possible indicators of climate change in the study area with respect to precipitation, temperature trends, crop performance, yields of water sources were sought. Also questions bordering on how the livelihoods of the farmers have been impacted and how the farmers' response to climate change as they experienced it were also addressed.

Primary data were obtained from households through interviews guided by a structured questionnaire. The content of the questionnaire was informed by literature on farmers' notions (Combest-Friedman et al, 2012; Aphunu and Nwabeze, 2012; Amos et al, 2014) and livelihood vulnerability (Hann et al, 2009; Shah et al, 2013).

The interview questions were grouped into six (6) groups (Table 1). The total number of questionnaires issued was determined by employing the total population of the 17 villages which the study area is made, up based on 2006 projected figures at a growth rate of 2.83%. The proportion of each village was then expressed as a percentage of the total population of the 17 villages. This was used to determine the number of questionnaires for each village. The Taro Yamane's (1973) formular for finite population was statistically used to determine the sample size. Based on this, 400 farmers' were interviewed in all the 17 villages proportionally to the percentage size of their population. The study subscribes to interviewing only heads of farm households. But where relevant information could not be provided by the head of farm households (assumed to be the decision-maker in farming), their spouse or other household members were asked to provide such information.

5.0. Data Analysis:

The first part of the study assesses farmers' notion of climate change and the study employs descriptive statistics in the analysis. To aid our analysis, data on Rainfall(R), Relative Humidity(RH) and Temperature in the study area from 2003 to 2013 was obtained from the Maritime Academy of Nigeria, Oron MET Observatory Centre to compare the notion of climate as perceived by the farmers. The data were analysed to show the behavior of annual precipitation, wet season precipitation and dry season precipitation between 2003 to 2013. The number of drought years occurring in the study area were calculated for the period 2003 – 2013 using Shewale and Kumar (2005) method. According to Shewale and Kumar (2005), a drought year is defined by annual rainfall being deficient by 26 percent of the long – term normal mean annual rainfall. This is derived by:

i. Calculating mean long-term annual rainfall.
ii. Find 26 percent of mean long-term annual rainfall.
iii. Subtract 26 percent of mean long-term annual rainfall from mean long-term annual rainfall.
iv. This value is the threshold for a drought year; if annual rainfall is less than this threshold, it suggests that year is a drought year.

The 95th percentile of daily rainfall between 2003 – 2013 was used as a threshold. The use of a percentile value as a threshold value for an extreme rain event means this threshold is location specific to Oron LGA but the methodology can be applied to other locations.

6.0. Results and Discussion

The socio-economic characteristic of individuals, such as gender, age, occupation, education, level of income etc play a significant role in determining the notion of the individual to climate change risk as well as their vulnerability (Wu, Yarnal and Fisher, 2002; Leiserowitz, 2006; Botzen, Aerts and Van den Berg, 2009; Combert-Friedman, Christie and Miles, 2012). As observed in Table 2, 49.75% of the respondents age falls within the active labour force. Generally, 89 percent of the farmers who responded are within the legal working age of 18 – 60 years. Although the relationship between age and climate change notion or perception is somewhat ambiguous, Akpata, Samuel and Adeola (2009) found a positive relationship between age and risk perception, while Aphunu and Nwabeze (2012) established a negative relationship. Studies have also shown that women are more likely to view potential environmental hazards as risky than men (Fothergill, 1996) and are generally more vulnerable to climate change (Dankelman, 2002). Significant percentage (65%) of the household heads are females which suggest, that they are more likely to perceive risks from climate change. The high preponderance of the female households is due to the fact that the culture of the people arrogate farming activities to womenfolk, while men play supportive roles. This confirmed findings by earlier studies. For example, studies of 74 developing countries indicate that women now head over 20 percent of the household in Africa and the Caribbean, and 15 percent of those in Latin America and the Middle East. The figures are much higher in Kenya, Botswana, Ghana and Sierra Leone where about 50 percent of the households are headed by women (Taylor, 1985).

Significant percentage (44%) of the household heads have large family size characterized between 7 – 10 members of the household. "Household size" used in this study includes every one living in the same dwelling with the respondents, which includes relatives, grand children and wards; it does not necessarily refer to the size of the nuclear family. Also, about 79% of the sampled houses had some form of formal education; however, only about 6% of the respondents have a University degree or its equivalent. Since knowledge of climate change tend to increase with level of education (Neadilse, Egbule, Chukwone, Agwu and Agu, 2015), the educational attainment of the sampled respondents portends that most of them will have some knowledge about climate change.

Based on IPCC definition of climate change as changes in climate variable that persist for an extended period, typically decades or longer (Solomon, Quin, Manning, Chen, Marguis and Averyt, 2007), it is assumed in this study that households who have lived in a given location for decades would be more likely to observe changes in climate variables, especially shift in the shoreline and the onset and end of the raining season among others. The result in Table 2 shows further that 54 percent of the sampled farmers have lived in the study area for over 20 years. Specifically, 75 percent of the respondents have lived in the study area for over 40 years, which suggests that they are likely to have noticed changes in climate variables in the study area; and this may have influenced their notion of the effects of climate variability impact on their livelihood. Also, the spatial location of households, in terms of geographic place and nearness to environmental hazards, is an important factor that affects perceived climate change risks (Brody, Zahran, Vedlitz and Grover 2008) and household vulnerability (Cutter, 1996). As indicated in Table 2, 63% of the respondents live within 100m of the coastline, which makes them more likely to notice changes in shoreline.

Several questions relating to climate change were asked using the farmers' questionnaire in order to elucidate the farmers' views on the notion of climate change. The distribution of their responses revealed that majority (71%) of the farmers had never heard about climate change (Table 3). This implies that the farmers and possibly other households in the study area are not adequately informed about climate change. This has obvious implication on climate change adaptation programmes, as responses cannot be effective without getting small holder farmers to understand the notion of climate change. This finding again confirms earlier study by Dube and Phori (2013) and with that of other researchers who argue that one of the greatest limitation to climate change adaptation in Africa is lack of climate information (Enujeke and Ofuoku, 2012 and Brayn, 2005). Although, majority of the farmers had never had about climate change, they did understand the concept, recognizing that there were changes in their local climate. For instance, it is observed that majority (84%) of the farmers perceived that there have been changes in their local environment, at various level (Table 3). To the farmers the concept of climate change is a technical concept they have never knew. They however knew and have considerable knowledge of local changes taking place in their environment, attributing such changes to myths and superstition as revealed from the focus group discussions.

Both participants in the focus group discussions and respondents in the farmers' questionnaires unanimously agreed that broad range of climate and ecological changes had occurred over the period that they have lived in the area. Some noted that these changes revolve around rainfall and temperature variability. Data gathered through the farmers questionnaires corroborated this assertion. For instance, as evidenced in Table 3, about 88 percent of the farmers' sampled perceived that the length of the average rainy season, which is usually from March/April to November, has changed significantly. Specifically, 60 percent of the farmers held the views that this changes is very significant while, 28 percent held the view that the change is significant.

The perceived change in the length of the average rainy season implies notion of changes in the timing of the average rainy season and the amount of rainfall over time. To this notion, about 78.9 percent and 88 percent of the sampled farmers perceived that both the amount of rainfall and the timing of the average raining season respectively have changed significantly over the years. In another vein, 79.8 percent of the farmers' sampled noted that temperatures of the years were increasing, and only 14.5 per cent said temperatures were not changing over years. While, 5.8 percent has the notion that temperatures were decreasing over years. This notion of increasing temperatures has been confirmed by the analyses of the average yearly maximum temperature obtained from the meteorological station in the study area (Fig. 2).

Recent studies such as that of Aphunus and Nwabeze (2012); Combest-Friedman et al, (2012) on climate change perception sought to identify the determinants of perceived climate change risks by employing empirical models. Combest-Friedman ***et al*** (2012) complemented the empirical analysis by using meteorological data to examine whether households' perception are in line with observed data on climate variables. Similarly, Devkota et al (2011) compared households' perception with meteorological data. This approach is employed in this study, by comparing the farmers' notion with meteorological data obtained from the Department of Meteorology and Marine Research (in Maritime Academy of Nigeria) Marine MET Observatory Station for rainfall and temperature in the study area. It is interesting to note that some of the notions of climate change held by the peasant farmers are in line with the observed data. For instance, the total annual rainfall for the study area is high, with an average annual rainfall of 3668.2mm (Fig. 1). The mean monthly rainfall and the average number of rainy days per month are given in Table 4.

From Table 4, it is clear that there is no month in the year that the study area does not receive rainfall on the average. The only variation in the amount of rainfall received is a gradual steady increase from January (except for the month of February, with a slight decline) until the peak in the month of July and September. Thereafter, there is a drastic and rapid drop in the quantity and frequency of rain till December. The data in table 4 confirms the farmers' notion on changes in the length of the average rainy season as well as the changes in the timing of the average rainy season. Similarly, the trend of the rainfall, as depicted in Fig. 1, has a positive gradient which indicates a general increase in the amount of rainfall over the years.

It could be adduced from Fig. 1 that the study area exhibited four seasons namely; the long dry season with the onset in November and cessation in March, the long wet season with on-set in late March and cessation in August), the short dry period which last for about two weeks within August and the late but short wet season from late August to October. The onset of the rains is always gradual with a sharper cessation. Each of these seasons support the cultivation of different crops. Both focus groups and respondents in the farmers' questionnaire were unanimous in the observation that rainfall pattern had changed and the amount of precipitation had notably increased. They observed further that the rainfall pattern and the seasons had become unpredictable. The general sentiment among the farmers is that the precipitation levels had increased significantly. This had led to negative effects on the livelihoods of the local communities for instance, the farmers noted that several expanse of their farmlands are flooded due to increase in the amount and duration of rainfall leading to decreasing crop yield. Beside the evidence of increased rainfall amount, there is also the issue of seasonal variability of rainfall timing. The general notion is that in the past, rains would normally start in early March. However, the seasons appeared to have shifted as the rains now commence as late as May. The June precipitation, it was observed could be very high or the distribution of precipitation afterwards could be too closely spaced for crops to grow. There is also a general feeling of uncertainty amongst farmers about the best time to plant crops due to the unpredictability and difficulties in planning farming activities.

Based on the analysis of the daily precipitation data obtained from the Marine MET Observatory Station in the study area, and the IMD definition for drought years, drought years have not been found to occur in the study area. This suggests that drought conditions defined by rainfall did not pose a threat to farming and agricultural related activities in area. The definition by the IMD only uses rainfall, even though, drought can also be defined by other factors such as agricultural output and environmental conditions (Shewale and Kumar, 2005). The threshold value in the IMD definition of annual rainfall deficiency of 26 percent of the long term normal mean annual rainfall does not guarantee to meet all interpretations of drought. This therefore suggests that, there is no formal and universally accepted definition for drought. The IMD definition may give an indication of occurrence of drought, it may not accurately define or identify drought-like conditions on the ground. This suggest certain limitations in defining drought by statistical means and why importance are place on the responses of farmers' in the questionnaire.

Associated with climate variability is the possible likelihood of increasing extreme rain events. These extreme rain events could cause devastating flood. Extreme and intense rainfall events have the potential to damage crops and croplands inhibiting agricultural production (Revadekar and Preethi, 2010). However, the number of extreme rain event per year in the study area does not appear to be increasing, indicating that farming has not become more vulnerable to such phenomenon.

Table 5 shows the various response strategies adopted by farmers to mitigate the impact of climate variation on crop production. All the farmers (100%) indicated changing the variety of crops planted, changing the timing of planting, re-location to new site, and planting of early maturing seed as response strategies employed to mitigate the effect of climate variation. Other response strategies recorded high percentage of usage, except, the use of weather forecast which recorded low level of usage (7.8 percent). This suggests that the farmers are inadequately disposed to the role of weather information to crop production. This findings collaborated the findings by Oluwasusi and Tijani (2013) and Ole, Anette and Awa (2009) that rural communities in Nigeria have always managed their resources and livelihoods in the face of challenging environmental and socio-economic conditions.

7.0. Conclusion and Recommendation

The study concludes that climate change phenomena manifest itself in different dimension in the study area. The study has revealed that increasing temperature and rainfall are altering the natural environment with obvious socio-economic and environmental implication on the livelihood of the peasant farmers. This is aggravated by the fact that growing crops is no longer viable as planting seasons often fail due to unpredictable climate conditions. Farmers' response to the changing climate is limited by several factors, among which include inadequate knowledge of the relevance and use of weather forecast. The study reveals that most of the farmers' were unaware of the concept of climate change, even though they have considerable knowledge of major changes taking place in their environment, attributing such changes to myths and superstition. We conclude that unless urgent steps are taken to educate the peasant farmers about their notion of climate change and possible pathways to adaptations, the increasing possibility of food insecurity in the study area is strongly feared. Against this background, the study suggests the need for other climatic variables such as radiation, relative humidity, wind intensity etc to be used as climatic data in future study. The study further suggests the need to establish the link between climate change and other means of livelihood, particularly fishing in the study area.

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Table 1: Coding of Research Instrument.

GROUP A	SUB COMPONENT	DESCRIPTION/CODING
A: socio-economic profile of farmers	A1= Age of head of household	[1]Numeric
	A2 = Sex of head of household	[2]Binary option: male and female [3]Numeric
	A3 = Household size	[4]this is coded on an ordinal scale from "no
	A4 = Level of Education	formal education" = 0 to "completed university degree = 4
	A5 = Number of years lived in the village	Numeric
	A6 = Number of years involved in farming	Numeric
	A7 = Distance of home from Coastline	Numeric. Lies between 0 – 300m
B: Climate change Awareness	B1: Knowledge of the term "Climate Change"	Binary options: Yes or No
C: Farmers Notion of changes in climate variables	C1: Notion of change in rainfall Amount	Qualitative data (Not at all, mildly, moderately, significantly)
	C2: Notion of change in timing of the average raining season	Qualitative data (not at all, mildly, moderately, significant)
	C3: Notion of change in the length of the average rainy season	
	C4: Notion of change in temperature	Qualitative data (not at all, mildly, moderately, significant)
D: Livelihood exposure to climate variability	D1: Extent to which change in temperature affects income from farming	Coded on an ordinal scale from "does not affect" = 0 to significant by affects = 3
	D2: Extent to which change in rainfall affects income from farming	Coded on an ordinal scale from "does not affect" = 0 to significant by affects = 3
	D3: Extent to which sea level rise affects income from farming	Coded on an ordinal scale from "does not affect" = 0 to significant by affects = 3
E: Farmers' Response	E1: Extent of response or adaptation	This is coded on an ordinal scale from "not able to respond" = 0 to Responding well" = 3
	E2: Methods of Response	Qualitative data
	E3: Challenges of response	Qualitative data

Source: Authors' Fieldwork 2014

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Table 2: Socio-economic characteristics of farmers sampled

Age	Response Frequencies	% Response
18 – 30	23	5.75
31 – 40	71	17.75
41 – 50	128	32.0
51 – 60	135	33.75
61 above	43	10.75
Total	**400**	**100**
Household size		
1 – 3	68	17.0
4 – 6	156	39.0
7 – 9	170	42.5
10 above	6	1.5
Total	**400**	**100**
Educational level of Household head		
No formal Education	85	21.25
Completed Primary School	212	53.00
Completed Secondary School	50	12.50
Post Secondary (OND/NCE)	31	7.75
University Degree	22	5.50
Total	**400**	**100**
Length of stay in the village (years)		
1 – 20	216	54.0
21 – 40	84	21.0
41 – 60	74	18.5
60 above	26	6.5
Total	**400**	**100**
Numbers of years involved in farming		
1 – 20	129	32.25
21 – 40	126	31.5
41 – 60	80	20.0
60 above	65	16.25
Total	**400**	**100**
Gender of Sampled Farmers		
Male	139	34.75
Female	261	65.25
Total	**400**	**100**
Distance of home from Coastline (metre)		
1 – 50	130	32.50
51 – 100	122	30.50
101 – 150	77	19.25
151 – 200	52	13.0
201 – 250	16	4.0
250 above	3	0.75
Total	**400**	**100**

Source: Authors' Fieldwork (2014)

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Table 3: Farmers Notion of Climate Change

Knowledge of the term Climate change	Resources	%
Yes	283	70.75
No	117	29.25
Total	**400**	**100**
Awareness of climate change		
Strongly aware	210	52.5
Aware	126	31.5
Not aware	64	16.0
Total	**400**	**100**
1 – 50	130	32.50
51 – 100	122	30.50
101 – 150	77	19.25
151 – 200	52	13.0
201 – 250	16	4.0
250 above	3	0.75
Total	**400**	**100**
Notion of changes in Rainfall amount		
Strongly aware	202	50.20
Aware	115	28.75
Not aware	51	12.75
Undecided	32	8.0
Total	**400**	**100**
Notion of changes in the timing of rainy season		
Very significantly	214	54.0
Significantly	109	27.0
Not significantly	48	12.0
Not at all	29	7.0
Total	**400**	**100**
Changes in the length of the average rainy season		
Very significantly	241	60.25
Significantly	113	28.25
Not significantly	25	6.25
Not at all	21	5.25
Total	**400**	**100**
Notion of temperature changes	**Responses**	**%**
Increasing	319	79.75
Decreasing	23	5.75
Not changing	58	14.5
Total	**400**	**100**

Source: Authors Fieldwork (2014)

Table 4: Mean Monthly Rainfall for Oron

Month	J	F	M	A	M	J	J	A	S	O	N	D	ANN
Mean Monthly Rainfall	**67.4**	**56.3**	**261.3**	**272.8**	**442.6**	**635.1**	**678.0**	**722.1**	**581.6**	**507.2**	**255.9**	**68.4**	**4548.7**
No. of days of Rainfall	**5**	**4**	**12**	**13**	**17**	**19**	**23**	**20**	**19**	**14**	**10**	**4**	**160**

Source: Computed from Data from Marine Met Station (MAN, Oron).

Table 5: Farmers' Response to Rainfall Variability in Oron

Response Strategies	Frequency	%
Changing the variety of crops planted	400	100
Changing the timing of planting	400	100
Planting cover crops	176	44
Movement of different site	400	100
Planting of early maturing farm seed	400	100
Crop rotation	192	48
Diversification into non-farm activities	271	67.8
Changing in harvesting dates	215	53.8
Application of farmyards manure	202	50.5
Lengthened fallow	185	46.3
Use of weather forecasts	31	7.8

Source: Authors fieldwork (2014)

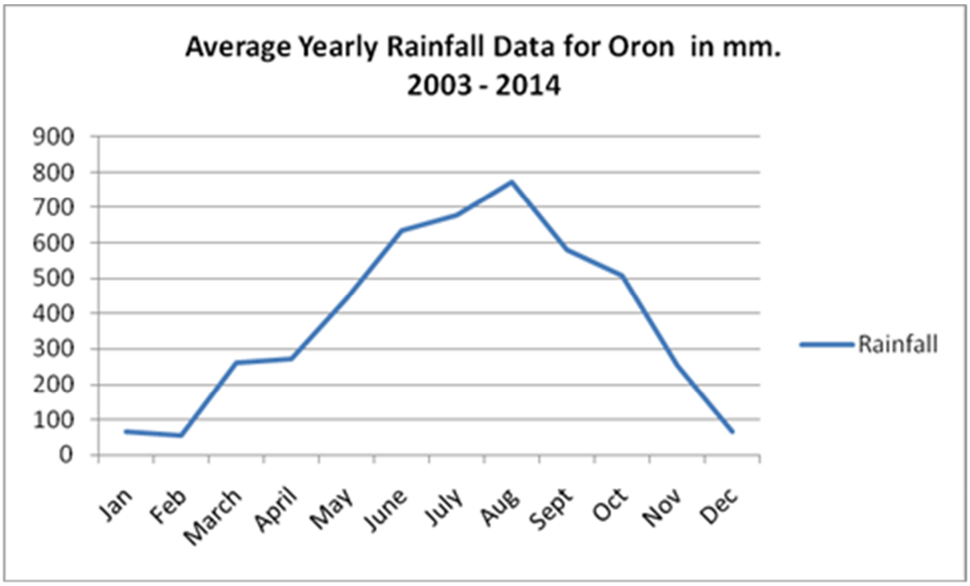

Fig. 1. Average Annual Rainfall in Oron

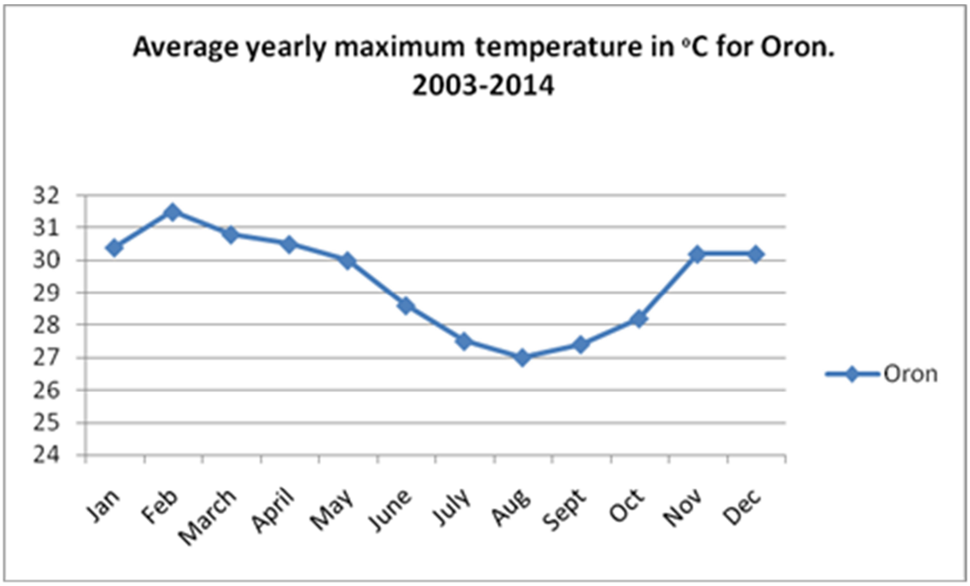

Fig. 2: Average yearly maximum temperature in Oron.

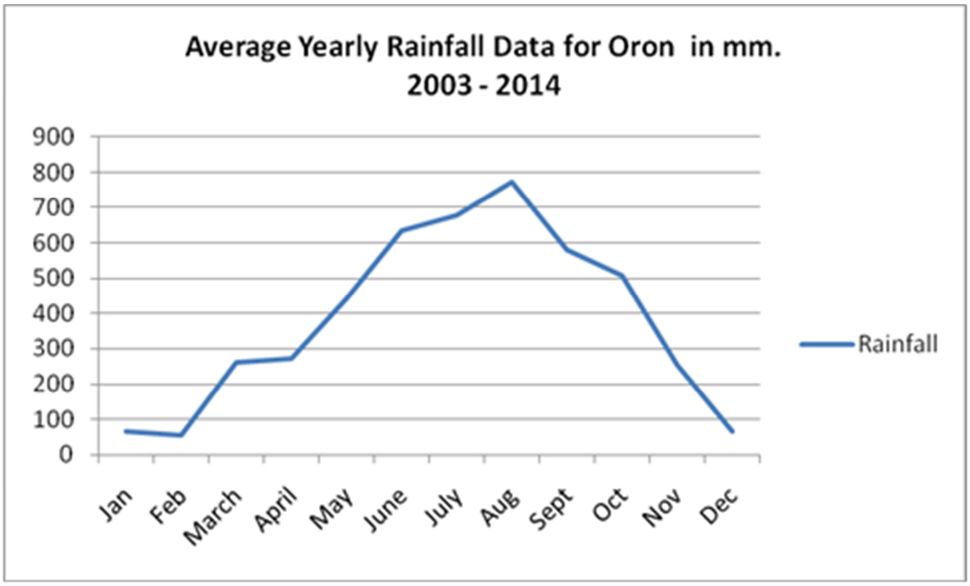

Fig. 1. Average Annual Rainfall in Oron

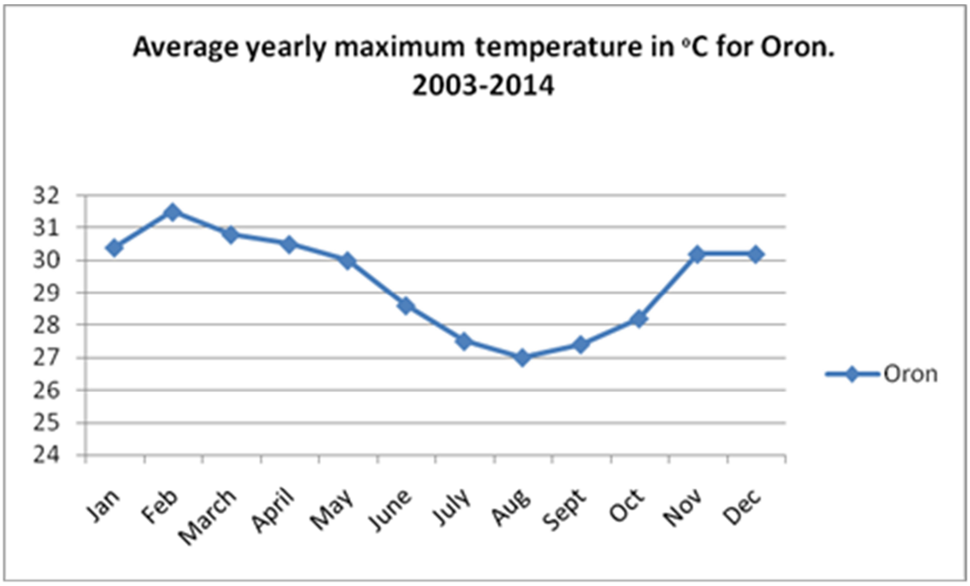

Fig. 2: Average yearly maximum temperature in Oron.