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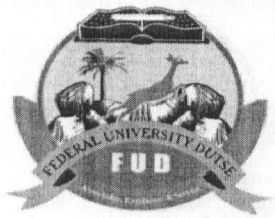

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- The manuscript should be between 14 to 18 pages double-line spacing in A4 paper, times new roman 12 point font size
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- Each article must be an original work of the author and has not been submitted to anywhere else for publication. Also, it should make significant contributions to the specific fields of interest.
- The article should be preceded by an abstract of not more than 200 words and 3-5 keywords.
- The author should ensure that there is a titled containing names (no Initials), address, institutional affiliation, e-mail address and phone number
- All tables, figures and photographs are to specially packed and camera ready
- Author should submit articles as a soft copy through electronic mail (e-mail) MS-Word attachment to thegazelle@gmail.com

CONTENTS

FARMERS' PERCEPTION AND ADAPTATION TO CLIMATE CHANGE IN YAURI COMMUNITY OF KEBBI STATE, NIGERIA

BY

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Abstract
Farmer's perception and awareness to climate change are effective measures to reduce vulnerability level of food production and enable farmers to prepare themselves and their farming activities towards the negative impacts of climate change. This study investigates farmer's perception and adaptation to climate change in Yauri community of Kebbi State, Nigeria. A total of 200 copies of questionnaires were administered in the 10 wards of the study area while 192 copies were retrieved and analyzed using descriptive statistics. The study revealed that over 90% of the respondents agreed that climate is changing significantly and the livelihood of farmers is affected negatively. The study also indicated that anthropogenic activities like deforestation, bush burning, overgrazing among others are the major cause of climate change. Furthermore, lack of awareness, poor climate change information dissemination and utilization are some of the challenges of climate change adaptation and mitigation efforts. The study advanced for participatory adaptation strategy that involves local farmers in climate change decision making and planning.

Key words: Climate change, Vulnerability, Farmers, Food, Perception, Adaptation.

Introduction

Agriculture is the main source of support for the majority of the rural and urban households in developing countries of Africa including Nigeria. Hence, adaptation of the agricultural sector to the negative effects of climate change may be necessary to ensure food security for the country and to protect the livelihood of rural households (Abid *et al*, 2015). The earth planet has warmed and cold many times during the 4.65 billion years of its history. At present, Earth appears to be facing rapid warming which most scientists believed result, at least in part, from human activities (Akpan, 2012).

Climate change refers to changes in mean weather variables and or variability of its properties which persists for an extended period up to decades or longer (IPCC, 2007). According to Ayoade (2003), climate change is attributed largely to the various activities of man, particularly, the introduction into the atmosphere, gases such as Carbon dioxide(Co_2), Methane(CH_4), Nitrogen(N_2O), Chlorofluorocarbons (CFCs) among others. Other anthropogenic activities which have been linked to climate change include broad scale deforestation, major technological and socio-economic shifts with reduced reliance on organic level and accelerated uptake of fossil fuels (Iroye and Abejirin, 2012).

There is no doubt that in the coming decades, the world will witness high temperatures and changing precipitation levels. The effect of this will lead to low or poor agricultural production. Evidences have shown that climate change is already affecting crop yields in many countries (IPCC, 2007; Deressa et al, 2008; BNRCC, 2008). This is particularly true in low income countries where climate is the primary determinant of agricultural productivity and adaptation capacities are low (SPORE, 2008; Apata *et al*, 2009). Many African countries which have their economies largely based on weather-sensitive agricultural production systems like Nigeria are particularly

vulnerable to climate change (Dinar *et al*, 2006). This vulnerability has been demonstrated by the devastating effects of recent flooding in Niger Delta region of the country and the various prolonged drought that are currently witnessed in some parts of northern Nigeria. Thus, for many developing countries like Nigeria that are highly vulnerable to effects of climate change, understanding farmer's perception and responses to climate variation is crucial as this will help in designing appropriate coping strategies.

Adaptation to climate change is an effective measure at the farm level, which can reduce climate vulnerability by making rural households and communities better able to prepare themselves and their farming activities to changes and variability in climate, avoiding projected damages and supporting them in dealing with adverse events (IPCC, 2001). The current level of support for the agricultural sector in terms of climate change adaptation in Nigeria is very low due to an ineffective climate policy and low technological and financial capacity of the country in adapting to climate change (OECD, 2011). Research shows that farmers' awareness, investment in new heat-tolerant varieties, crop insurance, social awareness and protection programs may be some important aspects of the adaptation policy to climate change (Schlenker and Lobell, 2010). Perceiving climate variability is the first step in the process of adaptation of farmers to climate change (Deressa *et al.*, 2011). A better understanding of farmers' concerns and the manner in which they perceive climate change is crucial to design effective policies for supporting successful adaptation of the agricultural sector. Furthermore, it is important to have precise knowledge about the type and extent of adaptation methods being taken up by Yauri farmers and need for further advances in existing adaptation setups. However, understanding how farmers perceive changes in climate and what factors shape their adaptive behavior is useful for adaptation research (Mertz *et al.*, 2009; Weber, 2010). The choice of adaptation methods by farmers depends on various social, economic and environmental factors (Bryan *et al.*, 2013). This knowledge will ultimately enhance the credibility of policies and their strength to tackle the challenges being imposed by climate change on farmers (Deressa *et al.*, 2009).

The most crucial issue in this study is to find out how farmers perceived the changing climate with regards to their agricultural activities and crop production, and also to investigate their adaptation strategies for sustainable agricultural productivity in Yauri community.

Impacts of Climate Change on Agriculture

The overall vulnerability of the agricultural sector in a country or community to climate change and variability is usually determined by a complex mix of factors that include the extent of climate variability, extent of reliance on agriculture, agricultural practices, pre-existing condition of the agricultural land base, institutional systems, cultural and social practices and market factors – all of which need to be considered in risk and vulnerability assessment. For instance, the availability of market and institutional factors to redistribute agricultural surpluses to make up for shortfalls reduces the risk of food shortages due to climate change and variability (Watson, *et al.* 1997).

Olanrewaju (2006) on the study of the implication of the late onset of rains in a coastal ecological area of Lagos State observed that most crop seeds planted depend largely on the status and reliability of the onset of rain. In the tropics, the onset, cessation and duration of the rainy season form important components of moisture resources status for determining the production potential of various crops. According to Olanrewaju (2006), crop experience moisture stress at the early stage of growth during the first decade of study and as the year progress; crop faces greater stress which later reverted during the last decade. This buttress the finding of Shaw (1979) that moisture stress is capable of reducing the crop leaf area and if the reduction reaches below 3-3.5, Leaf Area Index (LAI), yield reduction can be very large. With this analysis, Olanrewaju (2006) further concludes that this might be related to the observation made by Edefienene (2003) identifies that variations in coastal climate is the critical factor

influencing socio-economic activities in general and agriculture in particular.

United Nations Framework Convention on Climate Change -UNFCC (2007) submitted that agricultural sector is one of the most vulnerable to climate variability. These include direct climate-related threats such as extremes in temperatures and precipitation and changes in the growing seasons, and indirect impacts such as a decline in soil quality, pest and pathogen outbreaks and increased risk of fires.

UNFCCC (2007) further stressed that developing countries are mostly affected as nearly 70 percent of people live in rural areas where agriculture is the largest supporter of livelihoods, but technology generation, innovation and adoption do not keep pace with the adverse effects of climate variability.

It is important to note that not even industrialized countries are immune to considerable impacts of climate change. The yield of key crops dropped by as much as 36 per cent in some countries in Europe as a result of the 2003 heat wave, and uninsured economic losses for the agricultural sector in the European Union were estimated at €13 billion (IPCC, 2007). Olanrewaju (2009) stressed that one of man's activities that suffers the repercussion of climatic change most is agriculture. Climate determines the types of agricultural land use engaged in by man. In arable farming for example, climatic change may bring about the following among others:

(i) Regional shift in crop pattern;
(ii) Determination of the size and configuration of farmland;
(iii) Determination of type, status and magnitude of crop pests and disease.

Olanrewaju (2009) also observed that in order to effectively eradicate or limit crop-climate maladjustment, it is necessary to identify and estimate the effects of climate change on agricultural land use. This will involve identification and quantification of environmental indices that limit spatial extent of crop region. This method was employed to explain the spatial shift observed in melon production in

the Guinea Savannah Ecological Zone of Nigeria (Olanrewaju, 2004).

The IPCC fourth report (2007) states that the future productivity of the agricultural sector is closely linked to water availability, just as future water availability is closely linked to practices in the agricultural sector. Human water use is dominated by irrigation, which accounts for almost 70 per cent of global water withdrawals. The future extent of irrigated area is the dominant driver of future irrigation water use, together with cropping intensity and irrigation water use efficiency. Water quality is also impacted by the emission of nutrients and pesticides from agriculture both in developed and developing countries. This confirms the study carried out by Olanrewaju (2010) on the effect of climate on Yam production in Kwara State, Nigeria. The study revealed that the climate of Kwara State has changed and thus yam production is vulnerable. Furthermore, moisture stress in the early part of yam plant's life results in significant delay in the onset of tuberization. For instance the downward trend in yam yield observed in Nigeria during the period of 1970s to greater part of 1980s corresponds with the time Nigeria witnessed significant reduction in rainfall amount due to EL-Nino Southern Oscillation (ENSO) events.

In north China plain, Chen *et al.* (2004) modeled the effects of climate variability and water management on crop productivity and water balance. They used farming systems model, Agricultural Production Systems Simulator (APSIM) and discovered that to meet crop demand; a wide range of irrigation water supply would be needed due to the inter-annual climate variations.

James *et al* (2013) observes that majority of farmers in sub-Sahara Africa are aware of warmer temperatures and changes in precipitation patterns, and to respond to these changes, farmers have adopted crop diversification, planting different crop varieties, changing planting and harvesting dates to correspond to the changing pattern of precipitation, irrigation, planting tree crops, water and soil conservation techniques, and switching to non-farm income activities. Years of farming experience, household size, years of education,

access to credit facilities, access to extension services and off-farm income are among the significant determinants of adopting climate change adaptation measures. In their findings, they conclude that for sub-Sahara African farmers to develop more effective climate change adaptation strategies, there is the need for African governments to support farmers by providing the necessary resources such as credit, information and extension workers to train farmers on climate change adaptation strategies and technologies, and investing in climate resilient projects like, improving on existing or building new water infrastructure and building climate change monitoring and reporting stations.

Abid *et al* (2015) studied farmer's perception and adaptation strategies to climate change and their determinants in Punjab province, Pakistan and note that awareness of climate change is widespread throughout the area, and farm households make adjustments to adapt their agriculture in response to climatic change. Majority of the farm households adapted their farming to climate change. Changing crop varieties, changing planting dates, planting of shade trees and changing fertilizers were the main adaptation methods implemented by farm households in the study area. Their results from the binary logistic model reveals that education, farm experience, household size, land area, tenancy status, ownership of a tube well, access to market information, information on weather forecasting and agricultural extension services, all influence farmers' choices of adaptation measures. They also observes that adaptation to climate change is constrained by several factors such as lack of information, lack of money, resource constraints and shortage of irrigation water in the study area.

Mahmud *et al* (2008) studied impact of climate change on food production in a typical low-income developing country. Their analysis relies on primary data from 1,000 farms producing cereal crops in the Nile Basin of Ethiopia. They found that climate change adaptations , namely, changing crop varieties, adopting soil and water conservation measures, water harvesting, tree planting, and changing planting and harvesting periods have significant impact on farm productivity.

Extension services, both formal (extension officer-farmer), and farmer- farmer, as well as access to credit and information on future climate changes, affect adaptation positively and significantly. Farm households with larger access to social capital are more likely to adopt yield-related adaptation strategies. On the other hand, lack of information and shortages of labor, land, and money were identified as major reasons for not adapting.

Study Area.

Yauri Local Government is located southward on the eastern bank of the famous River Niger at about 200 kilometers away from Birnin Kebbi, Kebbi state capital. It falls within latitudes 10^0 and 30^0 N of the equator and longitudes 3^0 and 6^0 E of the Greenwich meridian (Figure.1). The south and western part of the study area share boundary with Niger and Zanfara states respectively. The study area covers about 3,380 square kilometers (1,306 sq. miles) as reported by Frank (1980).

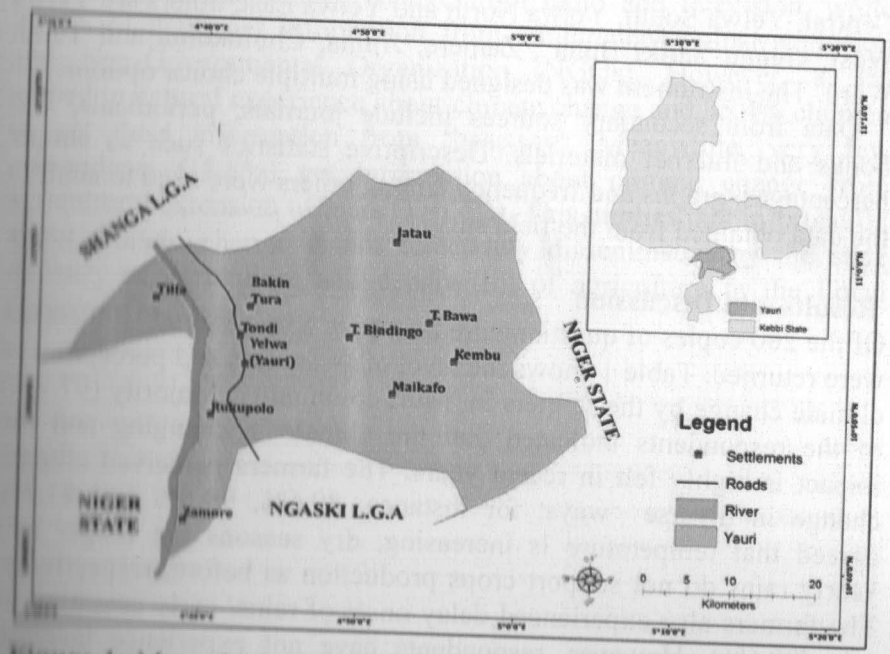

Figure 1: Map of the study area
Source: Ministry of Land and Survey, Kebbi State/Google.

Yauri enjoys a Tropical Continental type of climate of which according to Köppen-Geiger climate classification is 'Aw'. This is largely controlled by two air masses, namely Tropical Maritime and Tropical Continental, blowing from the Atlantic and the Sahara Desert respectively. These air masses determine the two dominant seasons - wet and dry. The wet season lasts from April to October; while the dry season lasts for the remaining period of the year. Mean annual rainfall is about 900mm. Temperature is generally high with mean annual temperature of about 27.5°C in all locations (Minka *et al*, 2013).

Methodology

Data for this research work were collected mainly from primary and secondary sources. Primary sources of data include questionnaire and interview. A total of 200 questionnaires were administered to the farmers in the ten (10) wards in Yauri Local Government. Using systematic random sampling method, twenty (20) questionnaires were distributed to each ward. The political wards in Yauri include: Yelwa Central, Yelwa South, Yelwa North and Yelwa East, others are Yelwa West, Gungu Sariki Buha , Zamere, Jijima, Chulukoma and Tondi Ward. The instrument was designed using multiple choice options.

Data from secondary sources include journals, periodicals, text books and internet materials. Descriptive statistics such as simple percentages, graphs and frequency among others were used to analyze the data obtained from the field survey.

Results and Discussion

Of the 200 copies of questionnaire that were administered, 192 copies were returned. Table 1 shows the level of awareness and perception of climate change by the farmers in Yauri community. Majority (97.9%) of the respondents indicated that the climate is changing and the impact is highly felt in recent years. The farmers perceived climate change in diverse ways, for instance, 89.6%, 99.5% and 81.3% agreed that temperature is increasing, dry seasons are longer and yearly rains do not support crops production as before, respectively. The farmers also experienced delay onset of rains/ early cessation of rain (90.6%). However, respondents have not experience increase

cases of drought during the period of study. This finding implies that farmers are aware and knowledgeable of the concept of climate change with its attendant effects on crop production in the study area.

Table 1: Perception of Climate Change by Farmers

S/N	Perception of Climate Change	Yes	%	No	%	NR	%
1.	Climate is changing in recent years	188	97.9	3	1.6	1	0.5
2.	Temperature is increasing	172	89.6	15	7.8	5	2.6
3.	Dry Seasons are longer	191	99.5	1	0.5	0	0.0
4.	Yearly rains are not supporting crops Production as before	156	81.3	23	11.9	3	6.8
5.	Incidence of flooding is increasing	163	84.9	18	9.4	11	5.7
6.	Drought cases are increasing	29	15.1	159	82.8	4	2.1
7.	Delay onset of rain/early cessation of rain	174	90.6	12	6.3	6	3.1
8	Streams/rivers are drying up/shrinking	183	95.3	6	3.1	3	1.6

Source: Authors Field Survey (2016)

The study further revealed that many of the farmers (84.4%), get information about climate change from radio and television, while 79.7% of them get information from conference/seminar/workshop and Non-Governmental Organization (NGOs). However, 81.3% agreed to natural experience about climate change and 35.4% claimed to get their information from 'hear-say'. Meanwhile, very few respondents (18.8%) get information about climate change from agricultural extension officers (Table 2). This implies that information about climate change is not effectively disseminated by the state ministry of agriculture and department of agriculture in the Local Government Area.

Table 2: Farmers' Responses on Sources of Information about Climate Change

S/N	Sources of Information	Yes	%	No	%	NR	%
1.	Agric extension service	36	18.8	150	78.1	6	3.1
2.	Radio/ Television	162	84.4	21	10.9	9	4.7
3.	News paper	17	8.9	143	74.5	32	16.6
4.	Conference/Seminar/workshop/NGOs	153	79.7	30	15.6	9	4.7
5.	'Hear say' from people	68	35.4	113	58.9	11	5.7
6.	Natural Experience	156	18.3	17	8.9	19	9.8

Source: Authors Field Survey (2016)

Another impediment to information is the level of education of the farmers. The study observed that only 8.9% of farmers accessed information about climate change on news papers. This is due to the fact that majority of the farmers are illiterates. According to Oderinde and Amosun, (2008) cited by Iroye and Abejirin(2012), the awful state of the nation environment can be linked to the twins factors of illiteracy and poverty. Without education, there is little knowledge about how people's activities and consumption pattern can be environmentally informed in a way that will reduced the emission of greenhouse gasses into the atmosphere.

Table 3: Perceived Causes of Climate Change

S/N	Perceived Causes	Yes	%	No	%	NR	%
1.	Natural Causes	61	31.7	128	66.7	3	1.6
2.	Human induced Causes like:						
	Overgrazing	186	96.9	2	1.0	4	2.1
i.	Deforestation/Bush Burning	179	93.2	10	5.2	3	1.6
ii.	Burning Fossil Fuel	153	79.7	21	10.9	18	9.4
iii.	Intensive cultivation of land	168	87.5	16	8.3	8	4.2
3.	Supernatural powers/unseen forces	15	7.8	170	88.5	7	3.6

Source: Authors Field Survey (2016)

On the perceived cause of climate change, majority of the respondents claimed that climate change is mostly human induced phenomenon.

For instance 96.9% of farmers agreed that overgrazing is one of the causes of climate change. Also, 93.2%, 79.7% and 87.5% claimed that deforestation/bush burning; burning fossil fuel and intensive cultivation of land respectively are some of the causes of climate change. However, few respondents (31.7%) claimed that natural causes contribute to climate change while minority still perceived climate change is being controlled by gods (7.8%). Imperatively, anthropogenic activities are the major causes of climate change and most farmers engaged in this climate change induced activities ignorantly without being aware of the environmental implications of their actions.

On the perceived effects of climate change, 87.5% of the respondent claimed that climate change has severe negative effect on their livelihood. 98.9%, 79.7%, and 76.0% believed climate change reduced crop yield, reduced vegetation pasture and soil fertility respectively. Many farmers also agreed that pest and disease outbreak (78.1%), increase flooding and erosion (84.9%) and excessive heat affect stored farm produce and seedlings (96.4%) are some of the negative effect of climate change. 71.4% also claimed that dry spell/drought affect planting date of crops (Table 4).

Table 4: Perceived Effects of Climate Change on Crop Production

S/N	Perceived Effects	Yes	%	No	%	NR	%
1.	Farmers livelihood is severely affected	168	87.5	15	7.8	9	4.7
2.	Reduced crop yield	190	98.9	1	0.5	1	0.5
3.	Reduced vegetation pasture	153	79.7	21	10.9	18	9.4
4.	Pest and disease outbreak	150	78.1	26	13.5	16	8.3
5.	Reduced soil fertility	146	76.0	28	14.6	18	9.4
6.	Increase flooding and erosion	163	84.9	19	9.9	10	5.2
7.	Excessive heat affect stored produce						
	And seedlings	185	96.4	4	2.1	3	1.6
8.	Dry spell/drought affect planting date	137	71.4	31	16.1	24	12.5

Source: Authors Field Survey (2016)

This observation implies that the negative effects of climate change on farmers' livelihood is very high and call for urgent attention by all stake holders. It is also adduced that food security is not guaranteed, if the current climate change scenario is not mitigated.

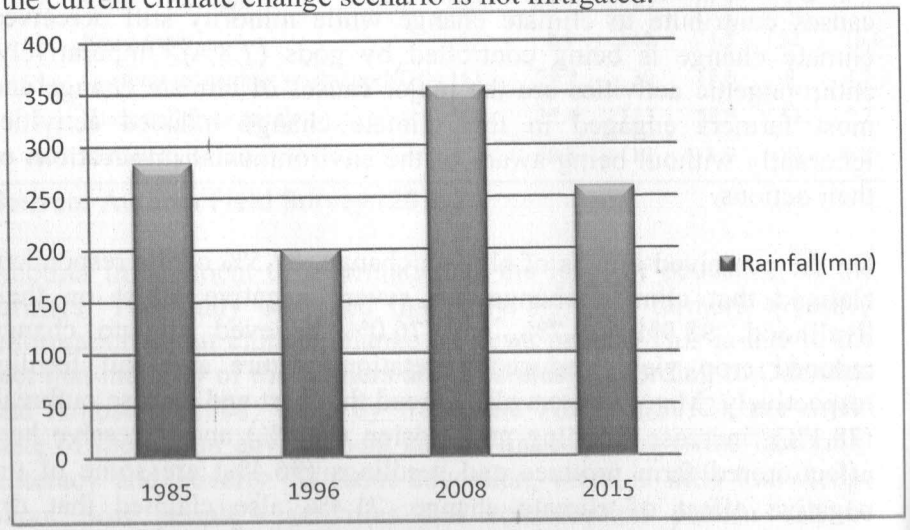

Figure 1: Variation in Mean Annual Rainfall in the Study Area (1985-2015).

Source: NiMET, Yauri (2016)

The adaptation/mitigation strategies to climate change by farmers in Yauri community are presented in table 5. Majority of the respondents employed traditional methods of adaptation/mitigation strategies like planting varieties of crops (89.6%), planting shaded trees (81.8%), and changing crop types and varieties (72.4%). However, other methods of adaptation/mitigation were also used. 55.7%, 96.9% and 87.5% of farmers claimed to use change crop planting date, used of chemical fertilizer and used of irrigation system respectively. Meanwhile, very few farmers (39.6%) used mulching method and 41.1% claimed to use erosion control method, only 8.9% respondents used short term climate prediction and research information while 43.2% of the farmers reduced bush burning activities in order to mitigate the effects of climate change in the study area.

The study revealed that short term climate prediction and research information about climate change are not fully utilized by the farmers; this could be due to lack of access to this information. Furthermore, many farmers used chemical fertilizer for their crops without considering the environmental implication and the negative effect of the chemicals in the soils and water in the study area.

Table 5: Adaptation/Mitigation Strategies to Climate Change by Farmers.

S/N	Strategies	Yes	%	No	%	NR	%
1.	Plant varieties of crops	172	89.6	15	7.8	5	2.6
2.	Use mulching method	76	39.6	103	53.6	13	6.8
3.	Plant shaded trees	157	81.8	19	9.9	16	8.3
4.	Reduced bush burning	83	43.2	95	49.5	14	7.3
5.	Change crop planting date	107	55.7	81	42.2	4	2.1
6.	Use chemical fertilizer	186	96.9	4	2.1	2	1.0
7.	Adapt erosion control methods	79	41.1	110	57.3	3	1.6
8.	Used irrigation system	168	87.5	18	9.4	6	3.1
9.	Used short term climate prediction and research information	17	8.9	172	89.6	3	1.6
10.	Changing crop types/varieties	139	72.4	47	24.5	6	3.1

Source: Authors Field Survey (2016)

Traditional method of bush burning is still very much in practice in the study area without considering the effects of carbon monoxide released into the atmosphere. This is due to poor sensitization and lack of awareness by relevant authorities.

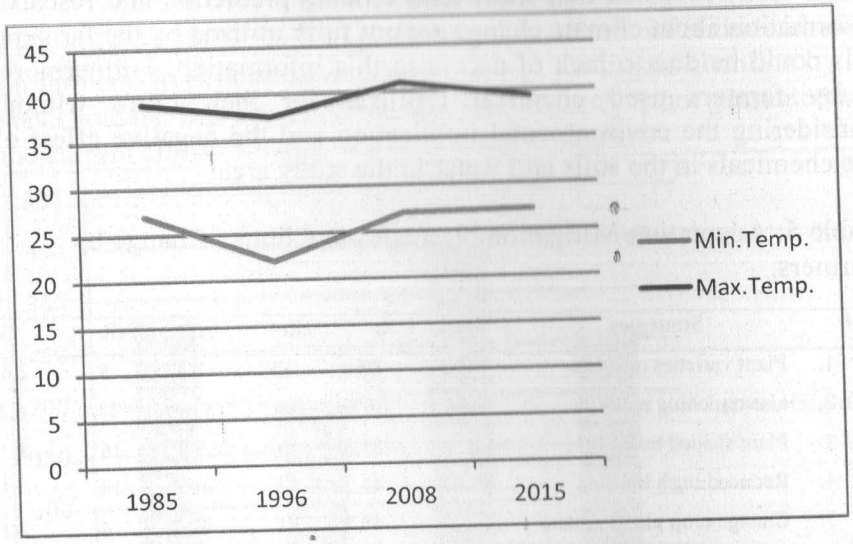

Figure 2: Variation in Minimum and Maximum Temperature in the Study Area

Source: NiMET, Yauri (2016)

In order to support the findings and show evidence of climate change in the study area, climate data from Nigeria Metrological station in Yauri were obtained and analyzed. The result revealed variations in annual mean rainfall, annual mean maximum and minimum temperature between the periods of 1985 to 2015, (see figures 1 and 2).

Conclusion and Recommendations

Climate change has become a global phenomenon that has attracted global concern and therefore demands international co-operation and collaboration. The effects of climate change on food production and food security in Nigeria cannot be overemphasized. Intense and frequent incidence of flood and erosion in the southern and central part of Nigeria, dry spell and delay onset of rains and early cessation of rain in the north are some of the undoubted evidences of many effects of climate change on farmer's livelihood.

However, the choice of adaptation and mitigation of the effects of climate change by farmers is highly influenced by the level of

perception and awareness to the menace of climate change. The study revealed that farmers to a large extent are aware of the dynamics of their local climate. They are aware of climate change and have developed traditional knowledge of mitigation and adaptation strategies. Meanwhile, ignorance, illiteracy and poor climate information dissemination and utilization are identified as some of the challenges to climate change adaptation and mitigation efforts by farmers.

According to Yaro *et al* (2014) the local farmers cannot adapt to what they don't know, therefore, successful adaptation and mitigation requires information and understanding of future change. Information on climate change should be made available to farmers to create more awareness and knowledge on the effects of some anthropogenic activities that contribute to climate change.

Furthermore, participatory adaptation strategy that involves local farmers in decision making and planning will ensure cooperation in climate change adaptation and mitigation.

Land use planning should be part of any intervention programme on climate change as land use change constitutes the greatest driver of deforestation. There is no doubt that in the coming decades, the world will witness high temperatures and changing precipitation patterns that will have more negative effects on food crop production if urgent measures are not taken to mitigate the impacts of climate change.

References

Abid, M. Scheffran,J. Schneider,U. and Ashfaq, M.(2015) Farmers' perceptions of and adaptation strategies to climate change and their determinants: the case of Punjab province, *Pakistan Earth Syst. Dynam.*, 6(12), 225–243. Accessed from www.earth-syst-dynam.net on 6th of June, 2015.

Apata T., Samuel,D., and Adeola, O,(2009). Analysis of Climate Change Perception and Adaptation among Arable Food Crop Farmers in South Western Nigeria. Paper presentation at the International

Association ofAgricultural Economists' 2009 Conference, Beijing, China, August 16-22, 2009.

Ayoade, J.O. (2003). *Tropical Hydrology and Water Resources.* Macmillan. London and Basingstoke.

Building Nigeria's Response to Climate Change (BNRCC), 2008: 2008 Annual Workshop of Nigerian Environmental Study Team (NEST): The Recent Global and Local Action on Climate Change, held at Hotel Millennium, Abuja, Nigeria; 8-9th October, 2008.

Bryan, E., Ringler, C., Okoba, B., Roncoli, C., Silvestri, S., and Herrero, M.(2013): Adapting Agriculture to Climate Change in Kenya: Household Strategies and Determinants, *J. Environ. Manage.* 114, 26–35.

Deressa, T., Hassan, M., Ringler, C., Alemu, T., and Yesuf, M.(2009): Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia, *Global Environ. Change,* 19, 248–255.

Deressa, T. and Hassan, T. (2010). Economic Impact of Climate Change on Crop Production in Ethiopia: Evidence from Cross-section Measures. *Journal of African Economies*, 18, (4), pp. 529–554

Deressa, T., Hassan, M., and Ringler, C.(2011): Perception of and adaptation to climate change by farmers in the Nile basin of Ethiopia, *J. Agric. Sci.,* 149, 23–31,

Dinar, A., Hassan, R, Kurukulasuriya, P, Benhin, J & Mendelsohn, R, (2006). The policy nexus between agriculture and climate change in Africa. A synthesis of the investigation under the GEF/WB Project: Regional climate, water and agriculture: Impacts on and adaptation of agro-ecological systems in Africa. CEEPA Discussion Paper No. 39. Centre for Environmental Economics and Policy in Africa, University of Pretoria.

Edafienene, E.(2003).Coastal Climate Variability and its Implication to Food Sustainability in Nigeria. A paper presented at the Regional

Conference on Climate Change and Food Sustainability in the 21st century held at Meteorological Station, Oshodi, Lagos.

Frank A. (1980).Gods and goods in Africa; persistence and Change in ethnic and religious identity in Yauri Emirate, North-western State, Nigeria. www.wikipedia.org/yauri_Emirate date accessed 10/11/15.

IPCC, (2001). Climate Change: Impacts, Adaptations and Vulnerabilities. Contribution of Working Group II to Third Assessment Report of IPCC, Cambridge University Press, New York, 75-108.

IPCC, (2007). Contribution of Working Group II to the Forth Assessment Report of the IPCC – Summary for Policy Makers. Retrieved on June, 12, 2015 from http://www.ipcc.ch.

Iroye,K. A. and Abejirin,O. J.(2012).Community perception of climate change in Ilorin Metropolis. Geo-Studies Forum: *An International journal of Environmental and Policy Issues* 5(1).104-112.

James S., Zibanani K., & Francis N. (2013.) Farmers' Perceptions and Adaptations to Climate Change in Sub-Sahara Africa: A Synthesis of Empirical Studies and Implications for Public Policy in *African Agriculture Journal of Agricultural Science*. 5 (4).

Judith L. (2010). Cycles and trends in solar irradiance and climate; Wiley Interdisciplinary Reviews: *Climate Change Journal*, 1 (3); 111-122.

Mahmud,Y., Salvatro,D., Temesgen, D., Claudia,R. and Gunnar, K. (2008). The Impact of Climate Change and Adaptation of Food Production in Low Income Countries. Evidence from the Nile Basin, Ethiopia. IFPRI. Discussion Paper No 00828. Centre for Environmental Economics and Policy in Africa. Pretoria, South Africa: University of Pretoria.

Mertz, O., Mbow, C., Reenberg, A., and Diouf, A.(2009): Farmers' perceptions of climate change and agricultural adaptation strategies in rural Sahel, *Environ. Manage.* 43(31), 804–816.

Mike L. (2009).Solar Change and Climate: an update in the light of the current exceptional solar minimum, Proceedings of the Royal Society.

Minka, S. and Ayo, O. (2013). Influence of cold–dry (harmattan) season on colonic temperature and the development of pulmonary hypertension in broiler chickens, and the modulating effect of ascorbic acid. *Dove Press Journal*. 34 (21).

Nigerian Environmental Study Team (NEST), (2004); Regional Climate Modeling and ClimateScenarios Development in Support of Vulnerability and Adaptation Studies: Outcome ofRegional Climate Modeling Efforts over Nigeria, NEST, Ibadan, Nigeria.

Olanrewaju, R. M. (2006). Implication of the Late Onset of Rain in a Coastal Ecological Area: The Case Study of Lagos and Its Environs. *Geo-studies forem*.3 (1&2).83-88.

Olanrewaju, R. M. (2009). Methods of Assessing the Impacts of Climate Change on Agricultural Land use. Perspectives on Nation Building and Development in Nigeria: *Environmental & Economic Issues*.6 (2). 53-64

Olanrewaju, R. M (2010). The Effect of Climate on Yam Production in Kwara State, Nigeria. *Environmental Issues* 3(1): 30- 34.

Organisation for Economic Co-operation and Development (OECD)(2011). The Economics of Adapting Fisheries to Climate Change, OECD Publishing, Chateau de la Muette, Paris.

Orindi V., Ochieng A., Otiende B., Bhadwal S., Anantram K., Nair S., Kumar V. and Kelkar U. (2006). in Thornton K., Jones G., Owiyo T., Kruska .L, Herrero M., Kristjanson P., Notenbaert A, Bekele N., and Omolo A.; Mapping climate vulnerability and poverty in Africa. Report to the Department for International Development, ILRI, Nairobi, Kenya.

Schlenker,W. and Lobell, D.(2010). Robust Negative Impacts of Climate Change on African Agriculture, *Environment. Res. Lett.*, 5, (14)

Shaw,A.B.(1979). "An Agroclimatic procedure for rice cultivation on the coastal areas of Guyana" *Malayan Journal of Tropical Geography*, 5. 67-81.

Stige, C.,. Stave, J., Chan, K. (2006). The effect of climate variation on agro-pastoral production in Africa. Proceedings of the National Academy of Sciences 103: 3049–3053.

Weber, E. U.(2010): What shapes perceptions of climate change?, Wiley Interdisciplinary Reviews: *Climate Change*, 1, 332–342.

Wolfe D., Schwartz, M. Lakso, A. Otsuki, Y., Pool, R. Shaulis. N. (2005). Climate change and shifts in spring phenology of three horticultural woody perennials in northeastern USA. *Internat Journal Biometeorol* 49:303-309.

Yaro, M., Egbe, C., Okon, A., and Bisong, F., (2014). Rural Peoples' Perception to Climate Variability/Change in Cross River State-Nigeria. *Journal of Sustainable Development*; 7(2), 25-36.