



PERCEIVED IMPACT OF CLIMATE CHANGE ON ECONOMIC ACTIVITIES IN UGHELLI NORTH LOCAL GOVERNMENT AREA OF DELTA STATE

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ABSTRACT: *The study assessed household perception of climate change on economic activities in Ughelli North Local Government Area of Delta State. Systematic sampling technique was employed to administer 291 copies of structured questionnaires to households in the area. Data obtained from the administered questionnaire were analyzed using simple percentages, tables, and principal components analysis (PCA). Results obtained showed that households in the area were knowledgeable of climate change. The study revealed that households perceived the impacts of climate change to include increased temperature (55%), decreased rainfall (22.7%), and decreased rainfall duration (12.4%). The study further identified households' perceived changes in economic activities to include decreasing working hours engaged in economic activities, decrease in food crop farming/fish farming, drastic changes in principal sources of income and livelihood, changes in crop yields and productivity and changes in availability of fodder and non-timber forest product (NTFPs), as well as decrease in workforce productivity. PCA results identified the use of herbicide/insecticide, burning of fossil fuel and deforestation, gas flaring and bush burning as main anthropogenic factors responsible for 80.2% of climate change phenomena in the area. Based on the findings, the study recommended that the government should encourage soft loans to farmers and fish farmers. This will ensure the steady supply of food, thereby increasing households' source of livelihood and nutrition.*

KEYWORDS: Climate change, Economic activities, Perceived impacts, Ughelli north LGA.



INTRODUCTION

In our world today, climate change is one of the greatest challenges faced by humanity. Climate change is a global trend and its impact on economic activities mostly in the developing countries has increased considerably. Climate change, which is a change in the mean state of the climate of an area or in its variability persisting for an extended period, is considered as a threat multiplier which aggravates environmental social and economic challenges for a long time, typically decades or longer. It also includes shifts in the frequency and magnitude of sporadic weather events as well as the slow continuous rise in global mean surface temperature. Climate change manifests in various ways, including changes in average climatic conditions whereby some regions may become drier or wetter than average (IPCC, 2014; Poudel, Funakawa & Shinjo, 2017). Over 63 per cent of the population in sub-Saharan Africa depend solely on agriculture as their main means of livelihood (Fadina & Barjolle, 2018). The variability and change in climate are major challenges hindering economic activities in the region.

This vulnerability is heightened by development challenges like poor warning systems, lack of basic infrastructure, endemic poverty and ecosystem among others (Intergovernmental Panel on Climate Change, 2007). Similarly, Obayelu et al. (2014) attributed the vulnerability of the region to the limited engagement in environmental, weak institutional capacity and adaptation issues, and lack of adequate knowledge and climate change adaptation. Climate change has the potential of causing serious environmental, health, and social-economic dislocations in many parts of the world especially in developing countries like Nigeria (Poudel et al., 2017). There is serious concern about the impacts of climate change on socio economic activities of households across the world, mostly in developing countries. It has been reported that while crops would respond positively to elevated CO₂ in the absence of climate change, the associated impacts of high temperatures, altered patterns of precipitation and probably increased frequency of extreme events such as drought and floods will impact negatively on households' socioeconomic activities, thereby widening the gap between the rich and the poor.

Climate change-related impacts, which include prolonged flooding, heat waves, drought, sea level rise, salinity, temperature, and rainfall variations, have become evident (Haque et al., 2012). People are directly exposed to changing weather patterns (temperature, precipitation, sea-level rise, and more frequent extreme events) and indirectly through changes in the quality of water, air, and food in addition to changes in ecosystems, agriculture, industry, human settlements, and the economy. People's perception and attitude towards the effects of climate change on the environment have received contradictory results over the years. Public knowledge and perceptions of the impacts of climate change are critical components within which climate change adaptations and mitigation will operate (Terdoo & Adekola, 2014). Worldwide, change in climate has been shown to have a significant impact on socio economic activities and other sources of livelihood. Changing precipitation patterns are exacerbating the vulnerability of agriculture, which is mainly rain-fed in many countries, mostly in sub-Saharan countries (Poudel et al., 2017).

According to the IPCC's Fourth Assessment Report and other scientific studies (IPCC, 2014), it is clearly understood that climate change has a direct impact on agriculture, livestock and fishing, especially in developing countries where people are living below the poverty line, and it will affect not only local, but also global food security (Bals, Harmeling & Windfuhr,



2008). Likewise, assets and livelihood opportunities are lost, purchasing power falls, human health is endangered and affected people are unable to cope. Climate variability has major impacts on peoples' lives and livelihoods and this has led to households changing from one profession to the other (Poudel et al., 2017; Hussain, 2016). These studies reported that households have adopted various practices to cope with the changing climate that strengthens their resilience.

Nigeria, like all the countries of sub-Saharan Africa, is highly vulnerable to the impact of climate change. Nigeria therefore needs innovative adaptation strategies that will empower the rural dwellers to cope with climate change and sustain their livelihood. If this is not looked into, peasant farmers and petty jobs in Nigeria, especially those in Ughelli north region, will suffer greater impacts from the emerging climate change-related problems. On this note, the extent to which households have the capacity to respond to or adapt to these changes has critical implications for human development at the household, community, national and global level. It is on these above mentioned reasons that the present study assessed households' perception of the impacts of climate change on economic activities in Ughelli North Local Government Area of Delta State, Nigeria.

MATERIALS AND METHODS

Study Area

Ughelli North LGA is found in Delta State; Ughelli north is one of the twenty-five local government areas in Delta State, south-south geopolitical zone of Nigeria. The headquarters of the LGA is Ughelli town. The study area is located between latitude $5^{\circ} 10'$ and $5^{\circ} 45'$ north of the equator and longitude $5^{\circ} 50'$ and $6^{\circ} 15'$ east of Greenwich (Figure 1). It is bounded in the north by Ethiope East LGA, in the south by Patani LGA, in the west by Ethiope East, Uvwie, Okpe and Ughelli South LGAs, and in the east by Ndokwa West, Isoko South and Isoko North LGAs. It has an area of 818 km² and a population of 321,028 according to the 2006 population census. The LGA has a number of rivers and streams flowing within its territory. Trade is an important economic activity in Ughelli North LGA with the area hosting a number of markets such as the Ughelli modern markets. Substantially large amounts of crude oil and natural gas are also found in Ughelli North LGA with the area hosting a number of local and international oil mining firms. Other important economic activities that take place in Ughelli North LGA include fishing, farming, and crafts making. This area was chosen for the study due to the high level of economic activities.

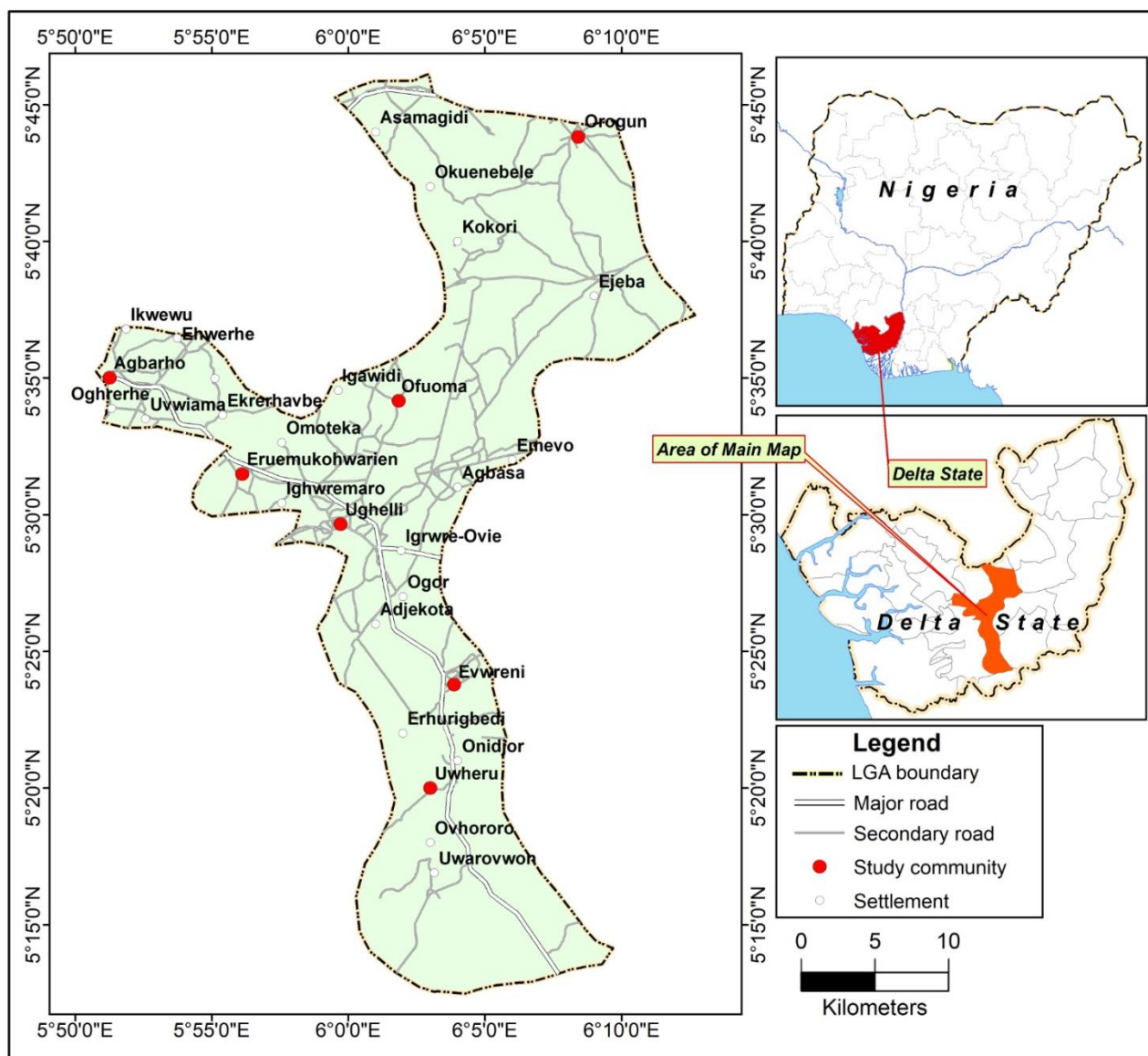


Fig. 1: Ughelli North Local Government Area showing studied communities

Data Collection Procedure

A structured questionnaire was used to collect the necessary data. This was systematically administered to households in Ughelli North Local Government Area. The study administered 300 questionnaire copies to households in the area; out of this number, 291 copies were successfully collected and used for the study. Systematic sampling was considered most suitable in this study due to the characteristic layout of streets which are poorly planned and numbered. The administration was such that on every street, the first household/building was sampled after which the sixth was administered a copy of the questionnaire and so on. The interval between each sampled household was five. During the data collection process, respondents were approached in their homes and only one household member was administered a copy of the questionnaire.



Method of Data Analysis

Data obtained from the administered questionnaire were analyzed using tables, simple percentages and principal components analysis (PCA). Principal components analysis was used to identify significant factors responsible for climate change in the area. PCA is a very powerful multivariate statistical technique which is performed to reduce the dimensionality of a data set consisting of a large number of interrelated variables, while retaining as much as possible the variability present in the data set (Jianqin et al., 2010). This was achieved by extracting only components with Eigenvalues >1 after Varimax rotation (Otitaju & Enete, 2016). In the present study, component loadings of (>0.80) were employed. According to Liu et al. (2003), component loadings can be classified as strong (>0.75), moderate (0.75–0.50) and weak (0.50–0.30). Statistical analysis was performed using Microsoft Excel and SPSS (22.0) for windows.

RESULTS

Socioeconomic Characteristics of Respondents

Information on the socioeconomic characteristics of respondents is shown in Table 1. The sex of respondents showed that males dominated the survey. This is because about 68.4% of the respondents surveyed were males, while 31.6% were females. The dominance of males is anticipated as males are breadwinners who engage in full time economic activities as their main source of livelihood. A similar result of male dominance of 67.8% was reported in Adamawa State by Adebayo et al. (2013). Information on the age of respondents showed a similar pattern. It showed that respondents within the ages of 40–49 yrs dominated the survey (36.1%), followed by those within the ages of 30–39 yrs and those between the ages of 50 yrs and above with percentage values of 22.7 and 18.9% respectively, while those <20 yrs had the lowest proportion of respondents of 4.5%. The general pattern therefore shows that the majority of the respondents (95.5%) fall within 20 yrs and above. It means therefore that the age of respondents involved in several economic activities in the study area is predominantly dominated by young adults. Similar age pattern of over 90% of young adults was reported by Raghuvanshi et al. (2017) in India. The age pattern observed has a far-reaching implication on the study, in that the young adults will be able to communicate their experience in the area in connection to the changing climate.

On the marital status of the respondents, the result showed that a larger percentage of the respondents were married (64.6%), followed by those who were unmarried (22.3%), while the remaining percentage represent respondents with marital challenges. In all, the result obtained shows that married individuals dominated the survey. This is expected as being involved in economic activities is required to be able to raise money and provide food to meet family needs. The educational status revealed that the respondents had different qualifications, ranging from primary to tertiary education. It showed that across the communities, a significant proportion (59.5%) of the respondents had secondary education, followed closely by tertiary education and primary education with 19.9% and 20.6% respectively. It is apparent from the result that a good number of the respondents precisely 79.4% have post-primary education. The result simply indicates high literacy level which would influence people's level of knowledge of climate change and its effect on economic



activities in the area. The educational status could also influence farmers' adoption of climate change measures.

Table 1: Socio-economic characteristics of respondents

Sex	Frequency	Percentage
Male	199	68.4
Female	92	31.6
Total	291	100.0
Age	Frequency	Percentage
< 20 years	13	4.5
20-29	52	17.8
30-39	66	22.7
40-49	105	36.1
50 and above	55	18.9
Total	291	100.0
Marital Status	Frequency	Percentage
Single	65	22.3
Married	188	64.6
Divorced / Separated	38	13.1
Total	291	100.0
Education	Frequency	Percentage
Primary	60	20.6
Secondary	173	59.5
Tertiary	58	19.9
Total	291	100.0

Perception of Climate Change in Ughelli North LGA

Households' knowledge of climate change and how they perceive climate change in the area is shown in Table 2. The result revealed that all the respondents had knowledge of climate change. The result obtained means therefore that climate change is not a new word to residents in the respective communities. The changes in rainfall duration and intensity and other extreme weather events have increased people's knowledge of climate change. The result obtained agrees with the findings of Kabir et al. (2016) in Bangladesh where they found that the majority of the participants (54.2%) had some knowledge about climate change. Respondents in the area engaged in diverse economic activities perceived climate change differently. As shown in Table 3, a good number of the respondents who are knowledgeable of climate perceived the impacts in terms of increased temperature (55%), decreased rainfall (22.7%), decreased rainfall duration (12.4%) and increased rainfall intensity (10%). With these varying climate change indices, it is apparent that climate change is not a new phenomenon in the area.

In a related study, Kabir et al. (2016) stated that the majority of knowledgeable participants perceived the impacts of climate change to include excessive temperature (83.2%), 94.5% perceived change in climate and extreme weather events, 91.9% observed change in rainfall patterns, and 97.8 % people believed increased in healthcare expenditure due to extreme weather events. The results obtained therefore show that people in the area are aware of the



impacts of climate change and they have diverse perceptions on its impacts. Similar assertions were given by Ajuang et al. (2016). In addition, respondents held the opinion that climate change caused by extreme weather events, such as increased temperature, has impacted on their economic activities. This is expected as 83.2% of the respondents stated that climate change has had considerable effects on economic activities.

Table 2: Knowledge of climate change and perceived indices

Variables	Category	Frequency	Percentage
Knowledge of climate change	Yes	291	100
	No	0	0
Perceived indices of climate change	Increased temperature	160	55.0
	Decreased rainfall	66	22.7
	Decreased rainfall duration	36	12.4
	Increased rainfall intensity	29	10.0
Perceived impact of climate change	Yes	242	83.2
	No	49	16.8

Perceived Causes of Climate Change in Ughelli North LGA

People in the study area have dissimilar understanding on factors responsible for climate change. On this note, principal components analysis (PCA) was employed to identify principal components perceived by the people to be responsible for climate change in the area. This statistical technique was employed due to the number of variables used to measure the perceived causes of climate change. The result obtained is shown in Table 3. PCA results of 10 variables resulted in the extraction of five components that accounted for 80.2% of the variations in the data set. Using component loadings of $\pm \geq 0.8$ as the criteria for selecting variables, principal component one (PC₁) had a strong and positive loading on two variables; the variables were use of herbicides (0.950) and use of insecticide/pesticides (0.947). PC₁ was accountable for 23.7% of total variance in the perceived set of data on the causes of climate change in the area and the positive loadings of the variables indicated increase in the use of insecticide/pesticide and herbicide. As a result of the two variables that loaded on PC₁, it therefore represented use of herbicide/insecticide. PC₂ also had two variables that loaded positively on it; the two variables were burning of fossil fuel (0.954) and deforestation (0.950). PC₂ was responsible for 18.5% of the total variance in the variable set and indicated increased burning of fossil fuel and deforestation.

PC₃ was accountable for 17% of total variance in the perceived set of data on the causes of climate change in the area and had also two variables that loaded on it. The two variables were continuous cropping (0.917) and overgrazing (0.907). Based on the nature of variables that are loaded in PC₃, it could be said to represent continuous cropping and overgrazing. PC₄ was accountable for 10.8% of total variance in the set of data and had only one variable that loaded on it. The variable was gas flaring (0.877). PC₄ symbolized gas flaring. The result



further showed that F_5 had one variable that loaded positively on it and the variable was bush burning (0.935). PC_5 was responsible for 10.3% of the variance in the data set and it represented bush burning. The result in Table 3 therefore identifies use of herbicide/insecticide, burning of fossil fuel and deforestation, burning of fossil fuel/deforestation, gas flaring, and bush burning as the five principal perceived factors responsible for climate change in Ughelli North LGA.

These five factors to a large extent contribute to climate change variability and impacts in the area. Herbicides/insecticides are used to control insects and pests as well as for weed control. The use of pesticides has increased as a result of the increasing climate change events such as increased temperature favouring the growth of pests and weed flora. Swedish University of Agricultural Sciences (2016) stated that higher moisture and higher temperature will increase the pressure from pests, and almost certainly result in an altered weed flora which is expected to increase the need for pesticides. In our agricultural fields, most of the pesticides used fall within herbicides, but climate change may result in a greater need for insecticides and fungicides in the future. The increased use of insecticides and fungicides will increase the concentration of chlorofluorocarbons in the atmosphere.

Increase in land disturbance in terms of continuous cropping and overgrazing are other human activities that cause climate change. Increase in these practices over time results in the loss of vegetation thereby increasing the daily temperature due to the loss in vegetal cover that would have helped in carbon sequestration. Since forest vegetation and soils are principal reservoirs of carbon, they help to reduce the atmospheric consequences of carbon dioxide (CO_2) concentration which results in global temperature rise; this is however interrupted and rendered functionless with the disappearance of green areas due to intensive farming systems and overgrazing. Burning of fossil fuel/deforestation also causes climate change because the practice results in the emission of greenhouse gases that heat up the lower atmosphere. These practices among others identified in Table 3 mutually cause climate change if not properly managed.

**Table 3: PCA result showing perceived causes of climate change in Ughelli North LGA^a**

Variables	Principal components				
	PC ₁	PC ₂	PC ₃	PC ₄	PC ₅
Use of herbicides	<u>.950</u>	.051	-.031	.011	.069
Use of insecticide/pesticides	<u>.947</u>	.035	.008	-.041	.052
Use of fertilizer	.751	-.124	.104	.069	-.136
Burning of fossil fuel	-.024	<u>.954</u>	-.008	.018	-.070
Deforestation	-.012	<u>.950</u>	-.026	.086	.000
Continuous cropping	.031	.028	<u>.917</u>	-.012	.051
Overgrazing	.038	-.060	<u>.907</u>	-.002	-.007
Gas flaring	-.053	-.008	-.096	<u>-.877</u>	.219
Soil degradation	-.020	.092	-.115	.679	.262
Bush burning	-.008	-.069	.053	.011	<u>.935</u>
Eigenvalues	2.37	1.85	1.7	1.08	1.03
% variance	23.7	18.49	17.01	10.78	10.25
Cumulative exp.	23.7	42.19	59.2	69.98	80.23

^athe underlined with coefficients $\pm \geq 0.8$ are considered significant

Perceived Impact on Economic Activities

The result in Table 4 showed that the majority of the respondents (precisely 90%) stated that climate change has caused changes in economic activities of the area. A similar result was reported by Alam et al. (2017). The result obtained is however expected as many people have been forced to change their economic activities over time. Households in the area are involved in various types of economic activities for livelihood, such as trading, farming, fishing, fish farming, okada and other businesses. Some traders who were involved in roadside fish businesses, for instance, had been forced to change the business due to the scarcity of fish as well as the high cost of fish, among others. Some of these fishes hardly caught in natural waters as a result are now grown in artificial ponds and sold at exorbitant prices. Furthermore, respondents were asked to rate the impact of climate change on economic activities in the area. Varied responses were observed, implying that respondents perceive the impact in different ways. The results obtained showed that 36.8% of the respondents rated the impact on economic activities as severe, 32% rated it as severe and 17.2% rated the impact as moderate, while 14.1% rated it as being mild. The pattern shows that a greater percentage (68.8%) of the respondents believe that climate change has a devastating impact on economic activities. This is apparent as several economic activities such as trading, farming and off-farm activities are impacted by the continuous change in climate. Loss of farm produce or destruction of farmlands has effects on household sources of livelihood and income, and this can make poor households become more vulnerable. The implication of the result in Table 4 is that small-scale farmers will struggle as a result of climate change to get a fair price for their goods, protect against weather and pests, and compete with large-scale monoculture agricultural systems to stay in business. According to Byrd and Demates (2017), such an upset has the likelihood to take away households' livelihoods and main source of income as well as harm entire communities who depend on selling the fruit or farm produce.

**Table 4: Perceived impacts of climate change**

Variables	Category	Frequency	Percentage
Rating climate change impact	Mild	41	14.1
	Moderate	50	17.2
	Severe	107	36.8
	Very severe	93	32.0
Impact on economic	Yes	262	90.0
	No	29	10.0

Perceived Impact of Climate Change on Economic Parameters

The result in Table 5 revealed that 86.3% of the respondents strongly stated that climate change has decreased the working hours engaged in economic activities. This group of individuals believes that climate change has rather decreased the working hours in economic activities. The decrease in working hours could be attributed to the increase in temperature that causes workers to retire to their home or stop rigorous activities due to hot weather conditions (increased temperature). This phenomenon is commonly found among farmers and some traders who are sometimes forced to stop work or selling due to an increased heat wave mostly in the absence of trees or umbrella to take shelter. The result obtained therefore implies that climate change results in increased temperature, which in turn negatively affects the working hours given to economic activities. This result lends support to the findings of Poudel et al. (2017) that climate change resulted in the decrease in working hours regarding economic activities among households in Nepal.

The result further showed that climate change had impacted on food crop farming/fish farming in the area. This is apparent as 80.2% of the respondents strongly alleged that food crop farming/fish farming has decreased over time due to climate change. The delay on the onset of rains as well as the sporadic nature of rains over time has had a significant impact on food crop farming/fish farming. This has made many farmers to complement farming with other economic activities (like trading) in order to make ends meet. Decrease in agricultural production has also been reported by Poudel et al. (2017), and this was attributed to the extreme climate events because of the high dependency on natural resources. The study reported that some households in Nepal take on off-farm activities due to the increased vulnerability of agriculture, in order to find off-farm income opportunities.

The result also revealed that 85.9% of the respondents affirmed that changes have taken place in principal sources of income and livelihood as a result of climate change. This individual is of the opinion that the changes in economic activities have had negative impacts on income generated from agricultural products. This has made many households, who before now depended completely on agriculture as a major source of income, to also take on off-farm activities for improved income opportunities. The result also showed that the majority of the respondents strongly stated that the changes in crop yields and productivity and changes in availability of fodder and non-timber forest products (NTFPs) are associated with climate change (Table 4). This is because increased temperature and decreased rainfall have a joint influence on crop yields and productivity. Increase in temperature without a corresponding



increase in rainfall amount and frequency will make plants wither and some that are able to tolerate the absence of moisture may not produce good yield. This is so because both temperature and rainfall are needed for crops to grow. In the same way, non-timber forest products (NTFPs) and fodder are also dependent on rainfall and temperature. Increased rainfall amount and decreased temperature (increased availability of moisture) favour the establishment and growth of NTFPs and fodder, but any contrary condition will affect the establishment and growth of NTFPs and fodder. In a related study, Mishra and Sahu (2014) stated that increasing trends of temperature and decreasing rainfall for all the seasons might have adverse impact on the health of the agriculture sector.

Decrease in workforce productivity is another economic impact of climate change. The result in Table 5 indicated that 80.1% of the respondents believed that climate change characterized by increase in temperature among other weather extremes has a remarkable impact on workforce productivity. This is expected as an increase in heat waves affects workers' level of concentration and this in the long-run affects work productivity. When the work environment is not conducive, there will be reduced productivity as workers may not be motivated to work and even when they intend to work, the existing environmental condition may not be favourable. This condition among others decreases workforce productivity. This agrees with the findings of Arent et al. (2014) that the impacts of climate change may decrease productivity and economic growth. The report further stated that climate could be one of the causes why some countries are trapped in poverty, and climate change may make it harder to escape poverty.

Table 5: Perceived economic impacts of climate change

Items	Total percentage response	
	A	D
Decrease in working hours.	86.3	13.7
Decrease in food crop farming/fish farming.	80.2	19.8
Changes in principal sources of income and livelihoods.	85.9	14.1
Changes in crop yields and productivity.	79.0	21.0
Changes in availability of fodder and non-timber forest products.	89.3	10.7
Decrease in workforce productivity.	80.1	19.9

Most Vulnerable Economic Activity to Climate Change

The responses of respondents were used to identify the economic activity that is most vulnerable to climate change (Table 6). The results obtained identified farming, fishing and trading as the major economic activities vulnerable to climate change. Civil service was identified as the least impact economic activity in the area. This is so as it does not have a considerable impact on workforce and monthly income. Among these three vulnerable economic activities, farming remains the most impacted. This is glaring as it constitutes the main occupation of a good number of people in the area. People in the area are basically agrarian, who depend on the soil for their source of livelihood. The people depend on rain-fed agriculture; as such, any changes in rainfall and temperature will have extensive effects on food supply and income generation. In Nigeria and many developing countries, the main economic activity is agriculture. As such, these economies are more vulnerable to climate change adverse impact due to its dependency on climate change sensitive activity. In Nigeria,



agriculture practice depends on the seasonal rainfall on which are dramatically decreasing seasons to seasons. The adverse impacts of climate change in the agriculture sector include reduced crop yield due to drought and floods and reduced water availability among others. In a related study, Enete and Amusa (2010) indicated that climate change is perhaps the most serious environmental threat to the fight against hunger, malnutrition, disease and poverty in Africa, mainly through its impact on agricultural productivity.

Table 6: Economic activities mostly impacted by climate change

Category	Frequency	Percentage
Trade/Business	24	8.2
Farming/Agriculture	145	49.8
Fishing	115	39.5
Civil Service	7	2.4

CONCLUSION

The findings from the study have shown that climate change phenomena and impacts exist in Ughelli North Local Government Area and the households have knowledge of climate change. The study clearly shows that the households in the area perceive climate change impact in different ways, with the majority understanding the impacts in terms of increased temperature, decreased rainfall, decreased rainfall duration and increased rainfall intensity. The findings from the study have also clearly shown that climate change characterized by extreme weather events significantly impacts and triggers remarkable changes in economic activities of households in Ughelli North Local Government Area. Due to the increase in extreme weather events over time, drastic changes in the economic activities have manifested in the area as many households have been forced to change their profession or line of business. It further reveals that extreme weather conditions in the area have resulted in decreased working hours and drastic changes in principal sources of income and livelihood, changes in crop yields and productivity and drastic changes in the availability of fodder and non-timber forest products (NTFPs) as well as decrease in workforce productivity. In addition, the study further reveals that households in the area attribute climate change phenomena to basically anthropogenic factors characterized by the use of herbicide/insecticide, burning of fossil fuel and deforestation, burning of fossil fuel/deforestation, gas flaring and bush burning. These anthropogenic factors are believed to be responsible for the changing climate events experienced in the area.

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