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### ASSESSMENT OF CLIMATE CHANGE PERCEPTION AMONG RURAL COMMUNITIES IN FUNTUA LOCAL GOVERNMENT AREA OF KATSINA STATE, NIGERIA

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#### ABSTRACT

*This study examines the way rural communities in Funtua Local Government Area of Katsina State perceived climate change. The study analyzed recent trends in temperature and rainfall for 30 years (1985–2014) in order to compare people's perception of climate change and observed data. The vulnerability of the rural people to the changing climate was also assessed. A total of 384 copies of a questionnaire were administered to households' head in ten selected communities in the study area. Descriptive statistics was employed to describe and summarize the collected primary data. The result of the linear trend line equation revealed that temperature and rainfall have been increasing in the study area. Findings also showed that majority of the rural people have a good knowledge of climate change in terms of increasing temperature and rainfall, high rainfall intensity and the occurrence of extreme weather events such as floods and droughts. The study further revealed that the poor, livestock, women and children are the most vulnerable individuals to the impacts of climate change. Agriculture was also found to be more vulnerable economic sector to the impacts of climate change due to its sensitivity to climatic parameters particularly rainfall and temperature. The study recommends enlightenment programs on climate change in order to reduce the vulnerability on the rural communities' people; and that measures should be taken for effective management of environmental resources, and to stimulate both agricultural intensification and diversification of livelihoods away from risky agriculture. Also, government should provide basic supports and farm implements such as fertilizers, tractors, improved seeds, among others to the rural people in order to increase their food production levels and hence, improvement of their standard of living.*

## 1. INTRODUCTION

Climate affect societies in many ways, and climate variability and change are important factors for societal development. Human activities have dramatically altered the world's climate. The impact is on almost every sector including human health, agriculture, infrastructure and natural resources.

Perception to climate change according to De Jonge (2010) refers to how people see and interpret their experiences that lead to particular understanding. Vulnerability on the other hand is the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change, including climate variability and extremes (Schneider *et al* 2007). It is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC, 2007).

Vulnerability to climate change differs considerably across countries, sectors, vulnerable areas and population. Marginalized groups in the poorest regions, particularly in Africa, are more vulnerable than those living in more prosperous nations even though the former are least responsible for these changes (UNDP, 2009).

Developing countries are the most vulnerable as they are poor and have limited resources and capacity to adapt to the effects of climate change (Wardekker, 2011). Africa is especially vulnerable to climate change due to the fact that a large share of its economies depend on climate-sensitive sector mainly rain-fed agriculture (Balgis, 2010). The climate of Nigeria has shown considerable temporal and spatial shifts in its variability and change since the late 1960s and early 1970s through a careful study of meteorological data. Extreme weather and climate events such as drought, floods, ocean surges, etc. have

become more frequent in occurrence. The impacts of these extreme events may be gradual but their destruction to lives and properties have negative impact to the economy (Nigerian Meteorological Agency, NIMET, 2012; Abaje, Sawa & Ati, 2014). Floods have become more of annual occurrences especially in the northern parts of the country with increasing intensity each year, leaving vast losses and serious injuries (Abaje and Giwa, 2010). Flooding as witnessed in some parts of Katsina state in 2012 and 2013 brought about injuries, death, and trauma as floods destroyed people's sources of livelihoods such as farmlands including farm produce and infrastructures worth millions of Naira (Abaje, Ogoh, Amos & Abashiya, 2015). Despite the fact that efforts have been made towards fighting climate change in Nigeria, vital information regarding rural communities' perception and vulnerability to climate change in the northern part of the country is still limited. This forms the basis of this research with particular reference to some rural communities in Funtua Local Government Area (LGA) of Katsina state. Therefore, the objectives of the study are to:

- i. analyze recent trends of temperature and rainfall for 30 years (1985-2014) in order to compare people's perception of climate change and observed change; and
- ii. assess the vulnerability to both the rural people and economic sectors due to the changing climate

## 2. Study Area

Funtua Local Government Area (Figure 1) is located between latitude  $11^{\circ} 12' N$  to  $11^{\circ} 70' N$  and longitude  $7^{\circ} 12' E$  to  $7^{\circ} 42' E$ . It is bordered by Giwa L.G.A of Kaduna state to the South, Faskari L.G.A to the North, Bakori and Danja L.G.As to the East and Dandume L.G to the West. Funtua has about 225,156 people as at 2006 population census (Federal Republic of Nigeria, FRN, 2010).

The climate is the tropical wet and dry type classified as Aw by Koppen. The total annual rainfall is about 1000mm (Abaje et al, 2015). Generally, the climate varies considerably according to months and seasons. A cool dry (harmattan) season from December to February; a hot dry season from March to May; a warm wet season from June to September; a less marked season after rains during the

months of October to November, which is characterized by decreasing rainfall and a gradual lowering of temperature (Abaje et al, 2015). The LGA is generally composed of undulating plains which rise up to about 600 - 700m above sea level. The vegetation of the area is the Sudan Savanna type which combines the characteristics and species of both the Guinea and Sahel Savanna (Abaje, 2007).

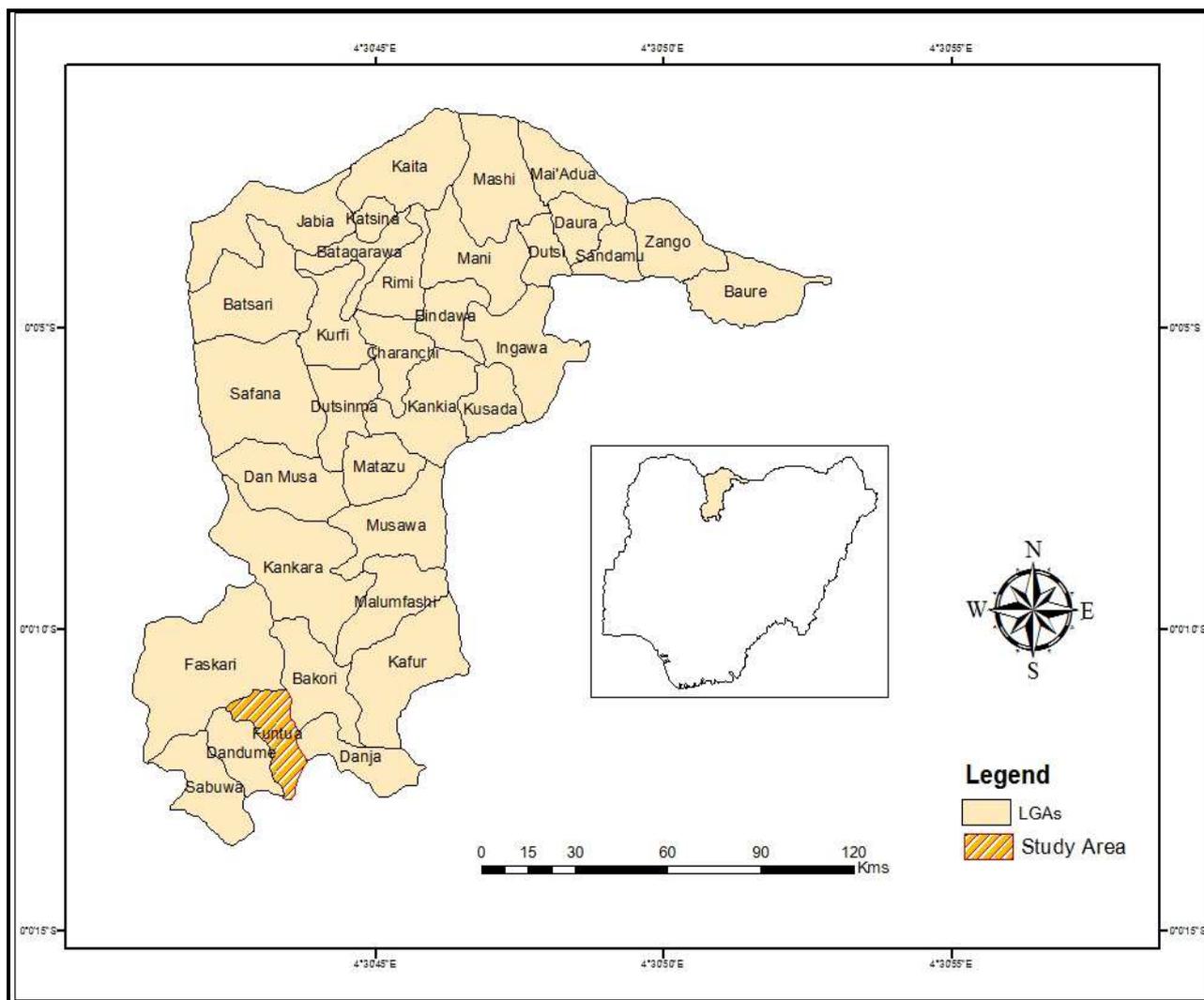


Figure 1: Map of Katsina State showing the Study Area

### 3. Materials and Method

Data on perception and vulnerability to climate change in the selected communities were collected through the administration of structured questionnaires. In order to determine the

sample size of the population, the Krejcie and Morgan (1970) method of determining sample size of a given population was adopted. Based on the method, the sample size used for this research work was 384. The formula is given as:

$$s = \frac{X^2 NP(1 - P)}{d^2(N - 1) + X^2 P(1 - P)}$$

where:  $s$  = sample size.

$X^2$  = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

$N$  = the population size.

$P$  = the population proportion (assumed to be 0.50 since this would provide the maximum sample size).

$d$  = the degree of accuracy expressed as a proportion (0.05)

Due to the fact that the 2006 census has no locality population, the 1991 population

census was then used. Based on the 1991 census, Funtua Local Government Area has 63 rural communities. Ten (10) communities were then chosen using systematic sampling method. The chosen communities were initially arranged serially in descending order based on their population. The first sample community was selected at random, then every 6<sup>th</sup> community in the population list was picked after the first sample community up to a total of 10 communities (Table 1). Sampling ten communities helped in making the sampling survey more thorough taking into consideration the time and cost involved in administering the questionnaires and monitoring the respondents.

**Table 1: Selected Communities and Number of Respondents**

<b>Selected Communities</b>	<b>Estimated population (2014)</b>	<b>Number of Respondents</b>
Maska	12,393	182
Kwangwai	3,525	52
Rafin Kanya	2,408	35
Unguwar Biri	1,831	27
Zamfarawa	1,362	20
Galadimawa	1,301	19
Nasarawa	1,188	17
Unguwar Mata	960	14
Tudun Maje	671	10
Mai Jibga	518	08
<b>Total</b>	<b>26,157</b>	<b>384</b>

The questionnaires were only administered purposively to household heads who are 42 years and above, and must have been residing in the community for at least 30 years. This was done in order to gather information from respondents who have had experiences in climate change over the years. Descriptive statistics based on summary counts of the questionnaire was employed to provide insights into individuals' perceptions and vulnerability to climate change.

Also, 30 years (1985-2014) monthly data of temperature and rainfall were collected

from the Nigerian Meteorological Agency (NIMET) Zaria. The climatic data for Zaria were used for the analysis due to: 1) the absence of a well-equipped synoptic station in the study area; and 2) the study area (Funtua) and where the data were collected (Zaria Synoptic Station) are very close and have the same climatic characteristics. Trend analysis of temperature and rainfall were carried out in order to compare people's perception of climate change and the observed change. The data were analyzed using Microsoft Excel 2013 Tool.

#### 4. Results and Discussion

##### 4.1 Observed Climate Changes

Figure 2 shows the observed average temperature trend of the study area from the analyzed data. From the linear trend line equation, estimation of changes in average temperature expressed in °C for the period of study (1985-2014) showed an increase of 0.36°C for the 30 years period of study at the rate of 0.012°C year<sup>-1</sup>. When compared with the long-term mean, it mean the average temperature has been increasing at the rate of 0.05% year<sup>-1</sup>. This is a clear indication that the earth's atmosphere is getting warmer in recent years. This observation is in line with the scientific consensus that the average temperature of earth's surface has risen between 0.4 and 0.8°C in the last 100 years

(Idowu, Ayoola, Opele & Ikenweuwe, 2011). The warming trend is also in agreement with the reports of other researches that the average surface temperatures have increased by 0.5°C or more during the last 50-100 years over most parts of Africa with minimum temperatures warming more rapidly than maximum temperatures (Rosenzweig *et al*, 2007; Trenberth *et al*, 2007); while over West Africa and the Sahel, surface temperatures have increased between 0.5-0.8°C between 1970 and 2010 (Niang, *et al*, 2014). The increase in temperatures is majorly as a result of increase in GHGs due to human activities as a result of increasing technological development and subsequent high level industrialization.

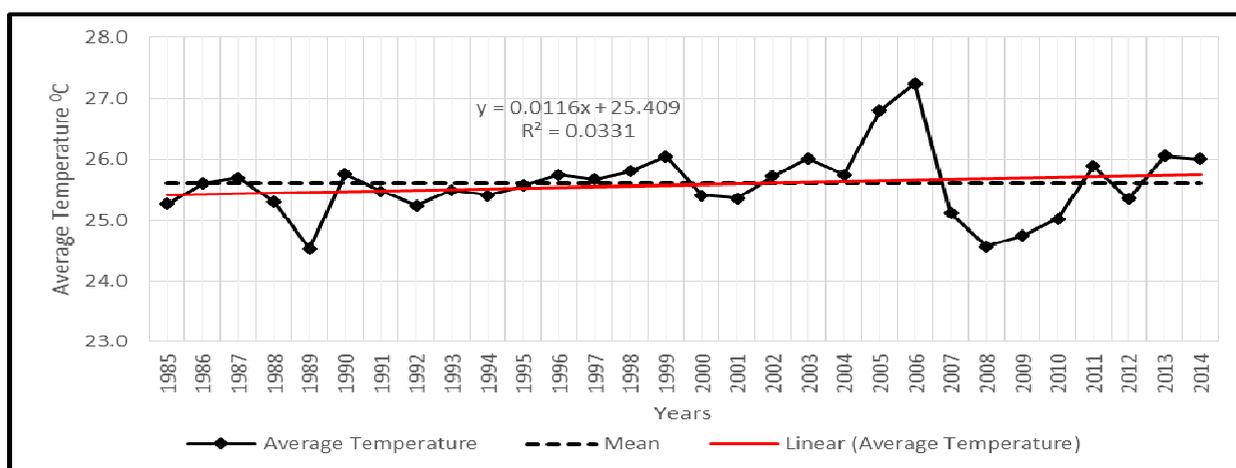


Figure 2: Trend of Average Temperature Data (1985 – 2014).

Figure 3 shows the observed annual rainfall pattern of the area. From the linear trend line equation, estimation of changes in annual rainfall expressed in mm for the period of study (1985-2014) showed an increase of 179.4mm for the 30 years period of study at the rate of 5.98mm year<sup>-1</sup>. When compared with the long-term mean, it mean the annual rainfall has been increasing at the rate of 0.56% year<sup>-1</sup>. The trend is in line with the findings of Abaje, Ati and Igusi (2012), NIMET (2012), and

Abaje, Ati, Igusi and Jidauna (2013) that the northern part of the country is now experiencing wetter conditions in recent years. This is also in agreement with the findings of Trenberth *et al* (2007) that increases in heavy precipitation events have now been observed, even in places where total amounts have decreased and that these changes are associated with increased water vapor in the atmosphere arising from the warming of the world's oceans, especially at lower latitudes.

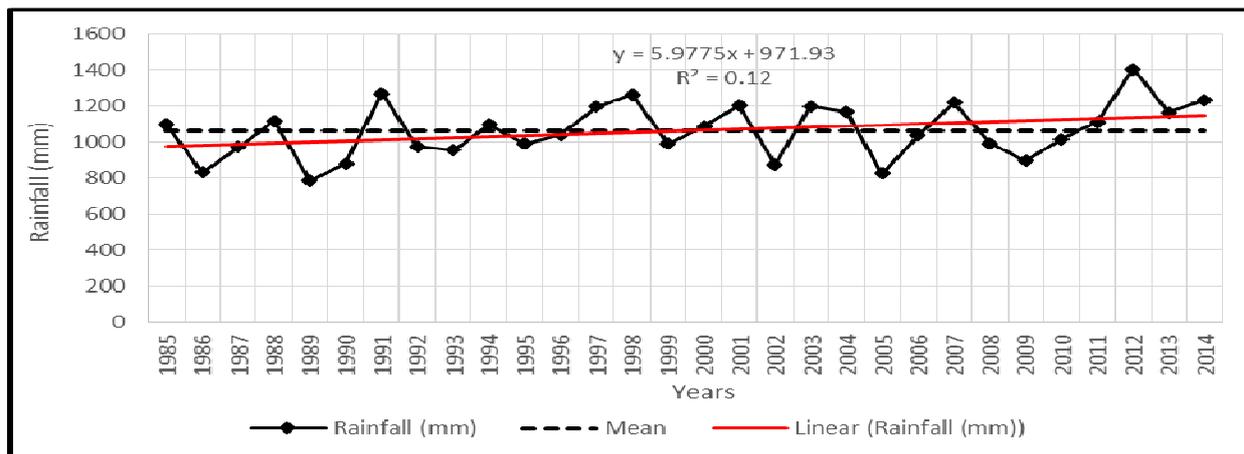
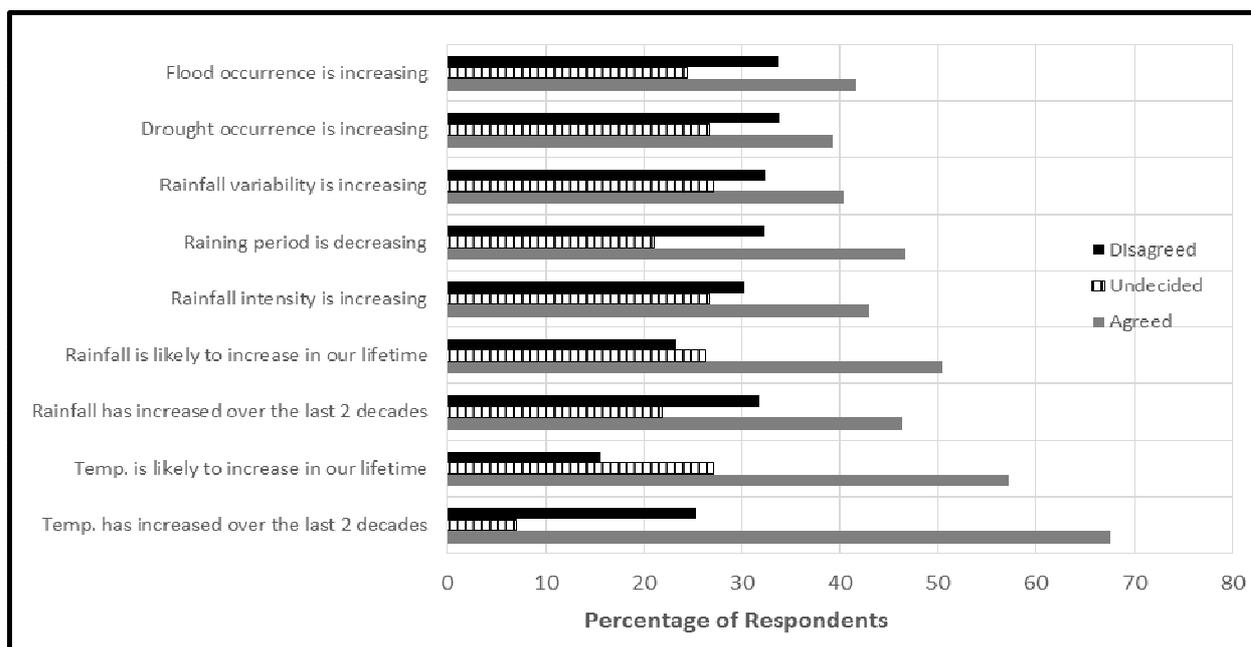


Figure 3: Trend of Rainfall Data (1985 – 2014).

#### 4.2 Perception towards Climate Changes

Figure 4 shows respondents’ perception towards climate change in the study area. Majority of the respondents (67.7%) believed that temperature has increased over the last two decades, and that it is likely to increase in our lifetime as agreed by 56,3% of the respondents. Respondents’ perception on increasing temperature is in line with the observed data in which temperature has been increasing in recent years. Rainfall according to 46.3% respondents is increasing significantly in the study area. Only 31.8% of the respondents opined that there is a significant decrease in rainfall

while 21.9% remained neutral. The perceived increased in rainfall is in line with the observed data. About 50.6% of the respondents believed that there is likelihood of rainfall to increase in our lifetime. In terms of rainfall intensity, about 43% of the respondents agreed that there is increase in the intensity of rainfall, while 30% of the respondents disagreed with that. So also, majority (46.6%) of the respondents had observed a decrease in the length of the rainy season and still, they attributed that to the late onset or early cessation of rainfall which is triggered by irregularity in climatic pattern.



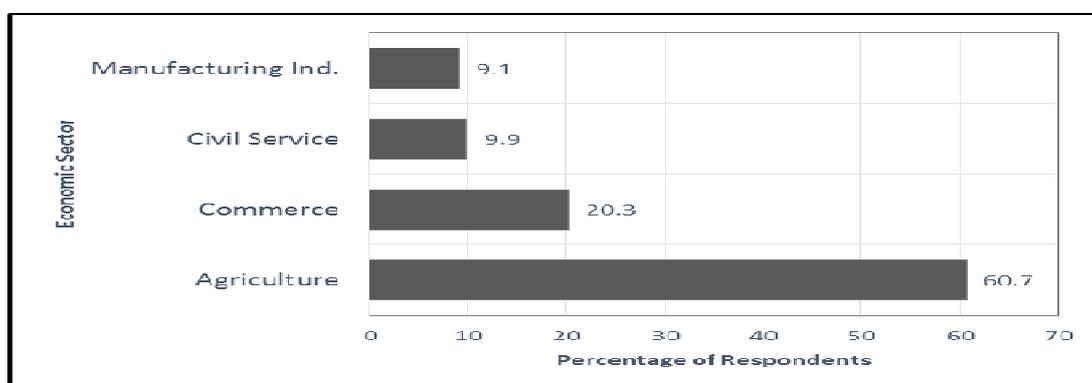
**Figure 4: Respondents Perceived Changes in Climate**

In terms of extreme events, 39.3% responded that there is increase in the rate of drought occurrence, while 33.9% said that there is reduction in the number of drought occurrence in the area. The drought occurrence as responded by the community dwellers is mostly as a result of irregularity in the onset or cessation of rainfall. Contrarily, the findings of Abaje et al, (2013) revealed that the sudano-sahelian ecological zone has experienced a severe drought in the 1980s but in the late 1990s and 2000s, there have been decrease in the occurrence of drought in the zone. Flood occurrence according to 41.7% of the respondents is increasing. This is mostly as a result of high rainfall intensity, poor physical planning and poor drainages. The increasing number of flood occurrence is in line with the findings of Abaje et al (2013, 2015) that flooding is becoming an annual occurrence in the northern parts of the country leading to loss of lives and property worth millions of Naira.

**4.3 Economic Sector Most Vulnerable to the Impacts of Climate Change**

Figure 5 shows the most vulnerable economic sector to the impacts of climate

change. About 60.7% of the respondents agreed that agriculture is the most vulnerable sector to climate change. Their main reason for choosing agriculture is that it is climate-sensitive and therefore, when there is an abnormality in climate especially temperature and rainfall, it will directly affect agricultural productivity. About 20.3% of the respondents agreed that commercial sector is the most vulnerable to the impacts of climate change. Their main reason is that businessmen depend directly or indirectly on farmers for trading. About 9.9% of the respondents believed that civil servants are the most affected group. This is because climate change affects agricultural productivity leading to scarcity of food stuffs in the market. The effect is a significant increase in the price of food stuffs and related agricultural products. This will now affect the consumption status of the civil servants. The remaining 9.1% believed that agro-allied industries are more vulnerable to the impacts of climate change simply because irregularity in climate leads to shortage in supply of raw materials which are used by manufacturing industries.



**Figure 5: Economic Sector Most Vulnerable to Climate Change Impacts.**

#### 4.4 Most Vulnerable Individuals to the Impacts of Climate Change

Figure 6 shows respondents' view on the most vulnerable individuals to the impacts of climate change. About 29.2% of the respondents said that poor people are most vulnerable to the impacts of climate change. This is because they have inadequate financial means of coping/adapting to climate change impacts. This is also in line with the work of Balgis, (2010) that developing countries

which are generally characterized with poor standard of living, limited resources and capacity to adapt to the effects of climate change are most vulnerable. 18.8% of the respondents believed that livestock rearers are also vulnerable to the impacts simply because livestock depend directly on natural resources which are climate-sensitive. When there is abnormality in climate, there will be shortage of pastures for animals to feed upon and this can result to malnutrition in the livestock.

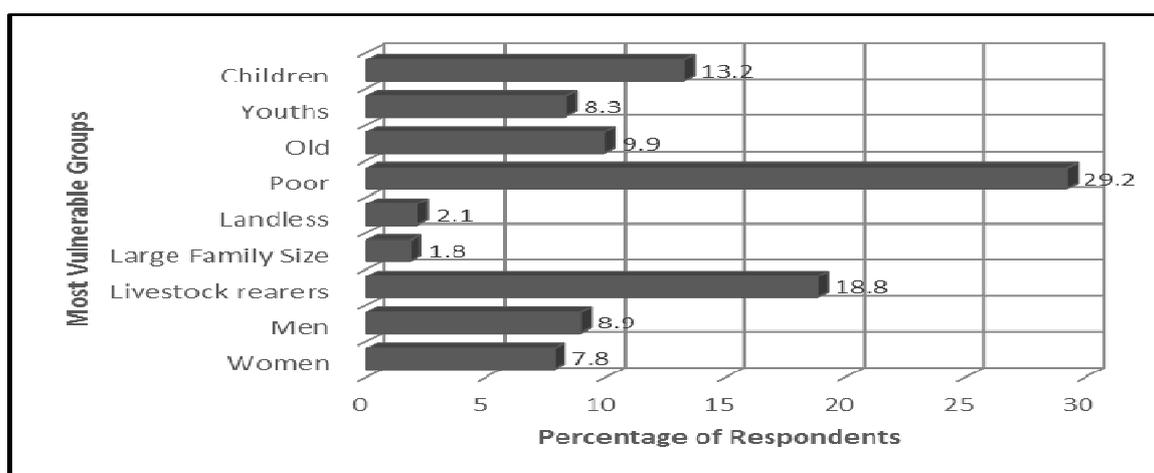


Figure 6: Individuals Most Vulnerable to the Impacts of Climate Change

About 13.2% of the respondents believed that children are more vulnerable to the impacts of climate change simply because they need full balance diet for their growth because they are prone to malnutrition disorders. 9.9% replied that old people are most vulnerable because they are not strong enough to withstand the situation, while 8.9% said that men are also vulnerable simply because they take care of families' responsibility. About 8.3% replied that youths are most vulnerable group, while 7.8% agreed that women, especially pregnant women, are vulnerable because they need the best diet for safe delivery and for the well-being of their children. About 2.1% and 1.8% said that the landless and large family size respectively are the most vulnerable to climate change impacts.

#### 5. Conclusion and Recommendations

Changes in temperature and rainfall amount from the linear trend lines generally showed an increasing trend from the beginning of the data (1985) to the recent years (2014). Majority of the people interviewed in the area have a very good knowledge of changes in temperature and rainfall amount, and occurrence of extreme climate events such as floods and droughts. Agriculture as the mainstay of rural food and economy suffers a lot from erratic weather patterns such as heat stress, longer dry seasons and uncertain rainfall. Declined in crop yields due to unfavorable weather and climate will lead to vulnerability in the form of food insecurity, hunger and shorter life expectancies. The most vulnerable groups are the poor, livestock rearers and children in that order.

The respondents' perceived causes of climate change that were scientifically proven includes: industrial pollution, destruction of nature, combustion of fossil fuel, gas flaring, used of chemicals among others. The strong religion belief of the people seems to have influenced their response to believe that community disobeying God is a factor that is causing climate change in the area. Climate change and its impacts according to some of the respondents are seen as a punishment from God, not as a result of physical (natural) or anthropogenic factors. In order to combat climate change impacts and vulnerability effectively in the

study area, it is recommended that the physical and human determinants of climate change should be clearly understood. Enlightenment programs on climate change challenges should be intensified. Government and non-governmental organizations, and development partners should provide basic supports and farm implements such as fertilizers, tractors, improved seeds, among others in order for households to increase their food production levels. This will go a long way in reducing climate change vulnerability in the area.

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