



AWARENESS AND PERCEPTION OF CLIMATE CHANGE AMONG FARMERS IN NIGERIA: IMPLICATIONS FOR FOOD SECURITY

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Abstract

Nigeria is characterized by high level of hunger, malnutrition and poverty, making food security a serious concern in the country. This is being worsened by threats of climate change which adversely affect agriculture; the predominantly livelihood activity in the country. The study examined the implications for food security of farmers' awareness and perception of climate change in Nigeria using evidence from farmers in Ebonyi State. Multistage random sampling technique was used to select 360 respondents for the study, while data were collected using structured questionnaire. Analysis of data involved the use of frequencies, percentages, means and rating scale, while the results were presented using charts, tables and graphs. The mean extent of knowledge of the farmers of climate change phenomenon is 2.74. About 16.1% of the respondents indicated knowledge to a great extent, 36.4% to a reasonable extent, 26.4% to a little extent, and 21.1% to no extent. Climate change is largely understood by 93.6% of the farmers as fluctuations in average weather conditions. The farmers are being impacted by climate change through increased weather uncertainties (3.71), reduced cropping season (3.60), decreased soil fertility and farm yield (3.48), early cessation of rains (3.33), delayed onset of rains (3.20) and increased temperature (2.89). Their sources of information on climate change are radio (66%), friends and relatives (56.2%), family (33.4%), personal observations (40%), social media (23%), extension agents (21.6%), internet (19%), cooperatives (12.1%) and religious bodies (10%). The study recommends the strengthening of agricultural extension system to engage in increased and continuous sensitization and education of farmers on climate change through radio, social media, internet, cooperative societies and religious organizations.

Keywords: Climate change, Farmers' perception, Food security, Nigeria

Introduction

Climate change is the worst environmental, social and economic threat that is facing the world today, with impacts in every aspect of human endeavour (Agawam and Pasricha, 2011; Edame *et al.*, 2011; Enete *et al.*, 2011; Ifeanyi-Obi and Asiabaka, 2014; Ozor *et al.*, 2015). It is described as the most serious environmental threat to the war against hunger, malnutrition, disease and poverty in sub-Saharan Africa (SSA), especially Nigeria where the impact of climate change is expected to be negative (Enete and Amusa, 2010; Enete and Onyekuru, 2011). This is notwithstanding that the impact of climate change is spatially heterogeneous across diverse regions. However, the threat is widely believed to be more severe in SSA due to their reliance on climate-sensitive (particularly, temperature and rainfall) sectors, such as agriculture and fisheries, coupled with their low GDPs, high level of poverty, low level of education, and limited human, institutional, economic, technical, and financial capacities (IPCC, 2007; UNFCCC, 2007; WBGU, 2004). According to Intergovernmental Panel on Climate Change (IPCC,

2007), climate change refers to 'a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties and that persist for an extended period typically decades or longer.' In the view of Ozor (2009), climate change is a change in climate over time, whether due to natural variability or as a result of human activity. It results from both natural and anthropogenic factors which lead to the emission and concentration of greenhouse gases (GHGs) in the atmosphere (WRI, 1993; CCIR, 2005). According to the South African Confederation of Agricultural Unions (SACUA, 2009), the main GHGs are carbon dioxide, methane and nitrous oxide which account for 80%, 14% and 6% of the total GHG emission, respectively. These greenhouse gases deplete the ozone layer (i.e. earth's protective shield) and also, trap heat (infrared radiation) near the earth's surface, resulting in the heating up of the surface of the earth, a condition known as global warming (NAS, 2001).

In Nigeria, the presence of climate change has been

reported (NEST, 2004) with different manifestations such as extreme conditions of flooding, temperature rise (heat waves), rises in sea levels, drought and desertification, wind storms, and the drying up of streams and rivers (Odjugo, 2010; Obioha, 2009; Ozor *et al.*, 2010; MOE-FRN, 2003). Also, the Nigerian Meteorological Agency (NIMET) has reported significant changes in weather patterns over the period 1941 to 2000, giving rise to fewer rainy days and shorter rainy season (Adelekan, 2009; Nwajiuba, 2015). The implications are enormous for the agricultural sector, which is Nigeria's predominant livelihood activity and mainstay of its economy. Agriculture contributes to food security, promotes industrialization and employment generation, and stimulates strong resilience to external vulnerabilities in addition to promoting shared prosperity (PWC, 2020). The sector according to the NBS (2021) engaged about 35% of the country's total labour force and contributed 24.45% to GDP in 2020 with crop production as the most important component, accounting for over 90% of the sector's total product.

Several reports have shown that higher temperatures arising from climate change result in decreased agricultural productivity and production, high evaporation rates and reduced soil moisture, lowering of the groundwater table and shrinking of surface water (FAO, IFAD, UNICEF, WFP & WHO, 2020; AGRA, 2014; IFAD, 2011; IPCC, 2007; Thornton *et al.* 2011; Nwajiuba, 2015). Also, heat stress reduces human labour use on farms, lowers labour productivity and leads to rapid deterioration and waste of farm produce. Furthermore, changes in the amount of rain, increased rainfall intensity and changes in rainfall patterns lead to decreased resource productivity and production. Changing and erratic rainfall patterns make it difficult for farmers to plan their operations, may reduce the cropping season and can lead to low germination, reduced yield and crop failure. Erratic weather interferes with processing of produce (such as sun-drying of crops and smoking of fish). Increased frequency of major storms causes damage to farm land, crops and livestock. Major storms can also cause road wash-outs, which make it difficult to access farms and to market products. World Bank has predicted about 30% drop in crop production in the country arising from erratic rainfall and higher temperatures (Forbes, 2015).

According to FAO (2008), climate change severely affects agricultural production, undermining food security in all its dimensions – food availability, food accessibility, food utilization and food systems stability. This worsens Nigeria's agriculture, which is mainly rain-fed and highly subsistent, involving the use of crude tools and uneconomic practices; further deepening the high level of food insecurity in the country. Food security is an indication of the non-existence of hunger and malnourishment (Oti *et al.* 2017). It exists, 'when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life,' (FAO, 1996).

In Nigeria, hunger, malnutrition and poverty hold sway as the country is largely food insecure. The country's unemployment level of 33.3% in the fourth quarter of 2020 represents about 40.6 million people. These people were within 15 – 64 years of age, and were available for work, actively seeking for work, but were without work. It is not surprising that poverty is very endemic in Nigeria. According to World Poverty Clock, Nigeria has the highest number of people living in extreme poverty in the world (Adebayo, 2018; Oti *et al.* 2020). These people not only do lack the basic necessities of life, but are also, full of hunger, malnourishment and deprivation. The State of Food Security and Nutrition in the World report show that 25% of the 250 million hungry and undernourished people in SSA in 2019 were from Nigeria (FAO, IFAD, UNICEF, WFP & WHO, 2020). Further to these, the 2020 Global Hunger Index (GHI) show that Nigeria is the 98th most hungry country in the world, in a class of 107 countries, with the undernourished population rising from 7.6% in 2012 to 12.6% in 2020 (GHI, 2021).

Concerted efforts are being made to develop appropriate responses and adaptation, aimed at ameliorating the adverse effects of climate change on agriculture and livelihood of rural dwellers in Nigeria (Nwajiuba, 2008; Anim, 1999; Anley *et al.*, 2007; Bradshaw *et al.*, 2004; Enete *et al.*, 2011; Farauta *et al.*, 2012; Kurukulasuriya and Mendelsohn, 2006; Nhemachena and Hassan, 2007; Oti, 2017; Oti *et al.*, 2019). In this line, the National Adaptation Strategy and Plan of Action (NASPA) developed two broad approaches to climate change impact reduction on agriculture (Nwajiuba, 2015); adoption of improved agricultural systems for both crops and livestock, and implementation strategies for improved resource management. However, adaptation efforts require not only that farmers perceive that climate is changing or could change, but also place strong emphasis on their perception to be willing to initiate action (Eakin *et al.* 2014).

Developing appropriate climate responses requires proper awareness, perception and understanding of climate change phenomenon by the stakeholders (farmers). As such, the cooperation and participation of farmers is required for the successful implementation of adaptation practices and policies either at private or public level. Having the right perceptions that the climate is changing unarguably is a necessary condition for the adoption of agricultural adaptation measures (Simelton *et al.* 2013; Makuvaro *et al.*, 2018). Mutchagata and Brown (2000) and Pugliese and Ray (2009) noted the important role farmers' perceptions and observations play in climate change adaptation. For Nzeadibe and Ajaero (2010), awareness and perceptions of a problem such as climate change shapes action or inaction on the problem. Similarly, Olorunfemi (2009) emphasized the need for timely and valid information on the possible consequences of climate change, people's perceptions on those consequences, available adaptation options and the benefits of slowing the rate of climate change. Many farmers do not believe in climate change,

let alone preparing, developing and channelling resources to adaptation actions. Farmers need to explicitly understand the nexus of climate change and agriculture, to aid their firm understanding of climate change phenomenon (Nkwusi *et al.*, 2015), particularly in SSA where farmers are poor and barely literate, and have rarely understood this phenomenon and how it impacts agriculture (Mutchagata and Brown, 2000; Pugliese and Ray, 2009).

It is in this line that numerous studies are being conducted towards better understanding of farmers' perception and knowledge of climate change, albeit at regional and national levels (Nzeadibe *et al.*, 2011a; Nzeadibe *et al.*, 2011b; Falaki *et al.* 2013; Lawrence, 2014; Nkwusi *et al.* 2015; Elia, 2017; Hitayezu *et al.* 2017; Asrat and Simane, 2018; Fierros-Gonzalez and Lopez-Feldman, 2021). However, such studies that utilized information from farmers in Ebonyi State in arriving at national or regional averages are limited. As such, the knowledge and perceptions of farmers in Ebonyi State of climate change are not well known. Farmers in Ebonyi State have peculiar livelihood conditions, culture and belief systems which could make or mar climate change adaptation processes and efforts in the country, if not taking into consideration. Climate change perception is a complex process which encompasses a retinue of physiological constructs such as knowledge, beliefs, attitudes and concerns if and how the climate is changing (Whitmarsh and Capstick, 2018; Fierros-Gonzalez and Lopez-Feldman, 2021). These constructs are shaped by farmers' characteristics, their experiences, the information they receive, and the cultural and geographic context in which they live (van der Linden, 2015; Whitmarsh and Capstick, 2018). Also, farmers' sources of climate change information and observations have not been adequately documented. At this internet era, innumerable sources of information abound, most of which disseminate inaccurate information on climate change and adaptation. It is important that farmers access climate change information from reliable sources to ensure that they have right perception and knowledge on climate change. The study investigated the implications for food security of farmers' awareness and perception of climate change in Nigeria. It specifically examined farmers' level of understanding of climate change, climate change impacts on agriculture and sources of climate change information. Findings from the study would enhance evidence-based agricultural thereby increasing agricultural production and food security in the country.

Methodology

The study was carried out in Ebonyi State, an inland Southeast State of Nigeria (Figure 1). It has a landmass of about 5,935sqkm, and population of about 2,176,947 in 2006 and 2,880, 383 in 2016 (NPC, 2007; NBS,

2018). The State lies between approximately longitude 7°38' – 8°30' East of the Greenish Meridian and latitude 5°40' – 6°45' North of the Equator (EBSDF, 1997). There are two distinct seasons in the State: the rainy season (April – October) and the dry season (November – March). Vegetation in Ebonyi State is characterized predominantly by tropical rainforest, and has average atmospheric temperature of 30°C and mean annual rainfall of 2100mm. There are three Agricultural Zones in the state: Ebonyi North, Ebonyi Central and Ebonyi South. Ebonyi State shares boundary with Benue State in the north, Abia State in the south, Cross River State in the east and Enugu State in the west. Agriculture is the major industry, and about 85% of the population of the State are engaged in the sector (Oti, 2013; NBS, 2018; EBSG, 2021). Rice, yam, cassava, potatoes, plantain, banana, vegetables, maize and groundnut are some of the crops grown in the State (Oti, 2013; EBSG, 2021). Others include cowpea, cocoyam, water yam, melon, potatoes and beans. The rest are oil palm, cocoa, and rubber. Some of the livestock reared in the State are goats, pigs, cows, horse, fish and poultry (Oti, 2013; EBSG, 2021).

Multistage random sampling technique was employed in the study. Firstly, two Local Government Areas (LGAs) were randomly selected from each of the Agricultural Zones. The selected LGAs include; Ohaukwu and Izzi in Ebonyi North, Ezza South and Ikwo in Ebonyi Central, and Afikpo South and Ivo in Ebonyi South. Secondly, from each of these selected LGAs, two communities were randomly selected; Ndaguagba and Umuezeka communities (Ohaukwu), Igwueledeoha and Otam (Izzi), Idemba and Enyibichiri (Ezza South), and Igbudu and Ochonyim (Ikwo). The remaining communities consist of Oso and Amangwu in Afikpo South, and Kpohokpo and Okova-Ogwo in Ivo. Lastly, 30 farmers were randomly selected from the selected communities giving a total sample size of 360 respondents. Data were collected with the aid of structured questionnaire administered using trained research assistants. Section A of the questionnaire determined farmers' extent of knowledge on climate change. Respondents were asked to indicate their extent of knowledge on climate change by choosing from given options: no extent, little extent, reasonable extent and great extent. Section B determined farmers' understanding of what climate change mean, while climate change impacts on the farmers were determined in Section C. Section D determined farmers' sources of climate change information. Analysis of the data involved the use of frequencies, percentages, means, standard deviation and rating scale. The rating scale was on four (4) points, with 2.5 as the cut-off point. Observations with points' ≥ 2.5 were considered important or serious. The results were presented in tables, graphs and charts.



Figure 1: Map of Nigeria showing Ebonyi State with its Agricultural Zones, LGAs, crops cultivated and boundaries

Results and Discussion

Rural Farmers' Level of Awareness of Climate Change Phenomenon

Results of the study on the extent of farmers' knowledge of climate change phenomenon are presented in Figure 2. The mean (\bar{x}) of the extent of farmers' awareness of climate change phenomenon is 2.74, while, the distribution of farmers' extent of knowledge of climate phenomenon show that over 52% of them have more than average knowledge of the phenomenon. In specifics, 36.4% of the respondents indicated that they know about climate change phenomenon to a reasonable extent, while 16.1% noted that their knowledge of the phenomenon is to a great extent. On the other hand, the results indicated that 26.4% of the farmers have little knowledge of climate change phenomenon, while

21.1% claimed they have no knowledge of the phenomenon. These findings imply that farmers have good and adequate knowledge of climate change. In essence, the efforts of Non-Governmental Organizations (NGOs) and policy makers in creating awareness of climate change in the country have been successful. Good and adequate knowledge of climate change is a prerequisite for climate change adaptation. This is particularly important since developing appropriate climate responses requires proper awareness, perception and understanding of the phenomenon by farmer stakeholders. This will help to ameliorate the adverse effects of climate change, thereby, boosting agricultural production and productivity, enhancing farmers' income and ensuring increased food security in the country.

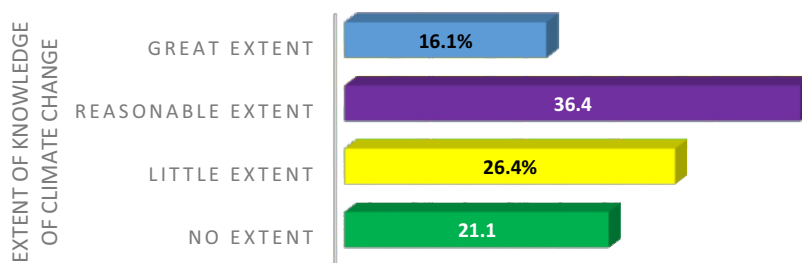


Figure 2: Extent of farmers' knowledge of climate change phenomenon (%)
Mean Extent of Knowledge = 2.7

Rural Farmers' Understanding of Climate Change Phenomenon

Farmers' understanding of climate change phenomenon is shown in Figure 3. The figure indicate that the predominant understanding of farmers of climate change phenomenon is “change in weather”. This is evident in the response of over 90% of the farmers. It agrees with the submissions of Nzeadibe *et al.* (2011a) that the most basic understanding of climate change is change in weather conditions, especially temperature and rainfall. Further to this, 72.9% of the respondents understood climate change as “high sunshine”, 68% as “heavy rainfall”, 45.8% as “little rainfall” and 31.1% as “low sunshine” and 18.3% as

“low sunshine”. These findings support the “variability” definitions and descriptions of climate change (IPCC, 2007; Ozor, 2009). Interestingly also, a sizeable proportion of farmers (18.3%) understood climate change as signs of end time and God's punishment to humanity for their sins. This understanding is not supported by any scientific information. Attaching spiritual or cultural sentiments to climate change could greatly undermine farmers' climate change adaptation. Such sentiments do not provide for any concrete, specific and measurable approach to managing or adapting to climate change. Food security therefore would be severely affected.

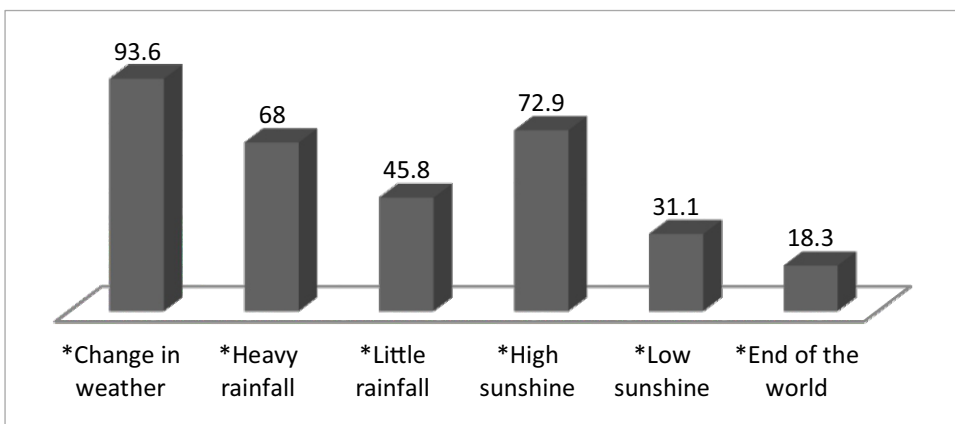


Figure 3: Farmers' understanding of climate change phenomenon (%)
**Multiple responses*

Rural Farmers' Perception of Climate Change Impacts on Agricultural Production

Findings from the study indicate that climate change is adversely affecting agricultural production, resulting in rising temperatures, unpredictable rainfall regimes, increased weather uncertainties, decreased soil fertility and agricultural productivity, and heightening food insecurity and debilitating livelihood conditions of rural dwellers. These are contained in Table 1. Table 1 show that out of 14 observed impacts of climate change on agricultural production and productivity of the farmers, nine were seriously affected. They include; increase in temperature (3.18), increase in rainfall intensity (2.89), delayed onset of rains (3.20), early cessation of rains (3.33) and shorter rainy seasons (3.06). Other serious impacts were increased weather uncertainties (3.71), reduced cropping seasons (3.60), decreased soil fertility and farm yield (3.48) and damage to farm lands, crop

and livestock (3.09). Weather uncertainty is the most serious impact of farmers arising from climate change. Agricultural production in Nigeria is highly weather-dependent, especially, on temperature and rainfall. Over 97% of food produced in the country is from rain-fed, making the sector highly vulnerable to rainfall variability. It is not surprising therefore that all the factors that relate to moisture supply to crops and livestock seriously affected farmers' production and productivity. Further to this, increased temperature leads to faster evapotranspiration, causing drought both for crops and livestock. As such, there is decreased agricultural production, deterioration of farm produce and reduction of farmers' income and purchasing power. These severely undermine all aspects of food security including food availability, accessibility, utilization and stability.

Table 1: Farmers perception of climate change impacts on agricultural production

Climate change impacts	Rating
*Increase in temperature	3.18
*Increase in rainfall intensity	2.89
*Delayed onset of rains	3.20
*Early cessation of rains	3.33
*Shorter rainy seasons	3.06
*Increased weather uncertainty	3.71
*Reduced cropping season	3.60
Increased flooding of farmlands	2.25
Increased incidence of drought	2.36
Higher incidence of pests and diseases	2.31
Increased weed growth	2.20
*Decreased soil fertility and farm yield	3.48
*Damage to farm lands, crop and livestock	3.09
Destruction of farm and market roads	2.20
Average rating	2.92

*Cut-off mark = 2.50; * - Serious impacts*

Sources of Climate Change Information for Rural Farmers

The source of information on climate change is very important towards having the right and accurate knowledge on the phenomenon. The study as presented in Figure 4, found that radio was the largest source of information on climate change to the farmers. Radio is a dominant means of mass communication, and is also relatively cheap and convenient to acquire, operate and understand relative to other mass media means. It is therefore expected that great majority of rural populace access information through the radio. Also, friends and relatives, personal observations and family were sources of climate change information for high proportions of the farmers. About 56% of the farmers received climate change information from friends and relatives, 40% from personal observations and 33.4% from family. These underscore the importance of family ties and associates in information dissemination in rural areas where there is strong value system for culture, family and neighbourliness. Further to this, extension agents provided climate change information to a great proportion of farmers (21.6%). Agricultural extension system serves as a link between research innovations and adoption/practice, and therefore provides a veritable opportunity for the dissemination of accurate research information to farmers, including climate change. This will enhance farmers' understanding of the phenomenon and prepare them for appropriate adaptation, increased productivity and food security. Other sources of climate change information for the farmers include; social media (23%), internet (19%) and newspaper (18%). The social media is becoming a very

popular means of information dissemination, especially among youths in the society. Social media tools such as Facebook, Twitter and WhatsApp have enabled people to develop, engage and share innovative contents, idea and experiences in every facet of human endeavour. However, such information are usually not from reliable sources and as such, not verifiable. These imply that some of the time, wrong information could be passed to farmers on climate change, which could hamper their effective adaptation, thereby, adversely affecting agricultural production and food security. Similar fate applies to climate change information sourced from the internet. Care and further investigation therefore, should be taken in accessing information from such sources. Further sources of farmers' climate change information include; agricultural cooperatives (12.9%), television (14%) and religious organizations (10%). Cooperative societies provide platforms for farmers to pool resources together, to take advantage of opportunities that will enhance their productivity and livelihoods. In this light, awareness and enlightenment campaigns and programmes on climate change could be organized for farmers in their cooperatives. It is cost effective, and also ensures wide reach of farmers in communities, irrespective of their social class, religion or some other primordial considerations. More so, the probability of receiving inaccurate information through this means is minimal, as information so provided could be verified. Similar advantages apply to climate information sourced from religious organizations; only that farmers who are not members of the particular religion or religious group could be excluded from participating.

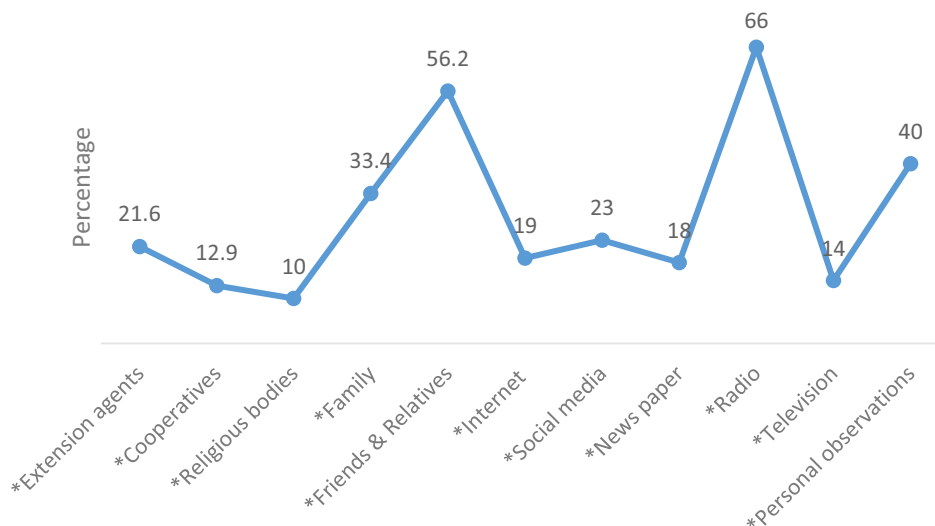


Figure 4: Farmers' sources of climate change information in Ebonyi State
* Multiple responses

Conclusion

The study examined the implications for food security of farmers' awareness and perception of climate change. The study found that the farmers have good knowledge of climate change phenomenon with 'change in weather condition' as their basic and predominant understanding of the phenomenon. The farmers are seriously being impacted by climate change, undermining agricultural production and productivity, reducing farm income and worsening food insecurity. Increased weather uncertainty, reduced cropping season, and decreased soil fertility and farm productivity are the most serious climate change impact of the farmers. Other impacts include; delayed onset of rains, early cessation of rains, increase in temperature, damage to farm lands, crops and livestock, and increased intensity of rainfall. Climate change information are sourced by farmers mostly through radio, friends and relatives, and family. Personal observations, social media, agricultural extension agents, internet, newspaper, television, cooperative societies and religious organizations are other sources of climate change information of the farmers. The study recommends increased and continuous sensitization and education of farmers on climate change through radio, social media, internet, cooperative societies and religious organizations using agricultural extension system. This is to ensure that only the right and accurate information on climate change are transmitted to farmers, thereby preparing them for appropriate and effective climate change adaptation such as increased use of irrigation in agricultural production. Increased use of irrigation will reduce the weather uncertainties involved in rain-fed agriculture arising either from delay onset of rains, early cessation of rains or high rainfall intensity (flooding), thereby increasing the length of cropping seasons. The adverse effects of climate change as such, will be greatly ameliorated, leading to increase in quality and quantity of agricultural production and productivity, increase in farm income and increase in food security.

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