DOI: https://doi.org/10.68064/jshe.2020.yfqcpy5e

JOURNAL OF THE SOCIETY FOR HUMAN ECOLOGISTS (JSHE)

Climate Change: A Leading Threat To Food Security In Nigeria

HEMBA, Andrea Eyikomisan & OCHIBGO, Susan Eloyi

Abstract

Climate change occurs in a number of ways, stretching from increased climate variability and slow variations in temperature and precipitation to increased incidence and amount of extreme events. Variations in climatic conditions constitute main challenges for agriculture productivity, this is because climate change affects access to good quality water, habitats and species distribution, timing and length of growing season, distribution of agro-ecological zones and Ecosystem stresses. Over 70% of Nigerians are basically farmers, who mostly depend on rain-fed agriculture. With the change in climate, there is a change in rainfall patterns, mostly delayed onset of the rainy season, farming of food crops is usually delayed and this in most cases results in poor harvest, which threatens the food security of most farming families. This trend is also of concern to the larger Nigerian population who depend on the rural farmers to supply the bulk of the food consumed in urban areas. These bad experiences especially of droughts and floods have caused many local or rural farmers to abandon their villages and move to the cities in search of other means of livelihood thereby causing economic hardships as prices of common staples tend to soar higher and the food security of the nation is at risk. Other factors mitigating against food security and under nutrition in the country are insecurity and government lukewarm attitude towards ending hunger and under nutrition. The impact of climate change on food security including agricultural productivity, and food security dimensions are discussed. The Global Hunger Index scores for Nigeria for the past two decades (2009 -2019) has been used to show that for the past twenty years, Nigerians have been in a state of serious hunger, highly undernourished and in a serious state of food insecurity. Recommendations such as providing farmers with information on early warning signs or signals to prevent them from investing heavily in flood prone areas to prevent the huge losses suffered by farmers as a result of flood and embarking on large irrigation projects to support poor farmers with water in drought prone areas so as to cushion the effect of poor farm yield as a result of low rain fall were proposed.

Keywords: Climate Change, Food Security, agriculture, hunger, vulnerable.

Introduction

The ecological challenge confronting man today is climate change owing to its perceived hostile consequence on the lives and property of humans. The activities of mankind have created a situation whereby it is becoming increasingly difficult to sustainably feed humanity. The Intergovernmental Panel on Climate Change (IPCC), (2018) reported that human activities especially burning fossil fuels like coal and oil has increased the concentration of atmospheric carbon dioxide which has given rise to increased greenhouse activities and has increased the average global temperature to about 1^0C in the past 150 years. This happens because the coal or oil burning process combines carbon with oxygen in the air to make carbon dioxide (CO_2). It is also predicted that this rise will further increase to 1.5^0C above the pre-

industrial era between 2030 and 2050 (IPCC, 2018). This will give rise to higher average temperatures in both land and ocean areas, and increase precipitation and drought in some areas. Climate change has become the leading threat to food security due to the adverse effects of droughts and floods. Other disasters such as increased heat, insect outbreaks, and increased wildfires, declining water supplies, health impacts in cities due to heat, flooding and erosion in coastal areas are additional concerns of climate change.

Investment in farming is expected to drop due to unexpected fluctuations in weather patterns and prices of food items. Climate is the major contributing factor to agricultural yield, thus climate and food availability are inextricably entwined. Considering the dependence of agricultural output on climate conditions and the importance of food availability to man, it can be said that agricultural yield is the most important concern of climate change effects. This concern has no doubt provoked a lot of studies on the likely effects of climate change conditions on crop and livestock produce as well as on the economic effects of this prospective produce changes. Idumah, Manhodo, Ighodaro and Owombo, (2016) examined the impact of some of these climatic variables on food production in Nigeria from 1975 to 2010. Eneji, Mallo, Dalut, and Garba, (2020) also examined the impact of climate Change on Agriculture and Food Security in Nigeria adopting a secondary data and the Ordinary Least Square (OLS) technique, involving a multiple regression model to analyze the causal relationship and coefficient of determination of climate change on food production and food security, as well as considering Agricultural Technology Innovation as alternative solution to the problems of climatic changes in Agriculture.

Climate change conditions may exacerbate food insecurity in areas currently vulnerable to hunger and under nutrition. This will largely have a negative effect on the food system worldwide, especially countries in Asia and Africa south of Sahara (including Nigeria) who are highly dependent on rain fed agriculture and are having high concentration of hunger and poverty. (Von Grebmer, Bernstein, Prasai, Yin and Yohannes, 2015). The Sub-Saharan Africa region accounts for more than 950 million people, approximately 13% of the global population and there are projections that by year 2050, this population shall increase to almost 22% or 2.1 billion. FAO (Food and Agricultural Organization, 2016). Undernourishment has been a long-standing challenge, with uneven progress across the region. Despite being reduced from 33% in the year 1990-1992 to 23% in 2014-2016, the percentage of undernourishment remains the highest among developing regions (FAO, 2016). Owing to rapid population growth of 2.7% per annum over the same period, the absolute number of undernourished people has increased by 44 million to reach 218 million. The slow progress towards food security has been attributed to low productivity of agricultural resources, high population growth rates, political instability and civil strife (Adesina, 2013; Ballard, Kepple, and Cafiero, 2013).

The hunger in Nigeria can be attributed to insecurity, changes in the rainfall pattern and flood (Von Grebme et al. 2015). The high rate of starvation caused by climate change and insecurity is a great threat to livelihood. According to the Food and Agricultural Organization (FAO, 2015) about 822 million people worldwide are malnourished and about 149 million are underdeveloped. Furthermore, not less than 2billion people are deficient in one micronutrient or the other (Von Grebme et al. 2015). Since 2015, the number of hungry people in Nigerian has been on the increase, this has been ascribed in part to the continuous volatility of the crisis-ridden region such as the northeastern states by boko haram militants. The farmer-herder clashes been experienced in the north central, south eastern, south western states and the Niger delta has caused economic down tune and this can be traced to climate change effects (Haider, 2019). The number

of climate related tragedies has been on the increase since the 1990s thereby affecting food production and causing an increase in the price of food commodities and losses of income (FAO, 2018).

The impact of climate change on food availability, food access, and food utilization, shall form the basis of discussion in this work. The evidence of climate change in Nigerian shall be highlighted. The global hunger index shall be used to show how Nigerians have been in a state of serious hunger, highly undernourished and in a serious state of food insecurity.

Although the words weather and climate sound similar, differences exist between the terms from the perspective of space and time. Weather reflects the state of the atmosphere at a particular time or place; it is the daily or short-term variations of different conditions of lower air in terms of temperature, pressure, wind, rainfall and so on.\, (Shiru, Shadi, Alias and Chung, 2018). On the other hand, climate is a statistical measure of the state of the atmosphere in terms of meteorological variables like temperature, rainfall, and humidity of a particular region for a period of more than thirty five years, (Von Grebmer, Bernstein, Patterson, Wiemers, Ni Cheilleachair, Foley, Gitter, Ekstron and Fritschel, 2019).

Climate change can be defined as a variation in either the mean state of the climate or in its variables persisting for an extended period typically decades or longer. It includes temperature increase (global warming, changes in precipitation pattern, sea level rise and increased frequencies of extreme weather events). (IPPC, 2018). Further, climate change follows a specific pattern of change in climate or its variables over time. On the other hand, climatic variability refers to sudden and discontinuous seasonal or monthly or periodical changes in climate or its components without showing any specific trend of temporal change. (IPPC, 2018). Global warming is defined as the increase in the average temperature of earths near surface air and oceans due to transmission of incoming short wave solar radiation and the absorption of outgoing long wave terrestrial radiation. (IPPC, 2018). Global warming is generally attributed to greenhouse effect caused by increased levels of carbon dioxide, Chlorofluorocarbons CFCs and other pollutants.

It has been reported that the average global rise in temperature per decade is 0.2^0 C, and this is as a result of human induced factors in addition to the global food system (IPCC, 2018). There is also an upsurge in the occurrence and magnitude of destructive weather events like storms, fire, flooding and drought. Since 1900, the sea level has risen by 16-21 centimeters (IPCC, 2014).

Food security is associated with food intake at individual and household, subnational and national level. A food secured household can be defined as one which has enough food available to ensure a minimum necessary intake by all members. The minimum is related to body size, weight, and sex, nature of work and for women in pregnancy and lactation status. At an individual level, a food secured person does not live in fear of starvation and hunger. According to the Food and agricultural Organization (FAO), (1984), the basic concept of food security implies that people at all times have both physical access to enough food rise live an active and healthy life. However, the most comprehensive and perhaps largely accepted definition came out of the world health summit at Rome in 1996 which states that Food security exists when all people at all times , have physical and economic access to sufficient, safe and nutritious food to meet their food preferences for an active and healthy life. (FAO, 1996)

The Food and agricultural Organization (1984) recognizes four essential pillars of food security. They are Availability, access, utilization and Stability and this is discussed below:

Food Availability

Food availability is a measure of food that is available, and will be physically available in the relevant vicinity of population during

production, stocks trade and transfers. The production of food to a very large extent depend on temperature and rainfall, therefore vulnerable to climate change. It is expected that there will be a decrease in food production due to increase in temperature, carbon dioxide concentrates in the atmosphere, water scarcity and catastrophic weather events like floods, droughts and heat waves. Even now, there is a fall in the yield of some major crops like maize, wheat and rice due to extreme weather events, epidemic of plant diseases, and declining water resources (Shiru, Shadi, Alias and Chung, 2018). Generally, the impact of climate change on agriculture is expected to be negative and threaten food security. Analysis have shown that people in developing countries in Africa and Asia which are already food insecure and vulnerable to climate change will be affected the most (Von Grebmer, Bernstein, Patterson, Wiemers, Ni Cheilleachair, Foley, Gitter, Ekstron and Fritschel, 2019).

Food Access

Food accessibility is a measure of a population's ability to acquire available food during given consumption periods through a combination of its own production and stocks, market transactions or transfer. Recent market volatility has highlighted the vulnerability of poor and marginal households to price shocks in many developing countries (Von Grebmer et.al., 2019). If there is a moderate increase in income levels and the amount of income spent on food remains high, increases in food prices will exacerbate food insecurity trends (Ogbuabor, and Egwuchukwu, 2017) Since agriculture is highly sensitive to climate patterns, changes in temperature and rainfall can reduce rural income for food and increase rural poverty.

Food Utilization

Food utilization is a measure of whether a population will be able to derive sufficient nutrition during the given consumption period from available and accessible food to meet its dietary needs. Climate change induced negative events can affect food utilization and food safety in a number of ways. In poor rural areas, food consumption patterns are mostly seasonal thereby affecting people's food security and nutrition during the lean season before harvest. Climate change may cut production and as a result, reduce food availability even more. It could also prolong the lean season hence, worsening the adverse effects on people's nutrition. Climate change can also reduce the nutritional value of the food that is cultivated. It has been reported that the higher CO_2 concentration decreases the protein, zinc and iron content of crops. Cenacchi, and Sulser, 2019). Consequently, it is estimated that by 2050 an additional 175 million people are likely to experience zinc deficiency and an additional 122 million people could be deficient in protein (Von Grebmer, Bernstein, Patterson, Wiemers, Ni Cheilleachair, Foley, Gitter, Ekstron and Fritschel, 2019). These impacts will be mostly felt by people living in poverty and those who derive their nutrition sources from plants. The poor from African countries, Asia and Middle East are mostly on the danger of suffering these effects.

Food Stability

Food stability is related to regular intake of food. Even if one's food intake is adequate today, one is still considered to be food insecure if one has inadequate access to food on periodic bases, risking a deterioration of one's nutritional status. Adverse weather conditions; political instability or economic factors (unemployment, rising food prices) may have an impact on one's food security status.

Evidence of Climate Change in Nigeria

Nigeria's climate has been shifting, this is made manifest in: rises in temperature; variable rainfall; increase in sea level and flooding; drought and desertification; land degradation; more frequent extreme weather events; affected fresh water resources and loss of biodiversity (Elisha ,

Sawa, and Ejeh, (2017); Ebele and Emodi, 2016; Olaniyi, Ojekunle, and Amujo, 2013). The periods and amounts of rainfall have amplified, creating enormous overflows and flooding in a lot of places in Nigeria (Enete, 2014). Rainfall variation is anticipated to continue to escalate. Rainfall in southern parts is anticipated to increase and rising sea levels are anticipated to aggravate flooding and submersion of seaside lands (Akande, Cosat, mateu and Henriques, 2017; Ebele and Emodi, 2016). Droughts have also become a reoccurring thing in Nigeria, and are anticipated to carry on in Northern Nigeria, occasioned by a drop in rainfall and increase in temperature (Amanchukwu, Amadi and Ololube, 2015; Olapido, 2010). The situation also puts Lake Chad and other lakes in the country at the risk of disappearing since they are already drying up (Dioha and Emodi, 2018; Elisha, Sawa and Ejeh, 2017). Temperature has increased meaningfully ever since the 1980s (Enete , 2014; Federal Ministry of Environment, 2014). Climate projections for the coming decades reveal a significant increase in temperature over all the ecological zones (Akande et al., 2017).

The weather and climate organization alleged the state of affairs was bothersome, and, if not given the desired attention, may possibly have a terrible effect on the economy and wellbeing of Nigerian people. It was further reported that the combined "one-day rainfall of more than 160mm over places such as Bauchi, Abakaliki, Calabar, Awka, Benin, Gusau, Jalingo, Lafia, Ondo and Warri between May and September in 2019 resulted into flooding which submerged hundreds of thousands of hectares of farmland and destroyed crops leading to huge losses". According to the report, some parts of the north and central states experienced a dry spell period just after the onset of the rainy season. "This led to the replanting of crop seeds in these areas, thus increasing the cost of production and contributing negatively to agricultural activities during the critical stages of crop development and harvesting." The 2019 review linked weather and climate elements to the upsurge of diseases such as Meningitis, Malaria and Cholera. (Izuaka, 2020). Nigeria is thus experiencing adverse climate conditions with negative impact on the welfare of millions of people

Impact on Agriculture: Nigerian produces a wide range of food crops. This include maize, rice, yam, cocoyam, beans, sorghum, soya beans, melon (Shiru, Shadi, Alias and Chung, 2018). It has been estimated that more than 70 percent of the Nigerian people are actively involved in Agricultural practices and depend on it as a sole means of livelihood (Onwutuebe, 2019, 3; Shiru et al., 2018; Nkechi, Ali and Eze, 2016; Federal Ministry of Environment, 2014). It is therefore pertinent to note that a decline in agricultural productivity will grossly affect the people's means of earning their living, food security, and economy of the country (Onwutuebe, 2019; Shiru et al., 2018; BNRCC (Building Nigeria's Response to Climate Change), 2011). The agricultural produce in Nigeria is mostly rain fed. Irregular rain fall patterns pose a big challenge to farmers in planning their farming activities (Anabaraonye et al., 2019; BNRCC, 2011). This has a net negative effect on crop production as a lot of crops are usually affected by even small rainfall and temperature changes (Sayne, 2011). The increase in crop failures and poor crop yields in the northeast has been attributed to increased temperature and drought (Sayne, 2011). In the seaside areas of southern Nigeria, flooding of farm lands and too much salinized soils for planting and eroding soils in the southeast has been attributed to raising sea levels (Sayne, 2011). This also has a negative resultant effect on crop yields.

In general, Increased temperatures, inadequate rainfall, drought and desertification contributes a lot in reducing farmlands and agricultural productivity (Ogbuabor and Egwuchukwu, 2017). In yobe state for instance, it has been shown that about 25,000 to more than 30,000 hectares of farmland has been lost to sand dunes and desert encroachment, affecting food and livestock production (Ebele and

Emodi, 2016). Reduced rainfall occasioned by climate variations can result in reduction in surface water resources and existing pasture lands.

Long period of no rain ascertained by climate variations can result in reduction in surface water resources and available pasture land. This can pose a great challenge to livestock farmers, making it difficult to get water and green pastures. This in turn results in loss of weight for animals and reduction in meat and dairy production (Ayanlade, Radeeny and Morton, 2017). Increase in atmospheric temperature has continued to pose a challenge to farmers in the storage of root crops and vegetable. (Ebele and Emodi , 2016).Large amount of rainfall in seaside areas, increase in sea level, flooding and erosion of farmland also decrease agricultural production (Anabaraonye, Chukwuma and Okafor, 2019; Amobi and Onyishi, 2015; BNRCC, 2011). A substantial part of farmlands have been eroded in recent times by flooding in some parts of Nigeria. (Nkechi et al., 2016).

Fisheries: In most cases the source of livelihood for people living in coastal areas depends largely on fisheries (Idowu, Ayoola, Opela and Ikenweiwe, 2011). Changes in climate however, affect the type of available freshwater resources. The effect differs from one region to the other, aggravating the already existing problem of flooding and drought (BNRC, 2011). The secondary effect of this is loose of means of livelihood and protein for the rural communities (BRNC, 2011). Increase in sea level and extreme weather events also affects seaside and marine areas (BNRC, 2011). Heavy storms disrupt activities of fishermen and fishing boats (Ebele and Emodi, 2016). The sustainability of inland fisheries is also negativity affected by increased salinity and drying lakes and rivers (Ebele and Emodi, 2016).

Food security and water: About 80 percent of Nigerians population depends on rain fed agriculture and fishing as their primary occupation (Abdulkadir, Lawal and Muhammad 2017; Ebele and Emodi, 2016)

The primary source of water for almost all Nigerian Farmers (agriculture and fishing) is rain water about 80% of the Nigerian populace are farmers (Abdulkadir et al., 2017). Therefore erratic rainfall patterns and other climate calamities like drought, flood, storm, and heat stress can cause serious food scarcity (Abdulkadir et al., 2017). Slow reaction to agricultural shortages can result in severe hunger (Sayne, 2011).

The northern part of Nigeria produces the highest amount of grains in the country (Madu, 2012). The negative impact of climate change in the northern part of the country has a serious implication on food shortages in the country (Madu, 2012). The situation is further worsened by the shrinking the Lake Chad which is the biggest source of irrigation water in northern Nigeria (Sayne, 2011).

Poultry farmers also have a fair share of the decrease in agricultural productivity as a result climate variations. It has been reported that extreme heat resulting from climate variations has a negative effect on the growth and productivity of chickens (Haider, 2019). The result of a study conducted in Kaduna and Oyo States reveals that about 10% in farmers in 2017 experienced loss in poultry farming due to increased heat (Haider, 2019).

There is also the scarcity of drinking water in Northern Nigeria due to drought. It is reported that rural dwellers harvest rain water for drinking and this constitutes more than half of the total drinking water consumption. Ground water table in the North are also reported to have dropped significantly in the last half century, partly due to the reduction in rainfall (Sayne, 2011).

Security impact

Climate change conditions are potential causes of resource based conflicts. This can be worsened by the shortage of food and water (Madu, 2016; Madu, 2012; BNRCC, 2011). The Northan Sahelian Zone is already faced with massive emigration and resettlement of people from areas affected by desertification to areas with better vegetation and grazing resources. This has triggered

resource-based crisis among herdsmen and farmers and inter-ethnic clashes in most parts of the country particularly in the Northeast, Northwest and Central parts of the Nigeria (Elisha et al., 2017; Nkechi et al., 2016; Amobi and Onyishi, 2015).

Nigeria's Global Hunger Index (GHI) and Climate Change

All of the manifestations of climate change events like; storms, fires, floods, and droughts have direct and indirect negative impacts on food security and hunger through changes in food production and availability, access, quality, utilization, and stability of food systems.

The Global Hunger Index (GHI) is a tool designed to comprehensively measure and track hunger at global, regional, and national levels. GHI scores are calculated each year to assess progress and setbacks in combating hunger. The GHI is designed to raise awareness and understanding of the struggle against hunger, provide a way to compare levels of hunger between countries and regions, and call attention to those areas of the world where hunger levels are highest and where the need for additional efforts to eliminate hunger is greatest (Von Grebmer et al., 2019).

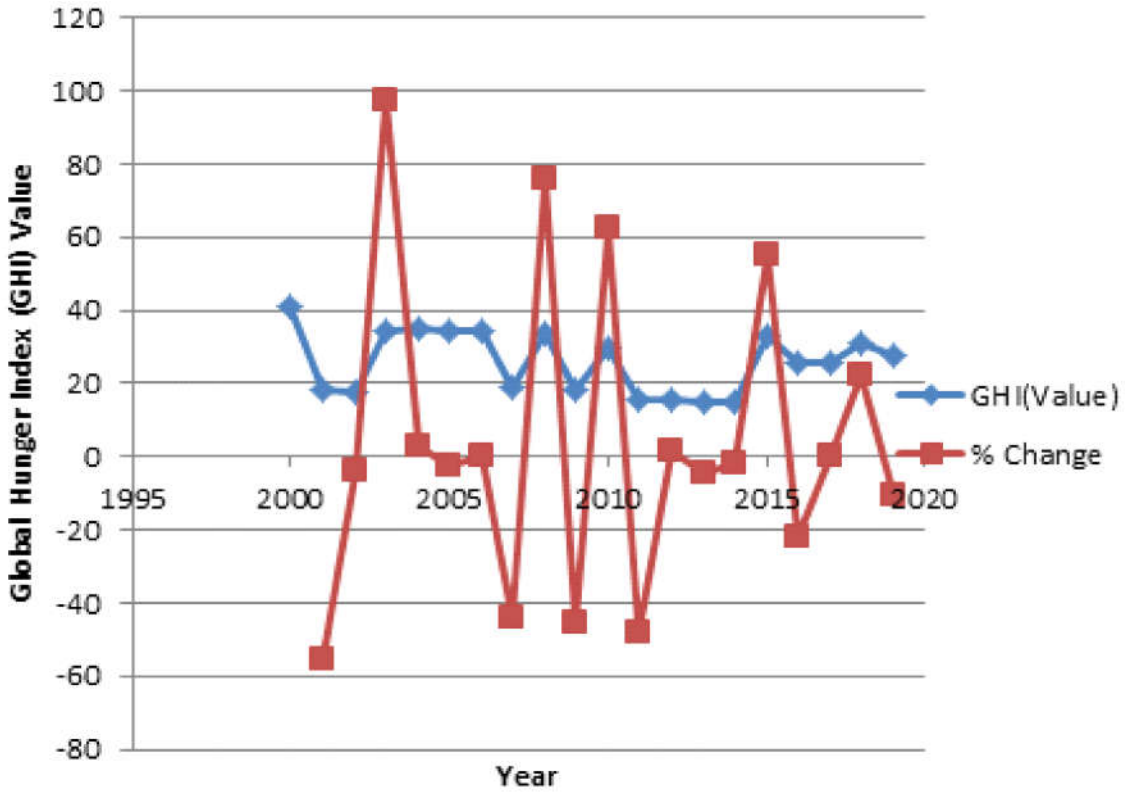


Fig 1: A graph of Nigeria's Global Hunger Index from 2000 – 2019. Source: (Von Grebmerk, Nestorova, Quisumbing, Fertziger, Fritschel, Pandya-Lorch, and Yohannes, 2009; Von Grebmer, Bernstein, Hossain, Brown, Prasai, Yohannes, Patterson, Sonntag, Zimmermann, Towey, and Foley, 2017; and Von Grebmer, et. al. 2019)

The Global Hunger Index data and information for Nigeria between year 2000 to 2019 (Von Grebmer et al, 2009; Von Grebmer, et. al., 2017 and Von Grebmer, et. al., 2019) is shown in the figure 1 above. The index rank for every country is on a 100 point scale, with 0 being the best score (i.e. no hunger) and 100 being the worst. However, no country has ever reached these extreme points of 0 and 100. The severity of hunger associated with range of possible GHI scores is as follows: ≤ 4.9 is low, 5.0-9.9 moderate, 10.0 – 19.9 serious, 20.0 – 29.9

alarming and ≥ 30 is extremely alarming (Von Grebmer, et.al., 2017).

Figure1 above reveals that the global hunger index score for the past two decades (2000 to 2019) in Nigeria keeps fluctuating. For instance, in 2000, Nigeria's Global Hunger Index score was extremely alarming (i.e. 40.80). The GHI score decreased from extremely alarming to serious in the year 2001 and 2002 (i.e. 18.20 and 17.50 respectively) and then increased to extremely alarming scores of 34.20 and 35.20 in 2003 and 2006 respectively. Between 2007 and 2015 the GHI score for Nigeria fluctuated rapidly from 19.13 (a serious level of hunger) to 55.18 (an alarming level of hunger). The almost yearly fluctuation trend in Global Hunger Index for Nigeria has continued unabated for the past two decades as can be observed in the percentage change in Figure 1. The 2019 Global Hunger Index ranks Nigeria 93rd out of 117 qualifying countries. The GHI score of 27.9 is quite an improvement from the preceding year (Otekunrin, Otekunrin, Momoh, Ayinde, 2019; Von Grebmer et al, 2019). However, it is only countries like Uganda, Zambabwe, Liberia, Angola, Central African Republic, Chad, Ethiopia and Sundan that has their GHI scores higher than Nigeria in Africa (Otekunrin et al, 2019; Von Grebmer, 2019).

The hunger in Nigeria in these years is ascribed majorly to climate change, inequality, and resource-based conflicts (Olomola, 2017). This shows that for the past twenty years Nigerians have been in a state of serious hunger, highly undernourished and in a serious state of food insecurity. This explains why there has been a lot of insecurity in the country for the past twenty years. Like the saying goes "a hungry man is an angry man" consequently, an angry man can destroy without guilt.

Conclusion And Recommendation

Variations in climatic conditions constitute main challenges for agriculture productivity. These challenges have increased the threat to hunger and subsequently, food security. Fundamentally climate change can be linked with violence in Nigeria. Shortages are trailed by undesirable secondary effects, such as additional ill health, hunger and unemployment. A slow reaction to these, in turn, enhances vulnerability to conflicts. Combatting the menace of food security demands ending hunger and under nutrition. The following recommendations towards mitigation and adaptation for Nigeria are here by suggested:

1. Relevant Government agencies and organizations like Nigerian Meteorological Agency must intensify investments in disaster stoppage and calamity risk reduction, particularly in vulnerable areas predisposed to extreme weather events by providing farmers with information on early warning signs. Increase investment in large irrigation projects like managing livestock operations and fisheries more efficiently.
2. The energy sector is very central to the mitigation of climate change in Nigeria. This can be achieved by controlling greenhouse emissions through increased investment in renewable energy development. The development of solar energy is new and growing at a Snell speed.
3. Increased investment in the production of sugarcane, maize and cassava by farmers can enhance the bioenergy sector.
4. Citizens are also advised to engage in lifestyles that support climate change mitigation. These consist of use of energy efficient appliances and more availability and use of public transportation.

Reference

Abdulkadir, A., Lawal, A. M. & Muhammad, T. I. (2017). Climate change and its implications on human existence in Nigeria: a review. *Bayero Journal of Pure and Applied Sciences, 10(2), 152-158.* https://

www.ajol.info/index.php/bajopas/article/viewFile/170772/160195

Akande, A. Costa, A.C., Mateu, J.& Henriques, R. (2017). Geospatial Analysis of Extreme WeatherEvents in Nigeria (1985– 2015) Using Self-Organizing Maps. *Advances in Meteorology*. https://doi.org/10.1155/2017/8576150.

Adesina, A. (2013). *Agricultural Transformation Agenda: Mid-Term Report May 29, -May 29,2013 Scorecard.* Abuja: Federal ministry Of Agriculture And Rural Development.

Amanchukwu, R. N., Amadi-Ali ,T, Ololube, N.P. (2015). Climate change education in

Nigeria: The role of curriculum review. Education, 5(3): 71-79. https://www.researchgate.net/profile/Nwachukwu_Prince_Ololube/publication/283081778_Climate_Change_Education_in_Nigeria_The_Role_of_Curriculum_Review/links/56292c5508ae518e34_7c967b/Climate-Change-Education-in-Nigeria-The-Role-of-Curriculum-Review.pdf

Amobi, D. & Onyishi, T. (2015). Governance and climate change in Nigeria: A public policy perspective. *Journal of Policy and Development Studies, 9(2), 199-210.* https://www.arabianjbmr.com/pdfs/JPDS_VOL_9_2/17.pdf

Anabaraonye, B., Chukwuma, J., Okafor, C. J. (2019). Educating farmers and fishermen in rural areas in Nigeria on climate change mitigation and adaptation for global sustainability. *International Journal of 35 Scientific & Engineering Research, 10(4),1391-1398.*

Ayanlade, A., Radeny, M. and Morton, J. F. (2017). Comparing smallholder farmers' perception of climate change with meteorological data: A case study from southwestern Nigeria. *Weather and Climate Extremes 15, 24–33.*

Ballard, T. J., A. W. Kepple, and C. Cafiero (2013). *The Food Insecurity Experience Scale:Developing a Global Standard for Monitoring Hunger Worldwide.* Technical Paper. Rome: Food and Agriculture Organization of the United Nations. http://www.fao.org/fileadmin/templates

BNRCC (Building Nigeria's Response to Climate Change). (2011). National adaptation strategy and plan of action on climate change for Nigeria (NASPA-CCN). Prepared for the Federal Ministry of Environment Special Climate Change Unit.

Cenacchi, N. and Sulser, T. (2019). *Effects of rising CO2 on protein, iron, and zinc availability in global diets.* https://www.ifpri.org/blog/effects-rising-co2-protein-iron-and-zinc-availability-global-diets

Ebele, N. E. and Emodi, N. V. (2016). Climate change and its impact in Nigerian economy. *Journal of Scientific Research & Reports, 10(6), 1-13.*

Eneji, M., Mallo, E.R. Dalut, N.A. and Garba, A. (2020). Impact of climate Change on Agriculture and Food Security in Nigeria. *Socialistic Journal*.6,41-59.

Elisha, I. , Sawa, B.A. & Ejeh, U. L. (2017). Evidence of climate Change and adaptation strategies among grain farmers in Sokoto State, Nigeria. *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT), 11(3), 1-7.*

Enete I. C. (2014). Impacts of climate change on agricultural production in Enugu State, Nigeria. *Journal of Earth Science & Climatic Change, 5(9), 234.*

FAO (Food and Agricultural Organization). (1984). *The State of food and agriculture. World Review: The ten years since the world food conference.* http://www.fao.org/3/a-ap664e.pdf

FAO (Food and Agricultural Organization) .(1996). *Report of the World Food Summit, 13-17November 1996.* http://www.fao.org/3/w3548e/w3548e00.htm

FAO (Food and Agricultural Organization). (2015). *Climate change and food security: risks and responses.*

www.fao.org/publications.

FAO (Food and Agricultural Organization). (2016). *Agriculture in Sub-Saharan Africa: Prospects and challenges for the next decade*. www.fao.org

Federal Ministry of Environment. (2014). United Nations Climate Change Nigeria. *National Communication (NC). NC 2. 2014*. https://unfccc.int/sites/default/files/resource/nganc2.pdf

BNRCC (Building Nigeria's Response to Climate Change). (2011). *National adaptation strategy and plan of action on climate change for Nigeria (NASPA-CCN).* Prepared for the Federal Ministry of Environment Special Climate Change Unit. http://csdevnet.org/wpcontent/uploads/NATIONAL-ADAPTATION-STRATEGY-AND-PLAN-OF-ACTION.pdf

Haider, H. (2019). *Climate change in Nigeria: Impacts and responses*. K4D Helpdesk Report 675. Brighton, UK: Institute of Development Studies.

Idumah, F.O., Mangodo, C., Ighodaro, U.B. & Owombo, P.T. (2016). Climate Change and Food Production in Nigeria: Implication for Food Security in Nigeria. *Journal of Agricultural Science*.8(2): 74-83

IPCC (Intergovernmental Panel on Climate Change). (2014). *Impact, Adaptation and Vulnerability. Part A. Global And Sectorial Aspects. Working Group II contribution To The IPCC Fifth Assessment Report*. Cambridge, UK: Cambridge University Press.

IPCC (Intergovernmental Panel on Climate Change). (2018*). Global Warming of 1.5^{0}c: An IPPC Special Report on The Impacts Of Global Warming Of 1.5^{0}c above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways in the Context Of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development and Efforts to Eradicate Poverty*. Geneva: World Meteorological org.

Izuaka, M. (2020). *Climate Change: How Changing Weather Patterns Impacted Agriculture, Health, other key sectors in Nigeria in 2019 – Report*. https://www.premiumtimesng.com/agriculture/agric-news/374042-climate-change-how-changing-weather-patterns-impacted-agriculture-health-other-key-sectors-in-nigeria-in-2019-report.html

Idowu, A. A., Ayoola, S. A., Opela, A.I. & Ikenweiwe, B. (2011). Impact of Climate Change in Nigeria. *Iranica Journal of Energy & Environment, 2(2),* 145-152.

Madu, I. A. (2012). *Spatial vulnerability of rural households to climate change in Nigeria: Implications for internal security.* Robert S. Strauss Center for International Security and Law at 37 The University of Texas at Austin.

Nkechi, G. O., *Ali, A., Eze, E.* (2016). Mitigating climate change in Nigeria: African traditional religious values in focus. *Mediterranean Journal of Social Sciences, 7(6).*

Olaniyi, O.A, Ojekunle, Z.O, and Amujo, B.T . (2013). Review of climate change and its effect on Nigeria ecosystem. *International Journal of African and Asian Studies, 1, 57*

Olapido, E. (2010). *Towards enhancing the adaptive capacity of Nigeria: a review of thecountry's state of preparedness for climate change adaptation.* Heinrich Böll Foundation.Nigeria.https://ng.boell.org/sites/default/files/uploads/2013/10/nigeria_prof_oladipo_final_cga_study.pdf

Onwutuebe, C. J. (2019). *Patriarchy and Women Vulnerability to Adverse Climate Change in Nigeria.* SAGE

Otekunrin, A.O; Momoh, S. & Ayinde, I.A. (2019). How far has Africa gone in achieving sustainable development goals? Exploring African dataset. https://www.sciencedirect.com/science/article/pii/S2352340919310029

Ogbuabor, J. E. & Egwuchukwu, E. I. (2017). The impact of climate change on theNigerian economy. *International Journal of Energy Economics and Policy, 7(2), 217-223.*

Olumola, A.S. (2017). *Ending Rural Hunger: The Case Of Nigeria. Africa GrowthInitiative*.Brookhaven.

Sayne, A. (2011). *Climate change adaptation and conflict in Nigeria*. Washington, DC: USIP. https://www.usip.org/sites/default/files/Climate_Change_Nigeria.pdf

Shiru, M.S., Shadi, S., Alias, N., Chung, E. (2018). Trend Analysis of Droughts During Crop Growing Seasons of Nigeria. *Sustainability, 10(3), 871.*

Syne, A. (2015). Climate Change Adaptation and Conflict in Nigeria. United States Institute of Peace: Special Report. www.usip.org.

Von Grebmer, K., J. Bernstein, A. de Waal, N. Prasai, S. Yin, and Y. Yohannes. (2015). *2015*

GlobalHunger Index: Armed Conflict and the Challenge of Hunger. Bonn, Washington, DC, and Dublin: Welthungerhilfe, International Food Policy Research Institute, and Concern Worldwide

Von Grebmer, K; Bernstein, J; Patterson, F; Wiemers, M; Ni Cheilleachair, R; Foley, C; Gitter, S; Ekstron,K. and Fritschel, H. (2019). *2019 Global Hunger Index: The Challenge of Hunger and Climate Change*. Bonn: Welthungerhilfe.

von Grebmer, K., J. Bernstein, N. Hossain, T. Brown, N. Prasai, Y. Yohannes, F. Patterson,

A. Sonntag, S.-M. Zimmermann, O. Towey, & C. Foley. (2017). 2017 Global Hunger Index: The Inequalities of Hunger. Bonn: Welthungerhilfe.

von Grebmer, K., B. Nestorova, A. Quisumbing, R. Fertziger, H. Fritschel, R. Pandya-Lorch, & Y. Yohannes. (2009). 2009 Global Hunger Index: The Challenge of Hunger: Focus on Financial Crisis and Gender Inequality. Bonn: Welthungerhilfe.