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Climate Change and Agricultural Production in Nigeria: A Review of Status, Causes and Consequences

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Abstract

The paper reviewed the causes, consequences and impacts of climate change in the Nigerian agricultural sector. The paper found out that, notwithstanding the existence of modern agricultural technologies, climate change which occurs with different weather varieties hamper productivity levels of both crops and animals in recent time in the country. Although there are information about the negative impacts of climate change in the country, much of these information are not on the doorsteps of the rural agricultural producers due to minimal existence of adequate trained change agents. As Nigeria is currently experiencing increasing incidence of disease, declining agricultural productivity, increasing number of heat waves, unreliable weather patterns, declining rainfall in already desert-prone areas, these gave ways to paradigm shift in the agricultural sector especially in the rural communities. Due to these increases there is decline in production of agricultural produce/products which is consequence of climate change. This paper recommends among other things that there is need for a systematic collaborative approach involving all the stakeholders - science experts and researchers, governments at all levels, policy makers, farmers associations, youths and women groups, private sectors: non-governmental and civil society organizations to work together in turning the critical challenges posed by climate change into opportunity/opportunities.

Keywords: Climate change, agricultural production, causes, adaptation

1. Introduction

In spite of technological approaches and development such as use of inorganic fertilizers, modern land preparation and planting of early season crops, mechanization in farming, agrochemicals, improved seed varieties, expansion of irrigation systems, genetically modified organism, among others,

weather is still a key factor in carrying out agricultural productions.

Weather is the short term state of the atmosphere at a specific time and place in terms of precipitation, temperature, wind, humidity, etc. The long term manifestation of weather and other atmospheric conditions in a



given area is called climate, and it is the main focus as it has to do with long term evidence or signs.

Climate is the general weather conditions in an area over a long period. Ngigi (2009) defined climate change as a change in climate that is attributable directly or indirectly to human activities, that alters the atmospheric composition of the earth which leads to global warming. Intergovernmental Panel on Climate Change (IPCC) in (2007) said climate change is a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period typically decades longer.

Climate change can be said to be changes in the earth's climate especially those produced by global warming. Climate change is considered as the most pressing environmental problem facing the globe today, affecting patterns of life and general living conditions.

Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods (that may range from decades to millions of years). It is usually caused by factors such as: biotic processes (such as humans, animals, etc), variations in solar radiations received by earth, volcanic eruptions etc. Climate change has repercussions such as upsetting seasonal cycles, harming ecosystems and water supply,

affecting agricultural farming systems and food production, causing sea-levels to rise etc.

The survival of agriculture is dependent on climate, and the two are inter-related because they both take place globally as recorded by Adejuwon, (2006). Nigeria is experiencing adverse climate conditions with negative impacts on the welfare of millions of people. Climate fluctuation is putting Nigeria's agricultural system under serious threat and stress, and Nigeria's agriculture is mostly rain-fed, therefore changes in climate affects productivity. In Nigeria, varieties of food crops are produced and are all dependent on rainfall, so that where rainfall is abundant, rain-fed crops are planted and in drier parts of the country, crops that do not require much rainfall are planted.

Flooding, droughts, erosion, off season rains, etc have sent growing season out of the way of a country that is dependent on rain fed agriculture. Climate change has resulted to lakes drying up and reduction in river flow in some regions, resulting in fewer water supplies for use in agricultural production (Ozor, 2009). The agricultural sector contributes some percentage in the Nigerian gross domestic product (GDP). Climate change effects on agricultural production thereby reduce the percentage of agriculture in the GDP of Nigeria. The threat of climate change on agricultural production affects every area of the agricultural sector. The sector has a great effect on Nigeria's economy as reported by



Odekunle, (2014). Given the impacts of climate change in agriculture, its study is important, because the livelihood patterns of millions of people is dependent on agriculture and it is on record that agriculture is the mainstay of the Nigerian economy.

Objectives of the Research

The broad objective of this research is to examine the effect of climate change on agricultural production in Nigeria.

The specific objectives include to;

- i. identify the causes and effects of climate change on agriculturists in Nigeria,
- ii. examine effects of climate change on agriculture especially on crop production,
- iii. examine impacts of climate change on animals; and finally, identify climate change adaptation problems in the country.

2. Research Methods

The study focused on Nigerian agricultural productivity in the context of the effect of climate change on agricultural production as a whole. This is because of the size and population of Nigeria as well as her position as the largest and most populous country in Africa. Added to these is because agriculture is the mainstay of the national economy. The study relies heavily on published and unpublished information from various sources especially that concerning agricultural sector

and climate change causes and consequences. Other sources of information about different predicaments of climate change effects were also explored. These include internet sources, grey literature and published opinions of experts. Meanwhile, other key documents consulted included materials produced, case studies, recent research reports including annexes and internal learning documents from development partners including the Intergovernmental Panel on Climate Change(IPCC). African Technology Policy Studies Network (ATPS), The MDG Centre for East and Southern Africa as well as universities where relevant information about the subject matter can be found among other agencies that are involve in climate change activities.

3. Results and Discussion

Causes of Climate Change

According to Botkin and Keller (2010), the phenomenon of climate change is linked to both natural and human causes' i.e. natural events and human activities are believed to contribute to the increasing climate change. Primarily, climate change is caused by increase in green house gases and even changes in ocean currents among others. Due to nature of science, not every single detail is ever totally certain and not all questions are yet to be answered. Below, are some of the causes of climate change and they include:-

- i. Changes in the earth's orbit: Changes in the shape of the earth's orbit (or eccentricity) as well as the earth's tilt



and precession affects the amount of sunlight received on the earth's surface.

- ii. Changes in the sun's intensity: changes occurring within or inside the sun can affect the intensity of sunlight that reaches the earth's surface. The intensity of the sunlight can cause either warming (for stronger solar intensity) or cooling (for weaker solar intensity).
- iii. Volcanic eruption: Volcanoes can affect the climate because they can emit aerosols and carbon dioxide into the atmosphere.
 - Aerosol emissions: volcanic aerosols tend to block sunlight and contribute to short term cooling. They do not produce long term changes because they leave the atmosphere not long after they are emitted.
 - Carbon oxide emission: Volcanoes also emit carbon dioxide (CO₂), a green house gas which has a warming effect. The level of carbon dioxide (CO₂) has risen since the last past millions of years.

The human factors that emit large amounts of green house gases includes: industrialization, burning of fossil fuel, gas flaring, urbanization, changes in global patterns of land use and agriculture. Furthermore, human activities that reduce the amount of carbon sinks as reported by (IPCC, 2007, and Nzeh, 2008) are deforestation, alterations in land use, water

pollution and agricultural practices. These human activities have been proven to contribute to the ongoing climate change in Nigeria.

Effects of Climate Change on Population of Agriculturists

Majority of the rural population in Nigeria survive through the production of agricultural products. Drying up of lakes, streams etc affect fishing. Also crops that are dependent on rainfall are affected. The dominant role of climate change is so obvious that even minor climate deteriorations causes or leads to devastating consequences especially in developing country like Nigeria. Climate change is a big threat to Nigerian food security, affecting both subsistence and commercial farming. Climate change causes an increase of diseases and pests, thereby declining agricultural production. Declining rainfall in northern areas of Nigeria is causing increasing desertification. The former food basket of the nation is now empty and people in the coastal areas who used to depend on fishing have their livelihoods destroyed by the climatic changes. As reported by Ikpi (2010), the increasing effects of climate change in agricultural production have led to the migration of people from rural areas to urban areas. This is so because, people who used to depend on agricultural production have been disappointed and so they have to look for better jobs or means to survive.



According to Nzeh and Eboh (2011); Aphunu and Nwabeze, (2012), in 1999 and 2000, more than 200,000 people were displaced by floods in Niger Delta. Meanwhile, in different parts of the country so many people have been killed by floods in several states especially in the Northern Nigeria where unusually heavy rains have swollen rivers and streams across the region. Agriculture remains the main source of livelihood for most rural dwellers in Nigeria.

Effects of Climate Change on Agriculture

In the recent time, literature stated that there are so many implications of climate change on agriculture. Climate change increases the frequency and severity of floods and droughts. It causes drastic changes in rainfall patterns with rising temperatures which introduces unfavourable growing conditions; it modifies growing seasons which could subsequently reduce productivity. Climate is the primary determinant of agricultural productivity. As reported by Ikeme (2009), Nigeria is currently experiencing increasing incidence of disease, declining agricultural productivity, increasing number of heat waves, unreliable weather patterns, declining rainfall in already desert-prone areas, in the north causing increasing desertification decreasing food production in central regions and destruction of livelihoods by rising water in coastal areas where people depend on fishing and farming.

Climate change may change the types, frequencies and intensities of various crops and livestock pests, also the availability and

timing of irrigation water supplies and the severity of soil erosion, Challinor and Wheeler (2008). Livestock's are also affected by climate change. They can be affected in two ways: the quality and amount of forage from grasslands. The qualities of grasses are affected by higher temperatures, which may lead to drying up of grasses, thereby reducing the nutritional values of livestock feeds.

Climate Change and Its Effects on Crop Production

There are different approaches for studying the implications of climate changes on agriculture; one of them is the crop yield analysis. Crop yield analysis estimates the effects of altered environments on crop productivity levels. Parry (2007) argues that the effects of carbon dioxide (CO₂) enrichment, without associated changes in climate would probably be beneficial to agriculture. High temperatures increase the rate of microbial decomposition of organic matter, thereby affecting adversely soil fertility in the long run. Increase in temperature also has effects on pests and diseases, increasing their chances of survival, thereby affecting crops which in turn affect productions.

An analysis of the biophysical impact of climate changes associated with global warming shows that higher temperatures generally hastens plant maturity in annual species, thus shortening growth stages of crop plants. It has also been reported by IPCC Intergovernmental Panel on Climate Change

(2007) that increase in uv-B radiation reduces yield in certain agricultural crops.

Climate change affects planting and harvesting periods. Due to this, there are occasional shifting seasonal rainfall patterns and severe precipitation events and flooding, delay planting and harvesting of plants. Climate change has effects on soil water balance which leads to changes of soil evaporation and plant transpiration; consequently the crop growth period may shorten in the future, causing crops yields to decrease. Climate change also decreases the crop rotation period, so farmers' needs to consider crop varieties sowing dates, fertilization levels when planting crops. Food quality is affected because of the increasing temperatures and decreasing crop growth periods. Changes in temperatures and precipitation patterns may lead to change in the length of growing seasons or the rates of photosynthesis by plants (Rosenzweig and Hillel, 1995), such changes could lead to decrease in crop yield. Increase in rainfall in some parts can lead to higher rates of soil erosion, leaching of agricultural chemicals.

Climate Change Impacts on Animals

There have been some notable and significant impacts of climate changes on livestock production. There are two types of effects which are; Direct and Indirect effect.

1. Direct effect is the constant exposure of animals to high temperatures, which causes reduction in growth and

productivity, decline in feed intake, weight loss, etc. For instance, when cattle are under heat stress, they are subjected to the following conditions:

- Reduced grazing time (because animals may be seeking shade).
- Reduced feed intake

In dairy cows, heat stress reduces the amount of milk produced, reduces milk fat and protein content and decreases reproduction rate.

For chicken and pigs they are susceptible to heat stress in so many area such as:-

- Reduced feed intake
- Reduced laying performance in chicken
- Decreased fertility and activity level
- Increased mortality

The effect of high humidity on animals depends on air temperature, area of evaporating surface, available water in the body and air movement. In Nigeria, animals with black skin are affected by solar radiation causing sun burn and skin cancer. Animals with white and glossy skins are less affected by solar radiation than those with dark coarse hair coat or skin.

2. Indirect effects: The quantity and quality of forage available to the animals is determined by climate. In high rainfall areas, plants grow faster. In arid regions or areas, lack of rainfall limits plant growth. High temperature and humidity provides a favorable breeding environment for external and internal parasites, fungi and bacteria.



3. Rising ocean temperatures and ocean acidification as a result of climate change in the country are radically altering aquatic ecosystems as reported by Nzeh and Eboh, (2011). There has been modification in fish distribution and the productivity of marine and freshwater species as affected by climate change. The rising ocean acidity makes it more difficult for marine organisms such as shrimps, oysters etc to form their Shells (a process known as calcification). As a result of this, the distribution productivity and species composition of global fish production is changing, making livelihood difficult for communities that depend on fisheries. The effect of sea level rise means that coastal fishing communities are in the front line of climate change, while changing rainfall patterns and water use impact on inland (freshwater) fisheries and aquaculture, Hale and Keller, (2008).

Climate Change Adaptation Problems

Numerous and various conditions will dictate the extent of adaptation. Climate change adaptation aims at mitigating and developing appropriate coping measures to address the negative impacts of climate change on agriculture. An important limitation to the effective adoption of climate change information in Nigeria's agricultural sector is the lack of a comprehensive baseline. Given the different interests, risk and resources faced by various stakeholders in agriculture, there is likely to be an extensive typology of adaptive

responses that may be appropriate for different agricultural zones. The different types of farming systems, tenure system, access to financial resources, level of skills, extent of support (i.e. from extension agents) etc also can affect adaptations to climate change.

Climate change adaptation is increasing on the agenda of researchers, policy makers and program developers who are aware that climate change is real and threatens to undermine social and ecological sustainability.

4. Conclusion

It has been shown by most farmers (mostly in the urban areas) that their awareness on weather patterns are changing as manifested in increasing flooding and changes in rainfall patterns. Others are on increase in temperature, high incidence of pests, diseases and weeds and even decrease in crop yields among other incidence. Meanwhile, their understanding of the concept of global climate change with regard to green house emissions, ozone layer depletion etc is still limited. It is therefore necessary that they have full knowledge of what climate change really is as it is perhaps the most serious threat to the fight against hunger, malnutrition, diseases and poverty in especially in Nigeria where its negative effects on agricultural production lead to more increase in the poverty level of the farmers at both urban and rural areas. It is therefore necessary for us to understand the knowledge of climate change and the best way



to adapt to climate change depending on agricultural zones. This review found out that the major challenges of Nigerian farmers include lack of climate change information and extension services, poor infrastructural development, lack/high cost of factors of production and even capital. It is therefore necessary that there should be an increase in the awareness level of farmers and general public in all these critical farming predicaments especially on climate change issues by the extension agents and different research institutions. There is also need for a systematic collaborative approach involving all the stakeholders such as science experts and researchers, governments at all levels, policy makers, farmers associations, youths and women groups, private sectors: non-governmental and civil society organizations to work together in turning the critical challenges posed by climate change into opportunities. This will assist the nation to generate more revenue at local and international markets from the agricultural sector as there is global crisis in the crude oil market.

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