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# AGRICULTURE AND FOOD SECURITY UNDER CLIMATE CHANGEIN MIDDLE BELT OF NIGERIA;CHALLENGE FOR SUSTAINABLE DEVELOPMENT

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**Abstract**: This paper reviews recent studies that have quantified the impacts of climate change on the agriculture and food security in middle belt of Nigeria's sub region. It starts with an overview of the principal aspects of climate change and their impacts on the four dimensions of food security.It then reviews model-based results and discusses the main findings that have arisen from these assessments. The likely impacts of climate change on the other important dimensions of food security are discussed indicating the potential for further negative impacts beyond those currently assessed with models. Strengths and weaknesses of current assessment studies are discussed, suggesting improvements and proposing avenues for strategies of having food security through a viable agriculture despite changes in the climate. Finally, limitations of the current modeling systems are discussed; this includes a discussion on potential surprises and some suggestions to improve future assessments to enhance their overall robustness and their relevance for policy makers.
Key words: Agriculture, Climate, Food security, hunger

## Introduction;

Agriculture is not only a source of the commodity of food but equally importantly a source of income. In the region where trade is possible at reasonably low cost, the crucial issue for food security is not whether food is available but whether the monetary and nonmonetary resources at the disposal of the population are sufficient to allow everyone access to adequate quantities of food. An important corollary to this is that national self-sufficiency at the individual level. The dimension to meet the availability of sufficient food is the overall ability of agricultural system to meet food demand in the region. These includes the agro-climatic fundamentals of crop and pasture production, stability of individuals who are ready to risk permanent or temporarily losing their access to the resources needed to consume adequate food.

Numerous measures are used to qualify the overall status and the regional distribution of global hunger, yet none of these measures covers dimensions and facets of food insecurity from climate change.

## Statement of the Problem

Nigeria with its large expanse of land, water and forest resources, its diverse climate and vibrant population has great agricultural potential. Agriculture, besides providing food for the nation, it is regarded as a vital component of Nigerian economy. The agricultural sector contributes more than 37% of GDP in the 21st century and employed more than 65% of adult labor force. Many numbers of policy measures to improve the performance of agricultural sector has been put in place. With the effect of change in climatic conditions, availability of water which is the focal nucleus of agriculture become uncertain thereby threatening the security of food sufficiency.

With the huge implication of climate change response measures for Nigeria's economy, there is no visible demonstration of the preparedness of the government to tackle climate change influence on food scarcity. The greatest cause for concern is that the blueprint for Nigeria's development Vision 2010 fails to give a mere acknowledgement on the importance of climate change to Nigeria's economy, let alone stipulate the development strategy with which to tackle it. Nevertheless, Nigeria should either prepare for the issues raised by climate change today or pay a higher price in the future.

**Study area**

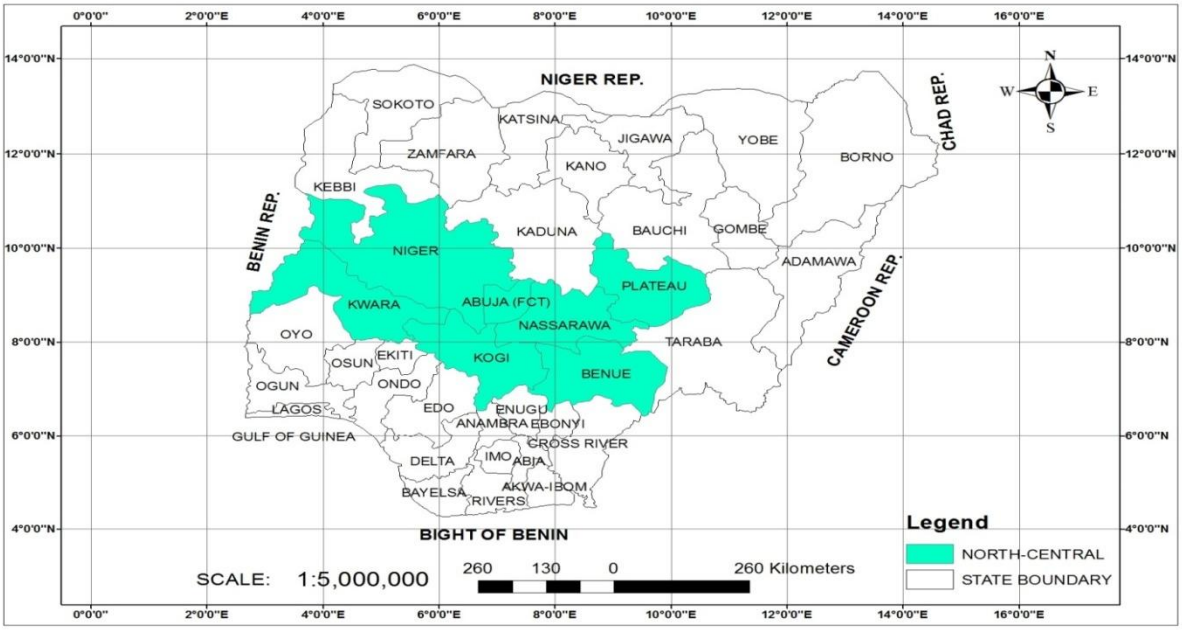



Fig 1: North Central Nigeria

Nigeria has a land area of about 910,770 km$^2$ one of the largest countries in West Africawith thirty-six states distributed into six geopolitical across five ecological regions. It shares a common boundary with the Benin Republic to the west, the Republics of Cameroon and Chad to the east, and the Niger Republic to the north. The Atlantic Ocean with a 960km coastline, borders the south. Nigeria is a physically and climatically diverse country. The country has great agricultural production-potentials, the physical and climatic diversity permits the growth of a wide variety of crops which are also been supplemented by substantial inland water resources. This sustainable exploitation potential holds a considerable promise for the providing livelihood and food security to the people of Nigeria. Middle belt of Nigeria covers about one-fifth (1/5) of the land mass area of the whole country. Covering themiddle part between sub-humid forest and the semi arid region. It is bounded in the north by semi Sahel ecological region and in the south with guinea savanna ecological region. These include Niger, Kwara, Kebbi, Nasarawa, Benue states and Federal Capital Territory. Abuja.

## Concepts of Climate Change and Food Security

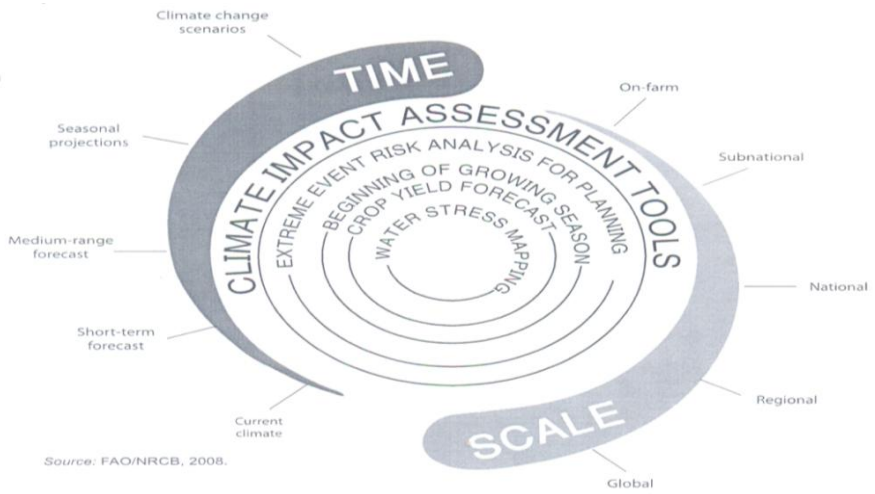



Fig.2: Climate Impact Assessment Tools.

Recent years have been among the warmest on record (Dafe, 2007) influenced by growing

concentrations of greenhouse gases that absorb solar radiation and warm the atmosphere( FAO/NRCB 2008). Research suggested that many changes in atmospheric gas are human-induced, which has led to the global average surface temperature increased over the 20th century by about 0.6° C within the lowest 8 kilometres of the atmosphere.The demographic influence appears primarily contributed through industrial production and energy consumption which lead to carbon dioxide emissions from fossil fuel use, secondly land-use changes, such as deforestation, effect from the exchange of carbon dioxide between the earth and the atmosphere, some agricultural processes, such as cultivation and livestock production. As such, both attention to demographic issues and the development of sustainable production and consumption to the processes involved in global warming.

Climate change affects agriculture and food production in complex ways. It affects agriculture and food production directly through changes in agro-ecological conditions and indirectly by affecting growth and distribution of incomes, and thus demand for agricultural produce. Changes in temperature and precipitation associated with continued emissions of greenhouse gases will bring changes in land suitability and crop yields. In particular, the intergovernmental panels on climate Change (IPCC) consider four families of socio-economic development and associated emission scenarios known as Special Report on Emissions Scenarios (SRES) A2, B2, A1, and B1. The SRES scenarios, A1 which is highlighted as the business-as-usual scenario corresponds to the highest emissions, and B1 corresponds to the lowest. The remaining scenarios are intermediate;importantly for agriculture and food supply SRES A2 assumes the highest projected population growth by the United Nations and is associated to the highest food demand. Depending on the SRES emission scenario and climate models, global mean surface temperature is projected to rise in a range from $1.8^0$c to $2.9^0$c with a range from $1.1^0$c for SRES B1, to $4.0^0$c with a range from $2.4^0$c to $6.4^0$c for A1 by 2100( Dafe, 2007). Medugu, (2009) in a daily trust news paper property and environment column presentation observed that Nigeria is one of the countries expected to be affected by the impact of climate change through sea level rise along her coastal regions, intensified desertification, erosion and flooding disasters and general land degradation which is threatening Nigeria food security.

## Impact of climate change as Constraints to food security

Climate change refers to 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. Climate change has the potential of affecting all natural and human systems which may be threat to human development and survival socially, politically and economically. Nigeria has a variety of ecosystems ranging from mangroves and rainforests in the south to savannah in the north bordering the Sahara. Here, middle belt is entrapped in between. Whether dry or wet, these ecosystems are being battered by global warming. While excessive flooding during the past decade has hurt farming in coastal communities and desertification in the Sahel has been blamed on overgrazing practices of the local population. It is been discovered that the real problem of climate change is that rainfall in the Sahel has been declining steadily since the 1960's. The result has been the loss of farmlands and conflicts between the farmers and herdsmen over ever decreasing grazing land. Many different communities, including fishermen, farmers, and herdsmen are now confronted with difficulties arising from climatic changes. Peoples' livelihoods are being harmed and people who are already poor are becoming even more impoverished. Climate refugees are being created as changes make some land unlivable and affect water supplies.

Food production through agricultural practice in Nigeria wetland is predominately rain-fed, whereby as the rainfall decline northward, people tend to adopt irrigation method especially along the river banks, middle belt of Nigeria thereforebecome vulnerable to the impact of climate change as it led to decline in the volume of river waters. The intermittent occurrence of droughts has tended to accelerate desertification particularly in the upper northern areas of Nigeria, endangering human and livestock population and rendering large tracts of land unusable Bukar, (1997). Due to this, desert encroachment on agricultural land is currently being addressed through a national afforestation program in Sokoto, Kebbi, Katsina, Kano, Jigawa, Borno and Yobe states which are sharing boundary with the middle belt states.

Middle belt of Nigeria is faced with the problem of rapid deforestation of the tropical forests for fuel wood and logging, shifting cultivation, land clearing for expansion of agricultural area, and overgrazing. Deforestation enhances water run-off, resulting in erosion, and exposing large tracts of land to direct solar radiation thereby reducing its productive capacity sharply. Forest area in the middle belt of Nigeria declined by 30% between

1980 and 1990 which continues at an estimated rate of 2.7% per annum, far outpacing the rate of afforestation (ODA, 1994).

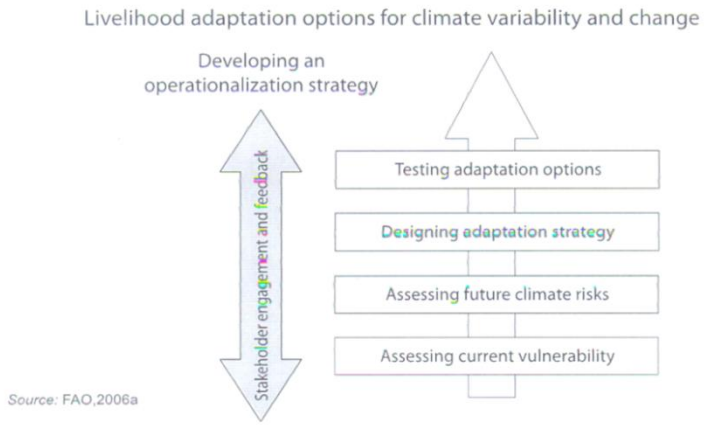
**Uncertainty on the availability, accessibility and utilization of foodunder Climate change;**

FAO argued that risk do exist when there is uncertainty about the future outcomes ofongoing processes. They are of opinion that average of 500 weather-related disaster are now taking place each year, compared to 120 in the 1980s; the number of floods has increased six ford over the same period (Oxfam, 2007). Population increases especially within the middle belt where people are migrating to due to desert encroachment to the northern part of the county like, Katsina, Maiduguri, and Sokoto etc. Although there is still a lack of reliable information about how future changes in temperature and precipitation regimes will affect specific locations, further scientific work on agriculture can reduce uncertainties exposed by the climate change.

Food availability is often determined by the physical quantities of food that are produced, stored, processed, distributed and exchanged. FAO calculates national food balance that include all elements thereby seeing it as the net amount remaining after production, stocks and imports have been summed and exports deduced for each item of food. On this ground, adequacy is assessed through comparison of available estimated consumption requirement.

Food accessibility is a measure to secure entitlements defined as set of resources including legal, political, economic and social accessibility required by an individual to obtain access to food (FAO, 2003). Devereux and Maxwell, (2001) noted that until 1970s food security was linked to national food production and global trade, but since then the concept has expanded to include households and individuals access to food. Adequate supply ensures that a person first have access to food through his entitlements to obtain and consume the food. Obviously, the entitlements that determine people's access to food depend on allocation mechanisms, affordability, and cultural and personal preference for particular food products. Increased risk exposure resulting from climate change tends to reduce people's access to entitlements and undermine their food security.

Food utilization is the use of food and how the person is able to secure essential nutrients from the food consumed. These includes nutritional values of diet, its composition and methods of preparation which includes the social values of foods, that dictate what kinds of food should be served and quality and safety of the food supply. Climatic conditions are likely to bring both negative and positive changes in dietary patterns and new challenges for food safety. On the other hand food system stability is determined by the temporal availability of and access to food. In long-distance food chains, storage, processing, distribution and marketing processes contain in-built mechanisms that have protected the global food system from instability in recent times.




The base of livelihood adaptation options for Climate variability and change can be observed through an operationalization strategy as identified by FAO,2007.

**The use of Fertilizers and other Agro-chemicals resulting to deterioration of food crop products.**

The application of fertilizer, herbicide and pesticide had been the source of high yielding of farm crops fordecades in this region. Without the use of fertilizers, many farm lands would have gone out of cultivation for lack of fertilizer due to soil exhaustion resulting from over cultivation or improper management (Adinna,2001).

A large number of people would have gone out of farming because it would have become uneconomical to engage in farming. The use of fertilizer is widely accepted to boost the growth of farm crops within the period of crop growth as reported by FAO not only because it enhance yield directly but because it helps condition the soil and encourages vegetal cover of crops within a short period of the raining season. The last adds humus to the soil and increases protection against erosion and high rate of evapo-transpiration resulting from climate uncertainty. It therefore increases soil moisture content and retention. If fertilizers, herbicides and pesticides are known to be wisely used by man most of the time , problems from its use would not have arisen. Unfortunately, human failures in this direction exposes man and his environment to serious hazards ( Adinna, 2001).

Food Poisoning has been noted from the inefficient use of fertilizer, pesticide and herbicide resulting in the retention of these either in the soil or in the crops. From these media, they are passed unto man who is then adversely affected by eating vegetables or tubers which are over-fed with water contaminated with $NO_3$ ( Olembo, et al.1990). Olembo (1990) argued that excessive use of farm chemicals seriously affects crop growth by storing in the grains, stems or plant leaves certain chemicals from fertilizers that are not fully utilized. Field experienced shows that when tubers are over fertilized, the yield is heavy but too much water content in tubers like yam affects the storage potential and taste. Cassava when affected do not yield high garri ratio or even starch for laundry. Grains do lose their quality for weevil defense. Olembo (1990), holds that in sugar plants,

- Excessive application of agro-chemical is responsible for low sugar content of sugar beets due to excessive nitrogen and nutritional disorders involving remnants of zinc from phosphate fertilizers.
- Seedlings are damaged by oxidizing fertilizer salts when they are applied too close to the shoots.
- Nitrogen increases/promotes soil acidity and induces aluminum and manganese toxicities especially when a remediation is not applied. Excess Nitrogen reduces irreversibly, the quality of grains like wheat reducing the protein content even when refertilization is done ( Fangmeter et al., (1997).
- Excessive use of fertilizer which increases the water content of vegetables attracts pests and other plant diseases particularly when nitrogen fertilizer is involved and also when there are dry spells which affect vegetation growth.

Marrington, et al.,(1997) show that when soils are treated with chemicals containing plant pest, specially aphids, absorb these substances. Consequently, excess addition of fertilizer minerals to the soil inhibit the survival of the organisms. Worms in the soils are known to avoid soils with high content of anhydrous ammonia. This chemical causes irritation in living organisms as on human skins when applying the fertilizer. Although theextent of effect in the soil is limited, worms and other related organisms in plants are highly security conscious. Heave use of nitrogen fertilizers adversely affect the process of symbiosis between organisms like nitrogen fixing bacteria and the soil itself. This defect, adversely affects the growth of nitrogen consuming crops like peas and some cover crops.

This is evident that when artificial fertilization of the soil for environmental sustenance takes place due to climatic uncertainty, natural soil processes are retarded. This is why fields fed with artificial fertilizers show obvious signs of better conditions and yield. However, at a distant future, soils that received natural treatment sustain more reliably baring poor management. Forth (1978) has argued that some of these pesticides such as DDT cannot be fully broken down and assimilated by the soil organisms because DDT as a synthetic product has a different structure from the similar soil organism. For instance, while the soil organism has $CH_2COOH$ with three CL is incompatible with that of the soil and so pesticides that resist degradation, and the remnants of DDT that remain in the soil become pollutant after a long time.

Soil as a living filter can absorb effluent from city and filter it into the ground water for reuse. When population increases, the breakdown of effluent into water and plant food is nolonger complete. Hence the sea weeds increase. More oxygen is needed to carry away the weeds and the effluents remain the same. To increase the problem, water consumption in cities increases and by implication, the ground water is depleted. As a result of the increases in the human and animal population, the soil and ground water can no longer perform their function of disposing the effluents loaded unto them.

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