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Agricultural Production and Climate Change: Need for Proper Extension Policy Formulation in Nigeria

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Abstract

Changes in climate are expected to have significant impacts on farm yields and product quality as a result of changes in temperature, moisture, air and soil. This paper reviews the effects of climate change on agricultural production and the need for extension policy formulation. The paper further dwelt on the need for sound agricultural policy but observed that much cannot be achieved in that direction without efficient and effective extension system. It recommends a well articulated and comprehensive agricultural extension policy which will address properly the issue of climate change and its mitigations/adaptation.

Keywords: Climate, Climate Change, Agricultural Productivity, Agricultural Policy, Extension Policy

1.0 Introduction

In recent years, discussions about climate change have been invigorated by many individuals and organizations throughout the world. This has resulted to many definitions of climate change by different experts. For example, Ozor (2009) defined climate change as change in climate (i.e. average weather condition) over time, whether due to national variability or as a result of human activities and is widely recognized as the most serious environmental threat facing our planet today. Intergovernmental panel on climate change (IPCC 2007) defined climate change as statistically significant variations in climate that persist for an extended period typically decades or longer. It includes shifts in the frequency and magnitude of sporadic weather events as well as slow continuous rise in global mean surface temperature. Climate change therefore can be precisely defined as all changes in climate due to human activities or natural variations. Climate change manifests itself in a number of ways. These include: changes in average climatic conditions which makes some regions to become drier or wetter on average, changes in climate variability which shows that rainfall events may become more erratic in some regions, changes in the frequency and magnitude of extreme weather events and changes in sea levels.

According to Eboh (2009) climate changes have three major causes namely; astronomical causes, volcanic eruptions and human socio-economicactivities, which lead to a build up of Carbon monoxide (CO), Methane (CH_4), Sulphur (iv) oxide (SO_2), etc. These gases are capable of absorbing terrestrial radiation from earth, re-radiating the heat back to earth, thereby leading to a general increase in temperature known as global warming. Experts generally believed that human activities are the main causes of changes in climate and that this comes in three major ways namely burning of fossil fuels, deforestation and growing world population.

Critical statistics of relevance to climate change show that the vulnerability of Nigeria to the threat of climate change is not just in the area of agriculture but almost in all sectors of development. Nigeria has to contend with the various environmental problems particularly desert encroachment from the north and coastal inundation (due to rising sea levels) from the south (Agwu, 2008). According to oneworld.net (2010), eleven out of the thirty-six states in the country referred to as the frontline states are gradually being swallowed up by desertification, the Sahara is advancing at an estimated rate of 600 meters per annum and over 55 million people in ten northern states could be affected.

Sea level rise is slowly eating away the coastal states; the Niger Delta may be the source of wealth but its

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low-lying terrain crisscrossed with waterways makes it extremely vulnerable to flooding; the protective mangroves of this coastlines has been largely lost to human intervention; half of the 15 million population of the city of Lagos lives less than six feet above sea level, including the wealthiest area of Victoria Island. In line with this, Agwu(2008) stated that by 1985, deforestation claimed 1,544sq miles of the nation's forest land while between 1983 and 1993 alone, Nigeria lost 20 percent of its forest and woodland areas; in northern Nigeria, especially the Sudan Saharan region, where desertification is a key environmental problem, drought have been reoccurring for the past three decades (IRIN,2005) thereby affecting food security and increasing cardio-respiratory health issues resulting from the increasing dust pollution.

1.1 Agricultural Productivity to Climate Change

The devastating consequences of climate change are most likely to be felt by rural dwellers whose livelihood are mainly land and weather dependent. Eboh (2009) noted that countries in Sub-Saharan Africa including Nigeria are likely to suffer the most in issues of climate change because of their greater reliance on climate sensitive renewable natural resources sectors like agriculture. The impacts of climate change on agriculture are projected to manifest through changes in land and weather regimes, specifically, changes in the frequency and intensity of droughts, flooding, water shortage, worsening soil conditions, desertification, disease and pest outbreaks on crops and livestock. Ozor (2009) pointed out that the nature of agricultural activities in developing countries like Nigeria, are still weather/climate dependent thus the onset of rains for instance signals the beginning of crop production activities and given that Agriculture in Nigeria is largely non mechanized, weather/climate assumes significance in every phase including the timing of cultivation, planting/harvesting operations, variety selection and transplanting. Farmers have therefore learnt to follow the weather/climate pattern as a major determinant for their farming operations. Unfortunately, the weather/climate conditions are no longer the same as it used to be. Farmers have been misled and often threatened by the uncertainties in rainfall pattern, temperature increase, sea level rises, prolonged drought, desert encroachment, flooding, erosion, crop and livestock failures, low productivity, pest and diseases etc. The sensitivity of agricultural productivity to climate change is obvious. This is because climate plays a dominant role in agriculture having a direct impact on the productivity of physical production factors, example the soil's moisture and fertility. Adverse climate effects can influence farming outputs at any stage from cultivation through the final harvest. Even if there is sufficient rain, its irregularities can affect yield adversely if rains fail to arrive during the crucial growing stages of the crops (Mowa and Lambi, 2006; Rudolf and Hermann, 2009). Globally, extreme weather is predicted to become more common and animals, plants and crops are all expected to be boldly affected. The effect of climate change is thus expected not to stop at just affecting the crops, plants and animals but will equally affect the lives of the farmers as well as the development of countries. The effects of climate change can be more explicitly identified using the Third Assessment Repot of the IPCC in 2001 which identifies a range of poverty-related climate change impacts as follows

- Reduction in crop yield due to decreased water availability, and new or changed insect-pest incidence thus fall in agricultural productivity of up to 30 percent over the 21st century are projected (Richards, 2003). This is also true because many rain fed crops are near their maximum temperature tolerance, so that yields are likely to fall sharply for even a small climate change.
- Such changes would have a major impact on food security, employment, incomes and economic growth thus reduction in crop yields can be expected to lead to localized food price rises.
- Huge displacement of people from coastal and densely populated low-lying areas and inundation would also result in salinization of these fertile areas.
- Exposure of millions of people to new health risks and malnutrition from the reduction in cropyields would increase the severity of diseases.

NEST (2004) summarized the impacts of climate change as follows

- Rise in sea level and the corresponding flood which destroys farm-lands, Dams and homes.

- Increased incidence and severity of extreme weather leading to scorching heat of the sun on humans and animals.
- Rising temperature also intensifies storms, floods, and droughts and fosters the spread of diseases by enabling mosquitoes, tick and other disease-carrying organisms including fungi to spread further in the field.
- Change in precipitation level leading to increased droughts, desertification and flood
    - Created a significant loss of food security
    - Vanishing of coastlands
    - Human displacement
    - Depletion of natural resources
    - Lack of clean and accessible water
    - Animal migration, pest management issues, diseases and other health issues and
    - Loss of cultural practices and traditional way of life, economic downturns, energy crises etc.

2.0 Sensitivity of Major Sectors of Agricultural Production to Climate Change

2.1 Crop Production

As temperature increases and rainfall pattern becomes unpredictable, crop yields are expected to drop significantly especially in sub-Saharan countries like Nigeria where Agricultural production is still dependent on rainfall. Also extreme weather events such as thunderstorms, heavy winds and flood devastate farmland and can lead to crop failure. Pests and diseases migrate in response to climate changes and variations. It is estimated that by 2100, Nigeria and other West African countries are likely to have agricultural losses of up to 4% of GDP due to climate change (Eboh2009). Parts of the countries that experienced soil erosion and operate rain-fed agriculture could have decline in agriculture yield of up to 50% between 2000 to 2020 due to increasing impact of climate change (IPCC 2007).

Mowa and Lambi (2006) and Rudolf and Hermann (2009) stated that even if there is sufficient rain, its irregularity can affect yields adversely if rain fail to arrive during the crucial growing stage of the crops.

Also, extreme weather leads to drying up of streams which are sources of drinking water in rural areas as well as irrigation water used by farmers during dry season crop production. Anyanwu (2008) in studying the farmer's perception of impact in climate changes on food crop production in Ogbomosho Agricultural zone of Oyo State, identified the significant effect of climate change on crop production as; low yield of crop, stunted growth of crop, ease spread of pest and diseases attack on crops, drying of seedling after germination and ineffectiveness of agricultural chemicals due to delay of rainfall. This agrees with the statement of Ozor (2009) that variations in rainfall pattern will affect crop production in varying ways depending on the location. He also went further to explain that changes in crop development and phonology as a result of climate change can cause shortening or lengthening of crop cycles that could lead to decrease or increase in productivity. Structural changes he said especially in carbohydrate status of plant can also occur. These changes when they occur will surely affect the nutritional value, taste and storage quality of some fruits and vegetables. Also increase in CO_2 can also lower crop water requirement by reducing transpiration per unit leaf area.

2.2 Livestock Production

Ozor (2009) stated that livestock production system in Nigeria would be vulnerable to climate change in respect of anticipated decrease in rainfall in the Sudan-sahelian zone and consequent reduction in the available pastureland. This he explained further by listing the various ways the anticipated decrease in rainfall will affect livestock as declining availability of surface water resources for animals, possible increase in salinity at watering point due to increase in temperature and evaporation in the face of reduced rainfall.

This is to say that further changes in rainfall and temperature will affect livestock production as well as availability of animal species. Some species might be unable to adapt quickly enough and habitat might not be available for them to move into. If global temperature rises by 2 degrees Celsius, 30 percent of all land living species might be threatened by an increase risk of extinction. This is supported by the findings of Issa (2009) which reported that commercial livestock producers are negatively affected by changing climate. Though increase in

temperature is generally seen to be destructive to the production of crops and human lives, it is worthy to note that livestock production could be boosted by temperature increase. This is to say that varying climate has varying effects on crops and livestock depending on the ecological location.

2.3 Fisheries

Fish farming and associated processes are becoming an important source of revenue and employment in Nigeria. Ozor (2009) stated that subtle changes in key environment variables such as temperature, salinity, wind speed and direction, ocean currents, strength of upwelling due to climate change sharply alter the abundance, distribution and availability of fish production in the country it is clear that changes in ocean dynamics could lead to changes in migrating pattern of fish and possibly reduced fish landings especially in coastal fisheries. All these will directly and indirectly affect the livelihood of fish farmers, their immediate families and their dependants. It will also affect the revenue sustenance of those who work or trade on fishery resources. Agwu (2008) noted three major pathways through which climate change will affect fisheries and aquaculture, as well as dependent communities and their economic activities as;

- Physical and climate changes in oceans and fresh waters, including increase in water temperature and changes in salinity among others.
- Changes in fish production, catch composition and species distribution resulting from a complex interplay of ecological changes and
- Physical changes to coasts, estuaries, wetlands, lakes and rivers caused by changing weather patterns, weather-driven natural disasters and sea-level rise. Fishery resources are known to be highly sensitive to marine environmental changes. Though they had always coped with these changes, future climate change will likely be so extreme that it may be difficult for them to cope with. Therefore, identification of proper adaptation strategies is a high priority for the fishery sector.

2.4 Forestry

The forest reserves of the nation are not left out in the threat posed by climate change. Eboh (2009) stated that climate change will affect agriculture and forestry through high temperature, elevated CO_2 concentration, precipitation changes, increased weeds, pests and disease pressure, and increase vulnerability of organic carbon pools. It is worthy to note that eleven out of the thirty-six states in the country referred to as the frontline states are gradually being swallowed up by desertification. As at 1985, deforestation claimed 1,544sq miles of the nation's forest land. Between 1983 and 1993 alone, Nigeria lost 20% of its forest and woodland areas. Nigeria's primary tropical forest in Cross River State has been decimated by 97% mostly since 1990 (Oneworld.net, 2010). The country's broader forest was estimated at just over 12% in 2005, being depleted at a rate of 3.3% per annum. The main cause is the demand for wood fuel. This depletion of the nation's forest reserves when critically looked at is not far from indirect effect of climate change. As a result of drying up of villages or communities forest which the dwellers depend on for firewood, they resort to the depletion of forest reserves as a means of getting wood fuel.

3.0 Need for Proper Extension Policy on Climate Change

Extension is too often merely seen as a vehicle for spreading scientific and technical progress and technology transfer. This is however a narrow and highly unsatisfactory definition. The dissemination of knowledge is not a one way street from scientists to producers. Farmers own knowledge must be collected and then disseminated. Farmers need more than just technical information. There is rarely a "one size fits all" solution to address the mix of technical, economic, commercial, social and environmental aspects that farming problems consist of. Farmers need information on many fundamentals include climate change but simply making information more readily available is not enough to ensure that it is used effectively. The Nigeria agricultural policy provided the framework for implementation of programmes and guidelines for agricultural development. The main objective was to attain self-sustaining growth in all the sub-sectors of agriculture and realization of the structural transformation relevant to overall socio-economic development of rural area (FMARD, 2000). This was expanded in

the revised policy to include promoting farmer friendly agricultural policy that achieves food security, eradicates poverty, develops the rural economy and protects the environment (FMARD, 2000). The objectives and strategies to achieve these agricultural policies emphasize the importance of agricultural extension to the goal attainment of the agricultural sector. To achieve increased production and improved processing in the sub-sectors of agriculture (crop, livestock, fisheries and agro-forestry), improvement of quality of life and production of environment friendly products and other objectives including the issue of climate change require extension effort. No doubt, agricultural extension brings about changes, through education and communication in farmers' attitude, knowledge and skills. The role of agricultural extension involves dissemination of information, building capacity of farmers though use of a variety of communication methods help farmers make informed decisions. Sinkaye, (2005) equates help in extension to empowering all members of the farm households to ensure holistic development. The Nigerian extension service is bedeviled by several problems which according to Agbamu, (2005) include:

- Inadequacy and instability of funding
- Poor logistic support for field staff
- Use of poorly trained personnel at local level
- Ineffective agric research extension linkage and instability of National agricultural extension systems among others.

Agricultural Extension was addressed under support services in the agricultural policy under the heading "Agricultural Technology Development and Transfer" and the aim was to teach rural people to raise their standard of living with minimum assistance and by their efforts. However, in this policy, the content is not explicit enough and vital issues were left out hence it will not be adequate to guide programme development system. The experience gained in the implementation of the policy over years and the recent trends in agricultural development world wide have necessitated the formulation of more focused sub-sectoral policies. The formulation and implementation of National agricultural extension policy as an instrument which will contribute to the attainment of National agricultural policy objective would be necessary considering the relevance of agricultural extension to the goal and objective of the agricultural policy. Government has responsibility for policy formulation, promulgation of regulations and initiation of programmes. The importance of agric extension policy was recognized long ago by FAO's Global consultation on agricultural extension (Swanson 1990, Contado 1997). The policy recommended among other things that all national governments develop and periodically review their agricultural extension policy and that the goal of extension policy must align with that of the agricultural policy. In the regards therefore, the need for proper extension policy formulation becomes very pertinent to achieve a well organized extension system for efficient and effective extension delivery in all aspects of sustainable agriculture and rural development towards the attainment of food security, poverty reduction, rural empowerment and environmental management such as occasioned by climate change. It is advised that extension will be provided on all aspects of agriculture and environment (crops, livestock, fisheries, agro-forestry, post harvest enterprises and sustainable agricultural practices) and cross cutting issues such as Nutrition and HIV/AIDS as well as Malaria prevention, environment friendly practices such as Integrated Pest Management (IPM) and Indigenous Knowledge Technologies (IKTs). Also to be of importance in he policy of extension as far as climate change is concerned include the awareness and education from the early stage the issue of climate change, the vulnerability of different clientele categories, gender, resource ownership to climate change, the possible mitigation and adaptation strategies to cope with the climate change. In essence, farmers' problems and needs will dictate extension agenda and local resources utilization with regard to climate change. Extension needs to go beyond technology transfer to developing skills and knowledge of farm families for sustainable agriculture and rural development. This calls for a paradigm shift from the Training and Visit (T&V) which involves emphasizing individual contact to more participatory approach. Extension policies should therefore adopt group approach to ensure that more farmers will be reached and all gender categories could be catered for through participatory approach. Policy on climate change should emphasize variety of extension methods to be used. Selection and use of appropriate methods to meet specific extension objectives with various categories of farmers will be necessary. They

include individual farm and home visits for follow up, group methods: demonstrations to farmers groups, field days, mass media to create awareness and reach large population at a time, farmers training, participatory methods, farmers field schools, focus group discussion etc. Also to be recognized is the decentralization of extension to the lower tiers of government as stated in Nigeria's agricultural policy. This will aid planning, implementation, monitoring and evaluation of extension programmes at the local levels. Example, if local governments (LGs) take responsibility for extension as the closest to the grass root, farmers' needs could be better met because the staff will be localized, conversant with needs of farmers and would be able to facilitate extension activities more effectively. Every activity should reflect local needs e.g training and mass media messages, and material should be locally produced. It is also necessary in terms of production e.g. Fisheries resources, potential for FADAMA, forestry/tree crops, arable, livestock or even environmental degradation/hazards which might require control measures e.g. flooding, erosion, soil infertility, water pollution. This will thus ensure effective resource utilization, conservation and adequate sustenance of the environment.

4.0 Conclusion and Recommendation

Climate no doubt can not be static. The weather changes from day to day so also does the climate change from year to year. However, a situation in which a change in climate continues in one direction at a rapid rate and for an unusual long period of time constitutes climate change. Climate change will have wide-ranging effects on the environment and on socio-economic and related sectors including water resources, agriculture, food security, human health, terrestrial ecosystem biodiversity etc. changes in rainfall pattern are likely to lead to severe water shortages and/or flooding. Melting of glaciers can cause flooding and soil erosion. Rising temperature will cause shift in crop growing seasons which affects food security and changes in the distribution of disease vectors putting more people at risk from the diseases such as malaria and dengue fever. Temperature increases will potentially severely increase rates of extinction for many habitats and species. These effects of climate change need not be taken for granted thus the need for proper extension involvement. Considering the fact that extension is closer to the rural people and available to all classes of clientele, incorporating faces of climate changes, the adaptation and mitigation to the coping and living with climate change makes it necessary for this paper. A sound agricultural policy is indispensable. This paper suggests the need for a national agricultural extension policy, a well organized extension system for efficient and effective extension delivery in all aspects of sustainable agric and rural development. It is also recommended that a committee on extension policy must take seriously into consideration the issue of climate change and try to make extension agenda farmer driven and participatory. Also recommended is the decentralization of Nigerian agricultural extension system and its efficient co-ordination at various levels to ensure effectiveness and sustainability. The paper further recommends among others

- The need for facilitating attitudinal change among key stakeholders in the agricultural sector
- The importance of raising awareness and training for early career researchers on climate change
- The fact that climate change adaptation strategies need to be location specific
- The need for facilitating exchange of climate change information throug appropriate combination of media.

Finally, highlights the importance of addressing climate change challenges in farming system in Nigeria and presents the policy implications and issues for policy action for addressing climate change in Nigeria.

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