

INTRODUCTION

1.1 Background of the Study:

Nigeria is ranked as one of the world's most vulnerable countries to the adverse effects of climate variability (World Bank 2010). Subsistence farmers suffer from climate variability related stresses in diverse ways. These include increased exposure to extreme climate variability events and conditions such as droughts, dry spells and floods. Given that agricultural production remains the main source of food and income for most rural communities, the increased risk of production failure associated with increased occurrence of extreme climate change condition poses a major threat to food security and poverty reduction. Adaptation of the agricultural sector to the adverse effects of climate variability is thus an important priority to protect and improve the livelihood of the farmers and to ensure food security (Bradshaw, Dolan, and Smith, 2004; Wang, Zerihum, and Feyen, 2009).

According to Egom (2006), the rural areas in Nigeria are characterized by poor social amenities, high poverty level, unplanned residential layout and other bottlenecks that impede farmers well being. Apart from these negative aspects, Okoye and Okpala (2010) opined that the rural area can be identified to have potentials such as better environmental quality, availability of prime lands, biodiversity, tourist site and indigenous or local knowledge.

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Farmers maintain closer ties with nature and their natural resources provide the base from which their basic needs are derived. For instance, a large part of the rural population depends on rain for agricultural activities (Tol, 2009). Agriculture is a climate dependent activity that places serious burden on the environment in the process of providing the teaming Nigeria population with food and fiber. The effect of climate on agriculture is related to variabilities in local climates rather than in global

climate patterns (Fraser, 2008).

Climatic variation is the mean state of climate on all temporal and spatial scales of weather event (Adger, Huq, Brown, Conway and Hulme, 2003). Climate variability is the resultant effect in the alterations of ecosystem structures to satisfy human land use and livelihood potentials of the human race. Effects of climate variation are physical, economic, social and cultural, endangering environmentally based livelihoods of the Nigeria population.

Adger, et al; (2003) posited that climate variability, poor infrastructure economic poverty, drought, excess rainfall, poor livestock health, reduced crop yields, low productivity and a range of other problems associated with climate variability will constitute important challenges for African countries in particular. The effect of climate variation is being felt by the whole population but, it will disproportionately affect vulnerable groups and vulnerable population (Lobell, Burke, Telbaldi, Manstranda, Fakon and Naylor, 2008). Africa's population in which Nigeria is a key player in terms of population size and market for agricultural produce domestically is very vulnerable to climatic and non-climatic changes, due to high level of poverty, conflicts and prevalence of diseases.

The unstable conditions of farming can thus, affect the overall productivity of farmers, make them avoid farming for sometime, produce at capacities below their best or have little gains for their efforts. Climate variation already poses significant impacts on the agricultural sector and there has been little commitment to make adaptation a national priority in the country. The drawbacks in adaptation are attributed to low and poor scientific development as most development innovations are not built on indigenous knowledge of farmers to provide for sustainability of new practices. Conspicuously, the associated impacts of climate variation are predominantly negative, with the most severe impacts being experienced in vulnerable communities made up of the bulk of Nigerian farmers practicing farming at subsistent levels, where capacity to adapt is very weak.

Climate variability have direct impacts that causes vulnerability to the natural and social systems through changes in average temperatures, temperature extremes and extreme weather events like flooding and droughts. Adaptation is the adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, with moderated harm or exploits beneficial opportunities (United Nations Framework Convention on Climate Change (UNFCCC) (2007).

The rural farmers, to a large extent have been able to develop their livelihood strategies in a way that enables them to constantly cope and adapt to the changing climatic conditions, pest attack and agricultural policies in the country. Farmers' ability to adapt to impacts of climate variation depends on factors such as wealth, technology, education, information, infrastructure, access to resources and management abilities. There is need to gain as much information as possible and learn the positions of the rural farmers and their needs about what they know and climate variation and change in order to offer adaptation practices that meet their needs (Lobell et al, 2008).

Effects of climate variabilities on agriculture are different and diverse depending on many factors such as time, location and response strategies (mitigation and adaptation) put in place. Changes in crop development and phenology for instance can cause shortening or lengthening of crop cycles that could lead to decrease or increase in productivity (Nicholas and Nnaji, (2010). They further maintained that structural changes, especially in carbohydrate status of plant can also occur. This may affect the nutritive value, taste and storage, quality of some fruits and vegetables. For instance, significant reduction of rainfall in the Sudan Sahel belt would make the region drier, with consequent reduction in crop productivity. Decrease rainfall in the region would also reduce the primary productivity of the grass-land areas in which livestock production is currently important.

Adaptations are adjustments or interventions, which take place in order to manage the losses or take advantage of the opportunities presented by changing climate (IPCC,

2001a). Nhemachena and Hassan (2007) reported adaptation as the process of improving society's ability to cope with changes in climate conditions across time scale, from short term (e.g seasonal to annual) to the long term (e.g decades to centuries). The IPCC (2001b) defines adaptive capacity as the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. Also, adaptation measure helps farmers guard against losses due to increasing temperature and decreasing precipitation (Hassan and Nhemachena, 2008).

Adaptation and mitigation can both be used to reduce the negative impacts of climate change. Mitigation refers to reducing climate change by reducing the GHG emissions (IPCC, 2001a). Although mitigation targets uprooting the major causes of climate variability and offers long-run solutions while adaptation is much more important for the group of developing countries. Fusel (2007) opined that emphasis should be focused on adaptation because human activities have already affected. Climate, climate variability continues given past trends, and the effect of emission reductions will take several decades before showing results, and adaptation can be undertaken at the local or national level as it depends less on the actions of others.

The goals of an adaptation measure should be to increase the capacity of a system to survive external shocks or change. The assessment of farm-level adoption of adaptation strategies is important to provide information that can be used to formulate policies that enhance adaptation as a tool for managing a variety of risks associated with climate change in agriculture (Nhemachena and Hassan, 2007). It should be known that adaptation to climate change requires that farmers first notice that the climate has changed and then identify useful adaptations and implement them (Maddison, 2006).

There are different ways of adapting to climate change in agriculture (Fatunase and Ajibefun, 2013) and many agricultural adaptation options have been suggested in the

literature (Gbetibouo, 2009). Moreover, different factors affect the use of any of these adaptation methods (Nhemachena and Hassan, 2007) Bradshaw et al, (2004) reported that crop diversification, mixed crop-livestock farming systems, using different crop varieties, changing planting and harvesting dates, and mixing less productive, drought-resistant varieties and high-yield water sensitive crops are important adaptation options in the agricultural sector. Again, Hassan and Nhemachena (2008) also showed that better access to markets, extension and credit services, technology, farm assets (labour, land and capital) and information about adaptation to climate variability, including technological development to climate and institutional methods, affect adaptation to change in Africa. Adaptations encompass a wide range of scales (local, regional, global), actors (farmers, firms, government), and types:

- Micro-level options, such as crop diversification and altering the timing of operations;

- Market responses, such as income diversification and credit scheme;

- Institutional changes, mainly government responses, such as removal-preserve subsidies and improvement in agricultural markets and;

- Technological developments-the development and promotion of new crop varieties and advances in water management technique (Smith and Skinner, 2002) .

Agricultural adaptation involves two types of modifications in production systems (Nhemachena and Hassan, 2007). The first is increased diversification that involves engaging in production activities that are drought tolerant and or resistant to temperature stresses as well as activities that make efficient use and take full advantage of the prevailing water and temperature conditions, among other factors. Crop diversification can serve as insurance against rainfall variability as different crops are affected differently by climate events (Obrien and Erikson, 2007; Adger et al., 2003). The second strategy focuses on crop management practices geared towards ensuring that critical crop growth stages do not coincide with very harsh climatic conditions such as mid-season droughts. Crop management practices that can be used include modifying the length of the growing period and changing planting and

harvesting dates (Obrien and Eriksen, 2007).

Several recent climate change impact modeling studies have incorporated adaptation (Nhemachena and Hassan, 2007). They include coastal zones; and timber which were all cited in Fatuase, 2013. These studies showed the importance of adaptation measures in substantially decreasing potentially adverse impacts of climate change and in strengthening the benefits associated with changes in climate IPCC, 2001b and Nhemachena and Hassan, 2007).

Rosenzweig and Solecki (2010) showed that there is great potential to increase food production under climate change in many regions of the world if adaptation is taken into consideration. In another study, Dawning (1991) showed that adaptation has the potential to reduce food deficits in African from 50 to 20 percent.

Therefore, this study will go a long way to opine adaptation strategies and the rate of utilizing them by rural farmers in the study area to combat the effects of climate variability and as well proffer policy recommendations of relevance to crop production in the agricultural zone and the nation at large, on how to boost food production vis-à-vis food security.

According to IPCC, (2007) Climate Variability refers to variations in the mean state and other statistics (such as standard deviations, statistics of extremes, etc) of the climate on all temporal and spatial scales beyond that of individual weather events. Change in climatic condition may be due to natural or anthropogenic external forcing (external variability). Adaptation strategies are the various ways in which a region or a sector responds to climatic changes for their survival through either autonomous or planned adjustment (Ibid, Campbell, 2008). Coping strategies are the actual responses to crises on livelihood system in the face of unwelcome situations and are considered as short-term responses (Nigatel Regassa 2011).

The causes of climate change has also been listed to include;

The Convergence Zone: This is a band of heavy rainfall over given area extending from near the Solomon Islands to East of the cooks islands (IPCC, 2007). It is the

strongest in the Southern hemisphere wet season. The ICZ (International Convergence Zone) stretches across the Pacific just North of the equator and is strongest in the Northern Hemisphere wet season.

The Monsoon occurrence arrival is driven by larger difference in temperature between the land and the ocean. It moves north to mainland Asia during the Northern hemisphere summer. (IPCC, 2007) The seasonal arrival of the Monsoon usually brings a switch from very dry to very wet conditions.

A household comprises a number of persons living together under one decision-maker who provides for all the members. In the study area, a household was found to be made up of either a man (with or without a spouse) or woman (with or without a spouse) as the head, children and or relations staying together, usually in the same building or apartment with the head providing for the needs of all the members in terms of food, education and other welfare needs. In some cases there are single person households-made up only one person – man or woman. The determination of climate variability adaptation among the male and female is considered an appropriate response to climate variability, especially for the small-holder farmers.

However, according to Nabikolo et al (2012), the response decisions and actions of male and female farmers may be influenced by various factors and that both male and female farmers are climate variability conscious and responsive; and this adds a gender dimension Nabikolo et al (2012), further pointed out that the ability of forest to provide essential services such as clean drinking water, outdoor recreation and quality wildlife habitat, in the face of harsh climatic conditions soon will change, especially as population grows, and, the demand for these services increase. The most rapidly visible and significant short term effects on the ecosystem will be caused by fire, insects, invasive species, and combination of multiple stressors, often occurring with increased frequency and severity. Although some regions will be affected more than others, these disturbances are likely to change the structure and functions of ecosystem across millions of acres over a short period of time with detrimental effects

on forest resources.

Ozor (2009) noted indirect effects of climate variability on agriculture to include effects on pests and diseases and the impacts of these on agricultural production. Midolas (2009) explained that increase in the frequency of extreme events such as prolonged drought or intensified flooding could create conditions that could be conducive to disease or pest outbreaks and severely disrupt the predator-prey relationships that normally restrict the proliferation of pests. The implication of these scenarios for the attainment of the Millennium Development Goals (MDGs) is obvious, especially in developing countries like Nigeria where systems resilience is low.

Uncertainties in weather patterns, rainfall, drought and flooding events have meant that rural farmers who implement their regular annual farm business plan risks total crop/livestock failure due to climate change/variability effects. To alleviate this problem, the agricultural sector has been prioritized as the most critical under the current climate change/variability scenarios as it will have direct impacts on rural livelihood and also as agriculture is the mainstay of most African national economies. In addition to independence of many of the economies on rainfed agriculture, a consultation exercise carried out by the African Technology Policy Studies Network (ATPS) and the United Nations Environment Programme (UNEP) facilitated Global Adaptation Network (GAN) (2008) revealed that factors such as increased intensity, frequencies, prevalence and uncertain patterns of land degradation, pest and diseases, drought, flooding events, and most importantly low technical and innovation capacity to adapt to climate change variability are the most significant indicators of farmers ability to implement, create, alter and implement multiple integration and adaptation measures.

Example of adaptation measures or strategies include, using scarce water resources more efficiently, adapting building codes to future climatic condition and extreme weather events, building flood defences and raising the level of dykes developing drought tolerant crops; choosing tree species and forestry practices less vulnerable to

storms and fires, and setting aside land corridors to help species migrate.

1.2 Statement of the Problem

Climate variability affects both natural and social systems through incidences of weather extremes and inter-annual variations. In some farming seasons the ability of rural households to grow enough to feed themselves is hampered to a large extent by short rainy seasons with torrential down-pour (Food and Agriculture Organization, (FAO), 2010. Umoh, et al; (2014) noted that Akwa Ibom State and the entire Niger Delta region of Nigeria is vulnerable to adverse impact of climate variability and change. This is particularly so because of widespread poverty, inequitable land distribution, over dependence on rain-fed agriculture, low income and poor institutional capacity.

Apart from inter-seasonal and inter-annual variations in climate, the State is also vulnerable to extreme weather events such as floods, severe storm and rising seas levels which translate into loss of food crops, households' food insecurity, households' displacements, starvation and exacerbating conditions that would lead to conflict, war and misery for millions of persons (Umoh, et al 2014). In some communities of Akwa Ibom State, heavy and continuous rainfall exceeding the absorptive capacity of the soil and flow capacity of rivers and streams are common. Inhabited areas situated adjacent to these rivers and streams, are subject to recurring inundation rendering the area "flood prone" and exposing rural households to risk. All these lead to social disruption and dislocation of rural populations especially in coastal communities thereby making them more vulnerable to climate variability.

In most emerging phenomena and accompanying interventions, aspect of social vulnerability to studies either taken at national or State levels. Several studies relevant to climate variability focused mainly climate change are often given less attention and this explains why there are few social vulnerability on the hydro-meteorological aspect of vulnerability (Boer and Jones, 2008). Social vulnerability of man to climate change has been considered the least in the disaster literature and are woefully

underestimated due to difficulty in quantifying them and, this explains why social losses are normally absent in after-disaster cost/loss estimation report (White and Howe, 2012), In Nigeria rural farmers have been modified in agricultural practices in response to the altered conditions. The rural households' adaptation or coping strategies that have been developed overtime provide a foundation for designing effective adaptation strategies. Drought, diseases and pest epidemics, decreasing water sources, lack of pasture, bush fire, hailstorms, changes in crop flowering and fruiting times were the major climate related risks reported across the study area. Farmers use a wide range of agricultural technologies and strategies to cope or adapt with climate variability. Mulching, intercropping and planting of good security crops were among the most common practices used. Other strategies were water harvesting for domestic consumption, other soil and water conservation technologies and on-farm diversification.

Farmers often use a combination of these technologies and practices to enhance agricultural productivity. The average maximum temperatures increased across the study area. Also there is a stable trend in average annual rainfall. Farmers also reported variations in temperature. Farmers' adaptation strategies are integrated crop, livestock, fish, agroforestry and natural resource management options, technologies, practices and adequate and good access to information sources, traditional or rural knowledge. The wisdom, knowledge and practice of rural farmers gained over time through experience and orally passed on from generation to generation has over the years played a significant part in solving problems, including problems related to climate variability. Rural households that lived close to natural resources often observe the activities around them and are the first to identify and adapt to any changes. The appearance of certain birds, mating certain animals, and flowering of certain plants are all important signs of change in times and seasons that are well understood in rural knowledge systems. Rural households have used biodiversity as an alternative against variation, change and catastrophe, in the face of plague. If one crop fails,

another will survive (Safick and Byg, 2007).

In coping with risk due to excessive or low rainfall, drought and crop failure, some rural farmers grow different crops and varieties with different crops drought and floods and supplement these by hunting, fishing and gathering wild food plants. The diversity of crops and food resources is often matched by a similar diversity in location of fields as a safety measure to ensure that in the face of extreme weather ,some fields will survive to produce harvester crops.

1.3 Research Questions

What are the socio-economic characteristics of the respondents?

What are the respondents' knowledge about climate variability?

What are the climate variability adaptation strategies by farming households in the study area?

What are the constraints to climate variability adaptation strategies by the respondents?

1.4 General Objectives

The general objective of the study is to assess the adaptation strategies to climate variability by farming households in Akwa Ibom State, Nigeria.

1.5 Specific Objectives

The specific objective of the study were to;

examine the socio-economic characteristics of respondents in Akwa Ibom State.

determine the respondents' knowledge about climate variability.

ascertain climate variability adaptation strategies by farming households in the study area.

ascertain the constraints to climate variability adaptation strategies by the respondents.

1.6 Hypotheses of the Study

The following hypotheses were stated in null form:

Ho₁: There is no significant relationship between the respondents' knowledge about

climate variability and their level of climate variability adaptation strategies.

Ho2: There is no significant difference between males' level of climate variability adaptation strategies and females' level of climate variability adaptation strategies.

1.7 Significance of the Study

The result of the study would provide scientist, risk managers/policy makers, and environmental and agricultural stakeholders with the necessary and adequate information guide for policies formulation and programmes. The result will also help the Akwa Ibom State citizens especially farmers in the rural areas to be enlightened on how to adapt to climate variabilities. Agencies of the government in charge of climate change will understand ways of adapting to climate variabilities and thereby helping to enlighten farming households (farmers) on how to cope with climate variabilities. It will also help both the male and female farmers to interact and share knowledge on the levels of utilization of climate variability adaptation strategies.

1.8 Scope and Limitation of the Study

The study focuses on the aspects of the strategies of climate variability by farming households in Akwa Ibom State. It is concerned with the socio-economic, knowledge level, adaptation strategies and constraints that influence the farming households in the community.

1.9 Definition of Key Concepts

Socio Economic Characteristics of farming households investigated were age, marital status, educational status, primary occupation, monthly income, Housing standard, household headship and household size.

Age means the chronological age of the respondents.

For the variable marital status, respondents fell into any of the following categories: single, married, divorced/separated and widowed.

Educational status refers to the highest educational level attained by the respondents.

Primary occupation was categorized into farming, trading, crafting and salaried job

(government or private).

Household size refers to the number of person living under the same roof and

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