ENVIRONMENTAL IMPACT OF CLIMATE CHANGE ON AGRICULTURAL PRODUCTION IN EKITI STATE, NIGERIA

***Ogundele, J. A.**
Jegede, A. O.
Department of Geography and Planning Science
Faculty of the Social Sciences, University of Ado-Ekiti
Ado-Ekiti, Ekiti State, Nigeria.
**E-mail: joeogundele@yahoo.com,honj23@yahoo.com*

ABSTRACT

Climate change will impact agriculture and food production around the world due to; the effects of elevated Carbondioxide (CO_2) in the atmosphere, higher temperature, altered precipitation and transpiration regimes, increased frequency of extreme events, and modified weed, pest and pathogen pressure. Data for this study were collected from primary and secondary sources. Primary source of data were collected using two sets of structured questionnaires. A total number of three hundred (300) questionnaires were administered on two categories of respondents in this study. Results from this study revealed that Food Crops are the major crops cultivated in the study area, and the effects of climate change on agricultural production results to soil loss, plant nutrient loss, textural change, increase in pests and diseases and poor yield germination etc. This study therefore recommended that cover trees should be planted, which will provide shade and reduce heat, due to climate change and the preservation of underground water.
Keywords: *Agricultural Production, Climate-Change, Environmental Impact.*

INTRODUCTION

Climate change and agriculture are interrelated processes, both of which take place on a global scale (Jeremy, 2008). Environmental impact of agriculture varies based on the wide variety of agricultural practices employed around the world. Global warming is projected to have significant impacts on conditions affecting agriculture including temperature, precipitation and glacial run-off. These conditions determine the carrying capacity of the biosphere to produce enough food for the human population and domesticated animals (Marcoux, 2000). Rising levels of carbondioxide would also have effects, both detrimental and beneficial on crop yield. The overall effect of climate change on agriculture will depend on the balance of these effects. Assessment of the effects of global changes on agriculture might help to properly anticipate and adapt farming to maximize agricultural production.

United Nations Report (2010) states that agriculture has shown to produce significant effects on climate change, primarily through the production and release of greenhouse gases such as carbon dioxide, methane and nitrous oxide, but also by altering the earth's land cover, which can change its ability to absorb or reflect heat and light, thus contributing to radioactive forces. Land use change, such as deforestation and desertification, together with the use of fossil fuels are the major

anthropogenic sources of carbon dioxide, agriculture itself is the major contributor to increasing methane and nitrous oxide concentrations in earth's atmosphere (United Nations, 2010). The exponential population increase in recent decades has increased the practice of agricultural land conversion to meet demand for food, which in turn has increased the effects on the environment. The global population is still increasing and will eventually stabilize, as some critics doubt that food production, due to lower yields from global warming, can support the global population (United Nations, 2008). Environment as defined by Afolabi (2005) is itself, the point in which one is found at a time, the surroundings, the more distant places, other earth components, conditions, prospects and problems, which account for its flourishing or otherwise. In general, the environment provides all life support system in the air, water, on land and in the forests (Glasson et al., 1999). Environmental problems therefore manifest as a result of different activities of man to earn his living and his livelihood.

Climate change is used to describe a change in the climate, measured in terms of its statistical properties, e.g. the global mean surface temperature (Bade, 2007). Thus, climate change is taken to mean the average weather condition of a place. Climate can change over a period of time ranging from months to thousands or millions of years. The classical time period is 30 years, as defined by the world meteorological organization (2007). The climate change referred to may be due to natural causes, e.g. changes in the sun's output, or due to human activities, for example, changing the composition of the atmosphere (Albritton, 2001). Any human-induced changes in climate will occur against the "background" of natural climatic variations. The effects of the impacts of climate change may be physical, ecological, social or economic. Evidence of observed climate change includes the instrumental temperature record, rising sea levels, and decreased snow cover in the northern Hemisphere (Intergovernmental Panel on Climate Change, 2007).

According to the Intergovernmental Panel on climate change (IPCC, 2007), most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in human greenhouse gas concentrations. It is predicted that future climate changes will include further global warming (i.e., an upward trend in global mean temperature), sea level rise, and a probable increase in the frequency of some extreme weather events. Climate change will impact agriculture and food production around the world due to; the effects of elevated CO_2 in the atmosphere, higher temperature, altered precipitation and transpiration regimes, increased frequency of extreme events, and modified weed, pest and pathogen pressure (Easterling et al., 2007). In general, low-latitude areas are at most risk of having decreased crop yields (Schneider, et al., 2007).

So far, the effects of "regional climate change on agriculture have been relatively limited (Rosezweig, 2007). Changes in crop phenology provide important evidence of the response to recent regional climate change (Parry, 2007). Phenology is the study of natural phenomena that recur periodically, and how these phenomena relate to climate and seasonal changes (Parry, 2007). A significant advance in

Phenology has been observed for agriculture and forestry in large parts of the northern Hemisphere (Rosenzweig, 2007). In many quarters, including the United Nations Framework Convention on Climate Change (UNFCCC) are of the opinion that further intensification of industrial agriculture is proposed as a solution to the problems of climate change to which it has contributed in the first place, without the impact of agriculture on climate change being addressed (Grain, 2007). In the current negotiations for a new climate treaty that is supposed to follow the Kyoto protocol in 2012, agricultural practices are proposed as a means for climate change mitigation and as part of carbon trading. A particular focus of discussion is the storage of CO_2 and other forms of carbon in the soil (soil carbon sequestration) (Dusterling, 2007). One question to address at the beginning is, what Green House Gas (GHG) emissions from agriculture do we already have now? About 40% of the land is currently used as agricultural lands, i.e., cropland, managed grassland, permanent crops including agro-forestry (Stern, 2006). A third of the arable land is used for feed production. Over the last 40 years, 13 million hectare of land, including 6 million forest land were converted to agriculture annually, leading to depletion of soil matter and Green House Gas emissions from soil.

The concept of sustainable development is applied to this study. The concept was propounded by the World Commission on Environment and Development (WCED) in 1987. This concept noted that sustainable Development is a development that meets the needs of the present generation without compromising the ability of future generation to meet their own needs. Development involves the purposeful change of the inherently complex environmental systems. The natural system (Agricultural products) are commonly consumed and multi-purpose in their social and economic roles.

Consequently, the effects of climate change are often wide spread both geographically and socially (Birch, 2007). From the foregoing, it is crystal clear, that agricultural activities, environmental activities, environmental factors, including climate change, human needs and natural resources are independent. Thus, a system analysis or assessment of the total environmental climate and agricultural developmental activities, and the storage of food products should be part of the overall planning process. In making developmental decisions, efforts to maintain or improve environmental quality, sustainable agricultural production and food security should be given sufficient weight. This is the basis of the concept of sustainable development, an idea first proposed in the eighties by the World Commission on Environment and Development (Rilwani and Osayande, 2003).

In essence, Sustainable Development is a process of change, in which the exploitation of agricultural resources, the direction of agricultural production and investment, the orientation of technological storage facilities and climatic factor are all harmony and enhances both the present and future potentials (Agricultural Production and Climatic Factors) to meet human needs and aspirations (WCED, 1987). The environment is referred to as the complex physical, chemical and biological

factors/processes, which sustain life (Okorodudu-Fubara, 1998). The natural elements in the world both in the rural and urban environment, all have organic and inorganic realms. The inorganic realms are the atmosphere, the hydrosphere and the lithosphere (Oruwari, 2001). Akinbode (2002) states that the environment is the totality of the places and the surroundings in which we live, work and interact with other people in our cultural, religious, political and socio-economic activities for self fulfillment and the advancement of our communities, societies and nations. In general, the environment is the most precious asset that we own, share and use together with other people for mutual benefits and enhanced welfare of the society at large. Thus, environment refers to all the conditions and objects that surrounds man.

Shaffer et al (2009) observe that climate change characterized as global warming is heading to large scale irreversible effects at continental and global scales. The Intergovernmental Panel on Climate Change (IPCC) in (2007) reports that the effects of global warming will be mixed across regions, for smaller values of warming (of up to 3^{o}C or about 5^{o}F) changes are expected to produce net agricultural production benefits in some regions and net agricultural production cost for others. Smith (2001) states that climate change is seen as any long-term significant change in the "average weather" of a region of the earth as a whole. Oguntoyinbo (1978) observes that if agricultural production is to be increased in a meaningful way in Nigeria, then the farmers must show willingness and ability to respond to economic incentives (for example, higher prices of food) created in the urban of food deficit areas. Obibiaku (1998) notes that the growth rate of food production and supply in Nigeria is low, therefore calls for redoubling of efforts in continuous research in agricultural production and efficient extension services so as to ensure sustainable agricultural produce and supply. The major objective of this study is to examine the level of environmental impact of climate change on agricultural production in Ekiti State, Nigeria. The specific objectives include to:

i. Examine the problems which emanates from climate change on agricultural production in the study area.
ii. Investigate the causes of climate change and its attendant impacts on agricultural production in the study area.
iii. Recommend possible remedial measures on the environmental problems of climate change on agricultural production in the study area.

METHODOLOGY

Ekiti State is located between latitude 7^{o}30^{l} and 8^{o}15^{l} north of the equator and longitude 4^{o}47^{l} and 5^{o}40^{l} of the Greenwich Meridian. Ekiti State was created on the 1st of October, 1996 and the naming of Ado-Ekiti as her administrative headquarters has witnessed rapid population growth and urbanization. The estimated population figure of Ekiti State released by the National Population Commission (NPC) stood at 2,384,212 (National Population Commission (NPC), 2007). The relief of Ekiti State consists of undulating plains. The highest contour line of 540m above sea level is

found around the North eastern limit of the state. The rocks are dominated by the crystalline rocks, which form parts of the basement complex geology of the South-Western Nigeria. Ekiti State has a total annual rainfall of about 1400mm with a low co-efficient variation of about 30% during the rainfall peak months, and with an average of about 112 rainy days per annum (Adebayo, 1993). The development of Ekiti State spread towards the routes of communication put differently, the settlement evolutionary structure and growth is a replica of Homer Hoyt's sector theory of 1939, which posits the sprawl of physical development in the direction of transportation routes. Data for this study were collected using two sets of structured interview and questionnaires. Simple random sampling method was used to select the respondent. A total of three hundred copies of questionnaires were administered, in which one hundred and twenty copies were administered on agricultural extension workers and farmers; thirty each to six local government areas in the state.

The six local government area (two each) were chosen from the three senatorial district, Ekiti South Senatorial District (Ikere Local Government and Emure Local Government Area/Ekiti), Central Senatorial District (Ado Local Government Area and Ifelodun/Irepodun local government area) and Ekiti North Senatorial District (Ikole Local Government Area and Ido-Osi Local Government Area). The data collected for this study were analyzed using simple percentage and frequency counts to indicate the degree of the environmental impacts of climate change on agricultural production and the direction to which reforms and adjustment should focus.

RESULTS AND DISCUSSION

Table 1: Major Crops Planted in the Study Area

Crops Planted	Frequency	Percentage
Cash Crops	90	22.5
Food Crops	260	65.0
Others	50	12.5
Total	400	100.0

Source: Fieldwork, 2011.

Table 2: Effects of Climate Change on Agricultural Produce.

Effects	Frequency	Percentage
Soil Loss	15	3.75
Plant nutrient Loss	50	12.5
Textural Change	26	6.5
Increase in Pest and Diseases	87	21.75
Poor Yield Germination	95	23.75
High/Low rainfall	55	13.75
Fluctual shortage of varieties	72	18.0
Others	400	100.0

Results on table 1 show that 22.5% of the respondents stated that the major crops planted in the study area were cash crops. 65.0% of the respondent observed food crops, while 12.5% of the respondents noted others. This suggests that the major/predominant crop planted by farmers in the study area is food crops, and as

such is more affected by climate change in the study area. Results on table 2 show that 3.75% of the respondents stated that the effects of climate change on the environment and agricultural produce in the area is soil loss. 12.5% of the respondent stated plant nutrient loss, 6.5% stated textural change, 21.75% stated increase in pests and diseases, 23.75% stated poor germination poor yield, 13.75% noted High/ low rainfall, and 18.0% observed fluctuation/shortage of varieties. This indicates that the major effect of climate change on agricultural produce in the study area is the increase in pests and diseases.

Climate change has intensified the need for abiotic stress tolerance in crops, but this does not mean, we must develop stress tolerant crops. Abiotic stress tolerance can also be developed through conventional breeding or by using already adapted crop varieties. In addition, we face climate change and peak oil, so we need to produce an increasing proportion of energy and fuels, including first and second generation agro-fuels, from biomass. However, there are insufficient natural resources including land and water for this expansion, so we must produce more from each hectare. For this, we need crops with increased yields. At the same time, we must also respond to climate change, so we need plants that can flourish in conditions of greater extremes of weather, heat, flood and drought.

Furthermore, emissions trading hinder emission reduction and efficiency improvements. But worst of all, we are speeding up the destruction of the biodiversity and ecosystems, that are crucial to any hope to stabilize climate, produce food and leave a habitable planet to future generations. Also, there are alternative models for the future of agriculture, but they are currently neglected in the United Nations Framework Convention on Climate Change (UNFCCC) process. They include biodiversity ecological agriculture and agro-forestry, which can increase food production and reduce the climate footprint of agriculture, as well as playing a major role in ecosystem restoration and maintenance. Agriculture should be recognized more clearly as a multi-functional activity.

It does not only produce food, medicine, materials, fibres, etc. it can effectively recycle wastes into for use in soil restoration, as well as many other roles. This includes protecting bio-diversity, soils, and water sources in tune with the local ecology (ecosystems functions) and has additional cultural, landscape and well-being values for people, over and above their need for nourishment. Altered Temperature and Geographic Range enable plants to grow outside their usual climatic conditions and regions; for example cold-tolerant eucalyptus trees. The danger of such an approach has not been assessed, yet, since eucalyptus is an invasive species, the risk exist that it becomes even more invasive and disrupt ecosystems by displacing native species. Thus, the trees and other plants growing in a new environment will also start interacting unpredictably with other organisms including pests. Green House Emissions and Cultural Agriculture, Agriculture or rather agro business and plantation companies, benefit from about 10% of Clean Development Mechanism (CDM) credits, including livestock manure management, heat generation from palm oil and

using agricultural residues from biomass. However, credits for carbon sequestration in soils have so far not been accepted under the United Nations Framework Convention on Climate Change (UNFCCC). In the case of no-till monoculture as a form of sequestration, there is evidence that it rather harm than benefits the climate and the soil still could be tilled at any moment, emitting carbon again. And for biochar, there is no consistent information of its fate in soils while any black carbon getting airborne from biochar practices would seriously contribute to climate change.

CONCLUSION AND RECOMMENDATIONS

Agriculture plays an important role in climate change, both as a contributor emitting Green House Gas emissions and as a potential reducer of negative impacts. The impacts of climate change on agriculture are already serious. Seasons and weather are becoming increasingly unpredictable and extreme. This can lead to major losses as farmers no longer know what or when to plant. If climate change continues unabated, the increasing extremes could lead to the collapse of the whole agricultural regions. Climate change also disrupts and alters pest and disease patterns, posing risks to agriculture everywhere. Based on the findings of this study, the following are recommended:

i Cover trees should be planted, which will provide shade and reduce heat due to climate change and the preservation of underground water.

ii Government at all levels should ensure that best measures to reduce the practice of bush burning is encouraged, because the practice reduces Green House Gas emissions, which contribute to climate change.

iii Enlightenment Campaign Programmes through electronic and print media on the negative impacts of climate change on agricultural production and the environment generally, should be carried out to ensure awareness on the causes and adverse effects of climate change on agriculture in the study area.

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