

**CLIMATE CHANGE ADAPTATION AWARENESS AND ATTITUDE
AMONG SECONDARY SCHOOL BIOLOGY TEACHERS AND
STUDENTS IN AWKA EDUCATION ZONE OF ANAMBRA STATE**

BY

UDEGBUNAM EUGENIA OBIAGELI

PG /MED/SD/12/62485

DEPARTMENT OF SCIENCE EDUCATION

UNIVERSITY OF NIGERIA, NSUKKA

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TITLE PAGE

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UNIVERSITY OF NIGERIA, NSUKKA

SUPERVISOR: PROF. NKADI ONYEGEGBU

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APPROVAL PAGE

This project has been approved for the Department of Science Education, University of Nigeria, Nsukka.

By

Prof, Nkadi Onyegegbu
Supervisor

External Examiner

Internal Examiner
Dr.J.J, Agah

Prof. Nkadi Onyegegbu
Head of Department

Prof. J,E,Umeifekwem
Dean of Faculty

CERTIFICATION

Udegbunam Eugenia Obiageli a postgraduate student of the Department of Science Education with Registration Number PG/MED/SD/12/62485 has satisfactorily completed the requirements for award of the degree of Master in Science Education. The work embodied in this project is original and has not been submitted in part or full for any other degree of this or any other university.

Udegbunam Eugenia Obiageli
PG/MED/SD/12/62485
(Candidate)

PROF.NKADI ONYEGEGBU
(Supervisor)

DEDICATION

This research is dedicated to my beloved husband and my children for their moral supports throughout the period of this study.

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UDEGBUNAM EUGENIA OBIAGELI

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ABSTRACT

The study is on awareness and attitude of biology teachers and students on climate change adaptation. Four research questions and two null hypotheses guided the study. Relevant literatures were reviewed under three major sub-headings of conceptual framework, theoretical framework and review of empirical studies. This study adopted descriptive survey research design. This study was carried out in Awka education zone of Anambra State. The sample for the study will consist of 464 respondents made up of 68 Biology teachers and 396 SSII Biology students drawn from six (6) public secondary schools in Awka education zones in Anambra State. First, simple random sampling technique (balloting with replacement) will be used to select one education zones (Awka, education zones) out of the six education zones in Anambra State. Also, purposive sampling technique was used to sample two LGAs out of the five LGAs in Awka Education Zone. The choice of the two LGAs is because they are among the areas that were adversely affected during the 2012\2015 flooding incidence in Anambra State. Two instruments were used for data collection in this study namely: Climate Change Adaptation Awareness Questionnaire (CCAAQ), and Attitude to Climate Change Adaptation Questionnaire (ACCQ). The instruments were administered to 20 respondents in a school outside the study area but have similar characteristics with the study area. The scores obtained from the trial testing was used to determine the internal consistency reliability of the instrument using Cronbach Alpha Formula and they yielded internal consistency reliability index of .96 and .97 respectively for the two instruments. This indicated that the items in the instrument are reliable. The data collected from the research questions were analysed using mean and standard deviation, while then null hypotheses were analysed using t-test at 0.05 level of significance ($P < 0.05$). Results of the study showed that biology teachers and students have low awareness level on climate change adaptation. Biology teachers and students have poor attitude towards climate change adaptation. Biology teachers and students in rural and urban areas have low awareness of climate change adaptation, although those in urban area had higher mean rating/ there was no significant difference in the mean rating of biology teachers and students on awareness of climate change adaptation by school location. Lastly, biology teachers and students in rural and urban senior secondary biology students had low attitude towards climate change adaptation/ there was no significant on difference in the mean rating of biology teachers and students on attitude towards climate change adaptation by school location

CHAPTER ONE

INTRODUCTION

Background of the Study

The greatest challenges that confront man and societies today and generation to come is the issue of global climate change which controls the global pattern of the vegetation structure, productivity, plants and animals species. It is very likely that its impacts on our lives will continue to increase in the lives to come. Climate is the measure of the average pattern of variation in temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count and other metrological variation in a given region over a long period of time (Howell, Capstick & Whitmarsh, 2016). Climate is the statistics (usually, mean or variability) of weather, usually over a 30-year interval (Baede, 2015). A region's climate is generated by the climate system, which has five components: atmosphere, hydrosphere, cryosphere, lithosphere and biosphere (Thornthwaite, 1948). The climate of a location is affected by its latitude, terrain and altitude, as well as well as nearby water bodies and their currents. Climates can be classified according to the average and the typical ranges of different variables, like temperature and precipitation that may occur as a result of over long and short timescales from a variety of factors in the climate.

Climate change may refer to a change in average weather condition, or in a time variation of weather around longer- term average condition (i.e., more or fewer extreme events) However, the term 'climate change' today is generally used when referring to the change in our climate which has been observed since the early part of the 20th century (Abaje and Giwa, 2007). Climate change is a fundamental element of the environment that causes alteration in an ecosystem if its variation becomes erratic. The shift resulting from climate change affects

elements of an entire environment, which makes climate change a global issue, but at various levels of impact (Ikehi, Ifeanyieze & Ugwuoke, 2014). Climate change also refers to the alternations in the atmosphere that are over and above natural climate change variation and that are as a result of human activity (Hall and Wreford, 2012). It could mean changes in climate overtime, including regional or global temperature changes and the increased prevalence of extreme weather conditions.

There are four schools of thought about climatic change. One finds evidence that we are entering the next Ice Age; another has confident that the earth is getting warmer; a third believes that there has been no significant change in historical times, and the fourth is agnostic in such matters (Leiserowitz, Smith and Marlon, 2011). Recent decades have seen record- high average global surface temperatures. In the past century, global surface temperature increased by about 1.4°F. In the past quarter- century, according to satellite measurements, the lower atmosphere warmed by 0.22- 0.34 °F per decade equivalent to 2.3°F per century (Baede, 2015). This well documented warming trend could result from several factors that influence the earth's climate, some of which are natural, such as changes in solar radiation and volcanic activity. Others, particularly the release of certain gasses to the atmosphere and land- cover changes, are anthropogenic (Hannah, Lovejoy & Schneider, 2005).

There are a variety of potential causes for global climate change, including both natural and human- induced mechanisms. Science has made great strides recently in determining which potential causes are actually responsible for the climate change that occurred during the twentieth century. This has provided evidence that greenhouse gases released to the atmosphere by human activities are one of the main causes of contemporary global warming which leads to climate change (Hall & Wreford, 2012). Change in climate is attributed directly or indirectly to

human activity that alters the composition of the global atmosphere and is observed over time. The natural processes are the astronomical and the extraterrestrial factors. The astronomical factors include the changes in the eccentricity of the earth's orbit, changes in the obliquity of the plane of ecliptic and changes in orbital procession; while the extra-terrestrial factors are solar radiation quantity and quality among others (Climate Change Information Resources- New-York Metropolitan Region (CCIR-NYC), 2005). On the other hand, the anthropogenic factor in climate change involves human activities that either emit large amount of greenhouse gases into the atmosphere that depletes the ozone layer or activities that reduce the amount of carbons absorbed from the atmosphere (Akpodiogaga 2010). The human factors that emit large amounts of greenhouse gases include industrialization, burning of fossil fuel, gas flaring, urbanization and agriculture. Other human activities that reduce the amount of carbon sinks are deforestation, alterations in land use, water pollution and agricultural practices. The human factors have been proven to be responsible for the on-going unequivocal climate change (Intergovernmental Panel on Climate Change (IPCC, 2014). According to Cline (2007) climate change is caused by the accumulation of greenhouse gases in the lower atmosphere. The global concentration of these gases is increasing mainly due to human activities, such as combustion of fossil fuels, which release carbon dioxide and deforestation which leads to reduced forests that remove carbon from the atmosphere. Climate change is often used to describe any kind of change in climate that may be natural or human- induced, (Union of Concerned Scientist, (UCS), 2002).

Climate change phenomenon has serious deleterious consequences for the earth in the form of significant variations in regional climates, recurrent droughts, excessive heat waves, windstorms, killer floods, sea rise and increase in diseases (Ekpoh & Ekpoh, 2011). Climate change is already beginning to transform life on earth, for example around the globe seasons are

shifting and sea levels are rising, there are higher temperatures, changing landscapes, wildlife exposure risk, increased risk of drought, fire and floods, stronger storms and increased storm damage, more heat- related illness, disease and economic losses (Ekpoh & Ekpoh, 2011).

Change in climate impacts the natural systems (ecological systems, hydrology and water resources, coastal systems) and the human society at large (including human health, settlements, food and fibre production, industry, energy and infrastructure), thus impeding the achievement of sustainable development (Mauricio, Federico & Garcia, 2013). The IPCC's 2007 climate change report gives the following climate related impacts for Africa: By 2020, between 75 and 250 million of people are projected to be exposed to increased water stress due to climate change. By 2020, in some countries, yields from rain- fed agriculture could be reduced by up to 50%. Agricultural production including access to food, in many African countries is projected to be severely compromised. This could further adversely affect food scarcity and exacerbate malnutrition. African countries are therefore among the most vulnerable to the impacts of climate change (Odjugo, 2012).

Africa is already the hottest continent but once climate change impact becomes stronger, temperatures will be even hotter and drought is likely to threaten already inadequate food supply (Himeidan, 2007). As climate change threatens Africans health, homes and the natural resources upon which many depend to survive, the population faces an urgent crisis. For people struggling with the challenges posed by climate variability, environmental degradation and poverty, climate change represents a tipping point (BBC World Service Trust, 2008). It is likely to alter the transmission patterns of disease such as malaria, increased incidences of cholera and meningitis. Mosquitoes, which carry many diseases, are very sensitive to temperature changes. Warming of their environment within their viable range boosts their rates of reproduction and the number of

blood meals they take, prolong their breeding season, and shorten the maturation period for the microbes they disperse. Also, health threats such as diarrhoea, asthma and stroke affect more people when temperature rises (BBC World Service Trust, 2008). Developed countries experiencing the impact of climate change are working out strategies to combat its effect and African countries, including Nigeria should not be left behind.

The climate change situation in Nigeria is not far from what the developed countries are experiencing. There are noticeable consequences of climate change in Nigeria, such as intense thunder storms, widespread floods and incessant droughts (Ekpoh & Ekpoh, 2012). Persistent droughts and flooding, off season rains and dryness have sent growing seasons out of cycle, in a country dependent on rain fed agriculture and hydropower. The agricultural sector contributes some percentage of the Nigerian Gross National Product and majority of the rural populace are employed in this sector. Climate deteriorations causes devastating socioeconomic consequences, which would manifest in food security challenges, damage to infrastructure and social dislocation. Considering the strong nexus between climate change and development, Nigeria is highly at risk in the area of food and nutrition, poverty and hunger reduction, and most importantly economic development. For these reasons Nigeria's efforts and actions must be informed by these realities.

Climate change has become an inevitable global problem, affecting almost every part of the world, in which Nigeria is not left out. Various evidences in the scientific literature indicates that in the coming decades the world will witness higher temperatures and changing precipitation levels (Ikehi, Ifeanyieze & Ugwuoke, 2014, Mauricio, Federico, Garcia, 2013, and Akpodiogaga, 2010). To this end, these challenges have necessitated various scientific debates at regional, national and international levels. Impact as used may be negative or positive or a

combination. What causes this change cannot be treated in isolation without looking at greenhouse effect which is caused by the release of destructive gases by human action which in turn brings about the warming of the earth surface by increase in the earth's temperature (Abaje & Giwa, 2007).

Nigeria daily temperature average differs according to location and period of the year. Average temperature ranges from 25°C in the southern coast to 40°C in the north. A rise in temperature of between 1.4°C to 5.8°C by 2010 according to Intergovernmental Panel on Climate Change, IPCC, will have serious negative effect on the socio-economic wellbeing of the country in the following ways: increase in amount of rains and number of rainy days -flooding in the coastal areas, higher risk of 100 years flooding occurring at shorter intervals; landslides especially in erosion prone areas; high temperature in the north will cause increase health issues such as meningitis, cataracts, malaria and yellow fever (Enete and Amusa, 2015). Desertification will increase and more droughts which encourage locusts and white flies, which in turn affects food and water supply; high cost of construction especially in the coastal areas; deforestation as a result of relocating of people from the flood affected areas of the coast; change in land use in the coast may have drastic effect on agricultural output and hence livelihood; wildlife will also be affected with possible effect on the entire food chain (Ngene, 2012).

A study on regional evidence of climate change in Nigeria showed that our temperature is steadily increasing especially from the 1970's between 1901-1935 and 1936-1970 climatic periods (Odjugo, 2010). The temperature anomaly shows that climate change signal is stronger as from the 1970's. The rate of temperature increase is higher in the semi-arid region than the coastal areas of Nigeria. The current available evidence shows that Nigeria, like most parts of the world is experiencing the basic features of climate change. Desertification process is advancing

southward and there is the potential submerge of the 853 kilometres stretch of coastline along Atlantic Ocean (Federal Ministry of Environment, Nigeria, 2012). Former Common Wealth Secretary General, Chief Emeka Anyaoku said that Nigeria is not immune to the disastrous effects of climate change despite the fact that it is not being prone to natural disaster such as earthquakes, typhoons or massive floods. The researcher further stated that, Nigeria is contributing significantly to the carbon dioxide emission through the gas flaring that has been going on in oil producing Niger Delta regions. Changes in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change adaptation can be achieved through proper climate change adaptation education to enlighten the citizenry about the dangers and possible ways of mitigating the impacts of climate change.

Adaptation refers to changes in processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate. It is also changes in a system, compared to a reference case that reduces the adverse effects of situation (Oruonye, 2011). It can also mean a way of anticipating adverse effect of climate change and taking appropriate action to prevent or minimize the damage they can cause, or taking advantage of opportunities that may arise. Adaptation to climate change is the adjustment in natural or human system in response to actual or expected climatic stimuli or their effect which moderate harm or exploit beneficial opportunities [IPCC, 2007]. Adaptation seeks to lower the risk posed by the consequences of climate change .It has been shown that well planned early adaptation action saves money and lives later. It is a practical step to protect countries and communities from likely disruption and damage that will result from effect of climate change. For example, flood walls could be built and human settlements moved out of flood plains and other low-lying areas. It means ensuring that those efforts are flexible and resilient enough to

mitigate the challenges that climate change may bring in the future. It is also a practical step of getting the young ones (youths) well informed and involved in climate change adaptation.

Adaptation to climate change includes all adjustments in behaviour or economic structures that reduce the vulnerability of society to changes in the climate system. Examples of adaptation measures include: using scarce water resources more efficiently; adapting building codes to future climate conditions and extreme weather events; building flood defence and raising the levels 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 (Ozor, 2010). According to an assessment by the Climate Prediction and Application Centre (ICPAC) we will ‘adapt’ or ‘die’ (Hall & Wreford, 2012). This shows that adaptation to the adverse effects of climate change is vital in order to reduce the impacts of climate change and increase resilience to future impacts.

Therefore, proper adaptation measure could help to minimise the adverse effects or to take advantage of any beneficial effects of climate change. Adapting to the changes has consequently emerged as a solution to address the impacts of climate change that are already evident in some regions (Ogali, 2010). This is because awareness and quality of knowledge on existence and issues relating to climate change adaptation could reduce the impact of the phenomenon.

Awareness is knowledge that something exists, or understanding of situation or subject at present time based on information or experience. (Chinedu, 2008) viewed awareness as a condition of being aware and able to understand what is happening around one. Awareness about any matter is removal of all misconception about the subject, but that doesn't mean that you must know that matter thoroughly. Awareness is the state or ability to perceive, to feel or to

be conscious of events, objects, thoughts, emotion or sensory patterns. Most Nigerians are not aware of what climate change is and its effects. According to Olorunfemi (2010), the biggest obstacle about climate change is the lack of awareness and knowledge, therefore Nigerians need to be educated and informed about climate change and how it can change their lives drastically. According to the UNDP report (2010), the level of awareness about climate change is rather low in Nigeria and it is likely to continue if no intervention measures are taken.

Awareness of climate change could help students and other individuals become scientifically and ecologically literate citizens, who can describe, explain and predict natural phenomena using sound ecological thinking, capable of full participation in a democratic sustainable society. The level of awareness on the impact of climate change could lead people to engage in activities that contribute to the problems of climate change. Adequate knowledge and awareness of the effects of climate change will help make communities to join forces in reducing the vulnerability of societies to climate related risks both now and in the future (Oruonye, 2011). According to IPCC (2013) analysis of a global survey finds that more than a third of the world's adults have never heard of climate change. For some countries, such as South Africa, Bangladesh and Nigeria, this rises to more than two-thirds of the adult population. The study says that education is the "single strongest predictor" of public awareness of climate change. Improving basic education and public understanding of climate change are vital to garner support for climate action. IPCC (2013) recorded that the awareness rates in developing countries were much lower. For example, 47%, 25% and 21% from Philippines, India, Egypt and Nigeria respectively said they were aware of climate change. The lowest levels of awareness was recorded for Nigeria. This poor awareness level of Nigerians could be as a result of the attitude of her citizenry toward climate change adaptation.

Attitude is the readiness to act in a certain way expressed by a person's words, gestures or facial expression. Okezie (2010) sees attitude as a state of mental and emotional readiness to response previously conditioned or associated stimuli. The above definitions presents attitude to mean the way an individual thinks or acts towards a given subject or issue. An attitude can be a positive or negative evaluation of people. This includes beliefs and positive and negative feelings about the attitude object. Okezie also added that attitude can guide experiences and decide the effects of experience on our behaviours. Public attitudes to climate change adaptation guides how and the manner they respond to challenges as a result of climate change. In Nigeria, many people now recognize climate change as a serious problem that warrants action. This is a major shift in attitude from just a few years ago (Akpodiogaga, 2009). Public attitude to climate change adaption has to do with the way and manner by which, individuals change their practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate. It is all about changes in behaviour that reduces the adverse effects of climate change.

Attitude towards adaptation to climate deals greatly with adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities. Attitude to climate change adaptation is the way of thinking and acting towards adjustment to the impact of climate change. Therefore, climate change attitude means the way of thinking and acting by individual towards the issue of global climate change. It is the feelings and concerns an individual could have regarding climate change.

In relation to the above discussions, attempt has been made to increase students' awareness and attitude towards climate change adaptation in secondary schools. For example, climate and general environmental related contents like our environment, physical environment,

sanitation, pollution, natural and manmade environmental hazards, deforestation, population, effects of industrial concentration, composition of atmospheric gases, weather and climate, classification of climate, major climate types of the world, were infused in most secondary school subjects like Geography, Chemistry, Physics, Biology, Agriculture, and Social Studies. These contents and subjects are veritable means of promoting climate change knowledge, awareness and attitude of secondary school students in Nigeria. With respect to the above Agaiinde (2006) added that schools through classroom instructions are making effort to create awareness on major environmental problems like climate change. Similarly, Chinedu (2008) and Ofoebe (2009) shared the view that the curriculum contents of most secondary school subjects could be effectively used to promote awareness of environmental problems as well as positive attitude towards solving the environmental problems.

In spite of the efforts, through school instructions to promote awareness and attitude towards environmental problems particularly climate change, it appears that the programme is not yielding the desired result (Egbuna-Ojukwu, 2016). This is because, people (including those who passed through the instructional programme in school) seem to have continued perpetuating actions such as bush burning, deforestation, burning of fossil fuel like petrol, coal, and crude oil which contribute to climate change. It is worthy of note that as these human actions that contribute to climate change continue, so shall the consequences of climate change continue to face human beings on earth. Thus, there is need to determine the level of awareness and attitude of students and teachers towards climate change adaptation in secondary schools. In determining the level of awareness and attitude towards climate change adaptation, consideration need to be taken on the influence of location on teachers* and students* climate change adaptation awareness and attitude.

According to (Igwe, 2003) location is a place where something or person resides. Location in the context of this study means a geographical area where somebody or something is situated. It could be rural or urban area. Rural areas are often made up of villages which may either be dispersed, nucleated or even linear in their pattern of distribution on the land, with few buildings and little number of people. It offers its settlers a simple and quiet life style. Their major economic activity is farming with few amenities and services centres. Thus, according to United Nations Development Programme UNDP, in Oruonye (2011) climate change awareness and attitude of the rural dwellers in Nigeria is directly proportional to the quantity and quality of information prevalent and available to them.

Urban areas are relatively large, dense and permanent settlement of socially heterogeneous individuals. They could be towns, cities, conurbations or metropolis. Urban areas have some characteristics such as a large and heterogeneous population, medical and political facilities, educational, recreational, banking administrative and social activities, with highly developed manpower (male and female), artisans. In urban areas, there is always high demand for facilities that require the use of high energy that produce excess carbon dioxide. It is the opposite of rural areas, with its sophisticated life style activities. The above disparity between the urban and rural areas could influence their awareness, and attitude towards climate change adaptation. In line with this assumption, Small and Nicholis (2003) opined that where people live (location) determine the how much information and knowledge that gets to them particularly in developing countries like Nigeria. Although, Agiande (2006) found out in a study in Calabar that location is no longer a barrier to students' awareness of environmental problems (like climate change). Ishaya and Obaje (2008) in a study in Kaduna also found out that location has no significant influence on students' awareness of the problems of climate change. For instance,

Ishaya and Abaje (2008) studied indigenous people's perception on climate change and adaptation strategies in senior secondary schools in Jema Local Government Area of Kaduna State. The study found out that the students' possessed low awareness and poor attitude towards climate change. Oruonye (2011) carried out assessment of the level of awareness of the effects of climate change among students in Jalingo Metropolis of Tabara State. The study found that the students used for the study are not aware of climate change and that they possessed low attitude towards climate change. Even though related studies have been done with respect to secondary school students' climate change awareness and attitude, there seem to be a paucity study on climate change in Anambra state.

Thus, the present study will determine the climate change adaptation awareness and attitude of senior secondary school Biology teachers and students in Awka Education Zone, Anambra State.

Statement of the Problem

Climate change is an emergent property of complex ecological and environmental systems, which in turn are influenced by complex human systems, including cultural, social, economic and political systems. Nigeria is highly at risk in area of food and nutrition, poverty and hunger reduction and most importantly economic development. The year 2012 witnessed tremendous drought and floods which led to late planting of crops, poor crop yields, destruction of farmlands and properties, rendering of people homeless as well as deaths, hunger, malnutrition, pests and diseases in many eastern States in Nigeria, especially in Anambra State. Indeed, related studies have been done with respect to secondary school teacher's and student's climate change awareness and attitude, there seem to have scarcity study on climate change

adaptation awareness and attitude in Anambra State. This study aims to determine the adaptive coping and adaptive capacity for specific population groups.

Climate change is an area that is in dire need of publicity to help the public make informed decisions in its adaptation and mitigation. The level of awareness and attitude of learners about climate change therefore needs to reflect that complexity and be multi-dimensional and multifaceted, rather than focusing only on single variables such as carbon dioxide emissions. Above all, awareness and attitude towards climate change adaptation is the practical enlightenment which can help learners deal with uncertainty whenever the menaces of climate change occur. This is because climate change has brought about severe and possibly permanent alterations to our planet geological, ecological and biological systems. The Intergovernmental Panel on Climate Change (IPCC) attributed these changes in climate to human activities. To ensure adequate adaptation and mitigation of the harmful impacts of climate change to our society, there is need for adequate knowledge of climate change. Hence the need to determine the awareness and attitudes of secondary school Biology students and teachers on climate change adaptation in Awka Education Zone of Anambra state.

Purpose of the Study

The purpose of this study is to determine the level of awareness and attitude of climate change adaptation among secondary school Biology teachers and students.

Specifically the study determined:

1. The climate change adaptation awareness of secondary school Biology teachers and students.
2. The climate change adaptation attitude of secondary school Biology teachers and students.

3. Biology teachers and students rating on climate change adaptation awareness by school location
4. Biology teachers and students rating on their attitude towards climate change adaptation by school location

Significance of the Study

The study has both practical and theoretical significance. Theoretically, the study is anchored on Albert Bandura's Social Learning Theory of 1963. Bandura posits that learning is a cognitive process that takes place in a social context and can occur purely through observation or direct instruction, even in the absence of motor reproduction or direct reinforcement. Hence interpersonal relationships in school environment can help in shaping learners adaptive capacity to climate change. Climate change is a complex phenomenon involving the interaction of many social and ecological factors. Importantly, it is context-specific, with each community facing its own unique climate challenges and constraints. Nor are these challenges fixed; they evolve over time and can be affected by changes in agricultural production. This theory is related to this study because it can help in ensuring social changes that might arise during the process of addressing climate challenges. Thereby helping to change student's attitude towards climate change adaption and create more awareness about climate change adaptation when it is found out that the students are not aware of how to adapt to climate change, the school authorities and teachers will begin to strategise on how to create awareness for students on adaptation strategies which will also affect the attitude towards climate change positively. This is possible because learning gives rise to novelty in propositional knowledge and there is links between social structure and adaptive capacity.

Another important theory is the Cultural Theory of Risk for climate change Adaptation by Mary Douglas of (1966). Douglas theory was found to be relevant to this study. The anthropologist sees that the way in which people perceive climate risk is informed by their social interaction and cultural world views comprising fundamental belief about society and nature.

The perception of climate change risk and vulnerability along with how people conceptualize the way nature function, influence the feasibility and acceptability of climate change adaptation planning, policy making and implementation. The cultural theory aim to explaining how people perceive and act upon the world around them. More specifically the theory claim that it is largely determine by social aspect and cultural adherence. Cultural Theory is a fine theory for explaining risk perception and interpretation for it produces a strong research of high quality support to hypothesized explanation.

Practically, the findings of this study could be beneficial to the following people, biology students, biology teachers, policy makers, education administrators, researchers, textbook writers and curriculum planners. It is hoped that the result of this study could help to improve the awareness and attitude of Biology students about climate change and enable them to develop positive attitude towards the environment to ensure proper adaptation and mitigation of climate change issues. It could enable them to become change agents on climate change issues in the community and to their peers.

To Biology teachers, the findings of this study could enable them improve on their knowledge and awareness about climate change adaptation and enable them to develop positive attitude toward climate change adaptation. The result of this study could also enable teacher develop strategies that could enable them teach students about proper climate change adaption.

Policy Makers such as inspector and supervisors of schools will also benefit from this study. The results of this study could have potentials for providing a knowledge base for policies and programmes/campaign on climate change awareness which is required to gather the support for action within government, NGO's (Non-Governmental Organization) , private sectors and the public at large. This could help greatly in policy formulation and planning that are geared towards controlling the impact of climate change in the study area and the country as a whole.

Educational Administrators will find this work as a rationale for organizing seminars or workshops on adaptive strategies on how they can handle the effect of climate change and its adaptation. It will further inform science teacher trainers in Colleges of Education and Faculties of Education in Nigerian Universities on the need to restructure or modify their teacher training programmers with the view to improving the knowledge understanding and attitude towards climate change.

Textbook writers in biology should incorporate in their textbook, the topic climate change adaptation issues. Also the result of this study could give textbook writers to incorporate climate change in their books to test the students' theoretical and practical understanding of the concepts, effect, impact and adaptive strategies to climate change.

Furthermore, the findings could help curriculum planners to inject innovations into the NERDC (Nigerian Educational Research and Development Council) biology curriculum by building on the study of climate change.

To other researchers, the findings of this study could also help them to determine the necessary areas that demand further research about climate change. This could help to ensure proper adaptation to climate change. The result of this study could serve as reference material to other researchers carrying out studies in climate change related issues.

Scope of the Study

This study is on climate change adaptation awareness and attitude among secondary school Biology students and teachers in Awka Education Zone of Anambra state. The study was carried out using senior secondary school SS2 Biology students and teachers in Awka Education Zone of Anambra State. School location will also be considered as possible factor in students and teachers awareness and attitude towards climate change adaptation.

Research Question

The following research questions guided this study

1. What are the mean ratings of secondary school Biology teachers and students on their awareness of climate change adaptation?
2. What are the mean ratings of secondary school Biology teachers and students on their attitudes towards climate change adaptation?
3. What are the mean ratings of biology teachers and students on climate change adaptation awareness by school location?
4. What are the mean ratings of biology teachers and students on their attitude towards climate change adaptation by school location?

Hypotheses

The following null hypotheses were formulated to guide the study and were tested at 0.05 level of significance.

HO₁: There is no significant difference in the mean rating of biology teachers and students awareness of climate change adaptation by school location.

HO₂: There is no significant difference in the mean rating of biology teachers and students on their attitude towards climate change adaptation by school location.

CHAPTER TWO

LITERATURE REVIEW

In reviewing the relevant literature, the conceptual, theoretical framework and empirical studies were considered under the following sub- headings:

Conceptual Framework

- Schematic representation of concepts
- Climate
- Climate Change
- Nigerian Change
- Adaptation
- Climate Change Adaptation Awareness
- Climate Change Adaptation Attitude

Theoretical Framework

Social Learning Theory by Albert Bandura (1963)

The Cultural Theory of Risk for Climate Change Adaptation (1966)

Empirical Studies

- Studies on Awareness of Climate Change
- Studies on Attitude towards Climate Change

Summary of the Literature

CONCEPETUAL FRAMEWORK

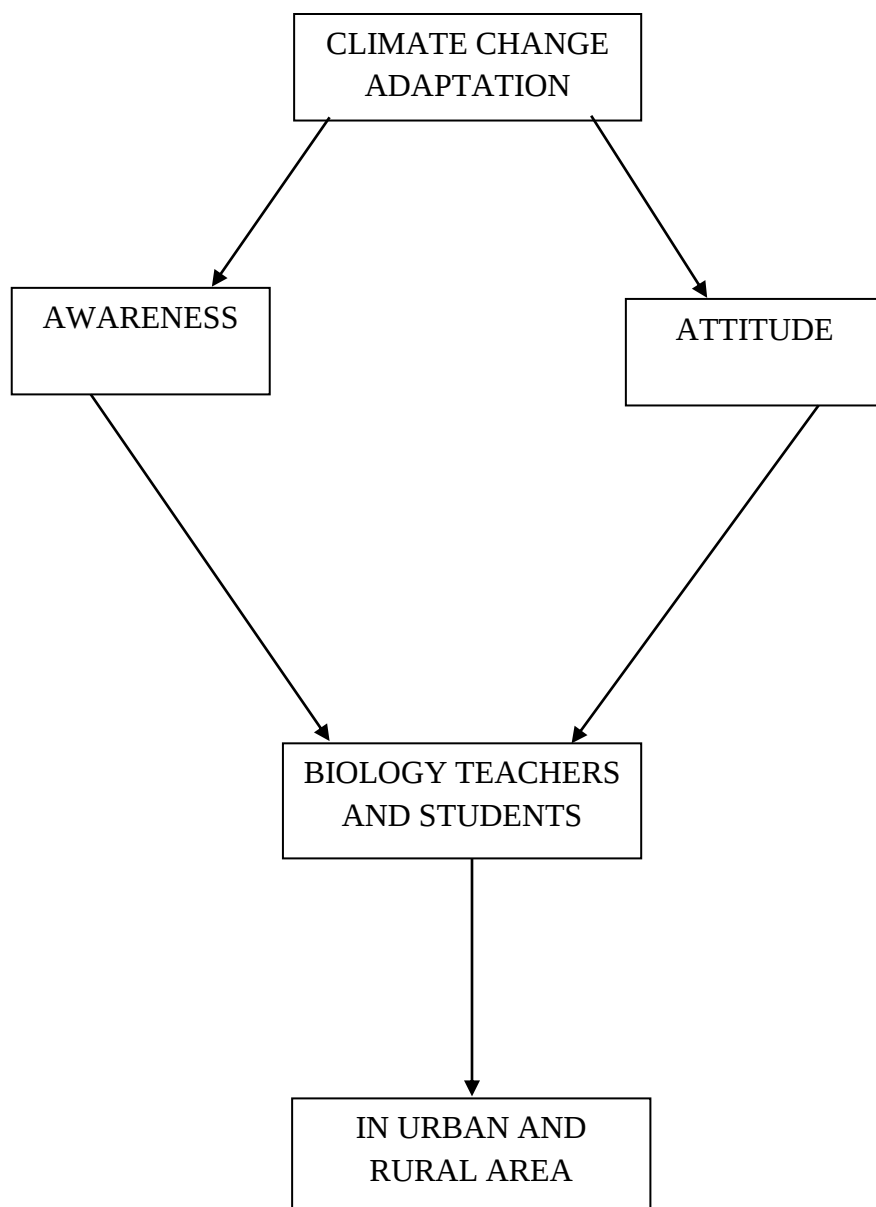


Figure I (Schematic Representation showing the relationship between the variables and the study)

The scheme shows the relationship among climate change adaptation awareness and attitude of biology teachers and students in senior secondary school in Awka Education Zone of Anambara state.

Climate

Climate is the regular pattern of weather condition of a particular place over a period of time. It is measured by assessing pattern of variation in temperature, humidity atmospheric pressure, wind, precipitation and other metrological variations over a long period of time.

Climate Change

Climate change is a change in weather condition or in the time variation of weather around longer time condition. Adaptation is not simply about doing more, it is about a new way of thinking and dealing with risk, hazard, and uncertainties of climate. Climate change adaptation includes all adjustment in behavior or economic structure that reduce the vulnerability of society to the changes in the climate system.

Awareness is the ability to perceive or feel or to be cognizant of events. Awareness towards climate change adaptation is the ability of individual to be conscious of the changes in the earth planet, manage and live drastically with them.

Attitude is defined as readiness to act in certain way expressed by person words or gesture or facial expression. Attitude towards climate change adaptation is the way of thinking and acting towards adjustment to the impact of climate change. The attitude of biology teachers and students towards climate change adaptation may be positive or negative. It is important to note that if biology teachers and students have a positive attitude towards climate change adaptation their adaptive capacity would be influenced.

Teacher is a person trained, recognized and employed to help learning in classroom situation in order to achieve set educational goals. Teachers are train to train others. Biology teacher is a person who educates students at the secondary school level and teach them the fundamentals of biology, the relationship between living and non living things, scientific concepts and processes, genetics and environmental issues. Students are people enrolled in school or other educational institution to attend classes in some courses or subjects in order to obtain a higher level certificate .Biology students are those people that are trained on subjects that related to scientific concepts and processes, living and non living things and on environmental issues. Students are the future agents of action who would implement climate change solution, if their level of awareness and attitude towards climate change adaptation is enhanced, It is on the light of this that the curriculum infused climate and general environmental related content like physical environment, sanitation, pollution, deforestation into most of the secondary school subjects which includes geography, biology, and social studies with the intention of promoting their awareness and attitudes towards climate change adaptation, However, education is the strongest predictor of public awareness of climate change adaptation, it is believed that enhanced awareness level on climate change adaptation through education would enable informed decision making on climate related issues which will in turn play a vital role on increasing adaptation and capacity of the students on climate change adaptation. Rural areas are often made up of villages which may either be dispersed, nucleated or linear in their pattern of distribution on the land, with few buildings and little number of people. Urban areas are relatively large, dense and permanent settlement of socially heterogeneous individual. They could be town or cities with large population, medical political and social facilities with highly developed manpower. The disparity between the rural and urban areas could influence their awareness and attitude towards climate change adaptation.

Climate change, also called global warming, refers to the rise in average surface temperatures on Earth. Climate change is due primarily to the human use of fossil fuels, which releases carbon dioxide and other greenhouse gases into the air. The gases trap heat within the atmosphere, which can have a range of effects on ecosystems, including rising sea levels, severe weather events, and droughts that render landscapes more susceptible to wildfires (Planton, 2013). Climate change has been regarded as the most serious environmental challenge of our time (Gidden, 2006). The Intergovernmental Panel on Climate Change (IPCC) (2007) Fourth Assessment Report (AR4) gave the most acceptable definition of climate change, which states that “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 extended period typically decades or longer”. It has been conceived as the fluctuation in weather over a relatively period of time (Yusuf 2012). According to Olanrewaju (2003), climate change is any form of long-term climatic inconsistency. The phenomenon has manifested in various forms across the globe- severe flooding, earthquakes, tsunamis, and drought among several others. Climate change refers to the change in the state of the climate that can be identified by changes in mean or variability of its properties and that persists for extended periods typically decades or longer (Atitola, 2009). Udenyi (2009) opined that climate change is simply a change in the climate condition of the world and that the scientists and others to be negative find the change. United Nation on Environmental Programme (UNEP) (2000) defines climate change as extreme reactions of the weather phenomenon, which creates negative impact on agricultural resources, water resources, human health, and depletion of ozone layer, vegetation, soil and doubling of Carbon dioxide in the ecosphere.

Going by scientific predictions on the issue, climate change has the potential to alter irreversibly the functioning of the earth's climate change and to produce a series of devastating environmental consequences, which will be, felt worldwide (Yusuf, 2012). This prompted Ayodele (2003) to state that secular variations in climate occurring over a period of 100 to 150 years may not qualify as a climate change if conditions will quickly reverse later, but a change in climate usually takes place over a long period of at least 150 years with clear and permanent impacts on the ecosystem. Climate change therefore according to Ekpoh (2009) is any long-term change in the patterns of average weather of a specific region or the earth as a whole. It is an abnormal variation in the earth's climate that usually occurs over durations ranging from decades to millions of years.

The System of Climate Change

The key to understanding global climate change is to first understand what global climate system is, and how it operates. According to Spore, (2008) each day, the sun emits rays of light unto the earth's surface. The earth absorbs part of the heat, reflects another share into the atmosphere and sends out a third share in the form of infra-red rays. These rays are cushioned by the clouds and water vapour, which stabilizes the earth's temperature under normal circumstances.

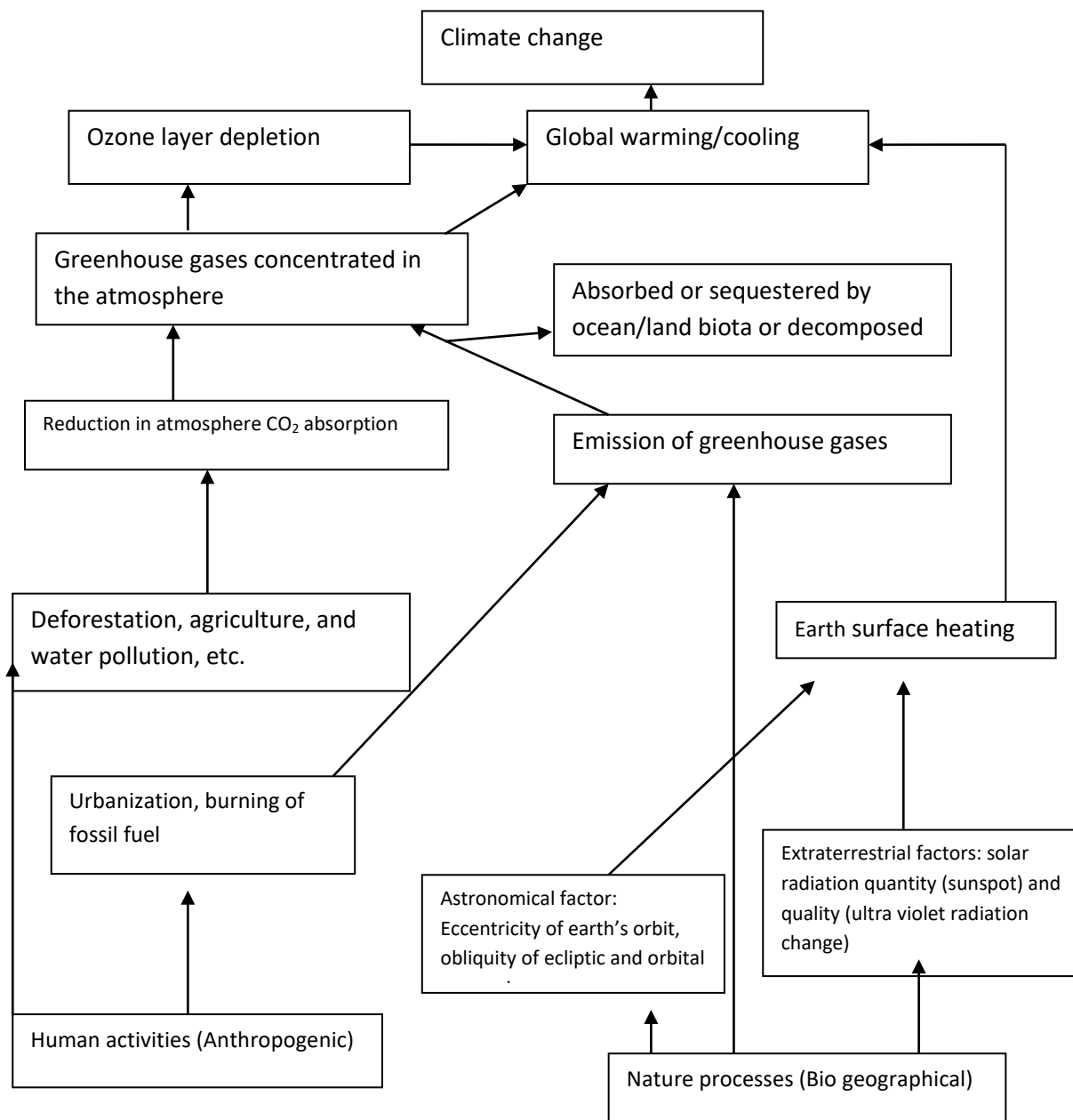
At the planetary scale, the global climate is regulated by how much energy the earth receives from the sun. However, the global climate is also affected by other flows of energy which take place within the climate system itself. The global climate system is made up of the atmosphere, the oceans, the ice sheets (cryosphere), living organisms (biosphere) and the soils, sediments and the rocks (geosphere), which all affect, to a greater or less extent, the movement of heat around the Earth's surface. The atmosphere however, does not operate as an isolated system. Flows of energy take place between the atmospheres and the other parts of the climate

system, most significantly the world's oceans (Odjugo, 2011). The significance of the ocean is that they store a much greater quantity of heat than the atmosphere. The top 200 meters of the world's ocean store 30 times as much heat as the atmosphere. Therefore, flows of energy between the oceans and the atmosphere can have dramatic effects on the global climate.

A drastic change in the climate systems either due to natural forces or due to unsustainable human activities results in the basic cause of on –going climate change and the advanced countries are most responsible (Deweerd, 2007). Intergovernmental Panel on Climate change (IPCC) (2007) shows that observed climatic data from developed countries reveal significant change in many physical and biological systems in response to global warming.

Causes of Climate Change

The causes of climate change are both anthropogenic (human activities) and natural as conceptualised in figure 1; by Odjugo, (2010).



Source: Odjugo, (2010)

Human activities contribute to climate change by causing changes in earth's atmosphere in the amounts of greenhouse gases, aerosols (small particles), and cloudiness. The largest known contribution comes from the burning of fossil fuels, which releases carbon dioxide gas to

the atmosphere. Greenhouse gases and aerosols affect climate by altering incoming solar radiation and out-going infrared (thermal) radiation that are part of earth's energy balance. Changing the atmospheric abundance or properties of these gases and particles can lead to a warming or cooling of the climate system. Since the start of the industrial era (about 1750), the overall effect of human activities on climate has been a warming influence. The human impact on climate during this era greatly exceeds that due to known changes in natural processes, such as solar changes and volcanic eruptions.

Greenhouse Gases

Human activities result in emissions of four principal greenhouse gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and the halocarbons (a group of gases containing fluorine, chlorine and bromine). These gases accumulate in the atmosphere, causing concentrations to increase with time. Significant increase in all of these gases has occurred in the industrial era. All of these increases are attributed to human activities. This statement agrees with Ezeah (2009) who described greenhouse gasses as those gaseous constituents of the atmosphere, both natural and anthropogenic that absorb and re-emit infra-red radiation. He stressed that many gasses in the atmosphere exhibit greenhouse properties. These include;

- Carbon dioxide which has increased from fossil fuel use in transportation, building, heating and cooling and the manufacture of cement and other goods. Deforestation releases CO₂ and reduces its uptake by plants. Carbon dioxide is also released in natural processes such as the decay of plant matter.
- Methane has increased as a result of human activities related to agriculture, natural gas distribution and landfills. Methane is also released from natural processes that occur, for

example in wetlands. Methane concentrations are not currently increasing in the atmosphere because growth rates decreased over the last two decades.

- Nitrous oxide is also emitted by human activities such as fertilizer use and fossil fuel burning. Natural processes in soils and the oceans also release N₂O.
- Halocarbon gas concentrations have increased primarily due to human activities. Natural processes are also a small source. Principal halocarbons include the chlorofluorocarbons (e.g., CFC-11 and CFC-12), which were used extensively as refrigeration agents and in other industrial processes before their presence in the atmosphere was found to cause stratospheric ozone depletion. The abundance of chlorofluorocarbon gases is decreasing as a result of international regulations designed to protect the ozone layer.
- Ozone is a greenhouse gas that is continually produced and destroyed in the atmosphere by chemical reactions. In the troposphere, human activities have increased ozone through the release of gases such as carbon monoxide, hydrocarbons and nitrogen oxide, which chemically react to produce ozone. As mentioned above, halocarbons released by human activities destroy ozone in the stratosphere and have caused the ozone hole over Antarctica.
- Water vapour is the most abundant and important greenhouse gas in the atmosphere. However, human activities have only a small direct influence on the amount of atmospheric water vapour. Indirectly, humans have the potential to affect water vapour substantially by changing climate. For example, a warmer atmosphere contains more water vapour. Human activities also influence water vapour through CH₄ emission, because methane undergoes chemical destruction in the stratosphere, producing a small amount of water vapour.
- Aerosols are small particles present in the atmosphere with widely varying size, concentration and chemical composition. Some aerosols are emitted directly into the

atmosphere while others are formed from emitted compounds. Aerosols contain both naturally occurring compounds and those emitted as a result of human activities. Fossil fuel and biomass burning have increased aerosols containing sulphur compounds, organic compounds and black carbon (soot). Human activities such as surface mining and industrial processes have increased dust in the atmosphere. Natural aerosols include mineral dust released from the surface, sea salt aerosols, biogenic emissions from the land and oceans and sulphate and dust aerosols produced by volcanic eruptions. The greenhouse gases however, naturally blanket the earth, keeping it about 33°C warmer than it would be without the existence of these gases in the atmosphere (Hopwood & Cohen, 2009).

Natural Causes of Climate Change

Climate change occurs when the amount of energy stored by the 'climate system' is varied (Atitola, 2012). The variation occurs when the balance for example between energy received from the sun and the radiated energy is disturbed. This disturbance can be caused by a number of natural mechanisms such as; volcanic eruption, ocean current, the earth's orbital changes and solar variations.

Volcanic eruption: When a volcano erupts it throws out large volumes of sulphur dioxides (SO₂), water vapour, dust, and ash into the atmosphere. Large volumes of gases and ash can influence climatic patterns for years by increasing planetary reflectivity causing atmospheric cooling. Tiny particles called aerosols are produced by volcanoes. Because they reflect solar energy back into space they have a cooling effect on the world. The greenhouse gas, carbon dioxide is also produced however the CO₂ produced is insignificant when compared to emissions created by humans.

Ocean current: The oceans are a major component of the climate system. Ocean currents move vast amounts of heat across the planet. Winds push horizontally against the sea surface and drive ocean current patterns. Interactions between the ocean and atmosphere can also produce phenomena such as El Nino which occur every 2 to 6 years. Deep ocean circulation of cold water from the poles towards the equator and movement of warm water from the equator back towards the poles, without this movement the pole would be colder and the equator warmer. The oceans play an important role in determining the atmospheric concentration of CO₂. Changes in ocean circulation may affect the climate through the movement of CO₂ into or out of the atmosphere.

Earth orbital changes: The earth makes one full orbit around the sun each year. It is tilted at an angle of 23.5 ° to the perpendicular plane of its orbital path. Changes in the tilt of the earth can lead to small but climatically important changes in the strength of the seasons. More tilt means warmer summers and colder winters: less tilt means cooler summers and milder winters. Slow changes in the Earth's orbit lead to small but climatically important changes in the strength of the seasons over tens of thousands of years. Climate feedbacks amplify these small changes, thereby producing ice ages.

Solar variations: The sun is the source of energy for the Earth's climate system. Although the Sun's energy output appears constant from an everyday point of view, small changes over an extended period of time can lead to climate change. Some scientists suspect that a portion of warming in the first half of the 20th century was due to an increase in the output of solar energy. As the sun is the fundamental source of energy that is instrumental in our climate system it would be reasonable to assume that changes in the sun's energy output would cause the climate to change. Scientific studies demonstrate that the solar variations have performed a role in past climate change. For instance a decrease in solar activity was thought to have triggered the Little

Ice Age between approximately 1650 and 1850, when Greenland was largely cut off by ice from 1410 to the 1720s and glaciers advanced in the Alps.

Current global warming however cannot be explained by solar variations. Some examples are evidence such as since 1750, the average amount of energy coming from the sun either remained constant or increased slightly. If a more active sun accused global warming, then scientists would expect to see warmer temperatures in all layers of the atmosphere. They have only observed a cooling in the upper atmosphere, a warming at the surface and in the lower parts of the atmosphere. This is due to greenhouse gasses capturing heat in the lower atmosphere. Also climate models that include solar irradiance changes cannot reproduce last century observed temperature trends without including a rise in green house gasses.

Climate change is global from the studies so far in its causes, but its consequences are far more reaching in developing countries particularly Nigeria. The need therefore arises to develop an instructional package to give an in depth explanation on the concepts, system and causes of climate change.

Impacts of Climate Change

The greatest challenge that confronts man and societies today and the generations to come is that issue of climate change. Our societies are dominated and even driven by ideas and products from science and technology (Igwe, 2003). It is very likely that its influence on our lives will continue to increase in the lives to come. Various global problems facing us today emanated from global scientific collaborations that depend largely on the ecosphere (Udenyi, 2010).

The impact of climate change describes the various impacts of climate change on different sectors and regions of the world. Climate change presents an immediate and significant threat to our natural and built environment and to the ways of life which co-exists with this environment (Stack, 2010). Increasing atmospheric concentrations of greenhouse gases are projected to lead to regional and global changes in temperature, precipitation and other climate variables resulting in global changes in soil moisture, an increase in global mean sea level, and increasing the frequency and intensity of more severe extreme events such as extremes of temperature and precipitation, floods, droughts, cyclones and so on in some places (IPCC, 2007)

Change in climate will impact natural system (ecological systems, hydrology and water resources, coastal system) and the human society at large (including human health, settlements, food and fibre production, industry, energy and infrastructure) thus impeding the achievements of sustainable development. Global climate change would affect diverse sectors through different pathways varying in complexity, scale (both spatial and temporal) and directness. Impacts of climate change can be divided into two broad categories:

Sectorial Impacts

This refers to changes likely to be felt across various sectors (covering both natural and human systems) with serious implications on societies often exacerbating existing vulnerabilities. A global assessment of climatic data since 1970 has indicated that it is likely that anthropogenic warming has had a visible influence on many physical, biological and human systems (IPCC, 2007). The observed impact can be due to climatic factors (land use, land degradation, urbanization, industrial growth and so on).

Impact on Ecosystem

With the increasing pressure of human induced changes, ecosystem will be further fragmented, and there will be degradation of natural habitats. This will alter the structure reduce biodiversity and perturb functioning of most ecosystems and compromise the services they currently provide (IPCC, 2007). Environmental Protection Agency (EPA) (2010) stated some ways climate change can affect ecosystem; the ocean and the atmosphere are constantly interacting, exchanging heat, water, gases and particles. As the atmosphere warms, the ocean absorbs some of the heat. The amount of heat stored by the ocean affects the temperature of the ocean both the surface and at great depths, which can affect the habitat and food, supplies of marine life eg plankton. Also the more carbon dioxide the ocean absorbs from the atmosphere, when it dissolves and reacts with sea water it forms carbonic acid which has negative effect on marine life. Species that cannot adapt to changing climate are at risk of extinction. The loss of a single species can have cascading effects because organisms are connected through food webs and other interactions.

Impacts of Climate Change on Coastal Systems and Low- Lying Areas

Throughout the 20th century, the global rise in sea level has contributed to increased coastal inundation, erosion and ecosystem losses. Rising temperature has led to loss of sea ice, thawing of permafrost and associated coastal retreat and more frequent coral bleaching and mortality. This has consequently led to an increase in sea level, displacement of people, loss of livelihoods and submergence of low –lying areas. There are strong interactions both within as well as between the natural and human systems in the coastal system. Thus, there is a need to have an integrated approach for the management of coastal zones.

The decreasing rainfall, increasing temperature and evapo-transpiration have resulted in either reduction of water levels or total dry up of some rivers and lakes in Northern Nigeria, while lake Chad in Nigeria is reported to be shrinking in size at an alarming rate since the 1970s (Chindo and Nyolong, 2005, Odjugo, 2007). This is a clear evidence of climate change because a notable impact of climate change is increasing rainfall in most coastal areas and decreasing rains in the continental interiors (IPCC, 1996; NEST, 2003).

Impact on Health:

Climate change can affect human health through a range of mechanisms. These include relatively direct effects of hazards such as heat waves, floods and storms and more complex pathways of altered infectious disease patterns, disruptions of agricultural and other supportive ecosystems and potentially population displacement and conflict over depleted resources such as water, fertile land and fisheries (Pachauri & Resinger, 2007).

World Health Organization (WHO) (2007) stated the following effects of climate change:

- Extreme high air temperatures contribute directly to deaths from cardio vascular and respiratory diseases particularly among elderly people. In the heat wave of summer 2003 in Europe more than 70,000 excess deaths were recorded.
- Pollen and other aeroallergen level are high at extreme heat which can trigger asthma.
- Floods are also increasing in frequency and intensity. Floods contaminate fresh water supplies, heighten the risk of water-borne diseases and create breeding grounds for disease carrying insects such as mosquitoes, also increased risk of diarrhoeal.
- Rising temperatures and variable precipitation are likely to decrease the population of staple foods in many of the poorest regions by up to 50% by 2020 in some African countries. This

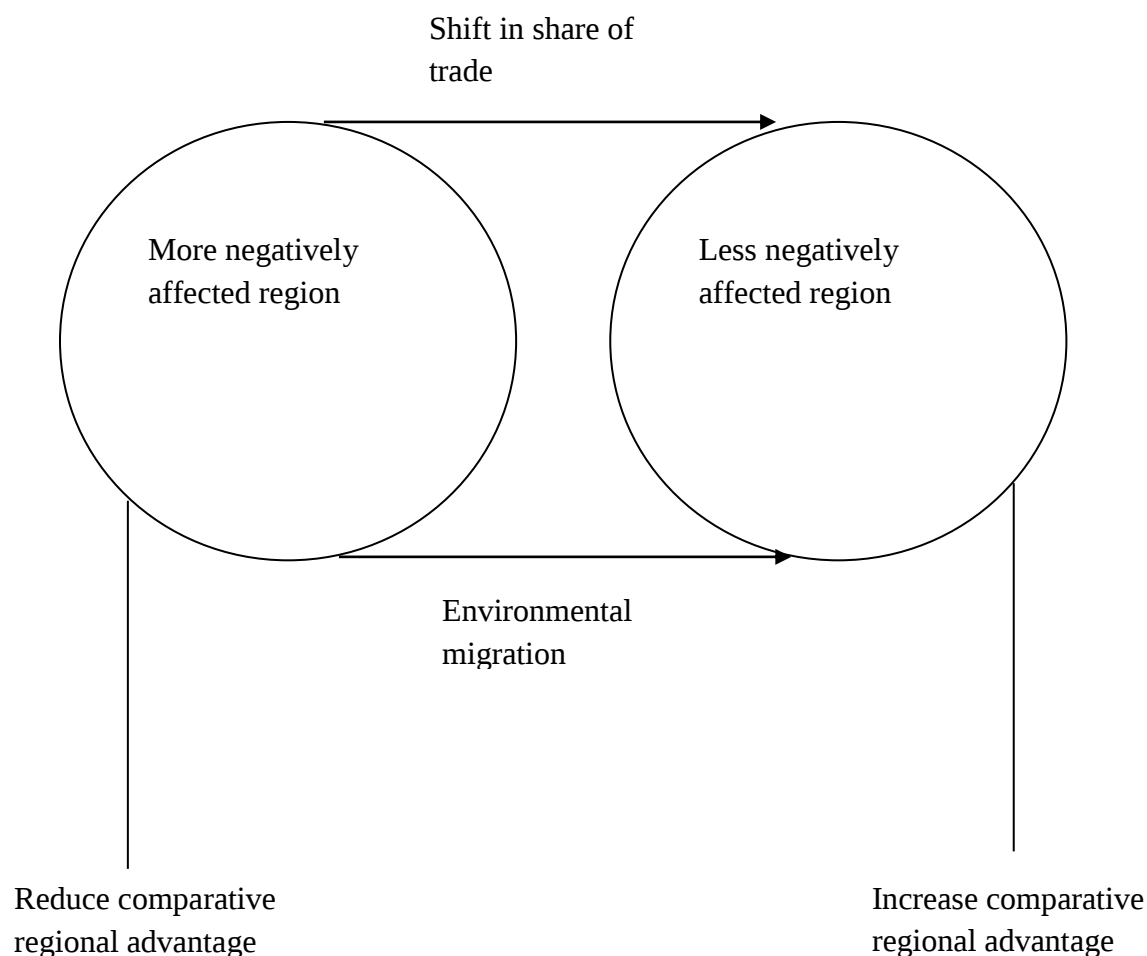
will increase the prevalence of malnutrition and under nutrition which currently cause 3.5 million deaths every year.

As Nigeria's inhabitants already suffer from nutritional imbalances (poor nutrition and malnutrition), climate change will only have a deleterious effect on food security. A shift could occur in the location of some vector-borne diseases such as malaria (mosquitoes) and sleeping sickness (tsetse fly). In response to shifts in the patterns of rainfall and temperature, mosquitoes currently thrive in locations where water logging and poor drainage typify the landscape. Malaria will increase due to the preponderance of stagnant pools of water resulting from sea-level rise related flooding (BNRCC, 2008). Under such circumstances, there is increased possibility of additional contamination of the limited sources of water and transmission of water borne diseases like cholera, typhoid fever, guinea worm infection and river blindness (Odjugo, 2010). Climate change can influence infectious disease. The spread of meningococcal (epidemic) meningitis is often linked to climate changes especially drought areas of sub-Saharan and west Africa are sensitive to the spread of meningitis and will be particularly at risk if droughts become more frequent and severe (Confalonieri & Menne, 2007). The great need calls for instructional package on climate change adaptation issues for students in secondary schools that will prepare them, to gain knowledge and acquire skills that will help them live a meaningful and healthy life.

Impact on Shelter:

Climate change may affect the migration of people within and between countries of the world. A variety of reasons may force people to migrate into other areas. These reasons include conflicts such as ethnic or resource conflicts and extreme events such as flooding, droughts, and hurricanes (IPCC, 2007).

General Effects of Climate Change on International Trade and Migration



Source: (IPCC, 2007: 27)

Regions with greater net benefits from climate change are likely to show trade benefits, along with environmental immigration (IPCC, 2007). Climate change may affect the migration of people within and between countries around the world. A variety of reasons may force people to migrate into other areas. These reasons include conflicts such as ethnic or resource conflicts, and extreme events such as flooding, drought and hurricanes. Extreme events displace many people, especially in areas that do not have the ability or resources to quickly respond or rebuild after disaster. Extreme events may become more frequent and severe because of climate change.

This could increase the number of people migrating during and after these types of events (Wilbanks, Romero, Bao, Berkhout, Cairncross, Ceron, Kapshe wood& Zapata, 2007). This statement agrees with Akonga (2001) who noted or showed that most of the destitute that emigrated as a result of drought and desertification usually move to nearby urban areas to beg for alms thereby compounding the already tense urbanization problems.

Impacts on Agriculture and food

Changes in climate could have significant impacts on food production around the world. Heat stress, droughts and flooding events may lead to reductions in crop yields and livestock productivity. Areas that are already affected by drought such as Australia and the Sahel in Africa will likely experience reductions in water available for irrigation (National Research Council, 2010).

Climate change has started to and will continue to impact negatively on agriculture and food security especially in tropical and sub-tropical regions because greenhouse gas emission would increase the risk of hunger by additional 80 million people by 2080 in Africa and Southern Asia (Odjugo 2001a; DFID,2006; Nwafor 2006, 2007 and Deweedt, 2007). Ahmed (1978) in (Odjugo, 2010) reveals that as at 1978 the preferred crops the farmers cultivated were guinea corn followed by groundnut and maize, but due to increasing temperature and decreasing rainfall amount and duration occasioned by climate change, the farmers as a means of adaptation in 2007 shifted to the production of millet followed by maize and beans.

Regional Impacts of Climate Change

This refers to changes with respect to different regions with varied geography, exposure and socio-economic status across regions and their ability to respond to the changing climatic conditions (IPCC, 2001). Major changes to climate change in the following region:

Africa

Africa is one of the most vulnerable continents to climate change. This situation is further worsened by its poor state of economic development and low adaptive programmes and capacity also where current information is the poorest, technological change has been the slowest and the domestic economies depends on the most heavily on agriculture (Mendelson, Dinar and Dalfelt, 2000). Climate change will put over 100 million people at risk of hunger by 2080 within 80% of them being in Africa (Carter, 2007). Agricultural production and the biophysical, political, and social systems that determine food security in Africa are expected to be placed under considerable additional stress by climate change (Food and Agricultural Organisation of United Nations) (FAO) (2007). Over sixty percent of African remains directly dependent on climate variability (Salinger, Sivakumar and Motha, 2005). The negative effects of climate change on crop production are especially pronounced in sub- Saharan Africa, as the agriculture sector accounts for a large share of GDP (Gross Development Production), export earnings and employment in most African countries. Furthermore, the vast majority of the poor reside in rural areas and depend on agriculture for their livelihood (International Food Policy Research Institute) (IFPRI, 2009).

African agriculture has the slowest record of productivity increase in the world. Seven countries are predicted to suffer the largest average losses in the agricultural sector in descending order (Nigeria, Sudan, Algeria, Cameroon, South Africa, and Morocco & Zaire) together these seven countries account for 47% of the damages in Africa. All of these countries have large agricultural sectors. Given the central role of agriculture, and the unprecedented changes in climate anticipated over the next few decades in the region, there is need to understand possible responses of Sub- Saharan Africa crops to climate change.

Biodiversity: Biodiversity is the foundation of ecosystem services on which human wellbeing is intimately linked. Climate change is at the heart of environmental discussion as a serious threat for human well being as well as for the biodiversity conservation (Nkombela, Namegabe, Kakogozo and Mumbere, 2011). Although biodiversity and ecosystem services experience changes due to natural causes (Millennium Ecosystem Assessment, 2005), this type of climate change, brought about by human activities is threatening to accelerate the loss of biodiversity already under way due to other human stressors(Hannah, Lovejoy and Schnelder, 2005). For example; in Arctic, shorter periods of sea ice coverage endanger the polar bears habitat and existence by giving them less time to hunt; warmer temperature in the pacific regions could reduce the number of male sea turtle offspring and threaten turtle populations. The sex of sea turtle hatchlings is dependent on temperature with warmer temperatures increasing the number of female sea turtles; in Africa, pressure from longer dry periods and shrinking living spaces are making elephants highly vulnerable to climate change (McCarthy, Canziani, Leary, Dokken and White, 2001).

People depend on biodiversity for food, fuel- wood timber and medicine and some human activities such as agriculture and poaching are likely to impact negatively on biodiversity (Nkombela, Namegabe, Kakogozo and Mumbere, 2011). Therefore the development of an instructional package to infuse climate change adaptation issues into senior secondary school biology curriculum would help to increase knowledge level of the importance of biodiversity in students.

Ecosystem Changes: Some regions in East Africa have become drier due to changes in land use pattern and climate. The warmer climate would disrupt natural ecosystem with grasslands and deserts expanding in area and forests reducing in area (Nagaira, 2007). The tropics would

become drier and agriculture would shift to the temperate regions. A warmer climate may also exacerbate existing environmental problems such as desertification, drought and soil erosion (UNEP, 1989 in Ngaira 2007). Ecological hazards such floods (the case of Bangladesh in 2002, 2003 and 2004), storms and forest fires (the case of Indonesia Oct.1997) might become common. Evidence of ozone depletion has already been detected in the South Pole where there is a hole in the Antarctic ozone (Ngaira, 2007).

Human Health: Human health, already compromised by a range of factors could be further hit by the negative impacts of climate change and climate variability (for example, previously malaria free highland areas in Ethiopia, Kenya, Rwanda and Burundi could also experience incidences of malaria by 2050s, with the conditions for transmission becoming highly suitable by 2080s).

Asia

Agriculture: Agriculture is one of the most vulnerable sectors to the anticipated climate change. More than 60 percent of the economically active population and their dependents-2.2 billion people rely on agriculture for their livelihood. In developing parts of Asia; Afghanistan, Bangladesh, India, and Nepal are particularly vulnerable to decline crop yields due to glacial melting, floods, droughts, and erratic rainfall among other factors (IFPRI, 2009). Climate can affect agriculture in a variety of ways, temperature radiation, rainfall, soil moisture and carbon dioxide (CO₂) concentration are all important variables to determine agricultural productivity and their relationships are not simply linear (Zhai and Zhuang, 2009). Increase in atmospheric CO₂ concentration can have a positive impact on crops yields by stimulating plant photosynthesis and reducing the water loss through plant respiration. This carbon fertilization effect is strong for crops such as rice, wheat, soybeans, fine grains, legumes and most trees,

which have a lower rate of photosynthetic efficiency. Crops like maize, millet, sorghum, sugarcane and many grasses, the effects are much smaller. Other factors such as a plant growth stage or application of water and nitrogen can also impact the effect of elevated CO₂ on plant yield (Zhai and Zhuang, 2009). Low adaptive capacity of farmers and their huge dependence on agriculture for subsistence will further increase their vulnerability. Therefore the need arises to develop an instructional package on climate change adaptation issues for senior secondary schools which would help to increase their adaptive capacity on issues related to climate change and agriculture.

Water: There has been an increased retreat of glaciers and permafrost in recent years due to unprecedented rise in temperatures. Accelerated glacier melt would result in increased flows in some river systems for the next two to three decades, resulting in increased flooding, rock avalanches from destabilized slopes and disruption of water resources. Freshwater availability projected to decrease in Central, South East and Southeast Asia by the 2050s, coastal areas will bear risk due to increased flooding, death rate from disease associated with floods and droughts expected to rise in some regions (IPCC, 2007). This would be followed by a decrease in flows, as the glaciers recede. Devastating floods have killed hundreds of people in India's Himalayan region of Uttarakhand and left tens of thousands in need of aid and rehabilitation. The disaster, which was triggered by heavy pre-monsoon rains on June 15th & 16th 2013, has been dubbed a 'Himalayan Tsunami' by local media due to the torrent of water that was unleashed. Landslides reportedly bury entire villages, while many roads, bridges and buildings have been swept away (Planton, 2013)

Coastal Areas: The South Asian region is highly sensitive to the consequences of climate change. It is known to be the most disaster prone region in the world supporting a huge

population of more than 1.3 million (UNEP, 2003). The coastal countries of the Indian Ocean region in Southeast Asia are highly vulnerable to climate change. Many are especially endangered because of their geographic location and topography. Bangladesh and Vietnam, for example are predicted to be among the most substantially affected countries in the world because of the large portion of their populations living in major river deltas exposed to sea level rise (Rabbani, Rahman and Islam, 2010). This is critical as climate predictions for the future highlights increase in frequency and intensity of extreme weather events like droughts and floods (IPCC, 2001).

Human Health: The frequency of occurrence of climate induced diseases and heat eat stress in Central, East, South, and South- East Asia has increased with rise in temperatures and change in rainfall variability. According to UNFCCC, (2007) heat stress and changing patterns in the occurrence of disease vectors affecting health Increases in endemic morbidity and mortality due to diarrhoeal disease in South and in Southeast Asia there is an increase in the abundance and/ or toxicity of cholera in South Asia.

Ecosystems: The ecosystem within the Asia/ Pacific region represents a key asset at local, regional and International level. They contribute directly and substantially to regional economies by providing food and water to sustain poor rural people as well as natural resources. Various studies show that the observed changes in terrestrial and marine ecosystem have become more pronounced in the region. Climate change is expected to increase threats to biodiversity, resulting from land-use/cover change and population pressure in most parts of Asia, increased risk of extinction for many flora and fauna species in Asia is projected, as a result of the synergistic effects of climate change and habitat fragmentation (UNFCCC, 2007). Furthermore,

the region is highly subject to natural hazards, such as the 2004 Indian Ocean Tsunami, the 2005 Pakistan Earthquake, and the 2006 landslides in the Philippines.

South America

Land Area: Latin America and the Caribbean cover an area of about 19.9 million km. This region includes countries with the planets' greatest fresh water reserves and is among the most biologically diverse. However, several countries in the region are vulnerable to extreme weather and climate and degradation processes affect other climate change phenomena that may endanger biodiversity and the general basis for development (Peru, 2006) .Almost three quarters of the dry land surface in Latin America. The combined effects of anthropogenic activities and climate change have brought a considerable decline in natural land cover in particular; rates of deforestation of tropical forest have increased during the last five years.

Countries such as Venezuela, Columbia, Mexico, Ecuador, Brazil, Argentina, Peru and Bolivia, among others have evidenced and suffered the impacts of climate change in the socioeconomic system, such as agriculture and fishing. These impacts are a consequence of the phase of the EL Nino Southern Oscillation (ENSO) phenomena, but also in specific health conditions, such as tropical and infectious diseases including malaria, dengue, leishmaniasis (cutaneous and visceral), yellow fever, cholera and diarrhoeas, and probably chagas disease (SAT) are a result of climate change.

Water: Climate changes will a pose a severe threat to the availability of water. It has been estimated that by the 2020s the net increase in the number of people experiencing water stress due to climate change is likely to be between 7-77 million. This will also affect the agricultural productivity, which particularly declines due to increase in temperature and reduced water availability.

Biodiversity: It is likely that there will be a significant extinction of species in many areas in the tropical zone. This will replace the tropical forests of Amazon and Southern and Central Mexico with Savannas. Further, it is anticipated that by the 2050s, 50% of the agricultural land will be subjected to desertification and salinization in some areas.

Coastal Areas: Coastal areas will be affected due to the rise in sea level and frequent extreme events, particularly in low-lying areas. This will have an impact on infrastructure to erosion, livelihood related to mangrove ecosystems as well as on the availability of drinking water.

Health: It is well established that climate is an important determinant of the distribution of vectors and pathogens such as those of malaria (*Anopheles spp- Plasmodium falciparum*, *P. Ovale*) and leishmaniasis (Sandflies) among many others in different areas of the world, including Latin America. This is particularly true in its tropical regions but also in its sub tropical areas (Rodriguez- Morales, 2005)

Increase in temperature would affect human health in polluted cities such as Mexico City and Santiago and Chile. Studies in Peru and Cuba indicate that increase in temperature and precipitation would change the geographical distribution of infectious diseases such as Cholera and Meningitis. It is well established that extreme events tend to increase death and morbidity rates (injuries, infectious diseases, social problems and damage to sanitary infrastructure) as shown in central America with Hurricane Mitch in 1998, heavy rains in Mexico and Venezuela in 1999, and Chile and Argentina in 2000 (IPCC, 2007).

Europe

Water: The main climate change consequences related to water resources are increases in temperature, shifts in precipitation pattern and snow cover, and a likely increase in the frequency of flooding and droughts. Depending on the region, climate change will have widely differing

effects on Europe's water. Higher temperatures will generally intensify in the global hydrological cycle. Annual precipitation trends in Europe indicate that northern Europe has become 10%- 40% wetter over the last century, whereas southern Europe has become up to 20% drier. Over the last century annual river discharge has increased in some regions, such as Eastern Europe, while it has fallen in others, such as southern Europe (EEA 2008)

Biodiversity: Biodiversity loss will be an advancing threat for Europe under climate change, and will cause significant welfare losses owing to ecosystem degradation. In northern Europe, some arctic and alpine species will disappear but the range of plants is very likely to expand northward and invasive species will find a better habitat in which to grow. The boreal region for example, could in principle gain many species from the south, leading to a high species turnover (Behrens, Georgiev and Carraro, 2010). Meanwhile, a sea- level rise will reduce habitat availability for bird species that nest or forage in low – lying coastal areas.

Biodiversity will diminish in Central Europe, moving northwards because of climate warming. In Austria for example, higher temperatures are forecast to erode the depth of snow cover and reduce biodiversity. The distribution of land use will change as the distribution of species in mountainous areas may shift upwards (Atomic Energy Authority(AEA), 2007) Plant species losses of up to 62% are projected for the southern regions, particularly in the mountains where there may be a loss of endemism owing to invasive species as well as a loss in plant range. The gradual rise in terrestrial and marine temperatures will cause the modification of natural habitats, which in the Mediterranean are already subject to intense pressures, and a massive loss of biodiversity (Magnan, Garnaud, Bille, Gemenne and Hallegatte, 2009).

Human Health: Modelling and assessing the impacts of climate change on human health are characterised by a high degree of uncertainty because of the increase in the heat- related

mortality rate while the number of deaths attributable to cold weather could decrease. Similarly, vector- borne diseases such as malaria or dengue fever could spread in Europe regions, and at higher altitudes. Like most other effects, those on health are unevenly distributed across Europe, with Central and Eastern Europe likely to experience the highest rise in heat – related deaths. Cold – related deaths are likely to fall the most in the British Isles and in Southern Europe (Behrens et al 2010). In Central Europe regions, climate change will generally decrease the mortality rate related to cold weather conditions, leading to a short- term improvement in the quality of life over approximately the next 15 years. In the long run, however, the impact of climate change will be negative and quality of life will decline (European Commission, 2009).

The Mediterranean countries appear to be those most affected in terms of human health issues. Mortality rates will be much greater in Southern and Southern- Eastern Europe, particularly in areas such as Greece and Portugal, due to the greater warming trend in these regions (World health Organization (WHO), 2007).

Agriculture: The effects of climate change on agriculture will be quite different in the northern, southern and eastern regions of Europe, thus intensifying regional disparities. In northern European agriculture will largely benefit from warmer temperatures, in terms of both crop yields and diversification. Productivity improvements in northern countries could reach 40-50% by 2080, with the largest increases in the hottest scenarios (ie +5.4 °C). The reasons for productivity improvements in northern Europe are mainly related to prolonged growing seasons, higher minimum winter temperatures and an extension of the frost- free period. Moreover, some crops that are usually cultivated in the south (such as maize, sunflower and soybeans, starch crops and cereals) will grow in the north (IPPC, 2007).

Impacts on central and eastern European agriculture, on the other hand will generally be negative, although there are differences between and even within countries of that region. Initially, owing to warmer temperatures, the decrease in precipitation and the longer growing seasons, there may be an improvement in crop productivity (cereals, oilseeds and sugar beet) in countries such as Bulgaria, the Czech Republic, Hungary, Poland and Romania (European Commission, 2009). In addition, Mediterranean countries, especially Greece, southern France, Italy and Northern Spain, may experience an increase in the frequency and intensity of winter floods caused by significant rainfall. This would lead to a further decrease in crop yields and possibly to a build-up of soil salinity, which would narrow the choice of crops. Meanwhile, in northern Portugal and western France, there may be a greater risk of forest fires, affecting adjacent areas of permanent crops (AEA, 2007).

North- America

Agriculture: Climate disruptions to agriculture have been increasing and are projected to become more severe over this century. Some areas are already experiencing climate-related disruptions, particularly due to extreme weather events. While some U.S. regions and some types of agricultural production will be relatively resilient to climate change over the next 25 years or so, others will increasingly suffer from stresses due to extreme heat, drought, disease and heavy downpours. From mid-century on, climate change is projected to have more negative impacts on crops and livestock across the country- a trend that could diminish the security of food supply. Climate change effects on agriculture will have consequences for food security, both in the United States and globally, through changes in crop yields and food prices and effects on food processing, storage, transportation and retailing.

Agriculture in North America has a long history of sensitivity to climate variability (e.g. the timing and magnitude of droughts and floods, extremes in heat and cold) and is subject to a wide

array of other factors that can limit potential productivity (e.g. troposphere ozone, pests, diseases, and weeds). Climate change is an additional factor that could enhance or reduce the sensitivity of the agricultural sector to these current stress factors. Adaptation measures therefore can help delay and reduce some of these impacts (IPCC, 1996).

Human Health: Many human healths are sensitive to weather, from cardiovascular and respiratory illnesses due to heat waves or air pollution, to alter transmission of infectious disease. The incidence of infectious diseases transmitted by air varies seasonally and annually, due partly to climate variation. In early 1990s, California experienced an epidemic of valley fever that followed five years of drought (Kolivras and Comrie, 2003). In Alberta, ambient temperature is strongly, but non- linearly associated with the occurrence of three enteric pathogens, Salmonella, E. coli and Campylobacter (Fleury, 2006). Many zoonotic diseases are sensitive to climate fluctuation (Charron, 2002).

The strain of West Nile Virus (WNV) that emerged for the first time in North America during the record hot July 1999 requires warmer temperatures than other strains. Also Lyme disease is a prevalent tick- borne disease in North America for which there is new evidence of an association with temperature and precipitation (Ogden, 2004).

Ecosystem: Climate change has caused ecosystems differences resulting in losses in both native and exotic species. For example, warming temperatures and fluctuating water supplies have impacted sustainable productivity and rates of mortality among recreational inland fisheries and commercial fisheries for salmonid species and walleye in North America (Babaluk, Reist, Johnson and Johnson, 2000). Climate change has resulted in changes in plant species, shifts in tree species, changes in the production of amphibian eggs and a shift in breeding migrations (Morgan, Pitelka and Sherliakova, 2001).

Impacts of Climate Change in Nigeria

Nigeria has a total area of 923,768sq km with water covering 13,000sq km and land 910,768 sq km. It has a coastline of about 853km. It is in West Africa bordering the Gulf of Guinea, between Benin and Cameroon. The climate varies; equatorial in south, tropical in centre and arid in the north. In Nigeria, flood disaster has been perilous to people, communities and institutions. In the year 2012, many parts of the country were affected by flood such as the following;

- The riverine communities in rivers Niger and Benue, and other parts of the country were affected by flooding chasing the inhabitants away and so many places. It shattered both the built- environment and undeveloped plan of the country. It claimed many lives, and millions of properties got lost due to its occurrences. One prominent feature about flood is that it does not discriminate, but marginalizes whosoever refuses to prepare for its occurrence. It happens without warning but with a surprise package that always delivers to unprepared community like the ones in Kwara, Niger, Kogi, Anambra, Kebbi and Delta States along the river Niger and Adamawa, Benue and Taraba States along river Benue (Etuonovbe, 2013).
- In mid- July 2012, flooding in Ibadan, Oyo State capital, caused many residents to flee from their homes. In late July 2012, at least 39 people were killed due to flooding in Plateau State. Heavy rainfall caused the Lamingo Dam to overflow near Jos, sweeping across a number of neighbourhoods and approximately 200 homes were submerged or destroyed. In that year also, discharge of water from a dam in neighbouring Cameroon, as a result of a downpour, triggers one of the most disastrous floods in the northern part of the country. Worst hit was Adamwa State, where no fewer than 89 schools were severely flooded, prompting the state government to indefinitely postpone the resumption of schools for the new academic year.

(Ogunde Shola Tope, Vanguard newspaper April 14, 2013. Changing rainfall patterns in Nigeria and global warming).

- The forest reserve in Nigeria is not left out in the threat posed by climate change. Francesco, (2008) stated that climate change will affect agriculture and forestry through higher temperatures, elevated Co₂ concentration, precipitation changes, increased weeds, pests and disease pressure, and increased 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. The country's broader forest cover 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. Therefore, because of the drying up of villages or communities forest, which the dwellers depend on for firewood, they resort to the depletion of forest reserve as a means of getting wood fuel.
- The sea level in Nigeria also is not left out. 15 million population of Lagos for example lives less than six feet above sea level, including the wealthiest areas of Victoria Island and Lekki Peninsula. Also the Niger Delta may be the source of oil wealth but its low-lying terrain criss-crossed with water ways makes it extremely vulnerable to flooding. Bearing in mind the high population density (9th largest population in the world) of the country any displacement of this mass of people will be catastrophic especially as over 50% of this population lives below poverty lines. Therefore adaptation to the impacts of climate change must be given priority if

the nations Millennium Development goals will ever be achieved (Ifeanyi- obi, Etuk and Jike- wai, 2012).

- In studying the impacts and adaptation of climate change in Northern Nigeria Okhimamhe, (2009) found out that diseases like persistent malaria, hypertension, ulcer, diarrhoea, asthma and diabetes are new ailments that were ushered in by the changing climate, with malaria being the most widespread. The researcher pointed out that thirty years ago, the people of the area relied on local herbs for treating illnesses, but now, they have to go to nearby fairly functional clinics for treatment especially because the herbs are no longer able to stop diseases. In addition most of the herbs used are no longer available. Some diseases like tick-transmitted meningitis are infectious diseases that can be influenced by climate change. Also extreme weather events are also known to facilitate some cardiovascular disease like asthma.

Nigeria, as a developing nation is particularly sensitive to the effects of climate change. A large part of the economy of the country depends on natural resources, which are particularly vulnerable to climate change. When those resources are affected, communities are implicated. Diseases, loss of livelihoods and settlements can force entire communities into relocation or complete extinction and even refugee status. The need arises for Nigerian to be educated and informed about climate change and how it can change our lives drastically. Lack of information and knowledge (education) about climate change also means that many Nigerians are reluctant to accept the reality of climate change. International Negotiator on climate change and Sustainable Development, Lekan Fadina and Environmental Activist, Demond Majekodunmi were guests of Saturday morning programme, Sunrise on Channels Television which held on the 19th of April 2014 to discuss issues of climate change and its dangers to mankind, especially to Nigeria. The experts revealed that the world was running out of time, and Nigeria must do something towards

taking measures on climate change because its life was at risk .This calls for integrated approaches for the adaptation and mitigation and one sustainable way to achieve this is through education and capacity building. To realize this, the curriculum of educational intuitions has to be modified to accommodate the current issues of climate change (Ozor, 2009).

Nigeria Climate

Nigerians is country in West Africa. Nigeria shares land Border with the Republic of Benin in the west, Chad and Cameroon in the east, and Niger in the north. Its coast lies on the Gulf of in the south and it borders Lake Chad to the Northeast. Nigeria is found in the Tropics, where the climate is seasonally damp and very humid. Nigeria is affected by four Climate types; these climate types are distinguishable, as one move from the Southern parts of Nigeria to the Northern part of Nigeria through Nigeria's Middle belt. Climate is the statistics of weather, usually over a 30-year interval. It is measured by assessing the patterns of variation in temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count and other meteorological variables in a given region over long periods of time.

The climate of Nigeria has shown considerable temporal and spatial shifts in its variability and change (Egbuna-Ojukwu, 2016) . Extreme climate and weather events (drought, flood, heat waves, ocean surges, etc) have become more regular. (Anyadike, 2009). The impacts of extreme weather and climate may be gradual but they are destructive to lives and property, negatively impact on the economy. Floods have become a perennial challenge with increasing intensity each year, leaving colossal losses and trauma. The low-lying coast of the country experiences perennial inundation due to ocean surges and strong tidal waves.

The climate of Nigeria is tropical; however there are wide climatic variations in different regions of the country. Near the coast temperatures rarely exceed 32 degrees Celsius (90 degrees Fahrenheit), but humidity is very high and nights are very hot. Inland there are two different seasons. A wet season from April to October, with lower monthly temperatures and the wettest month being June. Also a dry season from November to March, with midday temperatures that rise above 38° Celsius (100° Fahrenheit) but relatively cool nights, dropping as low as 12° Celsius (54° Fahrenheit). Average rainfall along the coast varies from about 180 cm (70 in) in the west to about 430 cm (170 inch) in certain parts of the east. Inland, it decreases to around 130 cm (50 inch) over most of central Nigeria and only 50 cm (20 inch) in the extreme north. The hot Harmattan wind from the Sahara sweeps across the northeastern areas which. The Harmattan wind is hot and dry and carries a reddish dust from the desert. The southwest wind brings cloudy and rainy weather.

In the coastal and south eastern part of Nigeria, the rainy season usually begins in February or March as moist Atlantic air, known as the southwest monsoon, invades the country. The beginning of the rains is usually marked by the incidence of high winds and heavy but scattered squalls. The scattered quality of this storm rainfall is especially noticeable in the north in dry years, when rain may be abundant in some small areas while other contiguous places are completely dry. By April or early May in most years, the rainy season is under way throughout most of the area south of the Niger and Benue river valleys. Farther north, it is usually June or July before the rains really commence. The peak of the rainy season occurs through most of northern Nigeria in August, when air from the Atlantic covers the entire country. In southern regions, this period marks the August dip in precipitation. Although rarely completely dry, this dip in rainfall, which is especially marked in the southwest, can be useful agriculturally, because it allows a brief dry period for grain harvesting.

From September through November, the northeast trade winds generally bring a season of clear skies, moderate temperatures, and lower humidity for most of the country. From December through February, however, the northeast trade winds blow strongly and often bring with them a load of fine dust from the Sahara. These dust-laden winds, known locally as the harmattan, often appear as a dense fog and cover everything with a layer of fine particles. The harmattan is more common in the north but affects the entire country except for a narrow strip along the southwest coast. An occasional strong harmattan, however, can sweep as far south as Lagos, providing relief from high humidities in the capital and pushing clouds of dust out to sea.

Given this climatological cycle and the size of the country, there is a considerable range in total annual rainfall across Nigeria, both from south to north and, in some regions, from east to west. The greatest total precipitation is generally in the southeast, along the coast around Bonny (south of Port Harcourt) and east of Calabar, where mean annual rainfall is more than 4,000 millimeters. Most of the rest of the southeast receives between 2,000 and 3,000 millimeters of rain per year, and the southwest (lying farther north) receives lower total rainfall, generally between 1,250 and 2,500 millimeters per year. Mean annual precipitation at Lagos is about 1,900 millimeters; at Ibadan, only about 140 kilometers north of Lagos, mean annual rainfall drops to around 1,250 millimeters. Moving north from Ibadan, mean annual rainfall in the west is in the range of 1,200 to 1,300 millimeters.

North of Kaduna, through the northern Guinea savanna and then the Sudan, Savanna zones, the total rainfall and the length of the rainy season decline steadily. The Guinea savanna starts in the middle belt, or southern part of northern Nigeria. It is distinguished from the Sudan savanna because it has more trees whereas the Sudan few trees. Rainy seasons decline correspondingly in length as one moves north, with Kano having an average rainy period of 120 to 130 days, and Katsina and Sokoto having rainy seasons 10 to 20 days shorter. Average annual rainfall in the north is in the range of 500 to 750 millimetres.

The regularity of drought periods has been among the most notable aspects of Nigerian climate in recent years, particularly in the drier regions in the north. Experts regard the twentieth century as having been among the driest periods of the last several centuries; the well publicized droughts of the 1970s and 1980s were only the latest of several significant such episodes to affect West Africa in this century. At least two of these droughts have severely affected large areas of northern Nigeria and the Sahel region farther north. These drought periods are indications of the great variability of climate across tropical Africa, the most serious effects of which are usually felt at the drier margins of agricultural zones or in the regions occupied primarily by pastoral groups.

Temperatures throughout Nigeria are generally high; diurnal variations are more pronounced than seasonal ones. Highest temperatures occur during the dry season; rains moderate afternoon highs during the wet season. Average highs and lows for Lagos are 31° C and 23° C in January and 28° C and 23° C in June. Although average temperatures vary little from coastal to inland areas, inland areas, especially in the northeast, have greater extremes. There, temperatures reach as high as 44° C before the onset of the rains or drop as low as 6° C during an intrusion of cool air from the north from December to February

As in most of West Africa, Nigeria's climate is characterized by strong latitudinal zones, becoming progressively drier as one moves north from the coast. Rainfall is the key climatic variable, and there is a marked alternation of wet and dry seasons in most areas. Two air masses control rainfall--moist northward-moving maritime air coming from the Atlantic Ocean and dry continental air coming south from the African landmass. Topographic relief plays a significant role in local climate only around the Jos Plateau and along the eastern border highlands.

The climate of Nigeria differs throughout three different regions of the country. Southern Nigeria is equatorial; Central Nigeria is tropical, while the northern region of the country is arid. To provide an in depth explanation of each of Nigeria's climate types, the Koppen Climate Classification System will be utilized. To begin, Nigeria's southern equatorial region may also be referred to the tropical rainforest climate or the equatorial monsoon climate. Under the Koppen Climate Classification system, the type of climate that encompasses southern Nigeria is that of the "Af" classification. This type of tropical rainforest climate produces heavy rainfall, with a constant temperature range with little differentiation. Next, the central region of Nigeria is considered to be tropical. When pertaining to the Koppen system, this tropical climate is referred to as a tropical savanna climate, or a tropical wet and dry climate. These climate types present defined wet and dry seasons, which Central Nigeria experiences annually. During the wet seasons, heavy rainfall occurs. The dry season brings high seasonal temperatures, accompanied by a west African trade wind blowing from the Sahara Desert to the north.

The last climate type present in Nigeria is arid, and is present in the nation's northern region. This arid climate is also known as the Sahel climate or tropical dry climate under the Koppen Climate Classification system. This type of climate experiences low rainfall and Northern Nigeria accrues less rainfall than any other area of the country. The rainy season is short lasting only a few months, while the rest of the year is dry and hot.

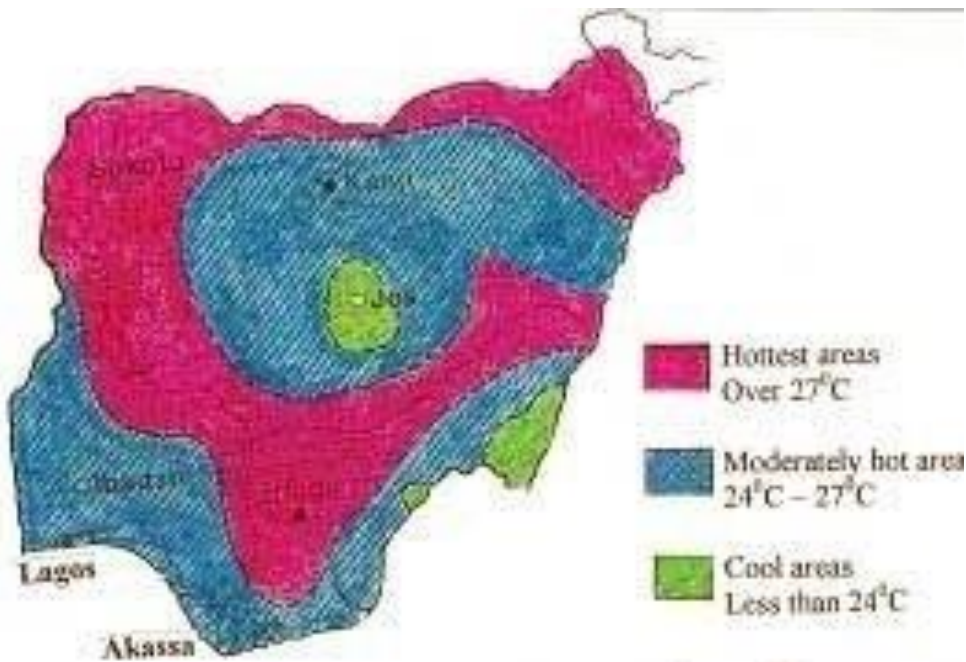


Fig 1: Koppen Climate Classification System, with maps of total annual rainfall and mean annual temperature variations of Nigeria.

Source: Thornthwaite, (1948)

To examine the annual range of temperature and precipitation in Nigeria, the cities of Lagos and Kano will be observed. First, the city of Lagos, Nigeria totals 1741mm of precipitation annually. Lagos' mean temperature is 27 degrees celsius or 80.6 degrees fahrenheit. Next, the city of Kano, Nigeria totals 826mm of precipitation and possesses an average temperature of 26 degrees celsius or 78.8 degrees fahrenheit. To get a better understanding of total precipitation and average temperature in Nigeria, the readings will be compared to the city of Denver, Colorado. The differences in total precipitation accumulation and average temperature can be expressed in the graphs below.

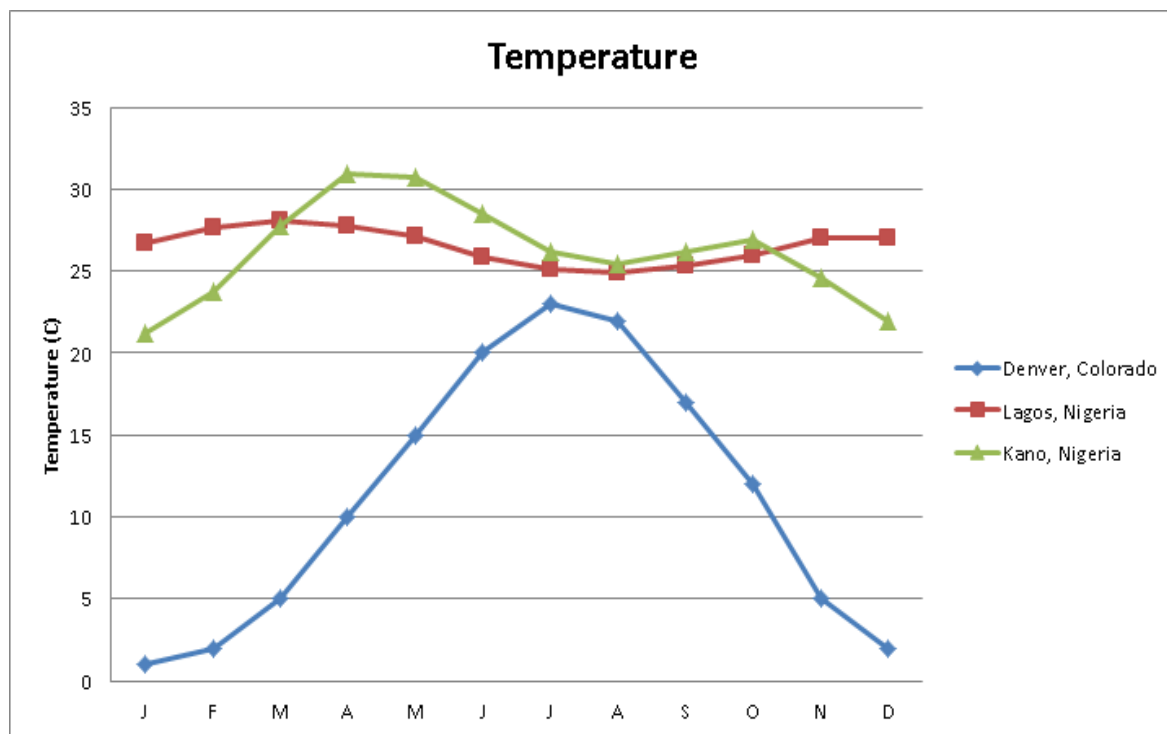


Fig 2: Graph of temperature in both Lagos and Kano when compared with Denver and Colorado

Source: Thornthwaite, (1948)

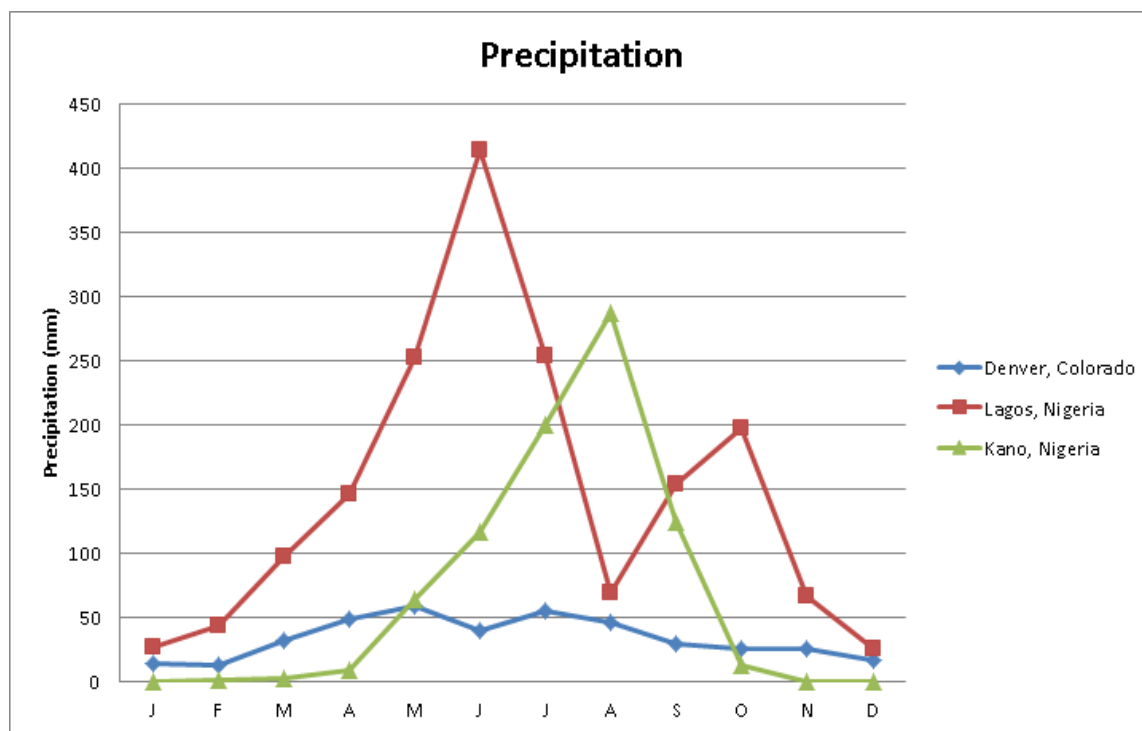


Fig 3: Graph of precipitation in both Lagos and Kano when compared with Denver and Colorado

Source: Thornthwaite,(1948)

When comparing the temperatures between Lagos and Kano to Denver, some significant differences are apparent. The temperatures in the Nigerian cities stay between a little over 20 degrees celsius and under 35 degrees celsius annually. In Denver, the temperatures range anywhere from just over 0 degrees celsius in the winter months, to just under 25 degrees Celsius in the summer month of July. Therefore, Denver experiences much more seasonality than Lagos and Kano in regards to temperature. The graphs above may also be used to compare annual precipitation between Lagos and Kano to that of Denver. Once observing the data on precipitation in the graphs, it is clear that Lagos and Kano experience more precipitation than Denver. The city of Denver, Colorado experiences precipitation without much seasonality.

However, Lagos and Kano possess much more precipitation seasonality comparatively. In Lagos there are two distinct wet seasons, which decline into less precipitation throughout the year. In Kano, there is only one wet season, which lasts April through October. The dry season in Kano lasts through November till the end of April, producing very little precipitation. After reviewing the graphs of temperature and precipitation in both Lagos and Kano, a conclusion about the seasonality of the two cities can be reached. In regards to temperature, Lagos and Kano do not produce much variation in temperature throughout the year, thus not producing any significant variations in temperature seasonality. Anyhow, when regarding precipitation, the two Nigerian cities do show differences in seasonality. They both contain wet and dry seasons throughout the year. The city of Lagos is located in Nigeria's equatorial climate zone, producing 1741mm of precipitation annually. Kano, located in Nigeria's arid climate zone produces 826mm of precipitation. Therefore, fluctuations in precipitation seasonality can be observed by comparing different climate zones in Nigeria to one another and precipitation seasonality is apparent in the country.

Nigeria is currently faced with adverse climate conditions that already have negative impacts on the welfare of millions of people. There are persistent droughts and flooding, and excessive rains resulting in disaster around the country (Okoyefi and Nzewi, 2013). The flood disaster in 2012 affected a lot of people in Nigeria especially women and children, while 363 people were killed, and over 2,100,000 were Internally Displaced. The quest for self-sufficiency in food production may be marred by the negative effects of climate change in agriculture. Farmers' expectations are met with frustration as a result of late arrival of rainfall and or excessive rainfall that results in heavy flooding. Farmers across the country are yet to recover from the destructive effect of 2012 floods that led to loss of lives and high cost of food production (Okoyefi and Nzewi, 2013). The socio-economic consequences of climate change in the agricultural sector can be best imagined than experienced.

In the southern parts of Sub-Saharan Africa, seasonal rainfall patterns have changed; floods and erosion are now common. Nigeria is not an exception as it experienced flooding and massive soil erosion on a yearly basis. The excessive consumption of fossil fuel like oil, gas, and carbon, and less attention on alternative energy source has led to a more increasing danger of the lives and properties of Nigerians. One of the biggest threats is growing climate unpredictability, which can make economic life difficult. The increased volumes of carbon dioxide and other greenhouse gases released by the burning of fossil fuels, land clearing, and timber harvesting in the tropics alone contributes 1.5 billion metric tons of carbon to the atmosphere, representing about 20 percent of human-made greenhouse gas emissions and a source that could be avoided relatively easily. Scientists from the Intergovernmental Panel on Climate Change (IPCC) carrying out global warming research have predicted that average global temperatures could increase between 1.4 and 5.8 °C by the year 2100. Changes resulting from global warming may

include rising sea levels due to the melting of the polar ice caps, as well as an increase in occurrence and severity of storms and other severe weather events (Egbuna-Ojukwu, 2016). Against this back drop, Nigeria is becoming the most exposed region in the world to the impact of climate change.

In Sub-Saharan Africa extreme weather will cause dry areas to become drier and wet areas wetter; agriculture yields will suffer from crop failures; and diseases will spread to new altitudes. By 2030 it is expected that 90 million more people in Africa will experience increase in malaria, already the biggest killer in Sub-Saharan Africa. Meaning, the environmental effects of climate change will have a direct impact on the economic development of Nigeria, even as the largest economy of Africa. There is increase in incidence of natural disaster, declining agricultural productivity, and a rising number of heat waves. The rate of declining rainfall causing increasing desertification, reducing the rich agricultural value that Nigeria is known for. The incidence of the rising water that submerged several communities should be treated as a matter of urgent concern, to avert future dangers to the lives and properties of the people in the affected communities across the country. Other negative impact of climate change is constant temperature rise, excessive and destructive rainfall, deep gully caused by heavy flooding, desertification leading to low agricultural yield, drying up of water bodies, intense agricultural land use, over grazing, bush burning, extraction of fuel wood and biotic, among other elements of environmental degradation.

Worse enough are women and children who are highly vulnerable and endangered in the devastation of our environment. This will lead to the increase in poverty and crime, when looking at the unimaginable long term impact caused by climate change to our environment and cultural heritage. While we burn up the planet's coal, pumping out emissions from coal, oil and gas reserves, and expose forests reserves, greenhouse gases are pouring into the atmosphere. The

delicate balance of atmospheric gases that sustains life is thickening, trapping more and more heat and irreversibly changing our world.

Having critically analyzed the challenges of climate change currently experienced in the Nigeria and some parts of West Africa, it is important to state the mandatory steps that are required to mitigate the problems of climate change in Nigeria. As a way of proactive measure, government should ensure it carries out an environmental impact assessment in the devastated areas of the previous flooding and other vulnerable areas around the country. Government should adopt the best global practice for the mitigation of global warming across the country. There should be routine sensitization programme across communities to help mitigate the looming dangers of global warming/climate change to a significant level. A mechanism for recycling of wastes, and replanting of every tree that is removed should be put in place. Our municipal laws should be strengthened to moderate the emission of greenhouse gases resulting from industrial energy. Finally, government must promote green revolution across the country. This includes forest and wild life preservation.

Adaptation

Adaptation is the process of adjusting to new conditions, stress and natural hazards that result from climate change. It is a process, action or outcome in a system (household, community, group, sector, region country) in order for the system to better cope with, manage or adjust to some changing condition, stress hazards, risk or opportunity (Smith& Wandel,2006). Fussel and Klein (2002) define adaptation as all changes in a system, compared to a reference case that reduces the adverse effects of climate change. Adaptation is the process through which organisms or populations of organism make biological or behavioural adjustments that will facilitate or assure their reproductive success and their survival, in their environment (Bates, 2005).

Adaptation is the principal way to deal with the impacts of a changing climate. It involves taking practical actions to manage risks from climate impacts, protect communities and strengthen the resilience of the economy. Adaptation refers to dealing with the impacts of climate change. Mitigation means dealing with the causes of climate change by reducing emission. Adaptation is a shared responsibility. Governments at all levels, businesses and households each have complementary roles to play. Individuals and businesses will often be best placed to make adaptation decisions that reduce climate risks to their assets and livelihoods.

Adaptation to climate change is a response to global warming and climate, that seeks to reduce the vulnerability of and biological systems to relatively sudden change and thus offset the effects of global warming (United Nations Framework on Climate Change, UNFCCC, 2010). Even if emissions are stabilized relatively soon, global warming and its effects will last many years, and adaptation will be necessary to the resulting changes in climate. Adaptation is especially important in developing countries since those countries are predicted to bear the brunt of the effects of global warming (Cole, 2008). That is, the capacity and potential for humans to adapt (called adaptive capacity) is unevenly distributed across different regions and populations, and developing countries generally have less capacity to adapt (Schneider, 2007).

Adaptation to changes in climate is nothing new. Throughout history, human societies have repeatedly demonstrated a strong capacity for adapting to different climates and environmental changes- whether by migration to new areas, changing the crops we cultivate, or building different types of shelter. However the current rate of global climate change is unusually high compared to past changes that societies have experienced. There are limits to the ability to adapt, so actions to mitigate climate change must continue. For example, the relocation of communities or infrastructure may not be feasible in many locations, especially in the short term over the long term, adaptation alone may not be sufficient to cope with all the projected

impacts of climate change. Adaptation will need to be continuously coupled with actions to lower greenhouse gas emission. This also could be followed by educating the younger ones on climate change issues by infusing it into related topics in the biology curriculum so as to reduce climate change related activities in the environment, and have a long time effect as they become change agents of the environment.

Climate Change Adaptation Awareness

Climate change adaptation awareness is the way by which individual perceive or feel towards adjustment in natural and in manmade system in respond to actual or expected climatic stimuli or their effect which moderate harm or exploit beneficial opportunities. The above definition present awareness to climate change adaptation as the way individual feel and concern towards adjustment to the impact of climate change According to (Oxley, 2010) increased awareness on climate change adaptation assist in implementing climate change adaptation measures such as adjusting in natural and in manmade system to reduce the likely impact of climate change. Increased sense of awareness on climate change adaptation can help to increase the disaster preparedness through developing and forecasting early warning and evaluation system .As some of these disasters like flood and drought are related to climate change, it will make good sense to be aware of climate change adaptation among various communities. According to (Fernandez & Show2013) Awareness on climate change must be integrated into adaptation and in the formulation of climate risk reduction plan. Therefore the students and other individuals awareness on climate change must be considered in climate change adaptation in the communities . This is necessary as the individuals are among the marginalised sector of the society that bear much of the impact of the disaster, and when people gain a better understanding of what is happening around them, then their willingness to become involve will be increased .

Climate Change Adaptation Attitude

It is now widely accepted that climate change is happening and the impacts affect the future development aspects of the society, including agriculture. Adaptation towards climate deals greatly with adjustment in natural and in human system in response to actual or expected climatic stimuli or their effect which moderate harm or exploit beneficial opportunities. Attitude towards climate change adaptation is the way of thinking and acting towards adjusting to the impact of climate change. It is all about changes in behaviour that reduce the adverse effects of climate change.

Public awareness of climate change is an important element that affects attitude towards climate change adaptation and influences climate change policy and co-communication. Understanding public perception of climate change as well as a risk (threat) affects people's behaviour particularly with regards to preparedness and attitude towards climate change adaptation. Socio-demographic characteristics play a key role in climate change perception and capacity to adapt. According to Brulle et al. The main factors affecting public perception and attitude about climate change are experience with extreme weather events, understanding of scientific information, media coverage of the issue, effort of advocacy groups and cues from the political elites and economic factors. Analysis of these factors showed that cues from the political and economic factors had largely affected public concern and attitude. Media coverage was also found to be an important element.

Theoretical Review

Social Learning Theory by Albert Bandura

Social learning theory was propounded by Albert Bandura in (1963) Bandura posits that learning is a cognitive process that takes place in a Social Context and can occur purely through observation or direct instruction, even in the absence of motor reproduction or direct reinforcement. The theory expands on traditional behaviorist theory, in which behavior is governed solely by reinforcements, by placing emphasis on the important roles of various internal processes in the learning. Social learning theory integrated behavioral and cognitive theories of learning in order to provide a comprehensive model that could account for the wide range of learning experiences that occur in the real world. The key tenets of social learning theory are that learning is not purely behavioral; rather, it is a cognitive process that takes place in a social context. Learning can occur by observing a behavior and by observing the consequences of the behavior (vicarious reinforcement). Learning involves observation, extraction of information from those observations, and making decisions about the performance of the behavior (observational learning or modeling). Thus, learning can occur without an observable change in behavior.

Social learning is a powerful avenue for effective climate change behavior change. Modeling behavior on others hand plays a key role in the establishment and maintenance of social norms. For example, people learn and remember how, where and when to put out the recycling as much from observations of those around them as by information from the council. Identity-related buying behaviors (e.g. clothes, cars, appliances) are influenced by those on whom identity is modeled and by those from whom a person is hoping to distinguish themselves. Jackson suggests the promotion of sustainable behaviors would benefit from the use of

influential role models and stealth marketing of pro-social messages. Exactly what information is gleaned from observation is influenced by the type of model, as well as a series of cognitive and behavioral processes, including: attention, retention, reproduction and motivation. An important factor in social learning theory is the concept of reciprocal determinism. This notion states that just as an individual's behavior is influenced by the environment, the environment is also influenced by the individual's behavior. In other words, a person's behavior, environment, and personal qualities all reciprocally influence each other.

Hence interpersonal relationships in school environment can help in shaping learners adaptive capacity to climate change. Climate change is a complex phenomenon involving the interaction of many social and ecological factors. Importantly, it is context-specific, with each community facing its own unique climate challenges and constraints. Nor are these challenges fixed; they evolve over time and can be affected by changes in agricultural production. This theory is related to this study because it can help in solving social changes that might arise during the process of addressing climate challenges. Thereby helping to change student's attitude towards climate change adaptation and create more awareness about climate change adaptation. Because learning gives rise to novelty in propositional knowledge, capacity to act and relationships, there is links between social structure and adaptive capacity.

Cultural Theory of Risk by Mary Douglas (1966)

Another important theory is the Cultural Theory of Risk for Climate Change by Mary Douglas of (1966). Douglas theory was found to be relevant to this study. The anthropologist sees that the way in which people perceive climate risk is informed by their social interaction and cultural world views comprising fundamental belief about society and nature.

The perception of climate change risk and vulnerability along with how people conceptualize the way nature function, influence the feasibility and acceptability of climate change adaptation planning, policy making and implementation. The cultural theory aim to explaining how people perceive and act upon the world around them. More specifically the theory claim that it is largely determine by social aspect and cultural adherence. Cultural Theory is a fine theory for explaining risk perception and interpretation for it produces a strong research of high quality support to hypothesized explanation.

Review of Empirical Studies

Studies on Awareness of Climate Change

Ochieng and Koske (2013) assessed the level of climate change awareness and perception among primary school teachers in Kisumu Municipality, Kenya. Three research questions guided the study. The design of the study is descriptive survey. A structured questionnaire was used to collect data on teachers' knowledge and perception of climate change from 100 respondents distributed in 20 primary schools in the area. Mean and standard deviation was used for data analysis. Findings indicate that the level of climate change awareness among primary school teachers in Kisumu Municipality is not significantly low, but there exists significant gaps in their knowledge. Results further indicate that primary school teachers in Kisumu Municipality perceive climate change as a threat. These findings necessitates capacity building to improve teachers' quality of knowledge on the subject especially if they are to be used as key actors in climate change awareness campaign in Kenya. This study is related to the present study in terms of climate change awareness knowledge but, The study differ because its focus is on the teachers awareness of the cause, effects and their classroom management strategies in climate change, while the present work is focused finding out awareness and attitude of climate change adaptation by Biology teachers and the student.

Nwankwo and Unachukwu (2012) conducted a study on teacher awareness of the cause and effects of climate change and their classroom management strategies in climate change era in Anambra state. The researcher adopted a descriptive survey design. The subjects used for the study was 1450 out of the 5783 teachers in 260 government owned secondary schools in the state. The sample was drawn using multi- stage sampling which included simple random sampling, stratified and purposive sampling techniques. The study was guided by three research questions and six null hypotheses. Data was collected using a 27 item researcher's developed questionnaire titled Teacher's Awareness of Causes and Effects of Climate Change and their Classroom Management Strategies (TACECCMS). Statistical mean and t- test were used for the analysis. The findings revealed among others that teachers are not quite aware of the causes and effects of climate change. Also teachers do not use classroom management strategies needed in the era of climate change. Based on the findings, they recommended that Government should without delay start organizing workshops and conferences for teachers at all levels on issues of climate change. This study is related to the present study in terms of awareness of climate change but differ because the present study wants to find out the awareness and attitude of respondents on climate change adaptation. The two studies are also similar in term of the design of the study which is descriptive design.

Owolabi, Gyimah and Amponsah (2012) conducted a study on assessment of junior high school student's awareness of climate change and sustainable development in Central region, Ghana. The study was guided by four research questions and four null hypotheses. It adopted the descriptive survey design and employed the purposive sampling technique which was used in selecting all the students from the 13 school (5 urban, 8 rural). This gave a population of roughly 5, 007 students. 400 research participants were selected to respond to the questionnaire items

based on their school curriculum. The result revealed that there were statistical significant differences in the awareness of climate change between students in rural and urban schools. However student's awareness of climate change and sustainable development was generally low. Also, there was no difference found in the student's awareness of sustainable development. The age of the student had no significant influence on their performance to the climate change and sustainable development test. Implications of these findings were discussed and it was suggested that climate change units be included in the teaching syllabuses/ curricular and teachers should give more attention to prescribed units of the textbooks. This study is related to the present study in terms of awareness of climate change but differ because the present study wants to find out the awareness and attitude of respondents on climate change adaptation. The two studies are also similar in term of the design of the study which is descriptive design.

Aklitu (2012) conducted a study which assessed whether (and the extent to which) loss of biological diversity and climate change have been incorporated into biology curriculum guides for Ethiopian secondary and preparatory schools. Six research questions guided the study. The sample for the study comprise of 281 students. The instrument for data collection in the study was a questionnaire. The research questions were answered using mean and standard deviation. The findings revealed that the revised curriculum guides have integrated a number of issues that could enhance understanding about the significance of biodiversity and consequences of its loss issues related to biodiversity have been addressed in one form or the other, in all grades except grade eleven. When it came to climate change, the revised curriculum guides offer little opportunity to integrate the issue. The study thus argues that, where such issues are not manifestly integrated into curriculum guides one cannot expect concrete action planned and executed against loss of biodiversity and climate change. The study is related to the present study

because it created need for climate change awareness but differ because the present study wants to find out the awareness and attitude of respondents on climate change adaptation. The two studies are also similar in term of the design of the study which is descriptive design.

Oruonye (2011) conducted a study on the assessment of the level of awareness of the effect of climate change among students of tertiary institutions in Jalingo Metropolis, Taraba State. A descriptive survey design was used for the study. The sample for the study comprised of 612 respondent. Five research questions and three hypotheses guided the study. Mean and standard deviation was used to answer the research questions and ANOVA and t test was use to test the hypotheses at 0/05 level of significance. The result of the finding showed that 18.2% of students interviewed have never heard about climate change before. Of the 81.8% that have heard about climate change, 89% do not know what climate change is all about, it causes, effects and possible adaptive or mitigation measures. This study is related to the present study in terms of awareness of climate change but differ because the present study wants to find out the awareness and attitude of respondents on climate change adaptation. The two studies are also similar in term of the design of the study which is descriptive design. The two studies differ in terms of the area of the study.

Idrisa, Ogunbameu Ibrahim and Bawa (2014) examined awareness and adaptation to climate change among farmers in Sahel Savanna agro- ecological zone in Boron State Nigeria. Four research questions guided the study. The design of the study is descriptive survey design. Also data for the study were collected from 225 respondents selected through multi- stage sampling technique. The instrument for data collection for the study was a structured questionnaire to measure the awareness and adaptation to climate change among farmers. Data was analyzed using mean and standard deviation. A socio- economic profile of the respondent

indicated that 48.85% were above years of age and majority 78.23% had educational qualification below the secondary school level. The study also revealed that a majority 79.12% of the respondents were small- scale farm holders and more than half 67.56% had fewer than 7 extension contacts during the 2010 farming season. An analysis of the source of climate change awareness revealed that majority 82.22% of the respondents was aware of the phenomenon of climate change of that number, extension service and friends / neighbours were ranked high as source of awareness about climate change accounting for 47.57% and 22. 43% respectively. Analysis of adaptation practices used by the respondents showed that planting ahead of rain 97.78% and planting of cover crops 80.00% were used most. Analysis of the relationships between some selected socio- economic variables and the use of climate change adaptation measures revealed that educational qualification and the number of extension contacts were the most important factors influencing the use of adaptation measures among the respondents. The main constraints on climate change adaptation measures by farmers in the study area were poor financial resources (86.67%) and unavailability of weather information 77. 78%.The study differs with the present study in terms of area of the study and respondents used for the study. This study is related to the present study in terms of awareness of climate change but differ because the present study wants to find out the awareness and attitude of respondents on climate change adaptation. The two studies are also similar in term of the design of the study which is descriptive design.

Ekpoh and Ekpoh (2011) carried out a study on assessing the level of climate change awareness among secondary school teachers in Calabar Municipality, Nigeria: Implication for management effectiveness. Three research hypotheses were postulated to guide the study. A self-designed questionnaire titled Climate Change Awareness Questionnaire (CCAQ) was

administered on a sample of 200 secondary school teachers. Population t- test and independent t- test were employed to analyze the data collected. Findings indicated that the level of climate change awareness was low generally among teachers and the awareness varied with sex. Also, teachers' access to sources of information on climate change was low. This study is related to the present study in terms of awareness of climate change but differ because the present study wants to find out the awareness and attitude of respondents on climate change adaptation. The two studies are also similar in term of the design of the study which is descriptive design.

Akinnubi *et al.*, (2012) carried an investigation on the level of climate change awareness among secondary school teachers in Ondo West Local Government Area in Ondo State. Three research questions and three hypotheses guided the study. The survey design was used and administered on fifty (50) secondary school teachers. Method of data analysis employed was population t-test and independent t-test. Findings indicated that the level of climate change awareness was low generally among teachers and the awareness varied with sex. Similarity between the two studies is that both discusses about assessing teachers awareness on climate change but they differs in location and also the above study assessed only teachers but the present study will assess both student and teachers awareness and attitude.

In view of the above Ezenwa (2013) investigated a study on relationship between secondary school teachers awareness of environmental problems and their practices in Enugu State. Two research questions and two hypotheses were used for the study. The population of the study include all the secondary school teachers in Enugu State that teach Geography, Biology, Chemistry, Agric Science and Physics. The population is two hundred and eighteen (218) teachers. The study adopted survey design and nine (9) secondary schools of seventeen (17) Local Government Area of the State were randomly sampled from the population of two

thousand one hundred and eighty-seven (2187) teachers. Six hundred and forty teachers were sampled carefully. Instrument for data collection was structured questionnaire that reflected the environmental issues. The teachers' responses were analyzed using multiple regressions. The findings of the study were that a positive relationship existed between secondary school teachers awareness of the environmental problems and their awareness of the risk prevention practices. The above study is related to the present study because both study investigated the awareness of teachers on environmental problems but differs in the location or area of study. The above study was carried out at Enugu State while the present study will be carried out in Anambra State. Also the above study included teachers preventive practices which is not found in the present study. Again the above study considered only secondary school teachers while the present study included the awareness and attitude of secondary school students and teachers.

Agboola (2016), carried out a study on Awareness of climate change and sustainable development among under graduates from two selected university in Oyo State, Nigeria. The study adopted a survey design, and the population for the study consisted of three hundred (300) undergraduate in university of Ibadan. The students were selected using purposively random sampling technique. Five research questions and five research hypotheses guided the study. Data obtained were analyzed using simple percentage and t-test. The result showed that undergraduates possessed high level of awareness to the sources of information and personal experience, public sources and education greatly influences their awareness. Also instrument for data collection was a 45-item each with Likert type response format titled "Awareness of climate change and sustainable development among undergraduate students" tagged ACCSDUS were administered. The reviewed study resembles the present study in that both studies are survey studies but they differ in terms of location that is the reviewed study was carried at Oyo State

while the present study will be done in Anambra State. Again, the population and sample of the reviewed study consists of undergraduates while in the present study the population and sample are made up of secondary school students and teachers.

Adebayo, Onu, Adebayo and Anyanwu (2012) conducted a study on farmers awareness, vulnerability and adaptation to climate change in Adamawa State, Nigeria. Six research questions and six hypotheses guided the study. A multi - stage sampling technique was used to select 340 farmers from the state. Primary data collected from the farmers included the socio-economic characteristic of the farmers such as gender, age, marital status and educational qualification as well as their climate change awareness and adaptation. The data were analysed with descriptive statistics. Majority of the farmers in the State are aware of climate change and submitted that climate change has affected their farming activities in recent years. The effects identified included reduced crop yield shortage of water and biomass for animals due to low rainfall and frequent dry spells. Similarly high temperature causes wilting of crops and diseases while excessive rainfall leads to destruction of farmlands and properties by flooding. The farmers are making efforts to adapt to climate change in various ways such as planting tolerant crop varieties, altering planting schedules, planting early maturing varieties and crop diversification. They however lack adequate information on how to adapt to climate change. This study is related to the present study in terms of awareness of climate change but differ because the present study wants to find out the awareness and attitude of respondents on climate change adaptation. The two studies are also similar in term of the design of the study which is descriptive design. The two studies also differ in terms of the location of the study.

Odjugo (2011) investigated the perception of climate change in Niger Delta region of Nigeria. 9 research questions guided the study. The design of the study is descriptive survey design. Three states were purposively selected and they included Delta, Bayelsa, and Rivers

State. In each state an urban and rural settlement were selected where 200 questionnaires were administered. 150 questionnaires were administered in each of the urban areas. 50 were used in each of the rural areas. The urban settlement used was Warri (Delta State) Yenagoa (Bayelsa State) Port Harcourt (River State) while the rural areas where the questionnaires were administered are Ute- Erumu, Oloibiri and Tabangh in Delta, Bayelsa and Rivers States respectively. In each urban area three quarters were randomly selected and in each quarter the names of the streets were written and five streets were randomly selected. In each street, 10 questionnaires were administered using the systematic random sampling. In each rural area, 5 quarters were randomly selected and in each quarter, 10 questionnaires were administered to respondents. In all 600 questionnaires were administered (450 to urban areas and 150 to rural areas). The data were analysed using percentages, correlation, ANOVA and t- test. The findings revealed that 42% of the respondents are ignorant of the concept of climate change while those who have varying degree of knowledge on the causes and effects of climate change shows that the television and radio are the main sources of their information. Most of the respondents are not aware of the main factors that cause global climate change like industrialization, urbanization and deforestation among others rather they choose local factors like gas flaring and bush burning as the major factors responsible for climate change/ Although, most local perception did not conform to scientific data local knowledge can be rapidly and efficiently gathered using systematic tools. The respondents were able to identify increasing temperature and changes in rainfall pattern as the main effects of climate change but other devastating effects outside their locality like melting of polar ice, sea level rise and desertification among others are not known to them. This study is related to the present study in terms of design of the climate change sensitization but differs because the present study seeks to identify the awareness and attitude of students and teachers on climate change adaptation.

Ugboaja and Ibiam (2010) carried out a study to evaluate the awareness of agricultural science students on climatic change in secondary schools in Abia State. Three research questions and three hypotheses guided the study. A survey design was adopted and a multistage random sampling technique was used to obtain a sample size of three hundred (300) students. The questionnaire was the instrument for data collection which was structured on four point rating scale. Analysis adopted descriptive statistics of frequency, percentage and mean. It was revealed that majority of the students were not aware of the most causes of climatic change. Both studies discusses student awareness on climatic change, but the difference was that in the above study only student, awareness were considered while in the present study students and teachers awareness on climatic change will be discussed.

Ezeugbor (2010) examined the principal's awareness and responses to the impact of climate change in secondary schools in Anambra State. The study was guided by two research questions and two hypotheses. The study used survey design and the population consists of all the two hundred and fifty eight (258) principals. Questionnaire validated by expert in education was used to receive relevant data for the study. Data collected was analyzed using population t-test statistical technique. The findings of the study revealed that principals awareness to climate change is low and as such could not respond positively to its impact in secondary schools. The similarity is that both study assessed the climatic change awareness. But the difference is that the in above study it was principal awareness on climate change while the present study will be on students and teachers awareness and attitude on climate change. Again the above study was carried out in Anambra State while the present study will be done in Anambra State.

Sofoluwe, Tijani and Baruwa (2011) conducted a study on framers perception and adaptation to climate change in Osun Sate in Nigeria. The study identified the adaptation techniques employed by farmers in the study area. Descriptive statistics and multinomial logic were used to analyze data obtained from a cross- sectional survey of 10 villages in two local

government areas in Osun State. The analysis of perception of farmers to climate change revealed a high increase in temperature and decrease in rainfall. This study is related to the present study in terms of adaptation to climate change but differ because the present study wants to find out the awareness and attitude of respondents on climate change adaptation. The two studies are also similar in term of the design of the study which is descriptive design.

Studies on Students Attitude to Climate Change

Skalík (2015) carried out a study on Climate Change Awareness and the Attitudes of Adolescents in the Czech Republic. Thus the main focus of the exploratory study is to offer a segmentation of Czech adolescents regarding the issue of climate change as it relates to the information sources they trust and as it relates to particular types of information on climate change – such as documents, processes, terms or numerical data. A sample of self-selected students from Masaryk University and students from several grammar schools in the Czech Republic participated in a quantitative study focusing on their knowledge of climate change, the information sources they use, and their pro-environmental attitudes. The survey revealed an extremely low level of student knowledge. A close correlation between the amount of information accessed and the students' evaluation of the seriousness of climate change was found. The students' trust in scientific evidence and their efforts not to rely on only one source of information correlate with their awareness. The students who understand climate change well are often post-materialists. On the other hand, well informed students do not feel more concerned and are not more globally focused than others. Although a clear correlation between awareness and level of consumption was not found, the better informed the students are, the more they feel personally responsible for climate change. Females are not on average better informed than males, but the feeling of personal responsibility is much stronger in females. Thus the study has

confirmed general assumptions regarding vague awareness about climate change in this specific context, and it presents a segmentation of the Czech student population for further social-marketing purposes. This study is related to the present study because it looked at student's attitude and awareness of climate change, but differ because the presents study is looking at climate change adaptation awareness and attitude among Biology students and teacher in Anambra State.

Wei (2014) investigated the perception, attitude and behavior in relation to climate change: a survey among CDC health professionals in Shanxi province, China. The purpose of this study was to assess the perception towards climate change, behavior change, mitigation and adaptation measures issued by the central government among the health professionals in the Centres for Disease Control and Prevention (CDC) in China. In 2013, a cross-sectional questionnaire survey was undertaken among 314 CDC health professionals in various levels of CDC in Shanxi Province, China. Descriptive analyses were performed. The study adopted a descriptive survey design. Mean and standard deviation was used to answer the research question, while independent t Test was used to test the null hypotheses that guided the study. Results of the study showed that more than two thirds of the respondents believed that climate change has happened at both global and local levels, and climate change would lead to adverse impacts to human beings. Most respondents (74.8%) indicated the emission of greenhouse gases was the cause of climate change; however there was a lack of knowledge about greenhouse gases and their sources. Media was the main source from which respondents obtained the information about climate change. A majority of respondents showed that they were willing to change behavior, but their actions were limited. In terms of mitigation and adaptation measures issued by the Chinese Government, respondents' perception showed inconsistency between strategies and relevant actions. Moreover, although the majority of respondents believed some strategies

and measures were extremely important to address climate change, they were still concerned about economic development, energy security, and local environmental protection. There are gaps between perceptions and actions towards climate change among these health professionals. Further efforts need to be made to raise the awareness of climate change among health professionals, and to promote relevant actions to address climate change in the context of the proposed policies with local sustainable development.

Arbuckle, Morton and Hobbs (2013) investigated the farmer beliefs and concerns about climate change and attitudes toward adaptation and mitigation: evidence from Iowa. Survey data collected from Iowa farmers are analyzed to answer the related research questions: two research questions that guided the study. Results indicate that farmers who were concerned about the impacts of climate change on agriculture and attributed into human activities had more positive attitudes toward both adaptive and mitigation management strategies. Farmers who believed that climate change is not a problem because human ingenuity will enable adaptations and who did not believe climate change is occurring or believed it is a natural phenomenon – a substantial percentage of farmers – tended not to support mitigation. The data for this research were collected through the 2011 Iowa Farm and Rural Life Poll (IFRLP), an annual statewide survey of Iowa farmers conducted by Iowa State University Sociology Extension. Iowa agricultural Statistics administers the survey following a survey postcard-survey mailing protocol. The 2011 survey was mailed to 2,030 farmers in February 2011. Useable surveys were received from 1,276 farmers, for a response rate of 63 %. Research questions, variables included in the model, and hypotheses two related research questions guided there search: (1) do Iowa farmers support actions aimed at climate change adaptation and mitigation; and, (2) are beliefs and concerns about climate change associated with support for or opposition to those activities. Analysis focuses

Sinatra, Kardash and Taasobshirazi (2012) examined the relationship among cognitive and attitude variables impacting college students' willingness to take mitigation action to reduce the impacts of human-induced climate change. The study adopted a correlational research design. Three research questions guided the study. One hundred and forty college students were asked to read a persuasive text about human-induced climate change and were pre and post tested on their attitudes about climate change and their willingness to take action to mitigate its effects. Mean, standard deviation and Pearson moment correlation were used for data analysis. The result of the study showed that students showed statistically significant changes in their attitudes about climate change and their willingness to commit to take action. A path model demonstrated that openness to change and a willingness to think deeply about issues predicted both change in attitudes and expressed willingness to take action. This research demonstrates that a persuasive text has the potential to promote change around complex socio-scientific issues. This study is related to the present study in terms of climate change attitude but differs because the present study is on awareness and attitude of students towards climate change adaptation.

Anable, Ecolane and Kelay (2006) undertook an evidence base review of public attitudes to climate change and transport behavior. Four research objectives and questions guided the study. The study employed a search strategy designed to capture all aspects of travel behaviour including the choice of all transport modes, car purchasing, the frequency and amount of travel and support for transport policies. Four research questions guided the study. 1202 respondents were used for the study. Mean and standard deviation were used to answer the research questions, the findings of the study showed that there is only a weak link between knowledge and awareness of climate change on the one hand and travel behaviour at the individual level on the other. Transport policies changes attitudes directly as a route to behaviour change, or they.

This study is related to the present study in terms of climate change attitude but differs because the present study is on awareness and attitude of students towards climate change adaptation.

Richardson (2015) carried out a study to evaluate students' attitudes towards embedding sustainability and climate change in nursing curricula among nursing students, some of whom had participated in a sustainability and health skills session, and determine whether the session could improve knowledge of sustainability. Three months after the sustainability session, students who had participated along with a sample of students who had not, completed a Sustainability Attitudes in Nursing Survey questionnaire. This investigated attitudes towards climate change and sustainability in nursing curricula and the costs of clinical and domestic waste disposal. Nursing students were positive about sustainability and climate change and its inclusion in the curriculum, irrespective of their participation in the sustainability scenario session. Participants in the sustainability session were more likely to identify correctly the cost of clinical waste disposal in the NHS. The sustainability and health skills session has the potential to improve nursing students' knowledge of the cost of clinical waste disposal. This study is related to the present study in terms of climate change attitude but differs because the present study is on awareness and attitude of students towards climate change adaptation.

Carter (2013) investigated the nature of science conceptions, attitudes towards evolution and global climate change, and course achievement in an introductory biology course. The study adopted a descriptive survey design. Four objectives guided the study. Previously-developed tools were used to measure students' conceptions of the nature of science and attitudes towards evolution, while national public opinion poll questions were used to measure attitudes towards GCC. Demographic questions were produced to target factors thought to influence attitudes towards evolution or global climate change. Overall sample size was N=620. Principle

Components Analysis was used to determine which variables accounted for the most variation, and those variables were analyzed using correlation tests, ANOVA, and ANCOVA to test for significant correlations and interaction effects. Changes in students' attitudes towards evolution and global climate change were both positively correlated with shifts in conceptions about the nature of science. Attitudes towards evolution were negatively correlated with religiosity. Knowledge of evolutionary science was positively correlated with attitudes towards evolution, but knowledge about GCC was not significantly correlated with attitudes towards GCC. The strongest correlates of GCC attitudes were political leanings. Findings support the hypothesis that a better understanding of NOS may lead to changes in attitudes towards politically contentious ideas that are not scientifically contentious. Though attitudes towards evolution correlated strongly and significantly with a number of other factors including knowledge of evolutionary science and religiosity, expected non-political correlates with attitudes towards GCC were absent. Giving students a good conception of the modern nature of science may lead to views that are closer to those of the scientific community. This study provides novel evidence of a linkage between student acceptance of evolution and attitudes towards GCC. This study is related to the present study in terms of climate change attitude but differs because the present study is on awareness and attitude of students towards climate change adaptation.

Christensen and Knezek (2015) carried out a study titled “The Climate Change Attitude Survey: Measuring Middle School Student Beliefs and Intentions to Enact Positive Environmental Change”. The Climate Change Attitude Survey is composed of 15 Likert-type attitudinal items selected to measure students’ beliefs and intentions toward the environment with a focus on climate change. This study describes the development of the instrument and psychometric performance characteristics including reliability and validity. Data were gathered from 1576 middle school students from across the United States in 2014 to validate the

instrument and establish the measurement properties of the instrument's scales. Factor analysis revealed two stable constructs representing beliefs and intentions, which were reconfirmed through multidimensional scaling and hierarchical cluster analysis techniques. Internal consistency reliability was found to be respectable for the survey as a whole as well as the two separate scales. The Climate Change Attitude Survey was created to fill a void in the measurement of middle school students' affective responses to the environment and climate change. Educators may find this survey useful for assessing pre- to post intervention attitude changes as well as for identifying differences in selected groups of students. Further development is targeted to include adding new constructs as well as testing the instrument with different population subgroups. This study is related to the present study in terms of climate change attitude but differs because the present study is on awareness and attitude of Biology students and teachers towards climate change adaptation.

Ambio (2013) investigates the influence of knowledge on attitude about climate change in the emerging adults' age group (16–17 years). Furthermore, the effects of a lecture in climate change science on knowledge and opinions were assessed. A survey was conducted in Austria and Denmark on 188 students in national and international schools before and after a lecture in climate change science. The results show that knowledge about climate change science significantly affects opinions about climate change. Students with a higher number of correct answers are more likely to have the opinion that humans are causing climate change and that both individuals and governments are responsible for addressing climate change. The lecture in climate change science significantly improved knowledge development but did not affect opinions. Knowledge was improved by 11 % after the lecture. However, the percentage of correct answers was still below 60 % indicating an urgent need for improving climate change science.

Againde (2006) studied environmental awareness and attitude of secondary school students the study was conducted in Ogoja education zone of Cross River State. Five hundred and forty four (544) senior secondary school students were randomly sampled. Structured questionnaire developed by the researcher was used for data collection and the data collected were analyzed using mean score and standard deviation .The major finding of study was that the student location has no significant influence on their environmental awareness and attitude. Ishaya and Obaje (2008) studied indigenous peoples perception on climate change and adaptation strategies in senior secondary school in Jema Local Government Area of Kaduna state. The study found out that location has no significant influence on students awareness of the problem of climate change. Chinedu (2008) carried a study on the environmental awareness and attitude of secondary school students .The study was conducted in Owerri education zone of Imo State and randomly sampled five hundred and thirteen (513) senior secondary school students. Questionnaire was used to collect data from the respondents. The data collected were analyzed using mean scores .The result of the study showed that location has no influence on the students environmental awareness and attitude. Ofobe (2009) in a study in Okigwe also found out that location has no significant influence on the secondary school students awareness and attitude towards environmental problem (like climate change). Oruonye (2011) carried out an assessment on the level of awareness of the effect of climate change among students in Jalingo Metropolis of Taraba State. The study found out that location has no significant influence on students awareness of climate change.

Summary of Literature Review

From the review, climate was seen as a weather condition prevailing in an area in general or over a long period. It is also the measure of the average pattern of variation in temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count and other

metrological variation in a given region over a long period of time. And climate change was referred to a change in average weather conditions, or in the time variation of weather around longer-term average conditions (i.e., more or fewer extreme events). However, the term climate changes generally used when referring to the change in our climate which has been observed since the early part of the 20th century and it is a fundamental element of the environment that causes alteration in an ecosystem if its variation becomes erratic. The study traced the instances of climate change devastation in both Nigeria and other countries of the world which brought in the intent of the study which is on adaptation. Adaption to climate change was seen as changes in processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate. It is also the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities. Awareness and attitudes of individuals towards climate change adaptation was reviewed.

Under the theoretical framework, Albert Bandura's social learning theory of 1963 in relation to climate change adaptation attitude and awareness. Bandura posits that learning is a cognitive process that takes place in a Social Context and can occur purely through observation or direct instruction, even in the absence of motor reproduction or direct reinforcement. Hence interpersonal relationships in school environment can help in shaping learners adaptive capacity to climate change. Climate change is a complex phenomenon involving the interaction of many social and ecological factors. Importantly, it is context-specific, with each community facing its own unique climate challenges and constraints. This theory is related to this study because it can help in solving social changes that might arise during the process of addressing climate challenges. Thereby helping to change student's attitude towards climate change adaption and create more awareness about climate change adaptation.

Lastly of the review of empirical studies, studies related to climate change, in terms of awareness and attitude towards climate change adaption were reviewed nationally and internationally. From the empirical studies reviewed, it was seen that so many researchers have delved into diverse studies in relation to climate change awareness, climate change adaptation and even on diverse individuals attitudes towards climate change adaptation, but there is scarcity of study on awareness and attitude of secondary schools biology students towards climate change adaptation in Awka Education Zone of Anambra state of Nigeria. Hence the present study will help to fill this gap in literature.

CHAPTER THREE

RESEARCH METHOD

This chapter describes the procedures that will be employed in carrying out this study; they are presented under the following sub headings: design of the study, area of the study, population of the study, sample and sampling techniques, instrument for data collection, validation of the instrument, method of data collection and method of data analysis.

Design of the Study

The design of the study is descriptive survey design. A survey research design is one in which a group of people or items is studied by collecting and analysing data from only a few people or items considered to be representative of the entire group. According to Ali (2006) descriptive research survey is an appropriate design for evaluating the effectiveness of policy guidelines for implementing educational programmes as it uses quantitative and qualitative information to identify, analyze and interpret conditions that exist in relation to set organizational policy guidelines. This design is considered appropriate and suitable for this study because it focuses on obtaining information and analysing data from a given population in relation to their awareness and attitude of Biology teachers and students towards climate change adaptation.

Area of the Study

The study was carried out in Awka Education Zone of Anambra State. Awka Education zone is comprised of five (5) local governments Areas namely Anaocha, Awka North, Awka South, Dunukofia and Njikoka. The choice of Awka Education Zone is based on the geographical location of the zone in Anambra State. This zone is plagued with many environmental challenges like several massive flooding submerging houses and shops, heavy wind and storms blast, erosion and global warming which have been strongly linked to the

effects of climate change. Upon these problem, the people in this zone still engage in activities like dumping of refuse inside the drainage system , building houses and shops on top of drainage channels, deforestation and bush burning which increases the aforementioned problems in the area.

Population of the Study

The population of the study comprised all the 68 Biology teachers and 3,958 SS II Biology students in sixty- one 61 public secondary schools in Awka Education Zone. Statistics Unit Post Primary School Service Commission (Awka Zone), (2018).

Sample and Sampling Technique

The sample for the study consists 464 respondents made up of 68 Biology teachers and 396 SSII Biology students drawn from six (6) public secondary schools in Awka education zones in Anambra State. First, simple random sampling technique (balloting with replacement) was used to select one education zones (Awka, education zones) out of the six education zones in Anambra State. Also, purposive sampling technique was used to sample two LGAs out of the five LGAs in Awka Education Zone. The criteria for using the two LGAs is because they are among the areas that were adversely affected during the 2012\2015 flooding incidence in Anambra State. According to State Emergency Management Agency. (SEMA), (2010-2015). In the two sampled LGAs, simple random sampling technique was used to sample three (3) secondary schools each from the two sampled LGAS. In the last stage, proportionate stratified sampling techniques was used to select 10% of the students population giving a total of 396. For the teachers no sampling was carried out since the population of the teachers are manageable and hence the entire population of the teachers were used as sample.

Instrument for Data Collection

The following instruments were used for data collection: Climate Change Adaptation Awareness Questionnaire (CCAAQ), and Attitude to Climate Change Adaptation Questionnaire (ACCQ).

Climate Change Adaptation Awareness Questionnaire (CCAAQ), is a questionnaire developed by the researcher for measuring the awareness of the respondents on adaptation measure for mitigating the impacts of climate change in the environment. The questionnaire comprised two parts. Part A is on personal data of the respondents; Part B deals with the item statements for the study on adaptation awareness. The part B comprised a list of 38 items, which the respondents answered using the following keys, Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD).

Climate Change Adaptation Attitude Questionnaire (ACCAQ) is a questionnaire developed by the researcher for measuring the attitudes of the respondents on adaption measure for mitigating the impacts of climate change in the environment. The questionnaire comprised two parts. Part A is on personal data of the respondents; Part B contains the item statements on attitude towards climate change adaptation. The part B comprised a list of 28 items, which the respondents answered using the following keys, Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD).

Validation of the Instrument

The two instruments for this study were validated by three lectures, two of the lecturers are from Education Biology and one lecturer from Measurement and Evaluation, all in the Department of Science Education University of Nigeria, Nsukka. In addition they were given the research topic, purpose of the study, research questions, and hypotheses. Validates were requested to carry a face validation on the instrument and the adequacy of the language for the

level of the students, and appropriateness of the instrument or the study. The corrections and recommendations made by the experts were used to produce the final version of the instruments. (See Appendix B, page 111).

Reliability of the Instruments

The revised instrument was subjected to trial testing with respondents from Model Secondary schools in Nsukka Local Government Area, which is not part of the study sample but has similar characteristics and environmental conditions with the sample. In line with this, the instrument was administered to twenty biology students and five Biology teachers in the secondary school. The scores obtained from the trial testing was used to determine the internal consistency reliability of the instrument using Cronbach Alpha Formula and they yielded internal consistency reliability index of .96 and .97 respectively for the two instruments. This indicated that the items in the instrument are reliable. (See Appendix V,)

Method of Data Collection

Short interactive training was given to the research assistants by the researcher on how best to approach the respondents. The researcher and the research assistants administered and collected back the copies of the instruments on the spot. This was done to ensure maximum return of the instrument.

Method of Data Analysis

The data collected from the research questions were analysed using mean and standard deviation, while the null hypotheses were analysed using t-test at 0.05 level of significance ($P < 0.05$). Based on the four point scale, a criterion mean score of 2.50 was used as the benchmark for decision taking. Therefore, any item that has mean below 2.50 were rejected while the items have mean of 2.50 and above were accepted. Independent samples t-test will be used to test all the null hypotheses.

CHAPTER FOUR

RESULTS

In this chapter, the results of the study were discussed in line with the four (4) research questions and two (2) null hypotheses that guided the study.

Research question 1: What is the mean rating of biology students on their awareness of climate change adaptation?

Table 1: Mean and standard deviation (SD) on Biology Teachers and Students Awareness on climate change adaptation

S/N	Item statements	X ₁	SD	DECISION
1.	Establishing weather monitoring equipment on school compounds to forecast events in the atmosphere	2.01	.70	Disagree
2.	Knowledge of routine measure of water levels	2.21	.86	Disagree
3.	Strengthening early warning sign	2.13	.79	Disagree
4.	Creating awareness among the citizenry	2.07	.78	Disagree
5.	Switching to early maturing varieties of crops	2.13	.79	Disagree
6.	Tree planting and reforestation	2.23	.84	Disagree
7.	Building of sea banks	2.35	.93	Agree
8.	Encouraging recovery of by- products and scraps for reuse	2.31	.88	Agree
9.	Encouraging recycle of waste materials	2.44	.99	Agree
10.	Planting trees that thrive on erosion lands eg Bamboo tree	2.62	.95	Agree
11.	Decrease the use of old cars	2.53	.98	Agree
12.	Conservation of the remaining forest	1.96	.76	Disagree
13.	Restraining the use of air conditioner	1.87	.72	Disagree
14.	Proper disposal of waste in the environment	1.85	.72	Disagree
15.	Increased use of wind energy	1.82	.67	Disagree
16.	Awareness campaign on climate change	1.85	.70	Disagree

17.	Mapping of risk and disaster areas	1.83	.73	Disagree
18.	Formation of climate change clubs in schools and localities	1.86	.73	Disagree
19.	Mounting awareness campaigns through the radio and television on climate change adaptation	1.81	.77	Disagree
20.	Sticking to master plans of towns and cities	1.93	.89	Disagree
21.	Stop dumping of refuse in the drains	2.03	.97	Disagree
22.	Ensure that drains are cleared regularly	1.98	.89	Disagree
23.	Making policy and programmes that provide opportunities for the displaced communities to earn livelihood	1.90	.87	Disagree
24.	Construction of dykes to stop water flooding in low area of land	2.11	.84	Disagree
25.	Construction of embankments to keep water back against pollution of the wetland	2.10	.85	Disagree
26.	Construct fish ponds in the flooded areas	2.01	.79	Disagree
27.	Explore other livelihoods other than agriculture	1.81	.73	Disagree
28.	Switch to other crops that can tolerate floods and heavy rainfall	1.78	.73	Disagree
29.	Provision of relief materials from good spirited individual and government	1.71	.70	Disagree
30.	Free medicine from government to flood victims	1.69	.71	Disagree
31.	Rehabilitation of destroyed infrastructure by government	1.80	.79	Disagree
32.	Helping people in evacuation areas	1.87	.84	Disagree
33.	Construction of surface dam	1.85	.86	Disagree
34.	Control burning of bushes	1.87	.84	Disagree
35.	Proper timing of tree planting activities	1.94	.89	Disagree
36.	Introduction of drought resistant plant species	1.94	.87	Disagree
37.	Planting early maturing varieties of crops and vegetables	1.91	.87	Disagree
38.	Use of direct seeding method, which requires less water	1.78	.79	Disagree
	Cluster Mean	1.99	.51	Disagree

Note below: The number of respondents for this study is 464 respondents made up of 68 Biology teachers and 396 SSII Biology students.

Data in table 1 showed that items 7-11, had mean rating above the mean cut off point of 2.50 while items 1, 2, 3, 4, 5, 6, 12-38, had mean rating below the cut-off point of 2.50. With the cluster mean score of 1.99. It showed that the students and teachers had low awareness level on climate change adaptation.

Research question 2: What is the mean rating of biology students on their attitudes towards climate change adaptation?

Table 2: Mean and standard deviation (SD) on Biology Teachers and Student's attitude towards climate change adaptation.

S/N	Item statements	X	SD	DECISION
39.	I do not think that proper environment management could stop the impact of climate change	1.75	.76	Disagree
40.	I am worried at the rate of flooding because it increases the effect of climate change.	1.73	.75	Disagree
41.	I always ask questions on Climate change adaptation strategies	1.69	.68	Disagree
42.	I predicate in planting of trees on open fields in order to check the incidence of erosion	1.70	.70	Disagree
43.	I believe that harnessing climate change impact will bring about safe environment.	1.74	.76	Disagree
44.	I am seriously concerned with the problem climate change may bring	1.68	.75	Disagree
45.	I am working hard to educate my friends about Climate change adaptation	1.64	.70	Disagree
46.	I have joined Climate change adaptation awareness club in my school to help.	1.70	.77	Disagree
47.	There is nothing I can do about Climate change adaptation that will make a meaningful difference.	1.80	.88	Disagree
48.	I am spreading the news of Climate change	1.70	.77	Disagree
49.	I have heard of climate change adaptation before	1.75	.79	Disagree
50.	I do not like to listen to news related to Climate change adaptation	1.71	.79	Disagree
51.	I believe that the problem of Climate change adaptation will be easy to handle.	1.80	.84	Disagree
52.	I am spreading news of Climate change adaptation within my area.	1.86	.85	Disagree
53.	I don't mind engaging in any activity to ensure proper climate change adaptation	2.35	.94	Agree

54.	Climate change adaptation will benefit only those who caused it	2.48	.96	Agree
55.	I think non adherence to Climate change adaptation strategies will make a lot of people to lose their job	2.59	.90	Agree
56.	I always plant trees to help reduce the rate of Climate change	2.67	.84	Agree
57.	I will be happy if the issue of Climate change is taken more seriously in my school.	2.65	.88	Agree
58.	I do not think I can do any meaningful thing to make difference about climate change	2.63	.84	Agree
59.	I am preparing myself to manage the effects of Climate change	2.69	.87	Agree
60.	I read any available information on Climate change	2.74	.87	Agree
61.	I read any available information on Climate change.	2.76	.91	Agree
62.	I encourage my friends to stop bush burning to prevent Climate change.	2.76	.91	Agree
63.	I will like the government to make an environmental laws against anybody who will cause climate change	2.75	.95	Agree
64.	I do not think that the climate is changing	2.74	.95	Agree
65.	I do not feel threatened about the problems caused by Climate change e.g. flooding, erosion.	2.67	.95	Agree
66.	I try to manage my classroom to avoid climate change effect.	2.70	.93	Agree
	Cluster Mean	2.19	.54	Disagree

Note below: The number of respondents for this study is 464 respondents made up of 68 Biology teachers and 396 SSII Biology students.

Data in table 2 showed that items 39-52 had mean rating below the mean cut off point of 2.50 while items 53- 66 had mean rating above the cut-off point of 2.50. With the cluster mean score of 2.19. It showed that biology teachers and students had poor attitude towards climate change adaptation.

Research question 3: What are the mean rating of biology teachers and students on climate change adaptation awareness by school location?

Table 3: Mean and standard deviation (SD) on biology teachers and students climate change adaptation awareness by school location.

Location	Number	Mean	Standard deviation
Rural	281	2.04	.51
Urban	183	1.93	.52

Data in Table 3 revealed the awareness of biology teachers and students on climate change adaption by school location which shows that teachers and student in rural area had a mean score of 2.04 while those in urban area had a mean score of 1.93. Based on the mean cut off point which is 2.50, it indicates that both rural and urban areas have low awareness of climate change adaptation, although those in urban area d higher mean rating.

HO₁: There is no significant difference in the mean rating of biology teachers and students awareness of climate change adaptation by school location.

Table 4: T-test analysis on significant difference in the mean rating of biology teachers and students awareness of climate change adaptation by school location

Location	N	Mean	SD	T	DF	Sig	Decision
Rural	281	2.04	.51	1.07	462	.488	NS
Urban	183	1.93	.52				

An independent sample t- test was conducted to compare the mean ratings of rural and urban area biology teachers and students on awareness of climate change adaptation. The result showed that there was a significant difference in the mean rating for rural (R= 2.04, SD= .51) and urban (U=1.93, SD= .52), $t(462) = 1.07$, $p > .488$ two tailed. The null hypotheses were therefore; not rejected indicating that there was no significant difference in the mean rating of biology teachers and students by school location on awareness of climate change adaptation.

Research question 4: What are the mean ratings of biology teachers and students on their attitude towards climate change adaptation by school location?

Table 5: Mean and standard deviation (SD) on influence of school location on biology teachers and student's attitude towards climate change adaptation by school location.

Location	Number	Mean	Standard deviation
Urban	281	2.26	.54
Rural	183	2.10	.52

Data in Table 5 on attitude of biology teachers and students in climate change adaption by school location which shows that teachers and student in urban area had a mean score of 2.26 which is higher than those in rural area which had a mean score of 2.10. Based on the mean cut off point of 2.50, it indicates that both teachers and students in rural and urban senior secondary biology students had low attitude towards climate change adaptation.

HO₂: There is no significant difference in the mean rating of biology teachers and students on attitude towards climate change adaptation by school location.

Table 6: T-test analysis on significant difference in the mean rating of biology teachers and students on attitude towards climate change adaptation by school location

Location	N	Mean	SD	T	DF	Sig	Decision
Urban	281	2.26	.54	1.55	462	.798	NS
Rural	183	2.10	.53				

An independent sample t- test was conducted to compare the mean ratings of rural and urban area biology teachers and students on their attitude towards climate change adaptation. The result showed that there was a significant difference in the mean rating for rural (U= 2.26. SD= .55) and urban (R=2.10, SD= .53), $t(462) = 1.55$, $p > .798$ two tailed. The null hypotheses were therefore; not rejected indicating that there was no significant on difference in the mean rating of biology teachers and students on attitude towards climate change adaptation by school location

Summary of the Findings

1. Biology teachers and students have low awareness level on climate change adaptation.
2. Biology teachers and students have poor attitude towards climate change adaptation.
3. Biology teachers and students in rural and urban areas have low awareness of climate change adaptation, although those in urban area had higher mean rating/ there was no significant difference in the mean rating of biology teachers and students on awareness of climate change adaptation by school location.
4. Biology teachers and students in rural and urban senior secondary biology students had low attitude towards climate change adaptation/ there was no significant on difference in the mean rating of biology teachers and students on attitude towards climate change adaptation by school location.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND SUMMARY

This chapter presents the discussion of the results, conclusion reached from the findings, educational implications the findings, recommendations, limitations of the study, suggestion for further studies and the summary of the study.

Discussion of the Findings of the Study

- Biology teachers and student's awareness on climate change adaptation
- Biology teachers and student's attitude towards climate change adaptation
- Biology teachers and student's attitude and awareness on climate change adaptation by school location

Biology teachers and student's awareness on climate change adaptation

Result of the study showed that the students and teachers had low awareness level on climate change adaptation. The result of this finding could be as a result of the fact that the biology teachers and students were not exposed to adequate instructions regarding climate change adaptation or because they paid a lazier affair attitude towards the instructions given to them. It could also be because they don't listen to news on television or radio giggles or read news papers where climate change awareness and strategies on climate change adaptation are been showcased or because they do not have access to internet materials to read and be aware of climate change adaptations. As a result of these reasons, they have low awareness on climate change adaptation. The finding is in line with Ishaye and obaje (2008) who found out in a study in senior secondary schools in Jema local government are of Taraba State that the students possess low awareness of climate change adaptation.

Similarly, Nzeadibe, Egbule, Chukwuone and Agu (2011), and Ozor (2009) also found out that people possess low awareness of climate change in their respective studies. These findings that have continued to show low climate change awareness among young Nigerians

particularly those in secondary schools could be as a result of the fact that the relevant subjects like Geography, Biology, Chemistry, Agricultural Science, Economics, Social studies and Primary science have not been effectively used to promote issues that borders on changing global climate.

Biology teachers and student's attitude towards climate change adaptation

The result of the study showed that biology teachers and students had poor attitude towards climate change adaptation. This finding could be as a result of ignorance of some strategies on climate change adaptation or because the respondents feel that it is not their business to ensure positive attitude towards their environment and this makes them to show nonchalant about it. It could be that they are not exposed to materials on climate change adaptation. This finding supports Oruonye (2011) who found out that the tertiary institutions student's possessed poor attitude towards climate change adaptation. Ishaya and Obaje (2008) also found out that secondary school students in Jema, Kaduna State, possessed poor attitude to climate change adaptation. This statement is based on the evidence of their findings that showed that people showed poor attitude towards climate change. Invariably, it could be argued that the student's low awareness to climate change adaptation influenced their attitude towards climate change adaptation. Corroborating the above, Omotosho (2007) and Intergovernmental Panel on Climate Change (IPCC, 2007) noted that people's continuous exhibition of poor attitude towards climate change is rooted on their inadequate awareness or knowledge of the causes and effects of climate change. The knowledge or awareness of climate change adaptation no doubt will affect their attitude towards climate change adaptation.

Biology teachers and student's awareness and attitude towards climate change adaptation by school location

The result of the study showed that Biology teachers and students in rural and urban areas have low awareness of climate change adaptation, although those in urban area had higher mean rating, test of hypothesis showed that there was no significant difference in the mean rating of biology teachers and students on awareness of climate change adaptation by school location. The low awareness and poor attitude towards climate change adaptation especially for those in rural area could be as a result of poor information about climate change and its adaptations provided to them. Government should endeavour to provide enough information about climate change awareness and adaptations provided to urban area students are made available to rural areas students as well to ensure that there is balance. Some contents that will expose students to be knowledgeable and aware of climate change adaptation should be integrated. The findings supported Oguniyi (2008) who revealed that there are problems of inadequate instructional facilities, poor attitude of teaching and inadequate teachers in most rural areas. Chinedu (2008) and Ofoebe (2009) also found that location has no significant different on student's environmental awareness and attitude in Owerri and Okigwe education zones respectively in Imo State. Discussing on the influence of location on student's awareness and attitude, Oruonye (2011) stressed that the level of under development of the rural areas in Nigeria could affect the quality of learning resources available in rural schools. Ishaya and Obaje (2008) argued that location of school may not affect student's awareness and attitude towards climate change adaptation since they derived their instructional content from the same curriculum.

Conclusion

Based on the findings of the study, the following conclusions were reached:

1. Senior secondary biology students and teachers had low awareness to climate change adaptation.
2. Senior secondary biology students and teachers have low attitude towards climate change adaptation
3. Senior secondary biology teachers and students in urban areas had higher awareness level on climate change than those in rural area, though there was no significant difference in their mean rating of teachers and students in urban and rural area on the level of awareness on climate change adaptation
4. Senior secondary biology teachers and students in urban areas had higher positive attitude towards climate change than those in rural area, though there was no significant difference in their mean rating of teachers and students in urban and rural area on their attitude towards climate change adaptation

Educational Implication of the Study

The findings of this study have implications to curriculum planners, science teachers particularly the biology teachers and biology students, educational administrators and textbook writers.

To curriculum planners, it shows that the current biology curriculum is not adequate in addressing the environmental issues in our society, hence there is need to infuse some of the issues into the curriculum to create awareness about climate change adaptation.

Again, this study has implication for biology teachers and students. The findings of the study showed that Biology teachers and students have low awareness and poor attitude towards

climate change adaptation. Therefore there is need for adequate enlightenment program for teachers and students to get them informed on the best practices towards ensuring adequate environmental management and mitigate incessant occurrence of climate change and be able to adapt well in cases of climate change occurrences.

The finding of this study has implication also for school administrators. The school administrators can organize workshops and seminars for teachers on the need to integrate climate change adaptation into their teaching and learning using topics that lend themselves to environmental issues.

Recommendations of the Study

Based on the findings of the study, the following recommendations were made:

1. Governments and non-governmental organization should ensure that quality education activities carried out in urban areas are obtainable in rural areas. To achieve this, there is need to ensure that qualified teachers are employed to teach in rural areas. Rural areas should be adequately equipped with necessary teaching and learning facilities to ensure effective and efficient learning.
2. Governments and non-governmental organizations should help by organizing workshops, seminars and conferences for teachers and students to exposed them to proper knowledge of climate change adaptation. This could enhance or improve their level of awareness and attitude towards climate change adaptation.
3. Secondary school curriculum planners should infuse more contents that could help the teachers and students to understand the causes and effects of climate change as well as the necessary adaptive measures to take, into the relevant subjects more especially in senior secondary schools Biology.

Limitations of the Study

1. The sample size of this study is small, therefore, the result gotten may not be generalized to a large population.
2. Most students did not understand some of the information on the questionnaire which made the researcher to spend much time as required in explaining these items to them.
3. Problem of absentees of the teachers and students elongated the duration for this study.

Suggestions

1. A similar study on awareness and attitude of biology students on climate change adaptation could be carried out using Chemistry, Basic Science and Physics teachers and students to determine their level of awareness and attitude towards climate change adaptation.

Summary of the Study

This study is on awareness and attitude of biology teachers and students on climate change adaptation. Four research questions and two null hypotheses guided the study. Relevant literatures were reviewed under three major sub-headings of conceptual framework, theoretical framework and review of empirical studies. This study adopted descriptive survey research design. This study was carried out in Awka education zone of Anambra State. The sample for the study will consist of 464 respondents made up of 68 Biology teachers and 396 SSII Biology students drawn from six (6) public secondary schools in Awka education zones in Anambra State. First, simple random sampling technique (balloting with replacement) will be used to select one education zones (Awka, education zones) out of the six education zones in Anambra State. Also, purposive sampling technique was used to sample two LGAs out of the five LGAs in Awka Education Zone. The choice of the two LGAs is because they are among the areas that

were adversely affected during the 2012\2015 flooding incidence in Anambra State. Two instruments were used for data collection in this study namely: Climate Change Adaptation Awareness Questionnaire (CCAAQ), and Attitude to Climate Change Adaptation Questionnaire (ACCQ).

The instruments were administered to 20 respondents in a school outside the study area but have similar characteristics with the study area. The scores obtained from the trial testing was used to determine the internal consistency reliability of the instrument using Cronbach Alpha Formula and they yielded internal consistency reliability index of .96 and .97 respectively for the two instruments. This indicated that the items in the instrument are reliable. The data collected from the research questions were analysed using mean and standard deviation, while then null hypotheses were analysed using t-test at 0.05 level of significance ($P < 0.05$).

Results of the study showed that biology teachers and students have low awareness level on climate change adaptation. Biology teachers and students have poor attitude towards climate change adaptation. Biology teachers and students in rural and urban areas have low awareness of climate change adaptation, although those in urban area had higher mean rating/ there was no significant difference in the mean rating of biology teachers and students on awareness of climate change adaptation by school location. Lastly, biology teachers and students in rural and urban senior secondary biology students had low attitude towards climate change adaptation/ there was no significant on difference in the mean rating of biology teachers and students on attitude towards climate change adaptation by school location.

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APPENDIX I
INTRODUCTORY LETTER TO RESPONDENTS

Department of Science Education
University of Nigeria
Nsukka.

Sir/Madam,

I am a postgraduate student of the above Department of the University of Nigeria Nsukka, I am currently undertaking a research study on Climate Change Awareness and Attitude among Secondary School Students and Teachers in Anambra State.

Please, kindly complete the attached questionnaire as honestly as you can. I wish to assure you that any information provided by you will be treated with confidence and use purely for research purpose.

Thanks for your co-operation.

Yours faithfully,

Udeegbunam Eugene Obiageli

Section A: Personal data of Respondent

Instruction: Please supply the following information in spaces provided.

1. Name of school

2. Gender: Male ☐ Female ☐

3. Status: Student ☐ Teacher ☐

4. School location: Urban ☐ Rural ☐

Section B: Questionnaire Items

Below are some questions designed to elicit information on the above topic. Please indicate your opinion by ticking [✓] in the appropriate column against the choice which best suit and represent your opinion.

Key 1: Strongly Agree (SA) = 4

2 Agree (A) = 3

3 Disagree (D) = 2

4 Strongly Disagree (SD) = 1

Cluster 1: Teachers and Students Awareness scale on climate change adaptation

S/NO	I am aware of the following measures of climate change adaptation	SA	A	D	SD
49.	Establishing weather monitoring equipment on school compounds to forecast events in the atmosphere				
50.	Knowledge of routine measure of water levels				
51.	Strengthening early warning sign				
52.	Creating awareness among the citizenry				
53.	Switching to early maturing varieties of crops				
54.	Tree planting and reforestation				
55.	Building of sea banks				
56.	Encouraging recovery of by- products and scraps for reuse				
57.	Encouraging recycle of waste materials				
58.	Planting trees that thrive on erosion lands eg Bamboo tree				

59.	Decrease the use of old cars				
60.	Conservation of the remaining forest				
61.	Restraining the use of air conditioner				
62.	Proper disposal of waste in the environment				
63.	Increased use of wind energy				
64.	Awareness campaign on climate change				
65.	Mapping of risk and disaster areas				
66.	Formation of climate change clubs in schools and localities				
67.	Mounting awareness campaigns through the radio and television on climate change adaptation				
68.	Sticking to master plans of towns and cities				
69.	Stop dumping of refuse in the drains				
70.	Ensure that drains are cleared regularly				
71.	Making policy and programmes that provide opportunities for the displaced communities to earn livelihood				
	Construction of dykes to stop water flooding in low area of land				
72.	Construction of embankments to keep water back against pollution of the wetland				
73.	Construct fish ponds in the flooded areas				
74.	Explore other livelihoods other than agriculture				
75.	Switch to other crops that can tolerate floods and heavy rainfall				
76.	Provision of relief materials from good spirited individual and government				
77.	Free medicine from government to flood victims				
78.	Rehabilitation of destroyed infrastructure by government				
79.	Helping people in evacuation areas				
80.	Construction of surface dam				
81.	Control burning of bushes				
82.	Proper timing of tree planting activities				
83.	Introduction of drought resistant plant species				
84.	Planting early maturing varieties of crops and vegetables				
85.	Use of direct seeding method, which requires less water				

Cluster 2: Teachers and Students attitude scale on climate change Adaptation

S/NO	ITEM STATEMENT	SA	A	D	SD
1.	I do not think that proper environment management could stop the impact of climate change				
2.	I am worried at the rate of flooding because it increases the effect of climate change.				
3.	I always ask questions on Climate change adaptation strategies				
4.	I predicate in planting of trees on open fields in order to check the incidence of erosion				
5.	I believe that harnessing climate change impact will bring about safe environment.				
6.	I am seriously concerned with the problem climate change may bring				
7.	I am working hard to educate my friends about Climate change adaptation				
8.	I have joined Climate change adaptation awareness club in my school to help.				
9.	There is nothing I can do about Climate change adaptation that will make a meaningful difference.				
10.	I am spreading the news of Climate change				
11.	I have heard of climate change adaptation before				
12.	I do not like to listen to news related to Climate change adaptation				
13.	I believe that the problem of Climate change adaptation will be easy to handle.				
14.	I am spreading news of Climate change adaptation within my area.				
15.	I don't mind engaging in any activity to ensure proper climate change adaptation				
16.	Climate change adaptation will benefit only those who caused it				
17.	I think non adherence to Climate change adaptation strategies will make a lot of people to lose their job				
18.	I always plant trees to help reduce the rate of Climate change				
19.	I will be happy if the issue of Climate change is taken more seriously in my school.				
20.	I do not think I can do any meaningful thing to make difference about climate change				

21.	I am preparing myself to manage the effects of Climate change				
22.	I read any available information on Climate change				
23.	I read any available information on Climate change.				
24.	I encourage my friends to stop bush burning to prevent Climate change.				
25.	I will like the government to make an environmental laws against anybody who will cause climate change				
26.	I do not think that the climate is changing				
27.	I do not feel threatened about the problems caused by Climate change e.g flooding, erosion.				
28.	I try to manage my classroom to avoid climate change effect.				