



## Environmental Challenges and Climate Change: Nigeria Experience

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Received 11 February, 2015; Accepted 10 June, 2015 © The author(s) 2015. Published with open access at [www.questjournals.org](http://www.questjournals.org)

**ASBTRACT:**-This study examines the impact of environmental imbalance, environmental challenges and climate change: A study of Nigeria experience. Climate change is a global problem requiring global solutions. Despite the considerable attention given to environmental protection and conservation, the effects of climate change still reoccurred. The objectives of this paper are: to ascertain the likely impacts of environmental imbalance and environmental challenges on climate change. The study also examines the linkage between environmental imbalance and environmental challenges on climate change in the ecosystem and in the lower physics of the atmosphere. The methodology adopted was purely on content analysis of secondary data and observed information from field survey. The study shows the cause of environmental imbalance, environmental challenges and climate change. However, atmospheric variables (positive and negative) are responsible of the gradual process and destruction of the ecosystem. The study tends to enlighten the public that environmental imbalance and challenges are the immediate and remote causes of climate change. The finding shows that human influences such as pollutants, chemicals, wastes, fertilizer, and deforestation among other interventions of the ecosystem are major determinants of environmental imbalance, environmental challenges and climate change. The way forward to ameliorate the effects of environmental imbalance, environmental challenges and climate change are the minima reduction of (CFCs) and (GHG's) in the three tiers of the ecosystem. Greenification of the lands, minimization of pollutants/contaminants in the atmosphere and major water bodies and the adoption of environmentally friendly technology should be upheld. Budgetary allocation on ecological funds to states should be on the increase. This will help to meet the challenges of environmental degradation and its influences. Countries should adopt the use of low carbon energy, unite to combat climate change, join climate change club, and to enforce the operationalization of the missions and summits on climate change.

**Keywords:**- Vulnerability, Environmental Imbalance, Environmental Challenges and Climate Change.

### I. INTRODUCTION

Climate change is a term used to explain the changes in the earth's climatic system. It is majorly concerned with a change due to an increase in the average atmosphere temperature. The incessant features of desert encroachment, glacier melting, wind patterns, environmental challenges, and ocean surge are clear indicators that the ecosystem is affected by climate changes. Climate change is a function of environmental challenges and imbalance in the ecosystem. The effects of climate change could be positives on the ecosystem that is where the indicators (troposphere temperature, humidity, temperature over ocean, sea surface temperature, ocean health content, temperature over land and sea level) are tilted towards increase in atmospheric temperature and negative where the indicators (glacier, snow cover and sea ice) are towards decrease. However, climate change connotes the varied changes in the amounts and patterns of climatic variables (rainfall, humidity, sunlight and wind) etc. These changes are attributed directly or indirectly to human impact and the activities that alter the composition of the global ecosystem and natural variability observed over comparable time periods (IPCC, 2007) as cited by Thomas, 2009. It is now a global concern that the impact of climate change today has been speed up due to geometric population explosion, socio-economic activities (industrialisation, agriculture, commercial and mining) and his quest for comfortability and sustainable development Ayo, (2009).

The International Energy Agency states that the power sector is responsible for 37% of all man-made Carbon Dioxide (CO<sub>2</sub>) emissions. It creates about 23 billion tones of CO<sub>2</sub> emissions per year – in excess of 700 tones a second. In turn, this CO<sub>2</sub> continues to heat up our planet which poses an unprecedented threat to human life and others organisms within the environment, the aftermath of these heats on the ecosystem is environment imbalance and climate change. In addition, generating electricity through the burning of fossil fuels, in particular carbon-heavy coal has a greater impact on the atmosphere than any other single human activity. The effects of these changes on the atmospheric temperature is the likely effects of droughts and desert encroachments, heat waves and a slow gain in sea levels that could continue for more than 1,000 years even if greenhouse gas emissions were capped. The panel's report predicts a "best estimate" that temperatures would rise by between 1.8 and 4.0 Celsius (3.2 and 7.8 Fahrenheit) in the 21st century.

Greenification is the only means through climate change can recover. It is glaring that tropical forests contained huge quantities of carbon oxide, a greenhouse gas that causes climate change. When large hectares (Sq km) of land are destroyed for human habitation and for other activities as industrial, agricultural, mining and other purposes, they release their stored carbon oxide prematurely in quantities and if compared greater than all the vehicles and trucks of the world. The effect of these is that, it gradually leads to a gradual increase in drought conditions. Tropical forests are home to most of the world's threatened species (lion, elephant, tiger, and leopard) etc and these species of animals are nowhere found near human communities due to population explosion and the pace of socio-economic activities. Trees naturally consume most of these gases (chlorofluorocarbon (CFC), methane, nitrous, toxin and Salina) thereby causing heat trapping and the aftermath effect on climate change. The volume of these gases has been doubled due to the burning of fossil fuels, the resulting increase in average temperature of the earth's surface amount from 40° to 60°. Apart from plants, people too lose their resources each time they witnessed climate change and environmental degradation. These impacts of these changes affect the increasing strife over dwindling supplies Chris (2006), It is now a global concern that climate change today has been speed up because of man's activities. However, Amina (2013), states that the failure to act now on climate change and environmental degradation may affect the chances of Nigeria's to achieve her ambition of Vision 20:2020 of becoming one of the world's largest economies by the year 2020.

Researchers have shown from climatic indicators that in the next two decades (probably between 2030 and 2050) that climate change is expected to cause approximately 250, 000 additional deaths per year, from malnutrition, malaria, diarrhea and heat stress. Climate change signified greater danger to developing nations like Nigeria and others and has resulted to about 95% of all diseases or disasters related deaths Okechukwu, 2013. Climate change is a global problem requiring global solutions. It may be limited to a specific region like in the arid areas or across the whole earth. The world *environmental day* (WED) is being celebrated on June 6<sup>th</sup> every year to proffer solutions of the effects of climate change and environmental challenge (erosion, floods, ocean surge, deforestation, desert encroachment, pollution via air, water, land and environmental management) etc. Climate change is the significant and lasting change that affects the statistical spread of weather patterns over long periods ranging from decades to millions of years. In 1988, the United Nations Environment Programme joined with the World Meteorological Organisation (WMO) to establish the Intergovernmental Panel on Climate Change (IPCC). The concern of this body is about the potentially serious destructive effect that will result from significant, short-term changes in world climate. The understanding of anthropogenic warming and cooling influences on climate variables has improved since the fourth assessment reports (FAR) on climate change in 1750 (Thomas, 2009). Before now, the rate of albedo determines the equilibrium temperature and climate of the earth.

Energy from the sun is distributed around the globe by the actions of wind, ocean current and other mechanisms. This results to differences in climatic pattern as observed in the varied regions of the earth's surface (Thomas, 2009). Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of ice and rising global average sea level to a great extent were all attributed to the discovery of the *Antarctica Ozone Hole* in 1987, in the lower physics of the atmosphere by Jean-Baptiste-Joseph Fourier (Thomas, 2009). The various summits on climate change from global leaders in the specialty of Public policy, Sciences and Businesses met at intervals on constructive dialogue among governments in finding solutions to climate change and environmental degradation. The varied protocols on climate change have made tremendous impacts on ways to ameliorate the effects of the surge on environmental challenges. For instance, the Montreal protocol (1987), Canada: the Kyoto protocol (1997), Japan: the World Business Summit (2002), Netherlands: the Copenhagen Protocol (2009), Denmark and the most recent Conference in Durban, South Africa (2011), all centred on the following among others:

- Global awareness
- Requirement and solutions to environmental balance, and
- The effects of climate change worldwide.

However, from the varied protocols on climate change, the Kyoto (1997) is still valid and most relevant as all others meetings of the protocols revolve around it. The objectives or achievements of these summits have not been attained due to the attitudes of some countries. The less privileged countries are gradually pulling out of the Kyoto treaty owing to their low pace of development which has led to the non-implementation of the Kyoto treaty. In addition to the slow implementation is the lack of economic interest, as most of the developed world e.g. Germany, France, USA, Denmark, China and Japan etc, are still in the production of Chloroflouro-Carbon (CFCs) and others related industrial chemicals and substances that causes environmental pollutants. You will recall that the banned on environmental pollutants has been signed into law since 1996. Environmentalist and other in related fields believed that environmental pollutants such as carbon dioxide, chlorofluorocarbon (CFC), methane, nitrous, toxin and Salina are responsible for the immediate and past cases of climate change and environmental challenges. However, of these gases the carbon oxide and Chlorofluorocarbon happens to be more destructive in nature because they trap more heat of about 76 times than any other gases (Thomas, 2009) and Ayo, (2009). Cunningham and Cunningham (2012), in confirmation with the arguments of Arrhenius (1896), and Faniran and Ojo (1980), states that the missions of the varied protocols and summits on climate change and environmental challenges are for the propose achievement of:

- The need for the Operationalization of the Green House Project;
- Contribution towards climate fund; and
- Reduction in Chloroflouro-carbon (CFCs) and related industrial chemicals and substances that causes environmental pollutants; a major determinant of climate change.

These schools of thought further states that the effect of environmental balance of the atmosphere is a function of climate change. Invariably we can deduce that environmental balance is responsible for climate change since environmental balance results to the following:

- It determines the rate of evaporation and evapo-transpiration of a place;
- It determines the rate of rainfall and pattern also of the amount of humidity on the earth's surface;
- It determines the seasons of the varied regions (equatorial, tropical, temperate and Polar).
- It determines the wind patterns of the year.
- It determines the conditions for planting and the types of crops harvested in most regions of the earth's surface; and lastly
- It makes life bearable for plants, animals and man.

Ayo, (2009), postulated the world greenhouse gases emission in 2002 as follows: Carbon Dioxide 52%, Chlorofluorocarbons (CFC) 24%, Methane 15%, Nitrous Oxide 06% and Water Vapour 03%. The implication of these gases is that since after the banned in 1996, there has been increase in the percentage of these destructive gases into the atmosphere. However, with the incessant increases of these gases the global carbon dioxide concentration varies from region to region, in the United Kingdom for example, carbon emission from industries constitutes about 4%, methane and oxide emissions such as chemicals and fertilizers constitutes about 7%, energy generated from fuel consumption (excluding transport) constitutes about 65%, carbon emissions from transport activities constitutes 21% while the remaining 3% are from other miscellaneous activities (Thomas, 2009). Carbon dioxide concentrations are due primarily to fossil fuel use and land-use changes, while those of methane and nitrate oxide are primarily due to agriculture. The global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 ppm to 379 ppm in 2005 (Thomas, 2009). The concentration of these gases exceeds by far the natural range over the last 650,000 years. The concentration of methane increased from a pre-industrial value of about 715 ppb to 1732 ppb in the early 1990s and to 1774 ppb in 2005. However, an increase of nitrate oxide was observed, as there was an increase from 270 ppb to 319 in 2005 (Thomas, 2009). Reducing carbon concentration to 350 parts per million would enable us to avert tipping points in climate change such as ocean acidification and the melting of permafrost and arctic ice. In Nigeria experience the situation is not too far, this is due to the pace of socio-economic developments and activities of man is the quest comfortability and population explosion.

### **AIM AND OBJECTIVES**

The aim of this study is to examine the likely effects of environmental challenges and climate change in Nigeria. In order to achieve this aim, the study has the following specific objectives:

- To determine the causes of environmental imbalance.
- To ascertain if the effects of environmental imbalance leads to environmental challenges.
- To ascertain if the effects of environmental challenges leads to climate change.
- To determine the likely effects of environmental imbalance, environmental challenges and climate change on ecosystem.

## METHODOLOGY

This paper is purely on content analysis. It utilises evidence mainly from secondary data and observed information from field survey. The secondary data was derived from literature review on environmental challenges and climate change. Observation techniques were also implored.

### Global Trend And Nigeria Experience In Recent Observations Of Environmental Challenges And Climate Changes

The global trend and the Nigeria experience on environmental challenges and climate change of recent times are as follows:

(a) The periods between 1995-2006 was rank among the twelve (12) warmest years in the instrumental record of increase in global surface temperature since 1850 Thomas, (2009) while in Nigeria, in the past ten years there have inconsistencies in environmental challenges and climatic variables Amina, (2013).

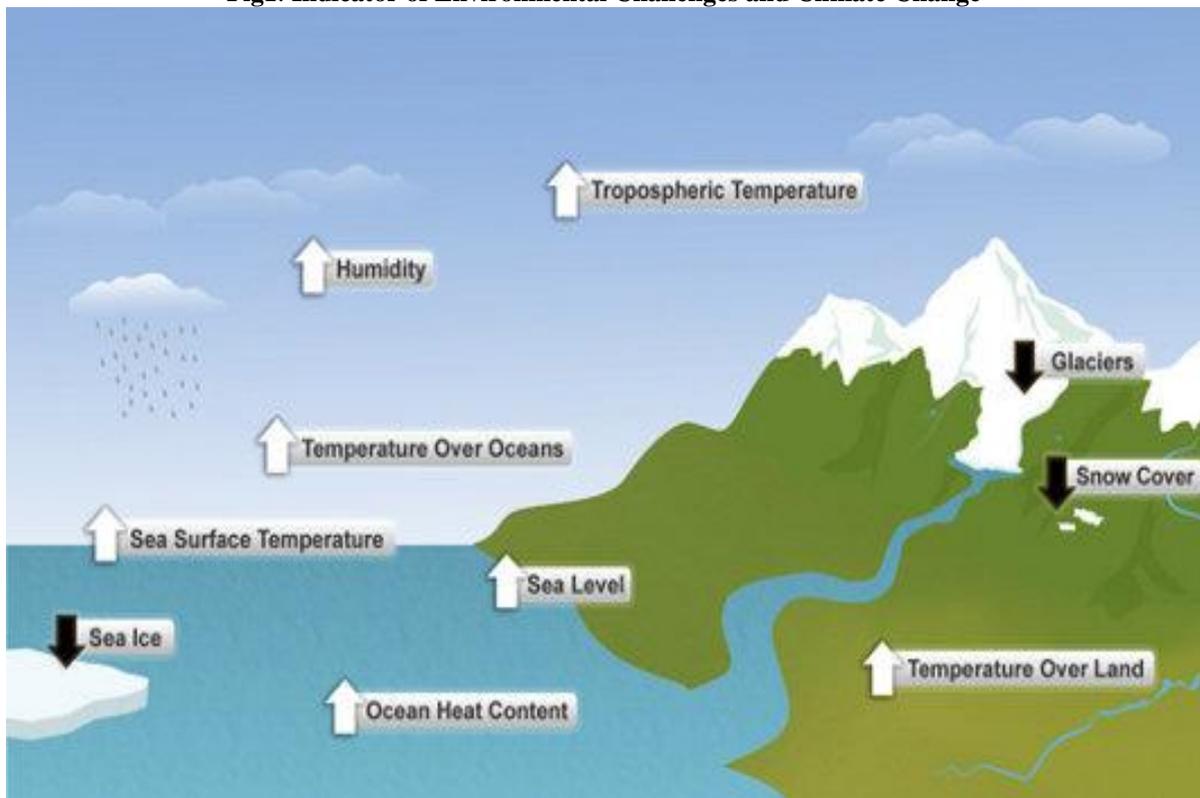
(b) At the global level, the average atmospheric water vapour content has increased since 1980 over the land and ocean as well as in the upper stratosphere due to the consistent increase in water vapour the air can hold while in Nigeria, the average atmospheric water vapour has been more favourably consistent in the northern part than in the south Amina, (2013).

(c) The average temperature of the global ocean has increased to depths of at least 3000m and the ocean has been absorbing more than 80% of the heat added to the climate system, and this warming has causes sea water to expand and contributing to sea level rise while in Nigeria, there has been a steady increase in the sea surface temperature and sea level of recent time Amina, (2013) and:

(d) Mountain glaciers and snow covers have declined on average in both hemisphere, wide spread decrease in glaciers and ice caps have contributed to sea rise between the periods of 1993-2003 (IPCC, 2007), as cited by Thomas, (2009).

## II. CONCEPTUAL AND THEORETICAL FRAMEWORK

Fig1: Indicator of Environmental Challenges and Climate Change



Source: <http://www.climatewatch.noaa.gov/2010/videos/soc2009>

The model shows the indicators of environmental challenges and climate change. The white indicator shows the positive variables. These variables are responsible for increase in atmospheric temperature. The black indicators show negative variables and are responsible for decrease in atmospheric temperature. The positives and

negative indicators account for the gradual processes, causes and effects of environmental imbalance, environmental challenges and climate change. Any of these variables e.g. excessive rainfall, heat (neither from natural and anthropogenic factor) and wind patterns can cause environmental imbalance in the ecosystem thereby leading to environmental challenges. A prolonged effect of these gradually lead to climate change. However, the cause of environmental challenges and climate change is attributed directly or indirectly to the changes of climatic variables and the activities of man that alters the composition of the chemistry and physics of global atmosphere in addition to natural variability observed over comparable time periods (Thomas, 2009).

Human economic activities are the leading sources and causes of climate change. These activities are causing the release of certain pollutants (atmospheric trace gases—mainly carbon dioxide, methane, nitrous oxide and CFSs) which tend to block the emission of heat from the earth surface. These gases are transparent to short-wave radiation from the sun, but absorb long-wave radiation from the earth, thus trapping heat. In theory, increasing their concentration in the atmosphere causes the earth to warm like a greenhouse. Scientists and government officials in the Intergovernmental Panel on Climate Change (IPCC), the most authoritative group on global warming, agreed it was “very likely” that human activity were the main cause of warming in the past 50 years. Unlike the ozone effect (in the upper atmosphere) the greenhouse effect operates mostly in the lower atmosphere (Hardy, 2003).

**Environmental Imbalance:** The ecosystems by default maintain global environmental balance. Anything that alters the normal function of the ecosystems and biota network creates imbalance that affects life on Earth. The destruction of agricultural land, atmosphere, vegetation and water bodies worldwide creates environmental imbalances so vast and widespread that conservation efforts struggle to keep pace with the damage. Environmental imbalance means the same with ecological imbalance. The inclusions of gases into the atmosphere have positive and negative reactions as well as incoming and outgoing radiation. Once these occur the physics and chemistry of the atmosphere are altered and these constitute environmental imbalance. Pollutants or contaminants on the three tiers of the environment result in ecological imbalance. For example, carbon gas in the atmosphere of 1% causes environmental imbalance, less than 1% causes deficiency of oxygen to animals and above 1% causes death of plants. There is an accurate balance between what the human gets from oxygen and between the amounts of released oxygen by plants. There is another balance between the released amount of carbon gas by human and the amount of carbon taken by the plants. The effects of environmental imbalance can be felt in water bodies e.g. pollutants/contaminants on aquatic organisms like fish, prawns etc while on the lithosphere, the effects of environmental imbalance is felt, e.g. the infiltration of plant nutrients and water is a function of the soil type and permeability. Erosion and floods result from environmental imbalance of the ecosystem. The features of erosion and flooding get higher with increase in rainfall patterns and this leads to environmental challenges of the ecosystem, Cunningham and Cunningham (2012).

**Environmental Challenges:** The ecosystem is poised with lots of environmental challenges. Areas with a high pace of socio-economic activities have a high rate of environmental challenges. The nature of heat energy, soil type and rainfall pattern are key factors to environmental challenges. Though, environmental challenges could be caused by natural and anthropogenic factors or forces. The latter results in pollution of the three tiers of the ecosystem; desertification, deforestation, floods, erosion, urbanization, over-population etc while the former results in earthquake, drought, volcanism, tsunamis, tectonic movement etc. However, natural challenges are severe and prone to volatile spots of earth tectonic movement and less control in nature. In Nigerian cities, the pace of socio-economic activities has led to urban challenges and deteriorations. Most cities are witnessing a high rate of environmental challenges and are rated among urban areas with the lowest livability index in the world. It is estimated that between 20 percent and 30 percent of the urban population enjoy decent urban life in the country. In the south and north eastern part of the country where the effects of environmental challenges of anthropogenic forces are well pronounced, one of the major challenges by the government of these areas is how to curb these ecological challenges.

**Climate Change:** The term climate change is used to explain the changes in the earth's climatic system. It is majorly concerned with a change due to an increase in the average atmospheric temperature. Changes in climate occur as a result of internal variability within the climate system and of external factors (natural and anthropogenic). The influence of external factors on climate can be compared using the concept of radiative forcing. A positive radiative forcing, such as that produced by increasing concentrations of greenhouse gases and carbon dioxide tends to warm the surface. A negative radiative forcing, which can arise from an increase in some types of aerosols (microscopic airborne particles) tends to cool the surface. Natural factors, such as changes in solar output or explosive volcanic activity, can also cause radiative forcing. Characterisation of these climate forcing agents and their changes over time is required to understand past climate changes in the context of natural variations and to project what climate changes could lay ahead. Thousands of meteorologists and other atmospheric and climate scientists have participated in periodic reviews of climatic data's.

The impacts of climate change are not evenly distributed – the poorest countries suffer it most, and if and when the damages appear it will be too late to reverse the process. Stern, (2006), states that tackling climate

change now is entirely possible and will cost us only 1% of global GDP. Scientists believe that the average temperature on earth will rise from 40° to 60° and by the end of the twenty-first century, if present fossil fuel use and forest destruction trends continue; such a warming will be accompanied by changes in the world patterns and a significant increase in sea level. Stern (2006), states that between 1850 and 2005 the average global temperatures have increased by 0.76°C. The observed warming is very likely (90%) due to increasing greenhouse gas emissions caused by human activities. Global greenhouse gas emissions have increased by 70% between 1970 and 2004. Global temperatures are expected to increase by another 1.8 – 4°C this century, possibly warming as much as 6.4°C. Ignoring climate change will cost us as much as US\$7,500,000,000 by 2050 (that's \$7.5 trillion, 20% of the global economy).

Furthermore, Hoffmaister (2007), states that climate change is an issue of international justice, that human actions affect our planet; it would be criminal to keep acting like we now know that it jeopardizes future generations. Tackling climate change is the pro-growth strategy for longer term, and it can be done in a way that does not cap the aspirations for growth of rich or poor countries. The international body on Climate Change in 2007, states that climate change is a long-term shift in the statistics of climatic variables and that the last decade of 20<sup>th</sup> century and the beginning of 21<sup>st</sup> century have been the warmest period in the entire global climatic system, and that the statistics of these instrumental temperature records started in the mid-19<sup>th</sup> through the 20<sup>th</sup> to the 21<sup>th</sup> century. In addition, Stern (2006), states that taking steps now to limit future impact global warming would be very expensive, tracking climate change is the pro-growth strategy for a longer term. Since climate change is a function of the changes of the statistics of climatic variables, Therefore, I contend that the activities of human in the past and present and the incessant statistical changes in climatic variables are responsible for environmental challenges' while the immediate human activities will determine the environmental challenges of the future.

### **III. CAUSES OF ENVIRONMENTAL CHALLENGES AND CLIMATE CHANGE**

The causes of environmental challenges and climate change are attributed to three main factors. These factors are as follows:

- Frequency Changes in climatic variables
- Environmental pollution
- Man's activities

#### **Frequency Change in Climatic Variables**

Frequency changes in climatic variables (*rainfall, temperature, wind pattern, humidity*) etc are some of the causes of environmental challenges and climate change in places and regions of the world. The irregular or incessant changes in temperature, pressure, humidity, rainfall, wind patterns and cloud covers has resulted to increases in atmospheric temperature, global average air and ocean temperature, ice-melting, sea-rise, flooding and tsunamis, inconsistency in rainfall pattern, erosion, epidemic outbreak, and desert encroachment etc is a function of environmental challenges and climate change. The variables of one or a combination of the above have gradual and insignificant effects on environmental balance of the ecosystem. Climate change is already affecting our communities through increasingly frequent and severe droughts, floods, extreme storms, rise in sea level, and heat waves. The result of excessive rainfall in tropical and temperate regions is a function of high temperature and evaporation processes within these regions. The thawing of ice-cap at the pole's have results to over flows of major water bodies and the aftermath effect on sea rise, ocean surge among others. Experts' states that this is expected to worsen over the next few decades if pragmatic steps are not taken to ameliorate these environmental menaces. Owing to the impact of atmospheric temperature, the destructive rays (gamma, ultra-violet and infrared) has much impact of the life of living organisms.

In South-East, Nigeria Anambra, Enugu and Imo states, the effects of environmental degradation and challenges is a function of the wind and rainfall pattern in that region for example, in the past two decades these areas has been prone to coastal and gully erosion as well as forest degradation. The implications of these is the lost of farm lands, a major livelihoods of locals. The challenges of erosion menace and ecological degradation have been the major environmental degradation of this people. In North-Eastern Nigeria, one of the major challenges of environmental degradation and climate change is how to combat desert encroachment and land bareness. The vegetation patterns are becoming thinner and striking. The Sahel savannah belt has been devoid from its natural state thereby exposing the areas to desert features and the incessant flooding of most rivers. Based on the above there have been incessant increased in atmospheric temperature and wind patterns in this region.

The implications of these are the high cost of fertilization of their farm lands, housing system etc. In addition, the Conservation International in 2007 states that higher atmospheric temperatures are expected to expand the range of certain dangerous vector 'borne diseases' including malaria. In south-south Nigeria, the changes in climate variables mostly in rainfall, atmospheric temperature and wind pattern has adverse effects

in agriculture, health and ecosystem. Experts also believed that the impacts of ashes, lava, stem and gases from hot volcanic spots constitute offensive odours in space (Thomas, 2009), and Hoffmaister, (2007). The effects of offensive chemicals and perfumes (soots, insecticides, ashes fumes, smoke) etc on the atmosphere constitute major challenges on the environment and climate change. Most of these gaseous aerosols and substances are not too atmospheric friendly and constitute major challenges and damage to the chemistry and physics of the atmosphere resulting with the depletion of the ozone layer.

### **Environmental Pollution**

Environmental pollution is a function of the amount of toxic waste and pollutants or contaminant in the atmosphere. The amount and nature of greenhouse gas in space determine the environmental balance and climate change of a place. An increase or reduction of these gases in the atmosphere has adverse effects on the environmental challenges of a place. Greenhouse gases (GHGs) come from a variety of sources e.g. (machines, automobiles, bush burning, waste, fertilizer, ashes, lava, stem). The manufacturing sectors and other related fields (fossil-coal, industrial waste, oil and natural gas) also constitute mainly to environmental pollution (Thomas, 2009) and Cunningham and Cunningham, (2012). Furthermore, the use of fossil fuels to meet world's needs is another contributor to increase in greenhouse gases e.g. (carbon dioxide ( $CO_2$ ), chlorofluorocarbon and methane). In Nigeria, the aegis of Environmental Rights Action (ERA) shows that about 1,000 oil spills are recorded annually in the Niger Delta region, the operations of the oil industries have endangered conflicts and impacted wetlands, water and sanitation problems (Ige, 2012).

In Nigeria, the cardinal regions with heavy industrial concentration e.g. south-west, north-central, and south-east are prone to environmental pollutions and ecological challenges than any other parts of the country. In south-south region for example where large oil and gas exploration takes place, the activities of environmental degradation, challenges and pollution have been on the rise in recent years. Okon (1998), states that the contact fleeing of residents still date of the people of Egbema and Ebocha communities of Ogbia-Egbma Ndoni Local Government Area of River state, is attributed to the activities of gas flaring and oil spill in the area. Since gas flaring began in 1964 by the Nigeria Agip Oil Company (NAOC) and it banned in 1996 the incidents of bush burning, land barrenness, premature, and still birth, blindness and mortality have been on the increase. Of late, the Bonny Oil Spill (River) has called for environmental clean-up by the host communities. However, the effects of these spills have led to loss of aquatic life, farmlands, drinking waters (depletion of water quality) and eventually pollution of the varied components of the ecosystem. This incidence is not far from what the neighbouring states and communities are experiencing for example in Bayelsa e.g. Brass, Tone-Brass, Sagbama, Olobiri, Ogoni are current in the radar of environmental pollution from these activities.

The struggle for justice and mercy on the effects on environmental degradation, ecological challenges and environmental pollution has led to the death of seasoned icon and environmental activist Sir, Ken Saro-wiwa among others. Of late, in October 19<sup>th</sup> 2013, oil spill from the platform of Mobil Oil Company in Eket Local Government Area in Akwa-Ibom state constitutes severe damage than good on the ecosystem and the communities. The people of these communities are yearning with the governments at the various levels to end this scourge and proffer ameliorable solutions on the negative impacts these activities have caused on the ecosystem and the lives of these citizenry. Also of late in Bayelsa, the recent Bonga oil spills and Kouluama gas explosion in 2008 and 2009 respectively, has led to ecological degradation and environmental pollution. The implication of these is the consequence effects on food chain, water pollution and death of aquatic life etc. Furthermore, the recent explosion in January 16<sup>th</sup> 2010 claimed the lives of a harmful expatriate and many indigenous staff of the multinational company (Ige, 2012). In northern Nigeria, the incessant illegal activities of miners mostly in Zamfara, Sokoto and Kebbi states are not far from the effects of environmental pollutions and environmental degradation on the ecosystem via air, land, and water bodies (Ige, 2012), and (Okpara, 2011). For instance, Lead explorations by local miners in Zamfara have been the most recent environmental degradation and pollution of the inhabitants of these areas.

Furthermore, the combination of calcium and magnesium in the atmosphere to some extent determine the pace of environmental challenges of a place and pollution of the area. Carbon dioxide which has more effects in lower the atmosphere constitutes series of matters and elements that alter the chemistry and physics of the atmosphere. These chemical parameters such as burning fuel (coal, petrol, wood) volcanoes (ash, aerosols) pool of water, respiration, decaying and putrefaction of plants and animals. The *Carbon Gy*, one of the atmospheric blankets of gases circulates in form of carbon dioxide to living organisms. Nitrogen and oxygen remain in fixed proportion throughout in the lower physics of the atmosphere and increase in heights over forty miles over the earth surface. Since the air thins with high-altitude (mountains over 3000ft or above 900m) the proportion of oxygen remains the same Ayo, (2009).

Fig: 2.CO<sup>2</sup> Emissions by Countries.

Rank	Country	Annual Emissions (In Thousands Metric Tonnes)	Percentage
1	China	6,538,367	22.30
2	USA	5,830,381	19.91
	EU (27)	4,177,818	14.04
3	India	1,612,362	5.50
4	Russia	1,537,357	5.24
5	Japan	1,254,543	4.24
6	Germany	787,936	2.69
7	Canada	557,340	1.90
8	UK	539,617	1.84
9	South Korea	503,321	1.72
40	Nigeria	95,272	0.32

Source: Ayo, (2009).

The above shows the annual emission in thousand metric tonnes by major countries and their percentage. China, USA and EU lead countries of the world in terms of environmental pollution and the production of Chloroflouro-Carbon (CFC). The implications of this are that these areas/region are heavily prone to the effects of environmental pollution due to their pace of socio-economic activities. India, Russia and Japan produced moderate environmental pollution while Germany, Canada, UK, South Korea and Nigeria are produced relatively low if compared to others. However, these could be one of the reasons why most of the advance countries are reluctant to effects the 1997 Kyoto treaty since they are still in production of Chloroflouro-Carbon (CFC) and others related industrial chemicals and substances that traps more heat than gases that causes environmental pollution. It has been observed that areas of high power generator machines for industrial and automobiles purposes are prone to the effects of environmental challenges and climate change than other areas, for examples, in Great Britain, Pittsburgh (USA), Ruhr (Germany), China and Japan (Asia) etc are associated with high level environmental challenges. The recent fire outbreak in Australia and the great storm in Philippines were attributed as natural phenomena and evolution of the ecosystem (Okpara, 2011).

### Environmental Degradation

Degradation of the ecosystem is a function of man activity. These have led to gradual depletion of the ecosystem and Ozone layer (O<sub>3</sub>). The Ozone depletion due to man's activities as stated above have allowed for more destructive rays (Infra-red 51%, Ultra-violet 8% and Gamma-ray 41%) into the earth's surface. The effects of these are the gradual extinction of some plants and animals, blindness of the eyes, cancer of the skin, excessive heat and global warming among others (Thomas, 2009). The intervention of man either for adaptation and comfort ability has contributes to the gradual depletion and heating of Ozone layer, environmental imbalance and the consequent effects on climate change. Deforestation for whatever purpose have added to greenhouse effect in two ways; this means, that fewer trees capture less carbon dioxide and produce oxygen while burning of woods send carbon dioxide back into the atmosphere at an accelerating rate Ayo, (2009). Environmental challenges such as vegetation degradation e.g. gas flaring: oil spillage: e.g. exploration and industrialisation: carbon dioxide e.g. engines and households: deforestation, and bush burning, etc has influences on environmental balance of a place, Cunningham and Cunningham, (2012). A combination of any one or all of the above led to environmental degradation.

The variations in the amount of insulation from place to place at given periods are factors deterring and influencing environmental balance of a place. Harsh climate resulting from the positives indicators as stated above poised more treat to environmental imbalance and challenges mostly in tropical and equatorial regions than negatives indicators with cool and lenient climate as in temperature and Polar Regions. In Nigeria, areas that are pruned with high level environmental degradation and ecological challenges has less socio-economic activities, agricultural and industrial activities is at the minima, residents of these areas are continued on the move (migration drift).

In South-east and South-south Nigeria where environmental degradation and ecological challenges persist, residents of the areas are ailing the government of mercy for justices and clean-up of the environment. Also, in these areas the major impact of environmental degradation has been the ravaging effects of flooding and its features. The terrain and topography aids environmental degradations. The location and

closeness of these areas to water bodies eases the impacts of flooding and it features on the land. Sea rise or ocean surge are the dominate effect of environmental degradation. In north Nigeria, most states along the frontiers are pruned to desert encroachment. Of late desert encroachment and its features has been worrisome to inhabitants of these areas, for example, the spread of the features of desert encroachment in Borno, Yobe, and Adamawa states among others has been alarming. The cry of these state governments is on the mission to reclaim the affected areas from the scourge of land barrenness and migration drift of her citizenry. The Yobe state government for example, as one of her proactive measures has engage the services of fifty-one (51) foreign environmental expatriates (mainly Professors) from the Philippines' Republic to proffer a lasting solution on how to combat these scourge in the area. The encroachment as put by environmental expatriate is spreading from the fringe areas to the interior at about 600 km per year, Owuru, (2013). In eastern Nigeria, the major environmental challenges have been on how to manage the effects of soil erosion. Soil erosion as we are aware is a function of the soil Cunningham and Cunningham, (2012).

Thercent floodof Ladgo Dam in Southern Cameroun in 2012 on most Nigeria rivers and land mass as well as in other states of West Africa have caused more havoc on environmental challenges in the country. The menace of the flooding that covered about 2/3 states in Nigeria, lasted for about two months in some areas of the north and south. The aftermath effect was theloss of life, property, agricultural farm lands and products, soil erosion, and the collapse of socio-economic activities among others what trillions of nairaOwuru, (2012). The National Emergency Management Agency (NEMA) states that Nigerian lost about N2.29 trillions to damages caused by these widespread flood in the country in recent time. Over 3.8 million persons were displaced. The agency further stated that the estimated loss was equivalent to 1.4 per cent of Nigeria Gross Domestic Product. From that incidence 363 deaths were recorded, 5,851 injured, 3,891, 394 people were affected and 3,891, 530 displaced. Okechukwu, (2013)

However, excess water in the soil can result to hydrocarbon pollution and where hydrocarbon pollution has reached the ground water level of about at 41% sites and at a based level, the ground water that serves local wells have up to 8cm layer of oil on them Okpara, (2011). The implications of these are that where this occurs, ground water quality is at a dices state, if immediate action is not taken to ameliorate the excess of pollutants. Furthermore, the release of water from atmosphere to land through the components of hydrological cycle has major impact on environmental imbalance of a place. Areas within the poles has better effects of environmental balance and climate change than areas around the equatorial and tropical regions. Areas within the aridregions are not left out. In addition, the decomposed human bodies, plants and the carcass of high and lower animals from affected areas results to outbreak of epidemic diseases.

I, therefore contend that environmental degradation and ecological challenges results from the frequent changes in climatic variables, environmental pollution, andman's activities. These variations affect directly and indirectly the environmental imbalance of the ecosystem.I therefore recommend that drastic measures should be taken to ensure environmental clean-up. Ecological funds should be judiciously allocated to equate with environmental challenges.

#### **IV. EFFECTS OF ENVIRONMENTAL CHALLENGES AND CLIMATE CHANGE**

The effects of human environmental challenges and climate change could be felt in any of the under listed:

**(a) Human Settlement:**Wind and rainfall pattern have much effect on global settlement. Settlement pattern varies from region to region mostly in areas that are prone to environmental challenges and climate change. Settlement pattern in semi and desert areas are aligned to wind pattern and direction. Traditionally, housing patterns in north Nigeria are built conventionally and in leeway area to align with the wind pattern and direction. Houses of these kinds have high roofs with ventilated windows to curtain the heat effect of climatic temperature. Drought resistance trees are planted around compound houses to shelter and serves as wind break on tropical winds. In south Nigeria, settlement patterns are either built leeway or wind way. The effect of high winds in the south is not as severe as that of the north but of the impact of destructive storms.

**(b) Energy Supply and Demand:**There have been insignificant changes in energy supply from traditional to conventional systems.Withadvancement intechnologies and increase in population,energy supply and demand have been on the rise. Energy todayproducesin varied ways and forms. Electric power and heat are produces more efficiently using both fossil fuels and renewable energy. Power plants using the Integrated Gasification and Combined Cycle (IGCC) process, for example, deliver efficiency gains along with reductions in air pollution by converting coal into a cleaner-burning gas. Additional efficiency gains can come from advanced technologies for other fuel sources in power plants, including natural gas and biomass. Renewable energy harnesses the powers of wind, sun, water, tides and other forces to produce electric power. Agricultural "biomass" products also can be used to generate electricity and heat when combusted with coal. Renewable offer the potential to generate electricity without producing greenhouse gases—or producing very little when compared to traditional energy sources.

(c) **Agriculture:** Agricultural system of the globe is a function of the climatic patterns of the area. The positive variables of climate change results more to tropical agricultural system while the negative variable results to temperate agricultural system. In northern Nigeria, the positive effects of climatic variables have led to environmental imbalance and the gradual disruption of the natural balance of water and nutrient for crops cultivation. The soil is so hard (red ferralite) that rainfall hardly seep into the ground, instead it simply flows across the surface. The implication of this is the traditional and systematic use of mechanized-irrigation system and the use of fertilizer applications to revamp the soil nutrient for agricultural purpose. In south Nigeria, the differential in soil type (hydro-morphic and juvenile) and climatic patterns have led to variance in crops production. In addition, the positive variables have led to the ease production of cereals crops and animal husbandry in the north and more roots and tuber crops to the south and middle belt.

(d) **Freshwater System:** Planktons, sea food and mineral salt are the essentials of freshwater system. Availability of freshwater distribution is more to humid than in temperate and arid regions. The volume and percentage of surface and groundwater have increased in recent times from 70% to 71%. This is due to excessive heat and incessant melting of polar ice owing to anthropogenic activities. The aftermath effective of this is global warming and climate change. The negative variables hold and drift more water for man use while the positive releasing more water to space. Contaminations of water either from point and non-point sources is more to anthropogenic factor than natural. Global water quality has deteriorated and degraded by the contents and changes of physical, biological and chemical parameters in water quality. The list of pollutants into water bodies is increasing day by day thereby causing more hazards on human health. The implication of these contaminants is that there is increase in physical, chemical and biological parameters of the fresh water system. Water quality fails to conform with WHO recommended standard and water become unsuitable for desired uses.

(e) **Human Health:** Climate change affects the social and environmental determinants of health. These include clean air, safe drinking water, and sufficient food and secure shelter. Reducing emissions of greenhouse gases through better transport, food and energy-use choices can result in improved health, particularly through reduced air pollution. Sea levels are rising, glaciers are melting and precipitation patterns are changing. Extreme weather events are becoming more intense and frequent. The positive variables are responsible for the extreme high air temperatures. These however contribute directly to high deaths toll mainly cardiovascular and respiratory disease, particularly among elderly people in the varied regions in Nigeria. High temperatures also raise the levels of ozone and other pollutants in the air that exacerbate cardiovascular and respiratory disease. Pollen and other aeroallergen levels are also higher in extreme heat. These can trigger asthma, which affects around 300 million people. Ongoing temperature increases are expected to increase this burden.

Furthermore, climatic conditions mostly in humid areas strongly affect water-borne diseases and other diseases transmitted through insects, snails or other cold blooded animals. Changes in climate are likely to lengthen the transmission seasons of important vector-borne diseases and to alter their geographic range. For example, climate change is projected to widen significantly the region of West Africa where terminal or environmental diseases occurs. For example, environmental disease such as malaria and water borne is strongly influenced by climatic conditions. At the global level, malaria kills almost 800 000 people every year and mainly African children under 5 years old. The *Aedes* mosquito vector is high mostly in the humid region and sensitive to climate conditions. Studies suggest that climate change could expose an additional 2 billion people to dengue transmission by the 2080s. The implications of climate change have severe impact on human health mostly in the areas of clean water, safe drinking water, food and shelter.

(f) **Ecosystem:** The incessant change in the seasons of the year in the ecosystem is aligned to the differential variations of the positive and negative variables that constitute environmental imbalance, environmental challenges and climate change. Adaptation of living and non-living things on the ecosystem is a function of the prevailing biomes and climatic conditions of the area. The contents and changes in the ecosystem is also a function of climatic variables. The food chain and food web in each biome is also a function of the varied types (freshwater, terrestrial and ocean) of the ecosystem. The effects of the positive variables on non-living things results to the likely features of aridity and hardness of the area while the negative results to insignificant greenification of the area. However, the implication of this is that there is water scarcity, hunger and environmental disaster. On the other hand, the effects of negative variables on non-living things results to soil creep and rocks tallus. The positive results to dampness and prevalence of organic matters of the area. However, in north and south Nigeria, apart from the adaptation of living things to their biomes, the ecosystem remains damp and dries and same with the features of tundra and desert climate.

## V. CONCLUSION

Climate change is time factor and gradual evolution of the changes of climatic variables in the ecosystem. The positive and negative variables must be at equilibrium and natural to maintain a steady state. Environmental imbalance, environmental challenges and climate change are functions of differentials in climatic variables. Environmental challenges and climate change and is more of climatic variations and human's influences and

intervention. The human changes range from simple waste substances (urine, household, perfumes, insecticide, fertilizer, dust, and smog), etc to complex gas flaring, automobiles, chemicals, deforestation, and pollutants of the environments. Climate change is more to industrialized countries owing to their pace of production and development of goods and services. Social uprisings, security challenges, extinction of plants and animals among others are some of the vices of the effects of climate change. Greenification, environmental friendly automobiles and reduction of greenhouse gases (GHGs) should be holdup. Less managed forests and others natural ecosystems and human activities aggravate climate change. Climate change impacts disaster such as the features of drought, desert encroachment, epidermis, floods and ocean surge have been on the rise in Nigeria in recent time. In Nigeria, natural phenomena such as earthquakes, volcanism and tectonic movement etc constitute zero degree to environmental imbalance, environmental challenges and climate change.

Climate change is a time factor and gradual process. The disruptions of the natural balance of the ecosystem have resulted in water scarcity, hunger and natural disaster. Environmental challenges and climate change can be minimize through greenification and reduction of Chloroflouro-Carbon (CFC) of the varied components of the ecosystem. Nigerian should look inward and adhered with the recommendations of meteorologist and climatologist which states greenification of the land should be given more priority. These bodies' further states that which advancement in science and technology, emerging technologies has the potential to transform energy production and this could offer solutions on our threatened environment and also on the impact of climate change. The impact of environmental challenges and climate change is a gradual process and time factor. Apart from the positive and negative variables, the indices of climate change are environmental imbalance, environmental challenges. I therefore content that Climate change is a function of environmental imbalance and environmental challenges and also a time factor of the changes of the indices of the ecosystem.

## **VI. THE WAY FORWARD AND RECOMMENDATIONS**

The damage caused by pollution vast and its proliferating fast. The greenhouse gas (GHG) emissions that caused global warming come from a wide range of sources (cars and trucks, power plants, farms). There are so many sources and types of gas pollution: there are also many options for reducing emissions. There are two ways to combat the impact of Climate change vis-a-vi: mitigation and adaptation. Scientists have proffered solutions to reduce the impact of climate change while economists evaluate the solutions based on cost and benefits. The United Nations Framework Convention on Climate Change makes clear that cost effectiveness is an important criterion (among others) in formulating and implementing climate policies.

One of the quickest and most cost-effective ways to reduce global carbon emission is to conserved tropical forests through greenification and afforestations. Continuous greenhouse gases emission at or above 10<sup>0c</sup> recent rate would cause further warming and induces changes in the global climate system during the 21<sup>st</sup> century. There should be a reduction of the greenhouse gases (GHGs) from variety of sources, (transportation, machines, agriculture and land-use, manufacturing, exploration and other related activities) which has amassed to chlorofluoro-carbons (CFCs) of the atmosphere. However, I contend that the following recommendations should be uphold:

- The depletion of ozone layer should be ameliorated by human's influences. Man should limit its intervention on the natural ecosystem in their quest for comfort ability in the environment. Waste substances and pollutants into water bodies should be reduce to the barest minima. The nitrogen and hydrological cycle of the atmosphere should be in their natural state with less human's interventions.
- Campaign on tree planting, parks and greener lands, urban/marketing garden and afforestation in man's habitats should be encourage while lumbering and deforestation of the natural vegetation should be discourage, there should be the conservation of acres on land.
- There should be awareness and enlightenment programme on the need and danger of the effects of environmental imbalance and environmental challenges on climate change. There should be some policy on climate change. Countries should adopt the use low carbon energy, unite to combat climate change, join climate change club, and enforce the operationalization of the missions and summits on climate change.
- The budgetary allocation on ecological funds to states should be on the increase to meet the challenges of environmental degradation and its influences, and
- Countries should adhere to the *seven principles* of (global engagement, energy, security, maximize conservation, measured and flexible approach, broad equity treatment, enable technology and transparency) in addressing climate change. The introduction of new technology like plant energy should be embrace, solar alternative for kerosene lamps and electricity should be well embraced.

## REFERENCES

- [1]. Adams, H. (2010), **Awake**: Our battered earth (January 22, 2000) pp. 3-11
- [2]. Adedeji, D and Eziyi O. I (2010), Urban Environmental Problems in Nigeria: Implications For Sustainable Development: Journal of Sustainable Development in Africa (Volume 12, No.1, 2010) Clarion University of Pennsylvania, Clarion, Pennsylvania ISSN: 1520-5509
- [3]. Adelegan, J., A., (2004), The history of environmental pollution of water source in Nigeria (1960-2004); the way forward; university of Ibadan.
- [4]. Amina, M. D. (2013), **Climate change is threat to Nigeria's Vision 20:2020**- World Bank Published: June 10, 2013
- [5]. Ayo, Tella. (2009), **Climate change: what you must know**; forward by Peter Okebukola, Unesco consultant on the environment; published by silverfoil printing press
- [6]. Ayoade, J.O. (1988), **Introduction to climatology for the tropics**: Spectrum books limited, sunshine house, Ibadan
- [7]. Ayoade, J.O. (2002), **Introduction to agro-climatology**. Ibadan vantage publishers
- [8]. Baruch and Givani (1987), **Understanding climate change and it impacts**; Spectrum books limited
- [9]. Chris, J. (2006), **Sustainable forest mosaics**; initiative partners vol. 3 (www. conservation, org).
- [10]. Cunningham, W. P and Cunningham, M. A (2012), **Environmental science**: A global concern, (twelfth edition), mc-hill international edition, unit 17, December 18<sup>th</sup>
- [11]. Edet, T.N., Ukpong A. J. and Ekwere, A. S. (2011), **African journal of environmental science and technology**, vol. 5 (13), Pp. 1152-1169, 29 December, 2011
- [12]. Edward, J.T, Charles, E.M and Frederick, K.L (1979), **Earth science**; (2<sup>nd</sup> edition) Vol.3
- [13]. Enquiry of Awka Capital Territory of Anambra State: The place of Environmental Knowledge for survival in H.C.Mba et al (eds) Ibid pp 13-28.
- [14]. Eugene, L. (1992), **Summit to save the earth**, time intervention; adenson press.
- [15]. Faniran, A and Ojo, O (1980), **Man's physical environment**, heinemann educational Book Ltd
- [16]. Freece, D. M. and Wood, A. M (1985), The foundation of geography; modern geography series book 1, first edition
- [17]. Henry, M. Kendall, Robert, M.G and Clifford, H.M. (1951), **Introduction to physical geography**. harcourt brace and world, inc. pp193-142
- [18]. Hoffmaister, F. (2007), **Understanding climate change**, New York. Vol. 4
- [19]. Howard, Frumkin. (2010), Environmental health from global to local, printed in the United States of America, second edition
- [20]. [http:// www.ncdc noaa.gov/oa/climate/global\\_warming. html](http://www.ncdc.noaa.gov/oa/climate/global_warming.html).
- [21]. [http://www. Climatewatch.noaa.gov/2010](http://www.Climatewatch.noaa.gov/2010)
- [22]. Ige, O. (2012), 'Nigerian tribune' newspaper 25<sup>th</sup> may, 2012.
- [23]. Intergovernmental Panel on Climate Change (2007), **Forth assessment report on climate change**
- [24]. IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: **The Physical Science Basis**: Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Adekanbi, E. O. (1979), **A Study of the industrial effluents and waste disposal habits of some industrial discharging directly into the Lagos Lagoon**.
- [25]. Jacobs, Tom (2007). "**Belief in 'Balance of Nature' Hard to Shake**". Miller-McCune. Retrieved 19 June 2011.
- [26]. Jason, J. Blackstock and Manjana Milkoreit. (2011), **Taking Global Climate Governance Beyond 2012: Reflections on CIGI '10** by: Published: December 1, 2011
- [27]. John, Cook (2009), **Indicators of climate change**: Series one
- [28]. Muoghalu, L. N and Okonkwo, A. U(2004), "Urban Environmental Factors of Flooding: A Preliminary
- [29]. Muoghalu, L. N. (2004). "Environmental Problems and their Effects on Human Life: From Awareness
- [30]. Newsweek International '**Earth at the summit**' news week international (June 22, 1992) pp.40-42
- [31]. Ng'angia J. K. (1990). "**The problem of atmospheric pollution in africa cities**", africa urban quarterly vol. 5 nos. 1 & 2 January and May, 1990. Pp 25-27
- [32]. Okechukwu, Nnodim. (2013), **The punch newspaper**, Tuesday November, 19<sup>th</sup> 2013
- [33]. Okon, Julius. (1998), **Nigeria newswatch magazine** October, 26<sup>th</sup> 1988.
- [34]. Okpara, Ignatius. (2011) **New Nigerian**, Wednesday September', 28<sup>th</sup> 2011
- [35]. **Omofonmwan, S. I and Osa-Edoh G. I (2008) The Challenges of Environmental Problems in Nigeria; Geography and Planning and 2 Educational Foundation, Ambrose Ali University Ekpoma, Nigeria. E-mail: profomofonmwan@yahoo.com**
- [36]. Oworu, Oloyede, (2012), **Africa independence television news**; an unpublished article on environmental challenges and degradation in Nigeria; the way forward
- [37]. Oyediran, Ojo, Kayode, Ojo and Feyi Oni (2001), **Foundation of physical and dynamic climatology**; published by sedec publishers
- [38]. Stern, Nicholas (2006), **The economics of climate change**; cambridge
- [39]. Strahler, A and Strahler, A. (2006), **Introducing physical geography**, fourth edition, john wiley and sons inc.
- [40]. Thomas, A. Easton. (2009), **Classical edition sources, environmental studies**, third edition published by mcgraw-hill company inc.
- [41]. to Action" in H.C. Mba et al (eds) Ibid. pp 93-107.
- [42]. Withgoth, J. and Brennan, S. (2011), **Essential environmental**; the science behind the stories, third edition, Pearson education, inc.
- [43]. Wright, R.T and Boorse, D. F. (2011), **Environmental science**: toward a sustainable future: eleven edition: International edition: Unit 10
- [44]. Wright, R.T and Nebel, B. J. (2002), **Environmental studies**; towards a sustainable future, eight editions
- [45]. Young, Gordon. (1970), **Pollution threat to man's only home national geographic**, eight editions
- [46]. Zimmerman, Corinne (2007). "**Ambiguous, circular and polysemous: students' definitions of the "balance of nature" metaphor**". *Public Understanding of Science* 16 (4): 393-406.