

# Climate Change and its Implications to Africa

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**Abstract-** Climate change is a reality and its impact are felt daily by communities around the world, The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as a change which is attributable directly or indirectly to human activity that alters the composition of global atmosphere and which is in addition to natural climate variability observed over a comparable time periods. This paper therefore examines the phenomenon called climate change, its meaning, history as well as manifestations and its implications to Africa. The paper recommended that adoption measures are emphasize in African urban centres and concluded that there is an urgent need to translate awareness of climate change impacts into those tangible adaptation measures at all levels of governance in the African countries.

**Index Terms-** Africa, Change, Climate, Global-Warming, Implications.

## I. INTRODUCTION

Environmental management resulting in desertification, degradation, decay and demise of lower level living things in the eco-system is a great challenge of the global community in recent times (Oyedele, 2010). This degradation has brought about the imminent global warming due to ozone layer depletion, loss of fauna and biodiversity due to deforestation and pollution. Of greater concern than other issues is climate change and global warming because of their effects on the environment.

The climate is a complex, interactive system consisting of the atmosphere, land surface, snow and ice, oceans and other bodies of water and living things, the atmospheric component of the climate system most obviously characterises climate (Le Treut, Somerville, Cubasch, Ding, Mauritzen, Mokssit et al 2007, p96). Climate is often expressed as the average weather and is usually described in terms of the mean and variability of temperature, precipitation and wind over a period of time.

Change, the only permanent phenomenon has finally hit our environment. The climate has changed; it will continue to change for the good of man or for his woes. This paper therefore is to examine the phenomenon called climate change, its meaning, history as well as manifestations and its implications to Africa.

Climate is central to most of human endeavour and therefore cannot be ignored just as architectural and engineering professionals need a deep knowledge of climate to proffer good designs for human environment so also do farmers need climate information for a successful cropping. Aviation experts' reference climate and its daily occurrence –weather, as they

reference some deities. One can safely say that the noises being made about climate change is therefore justified. Crop failure, a bye-product of climate change is too threatening to be contemplated. The current report of food shortage in the world is not unconnected with climate change.

## II. MEANING AND HISTORY OF CLIMATE CHANGE

Climate change or global warming refers to a measureable increase in the average temperature of the earth's atmosphere, oceans, and landmasses. Scientists believes earth is currently facing a period of rapid warming brought on by rising levels of heat-trapping gases, known as greenhouse gases, in the atmosphere(Encarta, 2005). According to UN Convention 2007, Climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time period. The term Climate Change implies a significant change from one climatic condition to another including changes in temperature, precipitations, wind and humidity. Because it affects other climate patterns, the aspect of climate that receives the most attention from scientists and policy makers is that of global temperature change (Global Climate Change: Resources for Environmental Literacy, 2007)

The global climate is warming, climatic zones are shifting; glaciers are stirring-up while the sea level is rising. These are not hypothetical issues or scientific fictions, these changes and other episodes are factual. Climate is defined as the average weather or regular variation in weather of particular region over a given period of time that is not less than 10 years. Long term alteration in global weather patterns, especially increase in temperature and stormy activity, regarded as a potential consequence of greenhouse effect is referred to as climate change. The atmosphere serve as a shield of life and the built environment, protecting us from ultraviolet rays and other harmful objects in orbit that infiltrate into the atmosphere from space. Global warming or climate change is measurable increase in the average temperature of earth's atmosphere, oceans and landmasses. It is a scientific consensus that the earth is currently facing a period of rapid warming brought on by rising levels of heat-trapping gases, in the atmosphere (Mastrandrea and Schneider, 2009). The fact that heat-trapping gases have been accumulating in the atmosphere is well established. Since the mid-19<sup>th</sup> century, the quantum of atmospheric carbon dioxide increased by about 25%. Recent investigations unveil that the atmospheric burden of greenhouse gases other than carbon dioxide, such as methane,

Nitrous oxide (N<sub>2</sub>O) and Chlorofluorocarbons (CFC's) is also growing at an alarming rate (Onuigbo, 2004).

Historically, an interglacial period began about 10,000 years ago, when the last ice age came to an end. Prior to that ice age, an interglacial periods, greenhouse gases such as carbon dioxide and methane naturally increase in the atmosphere from increased plant and animal life. But since the year 1750 greenhouse gases have increased dramatically to levels not seen in hundreds of thousands of years, due to the rapid growth of human population combined with developments in technology and agriculture. Human activities now are a powerful factor influencing earth's dynamic climate.

However, there is undeniable evidence that global temperature are increasing, based on direct temperature measurements and observations of other impacts such as melting glaciers and polar ice, rising sea level, and changes in the lifecycles of plants and animals. In fact, there is overwhelming evidence that greenhouse gas emissions from human activities are the main cause of the warming. Greenhouse gases retain the radiant energy (heat) provided to earth by the sun in a process known as greenhouse effect. Greenhouse gases occur naturally, and without them the planet would be too cold to sustain life as we know it. Since the beginning of the Industrial Revolution in the mid-1700s, human activities have added more of these gases into the atmosphere. For example, levels of carbon dioxide, a powerful greenhouse gas, have risen by 35% since 1750, largely from the burning of fossil fuel such as coal, oil, and natural gas. With more greenhouse gases in the mix, the atmosphere acts like a thickening blanket traps more heat (Mastrandrea and Schneider, 2009).

## 2.1 CLIMATE CHANGE MANIFESTATIONS

**2.1.1 Rise in Temperature:** The first noticed change which gave rise to Global warming which is now seen as the Siamese twin of climate change is rise in temperature. In some literature climate is rise in temperature. Also climate change and Global warming are treated as one and the same thing. "we are facing a convergence of the most serious crisis in the history of the planet-Global warming and climate change threatens the survival of the planet".

**2.1.2 Extreme Weather:** Floods and drought South Western Nigeria of 1980s and hurricane Katrina in New Orleans, Louisiana of 2005 are two quick examples to help us understand the concept of extreme weather that generates floods. Tsunami is flood on a very high scale that destroys life and property the tsunami of Dec 26, 2004 in Sumatra is a case in point.

Myanmar (Burma) recently experienced extreme weather that brought a devastating flood. More than 100,000 people were reported dead. Drought as a manifestation of climate change is being experienced here at home (Africa) where the desert is said to be advancing at 20m per year.

The definite outcome of this is destruction of arable farming, just as we experience flooding and advancing desert here do also other parts of the world are experience one form of extreme weather or the other the Arctic and Antarctic regions are experiencing thawing of ice which is causing flooding in some parts

**2.1.3 Rise in Sea Level:** the thawing of ice as noted above causes coastal flooding as is being witnessed in Lagos-Nigeria

yearly at the local level yearly flooding puts a strain on the budget of Lagos state and Federal government. Massive protective works require massive injection of funds this means other badly needed services such as education, health, housing and transportation may suffer.

## 2.2 CAUSES OF CLIMATE CHANGE

Climate change is made possible by the increase in the atmosphere concentration of Green House Gases (GHG) such as Carbon (IV) Oxide (Co<sub>2</sub>), Nitrous Oxide (No<sub>2</sub>), Methane (CH<sub>4</sub>), Hydrofluorocarbon (HFC), Perfluorocarbon (PFC) and Sulfurhexafluoride (SF<sub>6</sub>). All these gases absorb terrestrial infrared radiations (Oyebanjo, 2010). Infrared radiation from the high temperature sun is absorbed by the earth and some emitted in form of heat to warm up the earth to the suitable temperature required by the earth. With increasing concentration of GHG in the atmosphere the heat emitted into the atmosphere is re-absorbed and re-emitted to the earth. This tends to increase the average temperature on the earth's surface above tolerance levels. Further temperature increase is caused by some of the Green House Gas especially Chlorofluorocarbons (CFC) combining with ozone (O<sub>3</sub>) to delete the ozone layer in the atmosphere. Ozone presence in the atmosphere keeps about 99% of the solar harmful ultraviolet radiation giving off by the sun from the earth's surface (Ahmed, 2006).

Intergovernmental panel on climate change 1992 asserted that most of the increase levels of greenhouse gases have been caused by human activities such as burning fossil fuels, use of Chlorofluorocarbons (CFC), agriculture and deforestation.

## 2.3 CONCEPTS EXPLAINED

### 2.3.1 Green House Effects

Variations in Orbital Characteristics that is based on Milankovitch theory states that "normal cyclical variations in three of the Earth's orbital characteristics are probably responsible for some past climate change". The basic assumption here is that the cyclic events over a long period vary the amount of solar radiation. There are three phase of the variation namely eccentricity, the precession of the equinox and obliquity of the Earth's axis.

Eccentricity has to do with the control of "the shape of the Earth's orbit around the sun." The earth orbit exhibits two shape-elliptical and circular. A cyclic period of 100,000 years shows the earth's orbit changing from elliptical to being near perfect, circular orbit. What has been observed is that the top of the atmosphere receives more energy during the elliptical period and so "the greater the eccentricity of the orbit, i.e. the more elliptical it is, the greater the variation is solar energy received at the top of the atmosphere between the earth closest (perihelion) and farthest (aphelion) approach to the sun."

The precession of Equinox occurs when the Earth rotates on its axis. It manifests in form of wobbles akin to Grandma's spinning instrument to make thread out of raw cotton. The clobbering effect changes the orbital timing of the equinoxes and solstices. The cycle for this effect i.e. precession of equinox is about 26,000 years. According to Physical Geography.net, the earth is closer now (2015) Jan. perihelion and further away in July (2015) aphelion, but because of the precession, the reverse will be in 13,000 years and the Earth will then be closer to the sun in July. This means, of course that if everything else remains constant, 13,000 years from now seasonal variations in the

Northern Hemisphere should be greater than at present (colder winters and warmer summer) because of the Earth's position to the sun.

The tilt phenomenon exhibits thus - the larger tilt result, the greater variation in seasonal climatic variations. Warmer periods, i.e. summer months are as a result of greater tilts. Additional energy is produced at this period to melt the polar ice.

Colder winters have been known to produce less snow because of lower atmospheric temperatures. The net effect of this that if the warmer summers persist, there is the tendency for the polar glaciers to recede.

While the cause of climatic change discussed so far may appear less known to the lay persons, the issue of carbon dioxide emission is not. Nonetheless, it is this widely known issue that has been trivialized, denied, and ignore to man's peril. And alas, it is an issue within human control for man's benefits.

### **2.3.2 Atmospheric Carbon-dioxides Variations**

The means global temperatures are closely linked to variation in the concentrations of carbon dioxides in the atmosphere. The much talked about greenhouse effect is largely occasioned by the concentration of carbon dioxide in the immediate environment. Perhaps we should discuss the greenhouse concept before proceeding.

The greenhouse is an enclosure i.e. a house is roofed with translucent material that allow light energy to go in thereby generating heat that is trapped to stimulate a tropical climate. The greenhouse came into being as a result of botanists trying to cultivate tropical plant in the temperate regions. If we regard the earth as a house, and the atmosphere as the translucent roof, the phenomenon of trap as occurs in a greenhouse will be easily grasped.

Carbon dioxide is largely responsible for the earth greenhouse effect. The earth's energy balance is altered when certain gases like methane, water vapour and carbon dioxide absorb long wave radiation emitted from the earth's surface. The long wave re-emitted back to the earth in a see saw manner. When this occurs, the heat energy of the earth's surface is increased. It is said that without this greenhouse effect the temperature of the earth's surface would have been "a cold 180cel-cious rather than the present 150 Celsius." Why then are the hues and cries over the carbon dioxide included greenhouse effect?

### **2.3.3 Research Revelations**

i. Temperature variations are closely correlated to the concentration of carbon dioxide in the atmosphere.

ii. Temperature variations also are related to variations in the solar radiation received by the earth's surface as controlled by Milankovitch cycle.

iii. The past three decades have witnessed concentration of carbon dioxide on the earth's atmosphere.

iv. Human activities like the combustion of fossil fuels, conversion of natural prairie to farmland and deforestation in Africa and South America have caused the release of carbon dioxide into the atmosphere"

### **2.3.4 Volcanic Eruption and Sulphur-Dioxide**

Volcanic eruptions have been observed to have been followed by a short term climate change. The impression was that the volcanic dust was responsible for the cooling by partially blocking the transmission of solar radiation to the earth's surface. This has been found to be false as evidence has shown that most

of the dust returns to earth in about six months. Rather it was found out that the volcanic eruptions emit large quantities of sulphur dioxide gas which remain in the atmosphere for as long as three years.

The sulphur dioxide reacts with water vapour in the stratosphere to form "a densely optically brightly haze layer that reduces the atmospheric transmission of some of the sun's incoming radiation. A connection has been observed between the 1991 Pinatubo eruption and the global decrease in temperature of 1992 and 1993. Reflection of the sunlight back into space caused the cooling of the earth's surface

### **2.3.5 Ocean Circulation**

Changes in deep ocean circulation have been known to produce certain varieties of weather like El Nino that seems to re-occur every two to six years.

The cold water that sinks at the poles travel through-out the world's oceans. It gathers heat, becomes warm and less dense to allow its mix with surface water. The circulation returns to the poles with the warmth. This act warms up the poles making it a little habitable; out a continuous heating up of the poles has its negative effect after all.

## **III. GENERAL IMPLICATIONS OF GLOBAL WARMING**

It is known fact that the global climate has changed significantly in the last one century, the Intergovernmental Panel on Climate Change (IPCC) is an international group of scientists that evaluates scientific and technical information related to climate change and global warming (an increase in earth's temperature). The IPCC identified human activity as the primary cause for global warming. Human activities have produced inadvertent effects on weather and climate. Accordingly, addition of gases such as carbon dioxide and methane to the atmosphere has increased the greenhouse effect and contributed to global warming by raising the mean temperature of the earth by about 0.5°C (about 0.9°F) since the beginning of the 20th century. More recently, CFCs which are used as refrigerants and in aerosol propellants have been released into the atmosphere, reducing the amount of ozone worldwide and causing a thinning of the ozone layer. The impending consequences of these changes are vast. Global warming may cause sea-level to rise, and the incidence of skin cancer may increase as a result of the reduction of ozone (IPCC).

Besides, man's aspirations of living close to coastal and beach areas are potentially threatened by climate change. Impacts of climate change are likely to cause conflicts for society, such as where people want to live and where they can live safely. This could negatively impact our ability to continue to develop built environments to support some of our lifestyle aspirations. There is a need to start responding to the impacts of climate change within our built environment. This is required at both the individual building level and also for our neighbourhoods and communities – in the way that they are structured and serviced, allowing for greater resilience to sudden shocks. For example, in an effort to prevent such consequences, production of chlorofluorocarbons has been curtailed and many measures have been suggested to control emissions of greenhouse gases, including the development of more efficient engines and the use



of alternative energy sources such as solar energy and wind energy.

These implications are mentioned below:

- i. Rising sea level, leading to more coastal flooding during storms, erosion and permanent inundation.
- ii. Increased drought and an increased incidence of wildfires.
- iii. Severe stress on many forests, wetlands, alpine regions, and other natural eco-systems. Health as mosquito and other disease carrying spread disease over larger geographic regions.
- iv. Disruption of agriculture in some parts of the world due to increase in temperature, water stress, and sea level rise in low lying areas such Mississippi Delta, Lagos and Niger Delta areas of Nigeria.
- v. Intensity of hurricanes such as Katrina in New Orleans, the Tsunami and recent flood in Burma.
- vi. Destabilization of the Greenland and west Antarctic ice sheets, leading to much greater sea level rise.
- vii. Acidification of the world oceans and vastly increase rate of species extinction.
- viii. Eviction of people from their homelands.

#### IV. IMPLICATIONS OF GLOBAL WARMING FOR AFRICA

The topical issue now is the alarm raised on food shortage, Africa indeed is in trouble. Africa has been a continent of drought in parts for decades. Climate change may in fact be the last straw that will break the camel's back. This is so because food supplement from other lands may not be readily available any more due to global shortage. Can Africa indeed survive the onslaught of global food shortage and global warming?

The answer to the above question is that because of its poverty, it is dependent on locally grown food, recurrent droughts and floods, the civil unrest and political instability of failed states and diseases like malaria and AIDS pandemic, parts of Africa are in crisis. Global warning will make coping with these problems worse in some causes much worse.

Since Africa largely depends on rain fed agriculture for her existence, any disruption in the amount of rainfall available to Africa will definitely spell doom. The reality though scary, is that global warning (climate change) has been projected to reduce rainfall in even areas now known as water-scare environment by between 5% - 20%.

Countries like Niger, Chad, Sudan, and Burkina Faso are definitely endangered already. The situation will be exacerbated if further reductions in these countries are experienced.

Countries like Nigeria, Cameroon, and Ghana are already bearing a lot of burden on behalf of the sub-Sahara countries. This writer believes that until a country like Nigeria includes Chad, Niger, and Burkina Faso in her food budge and production, it will continue to experience the hunger-induced influx of citizen of the named countries into Nigeria. Now that food scarcity is predicate for the next decade, how many of these 'aliens' will Nigeria support. The xenophobia going on in South Africa has to do with the matter of the stomach. South Africa believes that foreigners especially Zimbabweans who flee their country to avoid hunger are dislocating them from their own livelihood. Africa has been described as a top notcher among the failed state of the world.

While parts of Africa are thriving, Africa is the world poorest continent, with 19 out of the world 25 poorest countries located in the continent. Using social, economic political and military indicators, a recent study on "Failed States" has 11 African countries in the top 20. Nearly 200 million Africans are undernourished and one third of Africa children are stunted or underweight. Sub-Sahara Africa has 10% of the world's population, but 24% of the world diseases burden.

Naturalists may attribute this to the God's anger. Even if this is so, the Gods should spare a thought for the hundreds of millions that will be affected if their anger persists. However the scientists using empirical evidence are concerned over the destruction to humans that will occur in Africa if climate change is not mitigated around the world and its effect is let loose on Africa.

Climate change (Global Warming) will affect Africa in the following observed ways: hunger, disease burden, political instability, brain-drain and decimation of populations.

**4.1 Hunger:** It has already been said that over 90% of agriculture is rain fed with "about 300 million Africa currently living in a water-scare environment" which increase in population could jack-up to 600 million peoples. If global warning persists, crop failure will occur in areas where rainfall diminished. Hunger is the attend-ant result. Many of the country concerned are not economically viable to import food. Foods donors will, reduce in number govern the current schism on food scarcity. The economic melt -down has further compounded the problems of food shortage in the world even in America. African American in Chicago will tell the story better.

**4.2 Brain- Drain:** Africa is experiencing flight of her well trained citizens to countries of Europe and America where life is more comfortable. For now it's because of jobs that are not available locally, every day, necessities of life like electricity, water good hospital, socio-physical security and adventure. When food security is added to already tense situations in some African countries, the rate of emigration of well-trained manpower can be imagined.

"A prime example of how climate change will impact human health is malaria. Currently, 360-400 million people live in area with malaria worldwide resulting in over one million deaths each year-with 90% of fatalities occurring in Africa. Ninety percent of malaria victims are children under five. Because climate change will help disease-carrying agent such as mosquitoes move in to area, millions of Africans could be exposed to malaria for the first time. Other vector borne diseases such as dengue fever will also increase. Beside t5hese disease, additional flooding from climate change will also exacerbate health resulting from poor sanitation such as cholera and diarrhoeas' (one of the leading killers of children). Finally climate - exacerbated malnutrition will weaken bodily defence and leave many Africans more susceptible to all types of disease including AIDS".

**4.3 Political Instability:** Population displacement is a sure recipe for internal and external attrition among people of the world. African cannot be an exception of this rule. It is population saying that a hunger man is an angry man. Food scarcity caused by crop failure which re due to global warning will heart up the polity. Some government have been toppled or voted out because of rise in price of bread and corn.

**4.4 Decimation of Populations:** The current examples are Burma volcano, hurricane Katrina in New Orleans, and the Tsunami of 2004, Rwanda presents an example for Africa. The 1994 genocide in Rwanda was preceded by an unusual drought that decreases crop production, as well as an influx of refugees escaping Burundi after a coup; food prices soared and famine ensued. Several months later the genocide began.

There are towns and villages in some coastal areas of Africa that are prone to flood. If global warming persists, such cities as Lagos, Port Harcourt in Nigeria and other such low lying cities in Africa may be in danger.

Inland flash flooding due to heavy rains is also projected an increase in intensity and occurrences. The 1997-98 floods in Kenya resulted in \$1billion in damage, and the floods in Mozambique in 2000 resulted in 2million people being displaced with 350,000 jobs lost impacting the livelihood of up to 1.5 million people.

## V. RECOMMENDATIONS

The following strategies and recommendations are made to lessen the impact of climate change in the African continent:

- i. Have bilateral relations with developed countries in terms of capacity building programmes, development of awareness programmes, information techniques and technology, offer solutions that will minimize climate change as well as monitoring mechanisms.
- ii. Legislation, Policy guidelines need to be enacted by the various countries legislative bodies. Strategy and policy on sustainable development, planning, energy, waste water, food, landscape character, biodiversity and transportation including aviation need to be made and conflicts avoided.
- iii. All tiers of government in African countries should develop, regulate and enforce climate change strategies and action plans implementation strategies.
- iv. There is need for close collaboration between public and private sector on barriers of sustainable development as well as research and development to simulate the development of broad portfolio of appropriate response to the challenges posed by climate change and sustainable technologies and practices.
- v. There is need to conduct a stock-taking of existing and proposed climate change data, studies and resources relevant to African environment.
- vi. The countries need to undertake a more detailed analysis of key environmental sectors and geographical locations at risk from climate change, link it to a feasibility study of adaptation options.
- vii. Support initiatives to build capacity in climate change skills within public and private institutions in the continent.

## VI. CONCLUSION

Africa is involved in stimulating climate change through bush burning, over grazing, logging for fire wood and furniture, Co2 emission from company and private electronic generators, CFC emitting equipment like refrigerators, air conditioners and perfumeries. It is unacceptable to ignore problems caused by climate change as being felt in all areas of endeavour. A holistic approach is required to appropriately respond to challenges posed by climate change and the creation of sustainable environment for development. Right policies, processes and decisions should be put in place in Africa now to create opportunities for sustainable development.

Fighting climate change by reducing greenhouse gas emissions (GHG) will not suffice alone. To ensure that the environmental and social challenges of global warming are overcome, it is also crucial for communities to adapt to climate change. Adaptation measures for urban areas are being emphasised for Africa, since compared to mitigation it is shorter term and less expensive and cost effective to implement, does not require intensive data which Africa lacks and can be incorporated into policies and plans that will ensure timely adaptation.

There is need to develop a robust set of principles, tools and data to underpin the evolution of Africa's environment to one that is well designed, high quality, inclusive, low carbon and sustainable. Above all, there is an urgent need to translate awareness of climate change impacts into tangible adaptation measures at all levels of governance in the African countries.

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