

## **Mitigation of and Adaptation to Climate Change in the 21<sup>st</sup> Century**

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### **Abstract**

Climate change and environmental sustainability has emerged as a major challenge to development in the 21<sup>st</sup> century, and is a threat to the achievement of Millennium Development Goals (MDGs). This paper extensively dealt with the concept of climate change. However various concepts were conceptualized, the consequences of climate change were mentioned in this study. The study highlighted the causes of climate change which includes unethical agricultural practices like: overgrazing, bush burning, deforestation, and gas flaring, result to the emission of gases into the atmosphere, and subsequently leads to the depletion of the ozone layer. The environmental justice theory was used as our theoretical foundation for this study. Some findings of this study are (1) Most viable mitigation of climate change is to develop functional geo- engineering. (2) Deforestation, bush burning, and other unethical agricultural practices are contributing to a high extent, to climate change. (3) People's awareness level to the dangers associated with climate change is low. (4) There are two strategies for mitigation of and adaptation to climate change; they are the strategies for averting the change (called the preventive options) and strategy for mitigating the effect of change. The study used the documentary sources as its method of data collection. Notwithstanding, the method applied in this study is the descriptive survey, while content analysis was used to analyze the data. Notwithstanding, the study made recommendations among others that government, organizations and individuals should launch awareness campaigns on the dangers of climate change which is as a result of some of our unethical actions and behaviour.

**Keywords:** Climate Change, Global Warming, Environmental Sustainability, Mitigation, Adaptation.

### **Introduction**

Climate change is one of the most serious environmental and human threats undermining the achievement of the Millennium Development Goals (MDGs) and the international effort to reduce extreme poverty. This is endemic because budgetary allocation of nation's meant for other aspects of the economy are now being channeled towards avoiding or mitigating the effects arising from climate change. Climate change and environmental sustainability has emerged as a major challenge to development in the 21<sup>st</sup> century. Speranza (2010) posited that recent research has noted the impacts of climate change on agriculture and natural resources management in the

Countries of Asia, Africa, and Latin America. As a result of low adaptive capacities and the projected impacts of climate change; a consensus has emerged that developing countries are more vulnerable to climate change than developed countries, because of the predominance of rain-fed agriculture in their economies, the scarcity of capital for adaptation, measures their warmer baseline climate and their heightened exposure to extreme events (Fischer 2005; Nnamdi and Ozor 2009).

Daniel and Cochrane (1994) argued that resource servicing are the capacity of the earth's atmosphere and biosphere to absorb and process certain level of greenhouse gas emissions without triggering long-run chemical changes that will alter global climate. In that sense, the atmosphere and the earth's living plants, represent essential resource services for the global climate. If we overuse those resource services, producing more greenhouse gases than the earth can process, the change in atmospheric chemistry will have catastrophic implications for life on earth.

The most compelling global environmental challenge is to formulate and introduce a coherent management regime over the resource services of the earth's atmosphere. Unlike many local environmental problems, the earth's atmosphere might be extraordinarily difficult and expensive to fix. Climate change is already upon us, therefore, it is necessary for us to take measures that will not quicken the depletion of the ozone but rather create awareness that any negative act to our environment is liable to increase the danger of climate change. What is then climate change?

### **Conceptual Explications**

**Climate change** refers to a change which is attributed directly to human activities that alter the composition of the global atmosphere and which are in addition to national climate variability observed over comparable time periods (United Nations Framework Convention on Climate Change, 1992). Theodore (2001) defined climate change as a significant periods ranging from decades to millions of yours. It may be a change in average (e.g., more or fewer extreme whether events). Climate change may be limited to a specific region or may occur across the whole Earth, such as global warming. The term anthropogenic forcing refers to the influence exerted on a habitat or chemical environment by humans, as opposed to a natural process. Anthropogenic forcing of the climate has likely contributed to a number of observed changes, including sea level rise, changes in climate extremes, decline in the Arctic sea ice extent, and to glacier retreat (Hegerl, 2007/ IPCC, 2007)

**Global Warming:** This is a direct resultant effect of ozone layer depletion due to the absorption of ultraviolet radiation to the earth surface. This is a most serious phenomenon that causes climate change. Global warming causes rise in sea levels as the ice gap melt due to high temperature, which result in the rising of water volume beyond the river banks. The end point of this is flood, which destroys farmlands, displaced people, cause famine and loss of biodiversity. The beginning of global warming is traceable to deforestation, burning of fossil fuel and other anthropogenic activities (Cunningham & Cunningham, 2002).

Global warming has been theorized to be a result of the emission of carbon dioxide and other gases that trap the sun heat in the atmosphere. Carbon dioxide increases in the atmosphere as a result of increased human activity, more heat is trapped. Deforestation contributes to increased carbon dioxide by removing trees, which absorb carbon dioxide and produce oxygen (Dye, 2008:229). Melinda (2005) posited that green

house gases trap the heat in the atmosphere by preventing terrestrial radiation from escaping into space; thereby continuously warming the atmosphere.

**Environment:** Ugwu (2010) defined environment as involving conditions that affect some body or something and the natural World in which individuals, animals and plants live. In the same vein, Coleman (2003) posited that environment refers to the external surrounding within which an organism lives, or any external factor that affect the organism's development, as distinct from human intrinsic genetic factors.

### **Theoretical Foundation**

The term *environmental justice* emerged as a concept in the United States in the early 1980s, and it has two distinct uses. The first and more common usage describes a social movement in the United States whose focus is on the fair distribution of environmental benefits and burdens. Second, it is an interdisciplinary body of social science literature that includes (but is not limited to) theories of the environment, theories of justice, environmental law and governance, environmental policy and planning, development, sustainability, and political ecology. The elements or tenets of the eco Justice theory include the following:

- ❖ Fair treatment and meaningful involvement of all people regardless of race, colour, sex, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations, and policies.
- ❖ Environment as encompassing "where we live, work, and play" (some definitions also include 'pray' and 'learn') and seek to redress inequitable distributions of environmental burdens (such as pollution, industrial facilities, and crime).
- ❖ Social transformation directed towards meeting basic human needs and enhancing our quality of life—economic quality, health care, housing, human rights, environmental protection, and democracy.
- ❖ Ecological responsibility in linkage with social justice is what the world needs now.
- ❖ Healthy earth community requires advocacy and action on urgent environmental issues in ways that connect with struggles for social and economic justice. "Eco-justice"
- ❖ Envisions and values both ecology and justice, since there will be little achievement of environmental health without movement toward socio-economic justice, and vice versa.
- ❖ Sustainability," a prominent concept in environmental studies and political discourse, have parallel ethical meaning, to the extent that they also encompass social justice principles (See Cobb, 1992).
- ❖ Religious environmental activists emphasize a responsibility to conserve resources, protect biodiversity, and respect all beings, both human and nonhuman.



**Source:** Dieter Hessel 2011.

The issue has suddenly become of great concern to all human irrespective race, colour, continent or religion. The theory establishes the importance of all persons to contribute towards the protection of our decaying planet earth. This may not be possible without the formulation of quality environmental laws and policies which must be enforceable within the boundary of the policy. The mitigation and adaptation to climate change will only begin when policies and environmental laws are geared towards the reduction of environmental degradation. This theory advocates that issues of environment and ecology should be handled urgently because failure to do that may degenerate into a more deplorable state that may be difficult to proffer solution. The issues of environmental management should transcend just being included in schools curriculum but should be preached in religious gathering. This theory believes that it is important to take precautionary actions to avoid the occurrence of future environmental disaster that could be pernicious to man in his environment.

#### **Methodology:**

The method applied in this study is the descriptive survey. The source of data collection used in this study is purely secondary. This includes data from books, journals, government publications, newspapers and dissertation. The study utilized a method that conformed to the nature of our study. This study employed the documentary analysis to describe and analyze data and information. The study is descriptive and explanatory; it describes and explains data. Therefore, content analysis as a tool of analysis was utilized in critically examining and analyzing the result, consequently conclusion and generalizations were made from such analyses

#### **The Causes of Climate Change and Environmental Degradation**

The causes of climate change are generally the same everywhere in the world but causes of environmental degradation could differ based on the various activities that could cause environmental degradation. Climate change is caused by the emission of greenhouse gases (GHGs) into the atmosphere which has today emerged as a major environment problem in the world (Ojemade, 2012). Human activities like burning of fossil fuels and land use practices especially deforestation, carbon-dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), Nitrous oxides (N<sub>2</sub>O), halocarbons (compounds that contain chloride, fluorine and Iodine) and other heat trappings gases are released in large quantity into the atmosphere has lead to the concept global warming.

The causes of environmental degradation are multiple, although the sources of such causes are quite few. One source of environmental degradation stem from the various activities which includes: mining, industrial activities, oil exploration and exploitations, power generation and transmission, road and rail constructions, quarries, waste treatment and disposal waste dumping and over fishing (Adamu, 2012). Melinda (2005) & Grace (2004) share similar views that the greatest contribution of the GHG emissions, (80%) comes from the burning of fossil fuels while (20%) is attributed to changes in land use, especially deforestation. Ugwu (2010) has revealed that the 19<sup>th</sup> and 20<sup>th</sup> centuries has marked the greater part of human transformation of the face of the earth and the nature of human own existence. Unfortunately it is also true that in the very fruit of this transformation, that is human conquest of human physical environment through modern technology, lie the seeds of humans own destruction in the form of overpopulation, water and air pollution, global warming, urban deterioration in the form of natural resource, and other fundamental environmental problems (Ugwu 2010: 158-9).

The causes of climate change can be divided into two categories, human and natural causes. It is now a global concern that the climatic changes occurring today have been speeded up because of man's activities. The natural variability and the climate fluctuations of the climate system have always been part of the earth's history however there has been changes in the concentrations of greenhouse gases in the atmosphere growing at an unprecedented rate and magnitude. The United Nations, governments, and many top Scientists around the World believe that we must act now to stabilize and arrest further changes. To understand climate change fully, the causes of climate change must be properly understood.

Akpodigaga, & Ovuoyvwiroye (2009) argued that climate change is caused by two basic factors which include natural processes (biogeographically) and human activities (anthropogenic). The natural processes are the astronomical and the extraterrestrial factors. The astronomical factors include the changes in the eccentricity of the earth's orbit, changes in the obliquity of the plane of ecliptic and changes in orbital procession while the extraterrestrial factors are solar radiation quantity and quality. On the other hand, the anthropogenic factor in climate change that involves human activities that both emit large amount of green house gases into the atmosphere and depletes the ozone layer or activities that reduce the amount of carbons absorbed from the atmosphere. The human factors that emit large amounts of green house gases include industrialization, burning of fossil fuel, gas flaring, urbanization and agriculture. On the other hand, human activities that reduce the amount of carbon sinks are deforestation, alterations in the land use, water pollution and agricultural practices.

The greenhouse gases are carbon dioxide (CO<sub>2</sub>), chlorofluorocarbons (CFCs), Methane (CH<sub>4</sub>), nitrous oxides (N<sub>2</sub>O) perfluorocarbons (PFCs), hydro fluorocarbon (HFCs) and sulphuric hexafluoride (SF<sub>6</sub>). Anthropogenic emission of CO<sub>2</sub> from fossil fuel burning is very unevenly distributed throughout the World with the industrialized nations contributing more.

Studies on climate change have discovered a connection between the concentrations of carbon dioxide in the atmosphere and mean global temperature. Carbon dioxide is one of the important gases responsible for the greenhouse effect (Pidwirny, 2010). However recent scientist suggest that human activities (industrial emission of green house gases, waste incineration, transportation, deforestation and so on ) are contributing significantly

in altering the climate, while others argue that it is not only human activities but a combination of various factors (Ojo, 2001, Ayoade,2003, Efe, 2008)

### **Effect of Climate Change**

Melinda (2005) identified some effects of climate change, he stated thus that as more green house gases are trapped in the atmosphere, it leads to increasing warming the globe, thereby resulting in different climate event in different places such as higher average surface, and ocean temperatures, more rapid evaporation and rainfall, more variability and severity in floods and draughts, rising sea levels, an increased frequency and intensity of extreme weather events, and an extended range of tropical diseases. Some impacts from increasing temperature are already happening, they include:

- Ice is melting worldwide, especially at the Earth's poles. This includes mountain glaciers ice sheets covering-West Antarctica and Greenland, and Arctic sea ice.
- Sea level rise becomes faster over the last century.
- Precipitation (rain and snowfall) has increased across the globe, on the average.
- Sea levels are expected to rise between 7 and 23 inches (18 and 59cm by the end of the century, and continued melting at the poles could add between 4 and 8 inches (10 to 20 centimeters).
- Hurricanes and other storms are likely to become greater.
- Species that depend on one another may go into extinction. For example plants could bloom earlier than their pollination insects become active.
- Flood and droughts will become more common.
- Less fresh water will be available. If the Quelccaya ice cap in Peru continues to melt at its current rate, it will be gone by 2100, leaving thousands of people who rely on it for drinking water and electricity without a source of either. Drought is becoming more frequent, deserts are expanding with its concomitant effects of weathering of vegetation, famine, drying-up and increasing dust (Dube,2002;Obioha,2005; Nwagbara, 2008)

### **Climate change impact in regions within the tropics**

S/No	Region	Impact
1.	Africa	Increased drought, desertification, flood, sea level rise at salt water intrusion affecting coastal areas. Changes in pattern and quantity of rainfall, decline in crop yield, land degradation, food security will diminish. Water resources like streams and rivers will be affected reducing water available for agriculture and power generation. Increased in tropical storms other extreme events.
2.	Asia	Increase in drought, reduced soil moisture, flooding etc
3.	Latin America	Flood and drought would increase. Increase in tropical cyclone.

Source: Mbalisi, 2008.

### **Approaches to Mitigate the Effect of Climate Change**

The mechanisms for implementing, monitoring and evaluating climate change programmes, has to be put in perspective. It is important to clearly put into perspective the climate change adaptation programmes which are often initiated in order to reduce the possible damage to people's livelihoods, property, environmental quality and future prosperity. Individual households, enterprises, interest groups and governments have to all contribute to bring about a better adaptability strategy to the existing and expected risks associated with climate change (Kumuyi, Adesanya, Olorunfemi, 2008).

No part of the World will be spared the consequences of global warming. This truly global problem requires a global action plan; the UN Framework Convention on Climate Change (UNFCCC) was adopted in 1992 by the World's governments for exactly this purpose.

Sachs (2005) stated that unlike Kyoto Agreement which focused only on emissions target, the new protocol would embrace a limit on overall greenhouse gas concentrations as well. Mitigation effort will involve increased energy efficiency, carbon capture and sequestration, development of non fossil technologies, green buildings, hybrid cars, and other promising technologies. This will be spurred by putting a price on carbon emission. Sachs (2005:94) argued that only by stabilizing the concentrations of greenhouse gases we can avoid passing climate thresholds of great risk to humanity and the earth's ecosystem.

Okunmadewa (2008:218) in planning strategies for tackling the potential problems of climate change a two-prong approach should be pursued. These are (1) strategies for averting the change, and (2) strategies for mitigating the effects of the change.

Strategies for averting climate change (called preventive options) fall into three categories: (1) those for reducing the demand for fossil fuels, especially by conserving and using alternative energy source, (2) those which adopt technical solutions to collect and control carbondioxide emissions and, (3) those which involve increasing biomass production including re-a forestation of denuded areas.

Strategies for mitigating the effect of climate change include measures that protect (protective options). For example, the application of technical, engineering or structural responses and those that will help to increase man's resilience (adaptive options) to the effect such as relocation, improved water and soil management, application of new agro-technology, improved land-use policies, maintenance of food reserves and the introduction of disaster relief measures. Other adaptive strategies are those that lead to improved choices. These include measures employed for (1) environmental monitoring and early warning systems, (2) acquiring and applying improved climate data, (3) providing public information and education, and (4) investing in the transfer and use of appropriate science and technology.

Okunmadewa (2008:219) concluded by saying, it is true to state that only few problems that have faced humanity in recent memory have the kind of global implications that the expected climate changes portend. While actions are important at national and regional levels, it is fair to state that global partnership should be the key goal in addressing the problems associated with climate change. In this regard the roles being played by bilateral and multilateral agencies (e.g. those of the United Nations Organization include UNEP, WMO and IOC) will be intensified.

Al Gore (1992) stated that the government cannot afford to wait until the scientific evidence demonstrates global warming, but rather the government must immediately impose a system of global environmental regulation. Mitigating climate change involves taking actions to reduce climate change or green house effect, some of these measures that can be taken to mitigate climate change include;

- Research into geo-engineering to produce more environmental friendly engines or machines.
- Transport and automobile industries should make cars with less carbon-dioxide emission.
- The World nuclear power operators should be encouraged to desist from activities that will continue to deplete ozone layer.
- Encourage reforestation and discourage deforestation and bush burning.
- Integration of climate issues into economic planning and management at both national and regional levels.
- Frequent campaign against climate change and increase in awareness campaigns on climate change and maintenance of environmental sustainability.
- Replace incandescent light bulbs with compact fluorescent bulbs which produce less heat (Ojemade, 2012:42).

Egbule, Agu, Neadib & Chukwuone (2011:21) found out the following adaptations of climate change, they includes;

- Planting cover crops like melon to help conserve soil moisture
- Mulching and use of organic manure
- Early planting with first rain especially for crops like maize and cassava.

### **Findings**

- ❖ The most viable mitigation of climate change is to develop functional geo-engineering. It will enhance the production of environmental friendly technology.
- ❖ Deforestation, bush burning, and other unethical agricultural practices are contributing to a high extent, to climate change.
- ❖ People's awareness level to the dangers associated with climate change is low even among the educated people, most especially among the majority of the population.
- ❖ There are two strategies for mitigation of and adaptation to climate change; they are the strategies for the averting the change (called the preventive options) and strategy for mitigating the effect of change.
- ❖ To achieve a better a sustainable environment; people should reduce their demand for fossil fuel and seek alternative energy sources.

### **Recommendations**

- ❖ Mechanisms and perspectives for adaptation and prevention of climate change should be put in place by the government, household, individual and organizations. This will guarantee the safety and sustainability of our environment.
- ❖ The government and environmental scientists should emphasize the use of environmental rationality; this can be used to assess the environmental performances of industries, technology, households and lifestyle.



- ❖ The government, individual and organization should look out for alternative sources of energy. To achieve this; huge fund and investment should be directed towards research and development (R&D).
- ❖ Policy makers and the government should promulgate policies and laws towards maintaining environmental sustainability. However, there should be disciplinary actions against individuals, industries, organizations and households found defaulting in environmental laws and policies.
- ❖ There is need for the government, organizations and individuals to launch awareness campaigns on the dangers of climate change which is as a result of some of our unethical actions and behaviour.

### Conclusion

Climate change has become an issue that should not be handled with levity. It is an issue that has transcended national boundaries and national concern rather it is now an issue of international concern. The high level and activities of industries and transport sector has contributed more in the emission of CO<sub>2</sub> into the atmosphere. The major cause of climate change is both anthropogenic and biological in nature.

The challenge of climate change has two dimension first is the strategies for averting the challenge of climate change and strategies for mitigating climate change. Developing strategies to mitigating the effects of climate change is a major challenge. States should make effort to demonstrated international partnership or rather global partnership in issues relating to environmental sustainability. Jeffrey (2009:107) posits that Climate change is already upon us, and it will get worse. The planet will continue to warm even without any further emissions and further emissions are certainly on the way. Many countries have already begun to experience the consequences of climate change: more drought (as in U.S. Southwest, the African Sahel, and Australia), heat wave (notably in Europe) rising tropical storms intensity (as with Hurricane Katrina), a widening transmission belt for malaria, and more. Countries need to invest in adaptation to climate change alongside their critical investment in mitigating emissions. Adaptation and mitigation are not alternatives, both are needed.

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