



THE EFFECTS OF CLIMATE CHANGE IN DEVELOPING AREAS: AN
ASSESSMENT OF THE AFRICAN SITUATION

FA Odimegwu

[Orcid.org/0000-0003-1653-6195](https://orcid.org/0000-0003-1653-6195)

Dissertation accepted in fulfilment of the requirements for the
degree *Master of Social Science in International Relations* at
the North-West University

Supervisor: Prof L Amusan

Graduation: May 2016

Student number: 24630349

Declaration

I hereby declare that this Mini-dissertation for an Honours degree in the Department of Political Science and International Relations at the North West University, Mafikeng campus titled THE EFFECTS OF CLIMATE CHANGE IN THE DEVELOPING AREAS: AN ASSESSMENT OF THE AFRICAN SITUATION has not been previously submitted by me for the purpose of a postgraduate degree at the North West University or any other institution.

This research is my original work. Any references to work by other scholars and institutions or any material from other sources have been duly acknowledged and referenced.

Signature: -----

Date: -----

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Student: Frank Azibuike Odimegwu

Signature: -----

Date: -----

-

Promoter: Professor Lere Amusan

Dedication

I dedicate this mini-dissertation to my lovely wife, Mrs. Mutombo Odimegwu. This research would not have been possible if it has not been for her support and prayers.

I also dedicate this work to the memory of my late mother, Priscilla Odimegwu and my late grandmother, Mrs. Lydia Alams.

Acknowledgement.

I would want to thank Father God Almighty for His grace and mercy in the course of this journey. May his name be praised!

I would also like to appreciate and thank Prof. Lere Amusan, my supervisor for his ever ready to assist mentality, his patience and his inspiring leadership that inspired me and kept focus throughout the research process. Thank you Prof. Lere Amusan. I am highly indebted to you sir.

I also want to thank Prof. Victor Ojakorotu for his candid advice and assistance whenever and wherever called upon to assist. May God you Prof. Victor Ojakorotu.

I greatly appreciate the assistance and support from Mr. John Nchoe- the faculty manager, Pastor Chima Edwards, Pastor Abel Nwachei and my children for their support and willingness to help.

God bless you all.

Abstract.

This research is meant to assess the effects and incidence of climate change and indigenous innovative measures in the developing African nations. The importance of the research are to highlight the extent of influence of climate change impact in the developing countries; examine the nature of climate change effect; determine the factors affecting the people's adoption of various adaptation strategies in the areas; identify problems faced as a result of the impacts of climate change. Climate change does not only threaten in sustainable development of socio-economic activities but also the totality of human existence of any nation; hence the crisis of human security. Data is gain to be drawn from both primary and secondary sources; using both quantitative and qualitative approaches. Simple descriptive statistic is to be used for data analysis. The study shows that there is increase in the effect of climate change in the places regarded as low rainfall, desertification, higher and high temperature altitude. The findings also noted that the key problems associated with climate change were; increase in the cost of living, farm input, and poor crop yields, increase in pest and disease incidence and of forest resources.

Keyword: climate change, mitigation, Adaptation, Africa, developing countries, effects

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LIST OF ACRONYMS

CC	Climate Change.
COP	Conference of the Parties.
CFC	Chlorofluorocarbon.
CTA	Technical Centre for Agriculture
FAO	Food and Agriculture Organization.
GCF	Green Climate Fund.
GHG	Green House Gas.
IPCC	Intergovernmental Panel on Climate Change.
IRI	International Research Institute for Climate and Society.
MDG	Millennium Development Goals.
UNFCCC	United Nations Framework Convention on Climate Change.
USDA	United States Department of Agriculture
UNEP	United Nations Environment Programme.
UNDP	United Nations Development Programme.
UN	United Nations.
COF:	Climate Outlook Forums.
GCM:	Global Climate Change Model.
LGP:	Length of Growing Period.
GDP:	Gross Domestic Product.
SSA:	Sub-Saharan Africa.

CBNRM:	Community Based National Resources Management.
DFID:	Department for International Development.
DRC:	Democratic Republic of Congo.
REDD:	Reduced Emissions from Deforestation and forest Degradation.
DMP:	Desert Margins Program..
CRiSTAL:	Community-Based Risk Screening Tool-Adaptation and Livelihood.
DRR:	Disaster Risk Reduction.
UNISDR:	United Nations International Strategy for Disaster Risk Reduction.
AfDB:	African Development Bank.
AUC:	African Union Commission.
UNECA:	United Nations Economic Commission for Africa.
WMD:	Weapon of Mass Destruction.
ClimDev-Africa:	Climate Development in Africa.
CAF:	Climate Adaptation Fund.
IFPRL:	International Food Policy Research Institute

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Climate change is the greatest threat to human existence on earth in the 21st century. It is a procedure of unnatural weather change, somewhat because of ‘nursery gases’ as an aftereffect of human activity.

The United Nations has warned that the devastating consequences of climate change, mainly caused by emissions from the Western nations will hit Africa hardest. It is important to note that the effect of climate change in Africa is deadly than the experts had thought. Approximately 70 million people are at risk from rising sea levels, while droughts, which have overwhelmed the Horn of Africa with increasing occurrences, will be more common (Institute of Environmental Management and Assessment (IEMA), 2012).

The report gives a clear assessment of what could happen on the continent if developed countries do not manage their carbon emissions. Approximately 30% of Africa’s coastline could disappear as sea levels rise between 15cm to 95cm in the next ten decades. Cities such as Cape Town, Dar es Salam and Maputo are at risk. With the exception of Lagos, the economic heart of Nigeria would submerge if sea levels rise by one metre. Alexander, a popular tourist destination in Egypt will also be affected. The number of people who will be at risk in Africa from coastal flooding disasters is expected rise from one million in 1990 to about 70 million by 2080 (IEMA, 2012)

Africa is particularly at risk due to its reliance on food in large amounts of arid lands. More than half of Africa’s cultivatable land is arid or semi-arid. Approximately about 90 percent of the poor work in agriculture. Unpredictability of rain fall forces them to rely on emergency food aid. Both developed and developing countries feel the impacts of climate change. But developing countries are likely to feel the effects more, not because they are the greatest contributors to climate variations, but because they lack economic, social and political settings to quickly react properly to the effects of climate variability. Climate change is expected to result in higher temperatures, more sporadic rainfall patterns and frequent droughts. Burdened on the countries already affected

with scarcity of water resources, the impacts of climate change are expected to affect all sectors of the economy (IEMA, 2012).

Climate change effects are mainly felt on agricultural production, health, social and economic conditions and also impacts on the people and the environment at large. These will likely escalate the impacts of drought and desertification by forcing millions of people to migrate for greener pasture.

Food and Agriculture Organisation (FAO) (2005) Global Forest Resources Assessment clearly indicated that forest and woodland in Sub-Saharan Africa cover at least 530 million hectares, in comparison to 710 million hectares in 1975. This ongoing degradation of natural resources reduces the chance of recovery of the agroecosystem to drought, thereby hampering the country's capacity to coping with climate change (Anuforum, 2009).

According to the World Health Organisation (WHO) (2004), heat fatigue, heat lassitude, skin eruptions, among others, are example of heat- cognate sicknesses resulting from climate change conditions.

De Chavez and Tauli- Corpus (2008) argue that issues of climate lead to the loss of revenue and economic opportunities. Migration within local communities as a reaction to the impact of climate change on local engenderments has deprived many households of adolescents and able-bodied labour. The migration of local adolescents and able- bodied men and women in search of greener pastures elsewhere because of climate change has greatly reduced economic opportunities in their own local communities. This will most likely erode them of their local economies and culture. The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (FAR) (2007) maintains that Africa is one of the most vulnerable continents (due to its physical and socio-economic characteristics) to climate change and variability, a situation aggravated by the interaction of multiple factors happening at different stages and low adaptive capacity. It should also be emphasised that agricultural products and food security in many African countries and regions are most likely to be adversely compressed by climate change and variability. Furthermore, FAR reports that the expected reduction in production in some countries may go as far as 50% by 2020 and crop net revenue could drop to about 90% in 2100 with serious implications on small-scale farming, which will adversely affect the continent's food security.

According to FAO (2010), climate change hampers the economic progress achieved by African states to date because of substantial diversion of resources required to fund adaptive initiatives.

Quoting Clement (2009) and Nelson *et al.*, (2009), FAO predicts that economic woes resulting from climate change will likely go up to 14% GDP if clear adaptation measures are not adapted and properly implemented. IPCC (2007) also predicts that dry and wet years will increase during the present century in the short- term. It will not be possible to predict the outcome of rainfall over the centuries in the Sahel, along the coast of Guinea and the Southern Sahara.

According to Druyan *et al.* (2008), the past climate trend might likely continue with semi-arid areas becoming more arid. Despite these challenges between models regarding the expansion or contraction of vegetation area, IPCC (2007) predicts that global warming in Africa might be higher than the global average predicted and may continue throughout all seasons. Africa is the most vulnerable in terms of water resources because of its heavy reliance on rain- based agriculture, poor water level control and the replenishment of reservoirs. High water temperatures, increased precipitation and long periods of low flows are likely to increase the intensity of water pollution, impacting on the ecosystem, human health, and water system reliability and operating cost (Parry *et al.*, 2007).

Climate induced change in flow regimes has resulted in reduced flow velocity in watercourses, temperature changes as well as deterioration in water quality, particularly in sub- Saharan Africa (FAO, 2010). According to Niasse *et al.*, (2004), this has affected the irrigation capacity of schemes, hydroelectric power generation and created conducive conditions for the proliferation of aquatic weeds. The rising of Sea levels in Africa from climate change poses major climatic threats to coastlands, settlements, lagoons, mangrove forest areas and poor locals living in coastal cities and floodplains. Due to the fact that ‘Greenhouse gases’ and agricultural problems are likely to increase as a result of increasing demands for foods and changes in diet, it is expected that the impacts of climate change on agricultural systems will not be the same though the long- term effects are expected to be negative. It is important to note that mitigation and adaptation measures are of importance, if the recorded development achievement is not to be eroded.

1.2 PROBLEM STATEMENT

There is the possibility that climate change may have far-reaching effects on various sectors of the African society. The susceptibility and adaptation of the study on climate vicissitude in Africa needs coordinated research efforts in several sectors to access possible effects from a transmuting climate and environment.

To further identify potential measures that may help ease the adverse effects in different sectors. The adaptation options should not interfere with the successful role of other sectors and should reflect societal preferences overall goals. Climate change has and will continue to have far reaching effects on the timing, flows and quality of water resources around the globe (Bates et al. 2008: Gerstetter and Vidaurre, 2012).

There is considerable dubiousness regarding the caliber of the projected changes, but the speed and intensity of extreme resultant effect is expected to increment the jeopardy of flood.

Shifts in the seasonal timing of dihydrogen monoxide availability will additionally increase the jeopardy of droughts for the Mediterranean and Southern Africa countries—among other regions (IPCC, 2007; IPCC-SREX 2012).

People and institutions seek to lower the peril posed by the consequences of climate change by acclimating to incipient conditions. Consequently, the direct impact of climate change on the natural environment will also lead to shifts in political and economy of the society. The concern with climate change is heightened given the connection agriculture has with impecuniosity. In particular, it is envisaged that the adverse impacts on the agricultural sector will escalate the incidence of rural impecuniosity. The impacts of impecuniosity are liable to be rigorous in Africa since the agricultural sector is a consequential source of livelihood for the majority of the local population. Since the majority of Africans and developing countries depend on rain-alimented agriculture and fishing as their source of living, this will lead to a high risk of food engenderment system being adversely affected by the variability in timing and the amount of rainfall, frequent outbreaks of crop pests and diseases and heat stress. Food shortages will increase and the possible tendencies for many farmers to lose their very source of livelihood due to climate change.

Low levels of education and poorly developed means of communications and marketing infrastructures will further complicate the already complicated task of developing location-specific responses that will adequately address the impacts of climate change. The quality of information in moving forward the climate change agenda and communicating relevant information to the public is very important (CTA, 2008).

1.3 RESEARCH QUESTIONS

The following research questions were raised in the study:

1. What is the caliber of vigilance of the impact of climate transmutation in developing Countries?
2. What is the nature of the effects of climate vicissitude in Africa?
3. What are the adaptation methods practised by local farmers in Africa?
4. What are the difficulties encountered by the farming rural population because of the Challenges of climate change; and
5. What are the behavioural change measures of individuals and institutions towards adaptation?

1.4 OBJECTIVES OF THE STUDY

The objectives are to:

1. Critically examine the caliber of vigilance of climate transmutation in developing countries;
2. Review the nature of the effects of climate transmutation in Africa;
3. Describe the local adaptation practice applied by farmers in Africa;
4. Analyse the difficulties encounter by the farming rural population because of the challenges of climate change; and

5. Evaluate individual and organizational behavioural changes towards climate change
Adaptation measures

1.5 SCOPE OF THE STUDY

This study covers the genesis of climate change and its effects in developing countries, with particular attention to Africa.

It has no specific timeframe, because it is an ongoing discourse which covers most of the impacts of global warming and indigenous innovative measures in developing African nations.

It also deals with adaptation and mitigation strategies to combat the epidemic and how it threatens the sustainable development of socio- economic activities and the totality of human existence and the crisis of human security.

Due to the fact that the matter is constantly evolving, some of the facts included, stretched beyond the present time. The reason is to represent the current situation for clear understanding.

Prevent the impacts of climate change in Africa.

1.6 SIGNIFICANCE OF THE STUDY

Mitigation and adaptation should compose the pillar of public information. It should be of utmost consequentiality to engage on solemn discussions so as to engender vigilance among the people on the devastating impacts of climate change. This can only work with substantial and concrete proofs. It then becomes very vital to undertake study within this discourse.

With sufficient adaptation practices in place, susceptibility to climate change will be greatly reduced. Albeit in Africa, the matter is not an incipient development, it has however not receiving the attention it deserves. The desideratum for such guidelines is very essential, especially as it pertains to design adequate strategies for mitigating its consequences on all paramount agriculture.

This study provides vital information on the effects of climate change and what people are doing to adjust in order to minimise losses since their livelihood depends solely on agriculture. It withal provides information on the nature of desertification and climate variations in various communities.

Furthermore because of lack of felicitous engagement among role players, the findings of the study will go a long way in availing agricultural, rural poor communities, even policy makers, researchers, regimes, international organizations with information and policy discussions. This study fixates on the evaluation of the different assumptions behind each of these views to make a structured assessment of how paramount the effects of climate vicissitudes in Africa might look homogeneous to.

1.7 RESEARCH METHODOLOGY

This is a thorough study on climate change and its impact in developing countries, especially Africa.

Therefore, to discuss the above- mentioned objectives, this study adopts both the qualitative and quantitative approaches.

The qualitative approach was used to analyse existing literature on the topic. It was based on already existing coursework, basics of past research, observations and evidence available on the subject matter, in order to strengthen the theoretical background of the topic.

The quantitative studies on climate change seek to measure the potential effects and other forms of consequences. Therefore, one finds in quantitative analysis a wide range of economic and social variables vital in determining the impact of climate change in developing countries, especially in Africa.

Observations, survey and document analysis and secondary data were used

1.8 ORGANISATION OF THE STUDY

The study is divided into five chapters. The first chapter is the introduction to the study and the rationale for the study. Chapter two is the literature review and the theoretical framework of the study. Concept and an analytical of theories of climate change were properly explained, the causes and the elements in order to show how it has evolved over the years. The theory is supported by evidence either against or in favour. It examines, among other things, the projection, results on crops and adaptation policy.

Chapter three examines the effects of climate change in Africa. It discusses how climate change will affect resources in African countries. It further expounds the challenges of climate change. It describes the challenges that impact on the ability to deal with the effects of global warming. Chapter four discusses the issue of development, what developing countries, especially Africa are doing to sustain growth and avert security threats posed by climate change and gender-related issues. Chapter five is the conclusion and recommendations in order to improve or prevent the impacts of climate change in Africa. .

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1.9 ETHICAL CONSIDERATION

The researcher is aware of the aim and purpose of this study. Plagiarism is avoided in this study through proper referencing of the sources of information since there was intensive and extensive review of relevant literature.

1.10 CONCLUSION

The greatest threat to humanity in this 21st century, no doubt, is the issue of climate change and its consequences. The African coastline has been seriously damaged by the devastating effects of climate change.

Therefore, it is a matter of obligation to find ways on how to mitigate and adapt measures to reduce and counter its impacts. Finding a problem and how it could be solved by governments, individuals and organisations in Africa, forms the basis of this study.

The objectives, methods applied in conducting this research and its significance are centred on the forces of climate change.

Imperatively, coordinated engagement with different role players and with concrete and reliable available information will help find the much needed solution that will assist most vulnerable African populations in order to adjust and minimise the ever growing impacts of climate change.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 INTRODUCTION

According to the Intergovernmental Panel on Climate Change Fourth Assessment Report (2007), about 75 to 250 million people in Africa may be exposed to increasing water shortage due to climate change in 2020 and this will negatively affect livelihood in the area. The area suitable for agriculture, length of growing seasons and production potentials are expected to decrease due to climate change. Proceeds from rain-fed agriculture in some countries could be reduced to about fifty percent. Thus, climate change will likely have a serious impact in developing areas, where about 800 million people would likely be malnourished.

According to the World Bank (2008), almost 75% of the poor local populations in developing countries depend on agricultural activities for their livelihood.

. Climate change is the manifestation of a great complex system consisting of five interacting parts; the (air), the hydrosphere (dihydrogen monoxide), cryosphere (solidified piece of the earth), the area surface, and the biosphere (piece of the earth where life subsist (De Chavez and Tauli-Corpus, 2008; Amusan and Odimegwu, 2015). According to Etvonovbe, “the devastating effect of climate change on the riverine, refers to the long time (about 35 years) average weather conditions of a region, including typical weather patterns, the rate and intensity of in clemencies, arctic spells and sultry weather”.

Shift of weather conditions over a period of time causes climate change. The average temperature on the planet has been growing in recent time; resulting in rigorous and capricious climatic conditions across the nations of the world. Climate change can impact on all natural networks, hence a threat to human growth and survival, convivially, politically and economically. The mixed Nations Framework Convention on Climate change (UNFCCC: 1992) characterizes environmental change as a transmutation of atmosphere specifically or by implication credited to human movement that impacts the piece of the ecumenical environment, which in combination to common atmosphere variability descried over an extensive span of time.. The UNFCCC draws a

line between climate change relating to human actions and climate variability relating to natural causes.

According to De Chavez and Tauli Corpus (2008), ecumenical warming is the average increase of the earth's surface temperature and oceans compared to previous centuries. Ecumenical warming is Greenhouse gases, such as carbon dioxide, emanating from human utilisation of fossil fuel and trapped heat in the atmosphere that regulates our climate. The gases subsist naturally, but humans have further polluted the atmosphere with supplemental carbon dioxide by burning fossil fuels for power (coal, oil and natural gas) and by deforestation.

Because more greenhouse gases trap more heat the average temperature around the world is increasing. Even the oceans also absorb this additional carbon dioxide, thereby making them acidic and less friendly for sea life. Other impacts include vicissitudes in soil erosion, storms, floods and droughts. The outcome would be full blown pabulum crisis, with deteriorating weather, energy decrease and general environmental breakdown all over the world.

2.2 CAUSES OF CLIMATE CHANGE/ VARIATION

Continuous burning of fossil fuels and natural gas- that constantly release CO₂ in the atmosphere at an ever alarming rate causes climate change.

The atmospheric condition of the earth has in the past, increased tremendously, as shown by geological evidence of ice ages, sea –level changes and by the record of human history over hundreds of years. It is always very difficult to say for sure the causes of past changes in the climate, but what is certain is that it is related to changes in ocean currents, solar activity, volcanic eruptions and other natural causes.

The difference now is that global temperature has risen tremendously over the past few decades. There is a very strong view of increases in average global air and ocean temperature, melting of snow and ice and rising global sea-level. The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report concludes that global warming is very clear. Atmospheric and ocean temperatures have been on the rise, more in the past five centuries, and probably for more than a millennium.

Scientists have known long ago that the atmosphere's greenhouse gases act as a 'blanket' that traps incoming solar energy and keeps the Earth's surface warmer than it should be and that an increase in atmospheric greenhouse gases leads to additional warming.

Climate change and global warming are caused by the buildup of greenhouse gases (GHGs) such as carbon dioxide, nitrous oxide and methane in the atmosphere as a result of man's activities—burning of fossil fuels, bush burning and cooking.

The burning of coal, oil and natural gas, as well as deforestation and various agricultural and industrial practices, are altering the makeup of the atmospheric state and contributing to mood change (www.gcricio.org). According to De Chavez and Tauli-Corpus (2008), GHGs are chemical compounds such as urine vapour, atomic number 6 dioxide, Methane and Nitrous oxide found in the air. Others such as hydro fluorocarbons (HFCs) and per fluorocarbons (PFCs) result greatly from human industrial processes. Hydro-fluorocarbons are organic elements made up of hydrogen (hydro) and fluorine (fluoro) capable of damaging the environment. Per-fluorocarbons are an end product of aluminum smelting and a semi-conductor, consisting of one or more carbon atoms in conjunction with four and six fluorine. Its global warming ability is one of the highest of all the substances.

All these add to nursery issue. In any case, water vapor and duplicate paper dioxide represent 90% of the aggregate Greenhouse three faculties of gas outflows. As far as immediate gift of these nursery gas, carbon dioxide contributes 55%, Methane 15%, Chlorofluorocarbon septenary 7% and N₂O 65% (UNDP, 2005). Carbon dioxide is an end creation of fossil fuel that delivers the greatly required get-up-and-go fundamental for transportation, assembling, warming, cooling, power era and others. Fossil fuel in a matter of seconds records for around 80 to 85% of carbon dioxide being discharged into the environment. Deforestation for farming and horticulture moreover adds to carbon dioxide emanations. Clearing for logging, farming and agribusiness additionally adds to carbon discharge.

Land used changes also contributes to about 15 to 20% of current carbon dioxide emissions (www.gcricio.org). Methane is the second most imperative of the nursery gasses issuing from person animation (www.ecearth.org/article/causes_of_climate_change). It is induced as an aftereffect of rice completion, cows and sheep decaying so as to fare and materials in landfill. Methane is withal

incited amid coal mining and oil penetrating and by gas pipeline escape. Nitrous oxide is a result of agrarian and mechanical practices. Chlorofluorocarbon (CFCs) is used in refrigeration, cooling and as solvents. HFCs were acquainted with supersede ozone that was devastating CFCs eliminated by the 1987 Montreal convention, altered in 1990 and 1992. Ozone in the lower piece of the air is another sort of nursery gasses caused from mechanical exercises. It is incited normally and by climatic responses including gasses produced by human exercises, including nitrogen oxide from engine transport and force engenderers (www.gcrio.org).

Characteristic transmutation in the atmosphere exudes from the collaboration between the environment and sea, alluded to as inner variables, and from outside reasons, for example, varieties in the sun's vitality yield which would remotely differ the measure of sun powered radiation treatment got by the ground's surface (www.eoearth.org/article/causes_of_climate_change), and in the measure of material infused into the upper air by dangerous volcanic ejections (www.gcrio.org).

2.3 PROJECTION FOR CLIMATE CHANGE

The main projection of future climate patterns are largely based on computer-based models for climate system that incorporates the important factors and processes of the atmosphere and the oceans, including the expected growth in greenhouse gases from socio-economic scenarios for the coming decades. The Intergovernmental Panel on Climate Change (IPCC) examined published results from different researchers and on the basis of the facts, has projected that by 2100, (IPCC) Fourth Assessment Report, Working Group 1 (2007).

- The global average surface warming (surface air temperature change) will increase by 1.1 to 6.4°C.
- The sea-level will rise between 18 - 59cm.
- The oceans will become more acidic.
- It is most likely that sultry extremes, heat waves cumbersomely hefty precipitation events will perpetuate to become more frequent.
- It is additionally most likely that there will be more precipitation at higher latitudes and it is likely that there will less precipitation in subtropical land regions.

- It is envisaged that tropical cyclone (typhoons and hurricanes) will be heavier, with more astronomically immense peak wind speeds and more clumsily hefty precipitation associated with perpetual increases of tropical sea surface temperatures.

With global surface warming increasing by 1.1 to 6.4°C as indicated above, there is a tendency for the sea-level to rise to an average level of 18- 59cm, that will cause the ocean to become acidic. Therefore, there is the tendency that hot waves and heavy precipitation will frequently occur with more precipitation in higher latitude and less in subtropical land regions. Finally, it is supposed that tropical cyclones will be heavier with greater wind speed and associated heavy precipitation with an increase in tropical sea surface temperatures.

The projected changes in climate are likely to alter the health status of millions of people, including increased deaths, diseases and injury due to heatwaves, floods, storms, fires, and droughts. Increased malnutrition, diarrhea, diseases and malaria in some areas will increase vulnerability to extreme, public health and development goals will be threatened by long-term damage to the health system from disasters.

Drought- affected areas will likely become more widely distributed. Heavier precipitation events are most likely to increase the incident of high flood risks. By the mid-century, water availability will likely decrease in mid- latitudes, in the dry tropics, and in other regions supplied by melt water from mountain ranges. This is because one sixth of the world's population is presently dependent on melt water from mountain ranges. While some mid-latitude and high latitude areas will initially benefit from higher agricultural production, for many others at lower latitudes, especially in seasonally dry and tropical regions, the increases in temperature and the frequency of droughts and flood will likely affect crop production negatively, which can increase the number of people at risk from hunger and increased level of displacement and migration. Again, tendencies exist for diseases such as malaria and diarrhea in areas in Africa that hitherto did not exist due to the effects of climate change. Climate change projection in Africa is challenged by limited sources of information.

While there is visible and growing evidence that climate change is widely known, regional and local trends many at times are clouded by the high yearly and inter-annual variability in climatic conditions. The inadequacy of meteorological data network and near difficult access to data in

many areas of Africa represents an additional challenge to determining climate change. How to determine good and quality information on climate change differs across the continent. There are various types of global climate change Model (GCM) simulation for various scenarios that are available, and they are being used to assess the effects that Africa might experience. Therefore, to authenticate future projections, the global climate change model should not only include the various physical methods used in determining the climate but should include all the necessary chemical and biological methods that on impact climate over a period of time. Many of the processes are either missing or not properly projected in this state- of- the art climate model.

The region will now have to find a way to increase temperatures that will affect agricultural and natural ecosystem; increase water scarcity and regional variations on water availability; reduce agricultural growing duration for parts of Africa; and intensify precipitation events that might escalate the level and flooding time. Table 1 shows an overview of climate changes projections for Africa.

Table 2.1: Overview of climate changes projections for Africa

Changes	Regions
Average conditions	
Increase in temperature	Entire continent (medium projected increase in annual average temperature: 3 to 4°C (end of century to present))
Decrease in rainfall	West coast of Africa as far South as 15°N Southern Africa
Increase in rainfall	Northern parts of East Africa
Uncertain projections in rainfall	Sahel (already high variability)
	Guinean coast
	Southern Sahara
Rise in sea level	Low lying islands and coastal zones Delta regions (Cape Verde, Comoros)
Extremes	
Increase in intense precipitation events	Entire continent (this applies also to regions of mean drying)

	because there is a proportionally larger decrease in the number of rainy days
Cyclones	Uncertain—changes in magnitude and frequency and shifts in
	Cyclone tracks possible

Source: Based on IPCC (2007)

2.3.1 PROJECTED CHANGE TEMPERATURE

The African continent warmed by about 0.5°C in the past century. It is believed that, the projected annual average increase in temperature will probably rise by up to 3 to 4 degree Celsius by the end of 21st century.

2.3.2 CLIMATE CHANGE PROJECTIONS FOR PRECIPITATION

The present precipitation degree will likely increase in the future. As global warming for dry areas progresses, there is the tendency for dry areas to become drier and wet areas to become wetter. Areas with less rainfall will most probably experience lesser rain. Places that had already received substantial quantity of rainfall are most likely to receive more. This will pose additional problems to livelihood and economic activities that depend on natural resources. Increase in temperatures will eventually lead to increase evaporation from the soil and water bodies. Anticipated changes in annual average precipitation are signs of overall wetting and drying of annual climate. It is these changes in the timing and level of monthly rainfall that when put together with changes in temperature and other conditions, result in changes in run-off and groundwater recharge. Substantial amount of research is ongoing to manage the GCM simulation results that help manage changes in the hydrological cycle and reshape river basins in order to manage changes in streams that flow and provide for the assessing of climate risks.

2.3.3 PROJECTED CHANGES IN THE LENGTH OF GROWING PERIOD (LGP)

While the level of changes differs in the growing period of corn, sorghum, rice, wheat and flowering in soya beans from one another, either because of the kind of the scenario and model applied, the general picture on how growing periods might look like across the region proves that the fall in the length of the growing period will be more visible in places where climatic conditions

are already problematic to agriculture-based means of sustenance. A fall in the length of growing is also visible in places with projected rise in rainfall due to improved evaporation under climate changes.

2.4 OUTCOME OF CLIMATE CHANGE ON CROPS

According to Zhu (2005), climate modification has both positive and negative effects on husbandry. But there can be a worst scenario in the long run that might be leading to food scarcity if nothing is done to arrest the position now. Crop yields are affected by many factors linked with climate modification. These factors are temperature, rainfall, extreme conditions, climate variability, and carbon dioxide in the atmosphere that is envisaged to cause global heating which will likely affect crop engenderment (USDA, 2007).

Temperature is a consequential factor in determining the pace at which plant metamorphoses through sundry points towards maturity. According to the International Fund for Agricultural Evolution (IFAD, 2009), increment in temperature set-up plant tissues which reduces the rate of digestibility and abjection of plant species. It quickens plant maturity, especially in crop species, thereby reduces the growth phase during which seedcase, seeds and cereal can absorb photosynthetic products.

It is additionally a factor that determines the extent of growing and grazing seasons and customarily has a vigorous impact on timing of developmental processes and on rates of expanding upon plant leaves. Limpidly, temperature reduces the engenderment of cereal caryopsis that forms the basis of most of the world's diet by 40 billion metric tons per class (Lorraine, 2007). In the Sahara neighbourhood of Africa, the length of the growing season has been greatly reduced by high temperatures with deleterious effects on crops (IPCC, 2007).

Critical stages for high temperature damage includes seedling emergence in most crops, silking and tasseling in corn, grain woolf in wheat and flowering in soya beans. It additionally leads to heat stress for plants, incrementing sterility with lowering overall productivity, incrementing evaporation from plants and soils and growing dihydrogen monoxide demands while reducing water accessibility (Brett, 2009).

For instance in Nigeria, Niger Delta areas receive high rain, while other places in the Northern area receive little or no rain which leads to transmuting growing seasons. Shifting in ecological zones and rainfall becoming more and more capricious and unreliable both in its volume and timing (Brett, 2009). The crop water system may be adversely affected by seasonal changes, within season patterns of surplus and inter- yearly variations of precipitation. An inordinate amount of precipitation can cause infections on crops, while very little can be disastrous to crop engenderment which will lead to a decline in agricultural productivity (IPCC, 2007), especially if the dry season occurs during the all consequential developmental stages. For example, moisture stress during the flowering, pollination and grain-fill stages is critically inimical to corn, soya beans, wheat and sorghum. Even Elmer rice which is the staple intellectual nourishment that feeds half of the domain's population can also be jeopardised (Lorraine, 2007). According to Brett (2009), 75 to 250 million Africans are likely to be exposed to an incrementation dihydrogen monoxide scarcity due to capricious and unreliable rainfall patterns.

The character and availability of water stored in the soil that is a vital stimulation to crop growth will be affected by changes to both precipitation and seasonal annual evaporation respiration. Agricultural green goods, with access code to intellectual nourishment in many African nations and neighbourhood are likely to be adversely compromised by climate variability vicissitudes in precipitation. The areas congruous for agriculture, the period of growing seasons and engenderment capacity, concretely along the margins of semi-arid and arid areas are liable to decline. In some countries, engenderment from rain- victualled agriculture could be highly reduced by up to 50% by 2020 (Brett, 2009).

Nevertheless, the increase of atmospheric carbon dioxide and ozone that have been seen in the past 20th century are likely to continue (USDA, 2009). As the levels of carbon emission change, the optimal growth ranges for different species also change species also alter their competitive powers and the composition of mixed grasslands changes. The proportion of browse in rangelands will increase in features as a result of increased carbon dioxide levels (IFAD, 2009).

Carbon copy dioxide, apart from being a greenhouse gas, also shock greatly on plant life because works absorb carbon dioxide during photosynthesis to garden truck sugar that is necessary for

growth. The level of the import of carbon dioxide fecundation differs greatly among plant character and from variety to variety.

Furthermore, an inquiry by the Federal Ministry of Environment in Nigeria (2003) revealed that the consequential impact of climate change due to incremented Carbonic acid gas, is pellucidly visually perceived in the engenderment of both C₃ crop (plant type with three carbon atoms in their biochemical sequence of reaction such as: cowpea, straw, soya dome, rice, potatoes, cassava and yam) and C₄ crops (plant types with four carbon atoms in their biochemical sequence of reaction such as: sorghum, sugar cane, millet and maize). Plants with C₃ photosynthetic pathway, omitting corn, can show productivity increase of about 20 to 30% even more when grown at twice present CO₂ level and at optimal conditions with C₄ crops (USDA, 2007).

In integration, the effects of carbon dioxide fertilization cannot compensate for the negative consequences from other environmental hazards. For example, studies on multi-class field and greenhouse gases with potato and dry beans conducted at Ithaca, New Incipient York, showed paramount engenderment production increases for both potatoes and beans at twice present CO₂ levels when day time maximum temperatures were sanctioned to infrequently reach 95⁰c during pod time establishment, there was no production walfare from higher CO₂ (Peet and Wolfe, 2000; Jifon and Wolfe, 2005).

2.4.1 CLIMATE CHANGE AND ADAPTATION

Adaptation is defined as “the adjustment in a natural or human system in response to actual or expected climate stimuli or their effects, which moderate, harm or exploit beneficial opportunities” (IPCC, 2007). Therefore, adaptation with impacts of climate change in essence, has become an important feature of global discourse on climate change (Amusan and Jegede, 2014: 53).

Examples of adaptation includes preparing risk assessments, protecting ecosystems, improving agricultural methods, managing water resources, building settlements in safe zones, delivering early warning systems, instituting better building designs, improving insurance coverage and developing social safety nets (ibid, p. 53).

To IPCC vulnerability is “the degree to which a system is susceptible to, or unable to cope with the adverse effects of climate change, including climate variability and extremes. Vulnerability is

seen as the function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity” (IPCC 2001).

The continent of Africa is poor and less developed, with income per capital very low, life expectancy and infant mortality also very high. Illiteracy is also very high. While literacy is at its lowest globally, Africa relies on its natural resource base, with weak and bad governance structures, with low capacity to react effectively and efficiently to climate changes. Violent armed conflicts and the sole dependence on foreign assistance further complicates the already complicated situations. The continent is tropical with hot and dry weather patterns and citizens live in sub-humid and semi- arid zones (ILRL, 2006).

As a result of the consequences of high climatic change, Africans have developed some strategies to manage and live with severe adverse conditions such as droughts. For about four or five thousand years now, Africa has come to be a semi-arid zone (Andah, 1993). A lot has been spent in capacity building in Africa, yet much more is needed to better the adaptive capacity of organisation and individuals (Denton et al., 2001).

The high level of low adaptive capacity also contributes to high vulnerability. This is as a result of many factors: worsening ecological factors; high levels of poverty; HIV/AIDS factor; uneven distribution of scarce land; and too much reliance on the natural resource base (Hulme, 1996; Magadza, 2003; Ikeme, 2003). Adaptive capacity improvement is an essential factor to reducing vulnerability in climate change.

2.4.2 EXPERIENCE AND LESSONS ON ADAPTATION

Despite the low adaptive strength, Africans, have engaged in customary patterns to deal with adverse climatic conditions. Communities, which hitherto faced adverse climatic conditions, have discovered and adopted different ways of coping with climatic catastrophes.

Constant droughts in all intent and purposes increase people’s vulnerability in the short-run, but will encourage adaptation in the medium and long- run (Mortimore, 2001). This implies that local populations have tried to manage the use of their little available resources to cope with severe conditions in climate change, which suggest a practical adaptive mechanism. This applies to drought prone areas of the African Sahel region that is constantly threatened by climatic hazards.

It is also instructive to note that the local population has developed better, effective and efficient early warning systems than developed agencies; after all, critical decisions are made at the household level (Rahmato, 1998). Remedies against droughts have been adopted by the nomadic pastoralists in the Desert Margins Programmes (DMP) of Kenya (Langill and Ndathi, 1998). Local farmers have also fashioned out a coping device and tactics in places where drought occurs often in order to evaluating the chances for successful household or village seasonal food production (Downing et al., 1998). The rural Senegal and Burkina Faso have improved their adaptive capacity by adopting pruning and fertilizer doubling method of free densities in semi- arid areas. This has helped to glue soil together and turn around desertification.

Other methods are:

- Diversification of herds and incomes, e.g. the introduction of sheep in place of goats in the Bara area of Western Sudan (Osman *et al.*, 2005);
- Reliance on forest products as a buffer to climatic- induced crop failure in climatically marginal agricultural areas (Dube *et al.*, 2005); and
- Manipulation of land that leads to land use conversion (changing from livestock to game farming in Southern Africa).

However, due to the fact that sizeable numbers of Africans were reported dead and affected by climate change and related sickness and diseases in the continent between 1993to 2002, it is estimated that about 136,590 and 250,000 died during the Soudano- Sahalian drought of 1968-73, alongside with about 12 million cattle as a result of salvation. This proved that traditional adaptation methods were not sufficient enough to deal with adverse climatic conditions (Tarhule and Lamb, 2003).

According to the IPCC Third Assessment Report, climate change is visibly glaring, and will continue even if global gas emissions are reduced considerably in the short to medium- term (Adger, 2004). In considerations to this fact and with regard to Africa's vulnerability to climate change, planned adaptation becomes crucial.

Adaptation of forestry includes the decentralisation of the local management of resources, that is, locally- based natural resources management (CBNRM) approach to promote the use of

ecosystems goods and services as opposed to a reliance on agriculture (in climatically marginal areas for agriculture) (Dube *et al.*, 2005) and the manipulation of land use in Botswana.

However home gardens and sheep fattening have greatly contributed to enhancing the resilient capacity know-how of small local farmers in Kordofan and Darfur regions of Western Sudan (Osman *et al.*, 2006). In many areas, food crops have replaced cash crops and various types of resilient crops have been introduced (DFID, 2000). Migration and local forced movements are presumed to be an adaptation option.

In coastal areas, the anticipated adaptation options include fisheries management. In the Seychelles, there is closed season control agreement between foreign fleets and the establishment of marine reserves. In West Africa, the options include the development of a sustainable Fisheries Livelihoods Programme. In the Niger Delta of Egypt, a system called dyke (which means building a barrier to prevent flooding from sea option) is used as it s worst form of flooding. However, it might probably cause serious groundwater salination and aggravate the impact of increasing wave action (UNEP, 2004).

2.4.3 ADAPTATION REQUIREMENTS

Although climate is changing and climate variability is due to increase in very high magnitude and intensity (IPCC, 2001), it is likely that the present adaptation strategies may be considered inadequate in the future. Serious considerations are needed if adaptation is to be perceived as an essential dynamic, continuous and non-linear process (ILRI, 2006). Correct and acceptable early warning forecast is considered a necessary element of adaptation, especially in predicting and cushioning the effects of floods, droughts and tropical cyclones and also for indicating the planting calendar to coincide with the beginning of the rainy season (Tarhule and Woo, 2002). It is also used to see if there will be diseases outbreaks in areas likely to suffer from epidemics (Kovats *et al.*, 2002).

According to Githeko and Ndegwa (2001), malaria epidemics in the highland Western Kenya can be predicted between two to three months to its occurrence, by using the information of Climate Outlook Forums (COF) to find out malaria- related climate change risks and warning against malaria outbreaks.

Education, information and training should be considered and encouraged as necessary tools among governments, institutions and individuals in promoting adaptation to climate change in Africa, since the continent is considered to be one of the poorest and is likely to be exposed to the worst scenarios of global warming.

Adaptation is widely recognised as a consequential part of policy replication to climate change because it avails farmers achieve their pabulum, income and livelihood security department objectives in the case of transmuting climatic and socioeconomic conditions, including variability, adverse weather conditions such as droughts and floods, and sensitive short- term vicissitudes in rural and immensely colossal- scale markets (Kandlinkar and Risbey, 2000).

Studies have revealed that without adaptation, climate change is generally lamentable for the agricultural sector. But with adaptation, susceptibility will be highly reduced (Easterling *et. al.*, 1993; Lemon, 2014; Rosenzweig and Parry, 1994; Reilly and Schimmelpfennig, 1999; Smit and Skinner, 2002).

The degrees of impact on the agricultural sector affected by climate change depend largely on its adaptive strength. Adaptive strength is the ability of a system to adjust to adverse conditions— climate change (including climate variability and extremes) to moderate potential damage, to take advantage of opportunities, or to cope with consequences (IPCC, 2001). Ideally, adaptation and mitigation should be considered together, as some adaptation measures can help reduce greenhouse gas emissions, while alternatively, mitigation measure can also be planned to reduce, and not inadvertently escalate the risks of disaster.

Some adaptation options are adopted routinely by the system in question as part of its normal operation. These adaptation responses are termed “autonomous” (Parry and Carter, 1998) to show the potential internal adjustment of a selected sector. Autonomous adaptation can follow three main categories: inbuilt adjustments, routine adjustments and tactical adjustments.

Inbuilt adjustment allows for the physiological or even unconscious adjustment to changed climatic conditions such as a plant stomata reacting to a change in environmental conditions. Routine adjustments are more conscious adjustments that occur within the system to variations in climatic conditions such as farmers altering a sowing date to take advantage of the most favourable

soil moisture conditions for that season. Tactical adjustments represent a more pronounced response to climatic variations outside the normal expectations of climatic variability. For example, a grower may decide to change crops from maize to sorghum in response to a hotter and drier environment. Autonomous adjustments represent many of the responses within a specific sector of society. More strategic adaptation response may be formulated across societal sectors as part of a specific government plan for climatic effects.

2.5 CONCLUSION

The issue of adaptation response has progressed from initial questions concerning the likelihood and magnitude of climatic effects to the issue regarding the most appropriate response.

This chapter has presented the literature review and the theoretical framework with regard to climate change in developing countries, especially Africa. It has also discussed projections in terms of climate changes in developing countries (Africa) and its impact on various crops.

Finally, it summarised adaptation and mitigation responses in dealing with the effects of global warming. The next chapter focuses on climate change and its effects on Africa.

CHAPTER THREE

CLIMATE CHANGE AND ITS IMPACTS ON AFRICA

3.1 INTRODUCTION

Climate change is without doubt, acknowledged as a fundamental human and environmental problem of the 21st century. Not fully understanding the issues surrounding climate change is one of the difficulties Africans and their governments. Climate change is without doubt, the cause of serious wars and conflicts in the continent. Therefore, it becomes important to understand fully the rudiments of climate change. All sectors of the African society have placed their energies in it. It is of a general view that global warming poses a great threat to the African society and its ecosystem. Unless something is done very quickly, the consequences will be grave and alarming in terms of sea-levels rising, floods, droughts and famine. Without doubt, climate change in Africa is disastrous and constitutes a security threat to the continent and its environments (Holden *et al.*, 2009; 23-41).

It is worrying that the negative consequences of global warming in Africa could create serious environmental degradation and exert demographic pressure that will cause the displacement of millions of Africans. It is speculated and advanced that as a result of climate change, African continent is bound to experience higher temperature rise, rising sea-levels and changing patterns of rainfall that will likely affect the greater majority of African populations. The effects of climate change in Africa are expected to be high. It will touch many sections and sectors of African lives. The consequences of this will be experienced and felt in agriculture and its production, and food security in a very high dimension. Droughts, higher temperatures, higher pests and diseases, increased desertification in the Sahara regions, erosions, floods and deforestation are all traces that climate change in Africa is a great threat to socio-economic and environmental development. It will have disproportionate consequences in the developing countries of Africa. The less privileged and poverty stricken Africans are the ones on the line and are the ones also experiencing the intensity of environmental pollution with all its accompanied economic underdevelopment.

Despite the growing concern about the challenges of climate change in Africa, there is no informed statistics to quantify the impacts of its economic cost, either individually or collectively. As long

as development is concerned, climate change has serious consequences on the ability of Africa to meet its millennium road map, with continuous pressure on agriculture, water supply and demand as well as health and political stability. There is a need for information regarding climate change in Africa. It is high time Africans took a critical look and understand the contents and implications of all international agreements on climate change signed by Africa countries regarding adaptation, mitigation and compensation.

Africa is among the least contributors to climate change and suffers most in its quest for sustainable development, water and food security. Efforts to critically evaluate its effects are clouded with challenges. Some impact of climate change are expressly known and understood, while others are clouded with uncertainties. Global warming is already seriously felt in Africa.

The ability to adapt to these outcomes is a pointer and paramount to achieving Africa's aims and objectives of its millennium road map.

3.2 CLIMATE CHANGE: NEED FOR INFORMATION

There is no universal agreed or accepted definition of climate change. This has led to various opinions on the subject matter. Climate change is suggested to be a long period of change in climatic conditions and can be said to be caused by human activities. Climatic conditions are always changing but the most noticeable are on geological time scales, but very infinitesimal to be noticed on the human scale. The system is highly difficult and very complex to understand.

It comprises the following:

- ❖ The atmosphere: gaseous matter above the surface of the earth;
- ❖ The hydrosphere: liquid below or on the surface of the earth;
- ❖ The lithosphere: land surface on the earth; and
- ❖ The biosphere: humans, animal life and plants on earth.

There is more to learn about the African climate. Irrespective of the advances so far made in Africa meteorological study of Africa, one is still to understand the level gravity of climate change, either as a continent, or as individual nations.

Basically, all one knows about climate change that has informed UNFCCC agreements depends on the medium and long- term forecast of carbon emissions from countries where relevant information is available. Africa is marginalised because there are no available and adequate records for the continent. If progress is to be made in terms of climate change, governments must roll up their sleeves and put in place proper, adequate and up to date research. Judging from utterances and actions of developed countries, it can be assumed that there is enough information on climate change that can help make decisions, but many at times, the data are not considered in policy formulation processes or is never made available to Africa.

According to a recent study by the International Research Institute for Climate Change and Society, loopholes exist in four main areas (IRI). They are in the areas of:

- ❖ Integrating climate change into policy;
- ❖ Practice integration;
- ❖ Services; and
- ❖ Climate change data (FAO, Climate Change and Food Security, seven).

Integration of climate change risk management into climate-sensitive development processes at all levels should be of paramount importance for Africa now, concludes IRI. Creating awareness of climate information and providing valuable data to decision- makers in climate- sensitive areas of high value will, to a greater extent, help meet the challenges of climate change ahead. Africa is still facing the challenges of uncertainty of how climate change could be used to determine potential changes occurring in a given area.

It can only be possible by investing in quality information in order to minimise the level of rural and regional uncertainty, or by distributing the risk by way of international networking. The future will always be blank, but the present level of uncertainty regarding potential rural or regional consequences of climate change can be minimized through improved research.

3.3 CLIMATE CHANGE AND THE CRISIS OF WATER RESOURCES IN AFRICA

Water resources are one of the areas that are greatly influenced by climate change. A good number of African states are meanwhile, witnessing considerable water challenges due to insufficient and unpredictable rainfall that is capable of causing flooding or droughts.

Africa and its food chain system are already vulnerable as a result of the effect of lack of water (Brown et al, (ed) (2009). It is envisaged that the sub- Saharan African populations will increase from 70 million in 2007 to about 100 million by 2030 and furthermore, by 150 million in 2050. The demand for water is also expected to double in the first half of the 21st century, without a corresponding increase in per capital need for food and water. Agriculture, which is the mainstay and source of livelihood and sustenance of a greater percentage of Africa's population is rain-fed. Consistent and long period of droughts, flooding and loss of arable land due to desertification and soil erosion, will cause a drop in agricultural production, hence crop failure and livestock losses, and this will endanger rural and pastoral communities. Pastoralist sections of the Horn of Africa (Ethiopia, Kenya and Somalia) have been the most affected by constant droughts.

Table 3.1: Summary of the impacts of climate change in Africa by 2009

Food affected	Low warning scenario	Mid-warning scenario	High warning scenario
Co ₂ atmosphere level in parts million (ppm)	600ppm	850ppm	1550ppm
Global increase in temperature	1.8°C	2.8°C	1.0°C
Global rise in sea level	0.18-0.38m	0.21-0.48m	0.26-0.59
Water	20-30% decrease in availability of water in vulnerable areas	Precipitation in sub-tropical areas falls by up to 2%. Annual mean rainfall increase by 7% in East Africa. Precipitation decrease of 20% along the Mediterranean coast	30-50% decline in availability of water in southern Africa
Agriculture and food	5-10% decline in crop yields in Africa	550million additional people at risk of hunger	Decrease of 15-35% in agricultural yields across continent
Extreme events	Up to 10ml more people flooding globally	Coastal flooding affects b/w 11 & 170ml additional people per year globally. 10-20% increase in cyclone activity in the southern Indian ocean	120 million people exposed to flooding globally. Tens of millions displaced in extreme weather events and climatic processes

Source Adapted from Oli Brown *et al.*, (ed), *Climate Change and Security in Africa*, Nordic Africa Ministers of Foreign Affairs Forum, 2009. The impact of climate change in Africa-[issafrica/Home](http://www.issafrica.org/uploads/paper220.pdf). (n.d.). Retrieved from <http://www.issafrica.org/uploads/paper220.pdf> (20: 12: 2014).

Just like in the past years, in 2014, water posed a serious challenge in Zimbabwe. This was either as a result of its scarcity or its abundance. In Harare, the capital, where standard of living is expected to shoot up than any other place, the supply of dependable water is a nightmare all through the year. Quality water greatly is compromised, full of white foams, brown or black precipitates that cause it to stink (The Herald, 5 January 2015).

In 2014, the Tokwe-Mukosi basin dam in Masvingo was overflowed. Rising water levels breached the 860 metre high dam under construction. The flooding displaced about 20,000 people and about 180,000 heads of goats, donkeys and cattle either died or were displaced. Houses, schools and important public infrastructure were either damaged or totally destroyed. In the process, about 2300 learners were left without learning infrastructure and the affected families relocated to Nuaretsi makeshift shelters (The Herald, 5 January 2015).

In the district of Muzarabani and Tsholotsho, flood also caused damage, both financially and in human resources. Just one rain turned Muzarabani into a big river. Streams were over flooded, buildings and agricultural products washed away, thirteen (13) bridges totally destroyed. In an attempt to contain the situation, the National Climate Change Response Strategy (NCCRS) was set up in 2014 by the Zimbabwean government to align climate change into the National budget and development plan (The Herald, 5 January 2015).

This structure (NCCRS), is needed to help fund the adaptation and mitigation programme within a 5 to 10 year plan period, is estimated to cost \$10 billion, (Walter Nyamukondiwa and Nyamudzai Kakore, Herald 5 January 2015).

According to the Seychelles News Agency report of 4 January 2015 entitled “Seychelles: a shaky start to 2015 as heavy rain hits capital”, the climate change impact was the same, threatening and ravaging cities. During the days of December 2014, heavy rainfall totally devastated and ravaged districts in the capital of Victoria, Mont Flueuri. In the Mainland of Mahe, it over-flooded business premises, drainage systems, houses and streets. Quite often, Seychelles experiences heavy rainfall in the months of January. January 2013 witnessed mighty and heavy rainfall as a result of tropical cyclones that caused great and severe flooding and landslide with an estimated cost of about \$8.4 million in damage.

Seychelles, a tropical archipelago consisting of 115 islands, experiences light rainfall through the year with heavy rainfall between November and March, referred to as the North- West monsoon.

In February 2014, the islands witnessed the worst flooding with horrifying effects. In Namibia, the case is same. According to the Namibian “New Era” reports of 5 January 2015 titled “Namibia: Omaheka farmers hold breath over rain” by Kuzeeko Tjitemisa, and another titled “Namibia: Windhoek water dams running dry”, by Deon Schlechter, Matjiuavi Tjerivanga a farmer of 35 years old, lamented that although there is still hope of rainfall in the community, he believed that farmers will face serious problems if the heavens continue to hold its rain from the areas. To quote him, “As you can see, December is a typical wet month and by now, the planting season should be in full force but instead, many farmers are still waiting for some rain to come so that they can plant.”

The lamentation continued: “we missed a lot of December showers” said a Talbot county farmer, Greg Gannon. He further maintained that, “we are typically waiting for a dry spell time of year but it’s a reversal because we are waiting for some moisture this time”.

According to the latest Namibian Water Dam bulletin in the ‘New Era’ of 5 January 2015, “Namibia: Windhoek water dams running dry” by Deon Schlechter, “the possibility of water shortages in Windhoek started off this year with very little rain recorded as well as severe drops in water levels in the three dams that supply the city”. The apparent delay of rainfall and the persistent heatwaves and lowering water levels generated fears among Windhoek city-dwellers, due to the fact that the three dams supplying the 330000 residents of the city now have a combined total average volume of forty-six (46%) percent. This led to the immediate call by the fathers of the city for a ten percent (10%) water usage reduction among the city’s population.

According to Namibia Water, water shortage is not common to Windhoek only, but also in most parts of the country due to the inadequate rainfall of November and December 2014 that caused the reduction in water levels of major dams in central parts of the country. As a result of this inadequacy in rainfall, the levels of Friedenhau and Oanob dams also reduced.

Recent modeling forecasts have predicted a shortage in water supply by 2020. According to independent water experts, this could happen earlier than predicted if the present state of rainfall

remains the same. This prediction is based on median scenario. In response to this obvious water disaster, the government, at the beginning of 2014, launched a N\$7.6 million water project to source out a parallel approach to water supply in order to help proffer long-term solution to affordable water in different parts of Omaheke, Otjizondupa and the Cuvelai delta. The Minister of Agriculture, Water and Forestry, John Mutorwa, while launching the project in conjunction with the city of Windhoek and Namibia Water, emphasised that the population and commercial growth encouraged the urgency of the project.

According to the Tanzania Daily News (Dar es Salaam) of 5 January 2015 report on Food and Agriculture entitled Tanzania: livestock keepers ready for climate change by Bilham Kimati. In Tanzania, the devastating consequences of climate change have overwhelming impacts on livestock farming rural communities, the Maasai in Moduli and the districts of Longido and Ngorongoro of Arusha. Despite the issue of migration, the impact of adverse climatic conditions such as high temperatures and protracted droughts exacerbated water supply efforts also increased the areas of dry grazing land.

The positive efforts of Maasai residents to mitigate a plan designed to achieve a long-term remedy to the harsh climatic conditions is commendable as it helped to subside the challenges. The efforts of non-profit governmental organisation, Hakikazi Catalyst and the International Institute of Environment and Development are laudable because they also reinforced the efforts of the locals, since they complimented the community's efforts of improving climatic adaptation efforts by creating a district level Climate Adaptation Fund (CAF).

Good governance is very important in mitigating the effects of climate change. Therefore, in recognition of this, environmental experts of and other concerned organisations are making frantic efforts to improve governance in order to mitigate the effects of climate change and assist communities to quickly recover from the consequences of difficult situations of climate change.

3.4 CLIMATE CHANGE AND FOOD SECURITY

According to the United Nations Development Programme, the achievement so far made in human development over the past decades might slow down or even amount to nothing if something serious is not done. As new challenges continue to rear their heads water and food security,

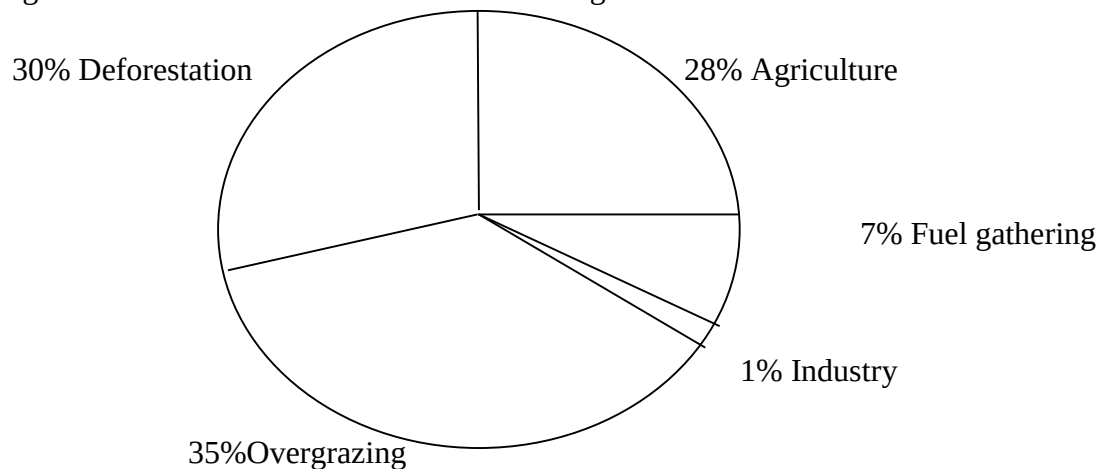
agricultural yields and access, nutrition and public health remain threatened. The consequences of climate change as a result of rising sea-levels, droughts, floods, heat waves and rainfall variations, might possibly by 2080, all things being equal, lead to malnutrition of about 600 million people. Hence, increase in the number of people facing water scarcity by 1.8 billion.

Various climate and non-climate actions influence the result of flood activities in river floods, flash flood, and coastal floods. Heavy precipitation actions are likely to be regular in most regions in the course of the 21st century. It would likely lead to an increase of flash and urban flooding risks.

Lately, most studies on the impact of climate change on food and agricultural sectors have been based on the principles of food production and international food supply, with less attention given to other parts of the food chain. Quiet recently, world food prices increased tremendously, causing untold hardships and sufferings among poor and vulnerable populations of the world, most especially in Africa. It is estimated that more than 100 million people went to bed hungry due to skyrocketing world price of rice between 2005 and 2008, with nearly 30 million in Africa. The cause of the high price of food remains land degradation. Using outdated farming methods and instruments, inadequate power supply, poor road networks and maintenance systems, poor farming facilities, poor and lack of water storage systems, zero irrigation potentials that hinder the growth and development of agriculture impact food security and limit trade in agricultural products.

The United Nations Food and Agriculture Organisation food summit held in June 2008 was not successful because of its inability to identify the part which sustainable land development can play to ensure food security. Land degradation is considered the major environmental challenge facing Africa today and also a major factor to meeting the basic needs of human beings. Poverty is the cause of land degradation because of high demands for farm land and energy requirements.

Figure 3.1: Human activities that cause soil degradation



Source: Erosion, Wikipedia, <http://en.wikipedia.org/wiki/Erosion> (accessed 29 October, 2013)

Several and consistent long periods of droughts flooding and loss of arable land as a result of deforestation, overgrazing and wood gathering for fuel that caused soil degradation, are creating low agricultural production, thereby limiting crop and livestock production. It will in itself endanger rural and pastoralist communities. The Horn of Africa's pastoralist population has been hard hit by the constant droughts that have led to livestock losses. This has plunged about 11 million pastoralists who depended on livestock as a source of livelihood, income and protein into crises, thereby forcing them to migrate out of drought affect areas in search for a better condition for survival. Climate change affects the four dimensions of food security in Africa (i.e., food availability, food accessibility, food utilisation and food system stability). Climate change also impacts on food production, distribution, purchasing knowledge and market flows. Agriculture is very vital for food security both in relation to food production for people to eat and as a source of livelihood for over 80 percent of the continent working population. If agricultural activities are jeopardised in developing countries in Africa by climate change, rural people will be at risk and vulnerability to food insecurity will escalate.

3.5 CLIMATE CHANGE AND FISHERIES

Fishery is an important source of livelihood of rural African communities. Droughts and floods, a significant impact of climatic change, affects the fishery sector resulting in low fish production. Production of fish is highly and adversely affected by droughts both in natural water and

aquaculture as a result of lack of water. In Malawi, the droughts of 1914-1915, 1966-1967 and 1993-1994 that led to the drying of Lake Chilwa resulted in low fish production. In coastal areas with lagoons, changes in the flow of freshwater affects fish species that are the basis of inland fisheries (Cury and Shannon, 2004).

While many African marine coastal fisheries are not likely to face huge physical impacts, the region's adaptive capacity to respond to climate change is relatively low and fish consumption high. As a result, they are highly vulnerable even to minor changes in climate and temperature (Allison *et al.*, 2009 and Daw *et al.*, 2009).

3.6 VEGETATION AND CLIMATE CHANGE

The migration of natural vegetation as a result of climate change shows how important climate change might possibly affect environmentally-related activities. Currently, there are few climate change analyses and vegetation results in Africa (Budyko vegetation model). The simplified Budyko vegetation model has been used to assess the global impact in vegetation patterns due to climate change (Monserudi *et al.*, 1993). Virtually, almost all changes in natural vegetation in the continent happened in sub-Saharan Africa. In the southern zone of the Sahel, Tropical savannah changed to desert. In the Eastern and Southern as well as Central African Republic, tropical changed to tropical seasonal forest (Monserudi *et al.*, 1993).

3.7 PESTS AND ILLNESSES

A high percentage of African people die because of climate change diseases and many more are still under the bondage of such diseases. Yellow fever, cholera, river blindness, diarrhea, malaria and tuberculosis remain issues of concern in the continent. These are solvable problems where adequate financial resources are available. Meanwhile, global warming remains a major health problem in Africa.

Malaria continues to be one of Africa's killer diseases. It is estimated that the malaria parasite has infected about 270 million African people. The total life cycles of mosquito development are a direct result of climate change. Malaria is regularly found in tropical areas of Africa. The highest increase in risks is prevalent in some parts of Southern Africa than in Eastern Africa where the risk is less.

The occurrence or rate and distribution of pests and diseases are as a result of the effects of climate change, especially because of prolonged breeding periods. Nevertheless, reduced rainfall may reduce pests' damage in some areas or regions (Mc Tegart and Sheldon, 1992). Increase in rainfall will also have the same result.

3.8 CLIMATE CHANGE AND RISE IN SEA-LEVEL

Sub-Saharan states along the tropical rain forest have become a serious target of environmental destruction. In 2004, the rise in the level of Indian Ocean destroyed the coast of Somalia leading to the death of many Somalis due to water-borne diseases. Rising sea-levels and its resultant effects has become a great concern to coastal states such as Kenya, Mozambique, Tanzania and also low-lying regions of San Tome and Principe, Madagascar and Equatorial Guinea (Amusan, 2009).

Many African cities are likely to be submerged due to the increase in sea- levels. More than 40 per cent of wildlife habitats would also likely disappear, and the production of cereal crops that is already very low in the continent will be reduced to the lowest percentage. An increase in local sea-levels increase due to climate change, will lead to catastrophic consequences (McTegart and Sheldon, 1992) such as inundation and displacement of wetland and low-lying coastal zones; erosion of shorelines; possibility of increase in coastal flooding; and possible decrease in the quantity of light water bottoms. These changes will inevitably alter the attraction of visitors to coastal zones. According to UNEP (1991), nearly 10 million tourists visited African countries in 1990 and more than half of them visited the coastal cities of Morocco, Tunisia and Egypt.

In Southern Africa, Hughes *et al* (1993) examined the impacts an increase in sea-levels in the Diep River/Rietulei system in Cape Town. They project that the shoreline could shift back by between 50- 135cm at different points due to climate change and if no work is done to protect it, the sea could break through many kilometers. The possible consequences of increasing sea-level in African countries such as Nigeria, Senegal, Cote d'Ivoire, Ghana, Liberia, Togo and Benin are discussed in Titus (1990). Chidi Ibe (1991) examined the vulnerability of three coastal cities of Lagos, Banjul and Dar es Salaam due to an increase in sea- level. Coastal erosion is problematic to these three cities and each is the economic power of the respective countries.

3.9 CONCLUSION

The impact of climate change is enormous and can only be tackled by collective effort. But lack of good understanding among African leaders and think tanks is the most difficult and serious matter facing the continent. It is therefore very important for the continent and its leadership to come to the party, double efforts and do something very tangible, think outside the box to alleviate the sufferings of the vast majority of its people. It is therefore for this reason that one can suggest a combination of factors of capacity building to help provide an enabling environment that will produce proper conditions to assist in the mitigation of the issue and the impact of climate change in Africa.

Most importantly, is the availability of adequate information for the masses. The information provided should be very simple and quick to understand, analyse and interpret. It should not be very detailed to avoid misinterpretation and misunderstanding.

Secondly, training and education will help in this process. Media is one essential instrument that can be used in the training and education processes, as it spreads messages very fast. Early warning is also an essential factor.

With the above in place, the effects of climate change in various communities and areas of the African society will be addressed and its impacts reduced.

CHAPTER FOUR

CLIMATE CHANGE AND DEVELOPMENT

4.1 INTRODUCTION

Sustainable growth is a necessity if Africa will meet its goal of halving poverty by 2015 in line with the Sustainable Development Goals (SDGs). To achieve sub-Saharan Africa's gross domestic product growth, the continent has to double what it is now to 7.5 percent. Nevertheless, Africa is responding to the threats of sustainable development by putting in place and formulating policies that will create a conducive environment for growth and sustainability at all levels of the society. The policies are meant to support and maintain economic growth, peace efforts, political stability and security, defend human rights and freedom of speech and associations, and also uphold gender equality. Much still needs to be done to realise the objectives of these policies. But what is evident is that the people and governments of Africa are prepared to better their conditions for a brighter and prosperous future.

4.2 GENDER AND CLIMATE CHANGE

Ecumenical warming is on the increase and is being recognised as a continental challenge, but the response to it has been based on purely scientific and economic factors. The continent is now faced with the dilemma of how to re-direct attention towards people-oriented and gender-awareness towards climate change policies and processes. Now, how to react to the various needs and concerns of women and men and demystify the mystery that tends to explain the gender inequalities that says women are most probably affected in the cause of climate change than men becomes of great importance. In this study, it is of utmost importance to talk about gender aspects of climate change. It charts a base for making climate change react more to gender-based and powerful transformation. It should involve inspiring examples of local, gender oriented innovations in developing countries. "The ABSENCE of women, particularly those from the global South in national and international discussions and decision-making on climate change and development must change (Robinson and Maathai, Huffington Post, 2010). This means that battle

to protect the environment is not only about technological innovations-it does include empowering women and their communities to hold their governments accountable for results”.

4.3 CLIMATE CHANGE AS A DEVELOPMENT AGENT

Climate change is an incrementing adverse climatic condition, elevating sea levels and catastrophic events as a result of human actions and the emission of greenhouse gas (GHG) that engender ecumenical warming. It is often visually perceived as a scientific and technical quandary, but it should not be visually perceived only in that light. Climate change should additionally be optically discerned from the gregarious, economic and political phenomenon with great implicative insinuations for gender equipollence and convivial equity.

As climatic conditions cannot always be predicted and adverse events such as floods and heatwaves become common, the poorest of the poor, women and men in developing countries, especially Africa, who has no say and contribute little or nothing to the problems of global warming, find their means of livelihoods heavily threatened and at the verge of extermination, yet have no voice and the least influence on climate change policy- making. For example, it is the rural African women who are likely not to have access to assets and employment opportunities, and who also always bear the brunt of extreme climatic conditions. It is important at this stage to discuss the magnitude of gender dimensions of climate change.

Climate change does not have equal consequences on women and men. It therefore means that neither their contributions to the factors of climate change nor the level of experience of its effects are the same. In many developing countries, especially in Africa, economic limitations, social and cultural norms that limit women access to a paid job implies that their means of livelihoods depend on climate sensitive sectors as subsistence farming, hewing of wood and water collection. It proves that gender inequalities in the distribution of wealth and opportunities are highly limited in the plight of climate change.

Due to the fact that women and girls are solely responsible for most of the unpaid jobs in household means that their dignity and livelihoods rest squarely in changes resulting from climate change. They work harder and walk long distance to secure ever increasing scarce resources, such as food, fuel and water and also nurse the sick linked to the effects of global warming. Because of

these, women and girls never have the opportunity to attend school, do not even engage in income generating activities or even get involved in community policy- making process. This further widened the gender inequality problem.

Adverse climate change also has negative impacts on men, especially poor ones. They are deeply stressed and anxious, especially when their means of livelihoods are threatened by the climate change and when they can no longer discharge their social responsibilities as family providers. Studies have shown that men are capable of taking high risks when stressed than women and girls. The signing of new agreements and the amendment of existing ones has made the rapidly changing international climate change architecture more complex. The Coalesced United Nations Framework Convention on Climate Change (UNFCCC) is currently dealing with the International framework on referencing climate modification and was the first to recognise the role of human interposition in climate change and the need to address carbon emanation.

Irrespective of the fact that UNFCCC reference human activities, it never in any way honourable mention sexuality gender throughout its framework. However, earnest lobbying by gender activist such as ecumenical network Gender CC and other civil organisations has made great in-roads in the climate change architecture. The Bali design Action established at the UNFCCC Group discussion of the Parties (COP) 13 in 2007 provided the substructure that took sex matters into account. While in 2008, UNFCCC secretariat tried to endeavoured to include and document sexuality categorical recommendations.

There were tangible effects, but the issue has not been resolved. Many climate change policies insurance and legal proceedings are still lackadaisical on gender. To verbally express the least, they still consider gender issues non-germane. Even when mentioned, it is often to integrate to subsisting existing legislation and only in the context of adaptation.

4.4 MARKET POLICIES AND GENDER ISSUES

Market-oriented policies have remained gender blind. Policies around migration and low carbon development have always remained gender insensitive. The current idea of lowering carbon emissions through a market structure mechanism that leads to economic incentives for reducing

emissions has failed to consider various social, cultural and economic factors that have essentially limited women's participation.

This has been the case of the forest aegis contrivance such as REDD (Reduced Emissions from Deforestation and Forest Degradation). Through REDD, developed nations have endeavoured to indite-off their carbon emissions by paying states for the conservation forest mostly in developing countries in order to enhance climate change mitigation by preserving carbon stored in trees. If ever gender is considered in a policy framework, it is done in postulations and in general contexts.

For instance, climate change adaptation policy passively refers to women only as vulnerable susceptible beneficiaries in lieu of recognising their rights as citizens with skills and experience as part to the solution. Women have played vital roles and will continue to play crucial roles in the sustainable adaptation in developing countries. It is infelicitous that their efforts and roles are often not recognised. There is an astronomically immense gender gap in climate change policy- making. The gender gap in climate change policy- making has contributed very much to the sedulously assiduous gender visual impairment of ecumenical warming policies. In the UNFCCC Conference of the Parties of 2010 (COP 16), women accounted for only 30% of all delegates and about 15% of all heads of delegations. According to Brody et al., (2008) BRIDGE Infrequent Paper: Gender and Climate Change: Mapping the Linkages-A scoping study on Erudition and Gaps, Brighton, climate change is not something incipient, but has now been optically discerned as a vital development issue in recent times. Even more recently, it is the amalgamation of gender vigilance in climate change research and replication.

This report, as yare for the UK Department for International Development (DFID), fixated on available literature on invigorating future research on intervention in gender and climate change. The report visually examined the key connections between climate change and gender inequality, identifying subsisting framework gaps between sexuality and the environment, reviewing how best to practise adaptation and mitigation and recommending areas of propitious discrimination for future study. It came to the conclusion that there is an urgent need to identify impediments to women's participation in decision- making and withal finding denotes of addressing obstacles by inspiring grassroots vigilance campaigns and leadership training.

4.5 GENDER INEQUALITIES AND CLIMATE CHANGE

According to Esplen's (2009) "Gender and Care: Overview Report; BRIDGE Cutting Edge Park, Brighton: BRIDGE/IDS, Care-giving can be a source of fulfillment and a solemn burden.

The prescribed social role of women and girls can affect their right and limit their opportunities and potentials, thereby complicating the already existing obstacles to gender equality and welfare. How, it is important to narrow the disparity in which the society and individuals understand and appreciate the value of various forms of care without making it work for only women.

Women additionally accounts for a high number of farmers in developing countries, especially in Africa, yet they have very circumscribed leverage to the resources they require to fortify their sources of livelihoods, such as land, livestock, technology, financial knowhow and inculcation. These will, in no minute measure, limit the abilities and capabilities of women to cope with incipient agricultural conditions in the face of climate change. This is according to the UN Food and Agriculture Organisation (FAO) (2011). The state of Victuals and Agriculture 2010-2011: Women in Agriculture, Closing the Gender Gap for Development, Rome (FAO), and the report surveyed gender inequalities in the agricultural sector. Referring to a recent study, it is argued that average women crop engenderments are around 20-30 percent lower to that of males due to disparities in agricultural resources.

The report suggests that closing the gender gap will not only help increase agricultural production by four percent but will also socially and economically benefit women and their communities. The report compared the disproportional gender data information from countries in Africa, Asia and South America, stating that the disparity in production is as a result of access and availability of resources. The report is divided into two phases: the first phase highlights the current level of women in agriculture across developing countries and the extent of the gender gap. The second phase of the report deals with the global food system.

4.6 GENDER AND WATER SCARCITY

Water is a vital resources threatened by global warming. Water has very glaring gender implications on women, because it is women who in all cases are responsible for collecting water and in many instances have to travel far distances to gain access to it. It is important to stress that

water is a scarce commodity in Africa, and to get it is very labourious. So women pay too much a price to get to the ever increasingly scarce water.

The following explains the consequences of limited water resources in its privatisation on women and gender relations in Africa. According to a study conducted by Ngozi Akosa and Oluyide, A. (2010) “Gender and Climate Change: Case Study Oko Agbon Odooyi Community”, Case Study Series 1, Lagos: Centre for 21st Century issues.

This study raises issues of gender implication on poverty, unemployment and lack of basic infrastructure and government’s contribution towards easing the situation in the face of climate change. Oko Agbon is a coastal poor rural community with a population of 100, 000 people in Lagos State, Nigeria, posed with challenges of climate change as a result of rising temperatures and salty fresh water. This study points out that there are hazardous implications for women and men in terms of health and household income, with 50 percent of monthly income spent on water for household use. However, it is not an exaggeration to say that community women bear the highest brunt of the water crisis.

The study suggests that if water challenges are to be addressed, there should be a linking bridge to connect the community to Lagos State and the water network. It also calls for access to information on climate change to help the community make informed and sustainable adaptation decisions. This is the first in a series of case studies published by Nigeria’s Centre for 21st century issues.

4.7 RISK DISASTER REDUCTION

Poor adult female and girls are exposed daily to higher risk in less developed areas than men and boys in the time of adverse climatic conditions such as flooding, quakes and other cataclysm due to gregarious and cultural inequalities as a result of limited memory access to entropy and training.

Men can as well be vulnerably susceptible but in different dimensions. It is consequential to emphasise that gender perspective is crucial in reducing danger in the case of cancel calamity. According to the Cumulated United Nations International Strategy for Disaster Risk Reduction (UNISDR) (2008), Gender linear perspective: Integrating Disaster Risk Reduction into Climate Change Adjustment-- **Good** Practice and Learned, Geneva: UNISDR, womens power to manage

natural resources in many ways provide paramount information for efficacious Climate Change Adaptation and Disaster Risk Reduction (DRR) policies. The composition highlights the high risks women and girls face in the case of weather- cognate hazards and argue that they should participate more actively in disaster readiness and replication efforts.

The report also identifies some gender- responsive mechanism used for design adaptive strategy to climate variety in European community and developing countries, especially Africa. For instance, community- bases Risk Screening Tool-Adaptation and Livelihoods (CRiSTAL) is a “determination support tool” designed to avail understand the linkage between climate cognate peril, gender cognation, people’s livelihoods and project activities. Presently, it is used in Mali in assessing scheme to cope in times of drought and that the key headstone plans for women was to emass Shea nuts as an emergency source of sustenance when family level engenderment are not enough due to inadequate rainfall. The report therefore suggests a preferential support be given to women to grant them access to natural resources to avail them make apprised resources management decisions.

4.8 GENDER AND CONFLICT

Climate change is the effect of human security problem as a result of risk conflict between countries and scarce resources for food and fuel production as well as human settlement.

The limited numbers of studies on gender and the likely consequences of climate related conflicts show that it can increase existing inequalities and create new vulnerabilities and also increase gender- based violence.

According to Winterstein, *et al.*, (2003), climate change causes conflict because of increase in natural disasters and scramble over resources. Conflict, environmental degradation, natural disasters and climate change have different impacts on women and men. They exacerbate existing gender challenges and age long gender roles. Women are the most affected by conflict and natural disasters and in most cases, are not considered in policy-making before, during and after hazards. This therefore calls for gender to be systematically aligned in other to adequately prevent conflict.

The following articles are also included in the study:-

“Women Carry Water, Men Take the Decisions: Gender, Conflict and Natural Resources”- because of the migration of men, women assume the responsibility of household keepers, thereby taking the traditionally men function of providing for the family. Women in some cases are denied access to natural resources and land ownership and excluded from policy making, thereby hindering peace building and economic recovery efforts. The study believes that for there to be relative peace, there should be conciliation and new establishments to change discriminatory laws and attitudes of the society.

“Gender Aspect of Climate Change induced Conflicts” advanced for the full implementation of UN resolution to ensure that women are included in all manners of climate change prevention and adaptation processes in order to enhance effective and efficient climate change policy that would avoid conflict.

4.9 SUSTAINABLE DEVELOPMENT

The impact of adverse economic growth and the problem of sustainable development in Africa that has limited the ability of Africa to cope with the threats of climate change will be the main concern for Africa in the coming decades.

Adapting to climate variability will be a serious challenge for sub-Saharan areas. The dependence of the rural population on rain-fed agriculture as a source of livelihood, the need, threat, food insecurity and the absence of well-established infrastructural facilities and institutional structures in the regions has made it very difficult for Africa to cope with natural climate variability.

In the previous years, harsh weather events in some sub-regions and the number of people affected by droughts and floods have dramatically increased. The socio-economic consequences of droughts could be as a result of the clash between natural and human factors—such as changes in the use of land and the demand and supply of water. Excessive water withdrawal will possibly escalate the consequences of droughts. The threat is intensified by global warming in some parts of sub-Saharan Africa.

According to recent predictions, mean rainfall is likely to decline in Southern Africa, while it will increase in parts of Eastern and Central Africa, with likely more adverse weather conditions. According to the World Bank report on development for 2010, Africa recognises and ensures that

the impacts of current development on climate change in its economy, population and developmental agenda be combined into climate negotiations.

Certainly, Africa needs enduring sustainable development. Enduring development in a continent threatened by global climate change should be by building people with adaptive capacity and also by adequate technical adaptive measures. The levels of production and sustainability of the African environment will rest on how climate changes are managed.

According to the United Nations report on development on Africa, the continent is not keeping the pace of development with the rest of the world. There are too many African populations living in abject poverty, with 330 million of them in sub-Saharan Africa. Poverty does not make people vulnerable but limits their power of choice. Natural disasters such as floods and droughts have the power to break people's will and ability to resist and cope with changes in adverse weather conditions.

If production fails, subsistence farmers will find it extremely difficult and will have little or no alternative to provide and feed their families. Approximately 70 percent of Africans relying on subsistence farming as their means of livelihood depend on natural resources (UN (United Nations), the Millennium Development Goals report.

Climate change is already having great impacts on Africa's development, yet government efforts to help the poor to resist or adapt to the effects is very minimal. Presently, Africa is not benefiting from the efforts of research on climate change.

4.10 CLIMATE CHANGE: A SECURITY THREAT TO AFRICA?

Climate change poses security threats to Africa, because it tends to promote social and political problems that can threaten the fabric of states and societies. Climate change has a tendency to weaken the political and economic fabric of African states that can lead to instabilities. This will also contribute to the problem of social security as it can threaten human health and delivery system.

Adverse weather conditions as a result of climate change that threatens human security will cause people to migrate, and migration possibly causes a stress in basic resources and water and can threaten political stability. Given the trend of conflict in political change in Africa, climate change

can escalate boundary disputes, territorial conflicts and resolutions in the continent. Pressure on the provision of water and supply is of high interest in the continent and can probably escalate tension. Tension on water supply will further complicate the already complicated problem of food production in Africa. It is paramount to note that the peril is not inhibited to humanitarian issues but withal on the security and political stability of African countries.

4.11 CLIMATE CHANGE AND URBANISATION

One of the authorities on climate change and urbanisation in Africa Barrios, Bertinelli and Strobl (2006), projected an increase in national urban share of 0.45 percent and a reduction of 1 percent in national rainfall.

However, Henderson, Roberts and Storeyard (2013) re-examined the issue and found out that there are inconclusive impacts of rainfall after taking control of agricultural price indices. But studies have two limitations. Firstly, according to Johnson (2010), they made use of national data, when most migration in Africa is rural, when we have significant within-country variations in climate change. We exploit within-country differences in Africa to find more accurate analysis of the impact of global warming on urbanisation (J. Vernon Henderson *et al.*, 2014).

Secondly, both studies examined at national urbanisation by using population data at regular 5-or 10 years differences. Such data depends so much on different values, especially in Africa where many population censuses are not constant and are not frequently timed.

Accordingly J. Henderson *et al.*, (2014) “50 Years of urbanisation in Africa: examining the role of climate change”, constructed a new data set of urban growth for sub-national regions on actual census information data, not on different values. Other research work use micro information data to study the impact of rainfall on migration, rather than urbanisation. They are very educative and cover other areas not examined by studies including movements across rural areas, between countries, and from rural areas to cities (Henry, Schoumaker and Beauchemin 2004 on Burkina Faso) or temporary or circular movement (Parnell and Walawege 2011). These studies interviewed local residents on migration while ignoring permanent migrations to cities, though demographic and health survey may be useful for that purpose (Young, 2013).

Other studies covertly examined how climate change can impact on the incomes of urban Africa. According to Jedwab (2011), the agricultural conditions of Ghana and Cote D'Ivoire have a great impact on nearby places that serve them. Gollin, Jedwab and Vollrath (2013) explain how the income from natural resources affect urban development, by simply extending two sector model of the rural-urban divide that includes various urban economic areas that might be affected differently.

4.12 DATA ON CLIMATE CHANGE AND URBANISATION

Shortage of demographic and economic data hinders empirical study on the impacts of climate change in Africa. Population censuses of urban countries are not regular and sample studies such as Demographic and Health Surveys (DHS) are not frequent and provided very little information before the 1990's.

Though there is a good number of geographical data frequently used by economists (Auffhammer, Hsiang, Schlenker and Sobel 2013), various researchers use national level population and economic data sets available from the United Nations and other related organisations on which African countries depend on.

Urban and rural population measures for sub-national regions, both provincial and districts were sampled from census reports. This includes countries with at least two available censuses with relevant information for a complete or nearly concluded set of sub-national units, where common unit over time can be clearly identified or where there is minor district boundary adjustment (Henderson *et al.*, 2014). Samples were obtained from over 32 nations but the samples from Namibia and Congo (DRC) were rejected because of the uncertainty of urban and district definitions and unreliability of data.

Due to the unreliability of census figures, Africa's most populous nation, Nigeria was also omitted (Okafor, Adeleke and Opara, 2007). Other African countries were also left out, either because they do not have the much needed census information or in many instances, could not provide a printed hard copy.

South Africa is an exception because it is developed and its provincial landscape was redrawn after 1994 and also due to pre-Apartheid migration restrictions. With a handful of exceptions, studies on the influence of climate change on husbandry squarely rest on precipitation.

4.13 CLIMATE CHANGE AND THE CHALLENGES OF DROUGHT AND KILLER WAVES

The current rainy season in significant parts of Africa is confronted with the reality of droughts, caused by the absence of rainfall over a period or a number of months. The resultant shortage of water has negatively affected crops estimates for the year and may well make some important food items unaffordable, especially to the poorest in the continent due to challenges of climate change.

This nature continues to tell us every day that indeed water is life. The dihydrogen monoxide we are referring to is of course potable water utilised in agriculture, industry and mining. Unlike countries in the Middle East, the high volumes of water in the oceans that wash away shores, the Indian and Atlantic, among the resources one should tap for these purposes. The impact of climate change has made it difficult for there to be enough water resources for mining, agriculture and industry.

In March 2007, in South Africa, the waters of the Indian Ocean crashed with great fury along the coast of KwaZulu Natal, killing a number of people and causing serious damages.

Scientists monitoring waves off the South coast reported the highest wave measured during the violent storms to a staggering 12m, measured off Richards Bay. According to Marius Rossouw of the council for scientific and industrial Research in Cape Town, “the Storms were the highest they have seen and measured on the coast of KwaZulu Natal in 23 years”.

The Durban Metro city deputy head of fire and disaster management, maintained that the damages were “extensive. Some of the damages included beaches and roads being washed away, water, electricity, sanitation and telephone services destroyed, while in some instances, buildings were inundated”.

As a result of its serious consequences, climate change threatens and continues to threaten virtually all countries on the shores of Africa. Hopes have not been lost as African leaders and governments

continue in their effort to creating awareness about the importance of water and the many challenges they face across the World in providing water to the people.

In March 2007, South Africa launched with excitement, the construction of a Dam in Sekhukhune Limpopo. The dam is expected to transform the lives of people in the region. It will do that by creating infrastructural capacity that will provide water to communities that have long suffered and struggled for water. The dam will also create job opportunities in the course of its construction. The related water infrastructure and the roads will support the local mines in the areas. In addition, it will create additional job opportunities for the local community.

According to the UNDP's Human Development Report (UNDP 2006, 9 November) in Kirstenbosch, South Africa, titled "Beyond Scarcity: power, poverty and the global water crisis", dedicated to the global struggle for access to adequate water and sanitation, the administrator of the UNDP, Kemal Dervis spoke about the profound influences made towards MDGs (Millennium Development Goals) human potential mores.

Water is a basic human want and a fundamental human right. Access to water which many countries in Africa take for granted, has the ability and potential to improve and change lives, expand choices and the exercise of basic human rights.

Kevin Watkins (2006), UNDP Human Development Report, maintained that 'Vaclav Havel once said that politics is not the art of the possible, but the art of imaging the impossible—and the making it happen'(ANC Today, volume 7, No 11, 23—27 March 2007).

4.14 MITIGATION AND ADAPTATION

There are ongoing discussions among many countries trying to find a way out to deal with the problem concerning climate change within the United Nations Framework Convention on climate change (UNFCCC).

The first agenda is to tackle the primary cause of climate change and how to reduce gas emissions for social action. The how to do it is still to be articulated, and it demands radical moves as to how communities are structured in terms of the usage of fossil fuel, industrial mechanisms, urban development, land distribution and its use.

The reduction of greenhouse gas emissions is referred to as mitigation. IPCC (2001) defines mitigation as an anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes the mechanism and processes to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sink. Developing new power sources for industry and transport, effective furnace systems and looking for renewable sources of energy are examples of mitigation efforts. Forest, vegetation and soils can be managed to take in carbon dioxide.

The most efficient method of addressing climatic catastrophe is to manage its impacts. Due to the quantity of greenhouse gases already accumulated in the atmosphere resulting from social and industrial activities, one should be able to devise a system to manage the impacts of climate change until mitigation policies are formulated and become effective.

Developing countries should be committed to change. The courage to accommodate these changes in climatic conditions is referred to as “adaptation” (IPCC, 2001). IPCC defines adaptation as the “adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderate harm or exploit beneficial opportunities” (<http://www.adaptationatlas.or/activityDetail.cfm?id=2405>).

Preparing for risk assessment, protecting the ecosystem, putting in place early warning systems, improving methods of agriculture, effective management of water systems, among others, are the model of adaptation.

These are closely connected to sustainable development, because they help reduce life risks and act as source of livelihood. At the same time, they help communities to cope with hazards of climate change. It is important to note that mitigation and adaptation are treated together because they complement each other.

For agriculture and water resources, vigorous but specific actions need to be taken. African countries are seriously affected by food security as a result of the impacts of climate change. Something has to be done to increase economic growth in order to maintain the present level of nutrition.

4.15 EFFECTS ON PROGRESS TOWARDS MILLENNIUM GOALS

Climate change is associated with development. According to the World Bank and nine other multilateral and bilateral organisations (AfDB et al., 2003), climate change is a threat to sustainable development and may likely hinder the progress so far achieved in catching up the target of the Millennium Development Goals by 2015 and even beyond unless serious action is taken to mitigate risks. The same message was echoed in the report of civil society organisations (IIED, 2007) and stakeholders. These reports discussed the interconnectedness between climate change and the objectives of various MDG's and problems associated to meeting the target of MDG. Its rate and speed will not be sufficient to meet its targeted income level, hunger, health and might not be able to grant people access to water and sanitation across Africa by 2015.

The most influential MDGs regarding climate change are: MDG 7, increase access to portable water, MDG 1, progress on food security and MDG 6, common death rate associated with malaria. Right now, there is no streamlined and adequate system assessment of the impact of global warming variability and changes in socioeconomic areas that are crucial to achieving and sustaining MDG's across the continent.

Table 4 .1: shows the list of Millennium Development Goals, targets and their present status in Africa.

MDG and measures of achievement	1990	2004	2015
MDG 1: People living on \$1 (ppp) as % of population	44.6	44	22
MDG 2: Net primary enrolment rate (%)	53	64	100
MDG 3: Promote gender equality			
Percentage of girls who complete primary education	51	61	100
Percentage of illiterate women in the 15-24 age group	80	88	100
MDG 4: Under-5 mortality per 1000 births	185	168	62
MDG 5: Deliveries attended by skilled health workers (%)	42	46	100
MDG 6: Combat malaria, tuberculosis, HIV/AIDS and other diseases			
Adult HIV/AIDS rate (percent of adult population	2.7	5.8	stop increase

Tuberculosis rate (cases per 100,000 excluding HIV infected)	337	49	stop increase
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MDG 7: Ensure environmental sustainability

Access to improved water sources (% of population)	49	56	75
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Access to improved sanitation (% of population)	32	37	66
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MDG 8: Develop a global partnership for development

Share of ODA flows (% of donor GNI)	0.33	0.22	0.7
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Source: World Bank: Millennium Development Goals

4.16 CONCLUSION

Sustainable development and growth are of great importance to Africa if the continent intends to manage the level of poverty reduction and achieve its millennium targets. Though Africa is managing to address the impact of climate change to sustainable growth by putting various measures in place, this will amount to nothing without addressing the issue of mitigation and adaptation to climate change, bad governance, bribery and corruption.

Africa loses about fifty billion dollars (\$50 bn) yearly due to illicit financial flights (El Baradie-former director of IAEA, 2015 6th annual Thabo Mbeki lecture, Unisa, Pretoria). It is therefore the responsibility of the government to harness the resources of the continent. Governments must start turning words into deeds.

The African Union should also be more robust and more finance orientated if it intends to meet its development goals.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The ability of developing countries to adapt to the impacts of climate change is limited by their resources and geography. Without assistance from developed countries to vulnerable countries, responsible for the emissions presently causing climate impacts, less developed countries will continue to be exposed to climate- related disasters. This is why international funds such as the Green Climate Fund (GCF), has been established to assist developing countries in their efforts to adapt to and mitigate change. The Green Climate Fund was established in Cancun, Mexico, during the 2010 COP 16 of November 29, followed by a promise to increase the fund to US\$100billion every year by 2020.

The benefits of GCF are adversely limited because the funding mechanism is not yet fully operational. The slow funding and lack of clarity on the funding financial structure are sources of continuous misunderstanding between developing countries and advanced countries.

The difference between what is wanted for developing countries to protect their populations from climate change and what is actually available to help them adapt is what is causing confusion over “climate injustice”. It is an irony of life that developing countries that have contributed very little to the rise in temperatures and that have high global emissions, Africa is still the least equipped in dealing with the impacts of climate change and is the most exposed to the consequences.

5.2 CONCLUSION

Something drastic and concrete has to be done to save Africa from the devastating catastrophe of climate disaster that is the cause of the escalating conflicts that hinders sustainable development in Africa. African governments should not only owe responsibility to managing global treaties on climate management, planning and service delivery activities for adaptation that will assist local institutions and other non state actors, but should work towards achieving the desired goal.

Lastly, the African Union Commission should exert pressure on the African Union members, leadership and regional organisations, as well as other stakeholders to respond favourably to climate related issues at all levels.

It is not all doom and gloomy for Africa. Hope is not lost. There is still a chance to fight this common enemy- climate change if Africa can stand as one and act now with the rest of the world and close the adaptation and emission gaps.

Finally, climate change policies and processes will only be considered effective and efficient and also be said to be fair only if and when they become more gender-oriented. This would mean accepting men and women as equal developmental actors, with limitations in different and unequal manners with differing and quite often conflicting needs and scale of preference (Kabeer and Subrahmanian, 1996). Greater gender- awareness implies considering women's rights of inclusion in climate change related issues. Simply recognising gender inequalities will not be enough and would solve little or no problem.

It is important to emphasise that climate change policies and involvement need to promote actively the participation of women that will in turn promote their right and gender equality for change. Gender transformation is a catalyst for effective climate change response and poverty reduction.

Transformation means equal opportunities in policy- making and decisions on climate change and governance at large, and also giving equal access to resources necessary to respond to adverse climatic conditions, where both needs are given equal and due considerations and where the large social limitation women's access to practical resources seems to exist. With great resolve, Africa and developing countries will overcome.

5.3 RECOMMENDATIONS

Irrespective of the fact that developed countries are to be held responsible for global emissions, Africa suffers from the devastating impacts of climate change. Africa has always been on the receiving end. During the colonial era, Africa was brutally destroyed by European powers that partitioned and colonised Africa.

The aftermath of colonisation and the partition of Africa is still felt in Africa today. That is the cause of the incessant conflicts and the continuous dictatorial problems present among the ruling elites. This is these colonial powers have helped African rulers to remain in power in order to further their national interests. At this point of high global emissions, Africa is still on the edge of being exterminated for the same cause that developed nations are totally guilty of. They are the highest contributor and Africa pays the price. The scope of the consequences of climate change could be unusually on social security and poverty because Africa depends on rain-fed agriculture for a living. Climate change is exacerbating water security in Africa. As demand exceeds supply, conflict becomes imminent across Africa.

The situation where people are exposed to violent conflicts due to delicate and vulnerable conditions of climate change are a fact that Africa has come to live with. As the concern over freshwater demand increases due to climate change, the harmful effects, right to water, its distribution and use is escalating and may well have dire repercussion to the stability of the continent.

Some Eastern African countries are likely to be engulfed in water crisis, unless urgent plans are put in place on how to share existing water reservoirs and rivers. Water is of an essence to humanity, there a necessity in all areas of human endeavour (that is agriculture and industrial production and power generation), and also critical for transportation of goods and services.

In as much as irrigation can be used to boost agriculture, it will also help improve economic growth and employment of the rural people, hence reducing the possibility of urban migration. It will also help solve the challenges of deforestation, soil degradation and droughts in some areas of Africa. Migration will definitely be as a result of climate change. Deforestation for farming, construction and wood for fuel also contributes to rural-urban migration in Africa.

These in many cases causes pollution, poor education and health delivery, employment challenges, poor housing facility and poor water supplies in Africa. In line with the above, emissions can be reduced from deforestation and degradation which will in turn stimulate mitigation, adaptation benefits while maintaining important ecosystem services.

One of the ways for Africa to help mitigate the future hazard of climate change is to increase the level of literacy, improve the standard of health care delivery, increase the system of land reform where it exists or establish one where it does not exist. Importantly, there should be public awareness education campaigns on environmental information about Africa. By improving literacy through educational institutions, knowledge will be generated concerning the impacts of climate change and how to militate against present and future occurrences. This educational awareness should cut across all levels of education.

Furthermore, print and electronic media have a very crucial role to play in this crusade of climate change in Africa. They raise public awareness by communicating with people about climate change and its consequences and what is supposed to be done in case of climate hazards.

Above all, there should be political will on the part of states to support societies by rolling out finance to support research that will help unveil and deal with the critical issue of climate change. Apart from the above, they should muster the courage to use the point so far established regarding climate change in policy formulation and implementation.

Corruption among African leaders is incessant and must be rooted out if Africa intends to meet its bogus development policies. Finances budgeted for projects never reach their destinations. In most cases, the funds disappear even before the start of the projects. This is the reason why there is no primary infrastructural facilities to cope with the incident of climate change, because the money disappears as soon as the project is announced. Corruption is endemic and has eaten deep the fabric of African society, and there are many abandoned projects to the dismay of the people.

Climate change has taken its toll across Africa and is quickly changing the topography of our dear continent- Africa. Unless urgent attention is paid to finding a proper and lasting mitigation and adaptation solution, Africa will have itself to blame, because climate change is a time bomb.

It is therefore important that all stakeholders come together and get involved in order to help remedy the situation or find solutions to the challenges of climate change. It is important that all hands be on deck to save Africa.

The December 2009 Copenhagen conference on climate change failed because it did not find a lasting and binding agreement on how to combat climate change. Those who went there, hoping

to find a lasting solution, were disappointed and left the conference depressed having not reached any structural framework on how to tackle the subject of global change and its disastrous impacts.

The recent Lima, Peru 5 December 2014 conference of the United Nations Economic Commission For Africa (UNECA) was crucial to the African Groups of Negotiators on Climate Change because they were committed in finding a lasting solution to ensure that the 20th Conference of Parties to the UNFCCC (COP20) realises its objectives that will be most favourable to Africa.

Re-affirming Africa's commitment, the president of the African Groups of Negotiators, Nagmeldin El Hassan, declared, "We have a mandate from science, from our people, from the African continent and from the United Nations itself, to strive for enhanced global climate activities to reduce greenhouse gas emissions and strengthen adaptation".

At the backdrop of this conference that took place in the Peruvian capital, the African Negotiators intend to use it to establish a system that is based on multilateral principle with international influences in order to fight against the ever growing threat of climate change in Africa.

It is important to note that from the onset, developed countries were not ready to shoulder the responsibility of the burden and the cost of climate change. Hence, their decision to delay any possible agreement. It is an irony of fact of trying to champion a cause which one is not ready to bear the burden and cost. All they are doing is to break the political will of the African leadership by shifting the burden and cost on them. To the developed countries, it is God for us and everyone to himself.

One of the reasons for the delay is probably that their national interest is not yet provided for. Once the national interest of developed countries is not protected to their satisfaction, they will ever make an about turn. Developed countries will ever want developing countries to come begging with cups in hand under strict conditions before they can cede to any agreement. Therefore, let developing nations honestly come together, by pulling their resources together and start somewhere to map strategies to mitigate the effects of climate change. They must take one step at a time.

Accusations and counter accusations will not help. There should be strong political will with basic structures coupled with good governance and placing the right people who are ready to defend the

cause of the African people. African countries should stop being subservient to developed countries, giving them the impression that Africa will not amount to anything. Africa has made progress. But irrespective of the progress so far made in their drive to uplift economic growth and the endeavour to encourage social drive, Africa is still lagging behind in their commitment to meeting its development targets. Therefore, urgent and decisive action should be taken to enforce strong transformation of economic and social activities of Africa.

Again, Africa may not be able to rise except it works in an integrated and unified fashion. Strong unity of purpose is key among African countries to combat and surmount the climate change crisis that is ravaging African countries. The issue of advancing opinions and working in a concerted effort, in a solid unity, will go a long way in managing the effects of climate change and also help in improving Africa's social and economic conditions.

It is high time developing countries, especially those in Africa start speaking with a voice and stop leaning on developed countries that do not have the least interest of Africa at heart, except to further their national interests. Developed countries, instead of helping to cushion the effects of global warming which they are the highest contributors, all they do is to set one developing country against the other in order to protect and maintain their colonial hegemony.

For example, the so called war on terrorism by the USA and the misleading false claim of discovery of Weapons of Mass Destruction (WMD) against Iraq that has enveloped billions of dollars without success. The billions of dollars the US and its allies have spent in Iraq, Afghanistan, Libya, Yemen and still spending in Syria would have gone a long way in solving the challenges of global warming and its consequences in the world, especially in Africa. What has Africa gained from the centuries of colonial exploitation, dehumanisation and slavery?

Nothing, but imposing in Paris, a new mitigation order that will be less compelling to them but more binding for developing countries. The new proposed order will greatly exclude their commitment in terms of adaptation, funding and technology, and this is meant to shift the responsibility of combating climate change on the shoulders of developing countries. What an irony of life.

Secondly, an external agenda setting will not be in the interest of Africa. It will be of great interest for developing countries, especially Africa to articulate an African- based workable agenda that best suits the challenges on the ground within the limit of their resources. Maybe that will help. Instead of the bogus agenda that is not feasible within the African context for Africa to meet the target of this bogus agenda, will turn her to continental beggar. It may not be easy, but with concerted effort, something very tangible could be achieved.

ClimDev-Africa partners (AUC, ECA and AfDB) should try as much as they can to organise regular conferences to generate new ideas, knowledge and innovations on how best Africa can mitigate the challenges posed by the disastrous impacts of ecumenical warming of climate change.

Furthermore, there are problems that have continued to hinder Africa's ability to combat the menacing issues of climate change. The key factor is Africa's near total dependence on foreign aid. According to available information and ECA research, Africa needs a rough estimate of \$200 billion yearly to support sustainable development, aid the progress of climate change adaptation and mitigation to ensure economic recovery.

Speaking on how best Africa can source funds, Carlos Lopes, Executive Secretary of ECA maintained that "for developing countries to access the funds they require, they must strive to mobilise additional financial resources, including by accessing financial markets, while developed countries must honour the financial commitments made in international forums. The continent must embark on reforms to capture currently unexplored or poorly managed resources. This includes curtailing illicit financial flows and rather transforming these funds into a powerful tool for enhancing domestic resource mobilisation as a way of furthering the continent's development". The good news is that despite the challenges of climate change in Africa that is threatening the destabilisation of major sectors—agriculture, water and energy, Africa surely but steadily is making serious headways in the transformation of its agriculture, while attending to its food, water and energy crisis in a desperate effort to maintain its present and future growth.

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