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Evaluation of the Effect of Climate Change on Africa: Case Study Nigeria

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ABSTRACT

Climate change has drawn a lot of interest among scholars in recent years. Researchers and specialists have for several years now intimated that there is significant climate change taking place as a result of human activity, leading to increasingly high levels of GHG emissions, to the extent that it has caused a significant shift in the general global environment, with substantial impacts on human lives. Climate change manifests itself in the form of temperature changes and changes in precipitation. Climate change has caused rapid temperature rise and erratic rainfall, in recent years, both of which have a significant bearing in the ability of the environment to sustain life. Among the areas affected include agricultural systems, water availability, ecological services, forestry activities, biodiversity, coastal systems, health, and subsequent food security, all of which are pertinent to the survival of human systems. In Africa, managing climate change presents several challenges owing to among other factors, the scarcity of resources, and limited capacity to confront the impacts of climate change. This study, examined the effect of climate change in Africausing Nigeria as a case study. Furthermore, this study also exposes the role of the African Union in mitigation and adaptation. The study extensively used secondary data as well as philosophical tools of critical exposition to carry out this research.

KEYWORDS: Climate Change, GHG emissions Africa.

INTRODUCTION

Separate studies by Joseph Fourier (1824) and John Tyndall (1860) showed that carbon dioxide gas in the atmosphere is responsible for trapping infra-red light from the sun (Craggs 1975). This infra-red glow is what causes an increase in the surface temperature of the earth. An accumulation of too much carbon dioxide in the atmosphere leads to a corresponding increase in the atmospheric temperature. Such an accumulation may be caused by the burning of fossil fuels and other human activities (anthropogenic activities). Since most industries are powered by fossil fuels, industrialization leads to the concentration of carbon dioxide gas in the atmosphere and hence the increase in surface temperature. In the pre-industrial age, the amount of carbon dioxide in the atmosphere was measured as 290 parts-per-million (ppm) (Jenkinson 1990). By 2010, the concentration had increased to 390 ppm with an annual increase of 2ppm (Brown 2019). Corresponding to the increase in the concentration of carbon dioxide in the atmosphere, the global average atmospheric temperature has increased by 0.740C since 1901 (Brown 2019). This increase in atmospheric temperatures leads to the interrelated

phenomena of global warming and climate change. Industrialization is closely associated with the economic might of a country because, through industrialization, countries provide jobs for their populace and exercise influence in the global market place by exporting technologies. This is the reason that has transformed climate change from being just a scientific or technological issue in international relations to being a political matter. The political dimension of climate change also touches on such interested parties like the oil-producing countries whose economic mainstay will be negatively impacted should the world stops relying on oil to power industries. On the other hand, the effects of climate change are so pronounced even threatening the livelihoods of such countries like the island nations whose landmasses may get submerged should the oceans continue rising (Bassey 2019). The international climate change regime has further created other players like the rain forest countries whose forest resources provide sinks to absorb carbon. As regards Africa, climate change discourse is of particular importance because the continent is the least developed in the world, yet it suffers the most from the impact of climate change due to poverty. Poverty renders the adaptive capacity of Africa to be very low and hence threatens the lives of its people.

Global warming refers to the long-term increase in the Earth's average temperature (Bassey & Pimaro 2019). Climate change, on the other hand, refers to significant changes in temperature, precipitation, and wind patterns among other factors. There is sufficient scientific evidence that climate change is caused by global warming. Climate change has become arguably the leading human and environmental crisis of the 21st century following its effects on the sustainability of the Earth due to adverse ecological, social and economic impacts. The phenomenon is also an issue of great significance in international politics for some reason. First, the environment is a common good such that the consequences of pollution by one state affect all the others. Secondly, reducing the use of fossil fuels to power industries is thought to compromise the economic standing of many nations. In the context of the present study, we study the impact of climate change on African, using Nigeria as a case study. The present study, therefore, seeks to look at the role of the African Unionin curtailing this problem.

CLIMATE CHANGE

The climate system plays a vital role to explain various aspects of climate science such as precipitation, temperature, energy transfer between the atmosphere and the earth, and the balance of radiation. The climate system is a complex multitude of five interactive components; the atmosphere (the casing or coverage of gasses surrounding the earth), the hydrosphere (mass of water in, on, and under the earth), the land surface, the cryosphere (glaciers, ice caps, and snow covers), and the biosphere (zone of life on earth). The climate system usually remains static due to the balance in the internal and external forces of the earth (Change 2007). However, any external force led by any change in one part of the system can be felt in the rest of the system. The sun and the earth's rotational cycles provide energy for the climate system and exert external forcing on the climate system. The two important processes including evaporation and precipitation, carry the winds and ocean currents and eventually distribute them back in various forms of energy. It is crucial to note that human activities such as emissions of greenhouse gases and changes in the land cover and land use also bring external forcing for the climate system.

Most of the earth's energy comes from the sun, through the atmosphere, in the form of light and short wave radiations. The earth absorbs some of these radiations and the rest is thrown back into the atmosphere as infrared radiations. Ninety-nine per cent of the earth's atmosphere is composed of oxygen (20.9 per cent), Nitrogen (78.1 per cent) and argon (0.93 per cent) (Change 2011). These gases have very distinct properties; therefore, do not interact with the passing by radiations. Water vapours, and other greenhouse gases, such as carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), ozone (O3) and halo-fluorocarbons (HFCs) have special properties. These gases are present in very minute quantities and play a key role to maintain the earth's average temperature. Apart from these gases, there are aerosols present in the atmosphere. Natural aerosols are tiny particles of dust, sand, volcanic ash, and liquid droplets of sea salt, found in liquid and solid form. The key role of aerosols is to reflect the sunlight back into space and this process tends to lower the atmospheric temperature

level. Most of these particles stay for very little time in the air and then fall back onto the ground. Since the industrial revolution, an increase in the burning of fossil fuel (containing sulfur) has considerably enhanced the concentration of aerosols in the atmosphere. Particularly, after World War II, the emission of sulfur dioxide has increased from 40 million to 100 million metric tons per year (Friedrichs 2019). Their concentration is generally present in the northern hemisphere compared to the southern hemisphere, as revealed by the glacial ice cores of the regions. Soot is black carbon and comes from industrial pollution, traffic, out-door fires, burning of coal and biomass. Besides, black carbon is produced by incomplete combustion of coal and burning of diesel fuels, bio-fuels, and outdoor biomass. Particles of soot absorb sunlight, and as a result, heat the air. The greenhouse gases and the water vapors present in the atmosphere provide a partial blanket for the earth, trap some of the infrared radiations, and re-radiate them in all directions, causing a warming of the earth. This phenomenon is known as the greenhouse effect, which an entirely natural process to keep the earth warm and habitable for the sustenance of life.

The Earth's climatic conditions have always been fluctuating between episodes of glacial and interglacial periods. Around 20,000 years ago, ice ages ended and succeeded by the era of the interglacial period (Pielke 2004). Records collected from the analysis of drilling of the ice caps reveal that these historical changes in the climate were led by the volcanic activities and some other natural causes. However, to some ecologists, there might be some uncertainty in the reliability of the evidence. During this period, huge ice sheets covered massive areas of North America and Europe; sea ice was much closer to the equator; temperatures of oceans were cooler; and the tropics were relatively drier than what they are at present time. 13,000 years ago, an unusual climate change, the Younger Dryas Event took place, advancing towards a warmer world. There was abrupt warming of 4 degrees in North Atlantic, Greenland, and Europe. However, data reveals that it was a global shift in the earth's climate. Overpeck et al. argue that "the climate system translated the relatively gradual astronomical characteristic of the past 18,000 years, into an interrelated sequence of abrupt climate events over an extensive area of the globe" (Brown 2019). The exact cause of the Younger Dryas event is still unknown, however, the trend of warming ended around 10,720 years ago (Schneider 2001). Various scientific studies demonstrate that the warmer, wetter period provided perfect conditions for the establishment of agricultural activities. The following period is known as the postglacial optimum or hypsithermal period when earth's climate became relatively cooler and drier. This also marked the beginning of the Egyptian and Middle Eastern civilisations and provided the basis of physical and historical records of the climatic changes in the Sahara, Middle East and the Far Eastern regions. Records indicate that this era marked the onset of milder monsoon summer circulation that had severe effects in the Sahara and Arabia. This was the time when arid conditions for the desert began.

Another remarkable climatic change was recorded around 4,300 years ago when the rainfall significantly declined in the Middle East and North Africa. After the continuous warming of 2,000 years, the glacial conditions changed with a drop of 6 degrees in average global temperature. However, the climate remained cooler until the fifteenth century, and again a spell of warming followed up. During 900-1300 AD, the Medieval Climate Optimum, or Medieval Warm Epoch brought moderate climatic conditions in winters as well as in summers, compared to the little ice age (Brown 2019). World data center for Paleclimatology concludes that the rise of temperature started from 600 AD and peaked during the early twelfth century. During this period, Europe and the adjacent regions of North Atlantic experienced anomalous warmth. Agriculture flourished at higher latitudes as well as in the mountainous regions. For instance, this warming led to grape production in England while olives and fig trees were harvested in northern Italy and parts of Germany. The Norse settlers in Greenland invested in dairy farms and did livestock rearing such as sheep. Followed by the little ice ages, during 1430-1850, there was massive snowfall and formation of glaciers in Alaska, Scandinavia, and Alps (Schneider 2001). Europe also experienced more than average cold winters while summers were also wetter than usual. Some Dutch traders noticed that during 1634-1700, canals froze and consequently, the trade exchange significantly affected (Kersey 2017). Last decade of the seventeenth century, harvesting was impossible in Finland and some other European states, which led to crop failure, famine, and hunger. The results were a massive flow of migrants from well-established villages. Comparison from various data sources concludes that the cold period of the

sixteenth to nineteenth centuries was always followed by an episode of a warmer climate. However, there were some regions where winters were long and severe than the usual weather pattern, while the climate remained moderately cold in other regions.

From a geological point of view, the major climate change events that took place millions of years ago led to strategic reserves of oil, gas and coal that are the key energy sources of the present time (Kersey 2017). Climatologists demonstrate that historical changes in the global climate have led to the evolution of a new and diverse variety of flora and fauna. The severity of either cold or warmth helped some species to survive and adapt to new conditions, with some characteristic changes (Kersey 2017). However, many species could no longer survive the harsh conditions and became extinct.

Climate change is considered one of the most serious threats to sustainable development globally. Studies have shown that about 90% of all-natural disasters afflicting the world are related to severe weather and extreme climate change events. Impacts of the projected climate change are expected in many sectors such as environment, human health, food security, economic activities, natural resources and physical infrastructure (IPCC, 2007). Climate change is a phenomenon that to a great extent is beyond human control. It all depends on whether humans (either individually or groups) are prepared to respond proactively or react afterwards to the challenges brought about by climate change. The impact of climate change on ecosystems and the natural resource base will disrupt the livelihoods of the billions of people who rely on land, water, forests and fisheries for their survival. The promotion of development activities and poverty reduction is difficult enough in much of Africa, Asia and Latin America, but climate change constitutes a major additional threat, bringing increasing variability and extremes (disasters). To face the consequences of climate change, a significant additional effort is required. Enhancing the capacity of different relevant stakeholders is essential. From individual and household to organizations – governments, NGOs, private enterprises, and all other relevant stakeholders – all will have to adapt (IPCC, 2007).

Climate change is one of the most serious environmental threats facing the world today. It is said that the main reason for climate change is the increasing concentration of greenhouse gas emissions (Bassey 2019). Man-made global greenhouse gas emissions have grown markedly in the past 30 years rising to 70 percent between 1970 and 2004. As humans emit more carbon dioxide and other greenhouse gasses into the atmosphere the greenhouse effect becomes stronger. This causes the earth's climate to change unnaturally. Consequently, the main human influence on the global climate is emissions of the key greenhouse gases- carbon dioxide, methane and nitrous oxide (Akpan & Leonard 2018). The accumulation of these gases in the atmosphere strengthens the greenhouse effect. At present, just over 7 billion tonnes of carbon dioxide is emitted globally each year through fossil fuel use and an additional 1.6 billion tonnes are emitted by land-use change, largely by deforestation. The concentrations of these gases in the atmosphere have now reached levels unprecedented for tens of thousands of years (Change, 2007).

CLIMATIC CHANGE AND TEMPERATURE VARIATION IN NIGERIA

Climate change is demonstrated in the form of variations in temperature, rainfall and extreme events. From UNDP records, the average annual temperature in Nigeria has been increasing progressively since 1960, to the current1.0°C more than it was then. This translates to around 0.21°C per decade. Going by this trend, it is estimated that the temperature increase will be between 1.0°C to 2.8°C by the time we reach the 2060s. It has also been noted that a wider variation is recorded in the warm season and less variation in the cool season (UNDP 2018). Further, data obtained from the Nigeria Meteorological Department indicates that the trend in temperature points to the fact that there has been general warming through time. This increase has been observed to vary in the sense that the rise in minimum temperature, that is, the temperature was taken at night or early morning has been higher than the rise in maximum temperature, which is taken at daytime (Federal Ministry of Environment Nigeria 2019). This leads to a reducing daily temperature range. This trend differs however in areas near large water bodies more so around the coastal area where it has been observed

that the minimum temperatures tend to either remain the same or to decrease while on the other hand, maximum temperatures continuously increase as years go by. This has led to days becoming hotter while nights and early morning temperatures remain the same or reduce marginally. It has also been observed that temperature rise is relatively higher in the northern parts of the country, which are generally arid, compared to other parts particularly in the season covering October to February (Odjugo 2010). Further, in the northern parts of the coast region, minimum temperatures have been found to decrease at a relatively faster pace than further south within the coastal region at similar periods. For instance, it was observed that temperatures in north coast of the country, dropped from an average temperature of 24.5°C recorded in the early 1960s to 23.5°C recorded in the recent ten years, a drop of 1°C, while Mombasa located in the south coast dropped from 23°C recorded in the 1960s to 22.7°C recorded in the recent ten years, which is a drop of about 0.3°C.

These trends are depicted in the Table 1 below.

Table 1: Temperature Growth Trend (both Minimum and Maximum), from 1980

Region	Minimum increase	Trend	Maximum increase	Trend
Western	0.8 – 2.9	Increase	0.5 – 2.5	Increase
North and North Eastern	0.7 – 1.8	Increase	0.1 – 1.3	Increase
Central	0.8 – 2.0	Increase	0.1 – 0.7	Increase
South Eastern Districts	0.7 – 1.0	Increase	0.2 – 0.6	Increase
South South Districts	0.3 – 1.0	Decrease	0.2 – 2.0	Increase

(Data from Nigeria Meteorological Department)

CLIMATE CHANGE AND RAINFALL PATTERNS IN NIGERIA

Rainfall Patterns and trends in Nigeria since the 1960s are determined by studying daily and monthly rainfall records. From the records, it has been observed that generally, the annual rainfall trend has been decreasing slightly in many areas. This implies that on the whole, the annual highest rainfall recorded and the measured intense rainfall levels over 24-hour period are comparatively lower in recent years than those recorded in the 1960s. The recorded values reduce progressively, showing a negative trend with time (Itiowe et al., 2019).It has been observed however that the highest rainfall decline is mostly recorded in the rainfall season of March- May, commonly referred to as the 'Long Rains' and which contributes the highest amount of rain measured as annual rainfall in most areas.

In the short rainy season, which mainly occurs in the period between September and February, an increase in the level of precipitation has been recorded in recent years compared with the early 1960s, extending into the usually hot, dry January and February period in most areas. This has among other reasons, been attributed to the El-Niño occurrences that have been observed to be more frequent in recent years. In addition, the increasing precipitation can also be attributed to warmer sea surface temperatures (SSTs) that are manifested in the River Niger, which is situated along the coast of West Africa coupled with the cooler SSTs in the eastern side of the River Niger(Itiowe et al., 2019).These SSTs are favourable for the increasing tendency of precipitation in the country in the short rains and can cause unusually heavy precipitation in the 'Short Rains' period as was experienced in 1961-62 and more recently, 2006-07 rainfall events, even without the presence of El-Niñoconditions.

It has also been observed that in September-October-November, (SON) and December-January-February (DJF), periods which constitute the drier seasons, rainfall is more intense and frequent in the coast and in northern Nigeria in recent years than it used to be in the1960s (Chineke et al., 2015). Further, in the period since 1960, records indicate increased variability in rainfall patterns during the DJF season. Some years recorded negligible rainfall during the season, and others had more rainfall than the normal average (Mohammed et al., 2015).Rainfall patterns have been more unpredictable and erratic since the 1980s with drier years manifesting more frequently and more severely.

The trends are as represented in the Figure 1 below.

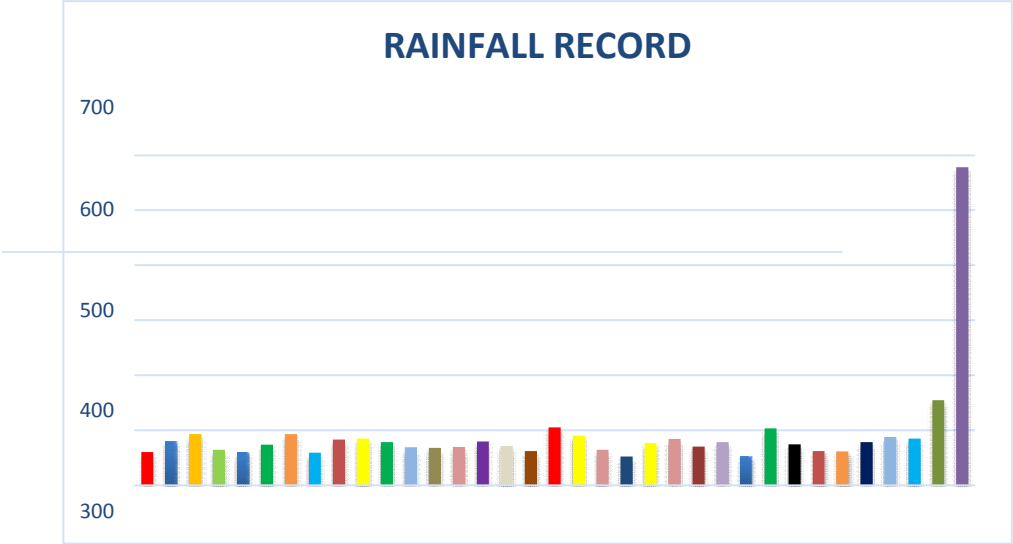

Figure 1: Rainfall Record

With regard to other aspects of rainfall, runoff has been recorded to range between 0.07 to 0.2 cubic meters with more significant variation occurring between seasons. It is noted that runoff during the long rains is much lower than the short rainsrunoff. Run off has been attributed in part to forest cover depletion with research showing that the removal of mature trees triggers greater streamflow than the removal of immature trees (Odjugo 2016).This is because the natural process of evapo-transpiration, in which trees absorb water,laterreleasingitbyevaporationmainlythroughtheleafsurface,andtoalesser extent through other parts of the tree, is hindered when severe deforestation takes place, as the trees that would transpire are depleted. This leaves a lot of rainwater on the ground surface with no other outlet rather than freely flowing by gravity towards the close-by streams and rivers causing flash floods, when in large quantities (Sylvester & Abdulquadir 2015).

The country has also had manifestations of extreme events. Since the ushering in of the 21st Century, there has been continued erratic precipitation patterns that have resulted in drought periods together with heavy rains and floods. The level of regularity and intensity of the extreme events have been recorded to have increased, in the last 30 years. Droughts have particularly been more frequent and intense in Western Africaand more especially in some parts of the country as abrupt rise in temperature has been recorded from time to time since the mid-1980s to early 1990s.On the other hand, the country experienced El Nino led rains in 1988-89 and nine years later in 1997-98. The El Nino rains triggered flash floods which disastrously impacted the affected areas with heavy losses in terms of life and wealth destruction. The initial five years of the new Millennium recorded a moderately wet pattern, while the latter five years were less wet with a severe drought being witnessed in 2009 (Cashin et al., 2017). In 2015, 2016, and 2017, the precipitation was considerably heavy and more thanaverage.These observed changes in the weather conditions have a profound impact on Nigeria's socio- economic sectors, especially those which heavily rely on natural systems and are therefore climate-sensitive. The key sectors that are most affected include agriculture; rangelands on which Nigeria's nomadic and pastoralist communities rely heavily, forestry, wildlife and tourism; water resources; aquatic and marine resources; health; as well as physical and social infrastructure.

Droughts in particular have had a serious negative effect in Nigeria, where a vast proportion of the land comprising 80% is arid or semi-arid (ASAL) (Zhou 2019). They reduce the already low levels of water used for both domestic and agricultural purposes, leading to serious food insecurity and

prevalence of disease thus causing great suffering among the people.One main observation in this study is that Nigeria is already negatively experiencing the ravages of climate change as manifested by among other occurrences the increased prevalence and geographical spread of diseases as well as the increased frequency and intensity of extremitiesof weather. The impacts indicate a worsening and perturbing future which requires concerted global and national efforts aimed at reversing atmospheric Green House Gas (GHG) emissions which catalyse global warming.

CLIMATE CHANGE IMPACTS ON AFRICA

Agricultural Sector

The food production systems in Africa most affected in the world to climate change because of extensive dependence on rain-fed farming, frequent floods as well as droughts which influence crops, livestock and also accelerate poverty which limits adaptation capacity. The agricultural sector is one of the areas that are eminently prone to changes in climate. The outcomes of climate change on agriculture are significant because of its effects on both human and plant health. An increase in temperatures and change in precipitation is the main variables affecting agriculture in the region. The report cites a load on food security, as well as livelihoods in Africa, that have been placed by the booming uncertain nature of weather patterns within the continent. The Burkina Faso floods and the drought in Ethiopia are some of the intensities of peril caused by the changing climate in the continent (Hussein 2011).

Sixty-five percent of Africa's labor force is employed by the agricultural sector, with 95% of agriculture in the region being rain-fed. This has resulted in a rise in food costs that have in turn affected economic growth in most parts of the region due to currency depreciation, conflicts as well as security threats. Kenya is a good example of this. The country endured yearly damages of 10-16% on its GDP, as a result of floods related to El-Nino witnessed in 1997/98, as well as La-Nina drought experienced in 1998/2000. Some of the major economic driving sectors e.g. transport, industrial and hydropower production have also been greatly affected (Awojobi 2017). Due to the food crisis in the region, hunger and malnutrition trends have remained sturrbornly high. It is estimated that by the year 2100, agricultural damage of between 2-7% of the GDP is estimated especially within the Sahara, with 2.4% in Western Africa, 0.4% in Central Africa and 1.3% in Northern as well as Southern Africa(Tirado et al., 2015). A decrement in fertile agricultural land is also expected. A rise in crop pests and infections is also expected and alteration of soil fertility. All these factors are expected to lead to failed nutrient access that will, in turn, raise the vulnerability to diseases like Malaria as well as Hiv/Aids (Tirado et al., 2015). Africa is predicted to be the utmost prone to changes in climate globally due to certain stress factors like damaged infrastructure, impoverishment as well as poor governance. The climate in the region is expected to rise by 1.5-4 degrees centigrade, with a yield production drop of up to 50%, leading to a fall in crop revenue of up to 90% by 2100. By 2080, Africa is estimated to be affected region by food insecurity in the world, possessing 40-50% of undernourished people. A decline in viable arable land production is also expected by the same year. An increase in crop pests and diseases and soil fertility is also expected. Some positive aspects are also expected because of changes in seasons as well as production cycles. Nigeria and Western Africa are estimated to have prolonged seasons of growing due to climate change (Ziervogel et al., 2014).

Health Sector

There is a booming accord that the overall climate is altering as a result of global development practices, which have generated environmental hazards on an international scale, involuntarily uncovering communities to greenhouse gases. Negative impacts of the shift augur to aggravate health inequalities and counter advances that have been done recently to advance public health, and resolutions to achieve Millennium Development Goals. In May of 2008, World Health Organization made a resolution prioritizing climate change as well as health, listing it on the WHO¨s health sector agenda which demands that member states facilitate actions that secure the public's health against changing climate (Change 2001). Climate change has both direct as well as effects on human health. Some of the downright effects include; morbidity, injury as well as mortality, which are as a result of change in climate-related severe weather effects like floods, drought, cyclones, skin and eye damage

due to UV radiation, and thermal stress as a result of heatwaves and cold periods (Owens et al., 2011). The indirect impacts include malnutrition, malaria, diarrhea, meningitis as well as neglected tropical diseases. Malnutrition, for instance, causes 1.7 million deaths per year in Africa and is regarded as a leading contributor to mortality globally. Malnutrition is also believed to be directly linked to food insecurity (World Health Organization, 2013). Malaria is also a major disease and cause of death in the region. An estimated number of between 700k and 2.7 million die annually due to malaria. The disease is a result of the combined effects of changing temperature and precipitation that provide a suitable environment for the easy spread of the disease (World Health Organization, 2013).

Water Resources

Climate change has a throng of impacts both short term and long haul on water resources in African states. They are; sea-level surge in estuaries, flooding, drought, depletion of rivers, and poor water quality for both surface and ground systems. In the 1970s and 1980s a period of low rainfall resulted to severe droughts in the region, especially in the Sudanian areas and the Sahelian regions. There has been an increase in serious floods in the Niger Basin attributed to rise in temperatures. Seasonal water shortages are also expected especially in the Southern part of East Africa (Gautam & Singh 2015). Reports indicate that an estimated population of almost 51% leaving in Sub-Saharan states doesn't have access to clean water while 41% do not have adequate sanitation. In most rural areas, women and girls are left with the sole burden of water collection, protection of water resources, maintaining of water systems as well as water storage (Boko et al., 2007). Climate change influences the water sector in such a big way. 25% of Africa's populace experiences periods of water stress, with an additional 69 % of the population experiencing water abundance (Boko et al., 2007). The water abundance, however, does not account for factors like access to clean drinking water as well as sanitation which greatly affect the quality of water available for human use.

Terrestrial Ecosystems and biodiversity

Great changes are happening in the distribution of the various categories of ecosystems in the continent, from deserts and grasslands to woodlands and savannahs as well as forests. Some three major trends have been observed within the continent. First, there is the enlargement of desert and reduction of the vegetated space. Second, there is an increase in humans' influence on the extent of natural vegetation (Piao 2017). Thirdly, there is a composite shift in the spatial dissemination of the natural vegetation in Western Africa, as well as an increase in woody vegetation in within Central and Eastern parts as well as South Africa. The main contribution of the changes includes changes in anthropogenic land use, especially agriculture expansion, fuel wood harvesting as well as livestock grazing Mountain ecosystems are changing due to climate change. Ice caps on Mt. Kilimanjaro are proposed to disappear by the year 2020. The Cameroon Mountains and the island-like Afromontane habitats that extend from Ethiopia through to South Africa could also be affected (Freudenberger et al., 2012). Changes in climate are expected to cause shifts in species range, and changes in the productivity of trees that could become strenuous for forest ecosystems. Other threatened species include migratory birds, manatees and marine turtles, and the mangroves. The long haul results of these are felt by the tourism and fisheries industries. Climate change causes changes in ecosystem composition leading to heightened susceptibility of ecosystems to natural as well as anthropogenic disturbances. It is also likely to cause species migration and habitat reduction.

African Union's Role in Mitigation and Adaptation

The African Union has and continues to play a very major role in safeguarding Africa's united stand in where matters of global governance, mainly negotiations and the evolving mechanisms are concerned. The Heads of States and Governments have overtime verdicts to assist member states in effectively and equitably dealing with the threats that are posed by climate change. African Union (AU) commission also embarked on elaborating the draft strategy that was done by a technically supported participatory process that included all key stakeholders from member states, UN agencies, Regional Economic Communities and other associates. The blueprint strategy was thereby established and polished through small specially designed and savvy working groups and was surrendered to the 4th extraordinary session on the African Ministerial Conference on Environment that was held in September 2011 in Bamako Mali. Four major pillars of the draft strategy include; climate

management, advancement of education, research, raising consciousness and advocacy, promoting national, regional as well as international cooperation, and lastly dominating and integrating climate change regulations in planning, budget and development process (Chersich & Wright 2019).

The AU has also partnered with the Canadian International Research Centre alongside the UK Department for International Development (DFID) to establish the Climate Change Adaptation in Africa (CCA), research and capacity development program whose aim is in improving the extent of African states to conform to change in climate change in a way that is valuable to the vulnerable groups. The program builds on current initiatives and previous experiences to develop a self-sufficient proficient body of prowess in Africa to enhance the capacity of African countries to adapt. The Green Wall Sahara Initiative is another program that was initiated in conjunction with ECA, FAO, UNEP, UNCCD, and OSS (Scholtz 2010). There is also the "Climate Dev. Africa" an action plan between the United Nations Economic Commission for Africa alongside the Global Climate Observing System, aimed at mainstreaming climate information into decision making for Africa development (Ssekamatte 2018). The African Union Congress (AUC) has continually supported the environmental initiative and its relevant action plan, affirming the economic value of climate susceptibility as well as change through the inclusion of a programme area on combating change of climate in Africa. The Commission has also backed up NEPAD's Africa Regional Strategy for the control of Disaster Risk, which endorses the value of order among agencies to address catastrophe blockage and response plans. The AU commission also partnered alongside the African Development Bank as well as UN Economic Commission for Africa in 2007 to support the new agenda, the Global Climate Change Observing System Africa.

This programme was designed to help in integrating climate information and services to support Africa's progress towards MDGs, as well as mainstreaming climate information in national development programmes that focus primarily on the most climate-sensitive sectors. The AU has strongly encouraged its member states in becoming party to the UNFCCC as well as the Kyoto Protocol to be able to efficiently arbitrate in upcoming rounds of meditation in its rights. Since August 2007, over 50 member states have become a party to the two. A bargaining structure was recommended for the UNFCCC/Kyoto deliberation process, which includes a negotiating unit comprising of Heads of States from Algeria, Mozambique, Uganda, Mauritius, Congo, Nigeria and Ethiopia, and a team of negotiating professionals from all member states party to the protocol. The African Group of Negotiators is under the guidance of the AU Assembly, CAHOSCC and the African Ministerial Conference (Burden& Greater 2015). The AU has also developed a hub for knowledge formation on climate change known as the African Climate Policy Centre (ACPC). The main role of the hub is highlighting the need for revised climate information for Africa, as well as strengthened use of the data in decision making through developing detailed capacity information governance as well as the diffusion of activities. The ACPC is a major section for Climate Development in the continent. It is an all-inclusive programme serving the Regional Economic Communities, governments and communities in Africa. It has three broad activity areas; Advocacy and Consensus Building, knowledge management, outreach activities and peer learning and lastly consultative services as well as technical collaboration comprising of capacity building and mobilization as well as technical assistance (AMCEN 2011).

In February 2016, the AU Commission and the Food and Agriculture Organization of the UN teamed up and floated a €41 million project named, "Action Against Desertification" aimed at supporting six African states, namely; Burkina Faso, Ethiopia, Gambia, Niger, Nigeria and Senegal in large-scale recovery of production landscapes that have been damaged by desertification and land degradation (Ssekamatte 2018). The project is financed under the 10th European Development Fund that supports African, Caribbean and Pacific States. This project was built on some of the best practices from the Great Green Wall for the Sahara and the Sahel Initiative, approved by African Heads of State and Government in 2007. The Initiative has enabled more than 120 communities in Mali, Burkina Faso and Niger to create a green belt on more than 2,500 hectares of degraded and arid land and planted more than two million seeds and seedlings from fifty native species (Ssekamatte 2018). Through the project,

a special hub was developed in the AUC to help support regulation, monitoring and evaluation, capacity building, resource acquisition and knowledge administration to scale up such efforts.

CONCLUSION

As one of the most vulnerable regions in the world to the projected impacts of climate change, Africa faces many challenges at this critical juncture. Traditionally, national development plans, poverty reduction strategy papers and sectoral strategies in climate-sensitive sectors have paid little, if any, attention to climate variability, and even less to climate change. Africa's ability to turn a threat into an opportunity hinges on actions taken today. Africa's concerns and its agenda on environmental change in general and global warming, in particular, are ignored by developed nations, which are the main factors affecting the global environment. Indeed, Africa has tried to present its case and pleas to the international communities and governments, as well as non-governmental institutions, on the dire present and future consequences of climate change on Africa. The African voice that was individually presented was not seriously considered. Climate change is already affecting people across Africa and will wipe out efforts to tackle poverty unless urgent actions are taken now in terms of adaptation, mitigation and compensation. Failure to reach an equitable agreement on climate change negotiations may have dire consequences for Africa in particular and the world in general. Furthermore, climate change is a serious global challenge that demands urgent, cooperative, fair and shared responsibility to act. To achieve effective cooperation in terms of climate change issues, it will be important to involve key stakeholders from the climate change community where they are not yet involved.

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