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CLIMATE CHANGE: THE WEST AFRICAN SITUATION

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ABSTRACT: Climate is said to define the culture and lifestyle of the people in the various continents of the world. There has been evidence pointing to changes in the earth's climate due to natural activities. However, greater concerns have arisen from the fact that man's activities have forced the change to proceed at an alarming rate. Evidence of increased surface temperature in the West African region over a twenty year period, coupled with studies of man's activities over this period of time has indicated that these activities are majorly responsible for the trend in climate change within the region. These activities have been shown to include deforestation, fossil fuel burning and generally industrialization in the region. Impacts of these activities have been noticed on land, water resources, forest and biodiversity. The consequence of increased climate change in these various areas are shown to have effects on food security, water availability, distribution of biodiversity and most importantly, the health of the human population in the region. Strategies to mitigate and adapt to these changes include mass literacy, water resource management and regulation of agricultural practices in the region. The academic community hold the greater percentage of the key to mitigating the change especially where mitigation strategy such as advocacy and education are concerned. Recommendations are adopting International, National, Regional and Sub-regional policies addressing climate change and ensuring that corporations assume responsibility for the environmental impacts of their activities and choose suppliers that adopt sustainable practices.

INTRODUCTION

Weather is the state of the atmosphere at a given time and place, with respect to variables such as temperature, moisture, wind velocity, and barometric pressure. History has shown variability in the earth's climate via evidence ranging from glacial periods where a significant portion of the earth's surface was covered with ice, to interglacial periods where ice retreated to the poles or melted entirely (Strahler and Strahler, 2005). It is a concept that the principal elements of global climate can interact with one another in a complex manner to generate change (Burroughs, 2007). However, this interaction process spans hundreds of thousands of years rather than the rapid changes which have been observed within the last two centuries. Evidence such as increase in global mean temperatures since the industrial revolution era, especially within the mid 20th century have pointed to climate change occurring more rapidly due to anthropogenic rather than natural sources (NASA 2009). In the light of these various evidence, this article attempts to evaluate the rapid changes in the climatic states of regions across the globe with a particular interest in the change occurring in West Africa, its effects on the region and the role of the academic community in mitigating the change.

CAUSES OF CLIMATE CHANGE

Several natural factors have been found to drive the change in the earth's climate. Most of these could be said to have helped in sustaining the existence of life on the planet (IPCC, 2001). Odjugo (2010) gives an illustration of the various contributions of both natural and anthropogenic activities to climate change. Other factors which equally drive the change include:

Volcanic Eruptions

This natural phenomenon can impact the global climate as they project aerosols into the atmosphere and reflect incoming sunlight back into space (Strahler and Strahler, 2005). This activity reduces the amount of solar radiation reaching the earth's surface and lowers temperatures in the troposphere (Wolfe, 2000).

Variations in the Earth's Orbital Characteristics

The Milankovitch cycles which are changes in the planet's orbit (the shape of the earth's orbit around the sun, the earth's axis of rotation over a period of time and the rotation of the earth on its polar axis), can alter the seasonal and latitudinal distribution of solar radiation and result in changes in the earth's climate (Strahler and Strahler, 2005).

Greenhouse Effect

This is a natural process by which greenhouse gases (GHGs) and water vapour absorb and re-emit solar infra- red radiation, balances in coming solar radiation and out-going radiation and keeps the earth's temperature at a level that is warm enough to support life in it. These gases include: Carbon dioxide, Methane, Nitrous Oxide. Carbon dioxide is one of the most important gases responsible for the greenhouse effect and studies of long term climate change have discovered a connection between the concentrations of CO₂ in the atmosphere and mean global temperature (Pidwirny, 2007). Human activities however have in several ways affected the earth's climate through various activities including:

Burning of Fossil Fuels

Although the concentration of GHGs in the atmosphere have historically varied due to natural processes, the era of industrialization has mediated the addition of significant amount of these gases in the atmosphere through human activities (U.S.EPA, 2008). Fossil fuels such as coal, petroleum and natural gas account for the great majority of the world's energy use. Due to the extremely long time involved in forming these fuels, they are essentially non-renewable resources. Obtaining energy by burning fossil fuels produces oxides of carbon, sulphur, and nitrogen, soot and fine-particulate ash. Carbon monoxide, an oxide produced by combustion of all fossil and plant fuels, is converted to carbon dioxide, which contributes to an enhancement of the greenhouse effect of the earth's atmosphere, resulting in an increase of the annual average surface temperature of the earth on the order of 0.5-1 degree Celsius since the middle of the nineteenth century (Fay and Golomb, 2002).

Deforestation and Desertification

The domestication of grazing animals and forest clearing, to enable availability of land for agriculture and/ or the establishment of industries and houses, has lead to permanent formation of deserts in certain areas (Burroughs, 2007). In most countries within the West African region, the increase in rural-urban migration which is somewhat directly proportional to increase in

demand for housing facilities has increased deforestation and increased the exposure of land surface to factors which encourage desertification.

WEST AFRICA, THE JOURNEY SO FAR: THE ATMOSPHERE

The region is characterized by a mixture of climatic zones; Sahelian (irregular rainfall lasting not longer than three months and not exceeding 500mm); Sudanian (rainfall less than 88mm); Tropical humid (annual mean rainfall approximately 1500mm) and Equatorial (annual rainfall above 2000) (UNEP, 2006). Odjugo (2010) provides evidence of increasing temperature in Nigeria. From the study, the air temperature patterns were similar between 1901-1935 and 1936-1971 but differed significantly from the patterns recorded from 1971-2005. The rise in temperature is an important factor and indicator as it concerns the assessment of climatic change for any given region. The interpretations of rise in temperatures provide a better understanding of the extent to which climate change occurs when studied vis-à-vis the other various factors such as thunderstorms, lightning, landslides, floods, droughts, bush fires, unpredictable rainfall patterns, sea level rise, constant loss of forest cover and biodiversity, drying up of rivers/lakes, increase desertification and land degradation (IPCC, 2007).

Although Odjugo (2010) observed decadal temperature patterns in his study, the significant increase in temperature which was observed is greater appreciated in the NASA- GISS' illustration (Fig 2).

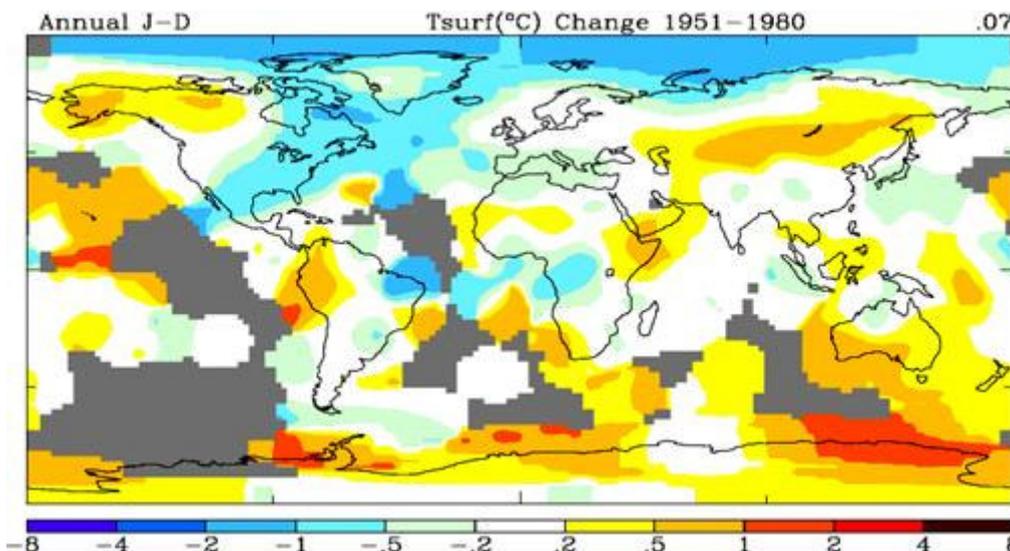


Fig 1: Annual mean surface temperature change, showing regional temperature between -0.5 and 0.5 degrees Celsius over a period of time (1951-1980). NASA (2009).

Temperature change is an obvious and easily measured evidence of climate change (IPCC, 2007). Evidence of surface temperature in the region reveals changes from an average of 0.2°C in the last twenty years to about 2°C as at 2008 (NASA 2009). Given the evidence of increased industrialization in the region, rural-urban migration resulting in densely populated cities, increased consumption of energy and necessity for transportation, the amount of factors which facilitate climate change has been increased and this could be seen as a rationale for the leap in surface temperature.

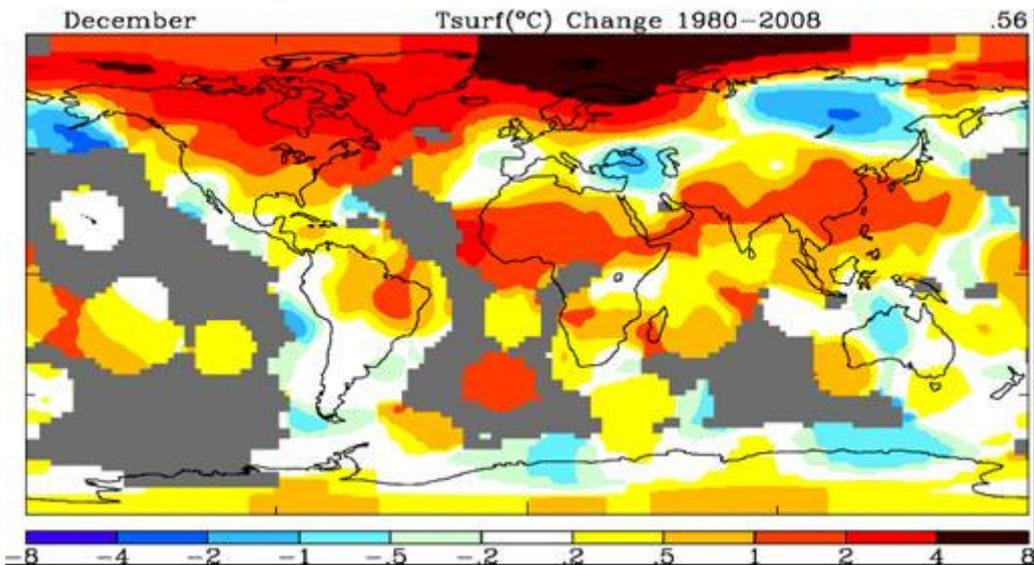


Fig 2: Monthly surface temperature between 1980 and 2008 showing increased change in regional surface temperature to about 2 degrees Celsius. (NASA 2009).

WATER RESOURCES

Wetland ecosystems and their diverse resources, provide food supply and income to many communities within the region (NEPAD, 2003). A classic example is the Niger River system which sustains biological communities including 250 freshwater fish species of which 20 could be termed as very rare species (WWF, 2002). Water resources in the region are characterized by extreme variability over both space and time and are highly vulnerable to variations in climate (UNEP, 2006). Lake Chad, once one of Africa's largest freshwater bodies and an important source of water and economic activity to the four countries (Chad, Nigeria, Niger and Cameroon) which share its resource, has been shown to dramatically decrease in size since the early 1960's with fifty per cent of its decrease attributed to human water use and the remaining fifty per cent attributed to shift in climate patterns resulting from the decline in rainfall since the 1960's (GSFC, 2001). It has been predicted that reduced rainfall and run-off, and increased desertification will see the lake shrinking even further (IPCC, 2001). The continuous loss of this water body will impact the availability of freshwater and the aquatic species contained in it for communities which depend on this water body.

The loss of Lake Chad can further be attributed to increased surface temperature which allows an increased rate of evaporation from the earth's surface (Buckle, 1996). This process has been encouraged by environmental pollution from sources such as detergents containing phosphorus, the leaching of fertilizers, sewage/ toxic dumping and heated water from the cooling systems of power plants (Mintzer, 1992). These pollutants allow the thriving of several micro organisms with algae as an example which results in the aging process and loss of the water body.



Fig 3: Loss of over 70 percent of the lake over three and half decades. The red colour (1973 and 1987) denotes vegetation on the lake bed and the ripples on the western edge of the lake denote sand dunes formed by the wind. The small patch of blue that is now the lake (2001) stands in great contrast to the wide swath of the old lake bed illustrated in green, indicating vegetation. Source: GSFC (2001). (<http://www.gsfc.nasa.gov/topstory/20010227lakechad.html>).

LAND

The agricultural and industrial revolution have sown seeds for profound impact on climate. Mechanization which enabled the clearing of native forests for extensive agriculture and livestock grazing has caused imbalance of heat and moisture exchange between the land surface and the atmosphere because forest clearing alters the amount of sunlight being reflected into space, increases rainfall runoff and reduces amount of moisture returning to the atmosphere (WHO, 2003). The exposure of land surfaces to the increasing prevalence of heavy rainfall currently experienced within the regions raises the fear that rural and even urban communities in West Africa could be eroded or completely destroyed.

FOREST AND WOODLANDS

The total forest cover in West Africa is said to be about 12 percent of its total land area (FAO, 2005), and certain forests (Guinea forest) are regarded importantly from biodiversity perspective due to their recognition as one of the world's biodiversity hotspots (CEPF, 2000). The forests and woodlands are a source of various medicinal and ornamental plants, fruits, honey, essential oils, meat and animal fodder (UNEP, 2006). The rate of deforestation is a major issue in the events contributing to climate change in the region. Agricultural expansion, overgrazing, urbanization and industrialization are the major threat to forest and woodlands as these activities deplete forest cover and expose the land surface to degradation through erosion and desertification.

BIODIVERSITY

This forms the basis for essential environmental services upon which life on the earth is dependent. It offers multiple opportunities for development and improving human well-being. The wide range of ecosystems (forests, savannahs, deserts, rivers, mountains, mangroves and seas) makes the West African region rich in biodiversity (UNEP, 2006). Half of the mammal

species on the African continent, including rare species such as Pygmy hippopotamus, Zebra, duiker and the drill are contained in the Guinea forest (UNEP and NESDA, 2004).

Climate change contribution to the decline of amphibian populations resulting from drastic reductions in the volume of water bodies after persistent dry weather, in combination with intensified human activities along the shorelines, has been recognized as the latest emerging threat to biodiversity in Africa (UNEP, 1999).

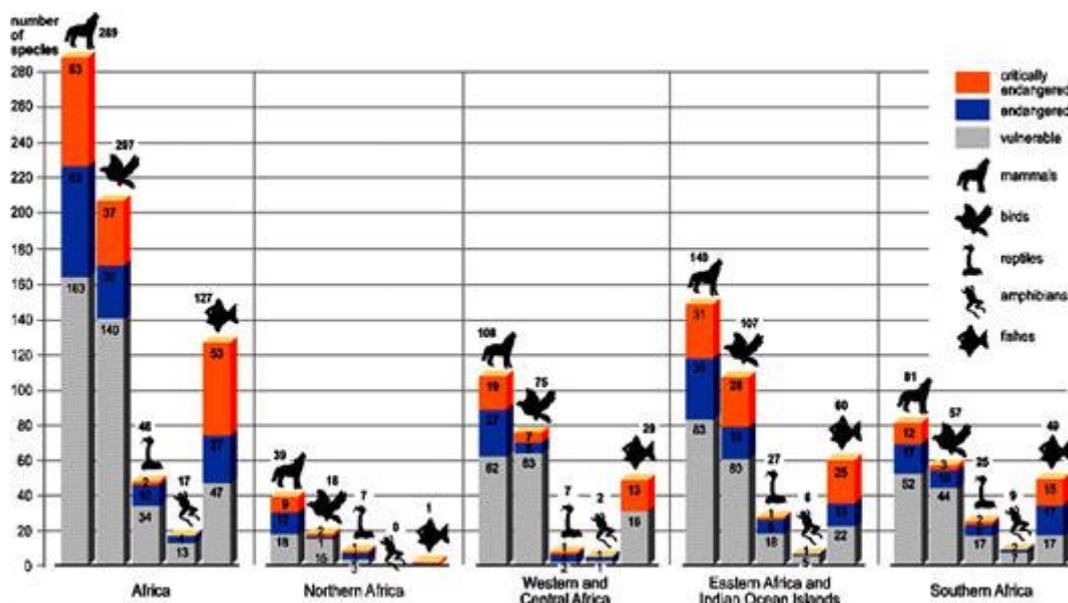


Fig 4: Threatened animal species in Africa, showing mammal, bird, reptile, amphibian and fish species, ranking each in the order of critically endangered, endangered and vulnerable to loss through climate change activities. Source: UNEP 1999.

POTENTIAL CONSEQUENCES OF CLIMATE CHANGE

Challenges to Agriculture and Food Production

Continuous climate change threatens to reduce agricultural production in the region due to events such as deforestation and fossil fuel combustion which drive the change and constitute global warming trends (Darwin, 2001). Increased green house gas emissions are associated with increase in mean global temperatures which will impact agricultural production by causing changes in growing seasons, sea level rise due to ocean expansion and increased frequency of weather events such as storms and floods (IPCC, 2001). The basic fact that the region's agricultural activities are essentially rain-fed makes it extremely vulnerable to climate change. Disturbing alterations in seasonal variations (patterns of rainfall and extended periods of drought) have been noticed and it could be said that more are expected.

The alterations in rainfall patterns have given rise to an increase in flooding. Between 1999 and 2008, Torrential rain led to the flooding of vast cultivated areas in Togo and especially Ghana (Karley, 2009). Similar cases of increasing rainfall intensity resulting in flooding has been experienced in most regions of Nigeria particularly the local communities with close proximity to water bodies (Odjugo, 2010). Improving agricultural extension services in order to increase awareness concerning the consequences of climate change on the agricultural sector especially crop production will improve adaptation. Establishing local, independent networks will

facilitate the exchange of information between communities across the region and improve adaptation to climate change within the region.

Rising Sea Level

Many greenhouse gases, including carbon dioxide, are estimated to remain in the atmosphere for more than a century and the effects on climate come through slowly, temperature and sea level will continue to rise during the twenty-second century, even if we stabilise emissions soon (Stern, 2006). Most of the damaging consequences of climate change are associated with water in some shape or form, including droughts, floods, storms, and sea level rise. Flooding from rainstorms may become worse if higher temperatures lead to increasing rainfall intensity during severe storms. An increase in the intensity of tropical storms would increase flood and wind damages. Levels of freshwater withdrawal in the region only represents about 1 to 3% of the region's total renewable water resources estimated at over 1000 billion cubic meters and the prevalence of current trends will see water withdrawal level increasing six fold before 2025 (GWP, 2000). The increasing temperature and decreasing rainfall in the semi-arid region of Northern Nigeria could be held responsible for the increasing evapotranspiration, drought and desertification in a few northern Nigerian states. (Adefolalu, 2007).

Health Effects

Most of the prevalence of diseases and other threats to human health is seen to largely depend on local climate change (WHO, 2003). Extreme temperatures could lead to disturbances in ecological systems as well as changes in a range of infective parasites which indirectly would impact the incidence of infectious diseases (U.S EPA, 2009). The rise in temperature will increase air and water pollution and result in high incidences of diseases associated with these various types of pollution, mostly cancers (IPCC, 2007). The increase in torrential rainfall and flooding will provide breeding habitats for certain pests and parasites thus increasing the regions risk to pest and parasite related diseases such as Malaria and Dengue fever.

Changing Forests and Natural Areas

The cultural identity of any region on the globe is deeply rooted in its biological environment because the plants and animals existing in these regions tend to define our lifestyles, most especially our dietary lifestyle (CBD, 2000). Apart from the loss of valued species of both crops, animals, insects and micro organisms, the West African region runs the risk of losing its cultural identity entirely to climate change.

Mitigation and Adaptation

“The effects of our actions now on future changes in the climate have long lead times. What we do now can have only a limited effect on the climate over the next 40 or 50 years. On the other hand what we do in the next 10 or 20 years can have a profound effect on the climate in the second half of this century and in the next” (Stern, 2006). Immediate reverse of the change is almost impossible, given the numerous data illustrating how far climate change has come. Considering the rapid rate and as Stern (2006) clearly puts it, whether we are willing or not is no longer an option as our past activities have invested enough factors to drive the change much longer. Therefore, measures to equip and enable the region adapt to these changes are of great necessity. A few measures include:

Education and Advocacy

Empowering individuals as well as local communities through workshops and programmes designed to educate and inform them of the importance of the various elements of weather/

climate to the different regions and the sustainability of life, the dangers of climate change and the need to cooperate with the Government in their effort to combat further changes in the climate of the region would be a great step towards adapting and reducing if not reversing the effects of climate change in the region. The use of press and visual media in educating the population of the various countries within the region on the need to adopt green and sustainable practices would be a great investment towards halting an increase in the trend of climate change.

Water Resource Management

Improving access to safe and adequate water supply. Improving irrigation technology, enhancing natural environments, and developing better institutional capacity for water resource management in countries within the region. The long-term environmental consequences of resource use must be addressed with integrated planning that involves people responsible for disaster response and water resource management.

Regulation of Agricultural Practices

The promulgation of decrees and formulation of policies addressing indiscriminate deforestation, grazing and other agricultural activities which have driven climate change will be a necessary mitigation strategy. Adopting sustainable agricultural practices such as afforestation and shifting cultivation should be encouraged. Government supported research into improved species of agricultural crops especially the crops largely cultivated in areas at high risk to the change would be a great investment.

RECOMMENDATIONS

A key mitigation strategy for climate change involves education and advocacy. This is achievable if every member of the academic community becomes an activist against the change. By this, every opportunity to spread the awareness of its effects and mitigation/adaptation measures would be seized by it in the classrooms, lecture halls, offices and lots more. In championing the cause to mitigate and adapt to climate change, it is most important that the entire members of the various societal classes are adequately informed and accommodated within the various mitigation and adaptation programmes as the dangers and threats posed by the changes in the region and global climate cuts across the various societal class.

The government could play a great role using the following;

- Adopt International, National, Sub-regional and Regional policies addressing climate change.
- Revise and harmonize policies on climate change among countries in the region.
- Ensure cooperation in the development of river and lake basins; in the development and protection of marine and fishery resources; and in plant and animal protection among countries in the region.
- Ensuring that corporations assume responsibility for the environmental impacts of their activities and choose suppliers that adopt sustainable practices
- Reducing reliability of Fossil fuels and increasing research into forms of renewable energy and technologies which discourage reliance on grey energy.

- Increased government participation/ adequate funding for research into clean and alternative fuel, improved agricultural species and adaptation strategies
- Set up committees to regulate activities within the immediate communities which would aid climate change, encourage activities that mitigate the change
- Frequent awareness campaigns through media such as peer group activities, action weeks, seminars and workshops

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