



Climate Change in Africa: Challenges for the 21st Century

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ABSTRACT

Climate change characterized as global warming has caused remarkable rise in sea levels, increase in intensity of extreme weather events, significant changes in the amount and pattern of precipitation, changes in agricultural yields, glacier retreat, increases in the ranges of disease vectors and mass species extinctions. Climate change has the potential to reverse the Millennium Development Goals of sustainable development. Understanding the potential impact of climate change and addressing the issues therein are fundamental to environmental stability and sustainability in the 21st century.

Keyword: Climate Change, Africa, Challenges, 21st Century.

INTRODUCTION

The impact of global warming on the environment and human life are numerous, varied, accelerating and taking scientists studying global warming by surprise. Unchecked global warming could affect most terrestrial ecoregions. Increasing global temperature means that ecosystems will change, some species are being forced out of their habitats because of changing conditions, while others are flourishing. Secondary effects of global warming, such as lessened snow cover, rising sea levels, and weather changes, may influence not only human activities but also the ecosystem (Mayhew, Gareth and Timothy, 2007). Studies suggest that a warmer climate in the United States would result in ecosystematic imbalance and cause lower elevation habitats to expand into the higher alpine zone (Smith and Tirpak, 1989). High elevation plants and animals have limited space available for new habitats as they move higher on the mountains in order to adapt to long term changes in regional climate. The depth of mountain snow packs and glaciers have also been affected by changes in climate. Thus, changes in their seasonal melting can have powerful impacts on plants and animals that rely on freshwater runoff from mountains. Rising temperature as a result of climate change may cause snow to melt earlier than expected and faster in timing and distribution of runoff. These changes could affect the availability of freshwater for natural systems and human uses, thus altering the ecosystem.

Species of plants and animals have been known to either increase or decrease in quantity and size due to climate change. For example, pine forest in British Columbia have been devastated by a pine beetle infestation, which has expanded unhindered since 1998 at least in part due to the lack of severe winters since that time; a few days of extreme cold killed most mountain pine beetles and have kept outbreaks in the past naturally contained (Jeremy, 2002). Also, the effects of carbon-dioxide released into the environment can spur growth of flora up to a point, which suggests that slow growing trees are stimulated in growth for a short period under higher carbon-dioxide levels, while faster growing plants like liana benefit in the long term (Jeremy, 2002). Scenarios studied by the Intergovernmental Panel on Climate Change, 2007, predict that global warming will continue and get worse much faster than was expected even changes in the timing of seasonal patterns in ecosystems. The IPCC further reports that the effects of global warming will be mixed across regions, countries and continents. For smaller values of warming of 1 °C to 3 °C, changes are expected to produce net benefits in some regions and for some activities and net costs for others. Greater warming may produce net costs in all regions. Developing countries are vulnerable to reduced economic growth as a result of warming (Smith, Weitz & Mix, 2007).

The Earth's temperature is rising and many consequences of global warming once though controversial are now being observed, it is based on this that one asserts that the earth's life-sustaining ecosystem is being assaulted by urbanization, deforestation, bush burning, pollution, extinction, migration and displacement of species. What is more, if human



activity is causing global warming, we may have years not centuries, to make the needed changes. At the very least, making such changes would mean promptly addressing the root cause of the earth problems-climate change- which is the result of human activities, greed, self interest, ignorance, inept government and apathy.

Causes of Global Warming

Many people are of the view that the earth is warming, but they are uncertain of both the causes and consequences. Human activities may be a factor, but not necessarily the primary one. However, the physical processes that underlie changes in the state of the climate that occur externally from variation in the sun's output and internally from changes in the concentrations of atmospheric gases, mountain building, volcanic activity and changes in surface or atmospheric albedo are factors responsible for climate change resulting in ecosystemic imbalance (Pidwirny, 2006). The work of climatologists has found evidence to suggest that only a limited number of factors are primarily responsible for climate change. One of such factors is the variations in the Earth orbital characteristics which laid claim to the Milankovitch theory which suggests that normal cyclical variations in the three of the earth's orbital characteristics is probably responsible for some past climatic change. The basic idea behind this theory assumes that overtime these three cyclic events vary the amount of solar radiation that is received on the earth's surface (Pidwirny, 2006). The first cyclical variation, known as eccentricity controls the shape of the Earth around the sun. The second cyclical variation results from the fact that, as the Earth's rotates on its axis it wobbles like a spinning top changing the orbital timing of the equinoxes and solstices resulting in the precession of the equinoxes and thirdly, cyclical variation is related to the changes in the obliquity of the Earth's axis of rotation over a 41,000 years period. When the tilt is small, there is less climatic variation between the summer and winter seasons in the middle and high latitudes; while periods of a larger tilt result in greater seasonal climatic variation in the middle and high latitudes. At these times, winters tend to be colder and summers warmer. Colder winter produce less snow because of lower atmospheric temperatures. Moreover, the warmer summers produced by larger tilt provide additional energy to melt and evaporate the snow that fell and accumulated during the winter months (Keeling and Whorf, 2006).

Another cause of climate change is the atmospheric carbon dioxide variations as studies of long term climate change have discovered a connection between the concentrations of carbon dioxide in the atmosphere and mean global temperature. Carbon-dioxide is one of the most important gases responsible for the greenhouse effect. Atmospheric gases, like carbon-dioxide, water vapour and methane are able to alter energy balance of the Earth by being able to absorb longwave radiation emitted from the Earth's surface. The net result of this process increases the quantity of heat energy in the earth's climatic system (Keeling & Whorf, 2006). Without the greenhouse effect, the average global temperature of the Earth would be cold minus 18° Celsius rather than the present 15° Celsius. According to Pidwirny (2006), over the past three centuries, the concentration of carbon dioxide has been increasing the Earth's atmosphere because of human influences. Human activities such as the burning of fossil Fuels, conversion of natural prairie to farmland and deforestation have caused the release of carbon dioxide into the atmosphere. Thus, the high concentration of carbon-dioxide in the atmosphere will enhance the greenhouse effect making the planet warmer. Also, explosive volcanic eruptions have been shown to have a short-term cooling effect on the atmosphere if they eject large quantities of sulphur dioxide into the stratosphere (Post, 2007). For example, Mount Pinatubo ejected about 20 million tons of sulphur dioxide into the stratosphere and researchers believe that the Pinatubo eruption was primarily responsible for the 0.8 degree Celsius drop in global average air temperature in 1992. Also, measurements made by satellites equipped with radiometer in the 1980s and 1990s suggested that the sun's energy output showed a decrease of 0.1 percent in the total output of solar energy reaching the earth. Thus, any change in its output will result in changes in the reception of isolation and generation of heat energy which drives the climate system resulting above all in global warming (Pidwirny, 2006).

Effects of Climate change on the Ecosystem



The dangers posed by climate change are nearly as dire as those posed by nuclear weapons (NASA, 1992). Thus, variations in climate has led to increased risk of many species, such as the polar bears at the Arctic and Antarctic regions (Armstrup and Thiemann, 2006). In the Arctic, the waters of the Hudson Bay are ice-free for three weeks longer than they were thirty years ago affecting polar bears. Species such as gyrfalcons and snowy owls are worst hit (Koshimies, 1999). Climate change resulting in rising temperatures is beginning to have a noticeable impact on birds (Hirsch, 2005). Butterflies have shifted their ranges northward by 200kilometres in Europe and North America. Plants lag behind and larger animals' migration is slowed down by cities and highways. In Britain, spring butterflies are appearing an average of 6 days earlier than two decades ago (Convey and Menze, 2002). Also seasonal behaviour by plants and animal species show recent change as four out of five species shifted their ranges towards the poles or higher altitudes. Frogs were breeding, flowers blossoming and birds migrating average 2.3 days earlier each decade; butterflies, birds and plants moving towards the poles by 6.1 kilometer per decade (Root, Price and Hall, 2003). Human activities have been linked as the cause of temperature rise and resultant changing species behaviour. According to McLaughlin (2002) species of butterfly are being threatened by precipitation change and linked extinctions of species to recent climate change.

Many species of freshwater and saltwater plants and animals are dependent on glacier-fed waters to ensure a cold water habitat that they have adapted to. According to Jeremy (2002), some species of freshwater fish need cold water to survive and to reproduce and this is especially true with salmon and cutthroat trout. Alterations to the ocean currents, due to increased freshwater inputs from glacier melt, and the potential alterations to thermohaline circulation of the world's oceans, may affect existing fisheries which humans depend. Rising temperature has caused the disappearance of glaciers thereby causing the shortages of freshwater for over 40 percent of the world's population. Also at risk are thousands of species of animals, including polar bears, whose hunting grounds are largely on the ice (Armstrup and Thiemann, 2006). In another development, forests especially in North America potentially face an increased risk of forest fires. The ten year average of boreal forest burned in North America, after several decades of around 10,000 square kilometer, has increased steadily since 1970 to more than 28,000 square kilometers annually (Jeremy, 2002). This change may be due in part to changes in forest management practices. Also, forest fires in Indonesia since 1977 has started to clear forest for agriculture. These occur from time to time and can set fire to the large peat bogs in that region. The carbon-dioxide released by these peat bog fires has been estimated, in an average year, to release 15 percent of the quantity of carbon dioxide produced by fossil fuel combustion (BBC News, 2006). Also changes in global climate pose a number of potential risks to mountain habitats and researchers expect that overtime, climate change will affect mountain and lowland ecosystems, the frequency and intensity of forest fires, the diversity of wildfire and the distribution of water.

Increasing average temperature and carbon-dioxide may have the effect of improving ecosystem productivity. In photorespiration, oxygen can enter plants chloroplasts and take the place of carbon dioxide. This causes the sugars being made to be destroyed thus, suppressing growth. Higher carbon dioxide concentrations tend to reduce photorespiration (EPA, 2006). Climate change has led to the displacement of persons and species of plants and animals as a result of hurricane surge in parts of Florida in the United States and other parts of the world. Millions of people have been displaced in such places as Shanghai and Calcutta as well as parts of Bangladesh. Increasing deaths, displacements and economic losses projected due to extreme weather attributed to global warming may be exacerbated by growing population densities in affected areas, although temperate regions are projected to experience some benefits, such as fewer deaths due to cold exposure (Knutson, 2008). Also studies of climate change on the ecosystematic imbalance predicts 18 percent to 35 percent of a sample of 1,103 animal and plant species would be extinct by 2050, based on future climate projections (Thomas, 2004). However, few mechanistic studies have documented extinctions due to recent climate change and one study suggests that projected rates of extinction are uncertain (Botkin, 2007).

Vulnerability of Africa to Climate Change

Developing countries, particularly Africa, appear at greatest risk from the effects of global warming; although their



emission are small when compared to the developed countries (Revkin, 2007) Climate change, especially indicated by prolonged drought is one of the most serious climatic hazards affecting the agricultural sector of the Africa continent. As most of the agricultural activities in African Countries hinges on rain fed, any, adverse changes in the climate would likely have a devastating effect on the sector in the region and the livelihood of the majority of the population.

Climate change in the already arid northern sub-region of Africa has enhanced desertification and brought about gradual decrease in forest cover thereby leading to extinction and displacement of species. In the Sahara and Sahel sub-regions, rainfall is expected to drop, resulting in soil degradation and an increasing number of dust storms. In northeast Africa, more intense dry periods and shorter wet seasons are expected to affect even huge river systems such as the Blue Nile, leading to serious water shortages and adverse consequences for agriculture and forestry sectors throughout the region. According to EPA(2006), Africa is losing nearly 10 million acres of forest every year-twice the worlds average deforestation rate. Across Africa the landscape is changing. The snowy caps of Mount Kilimanjaro, disappearance of glaciers in Uganda's Ruwenzori mountains are melting and the shorelines of Lake Chad, Tanganyika and Victoria are receding. The once mighty Lake Chad is half the size it was 35 years ago. These and many other changes have led to unreliable farming seasons and low water supplies- a serious problem for a continent almost entirely dependent on rain for its agriculture. Erosion as well as chemical and physical damages have degraded about 65percent of the continent's farmlands.

Adverse temperature, precipitation, sea level rise, atmospheric carbon dioxide content and incidence of extreme events may affect the agricultural sector through the reduction in crop yields and agricultural productivity. In the tropics and subtropics, due to high temperature, crop yields are likely to decrease. Climate change, therefore is expected to worsen the food supply hence exacerbate the widespread poverty in the Africa region. An increase in temperature is likely to reduce soil moisture, moisture storage capacity and the quality of the soil, which are vital nutrient for agricultural crops. It is also expected that the availability of water in most parts of Africa would decrease as a result of climate change. Rising temperature is likely to cause the manifestation of vector and vector borne diseases, where an increase in temperature and humidity has created ideal conditions for diseases, such as malaria, sleeping sickness and other infectious diseases that will affect man's productivity. Africa's vulnerability to climate change and its inability to adapt to these changes may be devastating to the ecosystem, thereby resulting in imbalance. This has affected virtually all sectors of the African economy.

RECOMMENDATIONS

Global warming will continue to increase and its effects on developed and especially on developing countries will be hazardous. This has led some nations, states, corporate bodies, non-governmental organizations and individuals to implement actions to try to curtail global warming or adjust to it. It is on this premise that this paper recommends:

- ❖ Countries should tackle and reduce their emission and production of fossil fuel.
- ❖ Nations should redouble their efforts at tackling pollution and global warming (Wen, 2007).
- ❖ The need to promote improved energy technology as a means of combating climate change. Accordingly, "the United States is committed to strengthening our energy security and confronting global climate change. And the best way to meet these goals is for America to continue leading the way toward the development of cleaner and more energy efficient technology" (Bush, 2008).
- ❖ Key practices and technologies in energy supply, transportation, industry, commerce and agriculture should be implemented to reduce global emissions,
- ❖ Developed countries should assist developing countries adopt alternative energy sources in order to reduce carbon emissions. Also, developed countries such as the United States and China should bear the cost of emissions.
- ❖ Campaigns should be intensified to emphasize the potential risks of climate change and promote the implementation



of stricter controls.

- ❖ Fossil fuel companies should scale back their efforts and call for policies to reduce global warming.
- ❖ With collective effort, with all partners in the international community cooperating to improve financing, combating, share knowledge and adopt advanced technologies faster, we can rise up to the challenge of fighting climate change in order to safeguard the ecosystem.

CONCLUSION

Global warming has increased the potential geographic range and virulence of tropical diseases. It has caused a major increase in insect-borne diseases such as malaria throughout Europe, North America, Africa and Asia. Climate change has made organisms and ecosystems adapt to a narrow range of pH and thus raised extinction concerns, directly driven by increased atmospheric carbon dioxide which have disrupted food webs and human societies that depend on marine ecosystem services.

The utmost concern therefore should be a better understanding of the potential impact, of the current and projected climate changes on the ecosystem in order to safeguard the environment for sustainable development in the 21st century.

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