

Mitigating the Effects of Climate Change in Semi-Arid Zones of Nigeria

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Abstract

Climate change is one of the greatest environmental challenges facing the world today and which has attracted the attention of many environmental scientists. Atmospheric concentrations of Greenhouse Gases (GHG) are rising rapidly as a result of anthropogenic activities. By burning forests and deforesting the earth, mankind is increasing carbon dioxide levels. Our intensive agriculture and leaking natural gas lines are major sources of methane (CH₄). Our industries are emitting chlorofluorocarbons (CFCs). Nitrous oxides levels are rising rapidly for reasons that are less clear. Less than 200 years since we began making major emissions greenhouse Gases are said to have been rising to levels higher than that previously seen. This is likely to be compounded by rising human population, which is most likely to multiply such activities that impinge on climate. This paper highlights potential impacts of climate in semi-arid zones of Nigeria and proffers adaptive and mitigation strategies

Key words: climate change, greenhouse gas, semi-arid, sequestration

Introduction

There are a number of environmental often inter-related and which have attracted much study and debate internationally. For example, population growth, conservation of resources, biodiversity and climate change. Of these, the later has been of greatest direct concern to the energy industry in the 1990's. The need for detailed study and policy development on an international scale led to the establishment of the inter-governmental panel on climate change (IPCC) and the united Nations framework convention on climate change (UNFCCC).

Available records indicate that the earth is warming and that the 1990's were the hottest decade of the entire millennium and 1997, 1998 and 1999 were three of the hottest years ever (WMO, 2001). The growing scientific consensus is that this warming is largely the result of emissions of carbon dioxide and other greenhouse gases from human activities including industrial processes, forest fuel combustion and changes in land-use, such as deforestation, degeneration and defoliation

of forests among others. In addition to warming, increases in sea level and changes in precipitation patterns including more frequent floods and droughts are likely. These changes over time are referred to broadly as 'climate change'

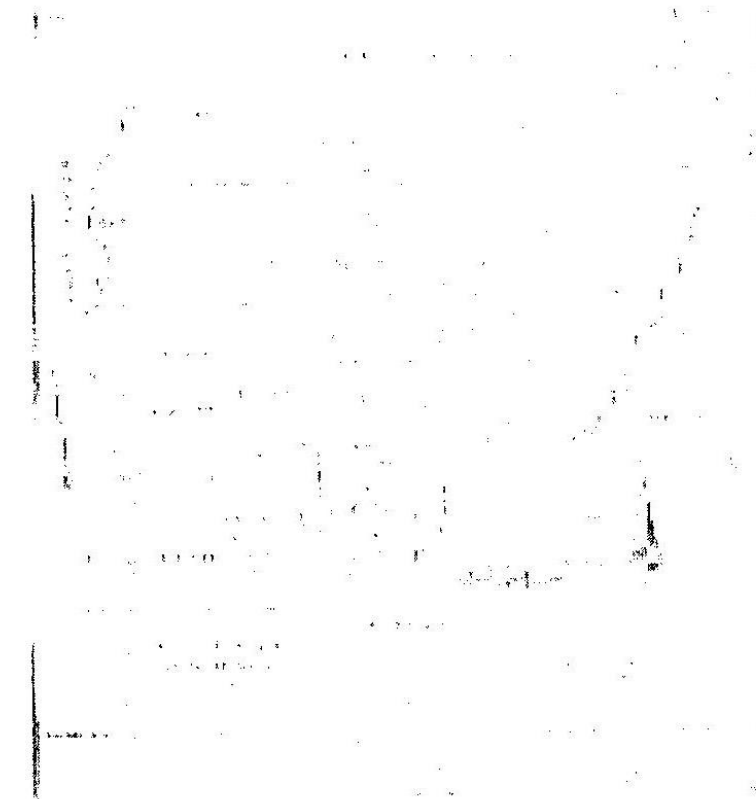
However, it is instructive to note that in spite of great advances that have been made in understanding and dealing with the problem of climate change at the international level, awareness of and concern for the problem at national or local remain poor or in some cases non-existent (NEST, 2003). The present study therefore attempts to look at the problem with particular reference to the semi-arid zones of Nigeria

Potential impacts of climate change in semi-arid zones of Nigeria:

There is a growing scientific consensus that virtually all ecological regions in Nigeria and their associated sectors spanning from the coast to the semi-arid north are vulnerable to climate change (NEST, 2003). The semi-arid zones of Nigeria comprise such states as Bauchi,

Borno, Yobe, Kano, Katsina, Jigawa, Sokoto, Kebbi and Zamfara and the several

degraded parts of Plateau state (see fig:1).



Available meteorological data on surface air temperatures for Sokoto, Kano, Bauchi, Katsina, Jigawa and Maiduguri show evidence of increasing surface air temperatures in recent years. This has led to increasing incidence of heat waves and its attendant health hazards as rightly reported by Abdullahi (2004) when several people were said to have been hospitalized in Dutse, Nigeria because of extreme temperatures. Related aspect of the impacts of increased temperatures in these zones is increase in energy demand for space cooling which would mean increase in energy bills particularly for urban dwellers. Increase temperatures in these regions encourage high rates of evaporation and consequent lower water balance levels. The high evaporation rate from water surface in rivers and lakes cause by increase in

temperature are likely to deplete the water resources and render them inadequate for large irrigation projects (Gairnier, 1968). Reduced agricultural productivity in these region arising from lower yields is suspected to be exacerbated by climate change and related events. Increase drought incidence in these regions would decrease water availability to crops and animal leading to severe reduction in yield and animal production which might ultimately lead to food insecurity, disruption in the supply of agricultural raw materials, loss of revenue, malnutrition and environmental displacement. Interregional trade, especially between southern and northern part of the country might be threatened. Improper land use practices, in these regions which is manifested in indiscriminate bush burning, removal of

farm residues over grazing, over cultivation deforestation largely for fuel wood, is most likely to increase drought incidence and desertification. These may contribute significantly to harmattan dust which may ultimately reduce the efficiency of renewable energy resources such as solar energy systems available in these regions through deposits of thin shields of dust on photovoltaic modules as rightly confirmed in the works of Yahaya and Sambo (1991). Studies have also shown that the large amount of dust in semi-arid area is likely to increase the subsidence rate by as much 50 percent. The dust cuts off much of the short wave solar radiation by scattering and this affects the albedo of the earth (Angstrom, 1962). The dust loading also produces greater cooling and radiation divergence in the troposphere (Chakravati, 1978). Thus, this phenomenon may lead to greater adiabatic cooling and enhanced atmospheric subsidence desiccation and drought on the margins of the desert. Similarly, Agho (2003) opined that there is possibility of dislodgment of solar and wind installation by strong wind storm aggravated by climate change. He noted that change in wind direction might render the wind resource useless particularly if the windmills have fixed orientations that are not aligned with the new direction.

Adaptation and Mitigation Strategies

Available evidence from various climatic zones suggests that present level of human adaptation to climate change is high and people have shown capacity to make a living in most climatic zones on the planet. With particular reference to the semi-arid zones of the country, Several adaptive techniques against the effects of climate change have been adopted which is implicated in the phenomenon of unpredictable rainfall patterns.

In his article Okpara (2003) have drawn our attention to the fact that local resource users respond to inadequate and unpredictable rainfall in Nigeria's dry belt triggered by climate change through the following:-

- i. Farmers see the planting of quick maturing species of varieties of crops (such as extra early maize or millet) as a way of combating desertification, because such plants make minimum demand on the scarce local water resource base. This same practice represents a coping mechanism or an adaptive strategy against the impact of climate change.
- ii. The practice of mulching with layers of straw on ridges in order to minimize the rate of evaporation is both a strategy for combating desertification as well a rational response to the effects of climate change.
- iii. Some farmers show preference for millet rather than maize as a way of adapting to the physical environmental conditions of the dry lands. Maize ordinarily requires more moisture and more frequent rains than millet. Planting millet therefore makes a lower demand on the water resource base of the dry land locality than maize. The practice thus responds to the incidence of desertification and the impact of climate change.
- iv. Farmer's practice bounding in order to trap rains and flood water for use during the dry season. Harvesting water through such bounding prevents the loss through run-off of an appreciable quantity of water, which is a critical resource in the dry lands. The practice assists in combating desertification in view of

its potential to provide water for sustaining plant and crop growing as well as animal rearing during the dry season. It is equally an adaptive strategy against the effect of climate change.

- v. An important aspect of combating land degradation is the judicious and optimum utilization of available soil moisture. Farmer in Nigeria's dry belt manifest their traditional knowledge in this regard by their preference for planting crops at the beginning of the cropping season along furrows rather than ridges. They perceive the ridges as harboring greater amounts of soil moisture and plant nutrients than the worn out ridges that were sites of field crops during the previous planting season. Planting along furrow therefore enables them to maximize plant access to and utilization of available moisture. Crops involved in this farm practice include millet, Cowpea, sorrel, etc. The planting season represents for the farmers, a tested strategy for combating land degradation or desertification. This practice is within the dry belt more than anywhere else, a time-tested adaptation to one of the long-term effects of climate change.

Mitigation Strategies through Carbon-Sequestration

Carbon sequestration is a strategy to slow the build up of greenhouse gases by keeping carbon-dioxide out of the atmosphere by storing the gas of its carbon component somewhere else (NEST, 2003). The simplest way to sequester carbon is to preserve trees and to plant more. In fact, wide range projections are available about the amount of carbon dioxide that can be

absorbed by trees(carbon-sinks) over the next decade(NEST,2003).Although, Houghton (1996) in his studies argues that substituting wood for fossil fuels reduces emissions of carbon indefinitely while afforestation withdraws carbon from the atmosphere for only a few decades. Thus, afforestation is not a long-term solution for removing carbon from the atmosphere.

Forestry projects (such as community based forestation and agro- forestry) are among the most effective measures that can help to lower net green house gas emissions to the atmosphere in several ways. The first is to prevent the carbon stored in standing forests from being released into the atmosphere. This can be achieved by reducing deforestation or by improving forest management practices such as reduced impact logging that reduces damages to the surrounding vegetation. For every forest or other ecosystems that is spared this excess carbon is stored and kept out of the atmosphere. The second is to actively increase carbon stocks, known as carbon sequestration through tree planting, improved soil management or by enhancing natural regeneration of degraded forestlands.

Forestation and reforestation are two most effective strategies that can play a significant role in mitigating the effects of climate change in the semi-arid belt of Nigeria. afforestation is artificial establishment of forest on land that was previously under different use (agriculture, peat extraction, mining e.t.c.), while reforestation is artificial establishment of forest on former forested lands (it should include post fire and post harvest regeneration).

In the semi-arid zones of Nigeria, forestation Programmes were vigorously pursued after the disastrous drought of 1972/1973. The arid zone forestation

projects (AZAP) achieved only limited success in some areas as village communities planted trees for shade and fruit in many semi-arid areas as noted by Adamu, (1993), and that little progress has been made in terms of the area covered since 1967 (NEST, 2003). It is pertinent to point out that the ability of any forestation Programme to stem the tide of climate change in these regions must depend very much on pursuit of mass afforestation Programmes in rural and per-urban areas accompanied with high community participation rather than more planting of shelter belts. As a measure to reduce the use of fuel wood for domestic cooking and heating, the use of improved cooking stove developed by the Sokoto energy research center (SERC) should be highly popularized throughout the semi-arid zone of the country.

In a related development, Nigeria should borrow a leaf from china by planting more large forest areas including "fuel forests" and introduce new varieties of highly productive, rapid growth, multiple use trees with high thermal values. This approach would significantly lessen the serious energy shortage in rural and urban areas of the country.

Sequestration through improved management of cultivated land

This involves improve tillage, water management and cropping practices that can increase the levels of soil carbon. Improved practices encompass a variety of tillage systems that reduce the loss of soil and water from cultivated land. Such conversion tillage (CT) systems will according to schlesinger (1990) leave more crop residue on the soil surface and lessen the amount of soil aggregate disturbance relative to conventional tillage practices, thereby increasing soil carbon levels. Similar observation were earlier made by

Quattro (1977) emphasizing that such techniques makes soil, water and other natural resources more sustainable. It is therefore pertinent to state that the practice of removing crop residue after harvesting in the zones should be totally discouraged through creating awareness of and concern for the problem of climate change at local and national levels. In this regard different stakeholders should continue their effort to provide public awareness of energy conservation through intensive education and effective dissemination of pertinent information.

Conclusion

This paper has examined the phenomenon of climate change and its potential impact in the semi-arid zones of Nigeria. It is observed that people in the semi-arid zone of the country have shown the capacity to adapt to the impacts of climate change. Strategies to slow down the build up of greenhouse gases through carbon sequestration were also highlighted. It needs to be reiterated that one of most effective ways to reduce emissions of carbon to the atmosphere is to decrease the rate of deforestation and increasing the area of forests. There is no doubt that these strategies or approaches will usher in an era of greater sustainability of the country's environment.

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