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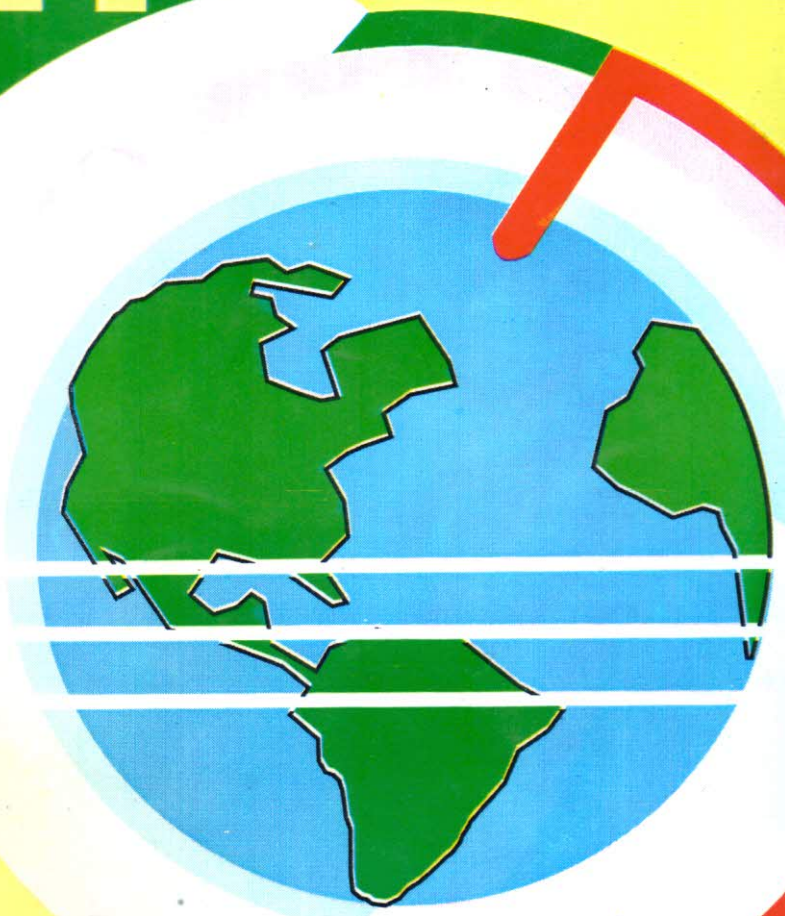

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CLIMATE CHANGE AND DESERTIFICATION: THE NIGERIAN PERSPECTIVE

Ojoye, S.
Department of Geography,
Federal University of Technology,
Minna, Nigeria.
dejyojo@yahoo.com.

Abstract

Desertification is a global phenomenon which has a devastating effect on the environment where they ravaged. The scorge is brought about by human activities which are controllable. This paper examines desertification in arid and semi-arid regions of Nigeria Vis-a Vis the consequences of global climate change. It also appraise the actions been put in place by the government to reduce the effect on the teeming population.

Keywords: Climate, Change, Impact, Desertification, Nigeria.

Introduction

Desertification, like climate change and loss of bio-diversity, is a global problem. However, it causes are complex, frequently local, and vary from one part of the world to another. The severity of impact also varies with less- developed countries experiencing greater human misery than those with the resources to provide short and long term relief to affected populations. Desertification problems have therefore become inextricably linked with food security, poverty alleviation and lack of development in poor countries while in developed countries the emphasis is on environmental degradation, inappropriate land use, loss of biodiversity and rural restructuring. Desertification problems have also become linked with the long term drought which have affected some parts of the world such as the African Sahel and were experienced in large parts of Nigeria most especially in areas north of latitude 10 degrees north.

This paper examines the issue of desertification in Nigeria, a developing country with a large arid and semi-arid zone whose principal land use on a larger basis is pastoralism. While every nation is different, there are parallels between what is happening in Nigeria and events in parts of South Africa. South America and the southern USA. All these areas were colonized by the Europeans in the last few centuries and have larger scale commercial grazing based on exotic animal species which is often export oriented. All face the cost price squeeze affecting agriculture

and all are associated with environmental degradation. There may therefore be common lesson to be drawn. Accordingly, the paper examines the extent and impact of desertification in Nigeria, explores the links with climate, and summarizes the policy response: it also raises some of the key questions which have yet to be answered about the problem.

The Desertification Issue

- **International perspective**

According to the International Convention to combat desertification (CCD: United Nations, 1994): Desertification means land degradation in arid , semi-arid and dry sub-humid areas resulting from various factors , including climatic variations and human activities, with the arid, semi-arid and dry sub-humid zone defined as '..... Areas, other than polar and sub-polar regions, in which the ratio of the annual precipitation to potential evapo-transpiration (PET) falls within the range from 0.05mm to 0.065.' Land degradation is defined as; "..... Reduction or loss of the biological or economic productivity and complexity of rain fed cropland, irrigated cropland or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes including processes arising from human activities and habitation patterns, such as:

(i) Soil erosion caused by wind and/or water
(ii) Deterioration of the physical, chemical, biological and economic properties of soil; and
(iii)Long term loss of natural vegetation.

The definition is unambiguous on the issues of what and where, but the question of why is not clearly answered. Put simply, this is because there are two polarized views on the causes of desertification (Warren and Khogali, 1992). At one extreme is the view that drought, which is normally a short term, natural fluctuation in climate which accelerate the long term rate of land degradation (Hull and Peter, 1996). This implies that when long term reductions in rainfall occur, such as those which have affected parts of the African Sahel over the last 30 years or so, the resultant degradation is a largely natural phenomenon and beyond the control of the nations experiencing it. At the other extreme is the view that traditional land use systems are often well adapted to periodic drought (Ellis et al. 1993). Desertification therefore tend to be human induced and arises because of pressure on land resources due to rising populations, unwise development policies and misuse of the land(Graetz, 1996).

The above two views are partially true but most desertification has multiple causes. Some of the extreme droughts experienced recently in both the Sahel and

other parts of the world may be a consequence of human-induced climatic change. Further complexity is added by the fact that vulnerability to drought increases as land resources become degraded and pressure on land often increases as population expands.

There is little doubt that desertification is a global problem but its complex nature means that there is no general solution. The CCD is therefore framed around the development of a set of national action plans supported by regional cooperation networks. It also emphasizes bottom-up rather than top-down approaches to dealing with desertification based on local community action.

- **Nigerian perspective**

The dry- land of Nigeria: physical characteristics

The dry-land of Nigeria forms an undulating plain at a general elevation from about 450m to 700m. More than half of the region is covered by ferruginous tropical soils which are deeply weathered and highly laterised. A large proportion of the region is also characterized by sandy undulating topography. The sandy soil is usually low in organic matter, nitrogen and phosphorus and may degrade rapidly under conditions of intensive rainfall (Mortimore, 1989). When an environment that is generally sandy like this is over-used denuded patches may appear as the wind-blown sand becomes mobile.

Average annual rainfall in dry-land of Nigeria varies from less than 500m in the northeastern part to 1000m in the southern sub-area, but it is unreliable in many parts. Unpredictability and unreliability characterize the pattern of rainfall. In addition to high inter-annual variability, the rainfall regimes of dry land of Nigeria are characterized by high concentration in a few months and intermittent and violent in character. Thus the region is, by nature, prone to recurrent and sometimes intense and persistent periods of drought. Droughts may result in the depletion of soil and shallow groundwater resources, and they are capable of disrupting, even if temporarily, the low level of resilience of the natural ecosystems of the affected areas. However, short-lived droughts may not necessarily achieve permanent environmental damage, but are capable of administering shock to the ecosystems. Protracted droughts that are being experienced in the region since the 1970s have more serious impact. During such extended dry periods, the land is under increased stress from both humans and livestock, and this may be severe enough to cause severe damage to the environment.

Desertification in the dry-lands of Nigeria

According to Part I Article 1 of the CCD, desertification is defined as land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities. The extent and severity of

desertification in Nigeria have not been fully established, nor has the rate of progression been properly documented. Nevertheless, there is a general consensus that desertification is by far the most pressing environmental problem in the dry-lands parts of the country. The visible sign of this phenomenon is the gradual shift in vegetation from grasses, bushes and occasional trees, to grass and bushes; and in the final stages, expansive areas of desert-like sand. It has been estimated that between 50% and 75% of Bauchi, Borno, Gombe, Jigawa, Kano, Katsina, Kebbi, Sokoto, Yobe, Adamawa and Zamfara States in Nigeria are being affected by desertification. These states, with a total population of about 29 million people, account for about 43% of the country's total land area (Table 1). In these areas, population pressure, resulting in over grazing and over exploitation of marginal lands has aggravated desertification and drought. Entire villages and major access roads have been buried under sand dunes in the extreme northern parts of Katsina, Sokoto, Jigawa, Borno, and Yobe States.

The pressure of the migrating human and livestock populations from these areas are absorbed by pressure point buffer states such as the Federal Capital Territory, Plateau, Taraba, Niger, Kwara and Kaduna States. It is reported that these buffer states also have about 10-15% of their land area threatened by desertification. This action leads to an intensified use of fragile and marginal ecosystems, resulting in progressive degradation, even in years of normal rainfall.

Table 1: Desertification Frontline States of Nigeria

	Land Area		Population	
States	Km2	% of Nigeria	No.	Density/Km2
Bauchi/ Gombe	64,605	6.99	4,294,413	66
Borno	70,890	7.67	2,596,598	37
Yobe	45,502	4.93	1,411,481	31
Kano	20,131	2.18	5,632,040	280
Jigawa	23,154	2.51	2,829,929	122
Katsina	24,192	2.62	3,878,344	160
Sokoto/ Zamfara	65,735	7.12	4,392,391	67
Kebbi	36,800	3.98	2,062,226	56
Adamawa	42,159	4.56	2,124,049	51
Total/ Average	393,168	42.56	29,221,471	97

Source: Annual Abstract of Statistics: Facts and Figures about Nigeria & Adamawa State Government.

As vulnerable as this zone is it has a high carrying capacity and is a home to over a quarter of the Nigerian Population. It supports about 90% of the cattle population, about two-thirds of the goats and sheep and almost all the donkeys,

camels and horses found in the country. The zone has also played a dominant role in the agricultural modernization of the country; promotion of export crops such as cotton, groundnuts and gum Arabic and of food crops, most especially in the production of the import substitution crops, notably rice and wheat.

Causes of Desertification in the Nigerian Environment.

Natural causes

The natural causes of desertification include the poor physical conditions of soils, vegetation, topography as well as the inherent extreme climatic variability, as evidence in periodic droughts. Climate variation is perhaps the most important natural cause of desertification and drought in the dry lands of Nigeria. The history of the sudano-sahelian zone of Nigeria is replete with severe and prolonged drought events, some lasting several years. The zone started at the 20th century with a prolonged drought of 1903 culminating in that of 1911-1914. Other droughts included those of 1919; 1924; 1935 and 1951-1954. Rainfall was relatively abundant in the late 1950s and the early 1960s. Since then average rainfall has fallen below the 1930-1960 mean for almost three decades with lows in both 1972-1973 and 1984-1985. In terms of rainfall deficiency, river discharges and Lake Chad level, the period 1983-1985 was the driest period in this zone and in this century as the lake fell to its lowest level and shank to its smallest area.

Evidence seems to suggest that the 1969-85 droughts were a function of tropical anomalies associated with the global atmospheric pattern. There is growing tendency to treat the 1969-1985 droughts as one and to regard that of the 1972-73 and 1983-85 as low in the continuum. Rainfall in the sudano-sahelian zone barely improved in 1975 over that of 1972-73 but was still much below 1941-1977 mean value. In 1976, large rainfall was recorded throughout the region while the length of the rainy season recorded was long. The slight recovery was immediately followed by a rainfall deficiency in 1977-78, which was as low as that of 1972. The year 1984 was the driest in the sudano-sahelian region within the period of instrumental records and this was evident from low rainfall, low discharges and low water level in Lake Child. With series of severe and prolonged droughts as witnessed since the 1950s, the sudano-sahelian environment, already a fragile environment and has become more vulnerable than ever.

Human activities

The anthropogenic factor is mainly the disruption of the ecological system, caused by poor land use and ever-increasing pressure put upon the available resources by the expanding population. More specifically, there are five primary causes, notably: exploitation, overgrazing, deforestation, wood extraction and had irrigation

practices. These are influenced by factors such as changes in population, climate and socio-economic conditions. It is obviously a complex inter-relationship, which include:

- ✓ Poor physical conditions in terms of soils, vegetation, topography and inherent extreme variability of climate as manifested in frequent drought;
- ✓ Disruption in ecological balance caused by bad land use and ever increasing demand being made on the available resources by the expanding population and socio-economic systems of the affected areas; and
- ✓ Improper land-use practices and bad land management

Combating Desertification in Nigeria

The Federal Government of Nigeria, within the overall framework of protecting the Nigerian Environment, has given prominence to the twin environment problems of drought and desertification. In combating this menace in Nigeria the Federal Government has instituted National Policies, Institutional and Legislative framework, Sectoral Programmes and Partnership Building.

National policy

Constituent elements to combat desertification and mitigate the effects of drought, within the framework of the National Policy on Environment, include the following:

- ✓ Developing of a National Action programme to Combat Desertification and mitigate the effects of drought towards the implementation of the Convention to Combat Desertification (CCD) in Nigeria;
- ✓ Integrating public awareness and education on causes and dangers associated with drought and desertification, as well as the constraints of CCD
- ✓ Strengthening national and state institution involved in drought and desertification control programme.
- ✓ Promoting sustainable agricultural practices and management of water resources including water harvesting and inter-basin transfers.
- ✓ Encouraging individual and community participation in viable afforestation programmes using tested pest and drought-resistant and/or economic tree species
- ✓ Encouraging the development and adoption of efficient wood stoves and alternative sources of energy
- ✓ Establishing drought early warning systems
- ✓ Involving the local people in designing, implementing and managing natural resources, conservation programmes for combating desertification and ameliorating the effects of drought
- ✓ Strengthening the nation's food security systems;

- ✓ Establishing, reviewing and enforcing cattle routes and grazing reserves.

Institutional and legislative framework

The establishment of Federal Environmental Protection Agency (FEPA) by Decree 58 of 1988 was probably the most far-reaching initiative undertaken by the Federal Government of Nigeria for the purpose of addressing the multifarious environmental problems (drought and desertification inclusive) and protecting the Nigerian Environment. The Federal Environmental Protection Agency also facilitated the establishment of State Environmental Protection Agencies (SEPA) in the 36 states of the Federation and the Federal Capital Territory [FCT]. The State Environmental Protection Agency is mandated to address all environmental problems [including Drought and Desertification] at the state level. The creation of the Department of Drought and Desertification Amelioration in the new Federal Ministry of Environment strengthens the existing institutional arrangement for more effective co-ordination of activities by government towards the implementation of the CCD in the country. This will further ensure a sharper focus to rehabilitation and restoration of desertified and desertifications like conditions in the affected areas.

Sectoral programmes

In Nigeria, several sectoral and multi-sectoral programmes have been put in place over the years to tackle the twin problem of drought and desertification. A brief review of some of these programmes is given below.

Management of water resources

Towards promoting sustainable utilization of water resources in the dry-lands, Nigeria established River Basin Development Authorities (RBRDAs) under the supervision of the Federal Ministry of Water Resources. The efforts of this authority include damming and diversion of rivers, and, in some areas, exploiting underground water. The RBDAs are also involved in improvement of community water supplies and provision of watering points in rangelands. The RBDAs that operate in the semi-arid region of Nigeria include the Sokoto-Rima, Hadejia-Jama'are, upper Benue, Niger River and Chad Basin Development Authorities. The Federal Government of Nigeria, with World Bank assistance, has also implemented a programme tagged National Fadama Development Project for the purpose of optimally utilizing the water resources of the wetlands of Nigeria for small scale irrigation

Agricultural development programmes

The Federal Government of Nigeria with World Bank Assistance has expended enormous resources to establish Agricultural Development Programmes (ADPs) in all the 36 States of the Federation and the Federal Capital Territory. The ADPs operate the training and visit (T&V) system of unified extension system covering the areas of Crop Production and Protection, Livestock Production and animal Health, Fisheries and Agro-Forestry and Gender related issues in Agriculture usually referred to as Women –In-Agriculture. This unified extension system is employed for the dissemination of proven agricultural technologies (aimed at ensuring sustainable development) to the small scale, resource poor farmers who are responsible for well over 90 percent of the national food production.

Energy resources

Although, Nigeria is blessed with abundant renewable energy resources, there is currently a heavy reliance on fuel-wood and fossil fuels. Sourcing of fuel wood for domestic and commercial uses is a major cause of desertification in the arid zone states of Nigeria. The Federal Government, through the Energy Commission of Nigeria (ECN), has put in place the following programmes for the purpose of promoting optimal utilization of renewable energy resources with a view to reducing deforestation associated with fuel wood sourcing:

- ✓ Training programmes on renewable energy technology
- ✓ Biogas and biomass utilization projects
- ✓ Solar photovoltaic electrification projects for remote rural areas.

All energy-related environmental projects that are being implemented in Nigeria are guided by the National policy on Energy

Links with Climate

Potential impact of climate change

While there are suggestions that desertification may be associated with climate change in other parts of the world, particularly through changes in ocean temperatures (e.g. Warren and Khogali; 1992, Williams and Bailing 1994). a simple linkage has not emerged in Nigeria. This may be because a relationship does not exist or the effect of climate change is relatively small compared with the impact of African settlement and changing land use in the range lands. Also, Nigerian arid semi-arid climate experience rainfall variability greater than that of comparable climate elsewhere in the world (Nicholls and Wong, 1990).This variability makes it difficult to detect climate change given that few records extend beyond a century. It has also produced natural ecosystems which are highly resilient in their undisturbed state for there is plentiful evidence of major variation in climate throughout the

quaternary (e.g. Nanson & Tooth in press). The impact of African settlement on that resilience is largely unknown but it may have been so severe that much of what was vulnerable to climate change has already been affected or destroyed and what is left is relatively robust. Alternatively, it may have increased the effects of climate variability by putting less affected ecosystem under greater stress. Establishing a relationship between climate change, climate variability and desertification is therefore unlikely to be easy.

Specific impacts of climate change which have implications for land use and land degradation include changes to hydrological patterns, plant species composition and plant productivity (Stafford Smith et al, 1994). There may be greater risk of flooding and erosion due to greater runoff. However, wet periods tend to promote revegetation and reduced erosion of the land surface while favouring channel erosion (Wasson & Galloway, 1986, Pickup, 1991). Enhanced runoff redistribution may occur, intensifying vegetation pattering and erosion cell mosaic structures in degraded areas (Stafford and Pickup, 1990). There may also be an increase in dry land salinity. Major changes in vegetation composition will come through shifts in rainfall pattern and increased runoff redistribution and will favour establishment of woody vegetation and encroachment of unpalatable woody shrubs in many areas.

Role of climate variability

So far, there have been no clear demonstrations of continuously increasing variability from meteorological records in Nigeria. There are however, well documented examples of shifts in rainfall over periods of several decades which may or may not be consequence of greenhouse gas emissions (Nicholls and Lavery, 1992). These fluctuations have had a considerable biological impact (McKeon et al. 1991) and may well show how Nigerian Ecosystem will experience and respond to future climate change.

The impact of rainfall variability is largely felt through changes in the pattern of plant growth since this provides fodder for grazing. The relationship between climatic variability and desertification is complex and poorly understood, partly because it is compounded by the impact of land use. It is sometimes argued that drought triggers degradation by reducing plant cover below the level already imposed by grazing so soil losses due to both wind and water erosion are higher (Warren and Khogali, 1992).Also, grazing activities immediately after drought can greatly reduce plant growth in future rain events(Hodgkinson, 1992).Thus, desertification might occur as a series of step changes in which latent degradation is precipitated by droughts with land condition maintained at a particular level or recovering between droughts or during wetter periods.

Conclusions

Nigerian rangelands have long been subject to climate change but have been exposed to desertification processes. The impact has been substantial but large areas are still in relatively good condition compared with other parts of the world with similar climate and land use.

There is evidence to suggest that desertification has been episodic with the maximum impact occurring when grazing is first introduced, during dry periods, or both. At present, the desertification rate seems relatively slow because of present climatic conditions and the fact that most of the country has already experienced the initial effects of pastoral development. Nigerian experience and level of success in dealing with degradation is typical of many developing countries with arid and semi-arid regions. The building blocks for effective action are increasingly in place but the results will not be known for decades. The African land use experiment continues, the consequences remain unknown, but ignorance of the ecosystem is no longer an excuse for failure.

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