The Environmental Studies

Desertification in Northern Nigeria: Causes and Consequences

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Abstract
Desertification is one of the most serious problems facing northern Nigeria with 580,841 km^2 out of the 927,892km^2 total land area of Nigeria and with about 62 million Nigerians directly or indirectly affected by desertification. Climatic variability, deforestation, extensive cultivation, overgrazing, cultivation of marginal land, bush burning, fuel wood extraction, faulty irrigation system and urbanization were identified as the major causes of desertification. An attempt was made in this paper to review such causes and consequences, with a view to identify some inadequacies and to make appropriate recommendations to policy makers. The paper argues that a lot of national and international interventions have to be made to curb the condition in Nigeria. It recommends that agriculture should transcend from development strategy to agric business and that governments at levels and non-governmental organizations should provide adequate water for the farmers, planting of Jatropha trees and some exotic trees that have economic benefits which would add value to the livelihood of the people, adequate funds should be provided to the frontline states to fight desert encroachment and set up a desertification monitoring center.
Key words: Desertification, Causes and Consequences and Northern Nigeria

Introduction

Desertification is one of the most serious problems facing northern Nigeria with dire economic consequences for the nation. Deserts are extremely dry areas with sparse vegetation. The word desert was derived from the Latin word desertus meaning abandoned (Lalley, 2013). Scholars have viewed this concept from diverse perspectives, social, economic, cultural, among others and the concept has often been thought of as desert encroachment. Medugu (2009) defines land degradation in arid, semi arid and sub-humid areas resulting from various factors climatic variations and human activity. A dynamic process observed in dry area ecosystems affecting ground water resources, animal and plants, soil human settlements and their activities.

Boykoff & Simmons, (2007) saw desertification as a process whereby the productivity of arid or semi arid land falls by 10% or more. It is explained that mild desertification is about 10-25% drop in productivity, serious desertification is 25-50% drop and very serious desertification is a drop of 50% or more which may lead to gully erosion and sand dunes (Emordi, 2013). Dregne (1986) explained that desertification is a land degradation process that involves a continuum of change from slight to very severe degradation of the plant and soil resources and is due to man's activities. He clarified the concept as the improvement of terrestrial ecosystems under the impact of man, the process of deterioration in these ecosystems that can be measured by reduced productivity of desirable plants, undesirable alteration in the biomass and the diversity of the micro and macro fauna and flora, accelerated soil deterioration and increased hazards for human occupancy. Barrow (1999) stated that desertification is a process whereby the ecosystem losses its capacity to maintain and repair itself.

Nigeria is one of the countries south of the Sahara faced with a rapid desert encroachment, with notable effects on the northern part of the country. Desertification phenomenon has been reported in northern Nigeria since 1920s, but the impact has been more glaring since the famine of 1971 to 1973 in this part of the country (Carvalho, 2007; Olagunju, 2015). Desertification affects fifteen northern states of the country (Jaiyeoba, 2002) and almost one-fifth of the total Nigeria land area is becoming desertified. These states supply most of the country's

agricultural products such as beans, soya beans, tomato, melon, pepper, onion, cows, rams and many more. Though climatic variability contributes to desertification phenomenon, but this is aggravated by the unsustainable activities of human beings in the environment. Such activities include deforestation for industrial purpose and fuel wood, urbanization, bush burning, agro-activities on marginal lands and other unsustainable agricultural activities (Climate Change Challenge.org., 2012).

Dada, Jibrin & Ze Ijeoma, (2006) observed that desert encroachment is moving southwards. The impact is intense because agro-economy of Nigeria is dependent on rainfall and hence affected by fluctuating weather. Nigeria signed the convention of the United Nation to Combat Desertification on 30 October 1994, the desert encroachment assumed increasing proportion becoming a threat to the nation's economy (Okoli and Ifeakor, 2014). Tercula (2015) reported that Nigeria loses about 350,000 ha of land every year to desertification and the impacts are manifested on the environment and general livelihood of Nigerians. Desertification causes loss of biological diversity, contributes to disease burden, alter geochemical composition of the soil, contribute to water scarcity, reduced agricultural yield hence, and contributes to food insecurity, reduced economic growth among other unfavorable impacts. As emphasized by Medugu (2009), a lot of policies and programs have been implemented by Nigerian government to combat desertification. The problem is rather aggravated, because the issue has been treated as a sectoral issue instead of an integrated approach that will bridge the gap between the formation of policy and strategies of combating desertification. Among such policies and programmes are Arid Zone Aforestation Project (AZAP) in 1977, the River Basin Development Authorities (RBDA) in 1987, Federal and State Environmental Protection Agency (FEPA /SEPA) and the Great Green Wall Project among others (Lassen, Horsbol, Bonnen & Pedersen, 2011).

Good arable land is lost by desertification through wind and water erosion, overgrazing, unsustainable farming practices and urbanization. The world loses over 6 million hectares of its land per year by desertification. These lands differ from natural deserts for they are a result of human activity, and they can be controlled if the causes are recognized early enough. Because just 70 m^2 is the minimum area of arable land required to feed a person, even a medium rate increase in population growth will give rise to land scarcity for about four billion people by the year 2050. Land degradation has been a dominant problem throughout the past decade. Most land is either desertified or vulnerable to desertification (Krall and Heil, 2013).

According to Article 1 of the United Nations Convention to Combat Deserti cation (UNCCD, 2011) deserti cation means "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities." Desertification has a multiple impact on the environment (soil erosion, water scarcity, disappearance of wild ora and fauna, depletion of soil fertility and biodiversity) and on populations (poverty, famines, migrations, con icts). Desertifications also have impacts on agricultural and rural development in developing countries and the future of small family holdings are at stake (Lorenzoni & Hulme, 2009).

Desertification, like climate change and loss of biodiversity, is a global problem. However, its 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 those of food security, poverty alleviation and lack of development in poor countries

while in richer 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 droughts which have affected some parts of the world such as the African Sahel recently and were also experienced in large parts of Australia in the 1890s, 1920s, 1960s and some part of early 2000 (Lorenzoni & Hulme, 2009).

Desertification is a major challenge facing humanity; 2 billion people are under threat and 9 billion people will have to be fed by 2050. The countries most exposed are in Africa, north and south of the Sahara, more particularly the countries in the Sahel, East Africa and Southern Africa. Desertification also concerns a large part of East Asia and Central Asia, China and the southern tip of South America, and also affects the developed countries such as Mediterranean Europe, Australia and North America. It becomes a cause for concern when it affects vaster areas, particularly during long periods of drought (Mare, 2011).

Desertification in Figures

i) This phenomenon concerns almost half the surface of the globe.

ii) All continents are under threat: 37% of arid areas are in Africa, 33% in Asia, 14% in Australia. Some are also found in America and the southern fringes of Europe.

iii) Arid areas under threat cover 40% of land, of which 66% are already affected (3.6 billion ha. in 2000) and 10% to 20% are seriously degraded.

iv) Of the dry lands stricken by deserti cation, 93% are pastures lands, 6% rain fed crops and 1% irrigated crops.

v) One-third of humanity is affected (Onyeanusi and Otegbeye, 2012).

Table 1: states affected by desertification, land size and population in Nigeria

States	Geographic region	Land area km^2	% of Nigeria	Population, NPC, 2006	Den sity
Sokoto Severe	North West	27,825	3.06	3,702,676	133
Zamfara Severe	North West	37,931	2.17	3, 278,873	86
Katsina severe	North west	23,561	2.01	5,801,584	246
Jigawa severe	North west	23287	2.56	4,361,002	187
Kano moderate	North west	20280	4.23	9,401,286	464
Kebbi severe	North west	36,985	2.06	3,256,541	88
Kaduna Moderate	North west	42,481	3.67	6,113,503	144
Borno severe	North east	72,609	4.79	4,171,104	57
Yobe severe	North east	46,609	3.12	2,321,339	50
Bauchi moderate	North east	41,119	3.52	4,653,066	113
Gombe moderate	North east	17,100	1.88	2,365,040	138
Adamawa moderate	North east	38,700	3.25	3,178,950	82
Taraba moderate	North east	56,282	3.19	2,294,800	41
Niger moderate	North central	68,925	2.58	3,954,772	57
Plateau moderate	North central	27,147	2.38	3,206,531	118
Total		580,841	40.54	62,061067	107

Source: National Bureau of Statistics, 2010; National Population Commission, 2006.

The extent and severity of desertification in Nigeria has not been fully established, had neither the rate of progression properly documented. Nevertheless, there is a general consensus that desertification is by far the

most pressing environmental problem in the dry land 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, and Zamfara States in Nigeria are being affected by desertification. These states, with a population of about 27 million people account for about 38 % 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 buffer states such as the Federal Capital Territory, Plateau, Adamawa, Taraba, Niger, Kwara and Kaduna states. It is reported that these buffer states have about 10-15 % of their land area threatened by desertification. This action leads to an intensified use of fragile and marginal ecosystems resulting into progressive degradation even in years of normal rainfall. As illustrated in Table 1, there are 15 desertification states in Nigeria's 36 states and the Federal Capital Territory. These states accounts for about 40.54% of the total land area of Nigeria with moderate to severe rate of desertification and about 62 million of Nigerians are either directly or indirectly affected by desertification problems.

Objectives of the Study

The main aim of the study is to x-ray the causes and effect of desertification in Northern Nigeria. The study was therefore examined under the following specific objectives, to:

1. Examine the causes of desertification in Northern Nigeria
2. Identify the consequences of desertification in Northern Nigeria
3. Suggest policies that are needed to ensure the conservation and protection of land use and vegetation

Causes of desertification

The causes of drought and desertification are numerous and complex, but like many other issues of environmental degradation, they are basically the resultant interactions of climatic influence and human activities in the environment. The causes include:

Climatic variability

Climatic variability is a major driver of many environmental degradation phenomena. Alteration of climatic conditions leads to naturally occurring phenomena of drought and desertification. There has been increasing level of greenhouse gases causing global warming, which in turn increase the variability of climate conditions. This alteration in the climatic conditions has manifested as follows;

i. A decrease in the amount of rainfall in dry lands making arid and semi-arid lands more vulnerable to desertification.

ii. High temperatures, combined with low rainfall which would lead to the drying up of water resources – drought, and;

iii. Poor growth of vegetation leading to the formation of a desert-like condition.

Projections from 1901 to 2005 showed that Nigeria is not excluded from the impacts of climatic variability and global warming with prominent localized effects in the highly industrialized cities and Northern Nigeria which has resulted into the observed environmental degradations. Increased temperature of average 1.1°C and decrease rainfall of average 81 mm were reported (Onyeanusi and Otegbeye, 2012).

Anthropogenic activities

Anthropogenic activities are changes in the environment caused by human beings. The anthropogenic factors have been the major cause of desertification just like many ecological degradation problems. Human contribute to desertification through poor land use and the ever increasing pressure put upon the limited available resources by the expanding population (NEST, 2011). Basically, human causes of desertification can be viewed to result from; exploitation of resources from ―non-ideal lands, over exploitation of land resources, unsustainable acts when exploiting, and none replacement of exploited resources or not allowing sufficient time for natural regeneration of exploited resources. The following human activities can cause desertification:

Deforestation

Deforestation is the conversion of forested areas to no forested land (Olagunju, 2015). Deforestation is the large scale removal of forests resulting to non-forest to meet various human needs. Logging, expansion of agricultural croplands, urbanization, fuel wood collection, mining and resources extraction, fire-hunting and slash and burn practices have been identified as the key drivers of deforestation. Nigeria is considered the world's highest deforested country and has lost about 55.7% of its primary forest. From 1990 to 2010, Nigeria nearly halved its amount of primary forest cover with an annual deforestation rate of 3.67% between 2000 and 2010 (FAO, 2010). The situation appears alarming that the FAO, (2010) states that the forest in Nigeria will disappear by 2020 if the current rate of forest depletion continues unabated (Onyeanusi and Otegbeye, 2012). Deforestation of dry lands destroys the trees and vegetation that bind the soil, and because of the prevailing climatic conditions in dry lands, the possibility of regeneration of denuded vegetation is low and hence, the land becomes desertified.

Extensive cultivation

Expansion of agricultural land to meet up with the food requirements of the increasing population has led to the degradation of land in Northern Nigeria. New lands are cleared of trees and other vegetations to establish agricultural croplands in the dry land, many of such lands are unable of recuperation, and hence desertification sets in. In Nigeria, overgrazing and over-cultivation have been reported to be responsible for the conversion of 351,000 hectares of land into desert each year (www.earthpolicy.org).

Overgrazing

Overgrazing is most common in the areas whose socioeconomic viability depend mostly on extrinsic system of animal husbandry. The dry lands of Nigeria is said to support much of the country's livestock economy, hosting about 90% of the cattle population, about two-thirds of the goats and sheep and almost all donkeys, camels and horses. In the Sudan and the Sahel zones, which carry most of the livestock population, nomadic herdsmen graze their livestock throughout the area and are constantly in search of suitable pastures. Additional pressure is also

put on these natural rangelands by livestock from neighbouring countries, notably Cameroon, Chad and Niger. Overgrazing removes the vegetation cover that protects soil from erosion (UNCCD, 2011) and degrades natural vegetation that leads to desertification and decrease in the quality of rangelands (Sheikh and Soomro, 2006). Between 1950 and 2006, the Nigerian livestock population grew from 6 to 66 million, an eleven fold increase. The forage needs of livestock exceed the carrying capacity of its grasslands (Lester, 2006).

Cultivation of marginal land

Cultivation of marginal areas is one of the causes of desertification. Marginal lands are areas that are unable to support permanent or intensive agriculture which could be easily degraded following cultivation. During the periods of high rainfall, people tend to extend farming activities into the marginal areas. When these periods of high precipitation is succeeded by abrupt dry periods, the exposed land with very little vegetal cover is prone to wind erosion. Desertification may set in which could be irreversible except through carefully planned rehabilitation programme.

Bush burning

Slash and burn agricultural practice and fire-hunting is a major cause of desertification in northern Nigeria. Owing to the low relative humidity in the area coupled with very dry harmattan wind, there is always a high incidence of bush fires every dry season. When this occurs too frequently, the vegetation may not regenerate; the soil is exposed to erosion and become degraded. Fuel wood extraction Due to socio-economic status of the people inhabiting Nigeria dry land, felling of tree for fuel wood will continue to increase if alternative sources of energy in the Sudano-Sahelian zone are not provided. The demand for fuel wood causes the removal of trees, shrubs, herbaceous plants and grass cover from the fragile land, accelerating the degradation of the soil to desert-like conditions (FAO, 2006). In Nigeria, more than 70% of the nation's population depends on fuel wood. Katsina alone, a northern state, has its over 90% energy from fuel wood (Mohammed et al., 2012). In Kano City, 75,000 tonnes of fuel wood are brought in by lorry and donkey within a radius of 20 km, which leads to denuding of the woodland (Medugu, Majid and Choji, 2008).

Faulty irrigation practices and management

Irrigation system is a common practice in northern Nigeria. Many farmers lack adequate skills improper designing and management of irrigation system which has resulted into desert-like condition of many irrigated farmlands as a result of water logging and salinization. This scenario is already a reality on a number of irrigation projects in Nigeria today, such as the Bakolori Irrigation, South Chad Irrigation and the Hadejia – Jamaare Irrigation Projects. For instance, the drying up of Lake Chad that started during the Sahelian drought of 1972 to 1973 is aggravated due to poorly managed irrigation system in the Chad Basin. This has caused the reduction of the lake from 25,000 m^3 in 1963 to about 3,000 m^3 in 1986. This prompted the government to stop all irrigation projects in the basin in 1989 because the level of the lake fell 3 m below the critical level (Medugu, 2007).

Urbanization

Nneji (2013) has attributed rapid economic growth and urbanization as causal factors of desertification. The problem is more severe and complicated in developing world. Clearing of lands to accommodate the

increasing population and accommodate the necessary infrastructure in northern region is commonly done without adequate environmental consideration; this has led to the removal of vegetation cover in the area and as such, making the area desertified. Urbanization in Kano City for instance has been estimated to be increasing rapidly at the rate of between 5 to 10% per annum (Federal Ministry of Environment of Nigeria, 1994). At least, 20,000 ha of land are cleared annually for construction (Betta, Ashong and basher, 2013).

Consequences of Desertification

Conflict

Most conflicts in Northern Nigeria are environmentally based, a large number of which is overgrazing, farmland and water. The conflicts are mainly between farmers and cattle herdsmen. The struggle for the remaining farm land has degenerated to communal clashes and also when cattle herdsmen move down wards in search of grazing land for their cattle they encroach on people's farms and this usually leads to crisis (Mohammed, 2015). The conflict between the Agatu people and Fulani's in Benue State, Biroms and Hausas in Plateau are good examples. A lot of these conflicts go on in Nigeria, some with large scale killing and property destruction (Biello, 2007).

Security threat

Government efforts and all measures on ground to overcome desertification and ensure food security, have been interrupted or even stalled in some areas by the terrorist insurgencies particularly the Boko Haram, whose activities are heavily felt in three frontline states of Borno, Adamawa, Yobe, have negative impact for agricultural production in the affected area. The crisis has deprived people from going to farm, and transportation of food to these areas is a serious security threat for those who wish to do that. Coupled with this is the fact that livestock farming is facing a major challenge because of the level of insecurity in the North Eastern part of the country where insurgents attack and loot ranches of their cattle and other livestock. This has made cattle owners to sell off their cattle to avoid economic loses (Benfield, 2012).

Poverty

The fragile semi-arid land of Northern Nigeria is unyielding to the efforts to reclaim it from desertification, due to the threat pose by the growing poor population in the area. The local people meet their needs from the natural environment by burning the scanty bush area for game, deforest for firewood, and their livestock overgraze the available vegetation. The 2010 poverty survey by the National Population Commission showed that the Northwest and Northeast geo-political zones, which are desertification frontline states, had the highest poverty rates in the country with 77.7 and 76.3%, respectively, relative to the national rate of 69.1% (Olagunju, 2015). The poverty condition will continue to impede the government reclamation efforts if holistic approach is not put in place to alleviate poverty in the country.

The Federal Ministry of Environment explained that Nigeria plunders its forest by more than 30 million ton of firewood annually due to pressure on urban poor who resort to the cheapest means of cooking (Abubakar, 2010). Desertification is one of the causes of poverty in Northern Nigeria. The social problem of poverty is a serious challenge many farmers face. Many of them cannot afford adequate livelihood and as well meet their basic needs because of low agricultural output, limited access to social and economic infrastructure like education, health,

potable water, sanitation among others. The farmers have to look for alternatives to meet their needs and many of them do this through the sale of firewood further deforesting the soil. About 2.6 billion people in the world rely on firewood and charcoal for cooking (Krall and Heil, 2013). Nigeria forest area depreciated from 131370 km^2 in the 2000 to 82218 km^2 in 2012 (World Bank, 2014). Most of the charcoal sellers claim that they are attracted to the business because it is a business one can do with little capital. A respondent who is a firewood seller explained thus: 'we cook with the charcoal, feed our family from it and support our husbands in paying our children school fees (Ahmad, 2010).

Table 2. Nigeria's Poverty head count Ratio at $2 a day % of population.

Year	National %
1996	68.65
2004	61.84
2010	62.03
2017	64.22

Source: World Bank 2015

A lot of people are faced with the problem of high cost of kerosene and cooking gas, thereby leaving people with no option than deforestation to provide fuel wood for the majority of the populace. Though the poverty level in Table 2 seems to be decreasing but the percentage is still very high. 62% of the population under poverty level has some negative implications for the national development of Nigeria.

Corruption

Government efforts have been slow. The federal government of Nigeria have budgeted a lot of resources to combat this menace but the funds are usually mismanaged, especially at the level of implementation. An enormous sum has been invested in these projects but with minimal result. A lot of malpractices go on at the implementation level because of the inadequacies or lack of the monitoring and evaluating units at this level (Mohammed, 2015).

Policy inconsistency

Policy inconsistency and implementation are some of the problems confronting desertification in Nigeria. There are several programs and projects with many directorates addressing this problem. FADAMA I, II, III, River Basin Development Authority, FEPA, SEPA, etc, some of which are duplicated and short lived as a result of poor policy and program implementation. Thus it becomes difficult to achieve credibility and better direction for the control of desert encroachment.

Food supply

Nigeria has 927,721 land area per sq km, with 38.429% of arable land area and 7.356% of permanent crop land area (World Bank, 2014). The affected areas (eleven frontline states) cover about 43.3% of total land area of the country (Olasupo, 2014). A large percentage of the people in this area like in some other parts of Nigeria, are dependent on agriculture for a livelihood. Grains such as millet, corn, wheat, sorghum, etc and livestock are produced in these areas and a large share of domestic food production is derived from here. For some time now,

bad weather conditions and environmental degradation have depleted land fertility to a degree that has affected food security. This impact is significant because Nigeria's agriculture is rain fed and the people have not taken full advantage of its irrigation potential estimated to be between 2 - 2.5 million hectares, the area under irrigation is estimated at about 220,000 hectares or less than 1% of the total areas under cultivation, (Ojo and Adebayo, 2012). The level of irrigated agriculture in relation to crop production is minimal and cannot guarantee food security. About 35 million people located in the eleven (11) frontline states in northern region (Boykoff, 2007).

Nigeria is facing threats of hunger and extreme weather conditions (Suleiman, 2011). The people in these areas are small scale farmers who use simple farming technology that cannot subdue the threats posed by their environment as well as the increasing aridity and desert encroachment from the far north fingers of Nigeria around the Sahel region. Desert encroachment has negatively affected agricultural production in these areas. For instance, more than 65% of Sokoto State is said to be under siege while about 55% of Borno State is afflicted (Emordi, 2013) and in some areas of these states, sand dunes have invaded vast areas of farm land and people cannot make proper use of the land because the dunes have made it inaccessible. These areas are the major producers of livestock and staple cereals such as millet, corn, sorghum wheat, beans, groundnut which are essentials for food security. Table 4 shows cereal output in Nigeria.

It could be seen from Table 3 that between 2005 and 2013, there was no significant increase in cereal production. Between 2005 and 2008, some increase was noticed, output increased from 26,031,000 metric tons (mt) in 2005 to 30,209,000mt in 2008, this was as a result of the implementation of various agricultural initiatives under the National Programme for food security but these increases are not significant enough. From 2009 to 2011, there was a decline; this could be as a result of many reasons. It could be as a result of the insecurity in some northern states or the farmers could not get adequate fertilizer and other inputs for their farms. The increase could be attributed to increased inputs and additional production by farmers who have relocated to safer areas.

Table 4 shows increasing trends in livestock and fish production, but the growth is not enough to guarantee adequate nutrition. Shortfalls point to the fact that much success has not been attained in this direction. The extreme dryness has affects ground water resources and disrupts the natural ecosystem of the area, especially the production of fish. Furthermore, there has been a steady decline in agricultural labor force. The inability to cope with the frustration of desertification and other challenges of the agricultural sector has made some farmers abandon farming to venture into non-farming activities. There have also been an unplanned population displacement and drift towards the Southern parts of the frontline states because a lot of arable land have been taken over by desert encroachment, thus making the dryness of the environment unsuitable for farming.

Table 3: Cereal production in Metric Tons.

Year	Cereal production in metric tonnes
2005	26,031,000
2006	28,864,000
2007	27,171,000
2008	30,209,000
2009	21,267,630
2010	24,656,270
2011	22,165,750
2012	26,333,000
2013	26,970,000

Source: World Bank 2014

Table 4: Livestock and Fish Production.

Year	Livestock	Fish
2006	97.31	552,323
2007	107.33	530,420
2008	110,13	601,368
2009	114.54	598,210
2010	118.06	616,981
2011	126.18	NA
2012	127.3	NA

Source: World Bank 2015

During the flag off of the desert control program in Kebbi State, the Minister of Environment, Hadiza Ibrahim Mailafiya disclosed that about 43.3% of total land area of the country is prone to desertification (Olasupo, 2014). In Yobe state for instance, it was indicated that productive land mass occupied by dunes have increased from 25,000 hectares to more than 30,000 hectares (Haruna and Bukar, 2010), with a negative impact on food and livestock production. With the inability of famers to engage in the proper management and conservation of the environment, poor crop yield and livestock production occurs, as a result, poverty sets in as they cannot meet their basic needs (Boykoff, 2009).

A lot of farmers in Northern Nigeria are dependent on irrigation which enables them carry out all year farming but the sources of irrigation water are shrinking. There is significant evidence of land degradation around Lake Chad which is situated in the eastern part of this area. It has receded from about 241,000 sqkm, in 1963 to about 3,000 sqkm in 1984 (Omofonmwan and OsaEdoh, 2008) and this is due to natural hazards like sand transported to the area by wind and man's misuse of the lake. Hadejia Valley Irrigation Project has remained uncompleted since inception in 1981. Related to this is the fact that tipa, a grass known as Kachalla (in Hausa); a perennial weed which grows along the river basin has negatively affected benefits from the basin by reducing the amount of water flow to some parts of the basin (Mohammed, 2012). This has reduced the number of hectares planted by farmers along the basin and in turn food production. The shrinking water levels has not only generated human suffering but have also affected hydroelectric power generation in the country.

Desertification has several effects on food security, the drought that occurred in the northern states between 1971 and 1973 seriously reduced production capacity, because of the intensity of the drought. Despite government programs on food security to help improve food production and make a better livelihood, these efforts have not translated to optimum output of food. Farmers have complained that their low crop production and versatility in crops produced have been hampered by ebbing water supply caused by the encroaching desert. They spend a lot of money on water and farm inputs and at the end incur losses. The frustrations in farming have made many peasant farmers to abandon farming for some other more profitable activities like commercial motorcycling where many of the young men have gone into. Some of the famers in the border areas have moved into the neighbouring country of Niger where they claim that government provides water for farmers and they pay

a token after harvest (Tercula, 2015). Many of the young men who have moved to other areas are now engaged as commercial motorcycle riders.

Government efforts in curbing Desertification in Nigeria

Nigeria is losing 2,168 sq.km of land range and crop land to desertification in northern Nigeria (Olasupo, 2014) and needs combined efforts of states and other stakeholders to contain further encroachment. Efforts to curb desertification have been on for a long time because of the devastating effect on the environment and society at large. During the colonial era, an Anglo-French Commission in 1937 investigated desertification reports in the Northern part of Nigeria and directed the emirate to embark on tree planting exercise to stop the encroachment (Medugu, 2009). After independence, government and other stakeholders like the World Bank, the United Nations – and others have directed efforts in human and material resources to combat the situation and in turn ameliorate the living conditions of the people in these areas. The Nigerian government in preparing strategies to combat desertification and ensure sustainable development in the National Action Plan (NAP) identified several sectoral policies as important in this regard. These include, National Policy on Environment, National Agricultural Policy, National Forestry Policy, National Conservation Policy (National Action Plan to Combat Desertification and Mitigate the effect of Drought in Nigeria, 2005) among others (Boykoff & Simmons, 2007; Carvalho, 2007). These policies are effective for the implementation of NAP plans. They are to help in public awareness, Environmental Education of the populace, poverty alleviation, forest conservation, protection of land for agricultural activities, and provision of alternative sources of energy and water.

The National Agricultural Policy Plans in combating desertification include:

1. Protection of agricultural lands against drought, desertification, soil erosion and flood.

2. Protection and Conservation of Forests.

3. Promotion of alternative sources of energy.

4. Integrated Water Resources Management.

5. Promotion of appropriate farming system.

The Federal Ministry of Agriculture is the implementing ministry and the activities of NAP are in harmony with the National Agricultural Policy (National Action Plan to Combat Desertification and Mitigate the effect of Drought in Nigeria, 2005). The Nigerian government signed the United Nations Conference on Environment and Development (UNCED) and other initiatives which included the establishment of a National Coordinating Committee on Desertification Control (NCCDC) which is the national body for the implementation of the Convention in Nigeria. The establishment of FEPA under Decree 58 of 1988 was an important step towards addressing desert encroachment, which the States Environmental Protection Agencies (SEPA) were established in the 36 states and FCT, it has the mandate to address environmental problems which also include desertification (Medugu, 2009). However in 1977, the Federal Government set up the Arid Zone Aforestation Project which is to examine the problem of desertification in the country and check desert encroachment. In these states, tree planting campaigns were launched and forestry projects to check deforestation. Under this program, Shelter Belts were established along the Northern borders of the country

and assorted tree seedlings were produced and distributed. Also in this light is the Tree Planting Campaigns of the Buhari administration of 1984, as a way to enlighten and motivate people on the negative effects of desertification and the need to combat it (Jibunor, 2014).

Efforts were also made by government to develop dams for electricity generation and river basins to aid irrigation in the dry lands, all in effect to promote food production in Nigeria. The Nigerian government also established dams, River Basins, FADAMA Projects I, 11, 111, etc. Also a department of drought and desertification was created in the Federal Ministry of Environment to coordinate government activities towards the implementation of the Coordinating Committee on Desertification (CCD). Another aspect is the Great Green Wall Programme (GGWP); a Global Tree Planting Project to halt desert encroachment initiated in 2005 by former president Olusegun Obansanjo, and was inaugurated in 46 local government areas in the 11 frontline states of Adamawa, Borno, Bauchi, Gombe, Jigawa, Kano, Katsina, Zamafara, Sokoto, Yobe and Kebbi.

The Federal government approved the sum of 10 million for the GGWP. It is a project developed by the African Union (AU) to address the detrimental social, economic and environmental impacts of land degradation and desertification in the region (Ministry of Environment, 2014). The programme was expected to generate economic activities for the citizens of the states involved and urge them to desist from felling but rather plant trees. Government has employed development programmes to foster sustainable human development in the affected areas and to help rehabilitate some of the degraded land, enhance food security, reduce rural poverty and general unemployment. Government has had several levels of support; some of which are finance and technical assistance, loans and capacity building. Some of these partners include World Bank, IAEA, IFAD, CIDA, UNDP, UNIDO, China, etc. Some of the partnership cooperation like Japan international Agency (JICA) and the UNEP/GEF has been completed while a host of others are ongoing. Government also collaborated with the Agricultural Development Company Limited, an Israeli firm to work under the 'desert to food programme' to eradicate the menace of desertification (Norwegian Council for Africa, 2014).

Legislative framework was also enforced to encourage the execution of these projects in Nigeria. Borno State for instance initiated both remedial and preventive measures such as:

i. The felling of trees (Control) Edit (Borno State Edict No 8) of 1987 to control the use of wood for fuel and to check the pressure on the states meager forest resources.

ii. The burning of bush (Control) Edit (Borno State Edict No 7) of 1987 to control bush burning.

iii. A new Ministry of Animal and Forestry Resources was established in 1987 to coordinate all desertification control project in the state and to serve as headquarters for Borno state implementation Agency for the National Committee for drought and desertification control in

Nigeria.

iv. Planned Grass planting Control among others. Also in Katsina State, a Non Governmental Organization known as Campaign for the Reforestation of Katsina State (CAREFOR) engaged in an enlightenment campaign on the need and urgency for reforestation by using posters and stickers, among others for public enlightenment campaign for reforestation in the state. More so, the Gidauniyar Jihar Katsina have expended the sum of 5.2 million towards enlightenment campaign on desertification on tree planting within the state (Shehu, 2014). Thus

for these efforts to succeed, they must be sustainable. Jigawa state for instance, in collaboration with the United States launched a programme to harness the potential of Gum Arabic to fight desert encroachment and reduce poverty in the state as the product has some economic value, (Haruna and Bukar, 2010). Further more in Sokoto State, the Sure P Programme embarked on tree planting which covered five (5) kilometer in every local government of the state. Government is also constructing earth dams in some local governments beginning with Isa, Illela, Sabon Brinin, Tanaza, Gada and others. The Sokoto State government has planted 170 Km of settler belts across the six front line local government. Despite government effort in financial and material resources, these programs have not generated permanent remedy to desertification and improved the wellbeing of farmers and livestock producers in the areas. Some of the trees planted as shelter belts to check the advancing dunes are withering. Most of these projects need rain fall to function and the operators have to wait for rain which in most cases is minimal.

Conclusion

Desertification is a global environmental problem of arid and semi-arid regions. The effect of desertification on the frontline state is devastating with serious implications on food supply which is exacerbated by shrinking water levels in dams and other irrigation bodies in the areas. Integrating climatic elements with human activities in transforming productive land, into an impoverished area can generally improve the environmental conditions and encourage crop yield and livestock production. With the northern states faced with these desert conditions, if urgent actions are not taken to combat this ugly trend frontally, then Nigeria will be in for a serious food shortage. Though government and other stakeholders have put in a lot of efforts to mitigate the effects of desertification on food security, yet the problem persists. Thus urgent measures should be taken to check its continued south wards movement.

Recommendations

1. As agriculture has transcended from development strategy to agric business, the private sector should partner with government and nongovernmental organization to make the best of the situation. Government should intensify efforts in the Public Private Partnership (PPP) between local and foreign companies. This partnership could import some necessary technology that could be used to harness some benefits from desertification: especially with Israel that has made a breakthrough in agriculture in the desert.

2. Federal and state government should intensify poverty alleviation programmes especially to provide adequate water for the farmers.

3. The Fadama projects thrive on irrigation, so to ensure the success of the program, all stakeholders should encourage all year round planting (dry season agriculture). More emphases should be at the implement level and as well as re-enforce the monetary and evaluation unit.

4. With the current global effort on renewable energy, government should invest on the planting of Jatropha trees and some exotic trees that have economic benefits and which would add value to the livelihood of the people.

5. Adequate funds should be provided by the federal and state governments and other stakeholders, for the frontline states to fight desert encroachment and set up a desertification monitoring center.

6. The local people should be encouraged to engage in tree planting campaigns and leguminous crops including other cover crops for preventing erosion leading to desertification?

7. Contour ploughing should also be encouraged to reduce erosion

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