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UNIVERSITY OF ILORIN,
P.M.B. 1515,
ILORIN, NIGERIA
geostudiesjournal@gmail.com

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# CLIMATE VARIABILITY, LAND DEGRADATION AND RURAL POVERTY IN NORTHERN NIGERIA: THE NEXUS.

*[1]Yahaya, O.Y., [2]Malik, N.A. and [1]Jeje, O.G.
[1]Department of Geography and Regional Planning,
Federal University Dutsin-Ma, Katsina State, Nigeria.
[2]Department of Geography and Environmental Management,
University Of Ilorin, Ilorin, Nigeria.
*Corresponding Author's e- mail: yyahaya@fudutsinma.edu.ng

## ABSTRACT
The problems of climate variability, land degradation and rural poverty are intertwined. This paper reviews the extent, impact and linkages between these three environmental phenomena in Nigeria with particular emphasis on the northern part of the country. Poverty is generally assumed to impose higher risk for resource management. Degradation occurs when the capacity of a natural ecosystem to renew itself is constrained by frequent disturbances due to human activity in the face of increasing climate variability. Conceptualizing the relationship between poverty, land degradation and climate variability becomes important in order to find appropriate solutions to these problems. It is recommended that a proactive policy should be formulated to help in ameliorating the poverty plight associated with environmental problems. Until such is done, rising incidence of poverty and escalating environmental problems will continue to threaten the livelihood of vulnerable communities and the survival of the nation.

**Key Words**: Climate variability, land degradation, rural poverty, nexus, and northern Nigeria

## 1. INTRODUCTION

The problems of climate variability, land degradation and rural poverty are intertwined, and most acutely experienced by populations whose livelihood depends principally on natural resources. Climatic changes are taking place in the context of other developmental stresses,

notably poverty, fluctuating oil prices, and food insecurity (FAO, 2006), as well as in combination with environmental change, drought and land degradation (Thomas et al., 2008). Researchers have shown that Nigeria is already being plagued with diverse ecological, economic and even social problems, which have been directly linked to the on- going climate change (Odjugo and Ikhuoria, 2003; Odjugo, 2010; NEST, 2003 and Oladipo, 1993). For examples, Odjugo and Ikhuoria (2003) revealed that climate change has started impacting on desertification in Nigeria. They observed that Nigeria north of 12°N is under severe threat of desert encroachment with migrating sand dunes which have buried large expanse of arable lands, thus reducing viable agricultural lands and crops production. Odjugo, (2010) also observed that the numbers of rain days dropped by 53% in the North-eastern Nigeria. The decreasing rainfall has led to shortening of the growing season thereby causing crop failure and food shortage. Oladipo (1993), in his own view observed that the inter-annual variations in the spatial patterns and characteristics of dryness/wetness condition indicate a tendency towards a generally drier than normal moisture condition in northern Nigeria, particularly since the early 1980s. This situation is worrisome for sustainability of human activities, especially as it relates to farming, the main economic drive of the people of northern Nigeria. Besides, the implications of climate variability for the dry/arid regions are seriously reflected in longer periods of drought and scarcity of water for agriculture and/or irrigation practices and domestic uses, thereby increasing levels of poverty among households, especially of more vulnerable groups like women and children.

Northern Nigeria occupies about 70% of the surface area of the country and lies within latitudes 6°27 N to 14°N and between longitudes 2° 44′E and 14°42′ E. It constitutes the 'grain basket' of Nigeria, producing a great proportion of the grains, such as maize, millet sorghum, and wheat that provide the main staple diet of the people (Oladipo, 1993). Northen Nigeria is composed of 19 of the country's 36 states. It is inhabited by over 50% of the country's 167 million people sparsely distributed across 79% of

the country's total land mass (Pate and Dauda, 2013). The region is known for its associated problems of climate variability, land degradation and mass poverty. Notable climatic variability is occurring in the amount, intensity, frequency and type of precipitation. Northern Nigeria generally exhibit high inter-annual variability in rainfall of between 15 and 20% (Oladipo, 1993). The region has equally suffered decrease in rainfall in the range of about 3.4% per decade since the beginning of the 19th century (FRN, 2003). This region is subject to frequent dry spells, often resulting in severe and widespread drought, capable of causing poverty for the people because of the decrease in rainfall. However, continued land abuse during droughts, increases land degradation.

The objectives of this research, therefore, are to assess the extent of climate variability, land degradation and rural poverty in northern Nigeria; examine the nexus between them; and offer holistic solutions to mitigate the impacts of climate variability and land degradation on the rural poor. These are problems that affect the quality of life of many people in this part of the country. It is therefore suggested that the recommendations made in this paper be considered by government and all stakeholders concerned.

## CONCEPTUAL ISSUES: CLIMATE VARIABILITY, LAND DEGRADATION AND POVERTY.

### Climate Variability

Climate variability and climate change are intertwined and has now become a pressing issue on the world's agenda. However, it should be noted that the two occurrences are not the same. Climate change as defined by the United Nation Inter-Governmental Panel on Climate Change (IPCC, 2007) is an change in the state of the climate that can be identified by changes in the mean and/or variability of its properties and that persists for an extended period typically decades or longer.

Climatic variability is otherwise defined as the fluctuation between the normally experienced climate conditions and a different, but recurrent, set of the climate conditions over a given region of the world (IPCC, 1998). It is also seen as a shift in climate, occurring as a result of natural and/or human interference (Wigley, 1999). According to Ayoade (2003), climate

variability is defined as those secular fluctuations in climate occurring over an area. He noted that even if that variation in climate is occurring over a long period of time, it may not qualify as climate change if conditions will quickly reverse later. Such climatic fluctuations or climatic variability are terms used to denote the inherent dynamism of climate on various temporal scales (Odjugo, 2007).

Climate change occurs as a result of both internal variability within the climate system and external factors (both natural and anthropogenic) (WHO, 2003). In other words, climate change is not the same thing as climate variability. Climate change assumes a relatively stable status for at least a long period of time usually decades, while in the case of climate variability; each variation tends to be short-lived. For example, studies have shown that while there is a general decrease in annual rainfall totals for the decades between 1963 and 1992 in northern Nigeria, there is an apparent increase for the year 1992 – 2002 and up to 2008 (Ati et al., 2009 and Abaje et al., 2012). This change in inter-annual rainfall amount portrays typical climate variability over the region.

**Land Degradation**

Land degradation occurs when the land's use by man is incongruent with the land's attributes (FAO, 1976). Land degradation has negative connotations that imply the loss of something of value within the environmental-economic system (Gretton and Salma, 1997). The lost of value may be related to the productivity of the land for agriculture, the environment as host to naturally-occurring species of flora and fauna or to the environment as a place for other human activities (such as mining and secondary industries, human habitation and waste assimilation) (Gretton and Salma, 1997). According to Abdulkadir (1993), land degradation is a reduction in the resource potential of a land through the actions or processes that may force the conditions of the land to become unpleasant and less useful to man.

Other definitions include – (i) "it is the diminution of the soil's current and/or potential capability to produce quantitative or qualitative goods or services as a result of one or more degradative processes (UNEP,

1982, 1984). (ii) "It is the decline in the biological productivity or usefulness of land resources in their predominant intended use, stemming from human activities and encompasses soil degradation and changes in the traditional landscape and vegetation due to human interference (Gretton and Salma, 1996).

Land degradation is primarily measure by decline in productivity which is witnesses through the loss in quality of soil, water and vegetation - the three ecologically and economically important attributes of land. Usefulness is a crucial attribute of land degradation. The declining usefulness of land resources indicates that human activity is crowding out pre-existing ecosystems at a rate above what would normally be expected in nature and the associated changes would be considered to be degradation once they infringe on the intended use of the land resources affected (Gretton and Salma, 1997).

**Poverty**

Poverty is multidimensional and there has been no universal consensus on its definition. Hence, it is a calamity afflicting all countries of the world. However, poverty seems to be a predominantly fundamental trait among developing and less developed nations of the world. McConnell and Brue (2005) define Poverty as a condition in which a person or a family does not have the means to satisfy basic needs for food, clothing, shelter and transportation. According to Edozien (1975), poverty is defined as "inadequacy of income to support a minimum standard of living". A broader definition of poverty could be derived from the basic needs approach to poverty. This approach states that poverty is the inability to meet basic material needs, which include food, water, clothing, shelter, education, health as well as basic non-material needs including participation, identity, dignity and being incapacitated to function and enjoy a decent standard of living (Ajakaiye and Adeyeye, 2002; Obadan, 2002). The concept of 'needs' includes the notion of what is conventionally regarded as necessary to lead one's life as an integrated member of a particular society.

Poverty can also be defined based on human development perspective. It

means a state of denial of the most basic opportunities and choices to human development in order to live a healthy and creative life. It includes deprivation to enjoy a decent standard of living, freedom, dignity, self respect and the respect of others (UNDP, 1997). Similarly, poor people often lack adequate food and shelter, education and health, deprivations that keep them from leading the kind of life that everyone values. They also face extreme vulnerability to ill health, economic dislocation, and natural disasters and they are often exposed to ill treatment by institutions of the state and society and are powerless to influence key decisions affecting their lives. (World Bank, 2001). Sanya (1991) and Schuber (1994) considered poverty as either absolute or relative. Absolute Poverty is measures in relation to the amount of money necessary to meet basic needs such as food, clothing and shelter. Relative Poverty defines poverty in relation to the economic status of other members of the society: people are poor if they fall below prevailing standards of living in a given societal context. Absolute poverty being the most severe is the extreme inabilities to lead an acceptable standard of living due to lack or limited access to the basic necessities of living while relative poverty measures, comparatively, the living standards that prevail among societies.

The causes of poverty in Nigeria are manifold. Studies have shown that there are divergent opinions on the causes of poverty in Nigeria. For instance, Olowa (2012) highlights the causes of poverty in Nigeria to include: low or negative economic growth, inappropriate macroeconomic policies, deficiencies in the labour market resulting in limited job growth, low productivity and low wages in the informal sector and a lag in human resource development. Ucha (2010) identifies unemployment, corruption, non-diversification of the economy, income inequality, laziness and a poor education system as some of the key factors contributing to poverty in Nigeria. On the contrary, Ford (2007) links poverty in Nigeria to high crime rates especially in the Niger Delta region where there is a sharp contrast between the rich and the poor. Thus, the masses cause social unrest because the wealth obtained from their territory does not get to them. In another report, Aluko (2003) identifies the destruction of the natural resources endowments as one of the causes of poverty in Nigeria. He

affirmed that the destruction of natural resources endowment has led to reduced productivity of agriculture, forestry and fisheries. This often resulted from desperate survival strategies of the poor as well as inadequate and ineffective public policy on natural resources management. Uduakobong (2015) summarizes the key factors that have accentuated the incidence of poverty in Nigeria in recent times to include: employment, terrorism and insurgency, Income inequality, locational bias of development efforts, non-diversification of the economy, corruption and geographical location. The geographical location of northern Nigeria speaks volume of the associated impacts of climate variability and prevalence of poverty in the region. It is located in the sahelian zones of Nigeria (Odjugo, 2010). Sahel in general is a poor environment in term of production of food, fuel and fibre and is inhabited by poor people struggling with harsh climate, degraded soils and underdeveloped infrastructures (Ardo and Bashir, 2007). The effect of climate variability and change on agriculture in this region ranges from pronounced seasonality of rainfall to repeated crop failures and declining yields which have led to falling farm incomes and the associated problems of food shortage, malnutrition and general impoverishment of local inhabitants (Mortimore, 1989; Ekpoh, 1996b; Mortimore and Adams, 2001). Thus, northern Nigeria is a pre-dominantly poverty stricken region. This can be partly explained by the fact that the North's economy is predominantly agricultural and the low productivity from agricultural sector occasioned by climate variability and change tends to contribute to the poverty level in this area.

## Linkages Between Climate Variability, Land Degradation and Rural Poverty

The first link between climate variability and land degradation concerns the suggestion that removal of vegetation (deforestation) may affect climate. This perception suggests that removal of vegetation cover affects the rainfall producing convection circulation in West Africa, leading to a decline in rainfall over the Sahel. Once there is rainfall inadequacy, aridity sets in, and hence may results in land degradation due

to inability of natural ecosystem to renew itself occasioned by low rainfall. Model studies of the interaction between land cover and climate, such as Varejao– Silva et al. (1998) indicate that the climate is sensitive to vegetation changes. For instance, Charney (1975) reported that rainfall over a semi-arid region may be affected if there is a change in the surface albedo (the reflectivity of solar radiation). He argued that bare soils have a higher albedo than vegetation surfaces; therefore, a decline in rainfall following increased deforestation is a possibility. This is because an increase in albedo can reduce the heat flux within the troposphere thereby weakening convention mechanisms and limiting cloud formation and precipitation (Hoffmann and Jackson, 2000). As a result, an increase in albedo may promote a positive feedback mechanism leading to a drier environment, unable to sustain natural vegetation recovery and may consequently cause prolonged drought (Wang and Eltahir, 2000).

The second link suggests that global climate changes exert a stronger effect on local climate patterns and land degradation. Natural climatic variability as well as global mean warming may be driving forces in desertification (Hulme and Kelly, 1993). Sea surface temperature may be a dominant factor influencing rainfall variability in general and the Sahelian climate in particular (Rowell et al. 1992). Much of the variability of the Sahara's areal extent can be explained by rainfall variability. Change in rainfall patterns alters the extent of arid, semi-arid and dry sub-humid areas (Yang and Prince, 2000). In view of this, savannas, a common dry land vegetation type in northern Nigeria, are likely to be particularly affected by global climate change as their water balance and vegetation are quite sensitive to water balance changes induced by temperature and precipitation changes.

The study by Grepperud (1997) concludes that in the relationship between poverty, land degradation and climatic uncertainty, it is unclear whether poverty in general induces farmers to manage their resources poorly in the long run. Most of the available studies look at the problem in term of the behavior of small-scale farmers and land degradation. Southgate (1988) maintains that small-scale farmers have been the main agents responsible for land degradation activities. For example, Blaikie

(1985) attributed the soil erosion in rural Nepal to the poor land use patterns of peasants. However, Lipton (1997a) states that it is irrational to expect people to knowingly behave in ways that destroy resources necessary for their survival or that of their future generations unless very strong pressures to do so are present. One of such pressure as noted by Lipton is the decline in common property resources. The implication of decline in common property of the poor is over-exploitation of available resources to meet present income or consumptions needs. For instance, as fuel wood becomes more scarce during drought, prices may become so high that it is very profitable for entrepreneurs to bring in trucks and transport fuel wood to the cities from far distances in the country side. In addition, farmers need to make money for food during drought and may have to do this by selling wood cut off their farm trees (Oladipo, 1993). By implication, deleterious falling of trees to meet demand may consequently lead to the disturbance of soil cover, development of sand deflation and increase in the susceptibility of exposed soil to wind and water erosion. Thus, the need to use wood as fuel continues unabated in many parts of northern Nigeria because government's efforts to reduce firewood consumption were not successful. (Oladipo, 1993). The effect of this continuous and increasing harvesting of fuel wood is the increasing rate of land degradation and climate variability.

Another most debilitating risk in the link between poverty and land degradation is that of drought in northern Nigeria. The combination of poverty and drought can have serious environmental consequences that will be threatening future agricultural productivity and the conservation of natural resources. Poor people are induced to scavenge more intensively during droughts, seeking out wood and other organic fuels, wild life and edible plants, both to eat and sell. This scavenging aggravates deforestation and damage to watersheds and soil already under stress from drought. The problem is aggravated by pastoral farming where farmers carrying extra cattle as insurance against drought may exploit and over burden the carrying capacity of the land and thus increasing the likelihood of permanent damage. Small ruminants can be exceptionally damaging to resources. Poorer households are generally responsible for raising small

ruminants, which are allowed to graze low quality resources especially on open access and common property land (IFAD, 1992).

**The Incidence and Prevalence of Rural Poverty in Northern Nigeria.**

Poverty is a universal phenomenon which cut across every known human society. However, the incidence and prevalence of poverty varies according to regions. Using poverty indicators such as literacy level, access to safe water, nutrition, infant and maternal mortality, and the number of people living on less than $1 a day, Nigeria is found to rank among the 25 poorest nations in the world below Kenya, Ghana and Zambia (World Bank, 2002). The phenomenon of poverty appears to be more concentrated in the rural than in the urban areas of the country. According to a report by the Federal Office of Statistics in 1992, about 34.7 million people in Nigeria are poor, out of a total population of 102 million. Out of this figure, 10 million people were said to be extremely poor, while 8.4 million of them lived in rural areas (Odumosu et al., 2000). In another report by the World Bank (1996), the number of rural poor is roughly twice that of the urban poor. Of the extremely poor, 85 per cent live in the rural areas and more than two-thirds lived on farms.

Poverty is more in northern Nigeria than in any other part of the country. The North-West, North-East and North-Central that makes up northern Nigeria have been the most poverty-ridden zones in Nigeria. To buttress this point, the National Bureau of Statistics (2007) reported that 38, 36 and 32 per cents of people in North-West, North-East and North-Central respectively lived below moderate poverty line in 1980. Again, from 1985, poverty became pervasive in all zones with the northern zones still maintaining a higher share of poverty in Nigeria. Another report of National Consumer Survey conducted by the Federal Office of Statistics (FAO) in 1997 shows that the North West zone had the least family expenditure of N2,941 per month out of the average of N4,058 for the country. The Eastern zone had the highest figure of N5,194, almost double the figure for the North-West zone. Also, the North West zone recorded the lowest figure of household income of N3,769. The North-West came

second only to North-east which recorded 55.8 per cent on the poverty scale (World Bank, 2001).

In July 2008, the Central Bank of Nigeria report also shows that all the ten states with the highest incidence of poverty are from the north. These are Jigawa (95%), Kebbi (89.7%), Kogi (88.6%), Bauchi (86.3%), Kwara (85.2%), Yobe (83.3%), Zamfara (80.9%), Gombe (77%), Sokoto (76.8%), and Adamawa (71.7%). In another report of the National Bureau of Statistics (NBS, 2012), 9 out of the top 10 poorest state in Nigeria are found in the north. They include: Sokoto (81.2%), Katsina (74.5%), Adamawa (74.2%), Gombe (74.2%), Jigawa (74.1%), Plateau (74.1%), Kebbi (72%), and Zamfara (70.8%). Ebonyi is the only Southeastern state among them with poverty prevalence rate of 73.6%. (Nigerian Bullettin, March 12, 2015). The north-west and north-east, according to the 2012 National Bureau of Statistics (NBS) data, have the highest poverty rates of about 77.7 and 76.3% respectively (UNESCO, 2012). In Nigeria, the three northern regions (north-east, north-central and north-west) have an average poverty incidence of 70% compared to 34% for the three southern regions (south-east, south-south and south-west). By this statistics, it implies that 70% of the people in the north live below £1 per day. In terms of number of people, the statistics means that 52.5 million northerners are poor (using 2006 census estimate).

**The Extent and Impacts of Land Degradation and Climate Variability in Northern Nigeria.**

The extent of land degradation already constitutes a serious threat to the environment, food production and quality of life in some areas of northern Nigeria. Human attempts to exploit the resources of the arid and semi-arid ecosystems in Nigeria, especially at the recent time of severe and persistent droughts, may have set the scene of ecological damage in the region. The situation is being aggravated by the enormous growth in human numbers which appears to be stressing the natural support systems throughout the country, particularly in the northern part. For instance, in many areas, sustainable-yield thresholds of the vegetation and soils are being breached. Bare unproductive surfaces, representing the last stage in

the degradation of over exploited soils, have been observed in the northeastern part near the Chad border (Oladipo, 1993). Majority of people in northern Nigeria are either pastoralists or sedentary subsistence farmers whose agricultural activities in form of grazing, cultivation, bush burning, wood cutting and poor irrigation practices contribute interactively, in one way or the other to land degradation.

Land degradation was believed to have severe impact on food security, livelihood socio-economic and cultural activities of the vulnerable group. For instance, Millennium Ecosystem Assessment (MEA) (2005) clearly demonstrate that as a result of land degradation, persistent reductions in the capacity of ecosystems to provide services such as food, water and other necessities, are leading to a major decline in the well-being of people living in dry lands. When faced with land degradation, people often respond by making use of land that is even less productive, transforming pieces of rangeland into cultivated land, or moving towards areas with adequate environmental resources (Adedayo and Yusuf, 2012). This can lead to unsustainable agricultural practices, further land degradation, exacerbated urban sprawl, and socio-political problems. The general ecological degradation in northern Nigeria is reported to have laid waste vast areas of the region. For example about 65% of Sokoto and Kebbi is said to be under siege while about 55% of Borno and Yobe state is afflicted. Also, the Maitatsine riots in Gombe, Kaduna, Kano, Maiduguri, and Yola between 1980 and 1985 was considered a form of socio-economic and political consequences of ecological degradation of the region during the drought of the 1970s and 1980s when there was an increase in competition for the scarce social and economic resources (Oladipo, 1993). The massive expansion of wheat production in the highly vulnerable areas of Borno, Jigawa, Kano, Katsina, Sokoto and Yobe states is an example of cultivation of the climatically marginal areas in northern Nigeria. The overall effect is the loss of land and water resources in those areas, decline in agricultural productivity, resources use conflicts between farmers and herdsmen and consequently a lower standard of living.

Available evidence on the nature of rainfall variability in northern

Nigeria suggests that a single overall mean periodicity is not observed. Rather, rainfall is primarily characterized by a multiple, non-symmetric cycle of anomalies with varying magnitudes (Ati et al., 2009 and Abaje et al., 2012). Rainfall analysis performed by Adefolalu (2007) also indicated that both the amount and area of the secondary rainfall maximum at 9° 10′ N latitude in Nigeria has declined with time. Average annual rainfall in northern Nigeria varies from 500mm in the northeastern part to 1000mm in the southern subareas, but it is unreliable in many parts. The pattern of rainfall is characterized by unpredictability and unreliability. Besides, inter-annual variability is high. (Oladipo, 1993). The implication of this is that the region is susceptible to frequent dry spells, often resulting in severe and widespread droughts, capable of large scale destruction of plants, animals and human life (Ati et al., 2009). In line with this, Oladipo (1993) equally observed that protracted droughts that are being experienced in the region since 1970s have more serious impact on agricultural production. People suffer from hunger, famine and death, including those of their animals. For example, Khalil (1974) emphasised that during the 1972-1973 drought, about 300,000 animals, representing over 13% of the total livestock population in the north-eastern part of Nigeria were estimated to have died, while agricultural yields ranged between 12 and 40% of the annual averages were destroyed (Oguntoyinbo and Richards, 1977). In 1987, about 5 million metric tonnes of grains valued at over #4 billion were reportedly lost to drought (New Nigeria, 12 January 1988 cited in Oladipo, 1993). Also, Grove (1973, cited in Oladipo, 1993) reported that during the 1913 drought, local people in Hausa land tore down the anthills in the bush for the small grains and chaff in the store room. People reportedly died like flies on every road and about 10000 deaths were estimated for Kano Province. The implication of the rather incoherent spatial pattern of occurrence of drought in northern Nigeria is that the probability of the whole region suffering from hunger, famine and death, including those of their animals due to climate variability is insignificant.

## RECOMENDATIONS AND CONCLUSION

**Implication for planning and sustainable development:** Significant portion of Nigeria population and economy are tied to activities that are climate sensitive, such as rain fed agriculture, livestock rearing, fisheries and forest product extraction. It is therefore an established fact that northern Nigeria is a climate sensitive region in which rainfall exhibits considerable variability on multiple time scales. Based on this, the poverty burden of majority of resource-poor rural dwellers in this region may be compounded by climate variability/change resulting in increased human misery. Poverty drives population to over-exploit the remaining natural resources, triggering a vicious cycle of accelerating land degradation and greater poverty.

It is therefore imperative in line with the Millennium Development Goals of halving extreme poverty by 2015, and sustaining progress beyond 2015, that existing government agencies and commissions saddled with the responsibilities for the strategic planning and co-ordination of natural policies related to climate change in Nigeria should integrate poverty eradication programmes as priorities of the vulnerable communities. particularly in northern Nigeria into the development process to meeting sustainability objectives.

Local and regional development policies that would recognize soil and water conservation strategies should be developed for sustainable livelihood and agricultural production. Renewable energy sources such as wind energy; solar energy, hydro-electric power energy and gas should be encouraged and made available at affordable rates as alternative to fire wood consumption. Until this is done, poverty-striking vulnerable households will continue to harvest trees both for cooking and a source of income by selling wood cut off their farm in form of charcoal.

More efforts should be directed towards livelihood diversification. The ability of the vulnerable communities to secure a livelihood through alternative non-agricultural economic activities should be incorporated in policy to combat land degradation.

In addition, developing adaptive capacity to minimize the damage to livelihoods from climate variability and change is a necessary strategy to

complement climate change mitigation efforts by the government. Adaptation should not be approached as a separate activity, isolated from other environmental and socioeconomic concerns that also impact on the development opportunities of the poor. Experiences suggest that the best way to address climate change impacts on the poor is by integrating adaptation responses into development planning.

In conclusion, northern Nigeria stands to be a region where majority of people are dependent on rain fed agriculture in an environment that is already affected by water scarcity (due to climate variability), mass poverty and land degradation. If this trend should continues, it is likely to loose two-third of the region's arable land and the livelihood of millions of small-scale farmers along with their animals in the nearest future. It is therefore highly imperative that the above recommendations be given urgent attention for sustainability of the region.

**References**

Abaje, I.B., Ati, O.F and Iguisi, E.O. (2012). Recent Trends and Fluctuations of Annual Rainfall in the Sudano-Sahelian Ecological Zones of Nigeria: Risks and Opportunities. *Journal of Sustainable Society, 1(2):44-51.*

Abdulkadir, A. (1993).Remote Sensing and Land Degradation. *Nigeria Journal of Remote Sensing 1(1): 65-72.*

Adedayo, A. And Yusuf, R.O. (2012) Environmentally-Induced Rural Out-Migration in Borno State, Nigeria. *The Nigerian Geographical Journal*, 8(2): 9-23.

Adefolalu, D.O.A. ( 2007). Climate Change and Economic Sustainability in Nigeria. *Paper presented at the International Conference on Climate Change, Nnamdi Azikiwe University,* Awka 12-14 June 2007.

Ajakaiye, D. O. and Adeyeye, V. A. (2002). Concepts, Measurement and Causes of Poverty. Central Bank of Nigeria (CBN) Economic and Financial Review, 39(4).

Ardo, J. and Bashir, A. E. (2007). Agroforestry-An Adaptation to Climate Change in the Sahel? A Research Plan, Pp 6.

Ati, O.F., Stigter, C.J. and, Oladipo E.O. (2002). A Comparison of Methods to Determine the Onset of the Growing Season in Northern Nigeria. *International Journal of Climatology, 22: 731-742.*

Ati, O.F., Stigter, C.J., Iguisi, E.O., and Afolayan, J.O. (2009). Profile of Rainfall Change and Availability in the Northern Nigeria, 1953-2002. *Research Journal of Environmental and Earth Sciences,* 1(2): 58-63.

Ayoade, J.O. (2003). Climate Change: *A Synopsis of its Nature, Causes, Effects and Management*. Vantage Publishers, Ibadan, Nigeria.

Blaikie, P. (1985). The Political Economy of Soil Erosion in Developing Countries. Longman, Harlow.

Charney, J.G. (1975). Dynamics of Deserts and Drought in the Sahel. *Quarterly Journal of the Royal Meteorological Society* 101:193-202.

Chindu, A. and Nyelong, P.N. (2004). Lake Chad: from Mega Lake to Mini Lake. *Arid Wetland Bulletin,* 6: 24-27.

Edozien, E.O. (1975), "Poverty: Some Issues in Concept and Theory", in *Rural Poverty in Nigeria* (*Op.cit.*).

Ekpoh, I. J. (1999b). Estimating the Sensitivity of Crop Yields to Potential Climate Change in North-Western Nigeria. *Global Journal of Pure and Applied Sciences,* Vol. 5, No. 3:303-308.

FAO (1976). A Framework for Land Evaluation. *FAO Soils Bulletin* 32. Rome, Italy.

FAO, 2006. The State of Food Insecurity in the World 2006. FAO, Rome.

Federal Office of Statistics (1997) *National Consumer Survey 1996/97*, Federal Republic of Nigeria, Abuja, Nigeria.

Federal Republic of Nigeria, FRN. (2003). Nigeria's first National Communication under the United Nations Framework Convention on Climate Change. The Ministry of Environment of the Federal Republic of Nigeria.

Ford, N. (2007). Nigeria: Pouring Oil on Delta's Troubled Waters? African Business Wednesday, August 1, 2007: Available at *http://www.allbusiness.com/ government/election-politics politics/8909190_1.html*

Grepperud, S. (1997). "Poverty, Land Degradation and Glimatic Uncertainty". *Oxford Economic Papers, October.* 49(4): 586-608.

Gretton, P. and Salma, U. (1996). Land Degradation and the Australian Agricultural Industry. Industry Commission Staff Information Paper, AGPS, Canberra, Australia.

Gretton, P. and Salma, U. (1997). Land Degradation: Links to Agricultural Output and Profitability. *Australian Journal of Agricultural Resources Economy,* 41: 209-225.

Grove, A.T. (1973). A Note on the Remarkably low Rainfall of the Sudan zone in 1913. Savanna 2, 133- 138

Hoffman, W.A. and Jackson, R.B. (2000). Vegetation-Climate Feedbacks in the Conversion of Tropical Savannah to Grassland. *Journal of Climatology, 13: 1593-1602.*

Hulme, M. and M. Kelly (1993). Exploring the Links between Desertification and Climate Change. *Environment* 35: 4, 39-11,45

International Fund for Agricultural Development (IFAD, 1992). *The State of World Rural Poverty: An Inquiry into its Causes and Consequences* by Jazair, I.M., Alamgir, and Panuccio, T. New York University Press, New York.

IPCC (1998). The Regional Impact of Climate Change: An Assessment of Vulnerability. In: R. T. Watson, M.C. Zinyowera, and R.H Moss. (ed) Special Report of IPCC Working Group II, Cambridge University Press, Cambridge. pp 517.

Intergovernmental Panel on Climate Change (IPPC, (2007). Climate Change, 2007: The Fourth Assessment Report (AR4). *Synthesis Report for Policy Makers.* Cambridge University Press, New York.

Khalil, I.M. (1974). North-Eastern State Report on Long Term Measures to Combat Drought. Government Printer, Maiduguri.

Lipton, M. (1997a). " Accelerated Resources Degradation by Agriculture in Developing Countries? The role of population change and resources to it". In S.A. Vosti and T. Reardon (eds) *Sustainability, Growth, and Poverty Alleviation.* Johns Hopkins University Press, Baltimore.

McConnell, C. R. and brue, S. I. (2005). *Economics (Sixteenth Edition).*

New york: McGraw – Hill Irwin, the McGraw-Hill Companies, Inc.

Millennium Ecosystem Assessment (MEA, 2005). Ecosystem and Human Well-being: *Synthesis Report,* Island Press, Washington D.C. USA.

Mortimore, M. (1989). *Adaptation to Drought: Farmers, Famines and Desertification in West Africa.* Cambridge University Press, Cambridge.

Mortimore, M. & Adams, W. M. (2001). Farmer, adaptation, change and 'crises' in the Sahel. *Global Environmental Change*, 11:49-57.

Nigerian Environmental Study/Action Team (NEST), (2003). Climate change in Nigeria. *A communication Guide for Reporters and Educators.* Ibadan: NEST

Obadan, M. O. (2002). Poverty Reduction in Nigeria, The Way Forward, Central Bank of Nigeria (CBN) *Economic and Financial Review*, 39(4):1-30

Odjugo, P.A.O. (2007). "The Impact of Climate Change on Water Resources: Global and Regional Analysis", *The Indonesia Journal of Geography, 39: 23-41.*

Odjugo, P.A.O. (2010). General Overview of Climate Change Impacts in Nigeria. *Journal of Human Ecology, 29(1): 47-55.*

Odjugo, P.A.O.and Ikhuoria, A.I. (2003). The Impact of Climate Change and Anthropogenic Factors on Desertification in the Semi-Arid Region of Nigeria. *Global Journal of Environmental Science*, 2(2): 118-126.

Odumosu, T., Atere, W. and Adewumi, F. (2000). Social Problems and Social Work in Nigeria; Centre for Planning Studies, Lagos University.

Oladipo E.O. (1993). A Comprehensive Approach to Drought and Desertification in Northern Nigeria. *Natural Hazards*, 8:235-261.

Oladipo E.O. (1993). Some Aspects of the Spatial Characteristics of Drought in northern Nigeria. *Natural Hazards,* 8: 171- 188. Kluwer Academic Publishers, Netherlands.

Olowa, O.W. (2012).Concept, Measurement and Causes of Poverty: Nigeria in Perspective. *American Journal of Economics,* 2(1): 25 – 36

Oguntoyinbo, J.S. and Richards, P. (1977). The extent and intensity of the 1969-73 Drought in Nigeria: A Provisional Analysis, in D. Dalby et al., (eds), *Drought in Africa 2: African Environment Special Report 6*, London, pp. 144-126.

Pate, U.A. and Dauda, S. (2013). Media and Socio-Economic Development in Northern Nigeria. *Malaysian Journal of Communication, 29(1): 1-19.*

Rowell, D.P., C.K. Folland, K. Maskell, J.A. Owen, and M.N. Ward. (1992). Modeling the Influence of Global Sea Surface Temperatures on the Variability and Predictability of Seasonal Sahel Rainfall. *Geophysical Research Letters* 19, 905-908

Sanya, B. (1991). Ogarnizing the Self Employed: The Poverty of the Urban Informal Sector. *International Labour Review* 30(1): 39-56.

Schubert, R. (1994). Poverty in Developing Countries: Its Definition, Extent and Implication. *Economics*, 49(50): 17-40.

Southgate, D. (1990). "The Causes of Land Degradation along Spontaneously Expanding Agricultural Frontier in the Third World". *Land Economics*, 66(1).

Thomas, A.D., Hoon, S.R., Linton, P.E., 2008. Carbon Dioxide Fluxes from Cyanobacteria Crusted Soils in the Kalahari. *Applied Soil Ecology 39, 254–263.*

Ucha, C. (2010). Poverty in Nigeria: Some Dimensions and Contributing Factors. *Global Majority E-Journal,* 1(1): 46 – 56

United Nations Environmental Programme (UNEP, 1982). World Soil Policy, United Nations Environmental Programme, Nairobi, Kenya.

United Nations Environmental Programme (UNEP, 1984). General Assessment of Progress in the Implementation of the Plan of Action to Combat Desertification, 1978–1984. Governing Council 12th Session, February 16, 1984, Nairobi, Kenya.

United Nations Development Programme (UNDP) (1997). *Human Development Report.* New York: Oxford University Press.

Varejao-Silva, M.A., Franchito, S.H. and Rao, V.B. (1998). A Coupled Biosphere-Atmosphere Climate Model Suitable for Studies of

Climatic Change due to Land Surface Alterations. *Journal of Climate* 11:1749-1767.

Wang, G.L. and Eltahir, E.A.B. (2000). Ecosystem Dynamics and the Sahel Drought. Geophysical Research Letter, 27(6): 795-798.

Wigley, T. M. L. (1999). The Science of Climate Change: Global and U.S. perspective. Pew Centre in Global Climate Change, Arlington, Virginia. p 48.

World Health Organization (WHO, 2003). Climate Change and Human Health. " Risks and Responses", Geneva, 2003.

World Bank (1996). *Nigeria: Poverty in the Midst of Plenty*, Report No.120 Washington DC.

World Bank (2001). World Development Report, 2000/2001: *Attacking Poverty: Opportunity, Empowerment And Security*. New York: Oxford University of Press.

Yang, J. and S.D. Prince (2000). Remote Sensing of Savanna Vegetation Changes in Eastern Zambia 1972– 1989. *International Journal of Remote Sensing* 21:301-332.