The Challenge of Climate Change to Rural Dwellers in Esanland

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Abstract: The study appraises the effects of climate change on rural dwellers in Esanland, Edo State, Nigeria. It investigates how the rural dwellers in Esanland perceive climate change. This is to deepen the understanding of the rural dwellers' awareness and vulnerability to climate change. The study uses primary and secondary data. Primary data is obtained through the administration of the structured questionnaire, conduct of in-depth interviews and field observation. The secondary data is sourced from textbooks, journals, conference proceedings, and publications of relevant government agencies. Descriptive method of data analysis is utilized to analyze the data. The results show that climate change has resulted in reduced soil fertility and food production; distorted the eco-system as well as induced health challenges among rural dwellers in Esanland. The study concludes that though there is a general awareness of climate change among rural dwellers in Esanland the area are still very much venerable to the adverse effects of climate change because of inadequate information, lack of finance among others.

Keywords: Esanland, Climate Change, Development, Poverty, Governance.

1. INTRODUCTION

Over the centuries, individuals, households and communities in every human society have had to contend with climate change in one way or the other. This has also meant that they have had to adopt different methods of adjustment to the consequences of climate change. These methods have in turn been influenced by their perception of climate change. However, for most rural dwellers in developing countries, who are also mostly engaged in agriculture for livelihoods, their adapting capacity is overwhelmed by the frequency and intensity of climate change (GTZ/Government of India, 2011). This is because agriculture is the human activity most directly affected by climate change and all too often the rural people lack the capacity to effectively adapt to the impacts of climate change (IFAD n.d. www.ifad.ng/climate/ factsheet/e.pdf). The study, therefore, examines the challenges of climate change adaptation in rural Esanland. First, it looks at issues of climate change manifestations in the study area; then at the people's level of awareness of climate change, and finally, the challenge of adaptation. This is because as noted by IPCC (2007) adaptive capacity is influenced by changes in wealth, human capital, information and technology, material resources, infrastructure, institutions and entitlements.

2. RESEARCH METHOD

A qualitative research method is used for the study. It relied on survey design to collect data from a sample population with the use of structured questionnaire, in-depth interviews and field observation, as research instruments. The study population is made up of rural dwellers in the five local government areas of Esanland. Ten rural communities with visible climate change manifestations were purposively selected with at least one from each local government area. They are mostly peasant farmers, illiterate and mostly uninformed. Twenty-five rural dwellers, consisting of male and female, who are not less than 40 years of age considered old enough to know about climate change manifestations in their communities, were selected from each of the communities totaling 250 respondents. The 250 respondents are deemed adequate for a descriptive study such as this. A total of 18 persons (Appendix 1) were interviewed. They included 5 persons of not less than an Assistant Director selected from relevant government agencies such as the Ministry of Foreign Affairs (which forms apart of Nigerian Government delegation to the Annual Conference of Parties to the UNFCCC); the Climate Change Department in the Nigerian Federal Ministry of Environment (charge with the responsibility of coordinating national response to climate change under the UNFCCC); Edo State Ministry of Environment; Federal Ministry of Agriculture, Ubiaja (which serves as link between the Federal Ministry of Agriculture and local communities in Esan land by bringing innovations in farming techniques and input to the local farmers); and the Nigerian Meteorological Agency (NIMET) (in charge of weather monitoring and forecasting in the country) where the Head of the Benin Station was interviewed. Others are two officers each from Esan North East and Esan Central; and one each from Esan West, Esan South East and Igueben Local Government Areas. The list also included the leader of one of the

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Farmers' Cooperative Groups in the study area. Two principal Staff of Nigerian Environmental Study/Action Team, a Non-Governmental Organization involved in climate change activities in Nigeria; two Staff (an agronomist as well as a project supervisor) with the International Institute of Tropical Agriculture (IITA), Ubiaja branch involved with breeding improved varieties of cassava and helping the farmers in the study area to adopt better farming techniques and inputs, were also interviewed. Also interviewed was a resident doctor with the teaching hospital, in Irrua, who is actively involved in community health and environmental issues in the study area and beyond. The primary data is supplemented with secondary data from textbooks, journals, conference proceedings, newsletters, government releases, and publications of relevant government agencies; magazines, newspapers, unpublished dissertations and the internet. Data obtained were analyzed using simple statistical representation.

3. STUDY AREA

Esanland is located in the tropical zone of the northern part of the Nigerian forest region. It is contiguous to three of the four ethnic groups of Edo State. Edo State (nicknamed: the Heartbeat of the Nation) was created on 27 August, 1991 and is among the 6 States that make up the South-South geo-political zone of Nigeria. It lies roughly between Latitude $6^0$4' N and $6^0$48' N and Longitude $5^0$44' E and $7^0$34' E, which puts the State within the tropical region. Esanland is bounded to the north and northwest by Owans and the Afemais from Etsako of northern Edo, to the west and southwest by the Benin Kingdom, to the south and southeast by the Deltan Igbos, and to the east by the River Niger and the Igala people (Akubor, 1995:2). Esanland is made up of a heterogeneous language group of people including the Igbos in Ekpon, the Igalas and the Ighans in Ilushi axis, the Edos in Igueben and the Esans who are in the majority. Esanland is in the Central Senatorial District of Edo State and is made up of several rural communities and a few urban areas and shares similar ecological and natural environmental features with groups like Tiv, Igbo, Igbirra and Igala among others but has its own distinct social settings (Akubor, 1995). Esanland spans five out of the eighteen Local Government Areas of Edo State. They include Esan North East, Esan Central, Esan West, Esan South East and Igueben Local Government Areas with Uromi, Irrua, Ekpoma, Ubiaja and Igueben as the headquarters respectively. The area has a total land mass of about 2,987.52 square kilometers, a population of over half a million with the majority living in the several rural communities spread across the area. It is blessed with arable land for agriculture which is the main occupation of the people. The area has varying weather condition from high temperature, high humidity to heavy down-pour of rain resulting in flooding and gully erosion in many of the communities (Omofonmwan and Kadiri, 2007). There are indications of climate change manifestations in the study area which include clean water scarcity, ecosystem distortion with species migration and heat stress among others.

4. STUDY OUTCOMES

The people of Esanland are largely spiritual people (Omorodion, 1993). Until recently most of the people were of the African Traditional Religion. However, Christianity has made significant inroads into the belief system of the people, especially among the women, children and the educated. Table **1** shows that while 228 (91.2%) indicated they were Christians, 7 (2.8%) and 15 (6.0%) were Muslim and Traditional African Religionists respectively. Religion plays a significant role in Esan people's relationship with the environment and the climate system as a whole. For instance, issues of soil fertility, rainfall pattern, thunder strikes and windstorms are often attributed to supernatural factors. The literacy level indicated that 35 (14.0%); 95 (38.0%); 84 (33.6%) and 36 (14.4%) were with no formal education; primary; secondary; and tertiary education respectively. This is an important factor because it determines the ability of an individual to understand policies and programs relating to climate change adaptation. According to Idrisa, Ogunbamiro, Ibrahim and Bawa (2012), the level of education of the rural dwellers influences the use of adaptation measures. The occupational distribution of the respondents shows that 212 (84.8%) were farmers; 20 (8.0%) were engaged in fishing; 8 (3.2%) were into trading, while the civil service had 10 respondents (4.0%). The occupational distribution implies that majority of the respondents, and by induction; the most of the rural dwellers in Esanland are engaged in agricultural activities. They are therefore susceptible to the adverse effects of climate change being engaged in weather-sensitive occupation.

4.1. Awareness of Climate Variability

According to the respondents to the questionnaire and the observations from the field survey there has been notable climate variability in the study area. Such

variability included changes in rainfall pattern, temperature and in wind storms. For instance, rain and windstorms have been identified to have noticeably increased in frequency and intensity in Esanland (Table **2**). Table **2** reveals that 112 (44.8) of the respondents attested to the noticeable change in rainfall pattern. While 54.4% believed that there has been more rain, 45.6% felt that there has been less rain. Either way, these have implication for their agricultural activities. More rain, for instance, would lead to the leaching of nutrients and soil erosion. This could negatively affect crop yield due to the loss of soil nutrients. Less rain, on the other hand, could also adversely affect crop yield, amid other consequences.

With regard to the onset and cessation of rain, there was a general consensus that there has been a noticeable trend of late onset of rain, accompanied by an early cessation. Table **2** reveals 167 (66.8%), and 83 (33.2%) respondents respectively are of the view that there has been late onset and early cessation of rain. This agrees with generally predicted and observable trend in several parts of Nigeria. Table **2** also shows that the respondents believed that there has been increased temperature while only 19 (7.6%) thought otherwise. According to Umoru (Deputy Director, Environment, Esan West Local Government in an interview on 12 June, 2018) and Okojie (Head of Department, Planning and Budgeting Esan West Local Government in an interview on 13 June, 2018),

> Rain is late in coming sometimes towards the end of March, followed by a long spell of the dry period, only for the rain to come back more forcefully, sometimes in late June to early August. Apart from the negative impact on agricultural activities such as decreased food production, the increased temperature has also resulted in some health challenges such as heat rashes, heat stress, in the area.

Dr. Chuks (an environmentalist and a resident doctor with the Teaching Hospital at Irrua, in an interview on 14 June, 2018) affirmed this. Increased temperature has also enhanced the breeding of some insects like mosquitoes that spread malaria. Windstorms have also increased in frequency and intensity in Esanland (Arikhan, Head of Department, Works, Esan Central Local Government, in an interview on 13 June, 2018). According to Mr. Arikhan, windstorms have destroyed farmlands, houses, and public utilities in places like Ileh and Irrua. In Irrua for instance, some buildings at the Local Government Secretariat had their roofs blown off.

4.2. Nigeria's Predisposition to Climate Change

Nigeria's predisposition to climate change could be broadly categorized into natural and human factors. While the natural factors have to do with its geographical characteristics, the human factors comprised of its level of human advancement in socio-economic and technological spheres.

Natural Factors

These are geographical factors that are outside the control of man. They are more or less permanent physical features of a country occasioned by its geographical location that makes the country susceptible to climate change.

Long Coastline

Nigeria has long coastline of over 800 kilometers (Nzegbule, 2008). The coastal region is host to important cities like Lagos, Warri, Port Harcourt and Calabar and also harbors the economic mainstay of the nation – the oil and gas sector. The coastal region has about 25 per cent of the country's population (FME, 2014). It is predicted that with an accelerated sea level rise of 0.5 meter, about 35 per cent of the Niger Delta could be lost; and with 1.0 meter rise, about 75 per cent of the region could be under the sea (FME, 2010; 2011). This was corroborated by Mr. Yerima P. Tarfa (personal interview with the Deputy Director, Climate Change Department, Federal Ministry of Environment Mr. Yerima P. Tarfa on 30 July, 2018).

According to a report, the country could lose close to 9 billion US Dollars as a result of a 0.2 meter rise in sea level that could result in massive environmental refugee problem involving at least 80 per cent of the inhabitants of the Niger Delta. It is also projected that with temperature rise of up to 3.2^0 Celsius, the country could experience a 0.3 per cent sea level rise by 2020 and 1 meter sea level rise by 2050 as well as loss of between 6 to 30 per cent of its coastal land by year 2050, worth between 100 billion and 460 billion US Dollars. Added to this is the threat to oil and gas installations as well as the agricultural and fishing occupations of the inhabitants of the coastal regions. Fauna and flora could also be endangered by this development. The Niger Delta has a coastland of under 6,000km^2 while the total mangrove area is about 8,000km^2. The economy is largely dependent on

economic activities that take place in the coastal region.

Table 1: The Bio-Data of the Respondents to the Questionnaire

Variable	Frequency	Percentage
Age Bracket (years)		
40-49	67	27.5
50-59	112	44.8
60 and above	71	28.4
Total	**250**	**100**
Sex		
Male	121	48.4
Female	129	51.6
Total	**250**	**100**
Marital Status		
Married	174	69.6
Single	9	3.6
Divorced	6	2.4
Separated	7	2.8
Widow	44	17.6
Widower	10	4
Total	**250**	**100**
Religion		
Christianity	228	91.2
Muslim	7	2.8
African Religion	15	6
Total	**250**	**100**
Literacy Level		
No Formal Education	35	14
Primary	95	38
Secondary	84	33.6
Tertiary	36	14.4
Total	**250**	**100**
Occupation		
Farming	212	84.8
Fishing	21	8.4
Trading	78	31.2
Civil Service	60	24
Total	**250**	**100**

Source: Field Survey, 2018.

Exposure to Accelerated Desertification

About two-thirds of Nigeria comprising the North East, North West and North Central are vulnerable to drought and desertification (FME/UNDP/BNRCC, 2011). Desertification reduces soil fertility, arable land and water resources. Studies have shown that the desert has advanced 90-100 kilometers within 17 years and is advancing at the rate of 5-6 kilometers per year. The increasing southward desert encroachment in Nigeria is a major source of concern (Ejiogu and Ejiogu, 2008). Sand suns caused by erosion from wind have rendered the land less fertile and submerged communities (FME, 2011). In 30 years, 90 per cent of Lake Chad has been lost to climate change (FME/UNDP, 2009).

Table 2: Awareness of Climate Change Variability in Esanland

Have you notices any change in any of these in your locality?	No. of respondents responding in the affirmative	Percentage
Rainfall pattern	112	44.8
Temperature	103	41.2
Wind Storm	35	14
Total	**250**	**100**
What is the nature of the change?		
More Rain	136	54.4
Less Rain	114	45.6
Total	**250**	**100**
Higher Temperature	159	63.6
Lower Temperature	91	36.4
Total	**250**	**100**
Late Onset of Rain	182	72.8
Early Rain Cessation	68	27.2
Total	**250**	**100**
Which of these is your community prone to?		
Flooding	73	29.2
Erosion	177	70.8
Total	**250**	**100**

Source: Field Survey, 2018.

Tropical Location

Developing countries such as Nigeria are vulnerable to climate change due to their tropical location. Countries with low latitudes are known to start with high temperature. These are countries that are close to the equator. Nigeria lies between latitude -3^0 and -16^0 North (UNSN, 2001). It is estimated that a 2 per cent rise in temperature for Nigeria will lead to a potential loss of GDP of 11 per cent by year 2060. Nigeria experiences high temperature throughout the year. The

mean for the country is 27°C; average maximum temperatures vary from 32°C in the coast to 41° Celsius in the North, while the mean minimum range from 21°C in the coast to under 13°C in the North (FME, 2003). Average temperature recorded in most parts of the country between 1960 and 2017 showed an increase, except in Jos area with slight cooling. The extreme North East, North West and South West had the most significant increases between 1.4°C and 1.9°C (BNRCC, 2011).

4.3. The Human Factors

The human factors are the developmental issues which can be improved upon but have remained infantile. They include the nature of the economy, the level of infrastructural development, size and states of the population among others.

Climate Dependent Economy

The Nigerian economy is largely weather sensitive. For instance, farming and fishing which directly and indirectly provide livelihoods for over 80 per cent of its population and which contribute about 40 per cent of the nation's GDP, are mainly rain fed (NEST, 2011). More than 90 per cent of agricultural products are by rural peasant farmers (FME, 2003). By contrast, the manufacturing sector with low capacity utilization, contributed only 4 per cent of the country's GDP in 2017 (FME, 2018). Okali and Nwajiuba, in Onyechere (2010) observed that agriculture is potentially the most vulnerable of all human and economic activities to the nature and effects of climate change, especially in developing countries. For a nation to be heavily dependent on such a sensitive economy makes it highly susceptible to the adverse effects of climate change. There is a potential threat to food supply system due to variability in timing, outbreak of crop pests and diseases and heat stress with the potential to cause loss of livelihood to many farmers. According to Fatuase and Ajibefun (2013) climate is the primary determinant of agricultural productivity. Also, agriculture is affected by climate due to a consequential reduction in quantity and quality of yields among other reasons. In the same vein, there is a high concentration of GDP generating industry in locations that are highly susceptible to climate change such as Lagos and the Niger Delta (Okali, 2004).

Poor Infrastructure

It is posited that countries with poorly developed infrastructure, insufficient public health and educational facilities, and/or low levels of emergency response mechanisms will experience more negative impacts of climate change (Onyenchere, 2010; FME, 2011). Nigeria has limited organizational and technical capacity to respond to climate change. The late President Musa Yar'Dua, while speaking at an informal high level meeting of Heads of States and Government at the instance of the formal United Nations Secretary-General, Mr. Ban Ki Moon, in September 2007, noted that

> The consequences of Climate Change are frightening and life-threatening. All countries are affected in varying degrees. The African continent is particularly vulnerable to the impacts of Climate Change, a vulnerability that is compounded by the continent's **massive infrastructural deficit**, endemic poverty and diseases burden (Okoh, 2008 (emphasis mine)).

The infrastructural decay in Nigeria does not need further commentary here. Suffix it to say that virtually every sector of the economy from transportation, education, energy, to health needs urgent attention. Their dilapidated state perpetuated by the pervasive systemic corruption weakens the nation's climate change adaptive capacity.

Table 3: Current and Projected Maximum Daily Temperature by Locations

Location	Current Mean Annual Maximum (°C)	Projected Increase by 2046-2065
Ikeja	31.6	1.4 – 2.3
Warri	32.0	1.4 – 2.3
Ibadan	32.0	1.4 – 2.5
Owerri	32.5	1.5 – 2.3
Makurdi	33.6	1.5 – 2.6
Ilorin	32.6	1.4 – 2.6
Abuja	33.1	1.4 – 2.7
Zaria	32.0	1.4 – 3.0
Kano	33.7	1.5 – 3.2
Sokoto	35.5	1.5 – 3.2
Maiduguri	35.5	1.5 – 3.2

Source: Building Nigeria Response to Climate Change (BNRCC), 2018.

Low Level of Technical Advancement

Nigeria is technologically under-developed. This has greatly hampered its technical capacity to respond

Table 4: Summary of Key Trends in Climate Parameters for Nigeria by Ecological Zone

Climate Variables	Mangrove Zone	Rain Forest	Tall Grass (Savannah)	Short Grass (Sahel)
Temperature	↑	↑	↑	↑
Rainfall	↑	↑	↓	↓
Rainfall Variability	↑	↑	↑	↑
Extreme Rainfall events (Droughts)	Likely	Likely	↑	↑
Extreme Rainfall events (Storms & Floods)	↑	↑	Likely	Likely
Sea Level rise	↑	NA	NA	NA

Keys: ↑ - likely to increase; ↓ - likely to decrease; NA – Not applicable.
Source: BNRCC, 2017.

appropriately to climate change. The country largely relies on technological transfer to cope with the adverse effects of climate change. The productive and technological bases which are the major drivers of real economy are weak, obsolete, disperse and the sectorial linkages are nonexistence.

Rapid Population Growth

Nigeria has a population of about 140.43 million (according to the 2006 National Population census) and an annual growth rate of 3.2% (FME, 2017). This means an estimated population of over 180 million people by 2018 majority of whom live in poverty. This weakens the resilience to a range of climate change risks. Added to this is the reliance by a huge proportion of the population on the environment for their livelihood. This negatively impacts on the environment and further predisposes it to climate change impact. These human factors and many others are major hindrances to Nigeria's adaptive capacity because they accentuate poverty and lower the people's capacity to build resilience and adapt to the adverse effects of climate change.

4.4. Effects of Climate Change in Nigeria

The growing level of awareness of Climate Change in Nigeria could be attributed to the effects of Climate Change on the ecological as well as the socio-economic life of the country (FME, 2003). There is no gainsaying the fact that virtually every sphere of the Nigerian economy is affected by Climate Change. The effects are not limited to agriculture alone but also to the lives and overall development of the country (Ozor, 2009). What then are these effects?

Agricultural Sector

Agriculture is the major source of food in Nigeria. It also provides much of the industrial raw materials, foreign exchange and employment for over 60 per cent of the country's population. The sector is heavily dependent on the weather. Climate Change is already taking its toll on the agricultural sector comprising crops' production, fishing and livestock rearing (Yahaya, Salam and Bamigbade, 2011). Climate change effects, manifesting in droughts, thunderstorms, heavy winds and floods devastate farmlands, leading to crop failure, pest and disease, as well as migration in response to the weather such as a decline in available surface water resources for humans and animals due to drought in the North and salinity in the South.

Efficient crop production in the tropics depends on the onset of rain and the length of the raining season because they form important components of moisture resource status which in turn determines the production potentials of various crops. Rainfall is noted as 'an active driving force' in agriculture. Apata, Samuel and Adeola (2009) believe that climate is the primary determinant of agricultural productivity. Thus, incidences of false starts or outright failure of rains, incessant prolonged dry spells during planting seasons, early cessation of rains, crop damage by storms and floods, rising temperature and pest infestation have resulted in increasing crop failure and/or loss of yield (Yahaya, Salam and Bamigbade, 2011). Severe drought occasioned by desertification as well as the non-availability of enough grazing ground for livestock especially in the Northern part of Nigeria are also affecting crop yield. This is now forcing herdsmen to migrate southward with attendant security implications. The sea-level rise and deforestation in the South East, and the de-vegetation and overgrazing in the Middle Belt region have resulted in grave consequences for the agricultural sector. Meanwhile decreasing crop yield implies reduced income for the farmers, most of

who are peasants and dwell in the rural areas. This poses a direct threat to livelihoods in particular and the overall development of Nigeria in general.

Coastal and Sea Level Rise

The temperature of the atmosphere over the earth's surface has risen by 0.75 degree Celsius globally. This has resulted in sea level rise with the potential of inundating low lying island states and endangering the lives of millions of people. In Nigeria, seven out of the thirty-six states have littoral status. Over 75 per cent of the over 30 million inhabitants of the Niger Delta live along the coastal area and survive mainly on fishing and agriculture (Onuoha and Ezirim, 2010). In other words, the wellbeing of over 20 million people living along Nigeria's coastal belt who are mostly farmers and fishermen/women are vulnerable to the shocks of climate change and may have been so adversely affected (Yahaya, Salam and Bamigbade, 2011).

Water Resources

Water resources would be vulnerable to the effects of climate change. The hydro-climatological systems of the different ecological zones in Nigeria would be altered with their consequences on the availability of water resources (Personal interview with Mr. Tarfa, 30th July, 2015). For instance, the increasing variability in precipitation is resulting in floods and intrusions of saline water in the southern parts of Nigeria while decreased precipitation is causing drought in the Savannah and Sahel regions of the North (FME, 2003).

Higher temperatures would increase the rate of evaporation from plants. This may increase Nigerians' dependence on groundwater resources in these areas. Climate Change-induced effects reduced river flow which will diminish hydro-power reservoir storage, further decreasing the nation's capacity for clean hydro-energy production (FME, 2003). The three categories of water supply (direct rainfall harnessing (found mainly in the rural areas), surface water comprising rivers, lakes and dams, and underground water) which are currently inadequate to meet the water demands of Nigerians could further reduce due to climate change. Decreased rainfall would lead to lower water tables with the attendant consequences. It is projected that reduced rainfall in many parts of Nigeria will further worsen the inability to meet people's demand for water leading to an increase in dependence on underground water sources (FME, 2003).

Table **5** shows that water demand has consistently outstripped supply for both the rural and the urban centres. The situation in the rural areas is more precarious due to continued neglect by successive administrations over the years. The table reveals that while about 50 per cent of the water demand in the urban area is met, the supply in the rural areas meet less than 10 per cent of the demand on a consistent basis. The projection into the future does not offer hope for improvement.

4.5. Climate Change Adaptation Measures in Esanland

Evidence of climate change manifestations abound in Esanland. The manifestations include increased rainstorm, rainfall variability, increased windstorm,

Table 5: Water Supply and Demand Projections for Nigeria (1996 – 2030 MLD)

Year	Population (Millions)			Water Supply (Mld)			Water Demand (Mld)		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
1996	50.7	39.6	90.5	2593.5	363	2956.7	4905.6	1596.0	6501.9
2000	62.8	44.7	107.5	3212.2	407.7	3619.9	6074.1	1792.5	7266.6
2005	82.1	51.6	133.7	4199.4	470.6	4670	7947.3	2069.2	10076.5
2010	107.3	59.5	166.8	5488.4	542.6	6031.1	10386.6	2386.0	12775.7
2015	140.3	68.5	208.6	7166.1	624.7	7730.8	13561.7	2746.9	16308.6
2020	183.5	78.9	262.4	9386	719.6	10105	17762.8	3163.9	20926.7
2025	240	90.9	330.9	12776	829	13605	23232	3645.1	26707.1
2030	313.6	104.9	418.5	16040.6	956.7	16997	30356.5	4206.5	34563.0

Note: (a) Base year (1996) urban water supply: 51.15 liters/person/day.
(b) Base year (1996) urban water demand: 98.6 liters/person/day.
(c) Base year (1996) rural water supply: 51.15 liters/person/day.
(d) Base year (1996) rural water demand: 51.15 liters/person/day.
Source: FME, 2003.

flooding, increased temperature (Personal interviews with Erasmus Arikhan, Director of works, Esan Central; Azekhuoria, Senior Administrative Officer, Esan Central; Umoru Samuel, Deputy Director of Environment, Esan West; Sylvester Okojie, Head of Head, Budget and Planning, Esan North East, Shaibu, Head of Department, Administration and Public Utilities, Esan South East; and Okokhue, Director of Administration, Esan North East; Christopher Enibhibhamun, Chief Executive Officer, Accounts, Igueben). According to Arikhan and confirmed by Okojie, Umoru and Shaibu, the effects of climate change in Esanland include: species extinction, gully erosion, land degradation, insecurity. For instance, they claim that rainstorms and windstorms have noticeably increased in frequency and intensity in Esanland. The cause of the windstorm they attributed largely to the loss of forest that used to act as a wind breaker. The deep gully erosion that has taken over the main road divided Ibhiadan-Enu community in Esan South East into two aside from the incessant destruction of houses and public facilities across Esan land. The effects also include loss of farmland and properties to River Niger in Ilushi, Ifeku in Esan South East; serious erosion problems in most of the communities including Ewatto, Ekpon, Udoh, Ekpoma, Olinlin, Ujabhole to mention a few.

The interviewees also observed that there have been increased youth unemployment and consequent security concerns in the area. The area has also witnessed conflicts between Fulani herdsmen and the host communities over the destruction of their farm crops by cattle such as in Opoji in Esan Central. Other effects include water scarcity due to destruction of water installations, water pollution, and dried water source in some areas; and the loss of lives and properties due to windstorm and erosion (Personal interviews with Arikhan; Okojie; Azekhuoria and Enibhibhamun). Anthropogenic factors were identified as the cause of climate change in Esanland. Such factors include illegal logging, indiscriminate use of chemicals especially herbicides, bush burning, building on water channels, poor waste management especially in the Urban centres, and pervasive poverty among others (Personal interviews with Umoru; Shaibu; Okojie; Arikhan).

On the response by the Local Government Areas, Arikhan (Personal interview) observed that the last direct intervention in Esan Central was in 2009/2010 although he was not categorical about the specific interventions. For Shaibu (Personal interview), Esan South East is incapacitated by the activities of the State government. This is the same thing for Esan North East (Personal interview with Okojie). Umoru remarked that state support has been mainly in the form of policies. He acknowledged the presence of the Federal Government in Esan West though he was not sure which of them was through UNFCCC process. Areas of intervention include schools, boreholes, roads and primary healthcare. The Federal Government also constructed a major water scheme at Ugboha in Esan South East to address the water problem in most part of Esanland (Personal interview with Okojie). The project was, however, never commissioned because of the conflict of interest between the host community and government officials (Personal interview with Okojie). Abandoned water projects dot the entire area – Ewohimi, Obedu, Ewatto, Ukoni, Ugbegun, Ohordua to mention a few. According to a resident in Ukoni, the contractor handling the water project has since gone with his workers and equipment without completing the project.

On specific assistance to rural dwellers, the Local Government Areas have at various times in the past undertaken sensitization programs to inform the rural dwellers on climate change issues. Efforts were made by the different Local Government Areas in the study area to organize trainings on income diversification; modern farming techniques; and the construction/ rehabilitation of feudal roads to ease evacuation of farm produce from the interiors (Personal interviews with Shaibu; Okojie; Omoru).

Ogundeko (Personal interview with Akeem Ogundeko) whose office hosts the research farm of International Institute for Tropical Agriculture (IITA) and NIMET's meteorological station and serves as link between the Federal Government and the rural people on agricultural pointed out that his office purchased and lease out tractors to accredited agents to hire out to local farmers at highly subsidized rate. He added that in conjunction with the IITA, the Federal Ministry of Agriculture organizes an annual farmers' day to sensitize the local farmers on new farming techniques and the availability of improved crop seedlings especially cassava which is a major and common farm produce in Esanland. This he said is against the backdrop of the threat posed by climate change.

The meteorological station which was meant to serve part of the study area has been abandoned by NIMET for some years now as none of its staff is stationed there to take the daily reading. Thus, data on

weather pattern in Esanland over the period covered by this study was not available as there was no NIMET staff on the ground to attend to the researcher.

Another interviewee, Kingsley Elughariwe (Research Supervisor with IITA, Ubiaja, in an interview on 14 September, 2018) noted that the Institute renders extension services to local farmers indirectly through the Agricultural Development Programs, and Cassava Growers Association. He noted that the Institute in Ubiaja which is mainly concerned with cassava has been able to introduce an early maturity variety to the area to mitigate the effects of climate change. Thus, the traditional variety of 3 years maturity is gradually being replaced with the 1 year maturity variety. Mr. Elughariwe also noted that the people are being sensitized on good farming practices. The new variety of cassava which is yellowish in color has also been noted to benefit the local farmers because it costs less to process into preferred yellow *garri* (Cassava flakes) as no additional red oil is needed. The major challenge, according to Mr Elughariwe, is that rural farmers do not attend meetings without monetary incentive. Unfortunately, neither IITA nor FDA gives monetary incentives.

Ogundeko (Personal interview) agreed with Elughariwe but added that most traditional rulers in the area are uncooperative if there is no immediate financial benefit accruing to them. Ogundeko cited a particular town that he and another officer visited to request the king (Onojie) to help mobilize his subjects to come to FDA office in Ubiaja to collect free inputs allocated to the community but they were refused audience because they had no money to present to him to announce their arrival.

Available information from the responses of all the interviewees indicates that there is a general awareness of climate change among the people in the communities in the Local Government Areas of Esanland. They are also in the known about the causes of climate change. In fact, they are familiar with the diverse manifestations of climate change in their areas. The LGAs can be said to have rendered assistance in form of information dissemination, sensitization on environmental issues including sanitation, new farming techniques, provision of improved seedlings and other farm inputs, youth empowerment, grading and reconstruction of rural roads to ease movements of people and farm produce among others. However, on adaptation, not much is been done by the LGAs to help the rural dwellers adapt to the adverse effects of climate change. This is probably due to the alleged starving of the LGAs of fund by the Edo State Government which has largely limited LGAs' ability to assist the rural dwellers through adaptation measures.

On the operation of the UNFCCC process in the LGAs in Esanland, there is awareness of the existence of the UNFCCC and its objectives. There have been some forms of Federal Government interventions in some key sectors including health, education, water, agriculture, as well as in organizing workshops and training programs. It is however unclear which of them is connected to the UNFCCC process. This is mainly due to the absence of a climate change unit in the LGAs in the mode of CCD at the federal level. Also the near non-existence of extension services in the study area is a major challenge in assessing the operationalization of the Convention on Esanland.

Flooding and Erosion Menace

Table **2** shows that 73 (29.2%) of the respondents to the questionnaire agreed that flooding was a problem, while 177 (70.8) attested to the existence of erosion problem in Esanland. With respect to flooding, it was mostly reported in communities along the bank of the River Niger. In this regard, communities like Ilushi and Ifeku have suffered the loss of lives and properties due to flooding according to respondents. Furthermore, the undulating topography of most parts of Esanland disposes several communities to the devastating effect of flooding and erosion (LEEDS, Esan Central, 2008; LEEDS, Esan South East, 2008 LEEDS, Esan West, 2008).

However, the small proportion of questionnaire respondents who identified flooding as an environmental problem in Esanland is rather ironic because flooding and erosion are most often found together in most locality. This is however instructive with regards to the perception of climate change among these respondents. Inability to correctly identify the effect of flooding will definitely have an impact on adaptation strategy. Notwithstanding, the opinion expressed by these respondents is contrary to findings through interviews and field trips. The field trips that were made in the heart of the rainy season afforded the study the opportunity to have a firsthand observation of the challenge of flooding in several communities in the study area. Flooding has caused extensive damage to several communities in Esanland. In Emu, for instance, it has caused a very deep gully which took over the major road connecting the community to other

Table 6: Value of Damage and Losses Across Sectors in Edo State

Sector	Damage =N='000	Losses =N='000	Total =N='000
Health	764.6	187.6	952.2
Water Supply	3,369	-	3369
Transport	4,719.3	-	4,719.3
Crops	-	3,896.8	3,896.8
Fishery	-	19.6	19.6
Livestock	139.1	138.7	277.8

Source: Compiled from Nigeria Post-Disaster Needs Assessment (PDNA) 2017 Floods, FGN, 2018.

communities. It also submerged several houses and divided a section of the community into two. As at the time of the study, the Edo State Government is constructing a new road to side-track the one taken over by erosion (Field survey). Other communities like Ewatto, Ekpon, Udoh, Olinlin and Ujabhole as well as virtually all the Local Government Headquarters in the study area is having problems of erosion and flooding.

Land Degradation

One of the known consequences of climate change is land degradation. Land degradation implies the deterioration in the quality of the land through the washing away of the topsoil or due to damage to the topsoil. The topsoil is critical to crop cultivation. In an interview with Mr. John Adjugo (formerly an official with NEST, but now a Program officer with OXFARM, on 10 February, 2018) indicated that land degradation resulting from the heavy downpour of rain, salinity, flooding and erosion is a major environmental challenge in Nigeria.

Table 7: State of Soil Fertility and Effect on Food Production in the Study Area

Category	Frequency	Percentage
State of Soil fertility compared to about 20 years ago		
Better	97	38.8
Worse	117	46.8
No difference	36	14.4
Total	**250**	**100**
Food production in your locality compared to about 20 years ago		
Better	108	43.2
Worse	116	46.4
No difference	26	10.4
Total	**250**	**100**

Source: Field Survey, 2018.

Table **7** reveals the perception regarding soil fertility to the effect that it has worsened in Esanland compared to about 20 years ago. Further probing reveals that erosion, indiscriminate bush burning, unregulated use of herbicides and fertilizers are among the factors responsible for land degradation in Esanland (Personal interviews with Arikhan, Umoru, Okojie on 12 and 13 June, 2018). This is however contrary to the view expressed by the rural dwellers through the questionnaire as they could not link the other identified factors to land degradation in the area. The table also shows that 38.8%, 46.8% and 14.4% of the respondents to the questionnaire see the soil fertility as better, worse, and no different respectively. Given the importance of the state of the soil to agriculture, it was no surprise that majority of the respondents believed that climate change has impacted negatively on food production in Esanland. While 43.2% are of the view that food production was better in comparison to 20 years ago, 46.4% believed that food production has worsened. 10.4% said there was no difference.

Eco–System Distortion

Interviews granted by Arikhan, Okojie and Umoru also revealed that there have been distortions of the ecological systems in Esanland. Primary forests (locally called Egbo) have given way to secondary vegetation of shrubs and grasses. Further interview revealed forest reserves and vast area of rubber plantations across Esanland have been depleted due to logging, firewood for domestic cooking and bush burning. Also animal and plant species are known to be on the verge of disappearing or to have totally disappeared including some yam varieties.

Table **8** indicates that 91 (36.4%) respondents agreed to the disappearance of plant species. The disappearance of plant species has implications for the health and general wellbeing of the people as some of

the disappeared plant species served as food and medicine to the local people. On the disappearance of animal species, only 53 representing 21.3% claimed that animal species have disappeared. The disappearance of animal species has robbed the people of a vital source of protein and delicacies of 'bush meat' as well as the opportunity to earn additional income from the sale of catch in excess of family need. The indiscriminate use of chemicals such as herbicides to control increased weeds, which in turn is caused by heavy rains, is endangering small animals such as snails and earthworms. These animals enrich the topsoil by creating burrows that help to decompose refuse and falling leaves and wood pieces. Thus, ecosystem distortion has implication for food production in the locality.

Table 8: Disappearance of Plant and Animal Species

Category	Frequency	Percentage
Plant Species	91	36.4
Forest	92	36.7
Animal Species	53	21.3
Water	14	5.6
Total	**250**	**100**

Source: Field Survey, 2018.

Challenge of Clean Water Scarcity

Water is very essential to life. Access to clean, sufficient, and reliable supplies of water is vital for human wellbeing including the lives of the rural dwellers in Esanland. Though there has been no record of dry-up of any water source 30.8% of the respondents (Table **9**) observe that there is a scarcity of clean water in the study area. This is confirmed by Okojie (interviewed on 13 June, 2018) who noted that the problem of lack of clean water is a serious issue in Esanland. Arikhan (interviewed on 13 June, 2018) was also in agreement noting that despite the presence of waterfalls, such as the Ugbalo waterfall and Afuda waterfall both in Esan Central, the potentials are not harnessed to provide portable water for the people. 10.8% of the respondents derive their drinking water from rivers. This is surprising because several rivers criss-cross Esanland. Other sources of clean water in Esanland include dug well through which 19.2%; rain water 38.3%; private or community borehole 18.8%; commercial water tankers 10.0% as well as pipe-borne water 2.4% of the respondents get their drinking water. It is germane to note that many of the *dug wells* are actually underground tanks used for harvesting and preserving of rain water. The depth of the wells and the skill in water harvesting and the management of the harvested water determine how long the water would serve the household yearly. The water situation is likely to persist or worsen given the decreasing length of rainfall, late onset and early cessation of rain as already indicated. On the disappearance of the water source, Table **8** reveals that only 14 respondents representing 5.6% indicated that there has been the disappearance of water source in their locality. Majority of the respondents do not share this view. Information available to this study from interviews and field survey shows that rivers' dryness is a very rare occurrence in Esanland. Investigations further revealed that some rivers such as Edimon in Ewatto are revered. Some practices such as fishing are forbidden there. There are superstitions that the rivers could disappear if *maltreated*.

Table 9: Questions on Water Related Issues

Category	Frequency	Percentage
Clean water scarcity		
Yes	173	69.2
No	77	30.8
Total	**250**	**100**
Source of clean water in your area		
Rivers	27	10.8
Dug Well	48	19.2
Rain water	97	38.8
Borehole	47	18.8
Tanker	25	10.0
Pipe water	6	2.4
Total	**250**	**100**

Source: Field Survey, 2018.

4. CONCLUSION

The study was carried out in Esanland, Edo State, Nigeria, to examine the impact of climate change as well as the challenges faced by rural dwellers in adapting to climate change. Temperature rise, rainfall variability, extreme windstorms resulting in desertification, gully erosions, sea level rise, land degradation, flooding, heat stress, species disappearance, salinity and clean water scarcity, loss of lives and properties, have been experienced in the study area. It is also observed that in the study area there is no climate change department at the Local Government Areas to bring the benefits of the UNFCC

Appendix 1: List of Interviewees

S/N	NAMES	DESIGNATIONS	ORGANISATIONS	LOCATION	DATE OF INTERVIEW
1	P. Tarfa	Dep. Director	Climate Change Dept., FME	Abuja	30/07/2018
2	M. Uhonmoibhi	Former Perm. Sec.	Min. of Foreign Affairs	Abuja	31/07/2018
3	J. Adjugo	Programme Officer	Formerly with NES, now with OXFARM	Ibadan	10/02/2018
4	P. Uwagbale	Dir. Environment	Min. of Environment	Benin City	11/06/2018
5	Peter Chidi	Admin Officer	NEST	Ibadan	11/06/2018
6	Eric Nmumu	State Met. Insp.	NIMET	Benin City	12/06/2018
7	Shaibu	HOD Admin & Pub. Utilities	Esan South East LGA	Ubiaja	17/07/2018
8	Samuel Umoru	Dep. Dir. Environemnt	Esan West LGA	Ekpoma	15/06/2018
9	Azekhuoria	Snr. Admin Officer	Esan Central LGA	Irrua	15/06/2018
10	Sylvester Okojie	HOD Budget & Planning	Esan North East LGA	Uromi	16/06/2018
11	E. Christospher	C.E.O Accounts	Igueben	Igueben	14/07/2018
12	Okokhue	Dir. Of Admin	Esan North East LGA	Uromi	16/06/2018
13	E. Arikhan	Dir. of Works	Esan Central LGA	Irrua	15/06/2018
14	K. Elughariwe	Research Supervisor	IITA	Ubiaja	10/09/2018
15	Lucky Ogbebor	Leader of a Farmers' Coop. Society	Farmer	Uromi	11/09/2018
16	Akeem Ogunmakin	Head of Station	Fed. Min. of Agric	Ubiaja	11/09/2018
17	Aina	Agronomist	IITA	Ibadan/Ubiaja	10/09/2018
18	C. Abejegah	Resident Doctor	Teaching Hospital	Irrua	

to the rural communities. It is in view of this that the study recommends the establishment of a Climate Change Focal Points Commission (CCFPC) to drive the implementation of the UNFCCC processes in rural areas of Nigeria.

REFERENCES

Akubor, E.O. (1995). *The Impact of Colonialism in Nigeria: A Case Study of Esan-Land, 1897-1960*. Zaria: M.A. Thesis, History, Ahmadu Bello University.

Ejiogu, A. and Ejiogu, B. (2008). 'Combating Climate Change for Sustainable Livelihood', in Chinedu Nwajiuba (ed.). *Climate Change and Adaptation in Nigeria.* Hohenhein-Stuttgart: M Magraf Verlag.

Esan Central Local Government (2008). *Local Economic Empowerment and Development Strategy (LEEDS)*, Irrua.

Esan North East Local Government (2008). *Local Economic Empowerment and Development Strategy (LEEDS)*, Uromi.

Esan South East Local Government (2008). *Local Economic Empowerment and Development Strategy (LEEDS)*, Ubiaja.

Esan West Local Government (2008). *Local Economic Empowerment and Development Strategy (LEEDS)*, Ekpoma.

Fatuase, A. and Ajibefun, A. (2013). 'Adaptation to Climate Change: A Case Study of Rural Farming Household in Ekiti State'. Impacts World 2013, International Conference on Climate Change Effects, May 27–30.

GTZ/Ministry of Environment and Forestry (2011). *Adaptation to Climate Change with a Focus on Rural Areas and India*. Government of India, New Delhi.

Idrisa, Y.L., Ogunbamero, B.O. Ibrahim, A.A. and Bawa, D.B. (2012). 'Analysis of Awareness and Adaptation to Climate Change among Farmers in the Sahel Savannah Agro-Ecological Zone of Borno State, Nigeria. *British Journal of Environment and Climate Change*, Vol. 2, No. 2, pp. 463-484 https://doi.org/10.9734/BJECC/2012/1475

Nzergbule, E. (2008). 'Forestry Development and the Challenge of Climate Change and Adaptation', in Chinedu Nwajiuba (ed.) *Climate Change Adaptation in Nigeria.* Hohenhein-Stuttgart: M Magraf Verlag.

Okali, D. (2004). *Climate Change and Nigeria: A Guide for Policy Makers. Ibadan: NEST*

Okoh, R. (2008). 'Mainstreaming Gender Climate Change Impact Mitigation Policy Regime', in Chinedu Nwajiuba (ed.) *Climate Change Adaptation in Nigeria.* Hohenhein-Stuttgart: M Magraf Verlag.

Omofonmwan, S.I. and Kadiri, M.A. (2007). The United Nations Development Agenda: Development for All. Department of Economic and Social Affairs. Accessed from www.un.org/esa/development/UNDA1 on 22/07/2018

Omorodion, F.I. (1993). Poverty Reduction and the Attainment of the MDGs in Nigeria: Problems and Prospects. *International Journal of Politics and Good Governance*, Vol. 2, No. 3, Quarter iii.

Onuoha, F.C. and Ezirim, G.E. (2010). Climate Change and National Security: Exploring the Conceptual and Empirical Connection in Nigeria. *Journal of Sustainable Development in Africa*, Vol. 12, No. 4.

Ozor, N. (2009). Implication of Climate Change for National Development – The Way Forward. African Institute for Applied Economics, Enugu Forum Policy Paper 10, 2009.

Yahaya, K.A., Salam, M.O. and Bamigbade, D. (2011). Economic Implications of Climate Change and the Imperative of Re-Directing Financial Resources in Nigeria. *British Journal of Humanities and Social Sciences*, Vol. 12, No. 2, pp. 10-17.

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