

**Towards Evaluating The Management Of Climate Change Impact On Rural Communities
Of Edo State, Nigeria**

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ABSTRACT

In the last few years, rising temperatures and rainfall has characterized the climate pattern of Nigeria and no doubt it is a clear evidence of climate change. The attendant effects among others have been the increased heat and rainfall regimes which have resulted in the increased infection of heat related diseases and rainfall related problems such as the loss of crops and farmlands. While these effects are on the increase, studies have shown that urban centres are given more attention than the rural areas by way of mitigation. The rural areas are the largest in terms of land size, resources and population and they suffer as much environmental problems as the urban centres. But because they are administered by the local government councils which in themselves are characterized poor financing, the rural areas are therefore besieged with inadequate or lack of administrative mechanism and framework for climate change effects. The aim of this research is to evaluate the management of climate change effects in rural areas in Edo State, Nigeria. To accomplish this, the study examined the change pattern of the elements of temperature and rainfall, the effects of the change, the management of the effects by the local council authority, the impact problems. The study utilized primary and secondary sources of data. For the primary data, questionnaire and direct interviews were conducted. A total of 363 questionnaires were made and administered on the population of the study area

while interviews were conducted on the heads of environmental units of the local government councils. Secondary data were sourced from documentary sources such as text books and articles in journals. Data on temperature and rainfall for 15 years were got from weather station in the Cocoa Research Institute, Udonmora, Edo State which is about 15 kilometres from the study area. The data collected were analyzed descriptively and statistically using tables. The findings were that rainfall and temperature pattern were changing and this change was having impact on farming, the physical environment, infrastructure and health in the study area. The **study** also identified the management techniques employed to ameliorate these impacts and the problems. Useful recommendations that will help reduce and ameliorate the effects of climate change and problems were therefore made.

INTRODUCTION

Awareness of climate change in Nigeria is very low and this is because over 70% of the population do not know about this phenomenon and are not also aware that it is the cause of excessive heat and rainfall in the last few years. The problem of awareness according to Nzeadibe, Egbule, Chukwuone and Agu (2011), include poor sensitization by government agencies and inadequate information from media sources like radio and television. Climate change according to Wu, X. and Xu, B. (2016), is the long term statistical shifts of the weather, including changes in the average weather condition or in the distribution of weather condition around the average.

According to the European Environment Agency (2008) the global average surface temperature has risen by 0.74⁰c in the 20th century. The global sea level has been rising 1.8mm per year since 1961 and the arctic sea ice berg been shifting by 2.7% per decade. Also different observational records of global average annual near-surface (land and ocean) temperature; the last decade (2008-2017) was 0.89⁰c to 0.93⁰c warmer than the pre-industrial average, which makes it the warmest decade on record (European Environment Agency 2008). The intergovernmental panel on climate change in 2001 predicted an average temperature rise of 1.5⁰c -5.8⁰c across the globe during the 21st century accompanied by increase and anomalous weather events including heat waves, floods and droughts. The effects of climate change are quite noticeable and according to Beyioku (2016), these include disastrous erosion and flooding, rising heat waves, drought, rising sea levels, melting ice caps, wind storms, land and mud slides, rising sea temperatures among others.

Climate change is principally a major problem caused by human activities such as gas flaring, carbon emissions, bush burning, deforestation, burning of carbons and urban growth and development and other activities. The consequences of these in heat mortality, dehydration, spread of infectious diseases, malnutrition, migration and damage to public infrastructure Beyioku (2016).

The enormity of this problem has challenged the governments around the world to take certain actions with the view of curbing global warming and reduce its effects. On September 3rd, 2016 the CNN Television News had reported a signing of the Paris Climate Change agreement by both the United States and China. This agreement sought to cut carbon emissions by half within the next fifteen years. This signing was declared significant because the two countries are said to account for about 40% of global carbon emissions. In the same vain other developed countries have taking measures to reduce burning of gases and other chemicals with changes in technology that is environment friendly. Solar heat material, batteries and solar driven cars and machines and the replacement of carbon coolants in air conditioner and fridges are now been manufactured. In most developing countries, not much effort has been made technologically much effort is however been made to ameliorate the effects.

In Nigeria the evidence of climate change is massive. Few decades ago Lake Chad which covered an area of 40,000 square kilometres now encompasses about 1,300 square kilometers. Also rising temperatures has led to the rapid southward expansion of the Sahara Desert. Farmlands and surrounding villages have become barren and there is now the emergence of derived forest or grasslands. Excessive Logging and over dependence on firewood is rapidly devouring the guinea Savannah of Nigeria. Excessive rainfall leading to gully erosions has completely devastated the lands in most parts of the east of Nigeria while rising sea levels are threatening the coastal regions with floods. These occurrences are having negative impacts where farmlands have become uncultivable, increasing disease infections, migration, violent clashes between herdsmen and farmers, flooding, heat related diseases, destruction of infrastructure such as roads among others. Due to low level of technology, Nigeria's effort has been on ways and means to ameliorate the impacts of these occurrences. The management of these occurrences and their impact has been through the Federal Ministry of Environment and the National Emergency Management Agency.

While these bodies are doing their responsibilities, not much can however be said to have been achieved due to problems such as lack of funds due to low budget allocation, lack of continuity

in programmes by successive governments and poor infrastructure. At the local government level, these problems are worse. It must be noted the local government council in Nigeria administer the rural areas of Nigeria. The rural areas are as affected by climate change as the urban centres. But because of poor funding of the local government councils and poor infrastructural development, these local councils through the departments of environment have achieved very little in managing climate change impact.

The study area is essentially a rural environment and it is administered by five local government councils. The impact of climate change is also very evident. The local government councils are saddled with the responsibility of managing the effects of climate change. What they are doing, which programmes are in place and how much they have achieved and the challenges they have is not known. It is upon this that this study wants to evaluate the management of climate change impact in this study area.

STUDY AREA

The study area is the five local government areas of Edo Central Senatorial District of Edo State Nigeria. The Senatorial District is located within Latitude 6⁰17' and 6⁰45' north of the Equator and Longitude 5⁰45 and 6⁰17' east of the Greenwich Meridian. It is bounded in the north by Etsako west and central local government areas, in the north-west and west by Owan west and Uhunmwode local government areas, in the south by Delta State and in the east by the River Niger.

The five local government areas are made up of several settlements. Apart from the headquarters which are the only urban settlements, all other settlements are rural. For the purpose of this study, the headquarters and three rural settlements from each local government area are used for this study. The rural settlements were selected by stratified sampling method where the highly populated, medium and the least populated were selected. Table 1 shows the local government areas and their headquarters, selected rural settlements and their population.

Table 1. Local Government Areas, selected settlements and Population

<i>Local Government Area</i>	<i>Headquarters and Selected Rural Settlements</i>	<i>2006 Population Census</i>	<i>2018 projected Population at 3.0% growth rate</i>	<i>0.001% of population</i>
<i>Esan West</i>	<i>Ekpoma</i>	<i>36,432</i>	<i>65,578</i>	<i>66</i>
	<i>Irukepken</i>	<i>14,226</i>	<i>25,607</i>	<i>26</i>
	<i>Emuhi</i>	<i>4,494</i>	<i>8,089</i>	<i>8</i>
	<i>Egoro</i>	<i>1,817</i>	<i>3,271</i>	<i>3</i>

<i>Esan Central</i>	Irrua	24,650	44,370	44
	<i>Opoji</i>	4,365	7,857	8
	<i>Eidenu</i>	2,012	3,622	4
	<i>Ibholulu</i>	1,239	2,230	2
<i>Esan South East</i>	Ubiaja	23,371	42,068	42
	<i>Ewohimi</i>	6,542	11,776	12
	<i>Ugboha</i>	3,112	5,602	6
	<i>Oria</i>	816	1,469	1
<i>Esan North East</i>	Uromi	32,197,	57,955	58
	<i>Egbele</i>	8, 323	14,981	15
	<i>Uwalor</i>	3,114	5,605	6
	<i>Ukoni</i>	1,961	3,530	4
<i>Igueben</i>	Igueben	21,451	38,612	39
	<i>Ekpon</i>	6,842	12,316	12
	<i>Ewossa</i>	2,672	4,810	5
	<i>Amahor</i>	1,358	2,444	2
<i>Total</i>		200,994	361,792	363

Source: Local Government Councils and the National Population Commission, Benin City (2018)

METHODS OF STUDY

Primary and secondary data are used in this study. Primary data were sourced from the Department of Environments in the secretariat of the local government areas and the field of study, that is, the residents of the selected settlements of study. To get primary data from the secretariat, five Interview schedule were distributed and administered on the Heads of Department of Environment in the five local government secretariats. Among others they were used to ascertain the level of climate change awareness created and the impact, the resources used, the measures adopted, the impacts and the common problems. On the other hand, questionnaires were used to obtain data from the residents of the study area. To this end, 363 questionnaires were made and distributed among the settlements. As shown in Table 1, 114 questionnaire were distributed in the local government headquarters (the urban settlements) while 249 questionnaires were distributed among the rural communities. In all 283 were farmers while 80 are into secondary and tertiary occupations. The systematic random sampling technique was used to distribute questionnaires among the sampled residents of these settlements. Among others, the questionnaires were used to get data on residents' awareness, the common problems of the change and the impact. 0.001% of the population of each selected settlement was used for questionnaire distribution as shown in Table 1.

Secondary data on the other hand were collected from relevant documentary materials, published and unpublished books, journals and internet sources. Data collected were analyzed descriptively and using tables.

Temperature and Rainfall Pattern of the Study Area

Characteristically the study area experiences the humid tropical climate which has two distinct seasons, the wet and the dry seasons. The dry season lasts between November and March and this period usually coincide with the period of low sun while the wet season lasts between April and October of each year and it is the period of high. This wet season is brought about by the South-West monsoonal winds which blows across the Atlantic Ocean into the hinterland while the dry season is brought about by the North-East trade winds which blows across the Sahara as at the time of winter in the northern hemisphere.

The mean annual rainfall is about 1915mm while the mean monthly temperature is 27^oc (Adejuwon 2011). The months of July and September have the highest rainfall while the months of December and January experiences the lowest rainfall of the year. The highest temperature in this area is recorded between January and March while the lowest temperature occurs in June and July. This shows that temperatures are relatively high all year round while rainfall is also heavy in the period especially May to October of every year. Table 3 and 4 shows annual rainfall and temperature records of the study area between 2003 and 2017. The data shows general but fluctuated high rainfall.

Table 2: Annual and Mean Rainfall of Study Area 2003-2017

<i>Year</i>	<i>Annual Rainfall (mm)</i>	<i>Mean Annual Rainfall (mm)</i>
2003	1703.00	141.90
2004	1925.00	160.70
2005	1595.00	132.92
2006	1972.90	164.40
2007	2036.50	169.71
2008	1819.70	151.63
2009	1882.00	156.85
2010	2094.40	174.50
2011	2127.20	177.31
2012	2824.40	235.40
2013	2606.70	217.22

2014	2433.60	203.61
2015	1327.60	110.69
1016	1559.30	129.96
2017	2652.20	221.09

Source: Cocoa Research Institute of Nigeria, Udonmora, (2018).

Table 3: Annual and Mean Temperature of Study Area 2003 - 2017

Year	Annual Temperature (°c.)	Mean Annual Temperature (°c.)
2003	326.53	27.20
2004	329.11	27.40
2005	318.72	26.50
2006	319.84	26.60
2007	310.45	25.70
2008	333.42	27.80
2009	343.47	28.60
2010	326.70	27.20
2011	318.82	26.60
2012	335.02	27.91
2013	337.52	28.10
2014	341.58	28.40
2015	320.56	26.74
1016	308.72	25.70
2017	316.94	26.43

Source: Cocoa Research Institute of Nigeria Udonmora, (2018)

Effect of Rainfall and Temperature Pattern in the Study Area

This study shows that high temperature and heavy rainfall causes flooding, erosion and heavy storms in the study area. Its associated impacts in the area include traffic congestion, poor infrastructural services, environmental degradation, poor yield on farmlands, and diseases infection.

Farming: The people of the study area are predominantly farmers. Farming is practiced more in the rural areas due to availability of land. Crops cultivated and produced include food crops such as yam, cassava, tomatoes and maize and tree crops such as cocoa, kola nuts and oranges. Temperature and rainfall change pattern in last few years is affecting farming. Responses from farmers show that high temperature and rainfall has caused disease infection

on crops, poor soil fertility, farm and crop loss due to erosion and flooding which ultimately has led to low farm output.

Of the 363 questionnaires distributed 283 or 78% respondents are farmers who practice mainly crop farming on full time and part time basis. Of the 283 farmers 249 or 88% are rural farmers while 34 or 12% are in the urban centres. Using the impact of rainfall pattern on rural farming, the 249 farmers agreed that the impact was high. They identified erosion and flooding as the commonest which in the last few years have not only made farm roads impassable due to gullies created, but has consistently washed away farm lands and crops. Among the farmers, 102 or 41% remarked that they have witnessed continuous flooding and the washing away of their farmlands and crops in the last 7 years. Farmers in Esan South East made particular reference to the devastating floods of 2014 and 2015 caused by heavy rains that saw the increase in the waters of the River Niger which overflowed its banks and washed away several communities and their farmlands. Also, 27 or 10.8% of the farmers remarked that they have witnessed crop failure and poor harvest as excessive rainfall make tuber crops like yam and cassava rot in the ground.

Physical Environment: Land and farming are the most valued in most rural areas. In the study area, rural lands have been devastated by erosion and flooding. Rural areas at proximity to urban centres are worst as they are places receiving waste water from urban centres. Emuhi community lands have become heavily fragmented due to excessive erosion from Ekpoma town. As a result of the fragmentation, the earth roads are difficult to use while houses and farmlands are severely affected. Most of the roads in the rural areas are earth roads which served mostly the purpose of transporting farm produce to the urban markets. Because the roads are not tarred, heavy rain often washed them and create gullies in them that make them almost impassable for most time of the year. In the urban centres, about 87% of the roads are also untarred and because of this, urban movement is often a serious task. Poor accessibility has grievous socio economic consequences. The rural farmers are all affected by the condition of rural roads. Apart from longer time spent on the roads, the cost of transporting goods is increasing while vehicle accidents are also very common. Of the 149 rural farmers, 36 or 24.% have been involve in vehicle accident in the process of moving from the rural to urban centres. Average cost of transportation between rural areas and their local government headquarters is on motor vehicles is ₦200 or 0.68 Dollars. It is of note to mention here that because of the nature of rural roads, motorcycle and tricycles are the most preferred means of transportation in the rural areas as accounted by 231 or 92.8% of respondents. This means is popular because it

is faster on the roads and also has the ability to meander through bad spots on the roads. Average cost of movement per person to the urban centres is ₦400 or 1.2 Dollars. This means is also popular in the urban centres and is the most used within the urban centres as accounted for by 96 or 84.2% of the urban respondents.

Infrastructure: According to Onokerhoraye (1982) over 65% of infrastructure in the Nigeria is located in the urban areas. This is also true of the study area where 62% of amenities are located in the local government headquarters of Edo Central Senatorial District (Omofonmwan, 2004 and Emily, 2011). Amenities in the study area and particularly the urban centres include hospitals, housing, tarred roads, electricity, schools, telephone, police stations, prisons, courts, post offices and banks. Using roads as an amenity of climate influence, it can be seen that roads and particular the urban roads are in deplorable conditions. The roads are characterized with pot holes and failed portions. A major cause is the constant flooding as can be seen in Ihumudumu road in Ekpoma and the Uromi-Ubiaja road. When it rains these and other roads are flooded and become almost impassable. Worse still the poor drainage system that are inadequate and lack good depth and network are always unable to drain the volume of heavy rain water. Apart from roads, many houses have also been affected. From the questionnaire survey, 9 houses in the rural areas and 5 houses in the urban areas have collapsed since the year 2008. The removal of soil around the foundation of such buildings for long year has partly been attributed. Some areas are erosion and flood prone. Examples are Ukpenu in Esan West, Ubiaja in Esan South East and Uwalor and Ukomi in Esan North East.

Health: The impact of climate change on health cannot be overemphasized. Temperatures affect virtually every aspect of the environment. The effect on man is mostly health related and according to Doerr, (2018), temperatures between 28-35⁰C can cause problems such as heat rashes, heat stroke, exhaustion, cramps and syncope in man. From the questionnaires distributed, 86% of respondents agreed that heat rash was the commonest problem that people suffer as a result of excessive heat from high temperatures. On the diseases which are influenced by high temperature and rainfall pattern in the area, 82% of the respondents identified malaria, 14% identified typhoid fever while 4% identified other diseases like cholera and diarrhea. These diseases come about when accumulated floods from heavy rainfall become breeding places for malaria causing pathogens or when water consumed is contaminated by fecal microorganisms that have been spread during heavy rainfall (Oredola, 2016 and NCDC, 2017). It should be noted that temperature impact on the life cycle of pathogens. For example temperature of 21⁰c to 23⁰c is very suitable for the development of mosquitoes that causes

malaria fever (Harvell et al 2002). To ascertain the claim of the respondents on these diseases, 5 year record of the diseases from the Primary Healthcare Centres in the study area were obtained as shown in Table 4.

Table 4. Reported Cases of Malaria, Typhoid and Heat Rash between 2013 and 2017 in the Study Area

Year	Malaria	Typhoid	Heat Rash	Total
2013	43,783	18,436	53	62,272
2014	48,417	17,338	49	65,804
2015	37,615	21,855	118	59,588
2016	54,952	24,675	34	79,661
2017	54,413	28,016	72	82,501
Total	239,180	110,320	326	349,826

Source: Primary Healthcare Centres in the Study Area (2018).

From the Table 4, malaria fever is obviously the most suffered disease in the study area and this accounted for 68% of the diseases listed. Typhoid fever accounted for 31.5% while Heat Rash accounted for 0.09% making it the least reported case. Let it be stated that 72% of the cases are from the rural communities in the study area while only 28% are from the urban centres. From the Table 4 also, one can see a general progression in the infection of these diseases which portend that more persons will be infected except adequate measures are taking.

Urban Environment. One of the commonest problems in the urban centres of the study area is indiscriminate waste disposal. The study of Ojeifo and Uwadiae (2005) shows that waste ranging from papers, plastics, metals, food remnants and wood material are usually disposed indiscriminately in the market places, open spaces, along roads, in drains and in other public places. Because of poor waste management practices by the people and the local government authorities, most parts of the towns are usually littered with wastes whenever there is heavy rainfall. Apart from creating poor aesthetics, the littered wastes create opportunity for bad smell and the breeding of pathogens that cause diseases. In a study of the problem of refuse disposal in Ekpoma and Irrua towns in Edo State, Ojeifo and Uwadiae (2005) observed among others, that lack distance to dumpsites, attitude of inhabitants and the local government council's inadequacies as responsible for the poor waste management in the area.

Management of Climate Change Effects and Problems in the study Area.

The management of climate change effects involves weather data gathering, dissemination of information based on data, awareness creation, response to effects of weather condition and the provision of facilities and equipment to ameliorate the effects. In the study area, the departments of environment in the local government councils are responsible for the management of climate change conditions. The techniques for administration include creating awareness for climate change and effects, responding appropriately to severe weather conditions and effects, facility provision and rehabilitation and the provision of equipment and personnel. From the field survey carried out however, it was discovered that very little of these goals are being pursued and achieved in the study area.

Field investigation shows that there is no form of climatic data gathering and information dissemination by the local government councils in the study area. The reason for this is that none of the councils have weather facilities from which data is gathered. Without weather data and information, it is practically impossible to disseminate information about weather conditions and possible effects.

For lack of data and information, awareness on climate change and effects was discovered to be low in the study area. The interview schedule administered on the local council authorities shows that they have little knowledge about the changing pattern of these climatic elements. Although they indicated that they are aware that temperatures are high all year and rainfalls are heavy in their periods and also know that effects occur from their occurrences but that they have never carried out any campaign to sensitize or create awareness about this.

For lack of information on weather data in the area, some residents now rely on mobile phones, print and electronic media for weather information. From the questionnaires administered, 44 or 12% of respondents have access to climatic data and information. Among this number, 36 or 82% get their data and information from their mobile phones while the remaining 8 or 18% gets theirs from other media sources such as radio, newspapers and television. The residents also remarked that the local authorities have never engaged the people in any awareness campaign to sensitize them on this change pattern and effects.

Management also involves quick response and inspection of places affected by climate change effect especially the action of heat waves, erosion, flooding and rainstorms. At the local government level, there exists Local Emergency Management Agency (LEMA). The department of environment is responsible for coordinating the objectives of this agency. The principal assignment is to provide quick response to emergency situations and take action that will

prevent a reoccurrence. In the study area, this assignment is seldom made by the local government when there is emergency situation. Even when steps are made, they are often of non effect. For example, the local council authorities were not able to manage the floods that occurred in the study area in 2014 when the river Niger over flooded its banks as a result of excessive rainfall. As at today, no concrete measure has been taking either in terms of feasibility studies, attending to the river banks, construction of adequate drainages system for the area, provision of relief materials or empowering local farmers who were worst affected by the floods.

Effective management involves the provision, replacement or repair of facilities to ameliorate the effects of climate change. For example, facilities negatively affected by the action of erosion and flooding such as roads and drainages which result in damages and make them channels for flooding are expected to be fixed. In the study area, most tarred roads of which 65% are in the urban centres have potholes and failed parts. The rural untarred roads which are over 10,800 kilometers are constantly been washed. The interviews on the local council shows that only 13 kilometres of roads have been constructed and tarred by the local government council since 2012 while only 52 repairs were carried out on potholes and failed portions of existing tarred roads. On the rural roads, no new construction has been carried out since 2012, only re-grading of existing roads has been carried out in few communities. On the whole very little is been done by the local government to respond to road situation affected by climate change.

Availability of equipment and personnel are basic for effective management of climate change effects. For example, waste disposal trucks are essential for environmental sanitation. In the study area, weekly sanitation by the local government is done every Mondays but restricted to market places for the purpose of revenue generation. General sanitation is also done in the area once every month. The success of the monthly sanitation especially in the urban centres has been adjudged to be fairly higher than of the rural areas (Okhai 2017). The success has largely been attributed to residents' participation rather than the local government councils. This is because apart from the general sanitation announcement which the council makes to the public prior to the exercise and the physical presence of men of the department of environment to coordinate and do surveillance, all collection and disposal are done by the residents'. Therefore most of the refuse disposed indiscriminately and spread by erosion and floods are often disposed by residents" Table 5 shows types and number of some sanitation equipment owned by the local councils in the area.

Table5: Types and number of some Waste Management Equipment and Personnel in the Local Councils

Local Government Council	Disposal Trucks	Pail Loaders	Personnel Carriers	Diggers	Shovels	Trained Personnel	Untrained Personnel
<i>Esan West</i>	2	1	1	7	5	4	8
<i>Esan Central</i>	-	-	-	3	2	4	4
<i>Esan North East</i>	1	-	2	7	6	3	5
<i>Esan South East</i>	1	-	-	5	3	4	6
<i>Igueben</i>	-	-	1	4	6	6	3
Total	4	1	4	26	24	21	26

Source Field Survey (2018)

Column 7 of Table 5 here shows the inadequate qualified personnel in the department of environment in the local council authorities. This is one of the reasons why the study area and particularly the rural areas are not always covered for inspection and sanitation. The consequence is that these rural communities are dirty and filled with refuse of all kinds.

Finally, the management of climate change effects also involves managing victims of floods, erosion and heat related diseases. The study area has 54 Primary Healthcare Centres that are owned and operated by the local government councils. Although there are doctors and other medical personnel and equipment, they are however inadequate, Also the Primary Healthcare Centres cannot handle severe cases. As shown in Table 4, malaria, typhoid and heat rash are the frequently reported cases associated with climatic influence. Victims of weather related cases often handle their cases by themselves as the local government does not take any responsibility in this regard

Problems of Climate Change Management in the Study Area

The problems of the management of climate change effects in the study area are many. They are inadequate facilities, inadequate manpower, lack of action plan for climate change effects

and the problem of funding the environmental department. The department of environment is responsible for environmental data gathering, plan formulation, enforcement and execution of plans and monitoring. This study has revealed that the departments in the local council areas have not been able to effectively handle most environmental challenges due to inadequate funding. For example budgetary allocation to this department has not exceeded 3 Million Naira or 855 Thousand Dollars in the last 15 years. This is rather too small for meaningful response to environmental problems. The highest budget ever presented by any council in the study area is 2 Billion Naira or 54 Million Dollars and this was in 2014. Every year, recurrent expenditure takes about 80% of budgets and what is usually left for capital and other developments is usually too meager to meet the aspirations of the people. Table 6 shows budgetary allocation to the departments of environment in the council authorities between 2013 and 2017.

Table 6: Percentage of Budgetary Allocation **(in Million Naira)** to the Departments of Environment of the five Local Government Council Areas

<i>Year</i>	<i>Esan West</i>	<i>Esan Central</i>	<i>Esan North East</i>	<i>Esan South East</i>	<i>Igueben</i>
2013	1.6	0.6	0.8	0.6	1.2
2014	1.6	1.2	1.1	18	1.4
2015	1.8	1.9	118	1.6	1.8
2016	1.6	2.4	34	2,2	0.9
2017	3.1	2.1	72	1.9	2.1

Source: Local Council Areas of the Study Area (2018)

CONCLUSION AND RECOMMENDATION

This study is an evaluation of the management of climate change impact on rural communities of Edo State Central Senatorial District. A process approach was followed in which rainfall and temperature conditions and their effects were examined while the role of the local authorities in mitigating and ameliorating these effects was ascertained. Primary and secondary data were used in the study and these data were analyzed descriptively with results presented in tables. The findings were that temperature and rainfall patterns are high or intense which is an evidence of climate change in the study area. On the impact of temperature and rainfall pattern, the study observed that these elements have great impact on farming, the physical environment, infrastructure development, the health of the people and the urban environment.

The study observed that the department of environment in the local council authorities was responsible for the administration and management of climate change effects. In managing

these effects therefore, this unit adopted the techniques of awareness creation, response to occurrence, facility provision and the provision of adequate equipment and personnel. However, the study discovered that the department of environment in the local council authorities was not able to effectively manage these effects due to inadequacies in all the areas of management. For example the departments of environment do not have facilities for climate data collection, awareness creation and dissemination of weather information, waste disposal facilities, enough personnel to respond to effect occurrence and funding. It is against these operational problems that the following recommendations believed to be capable of ameliorating the effects of climate change in the study area are made

First it is recommended that the five local government areas jointly build an automated digital weather station where daily reading and recording of rainfall, temperature and other climate elements data could be carried out. This station can be located in any of the local government areas provided it is build by experts in the field with clear adherence to installation provisions. Climatologist or meteorologist can therefore be employed to do the recording of data.

Secondly, upon the location of a weather station, information from the station on daily data recorded and weather outlook should be disseminated to the general public through the television or the internet so those with mobile phones can easily access them. This innovation can easily prepare people ahead in the case of any severe weather occurrence and effects.

It is also recommended that the local government councils should wake up to their responsibility in the areas of the provision and rehabilitation of facilities. As observed, many roads particularly rural roads are not tarred and the few urban roads that are tarred are dilapidating very fast with potholes and failed portions. Drainages are broken and wearing away and creating opportunities for flooding and erosion in the study area. The local government must therefore engage in the construction and rehabilitation of roads and drainages so as eliminate the problem of flooding and its effect on traffic and the health of the people.

The environmental department is grossly underfunded. For this reason it is unable to function effectively and efficiently in the study area. For lack of or inadequate funds vital materials and equipments needed for regular operations such as personnel carriers, waste disposal trucks, fire service trucks, pail loaders, graders and even simple shovel and diggers are not adequate. Also the number of trained personnel are inadequate to handle . The occurrence of severe weather condition or any other environmental problem must be attended to by qualified persons who have the requisite training. As it is presently the number of trained personnel is inadequate

therefore it is recommended that more personnel be employed, that is a minimum of 10 qualified personnel in each department of environment in the local government areas who should be sent on regular training.

Finally, the effects of rainfall and temperature in the area are enormous. As rural areas, their major occupation is farming. The threat of high temperatures and rainfall on farming in the last few years has been very great. In the process, crops and lands have been lost. If famine and hunger must be avoided in the area, the local government must give support to the rural farmers. The support should be in the form of financial assistance, provision of improved seedlings, land reclamation and other extension services to boost food production in the study area.

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