

Risk Management and Challenges of Climate Change in Nigeria

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ABSTRACT The world's climate is changing and will continue to change in the coming century at rates projected to be unprecedented in recent human history. The risks associated with these changes are real but highly uncertain. Societal vulnerability to the risks associated with climate change may exacerbate ongoing social and economic challenges, particularly for those parts of society dependent on resources that are sensitive to changes in climate. The main thrust of this paper is on the risk management and challenges of climate change in Nigeria. It reviews the incidence of climatic change in Nigeria, the vulnerability of Nigeria as a nation to climate change, and the consequences of climate change in Nigeria. The research design approach adopted in this work is the survey research technique. The findings provided the following insights: first, that industrial releases, deforestation, improper sewage disposals are human activities responsible for climate change; secondly, that flooding, drought, erosion, make up the challenges resulting from climate change, and lastly that government/agencies in charge do not really help to reduce the risk associated with climate change in Nigeria. Based on findings obtained, it can be concluded that bush burning, over grazing, gas flaring, CO₂ are responsible for Nigeria climate change while creation of environmental/climate refugees, threats to the future of children, reduction in economic growth, increases in diseases, immediate setback on agriculture, loss of biodiversity are some of the challenges as a result of change in climate. Essentially, Nigerian Government should provide solutions to manage the associated risk with climate change in Nigeria like, afforestation programme, good policies, development of biotechnology, integrated climate risk management, and technology that can capture at least 80% of carbon emitted by industries.

INTRODUCTION AND BACKGROUND

Climate change refers to any change in climate overtime, whether due to natural variability or as a result of human activity (McCarthy 2001: 2). It can also be seen as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (Parry 2007: 9).

Climate change has become a global issue in recent times manifesting in variations of different climate parameters including cloud cover, precipitation, temperature ranges, sea levels and vapour pressure (Ministry of Environment of the Federal Republic of Nigeria (MoEFRN) 2003: 43). The variations in climate parameters affect different sectors of the economy such as agriculture, health, water resources, energy etc. The main cause of climate change has been attributed to anthropogenic (human) activities. For example, the increased industrialization in the developed nations has led to the introduction of large quantities of greenhouse gases (GHGs), including carbon (IV) oxide (CO₂), methane (CH₄)

and nitrous oxide (N₂O) into the atmosphere. These GHGs are the primary causes of global warming. The global increases in CO₂ concentration are due primarily to fossil fuel use and land use change, while those of CH₄ and N₂O are primarily due to agriculture. There is no doubt therefore that the earth is getting warmer and human beings are mainly to be blamed (Spore 2008: 43). With reference to sub-Saharan Africa, there is growing interest on the likely impacts of climate change on agriculture, economic growth and sustainable development. Incidences of climate change include changes in soil moisture, soil quality, crop resilience, timing/length of growing seasons, yield of crops and animals, atmospheric temperatures, weed insurgence, flooding, unprecedented droughts, sea level rises and many more. There are projections of increases in rainfall in the humid regions of southern Nigeria, which are accompanied by increases in cloudiness and rainfall intensity particularly during severe storms. Similarly, the savannah areas of northern Nigeria were projected to experience less rainfall, which coupled with temperature increases, reduces soil moisture availability. Increased temperatures and accompany-

ing decrease in water availability reduce the length of growing seasons and yield potential and hence the areas suitable for agriculture, further adversely affecting food security over the continent (Thornton et al. 2006: 23-27). It is now clear that most adverse climatic and environmental impacts that occur today are manifestations of man's inadvertent modifications to climate on local and to a limited extent, regional scale in some activities of the distant past. Natural and human induced global environmental change belongs to the class of risk with high probability of occurrence and damage potential but in such a remote future that for the time being no one is willing to perceive the threat. Although the probability of occurrence and the damage potential are well known and clear, there is always a time lag between trigger and consequence which create a fallacious impression of security. Most disasters (including flood, droughts, desertification, land degradation, subsidence, etc.) are not random events without underlying causes; they are sudden manifestations of slow but continuous degradation processes (UNEP-GRID-Arendal 2005: 3).

Broad scientific agreement now exists that continued accumulation of heat-trapping "greenhouse" gases in the atmosphere is contributing to changes in the global climate, and in the climates of regions around the world (Crosson 1997: 1-3). An analysis of temperature records shows that the earth has warmed an average of 0.6°C over the past 100 years (Environment Canada 2008: 1). The warming is real and significant though its intensity has varied from decade to decade, from region to region and from season to season, and been mainly caused by greenhouse gases (Crosson 1997: 1-3). There is a growing consensus in the scientific literature that over the coming decades, higher temperatures and changing precipitation levels caused by climate change will be unfavourable for crop growth and yield in many regions and countries (Yesuf et al. 2008: 12). To what extent this will be the case in Nigeria particularly in the southeast rainforest zone where both temperature and precipitation approach extremes has not received much research interest. Disaster risk and climate change are two threats to human well-being that reinforce each other. Hence, they represent some of the greatest challenges to humankind in this century. Disaster risk is an intrinsic characteristic of human society, arising from the combination of natural and human factors and subject to exacerbation or reduction by

human agency. While the adverse impacts of climate change on society may increase disaster risk, disasters themselves erode environmental and social resilience, and thus increase vulnerability to climate change (O'Brien et al. 2008: 3). Climate change – and the likely increase in disasters – threatens to block pathways out of poverty in developing countries especially those in Africa. Any increase in disasters, whether large or small, will threaten development gains and hinder the implementation of the Millennium Development Goals (ISDR 2008: 55). In the coming decades, climate change is expected to exacerbate the risks of disasters, not only from more frequent and intense hazard events but also through greater vulnerability to the existing hazards (ISDR 2008: 59). Approaches toward the management of climate change impacts have to consider the reduction of human vulnerability under changing levels of risk. A key challenge and opportunity therefore lies in building a bridge between current disaster risk management efforts aimed at reducing vulnerabilities to extreme events and efforts to promote climate change adaptation (Olorunfemi 2008; Few et al. 2006). The long term horizon of climate change and current scientific uncertainties pose special challenges. Strategies that address challenges recognise that there is no best solution. In this sense, climate change provides new incentives for the need to plan ahead and to anticipate extreme events and trends (Zevenbergen et al. 2008: 23). Within the context of extreme weather events especially flooding, this means that management strategies must meet the present needs while providing a path of adjustment for the future.

Nigeria, like many other countries, is exposed to climate change-induced dangers of desertification, erosion, flooding and other ecological problems. Considering the strong nexus between climate change and development, Nigeria is highly at risk in the area of food and nutrition, poverty and hunger reduction, and most importantly, economic development. Consequently, Nigeria's efforts and actions must be informed by these realities.

Research Problem

The study, therefore, seeks to ascertain the extent to which climate change has affected Nigeria and the possible risk management strategies adopted to manage the challenges associated with the changes in climate. Despite that

there is favourable climate, yet there are some challenges that Nigeria is facing as a result of climate change. Among those problems are:

- ♦ Persistent droughts, flooding, and off-season rains have sent growing season out of orbit on a country dependent on rain-fed agriculture.
- ♦ Alarm bells are ringing with lakes drying up, increased risk of death, hunger, migration and a reduction in river flow in the different parts of the country resulting in low water supplies for use in agriculture, hydro power generation and other users.
- ♦ Increase in greenhouse gasses such as carbon dioxide and other gases which is problem to human existence.
- ♦ More than 100,000 farming families move southwards as a result of the desertification which is the resultant effect of climate change in the country.
- ♦ Increasing incidence of disease, declining agricultural productivity, and rising number of heat waves in Nigeria.

Climate change often appears very esoteric but in Nigeria it is real and this call for scientific study of this kind. Therefore, this research work will endeavour to examine those areas responsible for climate change, the challenges and possible risk management strategies to finding solutions to the changes.

Research Questions

Given the statement of problem outlined above, it becomes necessary to ask the following questions.

- ♦ To what extent has deforestation, industrial releases, improper sewage disposals as a result of human activities been responsible for climatic changes in Nigeria.
- ♦ Does flooding, drought, erosion, tropical storm, sea level rises pose the challenges/threatening results of climate change in Nigeria as a country.
- ♦ Do Government/Agencies efforts help to reduce the risks associated with climate change and are there solutions proffered by them to manage the associated risks of climate change in Nigeria.

Research Objectives

The broad objective of the research is to identify ways and means by which climate change in Nigeria and its risk/challenges in the

Nigerian environment could be managed to an acceptable level.

In order to achieve this, the research attempts to achieve the following key specific objectives:-

- ♦ To identify whether deforestation, industrial releases, improper sewage disposals are some of the major factors that are responsible for climate change in Nigeria.
- ♦ To identify the various challenges such as flooding, drought, erosion, sea level rise and effects that climate change poses on the country.
- ♦ To proffer solutions/ways to manage the associated risks of climate change in Nigeria.

Theoretical Foundation

Climate change is a global problem that requires global solutions and is also one of the most important issues on the global political agenda, with a series of efforts to find solutions through international negotiations. Climate change has become a global issue in recent times manifesting in variations of different climate parameters including cloud cover, precipitation, temperature ranges, sea levels and vapour pressure (Ministry of Environment of the Federal Republic of Nigeria (MoEFRN) 2003: 43). The variations in climate parameters affect different sectors of the economy such as agriculture, health, water resources, energy etc. The main cause of climate change has been attributed to anthropogenic (human) activities. For example, the increased industrialization in the developed nations has led to the introduction of large quantities of greenhouse gases (GHGs), including carbon (IV) oxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) into the atmosphere. These GHGs are the primary causes of global warming. The global increases in CO_2 concentration are due primarily to fossil fuel use and land use change, while those of CH_4 and N_2O are primarily due to agriculture. There is no doubt therefore that the earth is getting warmer and human beings are mainly to be blamed (Spore 2008: 4). With reference to sub-Saharan Africa, there is growing interest on the likely impacts of climate change on agriculture, economic growth and sustainable development. The world has risen to the challenge and has started to put in place legal and institutional mechanisms and measures to collectively tackle the issues of climate

change. The most prominent of these are the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. But since it is also a local phenomenon, interventions to cope with climate change impacts require the engagement of stakeholders at national and local levels. Adaptation requires the active involvement of different actors and responses at multiple levels.

Broad scientific agreement now exists that continued accumulation of heat-trapping "greenhouse" gases in the atmosphere is contributing to changes in the global climate, and in the climates of regions around the world (Crosson 1997: 1-3). An analysis of temperature records shows that the earth has warmed an average of 0.6°C over the past 100 years (Environment Canada 2008: 1). The warming is real and significant though its intensity has varied from decade to decade, from region to region and from season to season, and been mainly caused by greenhouse gases (Crosson 1997: 1-3). There is a growing consensus in the scientific literature that over the coming decades, higher temperatures and changing precipitation levels caused by climate change will be unfavourable for crop growth and yield in many regions and countries (Yesuf et al. 2008: 12). To what extent this will be the case in Nigeria particularly in the southeast rainforest zone where both temperature and precipitation approach extremes has not received much research interest. Disaster risk and climate change are two threats to human well-being that reinforce each other. Hence, they represent some of the greatest challenges to humankind in this century. Disaster risk is an intrinsic characteristic of human society, arising from the combination of natural and human factors and subject to exacerbation or reduction by human agency. While the adverse impacts of climate change on society may increase disaster risk, disasters themselves erode environmental and social resilience, and thus increase vulnerability to climate change (O'Brien et al. 2008: 3). Climate change and the likely increase in disasters threaten to block pathways out of poverty in developing countries especially those in Africa. Any increase in disasters, whether large or small, will threaten development gains and hinder the implementation of the Millennium Development Goals (ISDR 2008: 55). In the coming decades, climate change is expected to exacerbate the risks of disasters, not only from more fre-

quent and intense hazard events but also through greater vulnerability to the existing hazards (ISDR 2008: 59). Approaches toward the management of climate change impacts have to consider the reduction of human vulnerability under changing levels of risk. A key challenge and opportunity therefore lies in building a bridge between current disaster risk management efforts aimed at reducing vulnerabilities to extreme events and efforts to promote climate change adaptation (Olorunfemi 2008; Few et al. 2006). The long term horizon of climate change and current scientific uncertainties pose special challenges. Strategies that address challenges recognise that there is no best solution. In this sense, climate change provides new incentives for the need to plan ahead and to anticipate extreme events and trends (Zevenbergen et al. 2008: 23). Within the context of extreme weather events especially flooding, this means that management strategies must meet the present needs while providing a path of adjustment for the future. Climate change, which is attributable to the natural climate cycle and human activities, has adversely affected productivity in Nigeria (Ziervogel et al. 2006: 8). Available evidence shows that climate change is global, likewise its impacts; but the most adverse effects will be felt mainly by developing countries, especially those in Africa, due to their low level of coping capabilities (Nwafor 2007: 2; Jagtap 2007: 6). Nigeria is one of these developing countries (Odjugo 2010: 47-55). As the planet warms, rainfall patterns shift, and extreme events such as droughts, floods, and forest fires become more frequent (Zoellick 2009: 7), which results in poor and unpredictable yields, thereby making farmers more vulnerable, particularly in Africa (UNFCCC 2007: 9). Farmers (who constitute the bulk of the poor in Africa) face prospects of tragic crop failures, reduced agricultural productivity, increased hunger, malnutrition and diseases (Zoellick 2009: 5). It is projected that crop yield in Nigeria may fall by 10-20% by 2050 or even up to 50% due to climate change (Jones and Thornton 2003: 54), particularly because Nigerian agriculture is predominantly rain-fed and hence fundamentally dependent on the vagaries of weather. As the people of Nigeria strive to overcome poverty and advance economic growth, this phenomenon threatens to deepen vulnerabilities, erode hard-won gains and seriously undermine prospects for development. Therefore, there is a need

for concerted efforts toward tackling this menace.

The constant reportage of disasters occurring in Nigeria in the print and electronic media signals the enormous vulnerability of Nigerians to day-to-day natural and human-induced hazards. Recent Nigerian history is replete with various accidents and mishaps which reveal the lack of preparedness of this populous State to deal with emergencies. Nigeria's inadequate disaster management systems were even more harshly exposed when the nation endured a series of air crashes from 2005 to 2006 and beyond. All the violent conflicts and civil disturbances which ubiquitously flared up in many parts of the country over the past decade were characterised by the slow response of the security, emergency and relief agencies to crisis spots, and the consequent needless prolongation of the suffering of those who had been affected by them. As Nigeria marked the tenth anniversary of the 2002 Ikeja ammunition depot explosion disaster, and as the world continues the mop up activities following the recent massive earthquake devastation of Haiti, it has become imperative for Africa's most populous State to radically reorganise its disaster response capability, and to prepare a specific plan to improve the response capacities of the local people, improve their livelihood in everyday life, for example, by strengthening and improving housing quality, gainful employment and access to income. The urgency of these tasks has been made even more compelling by the fact that the country is reportedly within an earthquake-prone zone (Muanya 2010: 24-34). That Nigeria lacks the most basic standards of disaster risk prevention, management and reduction is a subject that has received considerable attention. By international standards, oil pipes ought to be replaced after 15 to 20 years, but most pipelines in use in Nigeria are about 20 to 25 years old, making them vulnerable to corrosion and leakage. In some cases, the pipes are laid above ground level without adequate surveillance, exposing them to wear and tear and other dangers. It is also noted that most of the facilities were constructed between the 1960s and early 1980s to the then prevailing standards.

Nigeria is vulnerable to climate change impacts due to its geography, climate, vegetation, soils, economic structure, population and settlement, energy demands and agricultural activ-

ities. The location and size of, and the characteristic relief in Nigeria gave rise to a variety of climates ranging from tropical maritime climate characterized by the rainforest along the coastal and southern section to the tropical hinterland climate associated with the Sahel in the north eastern section of the country. One irony in climate change as a global problem is that developing countries who contribute the least to cause the problems are the most vulnerable to its impact. They are the most vulnerable because they are least endowed with resources and technology to combat the problem and their economies are based largely on natural resources – dependent sectors that are climate sensitive. Nigeria happens to be one of those countries. Mendelsohn et al. (2000: 17-20) and Mendelsohn et al. (2006: 35-40) argue that the primary reason that poor countries are so vulnerable is their location. Countries with low latitudes start with very high temperatures. There are various reasons why Nigeria is vulnerable to climate change apart from being a developing country. For instance; it is established that every country is affected by climate change, but the degree with which it is impacted to produce damage differs, depending on geographical circumstances, the capacity with which to withstand the impact and the nature of the economy. Nigeria's vulnerability to climate change comes both from being located in the tropics, and from various socio-economic, demographic, and policy trends limiting its capacity to adapt to change. NEST (2003: 5-16), and Ayuba et al. (2007: 19) indicate that constant loss of forest cover and biodiversity in Nigeria is linked to global warming and climate change. Nigeria is a country already being plagued by diverse ecological problems which have been directly linked to changing climate. They are of the opinion that the effects will be more pronounced due to existing low level of coping capabilities in Nigeria and other parts of Africa (Ibid).

Integrated climate risk management, as a concept, would address both the hazards and vulnerabilities which configure particular risk scenarios and would range in scale from actions to manage the local manifestations of global climate risk, through to global measures to reduce hazard (for example, by reducing greenhouse gas emissions) and to reduce vulnerability (by increasing the social and economic resilience of vulnerable countries such as SIDS, for example). Integrated climate risk management would need to include elements of anticipatory risk

management (ensuring that future development reduces rather than increases risk), compensatory risk management (actions to mitigate the losses associated with existing risk) and reactive risk management (ensuring that risk is not reconstructed after disaster events). Moreover, it will have to take into account both potential impacts on socio-economic and environmental systems. Integrated climate risk management could provide a framework to allow the disaster community to move beyond the still dominant focus on preparedness and response and for the adaptation to climate change community to move beyond the design of hypothetical future adaptation strategies. In some regions, such as the Caribbean and the South Pacific, synergy such as this is already being achieved. However, urgent actions must be taken at the international, national and local levels if integrated climate risk management is to move from a concept to practice and serve to reduce risks and protect development.

RESEARCH METHODS

After considering the problem and purpose of this study, the survey research technique design was chosen, because it will provide answers to questions relating to climate change. The survey approach appeared best suited for this work since it is not feasible to interview the entire population. Furthermore, in surveys, there are fixed sets of questions, and responses are systematically classified, so that quantitative comparisons can be made. Answers to these questions are found in the secondary data or by conducting surveys. Therefore two major sources were employed in the quest to gather information for the study. They were both secondary and primary sources.

Structured questionnaire was used to source the primary data. The researcher followed a sequence of logical steps to develop a good questionnaire that would accomplish the research objectives. One hundred and thirty people drawn from Enugu State in Nigeria were given the questionnaire to complete. The respondents were promised a copy of the summary results of the findings to entice them to participate. This approach appears to have created much interest, and the willingness to participate might have been lower otherwise. Frequency table and percentages were used to analyze the data collected from the survey.

DATA ANALYSIS

This section concentrates on the analysis of the data collected for this research work in tabular form, in order to aid in the proper understanding of the respondents views pertaining to typical issues raises in the questionnaires. A total of 136 questionnaires were distributed to the respondents out of which 130 were validly returned.

Demographic Information of Respondents

Demographic information was collected to establish the number, gender and age distribution of respondents as explained in Table 1.

Table 1: Respondents' response rate

Total questionnaires	%	Returned questionnaires	%	Difference	%
100	130	95.59	6	4.41	

Source: Field Survey 2011

Table 1 shows that 6 questionnaires were not valid representing 4.41%. The remaining 130 questionnaires were valid and represent 95.59% of the total questionnaires distributed.

Table 2: Gender distribution of the respondents

Options	No. of respondents (No.)	Percentage (%)
Male	44	33.85
Female	86	66.15
Total	130	100.00

Source: Field Survey 2011

Table 2 shows that the numbers of female respondents are more than that of male respondents.

Table 3: The age distribution of the respondents

Options	No. of respondents (No.)	Percentage (%)
20-25yrs	25	19.23
26 – 35yrs	35	36.92
36yrs – above	70	53.85
Total	130	100.00

Source: Field Survey 2011

Table 3 shows that the age bracket that responded to the questionnaire is between 36 years - above with 53.85% followed by ages 26-35 years with 26.92% and the least age is 20-25 years with 19.23%.

Awareness Level of Climate Change

This section was undertaken to probe the awareness level of respondents, in order to ascertain their perception about climate change. The analysis and interpretation is as under:

Table 4: Awareness of respondents about climate change

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	39	61	100	76.92
No	5	25	30	23.08
Total	44	86	130	100.00

Source: Field Survey 2011

Table 4, shows that when the respondents were asked whether they know what climate change is all about, 76.92% of the people interviewed responded in affirmative, while 23.08% responded to the contrary.

Table 5: Knowledge about climate change

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
It is the weather condition	17	28	45	34.62
It is the change of weather at a particular time	8	17	25	19.23
No response	19	41	60	46.15
Total	44	86	130	100.00

Source: Field Survey 2011

Table 5, also shows that when respondents were asked what they know about climate change, 34.62% of the people responded that it has to do with the weather condition, 19.23% say it is the change in weather condition at a particular time, while 46.15% did not respond to this question.

Table 6: Solution to the problem of climate change

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	16	39	55	42.31
No	24	36	60	46.15
No response	4	11	15	11.54
Total	44	86	130	100.00

Source: Field Survey 2011

Table 6 shows that to many of the business people, farmers and few students, anything climate is a natural phenomenon beyond human control and as such cannot be solved by man but by God. Hence, when asked whether they think the problem of climate change can be solved at all, 42.31% responded in affirmative and most of them are educated and know much about climate change and think it can be solved, 46.15% responded negative, while 11.54% did not respond to this question.

Table 7: Problems of climate change affects you as an individual

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	29	67	96	73.85
No	15	19	34	26.15
Total	44	86	130	100.00

Source: Field Survey 2011

Table 7 shows that when asked whether they think the problem of climate change affects them, 73.85% responded positively, while 26.15% believed that the problem of climate change does not affect them in any way.

The Impact of Human Activities on Climate Change

This section takes into consideration the impact of human activities such as overgrazing, bush burning, extraction of fuel wood, pesticide use, gas flaring on climate change, as analyzed in Table 8.

Table 8 shows 114 respondents representing 87.69% of the valid returned questionnaires believed that excess grazing of animals like cattle, burning of bush, removal of fuel wood, continuous use of pesticide, gas flaring leads to

changes in climate in our country, while 16 respondents representing 12.31% of the returned questionnaire said no to that postulation.

Table 8: Improper land use causes change in climate

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	39	75	114	87.69
No	5	11	16	12.31
Total	44	86	130	100.00

Source: Field Survey 2011

Table 8 shows 114 respondents representing 87.69% of the valid returned questionnaires believed that excess grazing of animals like cattle, burning of bush, removal of fuel wood, continuous use of pesticide, gas flaring leads to changes in climate in our country, while 16 respondents representing 12.31% of the returned questionnaire said no to that postulation.

Table 9: Absence of greenhouse gases may reduce climate change

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	30	70	100	76.92
No	14	16	30	23.08
Total	44	86	130	100.00

Sources: Field Survey 2011

Table 9 reveals that 100 respondents representing 76.92% of the respondents were in support that absence of greenhouse gases such as CO₂ and methane, tilling of the soil, volcanic eruptions, burning of fossil fuels may reduce climate change while 30 respondents representing 23.08% of the respondents disagreed with this view.

Table 10: Poor human activities lead to climate change

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	30	77	107	90
No	14	9	23	10
Total	44	86	130	100

Source: Field Survey 2011

Table 10 reveals that 107 respondents representing 90% agreed that removal or cutting down of trees or forest from a place, releases of waste products from industries, improper getting rid of waste products can lead to change in climate, while 23 respondents representing 10% disagreed.

Challenges from Climate Change

This section considers the various challenges emanating from climate change. It also looks at the risks associated with the phenomenon as explicated in the following tables:

Table 11: Creation of environmental/climate refugees, threats to the future of children, increase in diseases could be some of the challenges/risk resulting from climate change

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	34	72	106	81.54
No	10	14	24	18.46
Total	44	86	130	100.00

Source: Field Survey 2011

Table 11 shows that 106 respondents representing 81.54% of the respondent agreed that climate change results in creation of environmental/climate refugees by displacing people from their settlements, children and youths who are the future hope of any nation are the most vulnerable group of this threats, and health and life styles of people are also affected by climate change, while 24 respondents representing 18.46% thought otherwise.

Table 12: Reduction in economic growth, immediate setback on agriculture, loss of biodiversity are few of the challenges face as a result of change in climate

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	37	83	120	92.31
No	7	3	10	7.69
Total	44	86	130	100.00

Source: Field Survey 2011

From the responses as shown in Table 12, the 120 respondents representing 92.31% agreed that climate change could cut economic growth,

poor yield of agricultural products, changes in ecosystems (crops/animals) are forced to adapt and those that cannot adapt are dying out, while 10 other respondents representing 7.69% disagreed.

Table 13: Flooding, erosion, drought, windstorm are not most (some) of the greatest risk/challenges faced by Nigerians due to climate change

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	9	6	15	11.54
No	35	80	115	88.46
Total	44	86	130	100.00

Source: Field Survey 2011

The Table 13 reveals that 15 respondents representing 11.54% were in agreement that flooding, erosion, drought, windstorm are not most (some) of the greatest risk/challenges faced by Nigerians due to climate change, While the other 115 respondents representing 88.46% disagreed.

Government Policies and Efforts to Combat Climate Change in Nigeria

This section takes into consideration the policies and efforts made by the government to tackle climate change in Nigeria, as analyzed in Table 14.

Table 14: Government provided facilities to alleviate climate change

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	10	10	20	15.38
No	34	76	110	84.62
Total	44	86	130	100.00

Source: Field Survey 2011

Table 14 shows that 20 respondents representing 15.38% would say yes to that, while 110 respondents representing 84.62% would say no that government/agencies have not provided good roads, power lines, dykes, bridges, regular pest and disease control, better management of forest resources as part of the solutions to manage climate change in Nigeria.

Table 15: Agencies in charge of climate change and government at all levels (local, state and federal) have enlightened Nigerians/put much efforts on the solutions to climate change

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	9	2	11	8.46
No	35	84	119	91.54
Total	44	86	130	100.00

Source: Field Survey 2011

From Table 15, only 11 respondents representing 8.46% believe that agencies in charge of climate change and Government at all levels have enlightened Nigerians more on the solutions of climate change such as promoting research work, establishing functioning commission/agencies, creation of public awareness, while 119 respondents representing 91.54% thought otherwise.

Table 16: Good policies have been utilized/implemented to bring solutions to the menace of climate change in Nigeria

Options	No. of respondents			Percentage (%)
	Male	Female	Total	
Yes	20	26	46	35.38
No	24	60	84	64.62
Total	44	86	130	100.00

Source: Field Survey 2011

Table 16 shows that 46 respondents representing 35.38% agreed that these programmes like reforestation, afforestation, continuous maintenance of infrastructures, biotechnology development, good policies have been implemented to bring solutions to the menace of climate change in Nigeria, while 84 respondents representing 64.62% answered that question in the negative directions.

DISCUSSION

Climate change or global warming has become a new reality, with deleterious effects: seasonal cycles are disrupted, as are ecosystems; and agriculture, water needs and supply, and food production are all adversely affected. Global warming (climate change) also leads to sea-level rise with its attendant consequences, and includes fiercer weather, increased frequency

and intensity of storms, floods, hurricanes, droughts, increased frequency of fires, poverty, malnutrition and series of health and socio-economic consequences. It has a cumulative effect on natural resources and the balance of nature.

The impact of climate change can be vast. In Nigeria, this means that some stable ecosystems such as the Sahel Savanna may become vulnerable because warming will reinforce existing patterns of water scarcity and increasing the risk of drought in Nigeria. As well, the country's aquatic ecosystems, wetlands and other habitats will create overwhelming problems for an already impoverished populace. Preliminary studies on the vulnerability of various sectors of the Nigerian economy to Climate Change were conducted by NEST. The sectors evaluated were based on seven natural and human systems identified by the IPCC, and condensed into five. They are:

- ♦ Human settlements and health;
- ♦ Water resources, wetlands, and freshwater ecosystems;
- ♦ Energy, industry, commerce, and financial services
- ♦ Agriculture, food security, land degradation, forestry, and biodiversity; and
- ♦ Coastal zone and marine ecosystems.

The study determined that virtually all of the sectors analyzed manifested some evidence of vulnerability to climate change. None were unaffected, nor will remain unaffected in future by changes to climatic conditions. In fact more recent assessment, although in regional and global scale, not only corroborate the patterns established by CN-CCCDP reports but captured more disturbing scenarios using more embracing and sophisticated approaches (Parry et al. 2007: 3). Indications are that the climate system is more sensitive than originally thought.

In general, Nigeria has many policies, strategies and plans that can address general adaptation measures in some climate change vulnerable sectors such as agriculture, water resources, forests and ecosystems, and coastal marine environment. However, the policy framework to align human development and climate change response efforts through adaptation is largely undeveloped in the country. The country's institutional capacity to respond effectively to climate change is weak. Apart from the SCCU in the Federal Ministry of Environment and a few institutions at the national level (for example, NIMET and the Climate Centre in Minna), there

is no formal institutional structure at state and local government levels to address climate change. Even then, the capacity of SCCU to drive and coordinate national climate change response is weak. There are very few people with proven competencies in the Unit and facilities remain inadequate. Furthermore, the national institutions, including the SCCU, are not properly funded.

Unlike Ghana, Nigeria has not been able to develop a structured approach to climate change adaptation. Ghana was able to do this through the implementation of Netherlands assisted Climate Adaptation Programme (NCAP) that enabled the country to undertake detailed vulnerability assessment of various sectors. The implementation of NCAP has also enabled Ghana to develop a National Climate Change Adaptation Strategy. Nigeria has no National Climate Change Policy and Strategy that should have presented Nigeria's current and future efforts to address climate change vulnerability and adaptation and therefore made risk management difficult. The First National Communication was produced November, 2003. The closest Nigeria is to having an acceptable adaptation response framework is a working document on Adaptation Strategies of Action prepared by HBS for the Special Climate Change Unit (SCCU) of the Federal Ministry of Environment, the Nationally Designated Authority for climate change in Nigeria. But there is no clear indication that the document has been adapted as a national plan of action.

There are many ways that climate change could affect Nigerians especially citizens of Enugu State. Some of the impacts will be direct, others will be indirect. Urban populations are growing and contributing to environmental degradation, loss of biodiversity, environmental decay, and water/air/environmental pollution. Nigeria will be affected by climate change in a variety of ways. Urban and rural population concentrations will be disrupted, particularly along the coastline due to sea-level rise and related phenomena. Also deforestation, industrial releases, improper sewage disposals are some of the major factors that are responsible for climate change in Nigeria. It was also observed that flooding, drought, erosion, sea level rise are the various challenges and effects that climate change poses on the country. Government / agencies in charge have not proffered solutions/ways to

manage the associated risks of climate change in Nigeria.

Some settlements are known to have already relocated farther inland from their original sites in response to sea incursion over some decades. Population displacement and migration from, and to, various human settlements will arise from either or both of drought incidence in the Northern states of the country and accelerated sea level rise in the coastal regions. Rises in sea-level will also threaten urban and rural infrastructure facilities in low lying coastal regions.

Extreme climate conditions such as high wind, heavy rainfall, heat and cold can result in wide-ranging scenarios such as tropical storms, floods, landslides, droughts and sea-level rise. Climatic catastrophes induce populations to be displaced (or decimated by death), which in turn can lead to conflict and civil unrest. As well, the public health infrastructure would be eroded if resources are diverted from its maintenance to disaster recovery. Communities and government would be burdened with having to make reparations to individuals for property damage and loss, unemployment, clean-up, and reduced socioeconomic viability of the communities affected.

Changes in weather and climate have been known to profoundly influence water resources, a factor that increases the vulnerability of humans to infection. Generally, water resources involve all forms of fresh water needed for life's necessities, ranging from domestic needs to drinking, washing and cleaning, to agricultural needs involving food processing and irrigation, to other general needs.

Climate change is surely one phenomenon that has tested the Nigerian government and so far, the government has failed the test looking at the low level preparedness of the country in tackling the imminent dangers of climate change. Apart from various workshops and seminars to pay lip services to the many problems climate change poses to the nation, some experts have said Nigeria still has no structure or any coordinated mechanism in place to tackle the challenge of climate change in the country.

The International Centre for Energy, Environment and Development (ICEED) and Nigerian, environmental group Non Governmental Organization (NGO), have continued to call on the Federal Government to put in place mechanisms

that would enable Nigeria mitigate and adapt to climate change difficulties but little has been done in that regard.

For example, the Climate Change Commission bill that seeks the establishment of a climate change commission that would coordinate climate change responses and action for the country is one issue that has lingered for so long in the legislative process and is still suffering delay. Many environmental stakeholders are beginning to describe the delay as a show of lack of concern of the danger posed by climate change.

CONCLUSION

With an estimated population of about 140 million people spread over a total area of 923,800 square kilometres, Nigeria is one of the most populous nations and one of the largest countries in Africa. This high population makes Nigeria a high potential contributor to global warming and consequently, climate change. Her productive activities are mainly agricultural and to an extent industrial which contribute substantial amount of greenhouse gases into the atmosphere thereby accelerating climate change. Even current estimates indicate that emissions from combined livestock population of over 44 million led to the emissions of over 1115g of methane (CH_4). Also, rice production led to the emissions of 1090g CH_4 , while savannah burning generated 109g CH_4 , 3.4g N_2O , and 2890g CO (Federal Ministry of Environment 2010: 45). These GHGs generated from several industrial processes in one way or the other finds its way into the atmosphere thereby increasing the threat of climate change in Nigeria. As long as these situations abound, so many activities in space are at one risk or the other. Present and future activities need to be planned and executed in space such that the future is not jeopardized. The issue of adapting the ways we live to climate change which includes planning for our urban and rural environment is being placed centre stage by recent flood events around the world and particularly in Nigeria. Hence, professionals in the building domain need to consider very carefully what they build and where they build it. Though the issue of climate change is becoming recognized by spatial planners with respect to flood risk, but its wider implications for biodiversity and water resources are neces-

sary for integration into plans. However, there seems to be a lack of engagement of the planning profession with climate change networks.

The growing trend of disasters in Nigeria has implications for national sustainability. This is because disasters, irrespective of the causal factors are associated with diverse externalities such as mortalities, loss of income, home, farmlands, social networks, livelihoods and infrastructure.

The climate change and variability are likely to worsen the prospects for poverty eradication unless action is taken to become response-capable. This requires a focus on reducing vulnerability, achieving equitable growth and improving the governance and institutional context in which poor people live.

In effect, the existing poverty reduction strategies are continuously challenged by climate change which often time deepens poverty. The country lacks capacity to anticipate and respond to climate change and variability related risk. There is no adequate information on seasonal forecast of climate variability to enable preparedness to climate related disaster and thus early warning facilities are grossly underutilized.

Strategies to reduce vulnerability should be rooted in vulnerability analysis and greater understanding of both household-level and macro response options that are available to decrease the exposure to climate risk. Increasing the response-capability of Nigeria will require information on seasonal forecast to enable the preparedness to climate variability as well as longer term climate prediction data to ensure that strategies to reduce vulnerability also reflect the underlying longer-term climate trends.

Climate related risk, aggravated by processes of global economic and climatic change poses a central unresolved development issues for many countries, particularly but not exclusively for SIDS. Unless such risks can be managed and reduced, the achievement of the UN Millennium Goals will be a mirage. Current approaches towards managing disaster risk and adaptation to climate change fail for different reasons to address the issue. The first is still predominantly focused on response to disaster events and fails to address the configuration of hazards, vulnerabilities and risks. Moreover, mono hazard approaches still prevail in contexts more and more typified by synergy and complexity and there is still a great deal to do in order to bring risk management and sustainable development concerns

and practices together. The second focuses on the impact of future climate change on risk but fails to make the connection with currently existing climate related risk events and patterns. At the same time, both approaches are divorced both in concept and in terms of the institutional arrangements and programming mechanisms at the national and international levels. If development is to be protected and advanced in countries affected by climate risks, an integrated approach to climate risk management needs to be promoted, building on successful approaches piloted by the disaster risk management community but mainstreamed into national strategies and programmes. Addressing and managing climate risk as it is manifested in extreme events and impacts in the here and now is the most appropriate way of strengthening capacities to deal with changing climate in the future.

RECOMMENDATIONS

Nigeria should focus more on economic activities that are tertiary in nature which generate little greenhouse gases; development should be limited in areas likely to be flooded; the citing of new facilities and the location of infrastructure should not be very close to the sea in order for them to be free from sea level rise; already threatened infrastructure /facilities should be relocated soonest; Nigeria should develop a technology that can capture at least 80% of carbon emitted by industries which are discharged into the atmosphere; the spaces in rural areas and urban centres should be earmarked or apportioned for rigorous and extensive tree planting; there should be a heightened public awareness on the danger associated with climate change; re-settlements should be encouraged in certain areas of the country;

Nigeria should develop a cleaner source of energy instead of it's over dependence on fossil fuel energy that generate greenhouse gases. While already existing energy production facilities should be physically protected with barriers; agencies responsible for the environment should enforce laws and regulations, particularly with respect to urban planning and development and adherence to industrial standards as well as erection of structures or utilities in ecologically sensitive areas; town and cities should be well planned and free of industrial and municipal wastes; there should be a decentraliza-

tion of commercial activities in the Central Business District (CBD) as this causes heavy traffic congestion and high level of gas emissions/exhaust emissions; industries should be relocated to more favourable sites. While appropriate location for new industries be mapped out; drains should be constructed in and around coastal areas of Nigeria; there should be emplacement of storm surge barriers around airports; sites for airports, motor parks and other facilities should be appropriately chosen; and there should be a modification of rural and urban land use, a development of alternative habitat areas and the protection of threatened ecosystems. Specifically, many different stakeholders in the development planning process should be leading researches, for example, National, State and Local governments are likely to look at changes in flood risk; public water corporations, relevant government agencies, as well as government regulators, should be looking at the impacts of climate change on water resources; and government agencies along with non-governmental organizations should be researching impacts of climate change on ecology, land management and the environment. Climate change and impact researches will need to specify changes in temperatures and precipitation and specify the changes in spatial and temporal respect. This is because spatial planning authorities need a basis for decisions taking into account climate changes, changes of the spatial structure and the possible reaction/involvement of the public to these changes.

Provision of information about the spatial impact of natural hazards connected to climate change is pertinent. There is equally the need to develop procedures to integrate high level quantitative climate risk assessment into the spatial planning process as well as identification of options and the articulation of decision pathways to the appraisal process. There is an urgent need for adjustment policies which intensify efforts to lower the potential for loss from future climate change impacts through the installation of risk reduction process on local and regional level.

Nigeria can in fact follow the example of the UK's plan-led system. This involves preparing plans that set out what can be built and where. The plan-led system was updated by an Act of Parliament (the Planning and Compulsory Pur-

chase Act) in December 2004. This PPS replaced Planning Policy Guidance Note 1, General Policies and Principles, published in February 1997. It is pertinent to note that very salient and robust issues were discussed which were of National attention.

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APPENDIX

OPERATIONAL DEFINITION OF TERMS

Risk: can be related directly to the concept of disaster, given that it includes the total losses and damages that can be suffered after a natural hazard: death and injured people, damage to property and interruption of activities. Risk implies a future potential condition, a function of the magnitude of the natural hazard and of the vulnerability of all the exposed elements in a determined moment.

UNFCCC: United Nation Framework Convention on Climate Change. It is the first international climate treaty. It came into force in 1994 and has since been ratified by 189 countries (USA included). More recently a number of nations have approved an addition to the treaty; the Kyoto Protocol which has more powerful (and legally binding) measures.

Kyoto Protocol: An agreement made under UNFCCC. Countries that ratify this protocol commit to reducing their emissions of carbon dioxide and five other greenhouse gases (GHG), or engaging in emissions trading if they maintain or increase emissions of these gases. The Kyoto Protocol now covers more than 170 countries globally but only 60% of countries in terms of global greenhouse gas emissions. The first commitment period of the Kyoto Protocol ends in 2012 and international talks began in May 2007 on a subsequent commitment period.

Afforestation: Is defined under the Kyoto Protocol as the direct human-induced conversion of non-forest land to permanent forested land for a period of at least 50 years.

Deforestation: The direct human-induced conversion of forested land to non-forested land (UNFCCC).

Greenhouse Gas: Atmospheric gas that traps the heat and is responsible for warming the earth and climate change. The major greenhouse gases are: Carbon dioxide (CO_2), Methane (CH_4), Water Vapour (H_2O) and Nitrous Oxide (N_2O). Less prevalent but very powerful greenhouse gases are hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride

(SF6). Those gases are regulated under the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. Some greenhouse gases are also regulated under the Montreal Protocol for their effects on the ozone layer.

Mitigation: A human intervention to reduce the sources of or enhance the sinks of greenhouse gases.

Disaster Risk Reduction: The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disaster, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and environment and improved preparedness for adverse events (UNISDR)

NEST: (Nigerian Environmental Study/Action Team) has the overall goal of acting in concert with an active nationwide membership to sensitize and empower Nigerians on issues of the environment and sustainable development, through the dissemination of factual information, training on skills acquisition and promotion of sustainable livelihoods.

IPCC: (Intergovernmental Panel on Climate Change) is a scientific intergovernmental body first established in 1988 by two United Nations organizations, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), and later endorsed by the United Nations General Assembly through Resolution 43/53. Its mission is to provide comprehensive scientific assessments of current scientific, technical and socio-economic information worldwide about the risk of climate change caused by human activity, its potential environmental and socio-economic consequences, and possible options for adapting to these consequences or mitigating the effects.

SCCU: (Special Climate Change Unit) Major activity of the Unit is the coordination of activities towards national implementation of the Climate Change Convention and the Kyoto Protocol.

NCAP: (Netherlands assisted climate adaptation programme) has been created to address this problem by assisting a number of developing countries to become self-supporting in formulating climate policy.