CPED Policy Paper Series 2011

PERCEPTION OF
Climate Change
IN THE NIGER DELTA REGION OF NIGERIA

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This Publication is supported by the Think Tank Initiative Programme initiated and managed by the International Research and Development Centre (IDRC)

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Ugbowo Housing Estate
P.O. Box 10085, Ugbowo Post Office
Benin City, Nigeria

First published in 2011

Series Editor:
Professor Andrew G. Onokerhoraye
Executive Director, CPED, Benin City

Printed in Nigeria by:

AMBIK PRESS LTD.
#4, Otike-Odibi Avenue, Isiohor,
Via Ugbowo Old Lagos Road,
P.O. Box 5027,
Benin City, Edo State.
052-880527 & 08074009192

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PREFACE

This policy research paper is part of the on-going research of the *Centre for Population and Environmental Development (CPED)* on the research theme titled "*Growth with Equity*" in the current strategic plan (2010-2014) of the Centre. Although numerous policies related to environment and climate change do exist in Nigeria covering several sectors such as environment, energy, agriculture, health and sanitation, housing and urban development, and gender, many of these policies were formulated solely by the federal government using the top-down approach. Furthermore, there is lack of proper coordination between these policies and sectors, which has limited the focus on climate change adaptation. A National Climate Change Adaptation Strategy could help address this situation by guiding the integration of climate change adaptation into government policies, strategies, and programmes, with particular focus on the most vulnerable groups. The fact is that the climate change debate in Nigeria so far has made little effort to package the issues in a way that ordinary people can even understand, let alone participate in. Until local groups living mainly in rural areas are assisted and given the opportunity to build their capacity, lower their vulnerability, and diversify their sources of income, policies on climate change cannot be successful. Local groups and actors are the key to achieving real impact on the ground. An important element of the importance of promoting the involvement of the disadvantaged groups at the local level in adaptation strategies to climate change is the effective promotion of access to information through advocacy activities. This prompted this study that analyses the level of climate change awareness in the Niger Delta region of Nigeria. 600 questionnaires were administered in the 3 purposefully selected states namely Delta, Bayelsa, and Rivers.

We are particularly grateful to the *Think Tank Initiative* for the support to CPED which has enabled the Centre to carry out the study that led to this policy paper.

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PERCEPTION OF CLIMATE CHANGE IN THE NIGER DELTA REGION OF NIGERIA

Introduction

IPCC (2007) Fourth Assessment Report (AR4) gave the most current and acceptable definition of climate change, which states that "climate change is a change in the state of the climate that can be identified (eg., by using statistical tests) by changes in the mean and /or the variability of its properties, and that persists for an extended period typically decades or longer". Climate change is different from the generally known terms like climatic fluctuations or climatic variability. Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Climate may vary on a large range of spatial and temporal scales. Spatial scales may range from local (less than 100,000 km^2), through regional (100,000 to 10 million km^2) to continental (10 to 100 million km^2). Temporal scales may range from seasonal to geological (up to hundreds of millions of years). Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).

Climate change is studied within different facets such as; the science of climate change, climate change vulnerability, sensitivity, adaptation and mitigation. The science of climate change is concerned with the degree of changes in climate, its variability, modelling and projection either at global or regional levels. Vulnerability to climate change is the degree to which geophysical, biological and socio-economic system are susceptible to, and unable to cope with, adverse impacts of climate change, including climate variability and extremes (IPCC, 2007). Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity. The term vulnerability may therefore refer to the vulnerable system itself, the impact to this system, or the mechanism causing these impacts. Based on a number of criteria in the literature (i.e., magnitude, timing, persistence/reversibility, potential for adaptation, distributional aspects, likelihood and importance of the impacts), some of these vulnerabilities might be identified as key. Key impacts and resultant key vulnerabilities are found in many social, economic, biological and geophysical systems.

The identification of potential key vulnerabilities is intended to provide guidance to decision-makers for identifying levels and rates of climate change that may be associated with dangerous anthropogenic interference

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(DAI) with the climate system. Ultimately, the determination of DAI cannot be based on scientific arguments alone, but involves other judgments informed by the state of scientific knowledge. Key vulnerabilities may be linked to systemic thresholds where non-linear processes cause a system to shift from one major state to another. Other key vulnerabilities can be associated with —normative thresholds defined by stakeholders of decision-makers (IPCC 2007). Sensitivity has to do with the potential for substantial harmful effects of which the ability to adopt is constrained mainly by human factors like poverty and limited technological knowhow. Adaptation is adjustment in natural or human system in response to actual or expected climatic stimuli or their effects (IPCC, 2007). Adjustments are possible in practice within the limits of available income and technology. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned. Adaptive capacities is the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (IPCC, 2007).There are individuals and groups within all societies that have insufficient capacity to adapt to climate change. The capacity to adapt is dynamic and influenced by economic and natural resources, social networks, entitlements, institutions and governance, human resources, and technology (IPCC, 2007).. Mitigation deals with strategies of man aimed at controlling or preventing the causes of climate change.

The key to understanding global climate change is to first understand what global climate system is and how it operates. At the planetary scale, the global climate is regulated by how much energy the Earth receives from the Sun. However, the global climate is also affected by other flows of energy which take place within the climate system itself (Fig. 1). This global climate system is made up of the atmosphere, the hydrosphere, the ice sheets (cryosphere), living organisms (biosphere) and the soils, sediments and rocks (geosphere), which all affect, to a greater or lesser extent, the movement of heat around the Earth's surface. The atmosphere, however, does not operate as an isolated system. Flows of energy take place between the atmosphere and the other parts of the climate system, most significantly the world's oceans. The significance of the oceans is that they store a much greater quantity of heat than the atmosphere. The top 200 metres of the world's oceans store 30 times as much heat as the atmosphere (Ngungar, 2010). Therefore, flows of energy between the oceans and the atmosphere can have dramatic effects on the global climate. A drastic change in the climate systems either due to natural forces or unsustainable human activities results in climate change.

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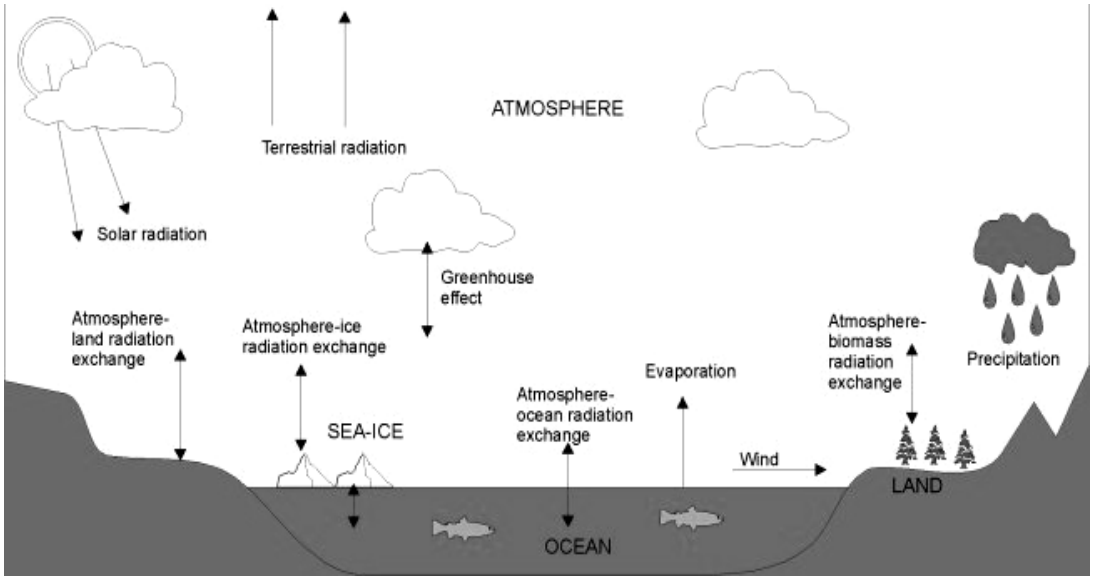

Fig 1: The Earth's climate system responds to changes not just in the atmosphere but also the oceans and the ice sheets, and over longer periods of time, movements of the Earth's crust and even the evolution of life itself.

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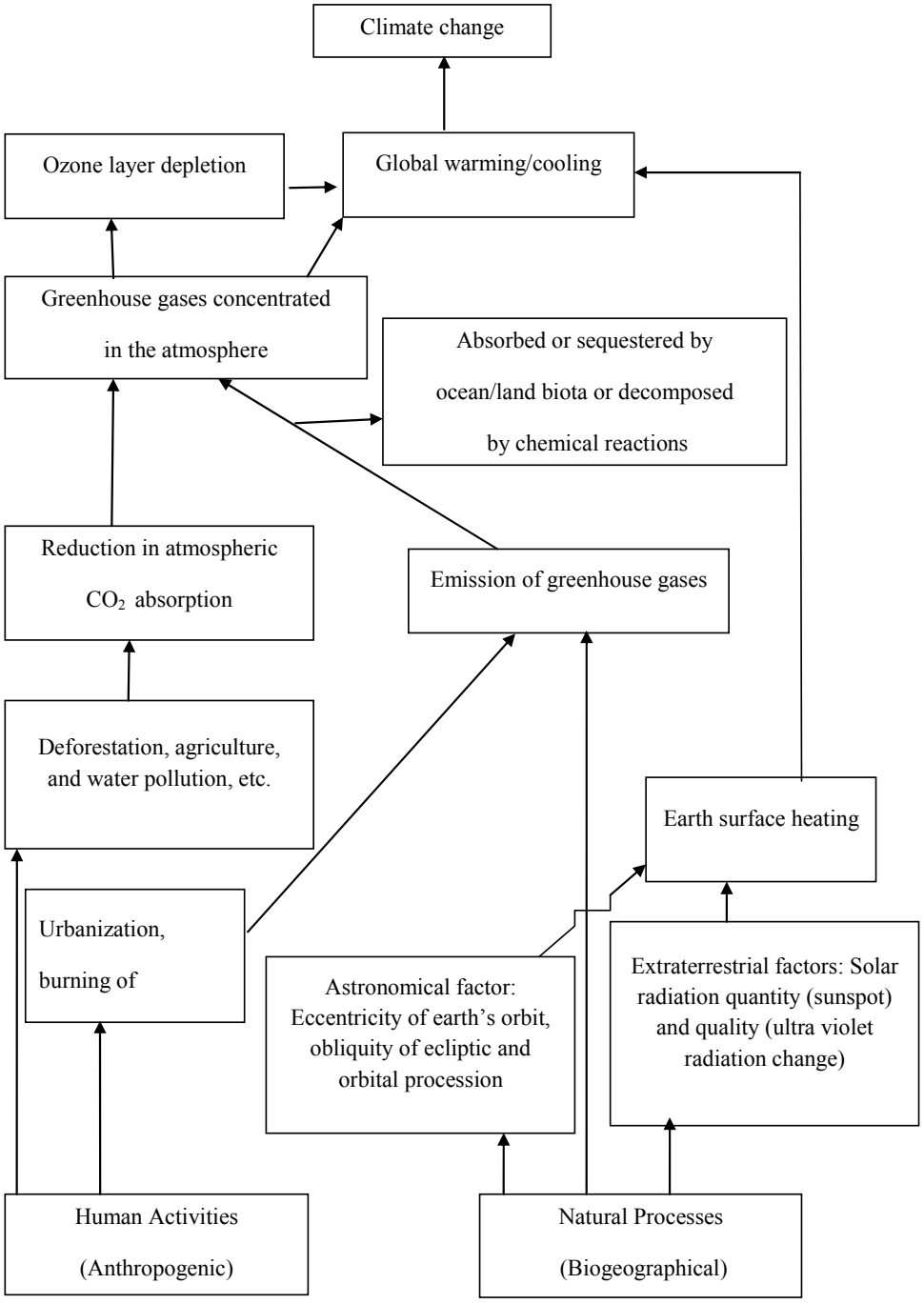

Fig. 2: Causal factors of climate change. Source: Odjugo, 2010.

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The alteration of the climate system which leads to climate variation and change is caused by both natural and anthropogenic factors as shown in Figure 2. The cause of the current climate change has been attributed to anthropogenic factors and among these human factors; carbon is a major contributor as shown in Figure 3. While these carbons are released more by the developed nations (Figure 4), the developing nations are worse hit by the adverse effects of climate change caused by these carbons and other greenhouse gases like methane, nitrous oxides and chlorofluorocarbons among others (IPCC, 2007).

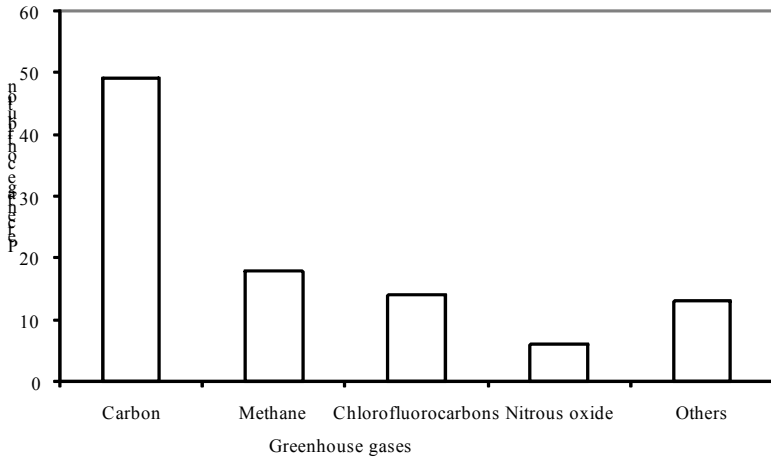

Fig. 3: Current contribution of greenhouse gases to the atmosphere

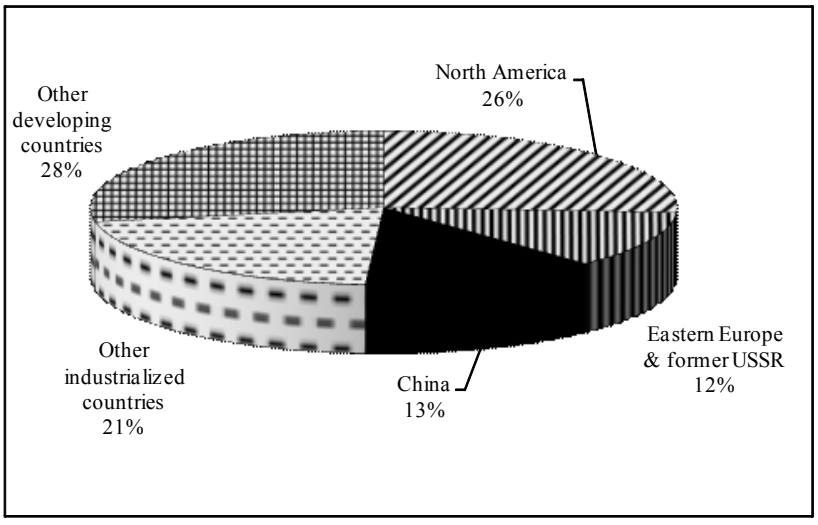

Fig. 4: Regional distribution of CO^2 emissions from fossil fuel combustion

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Various scientists have studied the different components of climate change to some extent. The causes of climate change have been scientifically studied and showed that industrialization, urbanization, water pollution, deforestation and transportation are among the highest contributors (IPCC, 1996; 2007; Ayoade, 2004; Hengeveld et al, 2005; Nwafor, 2007; Odjugo, 2009). Other researchers have concentrated on the effects of climate change and revealed that it has started impacting and will continue to impact on human health, ecological destabilization, melting of polar ice, sea level rise, coastal flooding, desertification, aggravation of coastal and gully erosion and extreme weather conditions among others (IPCC 2001; 2005; 2007; Odjugo 2000, 2001a; 2001b; 2005a, 2008; Odjugo and Ikhouria 2003; Okafor 2004; Buba, 2004; Nyelong, 2004; Ayuba et al, 2007). Some research efforts have also been focussed on mitigation and adaptation to climate change and the few studies in this area show that while climate change is caused more by the developed countries, the developing nations will suffer more of the effects because of their high level of vulnerability and low level of adaptation measures due to poverty and low technological development (Abiodun and Olabinupe, 2007; Nwafor, 2006; Adefolalu, 2007, Jagtap, 2007, IPCC, 2007, Odjugo, 2010). Climate change is expected to have serious environmental, economic, and social impacts on Nigeria in general and the Niger Delta in particular. The rural farmers, whose livelihoods depend on the use of natural resources, are likely to bear the brunt of adverse impacts of climate change. People's perception of climate change may be the most important factor determining their willingness to accept the scientific conclusion that humans are causing global warming.

The above review shows quite an array of research works in the science of various aspects of climate change. But the pertinent question is this: Is the outcome of these studies on climate change available to the general populace? Rukevwe (2008) shows that much emphasis has been devoted to the science of climate change but the education of the people and how they perceive the causes and impacts is lacking. Pam (2007) also reveals that while the concept of climate change is fully known to majority of those in the atmospheric science, it might not be so for many educated individuals in other disciplines and the uneducated ones. He therefore calls for studies on climate change education and awareness. It is the dearth of information on climate change awareness that prompted this study which focuses on the analysis of climate change perception in the Niger Delta Region of Nigeria.

THE STUDY AREA

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The Niger Delta has two basic definitions namely the geographical and the geopolitical. While the geographical definition deals with the physical limits and characteristic of the Niger Delta, the geopolitical definition is strongly associated with the availability of crude oil and natural gas. Geographically, the Niger Delta starts from the bifurcation of the Niger River at Aboh, Delta State to the north, bounded in the west by Benin River and east by Imo River with a total area of 25,900 km^2. By this geographical delineation the Niger Delta covers 2.8% of the total land mass of Nigeria and is limited to three states namely, Rivers, Bayelsa and Delta. The geographical Niger Delta region was sometimes called the Oil Rivers because it was once a major producer of palm oil. At that time, the area was the British Oil Rivers Protectorate from 1885 until 1893, when it was expanded and became the Niger Coast Protectorate.

In the year 2000, however, the Obansanjo regime redefined the region using the geopolitical subdivision based on oil production to include all the oil producing states like Abia, Akwa-Ibom, Bayelsa, Cross River, Delta, Edo, Ondo, Imo and Rivers. This definition extends the landmass of the Niger Delta to cover about 70,000 km^2 and makes up 7.5% of Nigeria's land mass, with some 31 million people of ethnic groups that include the Efik, Ibibio, Annang, Oron, Ijaw,Itsekiri, Igbo, Isoko, Kalabari, Urhobo and Yoruba among others. The geopolitical subdivision now appears more popular and is used in this study.

The Niger Delta experiences Equatorial type of climate (Koppen's Af classification) in the southern coastal area and Subequatorial in the northern part of the region. Temperature ranges 25 to 28^{O}C and rainfall between 2000 and 4000 mm. Relative humidity is between 70 and 90%. The vegetation of the Niger Delta consists mainly of swamp forest and tropical rain forest. The swamp forest is further divided into two. Nearest the Atlantic Ocean is a belt of saline/brackish mangrove swamp forest while immediately after that is the freshwater swamp forest. The well drained continental interior is covered by the tropical rainforest.

The area is endowed with a lot of agricultural resources which include food and tree crops like yam, cassava, maize, rice, cowpea, melon, groundnuts, potato, oil palm, rubber, coconut, raffia palm, cashew; pawpaw, etc. Fishing and livestock rearing are other agricultural activities taking place in the Niger Delta. The agricultural system is more of subsistence. Apart from the agricultural production, the Niger Delta also contributes to the national economy through petroleum and natural gas. Nigeria has become Africa's biggest producer of petroleum. Since 1975, the region has accounted for more than 75% of Nigeria's export earnings. Much of the natural gas extracted in oil wells in the Niger Delta is immediately burned, or flared, into

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the air at a rate of approximately 70 million m³per day. This is equivalent to 41% of African natural gas consumption, and forms a major source of greenhouse gas emissions in Nigeria thereby causing local pollution and contributing to global climate change.

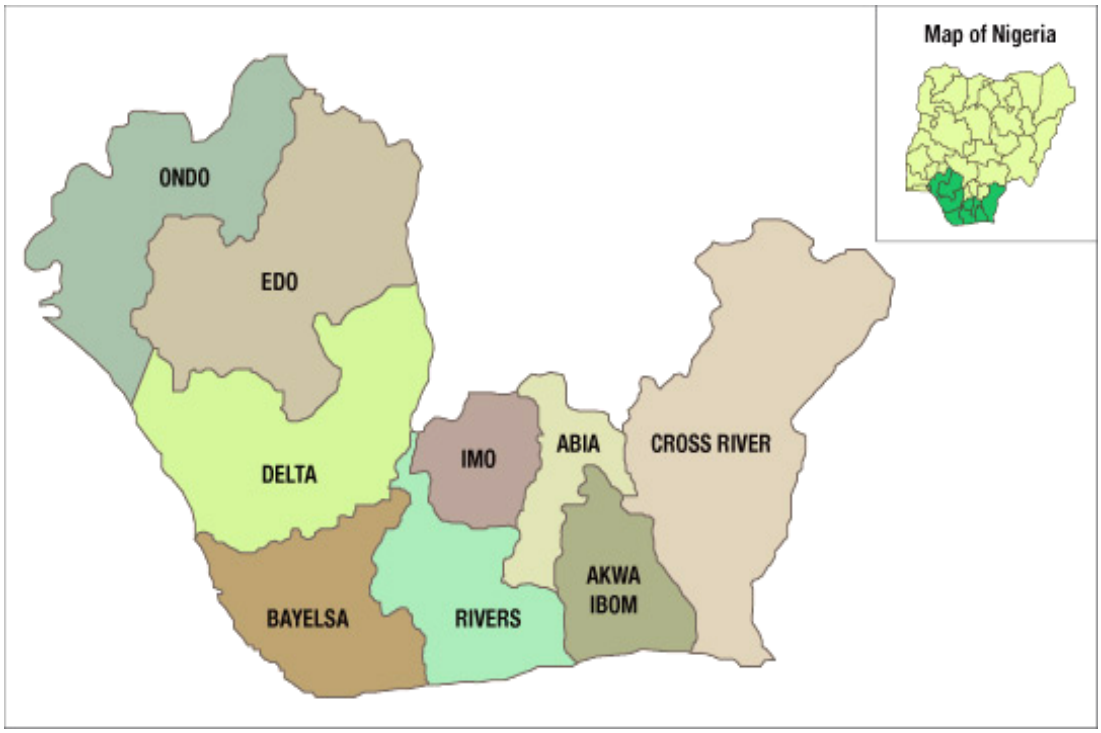

Fig 5: Niger Delta showing the geopolitical states

MATERIALS AND METHODS

The paper is designed to look into how the Niger Deltans perceive the concept of climate change awareness. Information is therefore needed from people on how well informed they are on the concept of and consequences of climate change. To do this, three states were purposefully selected and they include Delta, Bayelsa, and Rivers. These states have direct connection with the Atlantic Ocean, so any coastal impacts due to climate change must be known to them. In each state, an urban and rural settlement was selected where 200 questionnaires were administered. While 150 questionnaires were administered in each of the urban areas, 50 were used in each of the rural areas. The urban settlements used are Warri (Delta State), Yenagoa (Bayelsa State) and Port Harcourt (Rivers State), while the rural areas where the questionnaires were administered are Ute-Erumu,

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Oloibiri and Tabangh in Delta, Bayelsa and River States respectively. In each urban area, three quarters were randomly selected and in each quarter, the names of the streets were written and five streets were randomly selected. In each street, 10 questionnaires were administered using the systematic random sampling. In the street, every other inhabited building was selected and the questionnaire was administered to any adult in the house who volunteered to answer the questions. In each rural area, five quarters were randomly selected and in each quarter, 10 questionnaires were administered to respondents using every other inhabited building. Like in the urban area, a respondent was selected in each house to answer the question.

In all, 600 questionnaires were administered. While 450 of the questionnaires were administered in the urban centres the remaining 150 went to the rural areas. The data were analysed using percentages, correlation, ANAOVA and the T-Test. While the percentages helped us to determine the most outstanding factor the respondent chose to be the cause, effects and remedial measures of climate change, the correlation allowed us to analyse the strength of the relationship between respondents in the rural and urban areas. The ANOVA and T-Test helped us to analyse whether the observed variations are statistically significant.

RESULTS AND DISCUSSION

The composition of the respondents comprises male (56%) and female (44%). While the single respondents were 41%, the married, divorced, widowed and separated were 54%, 3%, 2% and 0% respectively. With regard to the length of stay, 45% of the respondents have stayed in the study area for over 30 year, 36% have spent 20 – 30 years, 15% have spent between 10 and 20 years while 4% have spent below 10 years.

As shown in Table 1, 81% of the respondents have stayed in the Niger Delta for at least 20 years. This length of stay of the respondents shows that they have been living in the area long enough to notice changes in the weather condition over time.

Table 1: Length of stay in the study area

Length (Years)	Percentage (%)
Above 30	45
20-29	36
10-19	15
Below 10	4

Table 2: Educational status of respondents

Educational status	Percentage (%)
Ph.D	2
Masters Degree	6
First Degree	34
NCE/OND	29
School Certificate	16
Primary School	8

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No formal education	5

Table 2 shows that 2% of the respondents obtained a PhD degree. While the Masters degree holders were (6%), the First degree or equivalent, Nigerian Certificate of Education (NCE) or Ordinary National Diploma (OND), Secondary School Leaving Certificate, Primary school and those without formal education were 34%, 29%, 16%, 8% and 5% respectively. The educational composition of the respondents reveals that 71% attended tertiary institution (OND and above). This is a clear indication that they are knowledgeable enough to provide reasonable answers to issues related to climate change. Majority of those without formal education are farmers and / or fishermen and women who are used to weather conditions for their agricultural production, so they have sound knowledge of annual climatic variation. The occupational status indicates that the public / civil servants (42%) constitute the bulk of the respondents (Table 3). This was followed by students (20%), agriculture (farming, fishing and hunting (16%), applicants (10%), Business (trading, transport, etc) (10%), and others (2%).

Table 3: Occupational status of the respondents

Occupational status	Percentage (%)
Public/Civil Servants	42
Students	20
Agriculture	16
Applicants	10
Business	10
Others	2

Table 4: How much do you know about climate change?

	(%)
Not heard of it	42
Know little about it	43
Know much about it	14
No comment	1

The respondents were asked how much they know about climate change. In their responses, 42% showed that they have not heard of it, 43% know little about it 14% know much about it while 1% declined comment on the question (Table 4). Generally put, 57% of respondents in the Niger Delta have some knowledge of climate change. This agrees with the Pew Global Attitudes Survey in 2006, which found that large majorities of respondents from developed countries had heard of global warming, while awareness remained quite low in several developing countries like Pakistan, Indonesia and Egypt. The report also suggests that many, especially in the Muslim world, have never heard of global warming. This lack of basic awareness of the problem has a wide range of implications, ranging from the lack of political pressure on local and national governments to act, to potentially greater long-term vulnerability as individuals and communities make decisions regarding urban and coastal development, agricultural and subsistence practices,

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water management, etc. (Anthony, 2007). Although the awareness level is still poor in Nigeria, it is relatively better than that reported by Pugliese and Ray (2009) which shows that only 44% of those in Sub- Sahara Africa are aware of climate change. The percentage of those who know much about climate change as shown in Table 5 is worrisome. While it was 22% in the urban area; the rural area is only showing 6%. Moreover, personal discussion with some of those who claimed to know much about climate change reveals otherwise as their knowledge is actually poor; majority of them could not say what climate change actually means. In general, the Niger Deltans understand climate change in terms of change in weather pattern. And this is limited to their sensual awareness of abnormal increase in the level of heat and the effect it has on farm yield in a rain-fed agricultural setting.

Table 5: How much do you know about climate change?

Region	Not heard of it	Know little about it	Know much about it	No comment	Aware
Urban	37	40	22	1	
Rural	47	45	6	2	
Mean	42	42.5	14	1.5	57

Table 6: Sources of information on climate change

Information Source	Rural %	Urban %	Total (%)
Television	4	30	34
Radio	19	8	27
Printed materials	3	19	22
Lecturers/teachers	2	7	9
Friends/colleagues	6	2	8

Those who are aware of climate change also made clear their sources of information as shown in Table 6. The respondents got to know of climate change mainly through television and radio presentations followed by printed materials like textbooks, bulletins, newspapers, journals and leaflets (Table 6). In the urban areas, television and printed materials are the major sources of information on climate change while it is the radio in the rural areas. Respondents in the urban area have access to electricity and have money to buy television sets; that is why they listen more to the television. Most rural areas in the Niger Delta have no electricity provided by the government and since most of the rural dwellers are very poor, they cannot buy generators (to power their appliances) or television sets. The basic truth about most rural

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dwellers in the Niger Delta is that, majority of them cannot afford the cost of buying a television set even if the electricity is there, so the best option is the radio transistor which they can afford.

The study also shows that 97% of the respondents have observed changes in the weather and climate in recent times, 3% claimed they have not noticed any change. Those who observed the changes in climate attributed the main cause to the Act of God (31%) (Table 7). Many of the respondents think that climate change is caused by God. The basic reason given is that climate change impacts are divine punishment being meted out on the world for the numerous sins that the entire world has committed against the environment and God who created it. The finding shows the pervasive influence of religion on the perception of the environment; an idea Pugliese and Ray (2009) refer to as the 'God-frame' thinking. Religious leaders and groups as well as local people have a very strong believe that the changes in the weather pattern had been ordained by God. The logic of what had been planned and set on course by divine agency naturally led to an iron-cast fatalism. People see themselves as powerless and could do little or nothing to change events within their own environment, thereby leaving everything for fate to decide.

Table 7: Perceived causes of climate change

Factors	Rural %	Urban %	Total (%)
Act of God	21	10	31
Industrialization	0.9	2.1	3
Urbanization	1	5	6
Deforestation	0.8	4.2	5
Gas flaring	14	6	20
Bush burning	10	4	14
Transportation	2	4	6
Agriculture	2.5	5.5	8
Water pollution	2.1	4.9	7

The human factors the respondents perceived to have caused the on-going climate change are also shown in Table 7. The main human cause of climate change as revealed by 20% of the respondents is gas flaring, followed by bush burning and agriculture. These causes of climate change that the respondents gave are in contrast with the scientific factors researchers have observed over the years about the global causes of climate change. The scientific facts on climate change show that the major causes of global climate change are industrialization, urbanization, transportation and agriculture that release greenhouse gases (carbons, nitrous oxide, methane,

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chlorofluorocarbons among others) into the atmosphere (NEST, 2003, IPCC, 2003, Akonga, 2001, Odjugo 2007a).

Although the reasons given by the respondents did not actually tally with the global causes of climate change, they were able to identify the local causal factors of atmospheric carbon concentrations in the Niger Delta. Gas flaring is a major source of air pollution in the Niger Delta region, although its impact is localized and statistically insignificant 20km from the flare sites (Odjugo, 2004; 2005b; 2007b). Other factors which have strong scientific support on the causal factors of climate change are deforestation and water pollution. These factors reduce carbon sinks and enhance or upset the amount of carbons in the atmosphere.

The respondents noticed that temperatures are increasing; there are changes in the rainfall pattern, increased erosion and changes in harmattan condition as the major effects of climate change (Table 8). These are the major effects in the study area but other very serious effects in other ecological zones of Nigeria and other parts of the world are not known to the majority of respondents. For instance, desertification, increased occurrence of drought and drying up of rivers and lakes are major effects of climate change in northern Nigeria (Odjugo and Ikhuoria, 2003; 2008). On the global scene, the most threatening effects of climate change are melting of the polar ice, flood problems, coastal inundation, ecological destabilization and sea level rise (Mcquire et al, 2002; Nyelong, 2004; IPCC, 2005; Odjugo, 2008,). Due to lack of awareness and poor knowledge of climate change by the respondents, majority of them are not aware of the most dreadful effects of climate change not found within their localities.

Table 8: Perceived effects of climate change

Effects	Rural (%)	Urban (%)	Total (%)
Increasing temperature regime	12	26	38
Changes in rainfall pattern	7	18	25
Ecological destabilization	0.2	0.8	1
Desertification	0.4	0.6	1
Sea level rise	0.5	1.5	2
Flood problems	0.9	4.1	5
Increased occurrence of drought	1.7	2.3	4
Melting ice	0.8	2.2	3
Reduce/increased land for agriculture	0.9	1.1	2
	0.4	0.6	1
Increase health problems	0.3	0.7	1
Drying rivers and lakes	1.1	1.9	3
Coastal inundation	1.8	6.2	8

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Increased erosion	1.6	4.4	6
Changes in harmattan conditions			

The respondents' claim of increasing temperature (38%) and changes in rainfall regime (25%) have scientific backing. Spore (2008) and Odjugo (2010) show that in Nigeria and worldwide, temperatures are on the increase. They showed that while global temperature increase is 0.74^0C since 1860 when weather record started, that of Nigeria is 1.1^0C since 1901. Rainfall pattern in Nigeria has been proven to be changing. While rainfall duration and amount is decreasing, the intensity is increasing (Odjugo, 2005b; 2009). The same papers also showed that while the short-dry-season has gradually moved from August to July, the area experiencing Equatorial climatic rainfall characteristics of double maxima rainfall is shifting southward thereby increasing the area with Sudan climatic type with single peak of rainfall.

Table 9: Perceived measures to reduce climate change

Measures	Rural (%)	Urban (%)	Total (%)
Public enlightenment	12.1	27.9	40
Reduced deforestation	3	7	12
Stop water pollution	0.2	0.8	1
Use of low cost solar energy cookers	0.3	1.7	2
Increased use of ethanol in petrol	0.2	2.8	3
Clean development mechanism	0.4	1.6	2
Increased use of solar, wind and hydro-electricity	0.4	0.6	1
Reduced use of wood for cooking, furniture and roofing	0.9	1.1	2
Mechanised agriculture	3	5	8
Stop bush burning	9	29	29

Majority of the respondents believe that to reduce the ongoing climate change and its impacts, public enlightenment should be vigorously pursued (Table 9). This is so because many of the respondents did not know what climate change is and are not aware that their actions of deforestation, bush burning and water pollution among others are contributing immensely to climate change. They are also of the opinion that to stop bush burning, reduced deforestation and to engage in mechanised agriculture will help to reduce climate change Table 9).

Other factors like increased use of solar, wind and hydro-electricity, stoppage of water pollution and other factors in Table 4 received little attention of the respondents as measures of reducing climate change. Personal discussion

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with most of the respondents shows that they are not aware of how increased use of ethanol in petrol, reduced use of wood for cooking, furniture and roofing among others will reduce climate change. This clearly depicts how ignorant majority of Nigerians are with respect to the causes and effects of climate change. Many concluded that it will be difficult to reduce the use of wood for cooking, furniture and roofing since cooking gas and kerosene are so costly and above the reach of many while alternative roofing and furniture materials like steel and iron, aluminium are too costly to afford. This is an indication that a lot is needed to combat climate change in developing poor nations like Nigeria. The respondents (77%) revealed that the media, government at all levels and the non-governmental organizations (NGOs) are not doing enough in sensitizing the populace on the causes and effects of climate change while 23% affirmed that they are doing enough.

As shown in Tables 7 to 9, the perception of climate change by those in the rural area is different from the urban dwellers. The way the urban respondents perceived the causes, effects and remedial measures of climate change is radically different from those of the rural area. This is made clearer by the results of the chi-square (χ^2). The χ^2 results show that the variation of the respondents between the rural and the urban areas on the sources of information about climate change is $\chi^2 = 1$ which is lower than the critical value of 3.84. This implies that the sources of information available to both rural and the urban areas is radically the same. The perceived causes of climate change between rural and urban dwellers in the Niger Delta stood at $\chi^2= 8.0$, the effects was $\chi^2=13$ and remedial measures was $\chi^2= 10$. All of these are higher than the critical value of 3.84 at $p < 05$. This implies that although the sources of information on climate change is almost the same to those in rural and urban areas, the way the respondents perceived the causes, effects and remedial measures is spatially different. The awareness level on climate change tends to be higher with those in urban area than the rural dwellers.

CONCLUSION AND RECOMMENDATIONS

The paper reveals that 42% of the respondents are ignorant of the concept of climate change while those who have varying degree of knowledge on the causes and effects of climate change shows that the television and radio are the main sources of their information. Most of the respondents are not aware of the main factors that cause global climate change like industrialization, urbanization and deforestation among others rather they choose local factors like gas flaring and bush burning as the major factors responsible for climate change. Although, most local perceptions did not conform to scientific data, local knowledge can be

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rapidly and efficiently gathered using systematic tools. Such knowledge can allow scientists to test specific hypotheses, and policy makers to design mitigation and adaptation strategies for climate change in the Niger Delta. The respondents were able to identify increasing temperature and changes in rainfall pattern as the main effects of climate change but other devastating effects outside their locality like melting of polar ice, sea level rise and desertification among others are not known to them.

The paper shows that majority of Nigerians within the Niger Delta have very poor knowledge of the causes and effects of climate change. This therefore calls on all levels of government in Nigeria to pursue vigorously, public enlightenment on the causes and effects of climate change using media like television, radio and newspapers. These media outlets/firms are recommended because they are the main sources of information to the respondents. The respondents in the urban areas view more of television and read newspaper so therefore, any enlightenment programme on climate change that is continuously (constant and regular) aired on television will be of great benefit to them while the radio will serve the rural people better. Moreover such programme should be produced by both local and national media outfits and newspaper publications. For better understanding, the radio and the television programmes should be produced using different languages spoken in the Niger Delta. Bill boards and posters are other veritable means of advertisement and public enlightenment in the Niger Delta. The government can also use these means of public enlightenment to educate people in the Niger Delta on the causes, impact, remedial measures and adaptation strategies to climate change.

Religious leaders, traditional rulers, market leaders and teachers should be sent by the government to 'train the trainers' short courses on climate change so that they can impact such basic climate change knowledge on their subjects. Almost everyone in the Niger Delta belongs to one form of religion or another ranging from Christianity through Islam and African Traditional Religion (ATR) among others. If the religious leaders are sent to short courses on climate change they could include into their sermons climate change issues thereby infusing such knowledge to their followers. It is the opinion of this paper that this method will go a long way in inculcating climate change ideas in the people because of two basic reasons. One, majority of the respondents already believe that the main cause of climate change is the Act of God, so teaching them how vulnerable they are, and how to adapt from the pulpit will significantly make a lasting impact. Two, Nigerians are so religious and strongly believe that their religious leaders are Men of God so whatever they say are of divine origin. Furthermore, training the teachers in all

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disciplines and at all levels is also advocated. This is necessary because climate change phenomena is not limited to the atmospheric sciences alone so also the effects. If every teacher has the basic knowledge of climate change he can then apply it to his discipline thus helping in the spread of climate change knowledge.

The Federal Government should make it compulsory that climate change should be infused into the school curriculum at all levels of education, starting from the Kindergarten through the University. It could be part of nature studies at the primary school level, social and integrated sciences at the junior secondary level, Geography at the senior secondary level which should be made a core subject, and a compulsory general course(s) at the tertiary levels. A sense of urgency should be given to this aspect by the Federal Government because climate change is one of the most pervasive threats to the Earth today, with Nigeria being badly plagued by desertification in the north and coastal inundation in the south. Nigeria has the power to address the root causes of climate change and limit its impact within her territorial boundaries, so educating all (young and old) will play a critical role in this effort.

Seminars and workshops on climate change should be organized more frequently by various levels of government and Non-governmental Organisations. Such seminars and workshops should be free to participants and the communiqué of such conferences be repeatedly relayed on different mass media. It is only when the people have an in-depth knowledge of the causes and effects of climate change and are aware of how vulnerable they are that they can adjust their actions and imbibe habits that will be less harmful to the environment thus limiting the climate change impacts.

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