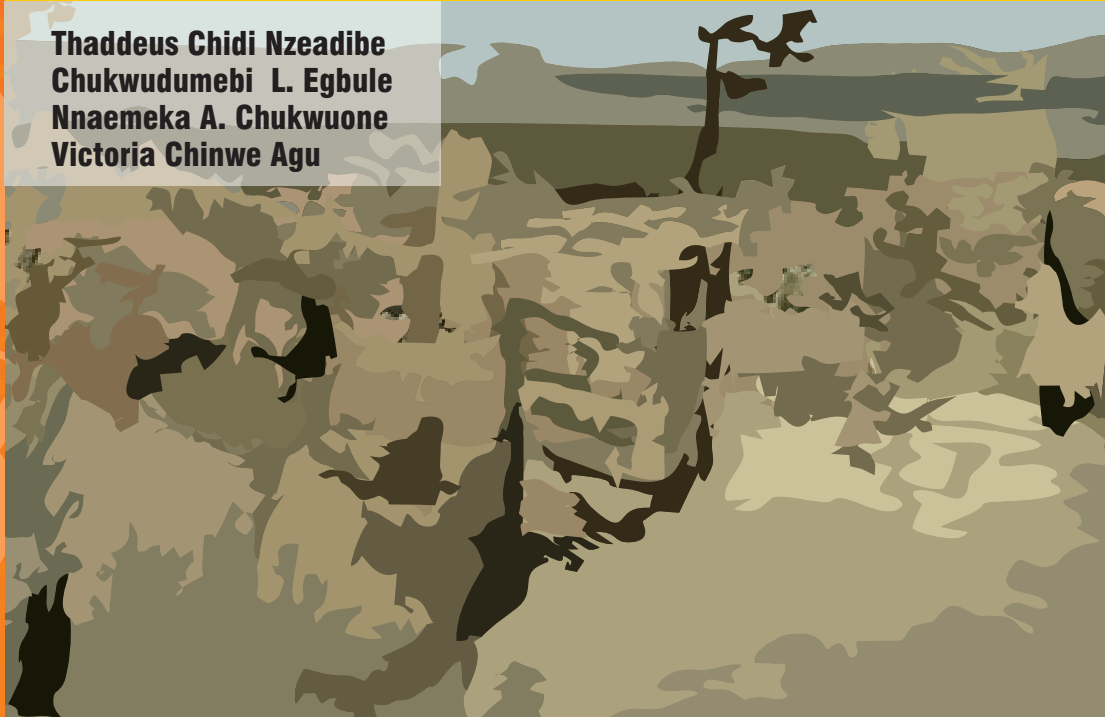




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## **Climate Change Awareness and Adaptation in the Niger Delta Region of Nigeria**

**Thaddeus Chidi Nzeadibe  
Chukwudumebi L. Egbule  
Nnaemeka A. Chukwuone  
Victoria Chinwe Agu**





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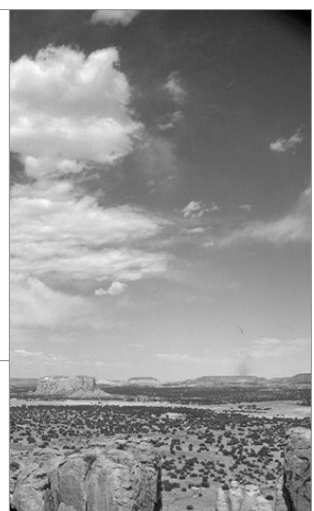
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# Abstract

Climate change is a major issue around which global development policy is being framed over the past few years. Because of low adaptive capacities and the projected impacts of climate change, a consensus has emerged that developing countries are more vulnerable to climate change than developed countries. This is due to the predominance of rain-fed agriculture in their economies, the scarcity of capital for adaptation measures, their warmer baseline climates and their heightened exposure to extreme weather events. The Niger Delta region of Nigeria is known to be particularly vulnerable because of its fragile ecosystem and human activities such as gas flaring that have heightened the propensity of climate change and its impacts in the region. Unfortunately, knowledge of Niger Delta farmers about climate change leaves much to be desired. Recognizing this, the present study sought to investigate farmers' level of awareness of climate change and potential adaptive measure for climate change in the region. The purpose of the study is to examine the level of awareness of Niger Delta communities about impacts of climate change and to identify and document innovations and practices for climate change adaptation by farmers in the study area. Multi-stage sampling technique was used to interview 400 heads of farming households in Cross Rivers, Delta and Rivers States. Analysis of the data utilized simple descriptive statistics while the results were presented as tables, figures and charts. Two single gender Focus Group Discussions (FGDs) were conducted in each of the survey states giving a total of six FGDs. Data from the FGDs complemented the survey results. Findings of this study indicate that the level of awareness of local communities of climate change impacts was still low in the Niger Delta region of Nigeria. About 60% of respondents know little or nothing about climate change and its impacts. It was found, however, that the mass media played a major role in climate change awareness in the study area. The results also indicate that the farmers have practiced some innovative indigenous measures for climate change adaptation for many years. This study concludes that extension workers, the media, researchers and civil society groups have something to learn from the Niger Delta farmers and could assist in diffusing these innovations for widespread adoption in other communities. At the policy-making level, it is recommended that policy makers should recognize and incorporate the innovative practices of the farmers in designing Agricultural and Climate Change Policy in Nigeria. More robust collaboration among stakeholders for evolving innovative approaches and adaptive measures for the climate change phenomenon in the region is advocated. Lastly, adequate investment in research and capacity building is imperative in building resilient adaptation to climate change impacts in the Niger Delta region of Nigeria.

# List of Acronyms & Abbreviations

ADPs	Agricultural Development Programmes
ATPS	African Technology Policy Studies Network
CREDC	Community Research and Development Centre
EIA	Energy Information Administration of the US
ERA	Environmental Rights Action
FGDs	Focus Group Discussions
FMENV	Federal Ministry of Environment of Nigeria
GHGs	Greenhouses gases
IPCC	Intergovernmental Panel on Climate Change
MDGs	Millennium Development Goals
NGOs	Non-governmental Organizations
NPC	National Population Commission of Nigeria
RRA	Rapid Rural Appraisal
STI	Science, Technology and Innovation
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNN	University of Nigeria



# 1. Introduction & Objectives of the Study

## **1.1 Context and justification of the study**

Climate change refers to a change which is attributed directly or indirectly to human activities that alter the composition of the global atmosphere and which are in addition to natural climate variability observed over comparable time periods (United Nations Framework Convention on Climate Change, 1992). Climate change is one of the most serious environmental and human threats undermining the achievement of the Millennium Development Goals (MDGs) and the international communities' efforts to reduce extreme poverty. It has, therefore, emerged as a major challenge to development in the 21st century. Recent research has also noted the impacts of climate change on agriculture and natural resources management in countries of Africa, Asia and Latin America (Speranza 2010). Because of low adaptive capacities and the projected impacts of climate change, a consensus has emerged that developing countries are more vulnerable to climate change than developed countries, because of the predominance of rain-fed agriculture in their economies, the scarcity of capital for adaptation measures, their warmer baseline climates and their heightened exposure to extreme events (Fischer et al. 2005; Nnamchi and Ozor 2009).

Human activities have tended to exacerbate climate change and its impacts on agriculture and livelihoods in some communities in Nigeria. For example, the Niger Delta region of Nigeria is reported to have over 123 gas flaring sites making Nigeria one of the highest emitters of greenhouse gases in Africa (Akinro et al. 2008). A recent study by the World Bank (2008) revealed that Nigeria accounts for roughly one-sixth of worldwide gas flaring. Nigeria flares about 75% of her gas and all take place in the Niger delta region. The flares have apparently contributed more greenhouse gases hence climate change in the region than anything else. It is to be noted that agriculture in the Niger Delta is highly dependent on rain as irrigation is seldom practiced. The changes in the rainfall pattern have greatly affected vegetation and agriculture. There is almost complete absence of primary forests. Uncontrolled logging, agricultural activities, acid rain, oil exploration and exploitation, urbanization and mining activities contribute to lose of vegetation. All these have contributed to climate change, the impacts of which are already being felt in the region with food insecurity, increasing risk of disease and the rising costs of extreme weather damage.

Climate change adaptation requires the development of natural resource management strategies that ensure the sustainable use of soils and water, halt biodiversity decline and deal with emerging issues such as growing demand for renewable energy. Societies must, therefore, respond through climate mitigation

measures (by reducing the concentration of greenhouse gases in the atmosphere) and finding ways to adapt to the impacts that warming will bring, such as shifting precipitation regimes, more frequent and severe extreme weather events, and sea-level rise. To cope with these obstacles, the rural poor draw on indigenous knowledge and innovate through local experimentation and adaptation. Hence, climate action through adaptation is therefore increasingly important. Adaptation is understood to include efforts to adjust to ongoing and potential effects of climate change (Mani et al, 2008). Within the context of climate change, adaptation includes the actions people take in response to, or in anticipation of changing climate conditions in order to reduce adverse impacts or take advantage of any opportunities that may arise.

Some recent studies in Niger Delta have drawn a link between effects of gas flaring on health and agricultural productivity, and people's perceptions and attitudes towards gas flaring, (Ibeanu et al. 2007; Dung et al. 2008; Edino et al. 2010) hence, an exacerbation of climate change and its impacts in the region. Noteworthy is the fact that farmers of Niger Delta communities, knowingly or unknowingly are adapting to the changing climatic conditions using their traditional knowledge, innovations and practices (Uyigüe and Agho 2007, 2009; Etuonovbe 2008). Despite all these, it does appear that the level of awareness of farmers in the region of climate change and its impacts leaves much to be desired. As a result, the need for more awareness-raising among stakeholders about the phenomenon cannot be over-emphasized.

This Working Paper presents some preliminary results and findings of the study on Climate change awareness and indigenous adaptive technologies in the Niger Delta Region of Nigeria. It reviews potential adaptation strategies which may be applied to agriculture in the Niger Delta region of Nigeria. The study aims to contribute to a framework for informing key stakeholders and decision-makers on and making them more aware of the climate change phenomenon with a view to stimulating discussion around this topical issue in research and policy circles.

## **1.2 The Research Problem**

The Niger Delta region of Nigeria which contains one of the highest concentrations of biodiversity on the planet could experience a loss of about 40% of its inhabitable terrain in the next thirty years (Finance and Development, 2008). This perceived situation can be attributed to concentration of greenhouse gases in the atmosphere, extensive dam construction, oil spillage, natural gas flaring, unfavourable farm practices, and over exploitation of natural resources found in the area. As majority of the people living in the Niger Delta are farmers, the environmental and social consequences of climate change is putting livelihoods at serious risks.

Agriculture in the Niger Delta is highly dependent on rain as irrigation is seldom practiced. The changes in the rainfall pattern have greatly affected vegetation and agriculture. There is almost complete absence of primary forests. Uncontrolled logging, agricultural activities, acid rain, oil exploration and exploitation, urbanization and mining activities contribute to lose of vegetation.

Climate change requires the development of natural resource management strategies that ensure the sustainable use of soils and water, halt biodiversity decline and deal with emerging issues such as growing demand for renewable energy. Societies must therefore respond by both minimizing further warming (by reducing the concentration of greenhouse gases in the atmosphere) and finding ways to adapt to the impacts that warming will bring, such as shifting precipitation regimes, more frequent and severe extreme weather events, and sea-level rise. To cope with these obstacles, the rural poor draw on indigenous

knowledge and innovate through local experimentation and adaptation. Hence, climate action regarding adaptation is therefore increasingly important.

Adaptation is understood to include efforts to adjust to ongoing and potential effects of climate change (Mani et al, 2008). Within the context of climate change, adaptation include the actions people take in response to, or in anticipation of changing climate conditions in order to reduce adverse impacts or take advantage of any opportunities that may arise. The need for, type and scale of adaptation depends on the kind of change taking place, as well as the vulnerability of people and natural systems to this change. This Working paper is not necessarily about impacts of climate change on Niger Delta communities as these are fairly well-known and documented. The paper is an attempt at reviewing the level of climate change awareness among farmers and communities in the Niger Delta and identifying those strategies hitherto undocumented which they are employing at the farm-level in adaptation to climate change in the region.

### **1.3 Objectives of the Study**

The overall objectives of the study on climate change awareness and indigenous adaptive technologies in the Niger Delta region of Nigeria were to:

- > Identify and document effective indigenous and emerging technologies and innovations for climate change adaptation in the study area;
- > Enhance behavioural changes towards climate change adaptation measures at individual and institutional levels in the study area;
- > Build the capacities of farming communities in the study area to adapt to climate change impacts;
- > Make policy recommendations for building climate change resilience at the state and national levels in Nigeria - Draw policy lessons for the State government's effort in promoting sustainable environment and climate change mitigation and adaptation;
- > Determine the level of awareness of local community about impacts of climate change;
- > Identify specific practices contributing negatively to climate change in the area;
- > Identify available extension services relating to climate change and adaptation strategies; and
- > Determine problems associated with adapting to effects of climate change.

### **1.4 Purpose of the Working Paper**

Following from the above, the purpose of this Working Paper is to:

- > Report the level of awareness of Niger Delta communities about impacts of climate change; and,
- > Document innovations and practices for climate change adaptation by farmers in the study area.

### **1.5 The Study Area**

The area of this study is the Niger Delta region of Nigeria. The Niger Delta covers an area of 70,000 Km<sup>2</sup> of marshland, creeks, tributaries and lagoons that drain the Niger River into the Atlantic at the Bight of Biafra. About one-third of this area is fragile mangrove forest, the second largest mangrove forest in the world. The biodiversity of the Niger Delta is very high with the area containing diverse plant and animal species, including many endangered, exotic and endemic animals and plants (World Bank 1995).

The Niger Delta has an estimated population of over 30 million people (NPC 2009), the bulk of which lives in rural fishing and farming communities. The region is also the headquarters of Nigeria's oil and gas industry and currently the only oil and gas producing region in Nigeria (Nzeadike and Ajaero 2010). Regrettably, activities of multinational oil companies have recently been linked to degradation of the natural environment,

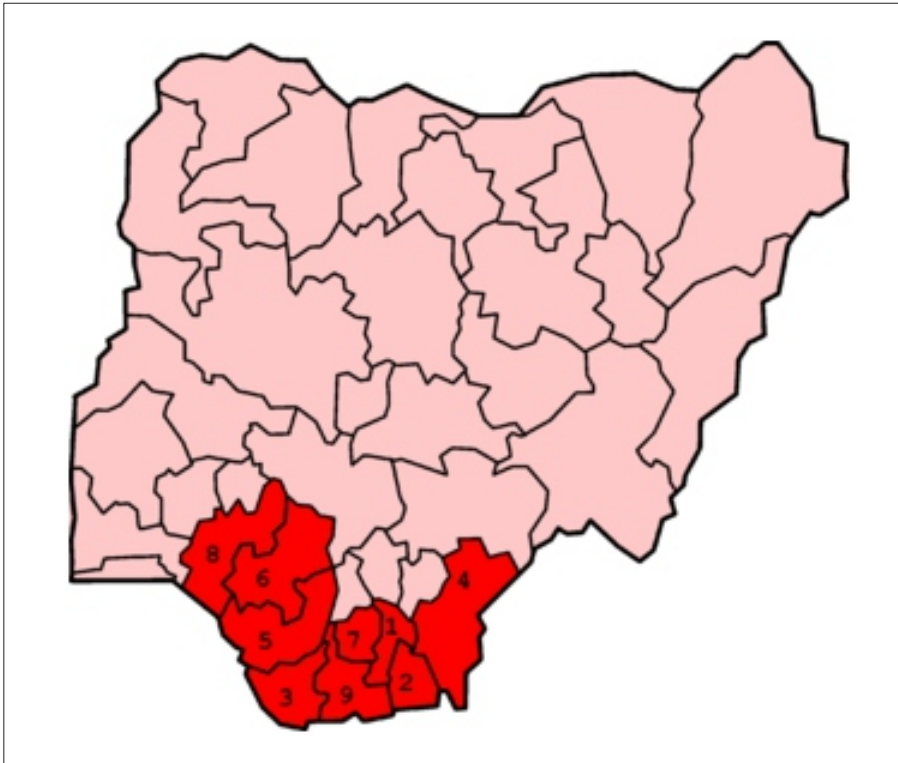
pollution and low agricultural productivity (Abutudu et al. 2007; Ibeanu et al. 2007) as well as insecurity of lives and property, hence, a reduction in quality of life expectations in Niger Delta communities (Nzeadibe and Ajaero 2010).

It is pertinent to note that over the years, persistent debates have raged over what constitutes the Niger Delta<sup>1</sup>. Officially, however, the Niger Delta consists of the nine States of Abia, Akwa-Ibom, Bayelsa, Cross-River, Delta, Edo, Imo, Ondo and Rivers. Ethnically, the region consists of the Ijaw, Urhobo, Efik, Ibibio, Ogoni, Edo, Yoruba (mainly Itsekiri and Ilaje) and the Igbo (Ibeanu 2006). The Niger Delta region is therefore of immense geopolitical, ecologic and economic importance. It is also an important agro-climatic region in Nigeria. In view of the problems and controversies inherent in the different definitions of the Niger Delta, this study adopts the official definition of the Niger Delta as consisting of the following nine states: Abia, Akwa-Ibom, Bayelsa, Cross-River, Delta, Edo, Imo, Ondo and Rivers. Fig.1 depicts the relative location of the Niger Delta region while Fig. 2 shows states of the Niger Delta region.



**Fig. 1: Relative Location of Niger Delta region (Source: Ugochukwu 2008)**

<sup>1</sup> These debates are largely driven by the politics and governance of petroleum resources. Consequently, four different socio-political and geographical definitions of the Niger Delta have been identified in recent development literature [see Ibeanu (2006) for a detailed analysis and discussion of these definitions].



**Fig. 2: Map of Nigeria showing the states in the Niger Delta Region**

*Key: (1) Abia, (2) Akwa Ibom, (3) Bayelsa, (4) Cross River, (5) Delta, (6) Edo, (7) Imo, (8) Ondo, (9) Rivers  
(Source: [http://en.wikipedia.org/wiki/Niger\\_Delta](http://en.wikipedia.org/wiki/Niger_Delta), 2010)*

## 2. Literature Review

### **2.1 Climate Change: Causes and Consequences**

Climate change has the potential to affect all natural systems thereby becoming a threat to human development and survival socially, politically and economically. Anthropogenic activities such as the burning of coal, oil, and natural gas, as well as deforestation and various agricultural and industrial practices, are altering the composition of the atmosphere and contributing to climate change. These human activities have led to increased atmospheric concentrations of a number of greenhouse gases.

Since its creation in 1988, the Intergovernmental Panel on Climate Change (IPCC) has conducted four assessments to date. These assessments show that Warming of the climate system is unequivocal. The IPCC Fourth Assessment Report stated that Continued GHG emissions [...] would induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century (Pachauri 2009). This study further stated that Delayed emission reductions significantly constrain the opportunities to achieve lower stabilisation levels and increase the risk of more severe climate change impacts. Africa has also been identified as being especially vulnerable because of low adaptive capacity and projected climate change impacts.

These findings of the IPCC are clearly in tandem with observations and events in the Niger Delta region of Nigeria where it is estimated that over 70 million cubic meters daily), amounting to about 70 million tonnes of carbon dioxide are flared off during oil and gas exploration and production activities (UNDP/World Bank 2004). Approximately 75 percent of total gas production in Nigeria is flared. It has been estimated that Nigeria accounts for about 17.2% of global gas flaring. As a result, more gas is flared in Nigeria's Niger Delta than anywhere in the world (EIA 2003). Flaring in Nigeria contributes a measurable percentage of the world's total emissions of greenhouse gases (GHGs) and is probably the greatest contributor of GHGs in the Niger Delta region. Due to the low efficiency of many of the flares much of the gas is released as methane (which has a high warming potential), rather than carbon dioxide. At the same time, the low-lying Niger Delta is particularly vulnerable to the potential effects of sea levels rising (Ugochukwu 2008; Ugochukwu et al. 2008).

Climate change in the Niger Delta affects rainfall pattern, emergence of diseases and pests, crop and animal production, fisheries, biodiversity, frequency and regularity of floods, human health (see Figs. 3 and 4 showing gas flaring in different parts of the Niger Delta region). It has been suggested that climate change could potentially contribute to increased incidences of flooding. This being the case, communities in the



Source: Ugochukwu 2008

**Fig. 3a: Gas flaring in farmlands in Rivers State**



Source: Ugochukwu 2008

**Fig 3b: Gas flaring in farmlands in Rumuekpe community, Rivers State**



Source: Environmental Rights Action, 2004

**Fig 4: Multiple gas flare points at Ebocha community, Niger Delta**



Source: Uyigwe and Agho 2007

**Fig. 5: Urban flooding in Benin City, Niger Delta**

Niger Delta would seem to be especially at risk with serious consequences for property, livelihoods and the environment. Fig.5 shows a recent episode of urban flooding in Benin City of Niger Delta, Nigeria.

## **2.2 Climate Change Research, Advocacy and Policy-making in the Niger Delta**

The past few years have witnessed a flurry of activities regarding climate change in the Niger Delta region of Nigeria. Some of these have been by non-governmental organizations (NGOs) and civil society groups while others are more academic and policy-oriented. Some Niger Delta-based NGOs such as Community Research and Development Centre (CREDC) and Environmental Rights Action (ERA) have also been active in trying to create awareness about impacts of gas flaring and its linkages with climate change and poverty in the region (Ibeanu 2006; Uyigwe and Ogbeibu 2007; Uyigwe and Agho 2007, 2009). Recent studies have addressed issues of environmental degradation and vulnerability and mitigation of climate change impacts (Akinro et al. 2008), coastal management and adaptation to climate change (Etuonovbe 2008), climate change, poverty and women's socio-economic challenges (Chinweze and Abiola-Oloke 2009). The need for building institutional and professional capacity of urban and regional planners in the face of the climate



challenge has also been advocated (Olujimi 2007). On the academic front, studies on climate change in the Niger Delta have tended to be orientated to social aspects and food security. For example, Edino et al. (2010) examined people's perceptions and attitudes towards gas flaring. This study concludes that most residents appear to be resigned to the continued presence of gas flaring activities in the community. The study, however, raised several questions on modeling perception and attitudes toward environmental problems in areas where political tension and economic adversity are prevalent. A related study explored the spatial variability effects of gas flaring on the growth and development of cassava (*Manihot esculenta*), waterleaf (*Talinum triangulare*), and pepper (*Piper spp.*) crops commonly cultivated in the Niger Delta (Dung et al. 2008). Findings of this study indicate that cassava yields were higher at location further away from gas flare while starch and ascorbic acid tended to decrease when cassava plant is grown close to gas flare. Curiously, however, the study also found that the waterleaf plant appeared to thrive better around the gas flare point (Dung et al. 2008).

At the policy-making level, the Federal Ministry of Environment of Nigeria (FMENV) set up a "Special Unit" on Climate Change. It was established in recognition of "importance attached to the issue of climate change and global warming, and in view of the enormity of activities required for the implementation of the Climate Change Convention and the Kyoto Protocol" (FMENV 2010). It is this Unit that has been the driver of the Ministry's Policy and Programmes on Climate Change. In addition, it was recently reported that the Ministry has commenced "massive" awareness programme on climate change in the nine erosion-prone states in the Niger Delta region and northern parts of Nigeria (The Punch Newspaper 2010). According to a Director in the Ministry, the programme would enlighten the people in the area about the threat and impact of the global phenomenon. However, this awareness programme which illustrated the impact of climate change, through jingles on television, radio and drama also had in participation "people at the grassroots" and some NGOs. It should be noted, however, that programmes, policies and activities of the Ministry on climate change do not seem to have specifically targeted and involved farmers e.g. the awareness campaign mentioned above (FMENV 2010). Consequently, farmers as major stakeholders appear to have inadvertently been left out in the climate change debate and policy making in the Niger Delta by governmental authorities.

In a related development, the climate change discourse in Nigeria received a big boost with a major conference that was organized by the Department of Geography, University of Nigeria (UNN) in 2009. The conference whose theme was Climate Change and the Nigeria Environment touched on various facets of the climate change phenomenon including agriculture and food security, socio-economic development, vulnerability and adaptation to climate change, climate change education and awareness (Anyadike et al. 2010). However, only a few papers dealt with climate change and its impacts in the Niger Delta region of Nigeria (Efe 2010; Ekuase et al. 2010; Ubuoh et al. 2010), while very little on indigenous knowledge systems and climate change awareness in Nigeria was presented (Nabegu 2010).

The conclusion of the above review is that studies on climate change and its impacts in the Niger Delta region of Nigeria are not lacking. What has been missing is the fact that major stakeholders particularly farmers have not been part of the climate change dialogue as their awareness level of the climate change phenomenon is dismally low. In addition, efforts have not been made to involve farmers' innovative practices and traditional knowledge systems in climate change adaptation in the region. This is a major challenge to researchers, civil society and policy makers in the quest for innovative approaches to food security and agricultural adaptation to climate change in the region.



## 3. Research Methodology

### 3.1 Study Population and Sample

The population for this study comprised farmers estimated to be about 7,814,858 which represented about 60% of the population of the sample states in the study area (NPC 2009). Multistage (random) sampling technique was used. Three states were randomly selected from the nine states that make up the Niger Delta region in the first stage. The states are Cross River, Delta and Rivers. In the second stage, using the delineation by the different states' Agricultural Development Programmes (ADPs), two agricultural zones were randomly selected from each state giving a total of 6 agricultural zones. From each of the selected zones, two blocks were randomly selected for study. This gave a total of 12 blocks.

First, residents from the selected blocks were invited to a community forum at which a preliminary identification of different categories of households was carried out. At the community forum, 15 rural households members made up of males, females and youths who constituted the focus group were purposively selected from the list of those identified and discussions were held with them. During the community forum, focus group discussion, and key informant interviews and with the help of community leaders, a sampling frame of all farmers was built up in each community. From this list, random samples of 35 respondents were selected and interviewed using semi-structured interview schedules. In all, a total of 420 respondents were interviewed. However, 400 completely filled questionnaires were used for analysis.

### 3.2 Data Collection

Rapid Rural Appraisal (RRA) (transect walks, identification and inspection of farm lands) was used first to encourage the respondents to describe their relationship with their natural resources, particularly the indigenous adaptation measures. Again, this helped in identifying variables of importance to the rural dwellers and in the formulation of questions that were included in the more formal semi-structured interview schedule in locally meaningful terms. Two single gender Focus Group Discussions (FGDs), one for men and another for women were held with farmers in each state with number of participants ranging from 10-21. This gave a total of six FGDs. The FGDs /Community fora were particularly helpful in eliciting clearer information on respondents' relationships to the natural resource base. Key informant information enabled the selection of different sites for in-depth study, while the semi-structured interview schedule was used to collect quantitative information from the randomly selected respondents.

### 3.3 Measurement of variables

The interview schedule was divided into eight sections (A-H). However, only Sections B and F are relevant to the analysis presented in this Working Paper. Section B determined rural households' level of climate

change awareness. Respondents' were asked to indicate the extent to which variables such as high rainfall, massive floods, food insecurity and hunger, extinction of planting and animal species etc represented their awareness level of climate change by ticking against the appropriate responses/options of "Yes" or "No".

Section F elicited indigenous and emerging technologies and innovations adopted by the farmers to mitigate the negative effects of climate change in their communities. In this case, respondents were asked to list / enumerate different indigenous practices and innovations adopted in the communities to mitigate the negative effects of climate change. The perceived levels of effectiveness of the different adaptation strategies were measured on a three-point Likert-type scale of very effective (3); effective (2) and not effective (1). Adaptation strategies with mean scores greater or equal to 2.0 were regarded more "effective", while strategies with mean responses lower than 2.0 were regarded as less effective.

### **3.4 Data Analysis**

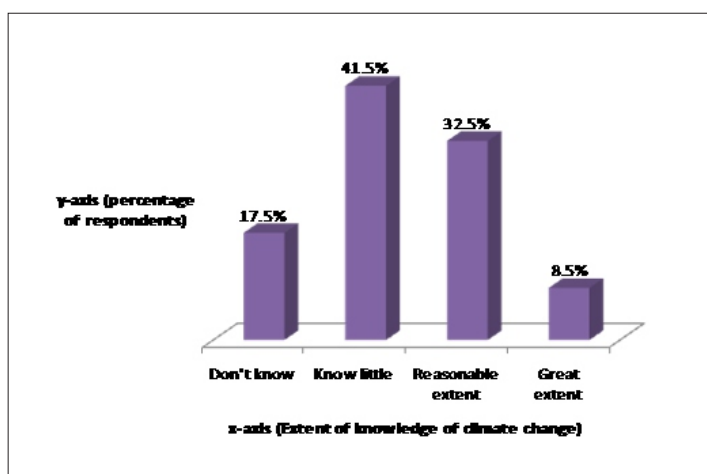
Analysis of the survey data entailed use of means, percentages, standard deviation and frequencies. The results were presented graphically in charts, graphs and tables. Data collected from FGDs and key-informant interviews were analysed by first transcribing and translating them from local languages to English and then organizing them into themes. Results of FGDs were content analysed and complemented the quantitative data. Verbatim quotations from FGDs are used to illustrate the indigenous adaptive practices of the farmers. Both data types were used in drawing of conclusions and policy implications on climate change awareness and adaptation in the Niger Delta region of Nigeria.

## 4. Preliminary Results & Findings

### 4.1 Farmers' Awareness of Climate Change in the Niger Delta

Results of the household questionnaire survey indicate that the level of awareness of local communities of climate change impacts was still low in the Niger Delta region of Nigeria. Nearly 60% of respondents know little or nothing about climate change and its impacts. Specifically, it was found that 41.5% of respondents indicated that they know little about the phenomenon while 17.5% stated that they do not know about climate change at all.

On the other hand, about 32% of respondents indicated that they know about climate change impacts to a reasonable extent. Only about 8.5% of the respondents claimed that they were very knowledgeable about climate change impacts. Fig. 6 shows the extent of knowledge of respondents to climate change impacts.



**Fig. 6: Extent of knowledge of climate change**

From Fig. 6, the mean ( $\bar{x}$ ) of the extent of awareness on climate change is 2.32 while the mean years respondents have lived in the communities was 27.10 years. Interestingly, 94.8% of the respondents indicated that they were aware of climate change impacts on their farming activities and on their lives. Table 1 presents a distribution of respondents' extent of climate change awareness in Niger Delta region of Nigeria.

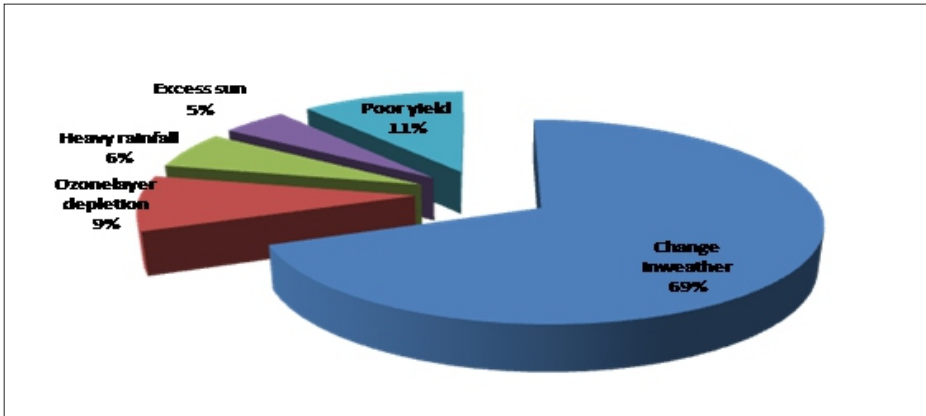
**Table 1: Distribution of respondents' extent of climate change awareness**

<b>Variables*</b>	<b>%</b>	$\bar{x}$
Extent of knowledge		2.32
<b>Knowledge on climate change on farming practices</b>		
Yes	94.8	
No	5.2	
<b>Understanding of climate change</b>		
Excessive rainfall	61.0	
Increased incidence of drought	56.2	
Crop failure	60.2	
Decline in fish production	24.2	
Pests and disease infestations	45.2	
High winds and heat waves	41.2	
<b>Years lived in the community</b>		27.10

\* Multiple Responses

#### **4.2 Farmers' Understanding of the Climate Change Phenomenon**

This study sought to elicit the understanding of the farmers of climate change. Farmers were asked to indicate their understanding of the phenomenon. Curiously, 69% of respondents reported that they understood climate change as "change in weather". This observation is probably representative of the most basic understanding of the term "climate change". 11% related climate change to "poor yield" while 9% understood it as "ozone layer depletion". Some farmers (6%) understood climate change as "heavy rainfall" while 5% regarded climate change as "excessive sunshine". Descriptive analysis of Table 1 shows that 56.2% of the respondents perceived it as "increased incidence of drought"; about 41.2% of them understood climate change to mean "high wind and heat waves". Table 1 also reveals that some respondents understood climate change to mean "excessive rainfall" (61.0%). Another factor that contributed to their understanding of the term is "crop failure/poor yield" (60.2%). Fig 7 presents a description of climate change phenomenon as understood by farmers in the Niger Delta.



**Fig. 7: Respondents' understanding of climate change**

### **4.3 Sources of Information on Climate Change**

Knowledge of climate change impacts is related to availability and accessibility of information on the phenomenon. It was found that the mass media (radio/TV and newspaper) was the largest source of information on the climate change phenomenon. A significant number of respondents, however, reported that their source of climate change information was informal contacts with friends. Table 2 presents different sources of climate change information to respondents. It is evident from Table 2 that the farmers received information on climate change from the following three major sources: radio/television (61.0%), newspaper (44.0%), and friends (43.8%). Other sources included internet (18.2%), researchers (14.8%), extension workers (13.8%), farmers' co-operative (10.2%) and politicians (3.5%).

**Table 2: Sources of information on climate change to farmers**

<b>Sources*</b>	<b>Percentage (%)</b>
Extension workers	13.8
Friends	43.8
Farmers co-operatives	10.2
Politicians	3.5
Internet	18.2
Newspaper	44.0
Radio/Television	61.0
Researchers	14.8

*\*Multiple responses*

#### **4.4 Climate Change and Potential Adaptive Measures for farmers**

Adaptation to the adverse effects of climate change is a key issue for all countries, especially developing countries, which are often the most vulnerable and least, equipped to defend themselves. De Chavez and Tauli-Corpuz (2008) defined climate change adaptation as the process by which ecological, social, or economic systems adjust to actual or expected climatic stimulus and their effects or impacts. Adaptation is widely recognized as a vital component of any policy response to climate change because it helps farmers achieve their food, income and livelihood security objectives in the face of changing climatic and socioeconomic conditions, including climate variability, extreme weather conditions such as droughts and floods, and volatile short-term changes in local and large-scale markets (Kandlinkar and Risbey 2000).

Studies show that without adaptation, climate change is generally detrimental to the agriculture sector; but with adaptation, vulnerability can largely be reduced (Easterling et al. 1993; Mendelsohn 1998). The degree to which an agricultural system is affected by climate change depends on its adaptive capacity. Adaptive capacity is the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damage, to take advantage of opportunities, or to cope with the consequences (IPCC 2001). Thus, the adaptive capacity of a system or society describes its ability to modify its characteristics or behaviour so as to cope better with changes in external conditions (Gbetibouo 2009).

Adaptation is understood to include efforts to adjust to ongoing and potential effects of climate change (Mani et al. 2008). Also, adaptation to climate change consists of initiatives to reduce the vulnerability of natural climate change effects (IPCC 2007). Adaptation to climate change requires that farmers first notice that the climate has changed, and then identify useful adaptations measures and implement them (Maddison 2006). Adaptation to climate change refers to any adjustment that occurs naturally within ecosystems or in human systems in response to climatic change that either moderates harm or exploits beneficial opportunities in response to actual or expected climate related environmental changes (IPCC Third Assessment Report). It is also defined by the UNFCCC as something that is about finding and implementing ways of adjusting to climate change. It looks into ways of responding to changes that pose

greater risks to life and livelihood and increasing damage-related costs such as climate change effects on rainfall, the strength and distribution of tropical storms, sea levels and glacier melt.

Adaptation measures always seek to reduce the risks and impacts of climate change, to moderate the negative effects, and to exploit beneficial opportunity. Adaptation is a proactive process because it envisages possible future changes in the climate, unlike coping measures which are reactionary ([www.nigeriaclimatechange.org](http://www.nigeriaclimatechange.org)). The devastating effects of climate change can be reduced if appropriate adaptation measures are employed. Many agricultural adaptation options have been suggested in the literature. They encompass a wide range of scales (local, regional, global), actors (farmers, firms, government), and types: (a) micro-level options, such as crop diversification and altering the timing of operations; (b) market responses, such as income diversification and credit schemes; (c) institutional changes, mainly government responses, such as removal of present subsidies and improvement in agricultural markets; and (d) technological developments - the development and promotion of new crop varieties and advances in water management techniques (Smith and Lenhart 1996; Mendelsohn 2001; Smit and Skinner 2002; Kurukulasuriya and Rosenthal 2003).

#### **4.5 Indigenous Measures for Climate Change Adaptation in the Niger Delta Region**

Varying strategies have been adopted by farmers in the Niger Delta for climate change adaptation. Table 3 shows that the percentage of respondents that adopted different strategies for climate change adaptation. For example, 80.2% planted with early rainfall; 77.2% adopted mixed farming; 75.8 used proper preservation of seeds as an adaptive strategy. Similarly, 74.2% adopted use of inorganic manure; 72.0% utilized organic manure; cover cropping was used by 71.8%; increase number of weeding of cropped land accounted for 67.5% use by farmers. Other noteworthy adaptive measures reported included protection of water sheds/mulching (64.5%), listening to information on climate change (59.2%), use of minimum/zero tillage (57.2%) and afforestation (56.0%) in cushioning the effects of climate change.

On the other hand, interactions during the FGDs indicate that farmers are adopting the “spiritual approach” or “prayers” for adaptation to the effect of climate change. They noted that “these changes are brought about by God and that they can only pray for mercies”. Some of the more widely adopted adaptive measures identified by the farmers themselves during the FGDs and community forums included:

- > planting cover crops like melon to help conserve soil moisture
- > zero tillage so as not to expose the soil to loss of nutrients
- > regular weeding of cropped farmland
- > early planting with first rain especially for crops like maize and cassava
- > mulching and use of organic manure
- > preservation and selection of seeds for next planting season

The farmers argued that while noticing the manifestations of climate change “we adopted these measures and they have been helping our crop farming activities”. When probed further on the sources of these innovative strategies for climate change adaptation, some of them remarked that “we did not learn the practices from anywhere and that they are indigenous to us”. Some of them further opined that “these measures have served us well in water and soil conservation and management”. Although the farmers acknowledged that “there are no local equivalents for the term Climate Change”, they noted that “the above

and many more have been practiced for so many years even before Climate change became a major issue in development policy in country”.

From the foregoing, it is evident that farmers in the Niger Delta have been practicing adaptation measures even before the concept of climate change became a topical issue in development policy discourse. The finding that these innovative practices are indigenous to the farmers in Niger Delta could have some implications for climate change and development policy in Nigeria.

**Table 3: Percentage distribution of adaptive strategies for climate change in Niger Delta**

S/N	Adaptive strategies	Yes (%)	No (%)
1	Conservation of water and soil	50.5	49.5
2	Use of organic manures	72.0	28.0
3	Use of inorganic fertilizer	74.2	25.8
4	Planting pest and disease resistant crop	40.2	59.8
5	Use of crops varieties that are well acclimated	45.0	55.0
6	Draining of wetland for crop cultivation	30.8	69.2
7	Making of contour bund around farmland	40.8	59.2
8	Cover cropping	71.8	28.2
9	Use of minimum tillage system (zero or minimum)	57.4	42.8
10	Use of irrigation system/water storage	37.2	62.8
11	Reforestation/ Afforestation	56.0	44.0
12	Use of chemicals like herbicide, insecticide	53.8	46.2
13	Increase in number of weeding of cropped land	67.5	32.5
14	Use of early maturing crop varieties	57.5	42.5
15	Protection of water sheds and mulching	64.5	35.5
16	Proper preservation of seeds and plant seedling used for planting	75.8	24.2
17	Use of weather-resistant variety	28.5	71.5
18	Planting of crop with early rainfall	80.2	19.8
19	Reducing access to eroded and erosion prone area	49.2	50.8
20	Mixed farming practices	77.2	22.8
21	Change of planting date	51.2	48.8
22	Use of recommended planting distance	41.2	58.8
23	Listening to information about climate change	59.2	40.8
24	Changing the timing of land preparation	43.2	56.8
25	Changing harvesting dates	45.2	54.8
26	Out migration from climate risk areas	31.2	68.8
27	Processing of crops to minimize post-harvest losses	54.0	46.0
28	Use of windbreaks/shelter belts	35.8	64.2
29	Reclamation of wetlands/ river valleys	23.8	76.2



## 5. Conclusions & Policy Implications

This paper has reviewed the state of awareness and adaptation of farmers to climate change in communities in the Niger Delta region of Nigeria. In spite of the fact that NGOs and Policy makers have made attempts at creating awareness of climate change and its impacts in the region, it does appear, however, that such campaigns have not have specifically targeted and involved farmers. As a result, farmers as major stakeholders appear to have inadvertently been left out in the climate change debate and policy making in the Niger Delta by governmental authorities.

Although the level of awareness shown by farmers in the Niger Delta is still low, it is evident that the farmers have been practicing adaptation measures even before the concept of climate change became a topical issue in development policy discourse. A major challenge to researchers, civil society and policy makers in the quest for innovative approaches to food security and agricultural adaptation to climate change in the region is to involve farmers and learn from the adaptive measures they are already practicing.

The power of the mass media to bring about behavioural change cannot be underestimated. The farmers indicated that radio/television were their main sources of climate change information. Policy makers could tap into the vast potential of the media to disseminate climate change information and create more awareness about causes, and consequences of climate change as well as strategies for climate change adaptation in the Niger Delta region.

More importantly, the observed adaptive measures are indigenous to the farmers. This means that extension workers, the media, researchers and civil society groups have something to learn from the Niger Delta farmers and could assist in diffusing the innovations for widespread adoption in other communities. The identified indigenous adaptive strategies have Science, Technology and Innovation (STI) policy relevance as such practices of the farmers could inform the design and implementation of future Agricultural and Climate Change Policy in Nigeria.

Climate change is a real threat to lives and livelihoods as well as to the environment. If the MDGs of food security are to be attained in the Niger Delta, then there is need for more robust collaboration among stakeholders for evolving innovative approaches and adaptive measures for the climate change phenomenon in the region. In addition, adequate investment in research and capacity building is imperative in building resilient adaptation to climate change impacts in the Niger Delta region of Nigeria.

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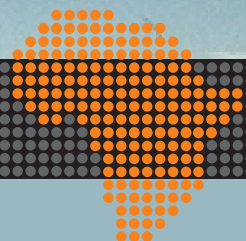
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