CPED Policy Paper Series 2011

CLIMATE CHANGE AND ADVOCACY

ON ADAPTATION STRATEGIES AT THE LOCAL LEVEL IN NIGERIA

ANDREW G. ONOKERHORAYE

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

i

BS-1 and SM-2 Ugbowo Shopping Complex,
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

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

TABLE OF CONTENTS

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

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 paper argues that the proof of effective climate change adaptation strategies in Nigeria is in improved resilience of the hundreds of millions of people living in communities most vulnerable to the impacts of climate change. Involvement of local authorities and community based organisations in the development of adaptation strategies will be crucial.

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.

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

INTRODUCTION

Climate change has become the primary environmental threat of the 21st century. Climate change has become a global issue of critical importance, increasingly acknowledged as one of the main challenges to sustainable development. Climate Change is posing a great threat to development in virtually every country and subjecting a large proportion of world population to extreme shortages of food, water and shelter, and in some cases perpetual poverty as a result of global warming. It is affecting patterns of life and general living conditions of people all around the world. Adverse impacts of climate change have already been observed on natural resources, food security, human health, the environment, economic activity and physical infrastructure. Climate change impacts ecosystems, livelihoods, human security and socio-economic development of societies, and has been described as the 'defining human development issue of our generation' (UNDP, 2008). Climate variability and change have the capacity to reverse major achievements in human development across a range of sectors if not addressed properly and managed well. Gains in the health and education sectors, for example, could be affected by food insecurity and water scarcity. Climate change is therefore a core development issue because all human societies are dependent on climate for survival and prosperity.

Due to the importance which the United Nations place on climate change, huge resources have been expended on the understanding of this phenomenon. The *Intergovernmental Panel on Climate Change (*IPCC) over the last two decades has succeeded in presenting scientific evidences through their Climate Change Assessment Reports to all, particularly world leaders on the urgency for immediate action to adapt and mitigate the impacts of climate change. The efforts to reach a common global approach to tackling climate change culminated in the December 2009 Copenhagen Conference and the formulation of a global legally non-bidding Climate Change. The current concern for climate change and its impact is based on a number of recent scientific analyses that suggest that potential climate change effects are at a scale that adds urgency not only to the efforts to prevent additional change, but equally important, to efforts to adapt to the impacts already occurring. Scientific analyses tend towards a general consensus that the Earth is presently tracking towards worst-case impact scenarios outlined in the *Fourth Assessment Report of the Inter-Governmental Panel on Climate Change* (IPCC, 2007).

The results of assessments carried out by the IPCC indicate that the impact of climate change is largely on the poor. Disasters such as floods and droughts have already killed and affected millions of poor people in different parts of the world. The consequences of climate change are expected to escalate in frequency and intensity according to recent predictions, all of which will be hardest on the poor. Climate change, therefore, is one of the greatest threats facing the poor. The enormous impact of climate change on the poor suggests that developing countries, especially those in sub-Saharan Africa, are greatly affected

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

by climate change because poverty is pervasive and there is a lack of financial resources, institutional capacity and structures to mitigate risks. Even small changes in the climate have the potential for extensive impacts. For example, changing rainfall patterns greatly impact farmers who rely on rain fed agriculture. This leads to food insecurity and loss of livelihoods, causing outmigration by men to seek other forms of income which in turn increases the burden of women left with little to provide for their children in the rural communities. As women tend to remain at home, this positions them well to act as stewards of the natural environment and utilize resources in a way that is both adequate for their family and community as well as environmentally sustainable.

Responding to climate change falls into two broad classes of action, *mitigation* and *adaptation*. Mitigation of human-induced climate change refers to measures that may either reduce the increase in greenhouse emissions (abatement) or increase terrestrial storage of carbon (sequestration). Although Nigeria, like other developing countries, is not required under the current global climate change negotiations to take on emission reduction commitments, it nevertheless has to adapt to the expected impacts of anticipated climate change. Responding to climate change through adaptation initiatives will require Nigeria to engage in a concerted effort, over the near- and long-term, to seek out opportunities and design actions to reduce the vulnerability of the people to climate change impacts. Nigeria needs to explore a number of opportunities that exist to build a climate-resilient society that is able to withstand or recover quickly from difficult conditions caused by the adverse effects of climate change.

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. Effective information dissemination and networking enhances people's knowledge base for proactive engagement on climate

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

change and its effects, and creates a sound foundation for policy formulation and action on climate change adaptation.

This paper argues that the proof of effective climate change adaptation strategies in Nigeria is in improved resilience of the hundreds of millions of people living in communities most vulnerable to the impacts of climate change. Involvement of local authorities and community based organisations in the development of adaptation strategies will be crucial. Risk reduction and risk management are key elements of adaptation. The remaining part of the paper reviews the key concepts relating to climate change and adaptation strategies; outlines the vulnerability to climate change in Nigeria and its impact; discusses the key elements of advocacy and adaptation strategies at the local level; and ends with some concluding comments.

PERSPECTIVES ON KEY CONCEPTS OF CLIMATE CHANGE

Climate change refers to a change in the average weather experienced in a particular region or location. Climate change may occur over decades or even millennia. Its causes may be natural, due to periodic changes in the earth's orbit, volcanoes and solar variability but climate change is mainly caused by human activities. These human activities, both agricultural and industrial lead to the emission of increasing quantities of polyatomic molecules into the atmosphere. These polyatomic molecules are heat-trapping gases and are also known as greenhouse gases (GHGs). The 'greenhouse gases include carbon dioxide (CO2), chlorofluorocarbons (CFCs), methane (CH4), aldehydes, nitrous oxides (NO)**x**, ozone (O3), water vapour (H2O) and others. CFCs not only contribute to global warming, but also deplete the ozone layer exposing humans to skin cancer and eye disease and disturb the equilibrium of the ecosystem. These greenhouse gases cause the greenhouse effect, which is the reduction of the amount of infrared radiation emitted by the earth surface which escapes to outer space by these gases' (Uyigue et al, 2010). The indications that climate change is occurring are consistent increases in temperature, varying rainfall patterns, more frequent extreme weather events, sea-level rise, rapidly changing seasons, ocean acidification and glacial melting. These changes are being felt around the world and are already having considerable socio-economic effects in addition to very significant ecological impacts (NEST, 2011).

Human-induced climate change science has emerged from meteorological and other bio-physical sciences, with the contribution of response concepts and terminology from environmental sciences, and more recently inter-disciplinary approaches involving the social sciences. The concepts are rapidly evolving through increasing engagement by diverse stakeholders. Many of the concepts of climate change have been codified by the Intergovernmental Panel on Climate Change (IPCC) and as such they represent the widest consensus on climate terms available. However, there are varying interpretations across the

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

literature, causing some mystification in the climate change debate. Responses to climate change have been grouped into two main categories: *mitigation* which focuses on addressing causes and *adaptation* which addresses effects. Mitigation has received most of the attention until recently.

Climate change mitigation is the action to decrease the intensity of radiation force in order to reduce the potential effects of global warming. Most often, climate change mitigation scenarios involve reductions in the concentration of greenhouse gases either by reducing their sources or by increasing their sinks. The United Nations define mitigation in the context of climate change, as a human intervention to reduce the sources or enhance the sinks of greenhouse gases. For example mitigation entails using fossil fuels more efficiently for industrial processes or electricity generation, switching to renewable energy, improving the institution buildings, and expanding forests and other "sinks" to remove greater amounts of carbon dioxide from the atmosphere. Most means of mitigation appear effective only for preventing further warming, not at reversing existing warming. The Stern Review identifies several ways of mitigating climate change. These include reducing demand for emissions-intensive goods and services, increasing efficiency gains, increasing use and development of low-carbon technologies, and reducing fossil fuel emissions (Stern, 2006, 2007).

Adaptation to climate change is a response to climate change that seeks to reduce the vulnerability of natural and human systems to climate change effects. Adapting to changes around us to have a better way of life is a basic human response and due to the slow action of industrialised countries to implement mitigation measures communities will need to adapt to the already inevitable effects of a changing climate. Even if emissions are stabilized relatively soon, climate change and its effects will last many years, and adaptation will be necessary. In other words even the most effective reductions in emissions, however, would not prevent further climate change impacts, making the need for adaptation unavoidable. Adaptation to climate change is therefore the process through which people reduce the negative effects of climate on their health and well-being and adjust their lifestyles to the new situation around them. In a nutshell adaptation is being better prepared or adapting to climate change, not fighting it, but learning to live with it.

Climate change adaptation is especially important in developing countries since those countries are predicted to bear the brunt of the effects of climate change. That is, the capacity and potential for humans to adapt is unevenly distributed across different regions and populations, and developing countries generally have less capacity to adapt. Adaptive capacity is closely linked to social and economic development (IPCC, 2007). The economic costs of adaptation to climate change are likely to cost billions of dollars annually for the next several decades. As the potential significance of the resulting changes and the links with human causes have become clearer, demands for assistance for the most vulnerable/least resilient have become louder (Nelson et al

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

2007) leading to adaptation moving up the agenda. The previously overlooked interactions between mitigation and adaptation are also receiving greater attention, because of the potential synergies and trade-offs implied for policy decisions (IPCC, 2007).

Closely associated with adaptation is the vulnerability of an environment and its inhabitants. There has been considerable interest in the concept of *vulnerability*, for which many definitions have been provided in the research literature, derived largely from differing conceptual models and frameworks. From the perspective of this paper, vulnerability is the susceptibility of a given population, system, or place to harm from exposure to the hazard and directly affects the ability to prepare for, respond to, and recover from hazards and disasters. Hazard vulnerability assessments describe who and what is exposed to the threat (hazard identification), and the differential susceptibility (the potential for loss, injury, harm, adverse impacts on livelihoods), and impacts of that exposure. Three distinct elements comprise hazard vulnerability assessments: exposure assessment (the identification of the risk source including magnitude, frequency of occurrence, and spatial impact); impact assessments (the consequences of a particular hazard or stressor on a population; and damage assessment (defining the direct and indirect losses (fatalities, infrastructure, economic) associated with a particular event). However, the integration of these three elements into a comprehensive vulnerability assessment for an area or region of concern is often lacking.

Social vulnerability describes those characteristics of the population that influence the capacity of the community to prepare for, respond to, and recover from hazards and disasters. Social vulnerability interacts with natural processes and the built environment to redistribute the risks and impacts of natural hazards and in this way creates the social burdens of hazards (Cutter et al. 2009). Social vulnerability helps to explain why some communities experience the hazard differently, even though they experience the same level of flooding or storm surge inundation. Understanding the differential impact of hazards as a product of the social vulnerability of a place, rather than exposure, is a critical element in formulating comprehensive mitigation plans (Cutter et al. 2009). Unlike biophysical vulnerability or other exposure indicators, social vulnerability is present, independent of the hazard type or threat source. In other words, social vulnerability is a pre-existing condition or an inherent property of existing communities, irrespective of the natural hazard of interest.

Resilience, often embedded within the vulnerability construct, speaks to the capacity of the population, system, or place to buffer or adapt to changing hazard exposures. Within the climate change community, resilience is used along with adaptation to gauge how society responds to this threat source (Cutter, et al 2009). Here the exposure unit is the ecosystem or the human-environmental system and focal questions are; 'Why and how do systems change'?, 'What is the capacity to respond to change'? and 'What are the underlying

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

processes that control the ability to adapt?' Key attributes considered include: thresholds of change, reorganization, capacity to resist, cope or recover from shock and stress; to learn and adapt.

There appears to be an increasing consensus that these different approaches to analyzing adaptation each offer useful insights to adaptation policy and practice. The degree to which development agencies have mainstreamed 'sustainability' within their activities has been variable. Pro-poor economic growth is widely considered to be central for achieving poverty reduction, but the sustainability of carbon-based development is now under greater scrutiny, with implications for development policies. The search is on for finding appropriate policies *and* the political will to implement 'climate-resilient development'. The sufficiency of market-based solutions and western notions of 'progress' as the way forward for reducing emissions and facilitating adaptation are increasingly being examined and critiqued. Activities can include: changes natural resource management and agricultural practices, building institutions, launching planning processes, awareness raising, promoting technology changes, establishing monitoring and early warning systems, empowering people, promoting policy changes, improving infrastructure, providing insurance mechanisms, and disaster relief.

The key components of effective adaptation strategies must entail linking micro-level processes to macro-level processes; engage a wide range of stakeholders to incorporate a diversity of perspectives; address current climate vulnerability and prepare for future change; context-specific, taking into consideration local circumstances; build on local knowledge and local capacity for dealing with change; and use an integrated and holistic approach. However, in the context of Nigeria it can be stated that the understanding of vulnerability to climate change and the strategies and pathways for adaptation are currently enveloped in situation of high uncertainties because adequate scientific data is lacking in many respects. Research is therefore needed to support improved understanding of the extent of past, current and future climate variability and potential climate change in Nigeria, as a basis for developing adaptation options likely to ensure that poor and disadvantaged groups benefit from the adaptation process rather than bearing the burdens (NEST, 2011).

IMPACT AND VULNERABILITY TO CLIMATE CHANGE IN NIGERIA

Nigeria has been facing and will continue to face many significant challenges associated with climate change. Using the scenario analysis for temperature and rainfall for the vegetation zones of Nigeria which was extensively discussed in the First Communication of Nigeria to the United Nations Framework on Climate Change Convention (FNC, 2003), Oladipo (2008, 2010) has shown that all sectors of Nigeria's socio-economic development, including the natural ecosystems, are vulnerable to

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

climate change. A recent document by HBS Nigeria (2009) has also documented evidences of Nigeria's vulnerability to climate change. Although Nigeria has a strong and diverse economy relative to other countries in Sub-Saharan Africa, significant portions of its population and economy are tied to activities that are climate sensitive.

The key elements of climate change in Nigeria relates to remarkable changes in temperature and rainfall. Meteorological data have shown that rainfall pattern in Nigeria has changed in the past decades. Oladipo (1995) reported that the decline in rainfall in Nigeria started at the beginning of the 1960s when a decade of relatively wet years ended. According to him, the persistence of below- mean rainfall in the last two decades in Nigeria is an indication of an abrupt change in climate. According to IPCC projection, the humid tropical zone of southern Nigeria which is already too hot and too wet is expected to be characterized by further increase in both precipitation and temperature. Precipitation increases of about 2 - 3% for each degree of global warming may be expected in the tropically humid zones of Nigeria and this could increase to between 5 and 20 per cent in the forest regions and southern savanna areas. In contrast, the savanna areas of northern Nigeria would probably have less rainfall, which, coupled with the temperature increases, would reduce soil moisture availability.

This situation may be worsened by the expected decrease in rainfall with greater drought probabilities and larger inter-annual variability (Oladipo, 2010). Thus across the country, from the north to the south, millions of people are already experiencing and reacting to changing seasonal patterns of rainfall, storm surges and increased heat. Nigeria's long (853km) coastline to the south means that the large population of coastal communities is vulnerable to sea level increases and storm surges. Communities to the north, in the Sahel, are especially vulnerable to increasing aridity due to higher temperatures and reduced rainfall. The key elements of Nigeria`s vulnerability to climate change can be categorised broadly under environmental and socio-economic patterns.

Environmental impact, vulnerability and consequences

The coastline of Nigeria is already undergoing pronounced morphological changes as a result of natural and anthropogenic activities. The natural changes are manifested in regular sea surges and tidal waves, while the changes brought about by human activities include construction of ill-designed jetties, sand mining, unplanned and accelerated infrastructural development, pollution and general land degradation. The 800 km coastline of Nigeria is experiencing the impact of Climate Change as shown by the situation in the Niger Delta region, which has a coastline spanning about 450km. The coastal zone of Niger Delta, which harbours some of the most strategic industries on which the economic development of Nigeria depend, has been experiencing environmental changes caused by climate change. A mechanical analysis of tide data from 1960-1970, shows that mean sea level rose to 0.462m above zero level of the tide gauge (Uyigue, *et al*, 2010). Beach erosion and coastal flooding are

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

widespread due to higher waves generated by onshore storm winds. Mangroves adjoining estuaries are receding due to wave incursion and beach breaching; their ecosystems largely sustain the rich biodiversity of the coastal zone. The receding shoreline coupled with the 30 to 60 km tidal excursion length around the Niger Delta suggests increasing salinization of upland ground water. Sea-beds reworked by storm waves threaten the integrity of offshore buried oil pipelines leading to rupture and oil spillage. Finally, the integrity of coastal engineering infrastructure and some industrial facilities are undermined by storm wave scouring and wave run-up, leading to possible closure of operations and job loss.

Furthermore, the *Nigerian Environmental Study/Action Team* (NEST, 2004), reported that sea-level rise and repeated ocean surges will not only worsen the problems of coastal erosion that are already a menace in the coastal areas. According to Oladipo (2010) an accelerated sea level rise of 0.5 - 1m that is anticipated for Nigeria would most likely worsen environmental and socio-economic problems of the coastal region of Nigeria. Sea level rise impact will include: inundation and flooding, exacerbation of coastal erosion, increased frequency of ocean storm surges, changes in ocean dynamics, which could have effects on fishery resources, and migration and nutrient distribution patterns. Many low lying areas will be affected by accelerated sea level rise and increased flooding from storm surges due to global warming. Beach erosion could pose more threat as a result of ill-designed jetties/groynes which could cause alterations in current directions with the result that erosion could shift to other places as being witnessed on the Bar Beach on Victoria Island, Lagos (Oladipo, 2010). In the context of the Niger Delta region which is the most strategic economic region in Nigeria, it has been estimated that with an accelerated sea level rise of about 0.5m, about 35% of the delta could be lost. With sea level rise of about 1.0 m about 75% of the delta could be lost. The number of people at risk, assuming no measure and development, would be 0.9 million, 2.10 million and 4.50 million with sea level rise of about 0.2 m., 0.5 m., and 1.0 m respectively, resulting in massive *environmental refugee.*

Flooding of low-lying areas in the southern parts of Nigeria has been observed. In some coastal localities in the Niger Delta region settlements have been uprooted while some oil wells have been lost to the ocean due to erosion. In the coastal regions of Nigeria noticeable climate change and sea level rise has contributed to the loss of biodiversity, rapid deterioration in land cover and depletion of water availability through destruction of catchments and aquifers. Persistent flooding and water logging due to accelerated sea level rise or extreme weather events could render forest regeneration more difficult. Similarly the savanna region to the north of the country is extremely vulnerable to the persistent reduction in rainfall. This could further lead to the wide spread degradation of habitats. In effect, climate change and sea level rise could affect the boundaries of the ecosystems and the mix of the species that compose them (Oladipo, 2010).

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

Closely related to the problem of flooding posed by climate change is that of soil erosion. As a result of widespread reduction of vegetation cover, all parts of the country are vulnerable to soil erosion resulting from climate change either in terms of removal of soil by wind and rain or deposition of same in low-lying and down-wind locations. With increased heavier rainfall many localities in the southern parts of the country have been exposed to increased rainfall-induced erosion. This is bound to intensify with increased and continuing climate change. On the other hand, the arid northern parts of Nigeria have been exposed to higher temperatures resulting in dry conditions which invariably underlie accelerated wind erosion. Experiences in different parts of Nigeria show that soil erosion is already of catastrophic proportions whether viewed as gullying or sheet erosion while floods annually ravage many parts of the country during the rainy season (Oladipo, 2010).

The consequences of climate change on flooding and drought is already having effects on the hydro-climatological systems of the different ecological zones in the country. This could be furthered altered with continuing climate change in the coming decades with their consequences on the availability of water resources. Higher temperatures changes are having dramatic impacts on the amount of runoff that becomes groundwater, which is the main source of water supply in many parts of the country. Similarly, reduced rainfall, particularly in the northern part, is having noticeable effects on the inability of the zone to meet people's demand for water. This suggests that the northern part of the country may have to increase its dependence on underground water sources. However, decreased rainfall is reflected in lower water tables and this could increase the water stress and problems of environmental sustainability and water resources management. Climate change will affect water use in all socio-economic sectors and consequently demand for water. Of particular significance is the fact that reduced river flow will reduce hydropower reservoir storage and thus reduce potential energy production (Oladipo, 2010). Water pumping requirements may increase significantly in response to increased water need for irrigation and residential, commercial, and municipal water use to off set temperature increases. This will be very critical in this era of energy deficiency in the country. Finally, excessive drought, which is likely to affect forest cover, will also pose problems for fuel wood supply.

Socio-economic impact, vulnerability and consequences

In a country such as Nigeria which depends on the exploitation and use of environmental resources for the livelihood of the vast proportion of the population coupled apart from their strategic role in the socio-economic development of the country, climate change is already having major impacts on socio-economic activities. Agriculture is one of the socio-economic sectors that are sensitive to climate change. A variety of foods crops are produced in Nigeria, all dependent on rainfall, so that where rain is abundant crops dependent on rain are planted, and in drier parts of the country, crops that do not require much

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

rain are cultivated. Climate Change phenomenon has affected agriculture in different parts of Nigeria in a number of ways. The uncertainties in the onset of the farming season, due to changes in rainfall characteristics often lead to an unusual sequence of crop planting and replanting which do result in food shortages due to harvest failure. Extreme weather events such as thunderstorms, heavy winds, and floods, devastate farmlands and often lead to crop failure. Pests and crop and diseases migrate in response to climate changes and variations which often pose a threat to livestock in the drier northern areas.

Consequently, subsistence agricultural households are most vulnerable to the impacts of climate change. Often the occurrences of these climate change induced effects have resulted in assets sale, indebtedness, out-migration and downward spiral in human development indicators. Such impacts will further aggravate the stresses already associated with subsistence production, such as isolated location, small farm size, informal land tenure, low levels of technology and narrow employment options, in addition to unpredictable and uneven exposure to world markets that smallholder farmers risk-prone in the face of climate change.

Indirect effects of climate change on agriculture include the effects on pests and diseases and the impacts of these on agricultural production, the impacts on health, and the impacts on agro-related socio-economic activities. Various pests would probably expand their distribution areas in the event of climate change. In general, the various impacts of climate change on crop production could have tremendous impact on income, employment and food production. There would also be significant impacts on the characteristics of labour, employment and population processes and their characteristics.

Two categories of industries in Nigeria are vulnerable to climate change. In the first place, industries with activities dependent on climate will be negatively affected. Secondly, sectors in which economic activity is dependent on climate-sensitive resources (agro-industry, biomass and other renewable energy production) will also be negatively affected. Industries located in the coastal zone such as beach-based tourism, oil and gas exploration will suffer the negative impacts of sea-level rise and attendant coastal inundation and flooding. On the other hand, industries located in the northern dry belt region of Nigeria will be exposed to the effects of warmer climate on water supplies that make process cooling and environmental processes more difficult and unduly expensive. This belt is equally prone to occasional devastating thunderstorms, floods and windstorms that can destroy industrial infrastructure, giving rise to cessation of activities and incurring costs for expensive repairs to damaged facilities. A variety of other industries such as construction, housing, transportation, energy generation and distribution, are all affected by the incidence of extreme weather and weather-related conditions.

Climate Change would also directly or indirectly affect population and human settlements in Nigeria. In general, about 15% of the country‘s population is

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

presently affected by climatic variation and sea level changes. Some settlements are known to have already relocated farther inland from their original sites in response to sea incursion over some decades. With climate change, between 50% and 60% of the population would be affected. Population displacement and migration from, and to, various human settlements will arise from either or both of drought incidence in the northern states Nigeria and accelerated sea level rise in the coastal regions.

The human health impacts of climate change in Nigeria would occur in various ways and because of the poor health status of many citizens, the impacts could be devastating. In direct terms, Nigeria's inhabitants already suffer from nutritional imbalances will only have a deleterious effect on food security. A shift could occur in the location of some vector-borne diseases, such as malaria (mosquitoes), sleeping sickness (tsetse fly) etc. In response to shifts in the patterns of rainfall and temperature; mosquitoes currently thrive in locations where water logging and poor drainage typify the landscape. Malaria will also increase due to the preponderance of stagnant pools of water resulting from sea-level rise related flooding. With respect to indirect impacts high flood frequency and water-logging due to climate change in localities hitherto unassociated with malaria will enhance the breeding of mosquitoes and thus the spread of malaria.. New evidences with respect to micro-climate change due to land-use changes such as swamp reclamation and deforestation suggest an increase spread of malaria to new areas (NEST, 2011)

ELEMENTS OF ADVOCACY AND ADAPTATION STRATEGIES AT THE LOCAL LEVEL

It is essential to examine the challenge of advocacy and adaptation at the local level in Nigeria in the context of the biophysical and socio-economic factors determining exposure and adaptive capacity and adaptation to climate change. Given limited resources, adaptation strategies must be targeted to those populations and households that are most vulnerable to global change, and must also equip those unable to adapt-generally the poorest-with tools and incentives that will allow them to undertake adaptation. In order to facilitate a coordinated and effective policy response to this complex set of challenges, this section of the paper outlines the key elements on advocacy and adaptation strategy at the local level.

Target groups in advocacy and the raising of awareness

Grassroots stakeholder participation in the implementation of adaptation programmes will play a major role in the context of local rural communities in Nigeria. The promotion of local stakeholder participation is thus needed, but with specifically targeted steps that enable poorer people to participate. Often natural resource management policies and programmes tend to assume that ecosystem dynamics are linear, predictable and controllable and have approached human and natural systems

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

as being essentially separate entities, rather than as strongly coupled, integrated systems which are complex and evolving. The contemporary approach has moved away from regulatory models for governing natural and cultural resources. New concerns with adaptive processes, feedback learning, and flexible partnerships are reshaping environmental governance. In the context of the climate change challenge, awareness raising, advocacy and capacity building are essential at the grassroots level in particular to respond to the challenges of climate change. As pointed out by Helmer (2007), 'local people are the real experts' in terms of climate change, as they know about any changes that are occurring best, as well as having traditional responses to cope with many of them. Support to local population in areas affected and threatened by climate change can strengthen their adaptive capacity. Such support includes improvements to traditional productions systems adapted to climate stress through greater access to marketing, infrastructure, research and development, and technology transfer.

A major feature of local knowledge is that their methods are locally appropriate, flexible and usually socially or environmentally responsible. Integrating this knowledge into climate change adaptation and the development process can contribute to local empowerment and build sustainability. However, the coping strategies of local population are often constrained by their lack of resources and information as well as organisational capacity (Mallick & Jilan, 2006). Their local strategies may end up therefore being either inappropriate to maintain their livelihoods in the longer term or may end up with the relatively more prosperous members of the community successfully adapting at the expense of the poorer households. Despite the need to integrate local knowledge, communities do not hold all the answers. Therefore there is clearly a need to bring the scientific expertise on future climate changes and adaptation techniques, together with the experience, traditional knowledge and locally defined vulnerabilities of the community, so that the best information from both sources can be combined into a strong community based adaptation response (Tanner, 2005).

The key and sustainable strategy that can be used to promote effective advocacy and adaptation on climate change at the local level is the adoption of community-based adaptation approach. This framework provides the opportunity for rural communities most negatively affected or prone to climate change to make choices and not having them imposed from outside; enhancing the ability of the community to have a wider range of choices in the future; climate risks are addressed together in a broader developmental framework; and it is a process that evolves over time, not a set of static assessments (Jones & Rahman, 2007). The goal of community-based adaption approach to climate change is to build the resilience of vulnerable individuals, households, communities and societies from the ground up. The approach is anchored on local priorities because it starts with local knowledge but also seeks to integrate scientific knowledge into decision making processes. Operates at multiple levels and

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

can be large scale, so long as communities remain at the centre of planning and action. Some of the key elements of the community-based strategy to climate change adaptation include: the promotion of climate-resilient livelihood strategies, including capacity building for planning and improved risk management; capacity strengthening of local civil society organisation so that they can provide better support to communities, households and individuals in their adaptation efforts; advocacy and social mobilization to address the underlying causes of vulnerability, such as gender-based inequality and poor governance.

Raising the awareness and building the capacity of local communities

Although the science of climate change is now well established, its predicted effects on communities are a fairly new issue for most people, especially those in rural communities. The level of awareness on climate change issues is therefore rather low in rural communities. For example there is a tendency to confuse the impact of oil exploration on the environment of the Niger Delta region with those of climate change. In fact most people in the region believe that oil exploitation is the only factor responsible for the changes in their local environment. Thus awareness on climate change related matters is essential for looking at any meaningful adaptation in different localities not only in the Niger Delta region but across the country. The inhabitants of local communities need to know about climate variability, change, impacts and risks related to such issues in order to prepare for the coming changes (Pender, 2010). Raising community awareness on various social issues through drama, song, community meetings, peer education amongst others are widely practised by NGOs in different parts of the world. These approaches can be adopted to spread the message of climate change and adaptation strategies in the different rural communities in Nigeria.

In the context of the situation in Nigeria awareness raising and capacity building can take place at four levels; household, community, institutional and state. At the household level the focus should normally be improving the capacity of vulnerable households to adapt to climate change impacts by making them aware of new livelihood strategies, using a group based approach. At the community-wide level key stakeholders such as community leaders, women and youth groups should be the focus of attention so as to increase their awareness of climate change impacts and to develop and implement community-level adaptation strategies. At the institutional level the capacity of local organizations that carry out their activities in the various local communities should be enhanced with respect to the collection and dissemination of information related to climate change; advocacy on climate change consequences; and awareness campaigns on climate change issues. At the statewide level advocacy should focus on key stakeholders to increase awareness of local climate change implications in their respective states and local people's needs.

A special population group within rural communities that require adequate attention on climate change awareness raising and advocacy comprise the children and the young in schools. As the

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

generation inheriting climate impacts, they have a right to be included in decision-making affecting their future. The focus should of necessity be on education in schools so as to create the community understanding needed for adaptation; building awareness among children and young adult who are often more open to change and can influence their families is likely to be a very effective process. Children also have rights in relation to the impacts of climate change: A right to be heard, a right to adaptation, a right to education. So adaptation plans should include the views and needs of children (Gautam & Oswald, 2008). Consequently, climate related issues need to be included in the education system and as part of the routine curriculum of academic institutions. There is no doubt that continued education on relevant aspects of climate change mitigation and adaptation would help prepare a pool of local and community level experts, who in turn would provide critical services in future years to come (Pender, 2010). Schools and educational programmes often run or worked with by NGOs and community groups can play a part in mobilising children.

Furthermore, any programme to raise climate change awareness or to promote adaptation measures at the local level in Nigeria needs to pay special attention to women because in the communities which are most vulnerable to climate change women constitute over 50 per cent of the population. Women are major participants in agricultural activities just as they are primary care-givers in times of disaster and environmental stress. Furthermore, since climate change is expected to reduce scarce resources further, the time taken to fetch water or wood, usually the responsibility of women, will increase their workloads thus limiting their opportunities to use adaptation measures or start alternative income generation schemes (Röhr, 2006). In order to address women's needs properly in relation to the impacts of climate change it is therefore of greatest importance that women are part of adaptation planning processes. In addition they need to be socially empowered and gender issues addressed in their communities as their inequality with men is a one of the main causes of their vulnerability. Women are not just victims to be protected but vital assets to help their communities respond to disasters and adapt to climate change, for they play a key role in protecting, managing and recovering their household and assets during a disaster and have a clear sense of what is needed to adapt better to climate change impacts.

Agricultural Production

Recent surveys in rural communities in Nigeria (CPED, 2004) indicate that over 65 per cent of the employed population is engaged in agriculture and related activities, which are largely nature and water-dependent. Considering the prevailing poverty of the vast majority of the farmers and other primary producers in rural communities, the adaptation strategy of 'bearing' or tolerating crop, fish or livestock losses is difficult if not impossible. Sharing losses is potentially a good adaptation strategy, already occurring informally within extended families but these are not satisfactory long term sustainable options for the poor. Similarly change of location as a strategy

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

is also not really possible for land resources per capita is already high and there is hardly any unproductive land due to increasing population density and over exploitation of farmlands in most rural communities. However, with advocacy activities in rural areas some adaptation is possible such as growing vegetables on marginal lands.

One important adaptation strategy which can be sustainable in rural communities relates to modifying the threats to crop production. This can largely be carried out by changing the varieties of crops grown, either by selecting appropriate traditional varieties or by using some of the varieties modified and developed by research institutes. Such processes can be carried out through the participation of farmers so that the best results would be promoted through farmer to farmer extension and awareness creation. In the dry land areas zero tillage is an important alternative agricultural technique in which the land is not ploughed and only small holes are made in the surface for planting of seeds or a line of ground is cut, which helps to conserve soil moisture as well as prevent weeds. In many developing countries, this technique has proved successful for maize and potato production. This technique could be also practised for a much wider variety of larger crops and vegetables. Crop planting and harvesting times can also be changed that recognize changing climatic conditions (Nambi, 2007). Farmers can be encouraged to delay their cultivation of certain crops and vegetables by a few weeks because rains tend to arrive late due to a changing climate. This can result in avoiding the need for irrigation thereby reducing the cost of production to the poor farmers. Use of organic manures has traditionally been used to improve the fertility and water-holding capacity of the soil. Application of organic manure or compost is an important climate change adaptation for soil applied with organic manure can supply water to plants for about two weeks even without rain, while soil without adequate organic manure holds water for only one week.

Livestock are affected by high temperatures leading to heat stress, which in turn reduces their appetite and therefore the amount of meat or milk that they produce. In hot locations adaptation involves: The right selection of breed, practical measures such as shade, and the feeding of livestock in the late afternoon instead of the morning (Padgham, 2009). In some developing countries such as Ethiopia where successive droughts have led to the death of large numbers of cattle, the adaptation method adopted relates to the planting of indigenous trees that can survive in dry conditions and whose leaves can be fed to cattle in times of hardship, as well as establishing feed reserves by enclosing sections of grazing land for emergency use (Dadi, 2007). Saline tolerant grass varieties can also be promoted as fodder in the coastal zone of Bangladesh (Ahmed, 2008a, 2008b). In case it becomes extremely risky to continue existing agricultural activities under an altered climate scenario, an alternative land use might be considered as the next available option. However, such changes in land usage should ideally lead to acceptable economic returns, optimising social goods and services (Pender, 2010). Intercropping a method of farming in which two different crops are cultivated in alternate rows, can also

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

be an adaptation strategy to climate change in many agricultural communities in Nigeria.

Health Care

The improvement of the human health situation in the rural communities rather than further deterioration due to climate change is a major development area where climate change awareness and various adaptation measures are essential. Rural communities in Nigeria are already largely vulnerable to outbreaks of cholera and other waterborne diseases. However, the effects of climate change are making and will in future make these more common and devastating. Advocacy and adaptation measures to counter this threat in the rural communities should focus on sanitation facilities and domestic water supplies, as well as purifying water, such as through using a mixture of lime, bleaching powder and alum (Pender, 2010), or according to the World Health Organisation even just bleaching powder.

The drastic reduction of rainfall as a result of climate change in the dry land areas due to climate change is bound to increase the reliance of the local population on shallow water wells and as many areas have dangerous levels of arsenic contaminating groundwater supplies alternative sources of water will have to be supplied in these areas. Awareness on avoiding arsenic containing water, encouraging nutrition or treatment for people who are suffering from arsenic poisoning will also be needed in these areas. Further concern is now also being raised about groundwater irrigation of crops in areas where arsenic contamination is high.

Saline contamination of drinking water in coastal and storm surge affected areas is another problem in relation to health. Deep tubewells and community or household rainwater harvesting tanks are the best solution (Pender, 2010). People need to be informed about the best water supply methods for households and the wider community in their localities. Furthermore, households particularly women who are mainly responsible for collecting water should be informed about the best way to collect rain water hygienically and efficiently, in larger quantities than before by adapting their traditional technologies so that adequate amounts of rain can be collected and stored.

Heat-stress related illness must be tackled by increased awareness especially in the hotter localities. Community-based heat wave action plans are needed to monitor the weather and keep people informed through community communication channels to publicise the upcoming conditions, along with information on how to avoid heat-related illnesses; promotion of traditional elderly care systems in which friends, relatives and neighbours are encouraged to visit elderly people during the hot weather and make sure they have sufficient water and proper ventilation to cope with the weather; provision of information and counselling to the public on avoidance of heat stress; mobile field teams making home visits to vulnerable households; and measures to ensure an adequate supply of water to communities (Stern, 2006).

Environmental degradation

Overall environmental conservation is a key component of the needed advocacy and climate change adaptation responses.

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

Wild food plants that are already adapted to difficult environmental conditions such as water logging or drought may be cultivated as a source of food, for sale or as a means of preserving biological diversity. The natural forests of most rural communities in Nigeria are basically gone due to over exploitation. The rural communities in coastal and wetland areas are equally threatened by disturbance to wildlife, such as nesting birds, conversion to agriculture, over fishing, using fixed nets which catch and kill non-commercial species as well as undersize immature fish, and water pollution. In this condition the added stress due to a changing climate will result in trees/plants dying, soils eroding and species becoming extinct. In order to help biodiversity and ecosystems to survive the threat of climate change it is important to reduce non-climatic stresses, such as pollution, over-exploitation, invasive alien species, and habitat loss and fragmentation. Strengthening the protection of wildlife and ecosystems like wetlands and forests, expanding the system of nature reserves and national parks and wider adoption of conservation and sustainable use practices are essential (SCBD, 2009).

With advocacy and government support and participation wildlife communities and corridors which are concentrations and belts of natural habitat such as trees or rivers that connect different areas of high biodiversity will be necessary and also possible to create at a community level by planting native species of tree along roadsides or by allowing wild plants and wildlife to flourish along river banks and creeks. Areas which are at present characterized by natural wildlife habitat/ecosystems could also benefit by being expanded in size to preserve the genetic resources of animals and plants within them which enables them to naturally evolve and adapt more effectively. Some adaptation measures that benefit both wildlife and communities through the expansion of suitable habitat include: mangroves that reduce coastal erosion; act as barriers against winds and storm surges (Pender, 2010). Advocacy on community based tree plantation establishment has been shown to benefit communities in different parts of the world in the short term with: fuel, fodder for livestock, reduced erosion, flood prevention, storm wind control, more medicinal plants, and creation of job opportunities, such as for those growing seedlings in nurseries. Then in the long term after 15-20 years timber and fruit could be available for sale.

Finally, an ecosystem-based adaptation approach that uses biodiversity and ecosystem services in an overall adaptation strategy can also be used in the design of projects. This approach includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to the adverse effects of climate change. Examples of ecosystem-based adaptation activities include: coastal defence through the maintenance and/or restoration of mangroves and other coastal wetlands to reduce coastal flooding and coastal erosion; conservation and restoration of forests to stabilize land slopes and regulate water lows; establishment of diverse agro-forestry systems to cope with increased risk from changed climatic conditions;

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

and conservation of agro-biodiversity to provide specific pools for crop and livestock adaptation to climate change (SCBD, 2009).

CONCLUSION

Climate change presents and will continue to present a major challenge for local development in different ecological zones in Nigeria. There is no doubt that its effects will likely intensify over the coming decades. Climate change impacts such as increased rainfall intensity, storm surges, flooding and environmental degradation effects are likely to increase in most rural communities in the country unless urgent action is taken by all stakeholders which should mandatorily include those living and making their livelihood in these areas. Adaptation will almost certainly be required in order to cope with these effects. In this regard, it is positive to note that rural dwellers in the country if properly motivated by advocacy activities have the potential to become key actors in planning and implementing adaptive responses. The fact that some inhabitants of rural communities are already engaged in this process through their traditional coping strategies demonstrates the importance and evolving role that rural dwellers have in building climate resilience through adaptation. It must be noted that whilst rural stakeholders should play a key role in planning and delivering community adaptation, it may fail in the absence of adequate political, policy, financial and professional support through advocacy and actions plans which are designed for implementation at the community level.

It is important that state and non-state actors recognise the need for the promotion of rural inhabitants in adaptation and try to engage them on a variety of levels in order to contribute to successful adaptation efforts. Often, support for new approaches and strategies to combat a new development challenge such as climate change can be absent until there is a clear need for them in which case there is considerable negative consequences of the impact of climate change. In respect of the need for climate adaptation at the local level in Nigeria, it is argued in this paper that early action can lead to better results and that a 'wait and see' approach may ultimately prove damaging and costly. In short, participation by rural stakeholders in climate change adaption will likely deliver most advantage in rural communities where it benefits from clear, early and wide-ranging support for the development and implementation of adaptation. In conclusion, as the inhabitants of the rural areas in Nigeria become more exposed to climate change effects, the participation of the inhabits of these areas in the amelioration of its negative effects will require increased support from all key stakeholders in the public and private sectors.

REFERENCES

Ahmed, A.U. (2008a). *Assessment of Vulnerability to Climate Change & Adaptation Options for The Coastal People of Bangladesh*. Dhaka : Practical Action, Bangladesh.

Ahmed, A.U. (2008b). *Effective Strategies for Adapting to Climate Change: Lessons from RVCC Project*, CARE-

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

Bangladesh. Dhaka : CARE, Bangladesh.

Aguilar, L. (2008). *Gender perspectives on climate change*, *52nd Session of the Commission on the Status of Women* New York, 25 February - 7 March 2008, Available at: http://www.gdnonline.org/resources/Aguilar_CSWgender-climatechange.pdf

Awosika, L. F. (1995). Impacts of global climate change and sea level rise on coastal resources and energy development in Nigeria. In: Umolu, J. C. (ed). *Global Climate Change: Impact on Energy Development*. DAMTECH Nigeria Limited, Nigeria.

Awosika, L. F., French, G. T., Nicholls, R. J. and Ibe, C. E. (1992). *The impact of Sea level Rise on the Coastline of Nigeria.* In: Proceedings of IPCC Symposium on the Rising Challenges of the Sea. Magaritta, Venezuela. 14-19 March, 1992.

Centre for Population and Environmental Development (CPED) *Niger Delta Regional Master Plan, Demographic and Baseline Survey*, Port Harcourt, NDDC.

Cutter, Susan L. Christopher T. Emrich, Jennifer J. Webb, and Daniel Morath (2009) *Social Vulnerability to Climate Variability Hazards: A Review of the Literature*, Columbia, University of Carolina*: Final Report to Oxfam America.*

Energy Commission of Nigeria (2008), *Assessment of Energy Options and Strategies for Nigeria: Energy Demand, Supply and Environmental Analysis for Sustainable Energy Development (2000-2030).* Abuja: Report No. ECN/EPA/2008/01

Etuonovbe, A.K. (2007), 'Coastal Settlement and Climate Changes – The Effects of Climatic Change / Sea Level Rise on the People of Awoye in Ondo State Nigeria'. *A paper presented at the FIG working week 2007, in Hong Kong*.

Etuonovbe, A.K. (2007), *Sustaining Coastal Management / Adaptation of Climatic Change and Sea Level Rise in the Niger Delta*, Integrating Generations FIG Working Week 2008, Stockholm, Sweden 14-19 June 2008.

FNC (First National Communication) (2003). *Nigeria's First National Communication under the United Nations Framework Convention on Climate Change,* Abuja: The Ministry of the Environment of the Federal Republic of Nigeria UNFCCC Website: http://unfccc.int/resource/docs/natc/nignc1.pdf

Gautam, D., & Oswald, K. (2008), *Children in a Changing Climate Research, Child Voices: Children of Nepal Speak Out on Climate Change Adaptation*. Action Aid/Institute of Development Studies: Brighton, UK.

Heinrich Böll Stiftung (HBS), (2009), *Response to Climate Change: Adaptation Strategies of Action for Nigeria, Lagos:* Heinrich Böll Stiftung.

Helmer, M. 2007. *Community Linkage: Why Community Responses are Central to Climate Change. 2nd International Workshop on Community Based Adaptation to Climate Change*. Organised by: Bangladesh Centre for Advanced Studies, IIED & The Ring. Radission Water Garden Hotel, Dhaka, 24th – 28th February, 2007

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

International Federation of Red Cross and Red Crescent Societies (IFRC) (2009), 'Climate Change Adaptation Strategies for Local Impact,' *Technical Paper for the IASC Task Force on Climate Change*

Intergovernmental Panel on Climate Change (IPCC), (2007), *Fourth Assessment Report. Impacts, Adaptation and Vulnerability; Summary for Policy Makers*. (AR4) http.//www.nl/ipcc/pages.media/AR4-chapters.html.

Jones, R.N., & Rahman, A.A.(2007), Community-based adaptation. Tiempo. 64. 17-19.

Mallick, D., & Jilan, G. (2006). 'Global Climate Change will hit the Poor the hardest. Bangladesh' Environmental Newsletter. 17. 1. December 2006. 6-8.

Mallick, D. (2009). *Fighting Climate Change and Poverty. Clime Asia*. December 2009. COP 15/MOP5 Special Issue. 3-10.

Nambi, A.A. (2007). 'Vulnerability Assessment and Enhancing Adaptive Capacity to Climate Change in Semi-Arid Regions of India', *2nd International Workshop on Community Based Adaptation to Climate Change. Organised by: Bangladesh Centre for Advanced Studies*, IIED & The Ring. Radission Water Garden Hotel, Dhaka, 24th – 28th February, 2007.

Nigerian Environmental Study/Action Team (NEST). (2004). *Climate Change and Nigeria: A Guide for Policymakers*. Ibadan, Nigeria

Nigerian Environmental Study/Action Team (NEST) (2011) *Building Response to Nigeria's Climate Change, Gender and Climate Change Adaptation: Tools for Community-level Action in Nigeria*, Ibadan, NEST

Oladipo, E., (2008), 'Climate Change and Sustainable Livelihoods – The Greening Options' *Paper presented at the First National Summit on the Environment*, Abuja Nigeria, 20 October

Oladipo, E. (2010), *Towards Enhancing the Adaptive Capacity of Nigeria: A Review of the Country's State of Preparedness for Climate Change Adaptation*, Lagos: Report to Heinrich Boll Foundation, Nigeria

Oladipo, E.O. (1995). An indication of abrupt change of rainfall and it potential impact on energy development in Nigeria. In: Umolu, J. C. (ed.). *Global Climate Change: Impact on Energy Development*. DAMTECH Nigeria Limited, Nigeria.

Pender, J.S. (2010), *Climate Change, its Impacts and Possible Community-Based Responses in Bangladesh* (2nd Ed). Dhaka, Bangladesh: Church of Bangladesh.

Röhr, U. (2006) 'Gender and climate change', *Tiempo,* 59. 3-7

SCBD. (2009), '*Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change*'. Montreal : Secretariat of the Convention on Biological Diversity Technical Series No. 41, 126 pages.

Stern, N. (2006) *Stern Review on the Economics of Climate Change*. October 2006. Crown copyright 2006.

Stern, N. (2007). *Stern Review on the Economics of Climate Change: Part III: The Economics of Stabilisation.* HM Treasury, London: http://hm-

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

treasury.gov.uk/sternreview_index.htm

Tanner, T.M. (2005), 'Responding to Climate Change', *International Workshop on Community Level Adaptation to Climate Change. Organised by: Bangladesh Centre for Advanced Studies,* IIED, CIDA, IUCN & The Ring. Pan Pacific Sonargaon Hotel, Dhaka, 16th – 18th January, 2005.

Uyigue, E, . O. A. Ediang and A. A. Ediang (2010) Combating Climate Change: The Role of Renewable Energy and Energy Efficiency *Iranian Journal of Earth Sciences 2 pp. 150-157*

United Nations Development Programme (UNDP). (2008). *Human Development Report*: Fighting climate change: Human solidarity in a divided world 2007-2008. pp.7. UNDP Website: http://hdr.undp.org/en/reports/global/hdr2007-2008/

UNDP (United Nations Development Programme),(2008) *Adaptation to Climate Change: The New Challenge for Development in the Developing World*. New York, UNDP

Uyigue E. and M. Agho (2007), *Coping with Climate Change and Environmental Degradation in the Niger Delta of Southern Nigeria*, Benin City: Community Research and Development Centre (CREDC) Nigeria

WEDO. (2007). *Changing the Climate: Why Women's Perspectives Matter.* Women's Environment and Development Organisation Information Sheet pp 2.

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