

**PUBLIC PERCEPTION OF COMBATIVE
STRATEGIES ON THE IMPACT OF GLOBAL
WARMING ON FOREST RESOURCES IN AKWA-
IBOM STATE.**

BY

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CERTIFICATION

I certify that this research work “Public Perception of Combative Strategies on the impact of Global warming on Forest Resources in Akwa-Ibom State” was carried out by IKERIOCHI, AUGUSTINE CHIEDO (Matric Number 20095703069) in partial fulfillment for the award of Master of Technology degree (M.Tech) in Environmental Technology of the Department of Environmental Technology, Federal University of Technology, Owerri.

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DEDICATION

This work is dedicated to my wonderful family. The study would not be possible without the relentless and caring support of my beautiful wife, Virginia, who remained focused and cheerful even during difficult moments, and my daughters Alarica and Chisara as well as my son Obinna, who gave me joy and encouragement, and supported me all the way.

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ABSTRACT

The application of satellite imagery in environmental monitoring has recently been extended to forest resources. Large hectares of Nigeria's forests are lost annually. It is suspected that climate change/global warming is a contributory factor. Therefore this research addresses the public perception of combative strategies on the impact of global warming on forest resources in Akwa-Ibom state. Thirty year time series of mean ambient temperature profile for 1980-2010 was regressed to show a sustained rising trend. Likewise decadal mosaic imageries of the study area were used to show the dwindling forest spatial extent and vegetal cover. Structured questionnaires were administered to ascertain combative strategies. A total of 180 volunteers were randomly selected from five Annang and Ibibio communities. Five point likert scales was used to analyze the data using descriptive statistics such as tables of frequency, mean and percentages. Results show that 65.6% of respondents were males while 34.4% were females. Majority of respondents were forest-dependent occupationists which include timber and firewood sellers at 26.1% and 22.2% respectively. Civil servants make up 26.7%. On the perceived effect of climate change in the study area, rainfall, flood and erosion ranked highest with a mean score of 4.34. This was followed by loss of forest cover with a mean score of 4.33. The least effect was identified to be a rising sea level and storm surge with a mean score of 3.86. The individual responses on adaptation/ coping measures to climate change showed that afforestation, reserve and plantation farming were the prominent adaptation measures with the mean score of 4.46. This is followed by alternative business such as retail shop and recharge card sales with the mean score of 4.15. Domesticating forest products scored 4.02 while biodiversity conservation had a mean score of 2.05. Of all the adaptation strategies, early warning system ranked lowest with a mean score of 1.47. The local communities undertake some adaption/coping measures such as active protection of existing habitat, increasing number of conservation areas and providing alternative livelihoods. They however lack the necessary information, early warning system and training. The coping measures by the indigenous communities have not been participatory and collaborative with other stakeholders. Application of the results reveals the need for governmental driven adaptation strategies to complement adopted coping measures to make mitigating measures effectively functional.

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CHAPTER ONE

General Introduction

1.1 Background to the study.

Forest can be conceived as a large area of land that is thickly covered with trees (Hornby, 2006). In other words, it is a continuous and extensive tract of woodland or an area largely cleared for agriculture and settlement but with small surviving portion of woodland, either unmanaged or maintained usually of commercial or timber value (Monkhouse and small, 1979). Dana (1980) defines forest as a community- technically an ecosystem- consisting of plants and animals and their environment. Trees are the dominant form of vegetation, but shrubs, herbs, mosses, fungi, insects, reptiles, birds, mammals, soil water and air are also essential part of the community and each interact with the others (Njoku, 2007).

The United Nations Food and Agriculture Organization (FAO, 1981) defines forest as land of more than half a hectare with tree canopy cover of more than 10 percentages that is not under mainly agriculture or urban use while the United Nations Environment Programme (UNEP) uses more than 40 percentage cover for open or fragmented forests (FAO, 1981). Forests provide food and energy for man and animals, wood as raw materials for industries and a source of capital and income. As a foundation for industrialization, they enhance the stability of the rural population, and provide safeguards for agriculture and habitats for wildlife.

Chris et al (1996) noted that trees play both ecological as well as economic roles in a farming system. Trees are the source of a wide variety of potential benefits as well as providing products including edible fruits and pods, animal fodder, building materials, honey, latex

and resins. Nigeria is faced with environmental problems such as drought, desertification, deforestation, industrial pollution, flood and erosion. These problems challenged Nigeria into establishing the defunct Federal Environment Protection Agency (FEPA) in 1988 and later in 1999, the Federal Ministry of Environment (FMEV) was created with the Federal Department of Forestry as one of the key departments, charged with the major to formulate policies aimed at protecting and managing the forest resources of Nigeria. Like other factors of natural environment, forests interact with the climate causing pressures which degrade, destroy and deplete the forests. Climate is one of the components of the natural environment which affect forests. In the context of this study, climate is considered to be the total experience of weather. The relationship between the forest ecosystem and climate is two-fold. On the hand, climate conditions responds or vary according to changes in forest cover, for example, deforestation boosts green house effect and reduce atmospheric water vapour an affect rate of evaporation. On the other hand, forests too adjust to trend inn climatic and allied factors like surface temperature, precipitation, soil moisture, atmospheric pressure, humidity, wind, sunlight intensity, duration, evaporation and evapo-transpiration. According to the United Nations Framework Convention on Climate change (UNFCCC), climate change is change attributed directly or indirectly to human activity that alters the composition of the global air temperature, and which is, in addition to the natural climate variability, observed over comparable time periods (IPCC, 2001). Global warming, as the major driver and manifestation of climate change, is here defined as the apparent rise in temperature of the earth induced in part by the increased accumulation of greenhouse gases (ghgs), such as water vapour,

carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbon etc. the consequence of global warming transcend all sectors of the world economy. The International Governmental Panel on Climate Change, IPCC (1990) predicted that if present rates of greenhouse gases emissions continue, the earth will experience a one degree centigrade (1°C) warming by 2030 at the latest and 3 degrees centigrade (3°C) increase in air temperature before the end of the 21st century. Natural systems, including forest ecosystems are highly vulnerable to global warming and climate change, which cause instability and disturbance of the landscape. Climate change which influences an irregular pattern of weather conditions of a particular place, will likely help to diminish Nigeria's forests if left unchecked. Indicators of land degradation and forest loss are already apparent in Nigeria due to climate change. Scorched and retreating forests, removal of soil nutrients by erosion and flooding, from heavy rainfall as in the southeastern zone are but a few. Climate change can also increase the incidence of pests and disease that attack forest trees leading to species depletion or loss in the various eco-zones of Nigeria in general, and Akwa-Ibom state in particular.

The northern limits of the tropical rainforest are already shifting southwest (Njoku, 2007). Given the sensitive nature of forest ecosystems, forest resources have become highly vulnerable to even slight changes in climate systems and pre-existing problems will only worsen with climate change. In view of the adverse situations as listed above, it has become necessary that something must be done to alleviate the problems, dangers and potential disasters that climate change could cause to our forest resources. This study calls for serious attention.

1.2 Statement of the problem

The constituent states of Nigeria each year join the world in celebrating the World Environment day every 5th June. The celebration calls our attention to world environmental challenges. In response to call for action which the occasion promotes, the Federal Government of Nigeria has initiated "Annual Tree Planting Campaign", to encourage states and local government areas to plant trees. These are efforts to protect and ensure quality environment.

As in other parts of the world, climate has varied in time and space in south eastern Nigeria, which includes Akwa-Ibom state (Ojo, 1986 and Nnaji, 1998), because the state is a major forest resource state in Nigeria. Such variations have impacted either positively or negatively on natural systems and environmental resources including forests necessitating the need to assess the efficacy of strategies adapted to ameliorate the impact of climate change on the forest resources in Akwa-Ibom state.

1.3 Aim and objectives of the study

The aim of the study is to access information on coping and adaptation strategies being adopted to mitigate the impact of climate change on forest resources of Akwa-Ibom state. The attainment of this goal will be achieved through the following objectives:

- (1) To determine the level of awareness of climate change impact on forest resources of Akwa-Ibom state among men and women.
- (2) Identify the adaptation strategies.
- (3) Assess the efficacy of the strategies to combat impact of global warming on forest resources in Akwa-Ibom state.

1.4 Justifications of the study

Nigeria is saddled with a lot of environmental problems, emanating from deforestation, flood, erosion, drought, and climate change etc. Data on the tropical forests of south eastern Nigeria and indeed Akwa-Ibom state are scanty. Forest management planning and related programmes cannot be based on unavailable, scanty or inaccurate data. It is presently believed that global warming is degrading and depleting the forests. It became necessary therefore to investigate the relationship between global warming and forest ecosystem in Akwa-Ibom state of Nigeria.

Consequently there are bits and pieces of previous and ad hoc studies in Nigeria which results are obsolete and never really addressed the impact of climatic environment on the forest. They cannot be used for any serious and meaningful planning and management of forest programmes. More so the dynamism of forest ecosystems require constant monitoring and evaluation to obtain current information that will be useful in forest management, hence this study.

1.5 Relevance of the study

Results and conclusions of this study will be useful to the Federal, State, local governments and rural communities in the following Areas:

- ❖ Facilitating improved access by local communities to weather and climate related information.
- ❖ Providing information of best coping practices.
- ❖ Planning sustainable management, conservation and extension of forest development programmes.

- ❖ Maintaining the health and productive value of forest and to ensure sustainable supply of forest resources.
- ❖ Predicting future condition of forests and mitigating vulnerability of forests and loss of forest resources as a result of climate change.
- ❖ Determining the present spatial and temporal spread of forest cover and implications for other environmental resources.
- ❖ Data generated from the study will be useful for future planning, and policy formulations for the remaining forests in the eco-zone.

1.6 Research Questions/ Research hypotheses

- 1: There are significant impacts of current climate change on forest resources of Akwa-Ibom state.
- 11: There are adaptation strategies to ameliorate the impact of current climate change on forest resources of Akwa-Ibom state.
- 111: The adaptation strategies employed to ameliorate the impacts of current climate change on forest resources of Akwa-Ibom state are efficacious.

Alternative hypotheses:

Hypothesis 1: There are no significant impacts of current climate change on forest resources of Akwa-Ibom state.

Hypothesis 11: There are no adaptation strategies to ameliorate the impact of current climate change on forest resources of Akwa-Ibom state.

Hypothesis 111: The adaptation strategies employed to ameliorate the impacts of current climate change on forest resources of Akwa-Ibom state are not efficacious.

1.7 The study area

1.7.1 Location and Delimitation

The study area is Akwa-Ibom state of Nigeria. The state was created in September 23, 1987. Akwa-Ibom state lies between latitudes 4°32" and 5°33" North and longitudes 7°25" and 8°25" East (NPC, 2006). Akwa-Ibom is located in the south eastern part of Nigeria, sharing boundaries to the east with Cross-River state, Abia and Rivers state to the west and the Atlantic Ocean to the south. The state is now a part of the Niger Delta region, comprising of nine states, namely: Cross-River, Akwa-Ibom, Abia, Imo, Rivers, Bayelsa, Delta, Edo and Ondo states. The state covers a land area of 6900 square kilometres (NPC, 2006).

1.7.2 Climate and Vegetation

Akwa-Ibom state is a typical rain forest zone with a humid environment. Rising surface temperature and variable rainfall make the area vulnerable to global warming. Akwa-Ibom state is located north of the equator within the humid tropics, having high surface air temperature regime, all year round. Mean annual temperature is 26–29 degree centigrade. The area has a wet coastal climate with mean annual rainfall of 2750mm. Most rainforest areas have one or more relatively dry months but droughts are relatively rare. Akwa-Ibom experiences about 1450 hrs/yr of acreage sunshine. Recent studies however, have revealed high fluctuation in rainfall characterized by sustained negative trend (Nnaji and Ijioma, 2003). This factor is crucial in discussing the hydrologic pattern and characteristics of the area. The study area has a high evaporation with annual values that range from 1500mm – 1800mm . There are generally two seasons in the year, the rainy and dry seasons. The rainy season lasts about 8 months (Nnaji, 1999). Maximum humidity is in July. Minimum humidity is in January. There is a little dry season in

between the rainy season called “August break”. The area is characterized by thick cloud of cumulonimbus type, experienced during the months of November – December to early March, while rainy season starts in mid March to end of November. Parts of the study area are within the saltwater, freshwater swamps, mangrove and mostly lowland tropical forest and secondary forest re-growth vegetation zone of Nigeria as described by koppen-Geiger climate classification (Nnaji, 2009).

In the salt and freshwater swamps, many plant species of the tropical rainforest such as *Milicia excelsa* grow here. Other species found here include, *Symphonia globulifera*, *Ficus spp*, *Alstonia congensis* *Albizia zygia*, *Napoleona vogelli* etc (Areola, 1983). From the coast inland, the mangroves give way to the tropical lowland rainforest dense evergreen vegetation of tall trees with closed canopy and undergrowth of small trees, shrubs and herbs. The northward fringe of the region is characterized by trees which are deciduous, losing their leaves for at least a part of the dry season. However there is widely scattered about the forest a substantial number of healthy merchantable trees of varying species and timber value including *Entandrophragma spp*. *Lovoa trichilioides* etc. There are also the moist semi-deciduous types in the dry forest zone such as *Kyaya grandifolia*, *Triplochiton scleroxylon* etc. The forest along the coastal belt of sedimentary rocks, have tall-buttressed trees.

1.7.3 Geology and Soil

The study area is within the tropical rainforest zone and the soils are largely a combination of hygromorphic soils, vertisols and ferralsols (Areola, 1983). The vegetation plays a double role of supplying humus to the soil and protecting it from erosion. The soil would naturally be fertile but excessive leaching has removed much of the plant food.

Further towards the coast, alluvial soils occur on the floodplains of rivers in the delta and along the coast. Along the rivers and streams in the area, the soils are sandy, light-hued and often almost sterile. In areas towards the delta, the soils are clayey and muddy, dark grey in colour, usually waterlogged and good for rice cultivation.

1.7.4 Population and Socio-economic activities

Akwa-Ibom state with a total of 31 local government areas has a population of 3,902,051 according to 2006 census figure (NPC, 2006). Considering the land area of the state, Akwa-Ibom can be considered to be densely populated. Socio-economic activities of the area centre predominantly on fossil fuel and other energy resources especially crude oil, natural gas and biomass. Akwa-Ibom is an oil producing state. It has contributed immensely to the country's foreign exchange earning through export of crude oil, refined oil and derivatives. The use of fossil fuel in Nigeria, as liquefied petroleum gas, premium motor spirit, aviation fuel, kerosene, diesel oil, fuel oil, significantly contribute to global warming in particular and environmental problems in general. The area is endowed with abundant forest resources. As a source of energy wood is widely used for domestic and industrial needs. The net effect of this usage is high rate of deforestation and lodging of carbon dioxide in the air. This means that the major sink of carbon dioxide will remain constantly under threat of disappearance, if the current rate of deforestation by anthropogenic and natural causes continues unabated. There is then the need to put in place mitigation and adaptation measures.

Tourism is an emerging and exciting economic activity in the area. There are the IT parks, 5-star Ibom meridian hotel and resort, world class golf course to boost tourism, revenue earning. Besides, people of the area engage in subsistence, rural based, small scale farming to produce their

own food crops. There is also estate farming for cash crops such as rubber, cocoa, rice, palm produce. The agricultural sector is likely to retain its relative dominance.

Map of Akwa-Ibom state showing local government areas is shown in Fig. 1 and map of Nigeria showing Akwa-Ibom state is shown in Fig. 2.

CHAPTER TWO

Literature Review / Conceptual Framework

2.1 Introduction

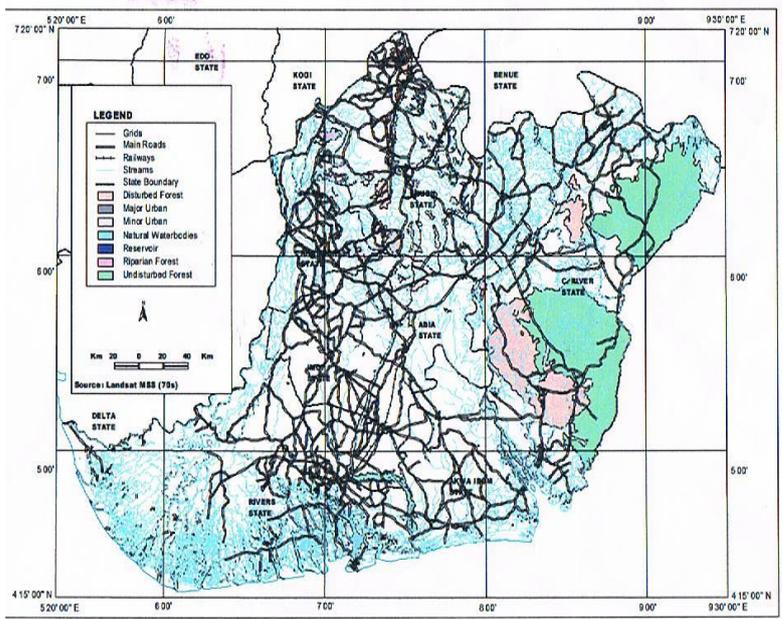
This chapter examines and reviews literature that relates to the evidence of climate change and global warming, tropical ecosystem and induced disturbances, the relationship between global warming and forest ecosystem, the forest resources of Akwa-Ibom state, and formulates a conceptual framework for assessing the adaptation strategies to the impact of climate change on forest resources.

2.2 Evidence of global warming trend / climatic variation

Climatic variation and change, in the history of the earth, are components of inevitable planetary dynamics (Schneider, 1992). The earth has experienced cycles of temperature and precipitation changes on a geological scale. As WMO (1979) and Ojo (1986) have observed, it is certain that climate must change or vary over time. Southeastern Nigeria and indeed other parts of the world have experienced climate variations and their consequences. For instance, Nnaji (1998) reported that variation in rainfall widened for the different climatic regions and individual locations on Nigeria in the last three decades of the last century.

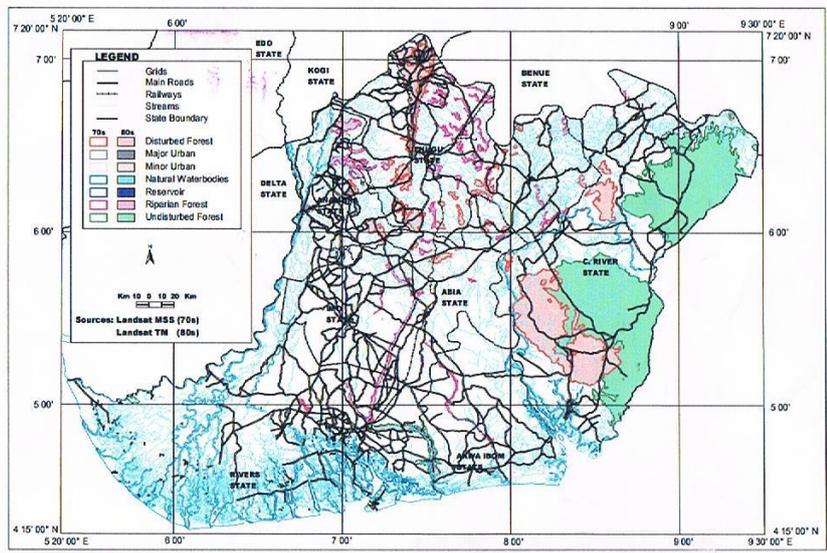
Global warming trend has been presented in several researches. Recent studies reveal the relationship between forest vegetal vigour and global warming (Njoku, 2007) as well as ascertaining the impact of rising temperature on degradation and depletion of forest cover in south-eastern Nigeria. Figures 3(a, b, c,) below show forest extent mosaic map of Southeastern Nigeria for three decades, 1980-1990, 1990-2000 and 2000-2010

MOSAIC IMAGERY: Providing forest cover size and spatial forest extent for 3 decades (1980-2010)



MAP: 1980
FIG. 3(a)

Forest extent mosaic map of south eastern Nigeria (1980-1990). Adopted from Njoku, 2007.



MAP: 1990

FIG. 3 (b)

Forest extent mosaic map of south eastern Nigeria (1990-2000). Adopted from Njoku, 2007.

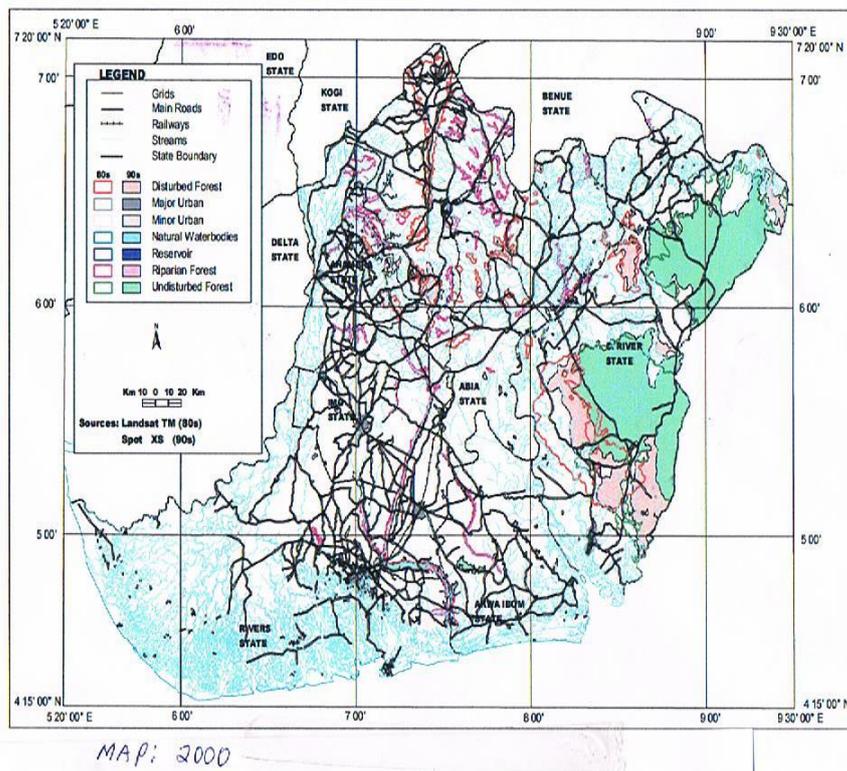


FIG. 3(c)
Forest extent mosaic map of south eastern Nigeria (2000-2010). Adopted from Njoku, 2007.

The study reveals that air temperatures showed a rising trend during the study period. The mean annual temperature for the three decades covered by the study is 25.4°C. The average for each decade 1980-1989, 1990-1999 and 2000-2010 are 22°C, 26.7°C and 27.3°C respectively. Amidst this temperature scenario, the forest cover was being degraded and depleted temporarily.

For Akwa-Ibom state, mean ambient air temperature for 1980 to 2010 was analysed. Fig.4 reveals that air temperature showed a rising trend during the study period. The mean annual temperature for Akwa-Ibom State for the three decades covered by the study is 30.7°C. The average for each decade 1980 – 1989, 1990 – 1999, and 2000 – 2010 are 30.3°C, 30.7°C and 31.1°C respectively.

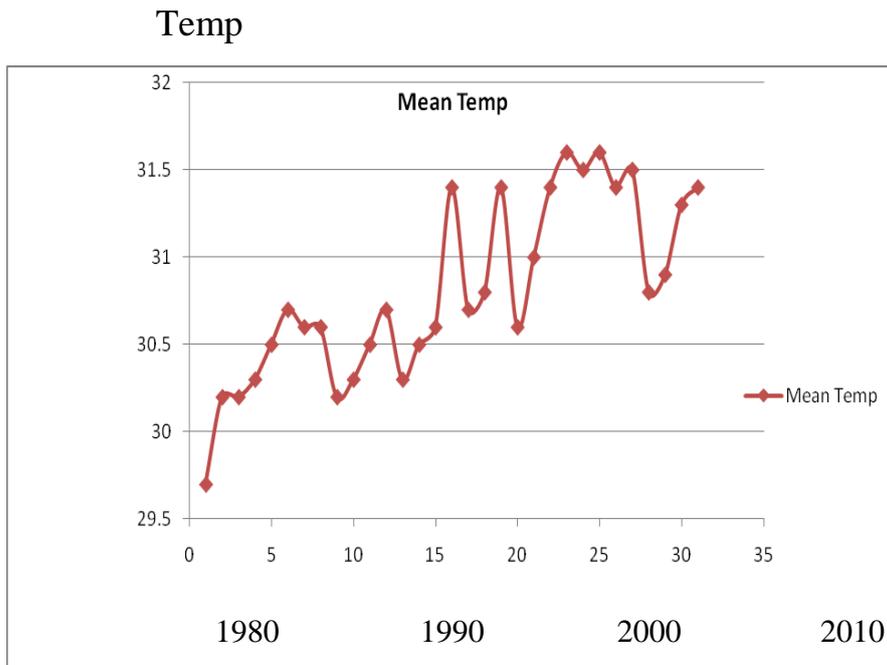


FIG. 4: Time series of mean annual air temperature for 1980 to 2010.

Elsewhere several other evidences of climate variation in Nigeria have been reported. Obioh (2002), for example, observed that steady rise in global surface air temperature trends and variable storm intensities are becoming regular feature of the climatic system. These cause distortions of local climate patterns and increase in evidence of weather-related disasters. Such disasters include flood, land slides/degradation, erosion, drought, deforestation and de-vegetation. These have become commonplace events in many parts of Nigeria. He also noted massive loss of forest resources in Nigeria as being traceable to climate change among other factors. Ojo (1986), Dale (2000, and 2001) stated that with current regime of climatic uncertainty due to climate change, forest resources stand the risk of many diseases, pest attack, forest fires, drought, windstorms and landslides.

Forests play a key role in the release, absorption and storage of carbon dioxide and other green house gases (ghgs) and so influence climate. According to Makarov and Bashmakov (1990), the relationship between

carbon-dioxide, deforestation, and climate is a vicious cycle. While forests have enormous potential to sequester and store large volumes of carbon, they will be undergoing considerable stress as they try to adapt to the changing climate. In fact, millions of hectares of forests will be dying as a consequence and will themselves become sources of carbon emissions. Obviously, this could limit their sequestration capacity and their contribution to mitigating climate change.

2.3 Tropical forest ecosystem and induced disturbances

Unabated deforestation, propelled by increased exploitation by forest-dependent communities, marks an important transition in man-forest relationship. In addition, population pressure combined with the impacts of climate change has contributed to undermining the regenerative capacity of forest areas (CTA, 2008). Tropical forest plants survive under given climatic conditions. As a result, certain factors of natural and anthropogenic origin influence the origin and sustainable growth and development of forest plants.

Most studies on the effect on forests of global warming focused on the ability of species to tolerate temperature and moisture changes and have ignored the effects of disturbances caused by alteration in climatic parameters (Ojima, 1991). Disturbances are defined as occurrences or events, fast or slow, long term or short term, regular or occasional, natural or anthropogenic, which causes instability in the normal processes and functions of any forest ecosystem. Disturbances which can be caused, altered or accelerated by global warming include fire, drought, invasion by introduced species, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, and floods (Dale, 2000 and 2001).

Disturbances shape forest systems by influencing their composition, structure, and functional processes (Franklin 1992). Nature takes a long

time to establish balanced ecological systems. Within Nigeria and elsewhere, natural disturbances having the greatest effects on forests including fire, drought, insects and pathogen outbreak, windstorms, and landslides. Some disturbances can be the combined function of natural and human conditions, example, forest fire ignition and spread. Each disturbance has ecological, social, and economic effects.

2.4 Association between global warming and forest cover

In a study in the U.S.A., Dale (2000) showed that the process of forest succession takes place only after disturbances. But when disturbances extend beyond their natural range of variation, the change in forests, structure and functions may be extreme. Disturbances can reduce leaf function, deform leaf structure, cause tree death, alter regeneration patterns by destroying seed banks, disrupt the physical environment through soil erosion and nutrient loss, and increase landscape heterogeneity such as patches of forest communities (Franklin, 1992). Generally, disturbances alter natural processes such as nutrient cycles and fire frequency and intensity.

2.5 Forest resources of Akwa-Ibom state

The Akwa-Ibom forest vegetation is dominated by woody species, the majority of which are trees. Some deforestation activities have reduced the true forests to patches found in forest reserves. The forest zone of Akwa-Ibom consists of coastal vegetation, mangrove forests, fresh water swamps, lowland rainforests and secondary forest re-growths. The forest resources provide timber and other products. Several species include – Mahogany (*Kyaya spp.*), Obeche (*Triplochiton spp.*), Afara (*Terminalia spp.*) Iroko (*Milicia spp.*), African walnut (*lovoa spp.*), others include Mansonia, Xylopia, among others. These appear

in complex vertical structure with trees up to 60 meters tall. The mangrove and swamp species include Red mangrove (*Rhizophoraceae*), White mangrove (*Avicennia*), *Rhizophora* spp. etc. There are also the non-timber forest resources of Akwa-Ibom state. The non-timber forest resources or products are sources of food, medicine and income. These products play an important role in cultural, traditional and spiritual lives of the people of Akwa-Ibom state. Mushrooms, spices, wild vegetables, seeds, leaves, roots, fruits, rattan and dye are utilizable species from the forests of Akwa-Ibom state. For majority of the people of the rain forest of Akwa-Ibom state, the values of the forests lie on the products especially non-timber forest products they derive from the forests. Some utilizable species of great economic value include: *Lycospermum secundiflorum* (palmae) for cane chairs, trays, cupboard, and tables. *Gnetum africanum*, is forest vine called “salad”. They are a source of protein, amino-acids and minerals. *Piper guinensis* is called bush pepper or hot leaf. The woody climber is a local spice. The seeds and leaves produce aroma used to prepare pepper soup. *Aframomium* spp. called Alligator pepper; the seeds are used for incantations by “Juju” priests, soothsayers, herbalists as well as in traditional ceremonies and in traditional medicine. *Mitragyna* spp. The leaves of this swamp growing trees are used as wrappers for preserving agricultural produce. *Thaumatococcus danielli* is called “moi moi leaf used to wrap moi-moi bean for boiling. *Pentaclethra macrophylla* is called oil bean tree. The seeds are slightly fermented and cut in small shreds to make very nutritious snacks called “ugba”. *Irvingia gabonensis* also called bush mango. The cotyledons are used as soup thickener for the famous “Ogbono soup”. *Elaeis guinensis*, the oil palm. This is one of the most important non-timber forest products in the state. The fruits produce palm oil which is a

major source of vegetable oil. Other products include palm kernel, palm wine, palm fronds, broom, and fibres for fuel (Okpeke, 1987). *Dacryodes edulis*, African pear or black pear. The oily pulp is roasted in ash or boiled and eaten with cooked or roasted corn. *Massularia cuminata*, *Randia* chewing stick. *Cola acuminata* and *Cola nitida*. The kolanuts feature prominently in cultural ceremonies and also offered to visitors as welcome. *Garcinia kola* (bitter kola) is offered to visitors or chewed for their medicinal purposes. Edible mushroom identified include elephant mushroom, ant-hill mushroom. Some mushrooms are associated with tradition.

The mangrove forest ecosystem of the Niger Delta including Akwa-Ibom, is a unique ecosystem with abundant natural resources. It plays a pivotal role in coastal protection and maintenance of habitats for a large range of threatened and endangered species. Tropical mangrove forest is regarded as one of the most endangered ecosystems especially in Africa because of its degraded environment (Adegoke, 2006). Mangrove forests have the potentials of utilization in Nigeria for their products which include tannins from the bark of trees, rayon pulp, paper pulp, methanol, charcoal, electric transmission poles, fuel wood, timber, animal skin especially crocodiles for leather industry. Mangrove forests are technically easier to manage compared to the species rich humid tropical forests. This is because the floristic composition is sparsely diverse when compared to the humid tropical forests but specially adapted to the habitat. Mangrove seeds retain viability for a long period while in the saline environment but lose viability soon after they are removed from the saline environment. Mangrove soils in the region are mostly acidic and characterized by high salt and water, low oxygen and high hydrogen sulphide contents. The threat to mangrove forest is a cause for concern as

Adegoke, (2006) revealed that 2134 hectares of mangrove ecosystem has been lost between 1986 and 2003 in the Niger Delta region.

2.6 Forest Management and global warming

Forest cover not only has a significant impact on global warming, they also influence it. Forests can practically reduce carbon emissions through sequestration – a technique of the removal of carbon from the atmosphere by natural processes. Any effort to improve forestry management amounts to increase in permanent carbon sinks/repositories. Through their destruction by man and climate, forests can be very serious sources of green house gases, but through their sustainable management, they can be important sinks of the same gases and so act as important buffers that cushion the impact of on-going global warming. Thus managing the remaining forests better can be accomplished by making investments that minimize the loss of forests area to deforestation, that maintain or improve tree growth, that minimize soil disturbance and residual stand damage during timber harvesting and that ensure quick and satisfactory regeneration of new forests. It also includes adopting socially acceptable programmes of forest protection of joint management, improving the management of the parks and protected areas ensure natural regeneration of harvested forests and forests damaged by fire, insects and diseases. Above all, there are three broad categories of forest-related interventions that could help stabilize GHGs emissions. Managing the existing forests better, expanding the area of forest cover, and using wood fuels as a substitute for fossil fuels is positive step towards sustainable forest management

Agro-forestry plantings and analog forestry offer some scope for improving carbon sequestration and storage in both the soil and biomass. Long rotation systems and traditional practices that use trees for windbreaks, border plantings and over-storey shades can sequester

carbon for many decades. Urban tree planting also offer the advantages of reducing GHGs build-up by sequestering carbon, by providing shade that reduces energy consumption for air conditioning in the dry season often characterized by heat wave regime, and by providing shelter that reduces heating system during the cold rainy season.

2.7 Adaptation Strategies to impact of global warming on forest resources.

International Institute for Tropical Agriculture shows from its research findings that science-based farming methods integrating the systematic use of fertilizers by farmers can significantly reduce the need to clear forest land for agriculture, one of the identified culprits for global warming (IITA, 2005). The findings show that the use of fertilizers and improved crop varieties by small-holder farmers could have averted the destruction of some 2.1 million hectares of the Guinea forest of West Africa and the subsequent emission of 1.4 billion tons of carbon dioxide into the atmosphere. The study also noted that at the beginning of the 21st century, only 18% of the original forest that once stretched from Guinea to Cameroon remained. This forest is one of the 25 global biodiversity hotspots identified by the United Nations and collectively contains 60% of all animals and tree species on the planet (IITA, 2005).

NEST (2003) explains that adaptation strategies entail adjustment in natural and human systems in response to actual and expected climate stimuli. The report explains that the world's poorest people who have contributed least to climate change may be the hardest hit by the effect of climate change, and estimated that there may be millions of environmental refugees when the impact of climate change kicks in (NEST, 2003). Therefore an organised systematic approach is needed to address the climate change problem while developing the framework and

capacity at various levels to assess and respond to climate change in all sectors. This is because adaptive responses do not follow specific pathways because they depend on the nature of the impact requiring individual community or ethnic responses. For example, countries affected adversely may have to change their agricultural systems especially those that heavily depend on rain-fed agriculture. The procedure therefore is to develop a framework for assessing vulnerability to climate change on sectoral basis, develop an implementation organ with adaptation options.

Adaptation is the process of changing something, for example, behaviour to suit a new situation (Hornby, 2006). Global warming, as climate change, has become a new reality with deleterious effects. To mitigate climate change impacts require actions and activities at policy level, community level, and information and communication strategies at both levels. CTA (2008) cites these actions and strategies as follows:

At policy level,

- Mainstream climate change into development policy via Poverty Reduction Strategy Papers (PRSPs), the UN Framework Convention on Climate Change (UNFCCC), National Adaptation Programmes of Action (NAPAs), and Sector Wide Approaches (SWAs), ratify charters and treaties on diminishing green house emissions.
- Establish soils information system that could include information on climate.
- Promote a participatory approach in the decision making process.
- Create strong synergies between the various actors – the private sector, rural and scientific communities, research, donor agencies, international community and the government.
- Revisit land tenure policies.

At the community level,

- Participate in evaluating the impacts of climate change and in selecting adaptation strategies.
- Promote community forestry and adoption of sustainable soil restoration and management techniques.
- Strengthen the capacities of rural communities and the decentralisation process and promote information sharing.
- Develop literacy and encourage training of local committees on questions of climate change.
- Improve the role of women in the dissemination of extension work activities and in decision-making.
- Sensitize rural populations to the question of sustainable use of all forest resources including timber.
- Establish systems and mechanisms to ensure respect of the law and regulations and to involve customary and traditional authorities in creating awareness.

INFORMATION AND COMMUNICATION STRATEGIES.

At policy level,

- Develop information and communication strategies at all levels and ensure communication is not just one way.
- Develop climate change platform where scientists, researchers, decision-makers, and practitioners could share their knowledge and experience on climate change adaptations.
- Facilitate development of Local Environment Action Plans through participatory environmental planning workshops.
- Provide regularly updated information on climate change issues.

At the community level,

- Promote village schools and field days where farmers share experiences of good farming practices, and agricultural shows where best or sustainable adaptive strategies are given awards.
- Participate in the identification and design of communication strategies through community workshops and develop community-based framework for monitoring environmental change.
- Promote village environmental news teams, who will monitor and regularly report any form of environmental issues.
- Set-up information centres to provide information to communities.
- Promote use of cell-phones or mobile phones to share / exchange information on weather forecasts.
- Promote local radio “Radio Rural” (FM stations).

No doubt, some adaptation strategies have been introduced and some are being adopted in Nigeria and in the study area. Unabated deforestation, propelled by increased exploitation by forest dependent communities, marks an important transition in man-forest relationships (CTA, 2008). In addition, population pressure combined with the impact of climate change has contributed to undermining the regenerative capacity of forest areas in Nigeria including Akwa-Ibom state.

Some studies have been conducted on impact of global warming on tropical rainforests of south-eastern Nigeria (Njoku, 2007). Also some studies have been done on adaptation and mitigation strategies to climate change NEST (2011), but this study focuses on the Public Perception of Combative Strategies on the Impact of Global Warming on Forest Resources of Akwa-Ibom state.

In view of the adverse situations as outlined so far, that climate change could cause to our forest resources, and the forest resources of Akwa-Ibom state in particular, this study calls for serious attention.

2.8 Conceptual Framework

The question of global warming has taken a centre stage in the recent discussions and studies involving climate change. Global warming, as the major driver and manifestation of climate change is the rise in temperature of the earth induced in part, by the increased accumulation of the Green House Gases (ghgs) such as water vapour, carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbon, among others (WMO, 1979). The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as change attributed directly or indirectly to human activity that alters the composition of the global air temperature, and which is in addition to natural climate variability observed over comparable time period (IPCC, 2001).

The Intergovernmental Panel on Climate Change (IPCC), was created by the United Nations (UN) and the World Meteorological Organisation (WMO) in 1988 to assess the risk of global warming due to human activities. A number of studies example Choisnel (1982), have suggested positive relationships between global warming/ climate change and forests. They argue that global warming directly affect photosynthesis which improve plant growth by a higher atmospheric carbon dioxide concentration, while Drake (2000), and Turner (1998) argue that global warming give rise to unfavourable climatic environment which reduce forest size, loss of species and biodiversity.

In the opinion of Clark (2003), tropical forests fuel global warming when dead trees release stored CO₂ back into the atmosphere. Forests therefore can end up contributing more carbon dioxide to the atmosphere

as temperature rises. Schimel (2003) further argued that global warming leads to a decline in tree growth and may cause trees to release more CO₂ through transpiration. This in combination with fires, deforestation and other processes make forests a source of CO₂ in warmer years thus enhancing the green house effect. Global climate has varied in time and space Ojo (1986) and particularly in Nigeria (Nnaji, 1999). Obioh (2002) further explains that such variations have impacted either positively or negatively on natural systems and environmental resources including forests.

There are concerted efforts by countries including Nigeria through the United Nations (UN) geared towards mitigating or ameliorating the effects of climate change. Such efforts include protocols, conventions and resolutions. One example is Kyoto protocol which could be regarded as the main UN plan for fighting global warming until 2012 (UNDP, 2000). There are also the Convention on Biodiversity proposes efforts to protect and conserve wildlife UN (1992), including forests in the face of global warming and climate change impacts. Also a panel of climate experts have been assembled and instituted known as the Intergovernmental Panel on Climate Change (IPCC) to monitor and report on the state of global climate (IPCC, 2001).

Climate change impact is very significant and multifaceted. An effective response and coping strategy must be aggressive and a widely supported action plan. The Federal Government of Nigeria acknowledges the importance of developing a national response to climate change. The government first created a national focal point: The Special Climate Change Unit (SCCU) within the Federal Ministry of Environment (FGN, 2003). It also mobilised the Inter-ministerial Coordinating committee on climate change. To build on and consolidate these initial climate change adaptation actions and to ensure a truly national response to climate

change, the Government of Nigeria and a number of partners have embarked upon the development of Nigeria's National Adaptation Strategy and Plan of Action (NASPA) (BNRCC, 2011).

Several studies have been done on adaptation strategies to ameliorate the impacts of climate change. Suggestions of studies have been that climate change affects all facets of our lives especially the farming community or agricultural production systems and so to mitigate climate change impacts require actions and activities at policy and community levels (CTA, 2008). In Nigeria, several studies on climate change adaptations have been conducted. Nnaji and Ijioma (2003) for example, suggested some adaptive strategies to ameliorate climate change in Nigeria's forests sector. Co-ordination and collaboration is key to efficacious strategies.

In line with this suggestion, Nigeria Environmental Study/Action Team (NEST) proposes a systematic approach to climate change and capacity development at various levels to respond to climate change in all sectors. This is because adaptive responses do not follow a specific pathway; they bother on the nature of the impacts requiring individual community of ethnic responses (NEST, 2003). In view of these suggestions, this study has been conducted to assess public perception of combative strategies on the impact of global warming on forest resources of Akwa-Ibom state.

CHAPTER THREE

Research Methodology

3.1 Introduction

Five communities in Akwa-Ibom state were selected for the study. The study used primary and secondary data derived from questionnaires and literature respectively.

Development of Data Collection Instruments:

Structured questionnaire was developed for use (See appendix 1). The questionnaire covered the demographic, weather/climate change impact and adaptation/coping aspect of the study.

3.2 Establishing the validity and reliability of the questionnaire.

Having developed the questionnaire, the next step was to establish their validity. Validity is the amount of systematic or built-in error in measurement.

A reliability test was conducted to enhance the questionnaire validity. This was done through a pilot test. This was carried out by administering the questionnaires to 20 respondents in Ayodehe community in Akwa-Ibom state. Two Focus Group Discussions (FGDs) were conducted, one for men and another for the women group. In addition, In-Depth Interviews (IDIs) of key informants (one male and one female) were conducted. These were intended to determine the reliability of the FDGs and IDIs. The data collected were analysed using Statistical Package for Social Sciences.

3.3 Sampling Technique

Akwa-Ibom state was selected for this study because the state is a major forest resource state in Nigeria. However, the knowledge of the

researchers and officials of the Agricultural Development Project (ADP) and the state Ministry of Agriculture in the state was relied upon to select communities randomly from five Annang /Ibibio communities with concentration of farming and forestry activities respectively. The selected five communities are:

IKOT EBOM ITAM: Ikot Ebom Itam is a peri-urban but farming community in Itu local government area. It is a fragile community whose livelihood is threatened by urbanization and an advancing ravine, the Ikpa river Basin. The major livelihood in the community is crop farming.

IFIAYONG USUK: This community is an erosion-prone farming community in Uruan LGA (located along Uyo-Nwaniba road). Farming, fishing and petty trading are the major occupation of the people. The sloped topography of the community has caused it to be regularly affected by gully erosion with a big gully running through the village and emptying into Ikpa River.

MBIABET EYEHEDIA: Mbiabet Eyehedia is a rural and farming community located in Ini LGA. It is popular for rice production. Oil palm trees, raffia palm, banana and plantain are grown. Timber species such as obeche and several non-timber forest products such as bush-pepper or hot leaf (*Piper guinensis*) abound. Mbiabet is flooded for approximately six months of the year between June and early December. It is one of the communities that make up the food basket of Akwa-Ibom state.

AYODEHE: Ayodehe is about 20 minutes drive from Uyo the state capital. It is a farming community. Besides farming, sand drilling and hunting are also important commercial activities.

IBAKA: Ibaka is in Mbo LGA of Akwa-Ibom. Ibaka is vulnerable to many climate change related hazards, particularly sea level rise, flooding, wind and rain storms. Due to the seriousness of the sea level rise many neighbouring communities have been displaced.

3.4 Data Collection

Both quantitative and qualitative data collection techniques were employed. A total of 180 respondents were sampled. Sampling intensity was 50 respondents /community. The researcher used some paid enumerators and also voluntary assistance from staff of the Ministry of Agriculture and local teachers to distribute, interview and collect the survey instruments (questionnaires). The distribution of questionnaires for data analyses were as follows: Ikot Ebom Itam - 30 questionnaires, Ifiayong Usuk - 50, Mbiabet Eyehedia - 30, Ayadehe - 50 and Ibaka - 20 questionnaires. Data collection took 3 months, from December 2011 to February 2012. Meteorological data were collected from NIMET Uyo, the Akwa-Ibom state capital. The purpose of the study was explained to the respondents who volunteered to participate in the research.

3.5 Methods of data analysis / Data analytical techniques.

A variety of analytical tools appropriate for each objective were used in analysing the data collected in the study. These range from descriptive presentations and story lines to mean values and graphs.

The questionnaire was analysed using descriptive statistics to show tables of frequency and percentages but mean values were calculated using 5-point likert scale statistical data analysis techniques. with categories as follows: Strongly Disagree (SD)=1, Disagree (D)=2, Undecided (U)=3, Agree (A)=4, Strongly Agree (SA)=5.

Objective 1: To determine the level of awareness of climate change impacts on forest resources of Akwa-Ibom state among men and women. The data were analysed using a 5-point likert scale statistical data analysis with categories as follows: Strongly Disagree (SD)=1, Disagree(D)=2, Undecided(UD)=3, Agree(A)=4, Strongly Agree(SA)=5.

Mean scores were calculated and used to gauge the awareness of the study population of a particular climate change issue. With this satisfaction, the intent was to provide reasonable information on which policy on climate change information could be built. In addition, the study used proportions/ percentages to show how the males and females responded.

Objective 2: Identify the adaptation strategies specific to the study area to cope with climate variations. This objective identifies the responses to climate change by male and female respondents in the study area. The analyses used mean values calculated from the responses by the male and female volunteers. The mean values from likert scale were useful in determining the coping capacity of the communities in the study areas. Also percentages were used to identify males' and females' responses.

Objective 3: Assess the efficacy of the strategies to cope with climate change. Initial efforts in assessing the communities coping or adaptation to climate change were directed to assessing the available indigenous knowledge / methods of coping with climate change. These were to give sufficient ideas of what people know and are used to already and could be improved upon. The indigenous approaches were being compared with best practices in order to build upon what is available to achieve sustainability in adaptation to climate change.

3.6 Limitations of the data and methodology

The study was faced with two important limitations. The first is concerned with primary data where respondents relied on memory recall to provide answers to some questions such as hazards that happened in the past.

The author collected and examined the types and scales of data used in the study. The methodology also examined the procedures utilized in achieving the aims and objectives of the research.

CHAPTER FOUR

Data Analysis and results Presentation

4.1 Introduction

This chapter explains procedure used to present results from analyzed data. 180 Volunteers were sampled. The data were analyzed from questionnaire information using descriptive statistics such as Tables of frequency, mean and percentages.

4.2 Distribution of respondents according to demographic characteristics.

Table 1 showed that 65.5% of the respondents were males while 34.4% were females. Respondents with West African School Certificate (WASC) or General Certificate of Education (GCE) recorded the highest percentage of 47.8% followed by those with Bachelor's degree or equivalent (16.7%), and lastly by those that had no formal education (5.6%). Respondents within the age group of 48 – 57 years recorded the highest percentage of (26.7%), while those within the age group of 58 – 67 years came last with (10%). Similarly, 56.1% of the respondents were married, 35% were single, while 8.9% were widowed.

A look at the occupation of respondents revealed that 26.7% of respondents were civil servants, including teachers, 26.1% were timber sellers, 22.2% were firewood sellers, 16.1 % were petty traders/grocery owners, while only 8.9% were farmers.

The demographic characteristics of the respondents show that most are married, had formal education, mostly males. Majority of the respondents are either civil servants or engaged in forest-related business or trade.

Table 1: Distribution of respondents according to demographic characteristics.

1	Sex	No. of Respondents	Percentages
	Male	118	65.6
	Female	62	34.4
	TOTAL	180	100.0
2	Educational level		
	No formal education	10	5.6
	Adult education	21	11.7
	F.S.L.C.	20	11.0
	W.A.S.C/G.C.E	86	47.8
	NCE, ND, OND	13	7.2
	B.Sc./HND	30	16.7
3	Age Group		
	18 – 27 years	38	21.1
	28 - 37 “	35	19.4
	38 - 47 “	41	22.8
	48 - 57 “	48	26.7
	58 - 67 “	18	10.0
4	Marital status		
	Married	101	56.1
	Single	63	35.0
	Widowed	16	8.9
5	Occupation		
	Farmers	16	8.9
	Timber sellers	47	26.1
	Firewood sellers	40	22.2
	Petty traders/grocers	29	16.1
	Civil servants/teachers	48	26.7

Table 2 presents a demographic character of the respondents according to sex. Of the 10 respondents who do not have formal education, 4.5% were males while 1.1% were females. Adult education recorded 21 respondents comprising of 7.2% males and 4.5% females. First school leaving certificate holders were 20 which include 8.8% males and 2.2% females. The largest respondents of 86 had WASC/GCE. This was made up of 32.8% males and 15% females. NCE, ND and OND holders were 13 which include 2.2% males and 5% females while 30 respondents hold BSC/HND comprising of 10% males and 6.7% females

Respondents within the age group of 48-57 yrs recorded the highest number of respondents of 26.7% comprising of 35(19.5%) males and 13(7.2%) females. The age group that recorded the lowest number of 18 participants of 4.4% males and 5.6% females was 58-67yrs. The other age groups were 18-27yrs with 28(15.5%) males and 10(5.6%) females, 28-37yrs had 25(13.9%) males and 10(5.5%) females while 38-47 yrs recorded 22(12.2%) males and 19(10.6%) females. With regard to marital status, majority of the volunteers sampled were married comprising of 64(35.5%) males and 37(20.6%) females. This was followed by single volunteers made up of 50(27.8%) males and 13(7.2%) females. The widowed participants comprised of 4(2.2%) widowers and 12(6.7%) widows.

The occupational distribution of respondents shows that the majority of those sampled were either civil servants/ teachers or engaged in forest related activities or business. The occupations are recorded as follows: civil servants/teachers 30(16.7%) males and 18(10.0%) females, timber sellers 47(26.1%) males. No females were engaged in this occupation among the respondents. Firewood sellers were made up of 11(6.1%) males and 29(16.1%) females, petty traders/grocers comprised of

20(11.1%) males and 9(5%) females. The least recorded participants were farmers which include 10(5.6%) males and 6(3.3%) females.

Table 2: Demographic character of volunteers according to sex.

1.	Sex	No. of Respondents	Percentages	
	Male	118	65.6	
	Female	62	34.4	
	Total	180	100.0	

2.	Educational level			
	No formal Education	Males 8 Females 2	4.5 1.1	5.6
	Adult education	Males 13 Females 8	7.2 4.5	11.7
	F.S.L.C.	Males 16 Females 4	8.8 2.2	11.0
	W.A.S.C/G.C.E	Males 59 Females 27	32.8 15.0	47.8
	NCE, ND, OND	Males 4 Females 9	2.2 5.0	7.2
	B.Sc./HND	Males 18 Females 12	10.0 6.7	16.7
3.	Age Group			
	18 – 27 years	Males 28 Females 10	15.5 5.6	21.1
	28 - 37 “	Males 25 Females 10	13.9 19.4	5.5
	38 - 47 “	Males 22 Females 19	12.2 10.6	22.8
	48 - 57 “	Males 35 Females 13	19.5 7.2	26.7
	58 - 67 “	Males 8 Females 10	4.4 5.6	10.0
4.	Marital status			
	Married	Males 64 Females 37	35.5 20.6	56.1
	Single	Males 50 Females 13	27.8 7.2	35.0
	Widowed	Widowers 4 Widows 12	2.2 6.7	8.9

5.	Occupation			
	Farmers	Males 10 Females 6	5.6 3.3	8.9
	Timber sellers	Males 47 Females 0	26.1 0	26.1
	Firewood sellers	Males 11 Females 29	6.1 16.1	22.2
	Petty traders/grocers	Males 20 Females 9	11.1 5.0	16.1
	Civil servants/teachers	Males 30 Females 18	16.7 10.0	26.7

4.3 Volunteers' knowledge of impacts of climate change on forest resources.

NOTE: In analysing the participant's knowledge of impacts of climate change, the demographic parameters of Sex and Educational standards are used. This is because these two parameters cut across the other demographic characters of Age-group, Marital status and occupation.

Table 3 showed that all the listed variables were a result of climate change. Majority of the respondents agreed that climate change causes intense rainfall, flood and erosion as well as incidence and spread of diseases and disease vectors. These had a mean score of 4.34 each. This was followed closely by loss of forest cover caused by rising temperature with a mean score of 4.33. The least effect was overflow of banks due to rising sea levels and storm surges which attracted a mean score of 3.86.

It is worth pointing out that intense rainfall, rising temperature, spread of diseases and vectors, problems of regenerative capacity of forests and shortage or diminishing forest resources were identified by respondents as the critical effects of climate change in the study area. Generally, it can be concluded that climate change has been obviously felt in Akwa-Ibom state.

Table 3: Volunteers knowledge of impacts of climate change on forest resources.

Impacts	Responses					Mean value of responses
	SA	A	U	D	SD	
	5	4	3	2	1	
1. Climate change causes intense Rainfall, flood and erosion	83	83	8	2	4	4.34
2. Rising temperature causes Loss of forest cover.	72	98	9	0	1	4.33
3. Climate change causes sea level rise and storm surges creating overflow of banks.	44	95	20	14	7	3.86
4. There is food scarcity and income loss due to reduction of forest resources.	77	78	15	9	1	4.23
5. Climate change causes the weakening of power and equity Position of most vulnerable in forest-dependent communities.	48	100	10	19	3	3.95
6. Climate change undermines the regenerative capacity of forests	65	101	9	2	3	4.24
7. Unabated deforestation by increased exploitation by communities	68	74	17	17	4	4.03
8. Loss of biodiversity & plant genetic resources as agricultural activities expands uncontrolled into forest areas.	73	68	18	7	14	3.99
9. Spread of diseases and vectors due to changes in the environment.	94	67	9	7	3	4.34

Male and female responses with regards to their knowledge of climate change are presented in table 4 below. On the question of intense rainfall, erosion and flood, 32.2% of males and 13.9% females strongly agree with this impact. Undecided respondents include 0.6% males and 3.9% females. Results reveal that no males disagree with this effect as caused by climate change, while a total of 3.3% of females disagrees. With the exception of 2.8% males and 2.2% females who were undecided all other respondents agree or strongly agree that rising temperature causes loss of forest cover. On the question of sea level rise, 16.7% males and 7.8% females strongly agree while 33.3% and 19.4% of males and

females respectively agree with this effect. Undecided males and females are 3.9% and 7.2% respectively. The study reveals that none of the females disagrees with this impact while about 7.8% and 3.9% of males disagrees and strongly disagrees respectively. All the males either agree that climate change causes food scarcity and income loss, 1.7% undecided, while 11.9% females strongly agree, 11.1% females, 11.1% agree, 6.7% undecided, 5% disagree and 0.6% strongly disagree. The weakening of power and equity position of most vulnerable recorded the highest Agree Response of 38.9% males while none of the females disagrees with this effect. Also, none of the females disagree that climate change undermines the regenerative capacity of forests, with 20.6% and 13.9% Agree and Strongly Agree respectively. Males recorded 5% undecided, 35.6% Agree, 22.2% strongly agree while 1.1% and 1.7% disagreed. Males recorded the highest response of 24.5% Agree and 21.1% strongly Agree with the impact of unabated deforestation by increased exploitation by communities. All the females agree with this effect with only 1.1% undecided, and 8.3% males undecided. No females strongly agree that biodiversity are a result of uncontrolled agricultural activities into forest areas, while all the males agree or strongly agree with this impact. On the question on the spread of diseases and vectors due to changes in the environment, 30% and 25% of males strongly agree and agree respectively, 5% undecided while 3.9% disagrees, and 1.7% strongly disagrees. All the females agree or strongly agree with this impact.

Table 4: Male and female responses/ knowledge of impacts/ effects of Climate change.

Impacts	Responses in percentage				
	SA	A	U	D	SD
	5	4	3	2	1
1. Climate change causes intense Rainfall, flood and erosion	M58 (32.2%) F 25(13.9%)	M59 (32.8%) F 24(13.3%)	M1 (0.6%) F 7 (3.9%)	M 0 F2 (1.1%)	M 0 F 4(2.2%)
2. Rising temperature causes Loss of forest cover.	M 52(28.9%) F 25(13.9%)	M 60(33.3%) F 38(21.1%)	M 5(2.8%) F 4(2.2%)	M 0 F 0	M 1(0.6%) F 0
3. Climate change causes sea level rise and storm surges creating overflow of banks.	M 30(16.7%) F 14(7.8%)	M 60(33.3%) F 35(19.4%)	M 7(3.9%) F 13(7.2%)	M 14(7.8%) F 0	M 7(3.9%) F 0
4. There is food scarcity and income loss due to reduction of forest resources.	M 57(31.7%) F 20(11.1%)	M 58(32.2%) F 20(11.1%)	M 3(1.7%) F 12(6.7%)	M 0 F 9(5.0%)	M 0 F1 (0.6%)
5. Climate change causes the weakening of power and equity Position of most vulnerable in forest-dependent communities.	M 16(8.9%) F 32(17.8%)	M 70(38.9%) F 30(16.7%)	M10 (5.6%) F 0	M19 (10.6%) F 0	M 3(1.7%) F 0
6. Climate change undermines the regenerative capacity of forests	M 40(22.2%) F 25(13.9%)	M 64(35.6%) F 37(20.6%)	M 9(5%) F 0	M2 (1.1%) F 0	M 3(1.7%) F 0
7. Unabated deforestation by increased exploitation by communities	M 38(21.1%) F 30(16.7%)	M 44(24.5%) F 30(16.7%)	M15 (8.3%) F 2(1.1%)	M 17(9.4%) F 0	M 4(2.2%) F 0
8. Loss of biodiversity & plant genetic resources as agricultural activities expands uncontrolled into forest areas.	M 73(40.6%) F 0	M 45(25%) F 23(12.8%)	M 0 F 18(10%)	M 0 F7 (3.9%)	M 0 F 14(7.8%)
9. Spread of diseases and vectors due to changes in the environment.	M 54(30%) F 40(22.2%)	M 45(25%) F 22(12.2%)	M 9(5%) F 0	M7 (3.9%) F 0	M3 (1.7%) F 0

Table 5 below presents the knowledge of various impacts of Climate change according to sex and educational standards of the respondents.

IMPACT 1: The respondents considered the significance of the question that climate change causes intense rainfall, erosion and flood. All respondents having WASC/GCE, NCE/ND/OND and BSC/HND agree

and even strongly agree with the significance of this impact. However, few percentages of those with lower educational standards of FSLC, Adult education and those with no formal education either disagree with the impact or remained undecided. This reveals the importance of educational level to be able to fully conceive and understand climate change and its impacts.

IMPACT 2: This follows the same trend of understanding as in Impact 1. There were some respondents with lower educational standards who were undecided. They include 1.1% males and 1.1% females with Adult education as well as 1.7% males and 1.1% females having FSLC. All other respondents agree that rising temperature causes loss of forest cover.

IMPACT 3: Has a good percentage of respondents, about a total of 11.7% disagree or even Strongly Disagree that climate change cause's Sea level rise and storm surge, creating overflow of banks. Also a high percentage as revealed in the table showed that those with a lower educational standard were Undecided because they were not sure of what really causes sea-level rise. None of those with a lower educational level strongly agreed with this impact. On the other hand, all those with higher education from WASC/GCE to BSC/HND agreed and even strongly agreed with Impact 3.

IMPACT 4: The results showed that females with FSLC, Adult education and no formal education do not strongly agree that food scarcity and income loss due to reduction of forest resources are as a result of climate change. Only 3.3% of those with Adult education agree with this impact. All respondents with WASC/GCE, NCE/OND and BSC/HND agree with impact 4 except only 2.8% of females with WASC/GCE that disagree.

IMPACT 5: The results show a general mix of opinion with regards to those with lower education from WASC/GCE to no formal education. All females in this educational level were either undecided, disagree or even strongly disagree that climate change causes the weakening of power and equity position of most vulnerable in forest dependent communities. Respondents with higher educational level of NCE/OND and BSC/HND all agree and strongly agree with Impact 5.

IMPACT 6 follows the same trends. All respondents from WASC/GCE to BSC/HND agree or strongly agree that climate change undermines the

regenerative capacity of trees. A look at the table shows that all females either disagree or remain undecided.

IMPACT 7: Unabated deforestation by increased exploitation by communities follows the same trend as in other impacts presented above. All the respondents with WASC/GCE, NCE/OND and BSC/HND agree with the above impact 7. Only 1.1% of males with WASC/GCE disagree. None of those with no formal education agree with this impact.

IMPACT 8: None of the respondents with NCE/OND, BSC/HND and also surprisingly those with Adult education and even no formal education disagree with the question of loss of biodiversity and plant genetic resources as caused by climate change impact. Only 1.1% of males and 0.6% of females with WASC/GCE disagree, and 2.8% of males and 2.2% of females strongly disagree.

IMPACT 9: Spread of diseases and vectors due to changes in the environment. None of those with no formal education agree with this impact. Conversely all those with WASC/GCE, NCE/OND and BSC/HND agree and even strongly agree with this impact. Educational level certainly directs how the communities understand the impact of climate change.

Table 5: Knowledge of impact of climate change according to sex and educational standards

IMPACT 1: Climate Change causes intense rainfall, flood and erosion.

Educational standard	SA	A	U	D	SD	Total (%)
No formal education	M 1.1%	M 2.8%	M 0.6%	M 0	M 0	4.5
	F 0	F 0	F 0.6%	F 0.6	F 0	1.2
Adult education	M 3.3%	M 3.9%	M 0	M 0	M 0	7.2
	F 0	F 0	F 2.8%	F 0.6	F 1.1%	4.4
F.S.L.C	M 4.4%	M 4.4%	M 0	M 0	M 0	8.8
	F 0	F 0.6%	F 0.6%	F 0	F 1.1%	2.3
WASC/GCE	M 15.6%	M 17.2%	M 0	M 0	M 0	32.8
	F 7.2%	F 7.8%	F 0	F 0	F 0	15
NCE,ND,OND	M 1.1%	M 1.1%	M 0	M 0	M 0	2.2
	F 2.2%	F 2.8%	F 0	F 0	F 0	5.0
BSC/ HND	M 6.7%	M 3.3%	M 0	M 0	M 0	10.0
	F 4.4%	F 2.2%	F 0	F 0	F 0	6.6

IMPACT 2: Rising Temperature causes loss of forest cover.

Educational standard	SA	A	U	D	SD	Total (%)
No formal education	M 1.7%	M 2.2%	M 0	M 0	M 0.5%	4.4
	F 0.6%	F 0.6%	F 0	F 0	F 0	1.2
Adult education	M 2.2%	M 3.9%	M 1.1%	M 0	M 0	7.2
	F 1.1%	F 2.2%	F 1.1%	F 0	F 0	4.4
F.S.L.C	M 1.7%	M 5.5%	M 1.7%	M 0	M 0	8.9
	F 0	F 1.1%	F 1.1%	F 0	F 0	2.2
WASC/GCE	M 11.1%	M 21.7%	M 0	M 0	M 0	32.8
	F 7.8%	F 7.2%	F 0	F 0	F 0	15
NCE,ND,OND	M 1.1%	M 1.1%	M 0	M 0	M 0	2.2
	F 1.1%	F 3.9%	F 0	F 0	F 0	5.0
BSC/ HND	M 8.9%	M 1.1%	M 0	M 0	M 0	10.0
	F 2.8%	F 3.9%	F 0	F 0	F 0	6.7

IMPACT 3: Climate Change cause sea level rise and storm surges creating overflow of banks.

Educational standard	SA	A	U	D	SD	Total (%)
No formal education	M 0	M 0.6%	M 1.7%	M 2.2%	M 0	4.5
	F 0	F 0	F 1.1%	F 0	F 0	1.1
Adult education	M 0	M 0.5%	M 2.2%	M 1.7%	M 2.8%	7.2
	F 0	F 0.5%	F 3.9%	F 0	F 0	4.4
F.S.L.C	M 0	M 3.9%	M 0	M 3.9%	M 1.1%	8.9
	F 0	F 0	F 2.2%	F 0	F 0	2.2
WASC/GCE	M 11.1%	M 21.7%	M 0	M 0	M 0	32.8
	F 7.2%	F 7.8 %	F 0	F 0	F 0	15
NCE,ND,OND	M 1.1%	M 1.1%	M 0	M 0	M 0	2.2
	F 2.2%	F 2.8%	F 0	F 0	F 0	5.0
BSC/ HND	M 1.7%	M 8.3%	M 0	M 0	M 0	10.0
	F 1.1%	F 5.6%	F 0	F 0	F 0	6.7

IMPACT 4: There is food scarcity and income loss due to reduction of forest resources.

Educational standard	SA	A	U	D	SD	Total (%)
No formal education	M 1.1%	M 1.7%	M 1.7%	M 0	M 0	4.5
	F 0.	F 0	F 0.5%	F 0	F 0.6%	1.2
Adult education	M 1.7%	M 5.6%	M 0	M 0	M 0	7.3
	F 0	F 3.3%	F 0	F 1.1%	F 0	4.4
F.S.L.C	M 1.1 %	M 2.8%	M 5%	M 0	M 0	8.9
	F 0	F 0	F 1.1%	F 1.1%	F 0	2.2
WASC/GCE	M 17.2%	M 15.6%	M 0	M 0	M 0	32.8
	F 6.6%	F 5.6%	F 0	F 2.8%	F 0	15
NCE,ND,OND	M 0.6%	M 1.6%	M 0	M 0	M 0	2.2
	F 3.3%	F 1.7%	F 0	F 0	F 0	5.0
BSC/ HND	M 6.7%	M 3.3%	M 0	M 0	M 0	10.0
	F 4.4%	F 2.2%	F 0	F 0	F 0	6.6

IMPACT 5: Climate change causes the weakening of power and equity position of most vulnerable in forest dependent communities.

Educational standard	SA	A	U	D	SD	Total (%)
No formal education	M 0	M 0	M 2.2%	M 1.1%	M 1.1%	4.4
	F 0.6%	F 0.6%	F 0	F 0	F 0	1.2
Adult education	M 0	M 3.9%	M 1.7%	M 1.7%	M 0	7.3
	F 1.7%	F 2.8%	F 0	F 0	F 0	4.5
F.S.L.C	M 2.2%	M 2.2%	M 1.1%	M 2.8%	M 0.6%	8.9
	F 1.1%	F 1.1%	F 0	F 0	F 0	2.2
WASC/GCE	M 5%	M 22.2%	M 0.6%	M 5.0%	M 0	32.8
	F 1.7%	F 13.3%	F 0	F 0	F 0	15
NCE,ND,OND	M 0.6%	M 1.7%	M 0	M 0	M 0	2.3
	F 4.4%	F 0.6%	F 0	F 0	F 0	5.0
BSC/ HND	M 5%	M 5.0%	M 0	M 0	M 0	10.0
	F 4.4%	F 2.2%	F 0	F 0	F 0	6.6

IMPACT 6: Climate Change undermines the regenerative capacity of trees.

Educational standard	SA	A	U	D	SD	Total (%)
No formal education	M 0.6%	M 1.1%	M 2.8%	M 0	M 0	4.5
	F 0.6%	F 0.6%	F 0	F 0	F 0	1.2
Adult education	M 1.7%	M 3.3%	M 0.6%	M 0.6%	M 1.1%	7.3
	F 1.1%	F 3.3%	F 0	F 0	F 0	4.4
F.S.L.C	M 2.8%	M 3.3%	M 1.7%	M 0.5%	M 0.5%	8.8
	F 0.6%	F 1.7%	F 0	F 0	F 0	2.3
WASC/GCE	M 16.7%	M 16.1%	M 0	M 0	M 0	32.8
	F 8.9%	F 6.1%	F 0	F 0	F 0	15
NCE,ND,OND	M 0.5%	M 1.7%	M 0	M 0	M 0	2.2
	F 0.5%	F 4.4%	F 0	F 0	F 0	4.0
BSC/ HND	M 1.1%	M 8.9%	M 0	M 0	M 0	10.0
	F 1.1%	F 5.5%	F 0	F 0	F 0	6.6

IMPACT 7: Climate change impacts on forest resources due to unabated deforestation by increased exploitation by communities.

Educational standard	SA	A	U	D	SD	Total (%)
No formal education	M 0	M 0	M 1.1%	M 2.2%	M 1.1%	4.4
	F 0	F 0	F 0.6%	F 0.6%	F 0	1.2
Adult education	M 2.8%	M 2.8%	M 1.7%	M 0	M 0	7.3
	F 0.6%	F 1.7%	F 2.2%	F 0	F 0	4.5
F.S.L.C	M 0	M 0.6%	M 3.3%	M 4.4%	M 0.6%	8.9
	F 0	F 0	F 0.6%	F 1.1%	F 0.6%	2.2
WASC/GCE	M 15%	M 16.7%	M 0	M 1.1%	M 0	32.8
	F 5.6%	F 9.4%	F 0	F 0	F 0	15
NCE,ND,OND	M 1.1%	M 1.1%	M 0	M 0	M 0	2.2
	F 2.8%	F 2.2%	F 0	F 0	F 0	5.0
BSC/ HND	M 5.5%	M 4.4%	M 0	M 0	M 0	10.0
	F 4.4%	F 2.2%	F 0	F 0	F 0	6.6

IMPACT 8: Loss of biodiversity and plant genetic resources as agricultural activities expands uncontrolled into forest areas.

Educational standard	SA	A	U	D	SD	Total (%)
No formal education	M 1.7%	M 1.7%	M 1.1%	M 0	M 0	4.5
	F 0	F 0	F 1.1%	F 0	F 0	1.1
Adult education	M 2.2%	M 3.9%	M 1.1%	M 0	M 0	7.2
	F 2.8%	F 1.1%	F 0.6%	F 0	F 0	4.5
F.S.L.C	M 0	M 0	M 4.4%	M 1.7%	M 2.8%	8.9
	F 0	F 0	F 1.7%	F 0.5%	F 0	2.2
WASC/GCE	M 16.7%	M 12.2%	M 0	M 1.1%	M 2.8%	32.8
	F 6.7%	F 5.5%	F 0	F 0.6%	F 2.2%	15
NCE,ND,OND	M 1.1%	M 1.1%	M 0	M 0	M 0	2.2
	F 2.8%	F 2.2%	F 0	F 0	F 0	5.0
BSC/ HND	M 4.4%	M 5.5%	M 0	M 0	M 0	9.9
	F 2.2%	F 4.4%	F 0	F 0	F 0	6.6

IMPACT 9: Spread of diseases and vectors due to changes in the environment.

Educational standard	SA	A	U	D	SD	Total (%)
No formal education	M 0	M 0	M 1.7%	M 1.7%	M 1.1%	4.5
	F 0	F 0	F 0	F 0.5%	F 0.6%	1.1
Adult education	M 3.3%	M 2.8%	M 1.1%	M 0	M 0	7.2
	F 1.7%	F 1.7%	F 1.1%	F 0	F 0	4.5
F.S.L.C	M 5%	M 2.2%	M 0.5%	M 1.1%	M 0	8.8
	F 0.6%	F 0.6%	F 0.6%	F 0.6%	F 0	2.4
WASC/GCE	M 19.4%	M 13.3%	M 0	M 0	M 0	32.7
	F 11.1%	F 3.9 %	F 0	F 0	F 0	15
NCE,ND,OND	M 1.7%	M 0.5%	M 0	M 0	M 0	2.2
	F 3.3%	F 1.7%	F 0	F 0	F 0	5.0
BSC/ HND	M 3.3%	M 6.6%	M 0	M 0	M 0	9.9
	F 2.8%	F 3.9%	F 0	F 0	F 0	6.7

4.4: Respondents' Appreciation of Combative Strategies on the Impact of Global Warming.

Table 6 showed that all the listed variables were applied to combat, adapt to / cope with climate change. Their individual mean scores however showed that some adaptation/coping measures were applied more than others. Afforestation, tree planting, forestry management and forest reserves and plantations have been undertaken the most for climate change adaptation, with mean score of 4.46. This was closely followed by media awareness and alternative business or occupation by forest

dependent households with mean score of 4.15. A large number of respondents with mean score of 4.02 have started domesticating forest products or resources. Of all the adaptation measures Early Warning systems ranked the lowest with a mean score of 1.47. This was followed by Accuracy, Timeliness and Volume of media coverage with a mean score of 1.57. Availability and development of credit and loan schemes also ranked very low with a mean score of 1.58. It is necessary to point out that while climate change has affected the whole communities in Akwa-Ibom state, there is no serious coordination and collaborative efforts to mitigate the effects of climate change. Individual households and communities continue to battle this threat on their own, and applying adaptation and coping measures as and when they deem fit.

Table 6: Distribution of respondents according to their appreciation of adaptation /coping measures to climate change.

Coping strategies		Responses					Mean value of measures
		SA	A	U	D	SD	
		5	4	3	2	1	
1	Media awareness for causes And effect of climate change.	72	78	20	5	5	4.15
2	Accuracy, timeliness and volume of coverage	1	1	8	80	90	1.57
3	Early warning systems	0	1	4	74	100	1.47
4	Participatory videos, workshop and TV to share experiences	5	7	25	80	63	1.95
5	Conserve biodiversity in the wild In the field to mitigate threats of declining agro- biodiversity for food	10	30	15	65	60	2.25
6	Coordination and enforcement of environmental policies.	2	5	17	86	70	1.79
7	Stimulate afforestation, forestry mgt, tree planting & forest reserves.	90	85	3	1	1	4.46
8	Develop credit and savings schemes and climate insurance for rural people.	1	2	7	80	90	1.58

9	Consider alternative business or occupation from forest dependency for household income & food security	50	65	40	40	35	4.15
10	Domesticate forest resources to reduce pressure on forests.	75	68	15	10	12	4.02
11	Reduction in fuel wood demand through alternative energy sources	5	15	8	90	62	1.95

Table 7 below showed the responses of males and females with regard to appreciation of adaptation/coping measures to climate change. On the question of media awareness, both males and females agreed that it is an effective measure at 3.2% males and 11.1% females respectively. This was followed by Strongly Agree (23.3%) and (16.7%) for males and females respectively. Males and females that were undecided are 6.7% and 4.4% respectively. Few males and females disagreed with the effectiveness of this measure. Majority of the respondents were either undecided or disagreed with the accuracy, timeliness and volume of media coverage as 27.8% and 16.7% males and females respectively disagreed. Also more emphatically 32.8% males and 17.2% females strongly disagree with this measure. The same is the case with early warning system where no female respondent agreed. Only 0.6% males agreed. The majority agreed or strongly agreed. Most males and females also disagreed that participatory video, workshops and TV to share experiences were effective coping measures. Males 22.2% and 22.2% agreed with this measure while 28.9% males and 6.1% females strongly disagreed. The undecided participants included 10% males and 3.9% females. On the question of biodiversity conservation, there was a mixture of responses. While 10% of males agreed with this measure, 10.6% of females strongly disagreed. However 22.8% of males and 13.3% females disagreed. Again, majority of males and females at 31%

and 16.7% respectively disagreed that coordination and enforcement of environmental polices had been effective. No females agreed with this measure. However, afforestation, tree planting and forest management were favourably regarded as effective measures recording 35% males and 12.2% females agreed while 27.8% males and 22.2% females strongly agreed. No females disagreed with this measure. On the other hand, no males agreed with credit and savings scheme as effective coping measure. Majority of males 27.8% and 36.7% disagreed and strongly disagreed with this scheme while only 16.7% and 13.3% of females disagreed and strongly disagreed. All the female respondents agreed to go into alternative business or occupation with the exception of 3.9% females that were undecided. Males had mixed responses with 16.7% each for agree or strongly agree. 18.3% males and 3.9% females were undecided to consider alternative business. Majority of males and females favourably consider domesticating forest products/resources as good adaptation measures. Also, 21.1% males and 16.7% females agreed with this measure while 30.6% male and 11.1% females strongly agreed. However 3.9% males and 2.8% females strongly disagreed in domesticating forest products. Reduction in fuel wood demand was not favoured by any females sampled but 8.4% and 2.8% males agreed and even strongly agreed. However, the majority of males 27.8% and 22.2% females disagreed and further 22.8% and 11.7% of males and females respectively strongly disagreed that reduction in fuel wood demand through alternative energy sources was a good adaptation/ coping measure to climate change.

Table 7: Male and Female Responses with regard to their appreciation of Adaptation / Coping measures to Climate Change

Adaptation/ Coping measures		Responses in percentages.				
		SA	A	U	D	SD
		5	4	3	2	1
1	Media awareness for causes and effect of climate change.	M 42(23.3%) F30 (16.7%)	M 58(32.2%) F 20(11.1%)	M 12(6.7%) F 8(4.4%)	M 3(1.7%) F 2(1.1%)	M 3(1.7%) F 2(1.1%)
2	Accuracy, timeliness and volume of coverage	M 1(0.6%) F 0	M 1(0.6%) F 0	M 7(3.9%) F 1(0.6%)	M 50(27.8%) F 30(16.7%)	M 59(32.8%) F 31(17.2%)
3	Early warning systems	M 0 F 0	M 1(0.6%) F 0	M 3(1.7%) F 1(0.6%)	M 34(18.9%) F 40(22.2%)	M 79(43.8%) F 21(11.7%)
4	Participatory videos, workshop and TV to share experiences	M 4(2.2%) F 1(0.6%)	M 4(2.2%) F 3(1.7%)	M 18(10%) F 7(3.9%)	M 40(22.2%) F 40(22.2%)	M 52(28.9%) F 11(6.1%)
5	Conserve biodiversity in the wild In the field to mitigate threats of declining agro-biodiversity for food	M 7(3.9%) F 3(1.7%)	M 19(10.6%) F 11(6.1%)	M 10(5.6%) F 5(2.8%)	M 41(22.8%) F 24(13.3%)	M 41(22.8%) F 19(10.6%)
6	Coordination and enforcement of environmental policies.	M 2(1.1%) F 0	M 5(2.8%) F 0	M 10(5.6%) F 7(3.9%)	M 56(31%) F 30(16.7%)	M 45(25.5%) F 25(13.9%)
7	Stimulate afforestation, forestry mgt, tree planting & forest reserves.	M 50(27.8%) F 40(22.2%)	M 63(35%) F 22(12.2%)	M 3(1.7%) F 0	M 1(0.6%) F 0	M 1(0.6%) F 0
8	Develop credit and savings schemes and climate insurance for rural people.	M 0 F 1(0.6%)	M 0 F 2(1.1%)	M 2(1.1%) F 5(2.8%)	M50 (27.8%) F 30(16.7%)	M 66(36.7%) F 24(13.3%)
9	Consider alternative business or occupation from forest dependency for household income & food security	M 30(16.7%) F20 (11.1%)	M 30(16.7%) F35 (19.4%)	M 33(18.3%) F 7(3.9%)	M 40(22.2%) F 0	M35 (19.4%) F 0
10	Domesticate forest resources to reduce pressure on forests.	M 55(30.6%) F20 (11.1%)	M 38(21.1%) F 30(16.7%)	M 13(7.2%) F 2(1.1%)	M 5(2.8%) F 5(2.8%)	M 7(3.9%) F 5(2.8%)
11	Reduction in fuel wood demand through alternative energy sources	M 5(2.8%) F 0	M 15(8.4%) F 0	M 7(3.9%) F 1(0.6%)	M 50(27.8%) F 40(22.2%)	M41(22.8%) F21(11.7%)

CHAPTER FIVE

Discussion, Conclusion and Recommendations

5.1 Introduction:

This chapter discusses the research findings, makes a conclusion based on the findings and gives recommendations for solutions to impacts of climate change. This chapter also outlines limitations of the research and finally suggests areas for further research.

5.2 Discussions of Research findings.

This study assesses public perception of the strategies to combat the impact of global warming on forest resources of Akwa-Ibom state.

From the questionnaire instrument administered, about 65.6% of the respondents were males, and 34.4% were females. More males volunteered to participate in the study because the study was on forest resources. On the educational standards of the volunteers, almost half of the respondents had WASC/GCE followed by those with BSC/HND. The implication of this is that the volunteers sampled are literate and able to understand what climate change is and evaluate/assess its impacts. The age groups sampled range from minimum of 18years to a maximum of 67 years. The dominant age groups were 48-57 years and 38-47 years making up 26.7% and 22.8% respectively. This shows that people involved in forest related activities or occupations are in this matured age-group. Majority of those sampled were married (56.1). The occupation of the volunteers showed the predominance of forest related trade or occupation because timber sellers and firewood sellers made up a total of 48.3%. On the impact of climate change, majority of those sampled believed that climate change causes intense rainfall, flood and erosion, rising temperature causes forest cover loss, climate change

undermines the regenerative capacity of forest areas and that that climate change causes the spread of diseases and disease vectors. This was revealed by a 5-point likert scale analysis to show mean values of respondents' responses. The implication of this is that the forest and forest resources of Akwa-Ibom state are threatened by climate change.

The responses of the volunteers with regard to sex and educational standards showed the importance of education in understanding climate change impacts, and varied views of males and of females on some climate change issues. The study reveals that the responses of those with higher educational level agree or strongly agree with the impacts of climate change while those with a lower educational standard either disagree or remained undecided. Sex also plays a role in the volunteers' responses on some issues. For example females with lower education made up about 2.8% of those that do not agree that food scarcity and income loss due to reduction of forest resources were as a result of climate change. This scenario was also observed on the question that climate change undermines the regenerative capacity of trees. Whereby all respondents from WASC/GCE to BSC/HND agreed with this impact, all the females with FSLC, Adult education and No Formal education disagreed with this impact or at best remained undecided. With regard to unabated deforestation, all respondents with No Formal education disagreed with this impact. Educational level and sex certainly directs how the communities understand and know the severity of the impacts of climate change. With regard to coping /adaptation measures, a good percentage of people in the study area are aware of causes and effects of climate change but lack adequate coverage and early warning systems and training. Some adaptations measures undertaken by the people in the study area have not been participatory and collaborative with other

stakeholders. Individual households and communities cope with this threat on their own with little coordination or guidance.

5.3 Research Conclusions.

Akwa-Ibom state like other states in southeastern Nigeria is affected by climate change. It can be concluded that, there is rise in mean surface temperature. Other meteorological variables and anthropogenic factors combine with rising temperature to reduce size of forest cover in the study area. If this trend continues unabated, it can be said that Akwa-Ibom state would not have forests in the next three decades. Presently, the people of Akwa-Ibom state being aware of the effects and consequences of climate change have undertaken some coping measures. However, the adaptation measures are isolated, uncoordinated and non-participatory. The only measure that is participatory is the federal government introduced annual tree planting day, which is being enforced and coordinated by the state and local governments. Not much has been achieved by this strategy. The results of this study have therefore necessitated some recommendations.

5.4 Limitations of Research

Records of climate change effects and adaptations strategies were not readily available in the study area. The researcher therefore relied on questionnaire instruments for data. Again, respondents may not fully understand the purpose of the study. They may be afraid that government intends to formulate policies that may not favour them especially where the enumerators were either civil servants or teachers. Also most rural dwellers are not well educated to understand the contents of the questionnaires. There was also a problem of coverage as not all local

government areas was covered due to time and logistics during enumerations.

5.5 Recommendations for Planning and Management of Forest Resources.

A large number of people of Akwa-Ibom state depend on forest and forests resources for their livelihood. There is therefore a need for a sustainable management of these important resources, to meet the present day needs and to ensure availability for future generations. Appropriate measures should be taken to protect the forest against harmful effects of global warming and climate change. General recommendations for policies, programmes and other measures for forest include:

1. Community-Based Natural Resources Management (CBNRM): In collaboration with communities, the Federal Government of Nigeria should launch a national Community-Based Natural Resources Management Programme.

2. Natural Forest Policy: the government should:

- ❖ Actively support the implementation of existing National Forest policy to presume, expand and connect protected areas (forest estate).
- ❖ In parallel, review the policy and programmes to ensure they address the current and predicted impacts of climate change.
- ❖ Implement broad afforestation and re-greening programmes

3. Research Programmes: government should implement Research Programmes to:

Investigate improved varieties of trees that are adaptable to a changing climate.

4. Forest Inventory: Government should develop an up-to-date forest inventory and monitor forest cover and composition across Nigeria.

5. Business Incentives: The federal and state government should collaborate to provide incentives for investment in tree planting business and low interest loan.

6. Civil society (CSOs and communities):

- ❖ Participate in the CBNRM programme and encourage development of community forestry.
- ❖ CSOs should expose and implement programmes focused on domestication of forest products e.g. Afang, bush mango etc. in order to reduce pressure on forest.

At the policy level:

- ❖ Mainstream climate change into development policy via poverty reduction/ alleviation of aggressive free-planting and agro-forestry practice for border plantings, wind breaks, over storey shade to sequester carbon and agro-forestry resources for incomes.
- ❖ Promote a participatory approach in the decision-making process and provide top-down approach.
- ❖ Create strong synergy between the various actors, inter-ministerial technical commission on climate change, involve the private sector, rural and scientific communities, research institutions and universities.
- ❖ Develop information and communication strategies on national and state levels where researchers, scientists, decision-makers and practitioners could share the knowledge and experience on climate change.
- ❖ Facilitate development of local environmental actions plans through participatory environmental planning workshops.

- ❖ Promote and support daily television and radio impacts of climate change on adaptation /coping strategies/ measures.
- ❖ Revisit land tenure practices.

At the community level:

- ❖ Promote community forests and intensifying tree planting for sustainable forest management and soil restoration.
- ❖ Strengthen the capacities of rural communities and the decentralisation process and information sharing on climate change.
- ❖ Improve role of women and the youths in the dissemination of extension work activities and in decision-making.
- ❖ Sensitise rural populations to the question of sustainable use of all forestry resources, including timber.
- ❖ Promote village schools and field days where farmers share experience of good farming practices and agricultural shows, where best or sustainable adaptive strategies are given awards.
- ❖ Promote village environmental news teams who will monitor and regularly report any form of issues such as climate change.
- ❖ Promote information centres, local radio, “Rural FM (FM Station), mobile phones to provide information to communication and share / exchange information on weather and climatic change.
- ❖ Establish systems and mechanisms to ensure respect of the law and regulations.
- ❖ Involve customary and traditional authorities in creating awareness and enforcing environmental laws and regulations.

This study has revealed that the degradation of vegetation and forest resources of Akwa-Ibom state will continue until short or long-term policies and adaptation strategies are implemented to mitigate the impact of climate change and global warming. If the above recommendations are

addressed and implemented, the impact of climate change on forest resources of Akwa-Ibom state will be minimal, and the overall forest vegetal health, vigour and resources will improve.

5.6 Suggestions for Further Research.

The strategies recommended for climate change adaptation and improvement need more research for more effectiveness. More research also should be directed towards developing more integrated approaches to forest management. Some very useful forest species and resources such as the popular oil bean (*Pentaclethra macrophyllum*), used for local delicacy, African salad and Udara (*Chrysophyllum albidum*) are experiencing gradual extinction. Research is therefore needed urgently to identify the stress limits of these species, as a result of climate change and global warming.

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Appendix 1.

RESEARCH QUESTIONNAIRE

(NOTE: This questionnaire is for a Master of Technology degree research of the Federal University of Technology, Owerri. Please answer to the best of your knowledge. Your participation in this study is voluntary. Your consent to participate is appreciated. The information you provide will be treated in strict confidence).

INSTRUCTION: indicate your response by ticking where applicable.

SECTION A

Demographic / Socio-Economic Information.

1. What is your sex? Male _____, Female _____.
2. Marital Status: Single _____, Married _____, Widowed _____, Divorced _____.
3. Which is your highest qualification?
(a) No formal education _____, (b) Adult education _____, (c) First School leaving Certificate _____, (d) WASC/GCE _____ (e) N.C.E _____, (f) National Diploma _____, (g) O.N.D _____, (h) H.N.D _____, (i) B.Sc. _____, (j) P.G. Diploma _____, (k) M.Sc _____, (l) Ph.D _____ (m) others _____.
4. In what year were you born? _____.
5. Your occupation (Tick as appropriate)

Civil Servant		Business/Contractor	
Politician		Artisan	
Farmer		Craft	
Teacher		Timber Seller	
Petty Trader		Firewood Seller	
Fishing		Others	

6. Are you a member of any social group? If YES, list the name of the social group.

SECTION B

Climate change Impacts.

7. Do you know what climate change is? YES _____, NO _____.
If YES, rank the effects of climate change on the following using the keys provided- Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), Strongly Agree (SD).

8. AGRO_PASTORAL SYSTEM:

- (a) Reduce productivity due to variable land and water resources. _____.
- (b) Reduction of pastoral land as a result of desertification. _____.
- (c) Spread of diseases due to changes in environmental factors. _____.

9. CROPPING SYSTEM:

- (a) Reduce production due to changing rainfall pattern. _____.

- (b) Causes emerging diseases, pests and vectors._____.
- (c) Alters spatial redistribution of pests._____.

10. BIO-PHYSICAL IMPACTS:

- (a) Increase conflicts over the use of water resources._____.
- (b) Causes overflow of banks due to rising sea level & storm surges._____.
- (c) Causes loss of bio-diversity and plant generic resources as agricultural activities expand uncontrolled into forest areas._____.
- (d) Causes intense rainfall, flood and soil erosion._____.

11. FORESTRY AND AGRO-FORESTRY:

- (a) Causes deforestation by increased exploitation by forest-dependent communities._____.
- (b) Climate change undermines the regenerative capacity of forest areas._____.
- (c) Causes rising temperature which causes loss of forest cover._____.
- (d) Causes decrease in precipitation leads to loss in forest cover._____.

12. SOCIO-ECONOMIC IMPLICATION:

- (a) Reduced capacity of natural resources to support productive agriculture._____.
- (b) Food scarcity due to a reduction of forest resources._____.
- (c) Rising food prices._____.
- (d) Weakening of the power & equity position of most vulnerable in forest-dependent communities._____.

SECTION C

Adaptation and coping strategies to climate change.

13. Do you consider the following as appropriate coping strategies to ameliorate the effects of climate change on forest resources? (Rank as above).

- Control overgrazing_____.
- Encourage new fodder resources management system_____.
- Introduce sustainable management measures in rain fed & irrigated agriculture
- _____.
- Study climate change indicators and rising temperatures_____.
- Introduce seed preservation on-farm and community seed banks _____.
- Encourage conservation farming, staggered farming & water harvesting
- _____.
- Conserve biodiversity in the wild & in the field for food and agriculture _____.
- Intensify coordination & enforcement of environmental policies_____.
- Stimulate afforestation, forest & range mgt. and delineate protected areas _____.
- Increase awareness of the importance of agro-forestry in food security _____.
- Accurately assess hazards and critical mitigation points_____.
- Stimulate agri-business & rural development for food security & welfare _____.
- Develop credit/savings schemes & climate insurance for rural communities_____.

- Ensure gender issues are taken into account in assessing climate impacts_____.
- Fulfil commitments to climate investments funds to support mitigation _____.
- Consider alternate business from forest dependency for household income_____.

14. Do you consider any of these appropriate strategies for communicating the impacts and coping strategies of the impacts of climate change to the populace?

- Media awareness for the causes and effects of climate change. _____.
- Volume of media coverage. _____.
- Accuracy and timeliness of media/communication coverage. _____.
- Early warning systems for communication through radios, mobilephones_____.
- Participatory video-workshops and TV to share experiences on impact & coping strategies _____.

SECTION D

Others:

15. List other ways you are affected by climate change not mentioned above

16. List other adaptation/coping strategies you use to mitigate impact of climate Change_____

17. Other comments or suggestions about climate change adaptation and combative strategies.

Thank you very much for your time.

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