

Public Perception of Combative Strategies on the Impact of Global Warming On Forest Resources in Akwa-Ibom State, Nigeria

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ABSTRACT

This research addresses public perception of combative strategies on the impact of global warming on forest resources of Akwa-Ibom state, Nigeria. Mean annual air ambient temperature of the study area for 3 decades (1980 to 2010) was regressed to reveal a sustained rising trend. Decadal mosaic imageries were extracted to establish reduced forest spatial extent and vegetal cover loss. The study randomly selected 180 respondents from 5 forest dependent communities. In analyzing the data, descriptive statistics was used with 5-point likert scale. Results of the study show that the local communities are aware of the impacts of global warming. They undertake some coping strategies to combat the impact, such as intensive afforestation and tree planting, domesticating forest products/resources, alternative business or occupation and media awareness. The efforts of these communities are uncoordinated and isolated, hence the need for governmental and professional inputs and collaboration with other stake holders. This will make the combative strategies more effective and sustainable.

Key words: Global warming, combative strategies, forest resources, Akwa-Ibom state, Nigeria.

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INTRODUCTION

The question of climate change has taken center stage in recent discussions and studies involving deforestation. For example, Choisnel (1992) suggested positive relationship between global warming and forest decline, while Schimel (2003) argued that global warming contribute to a decline in tree growth by exacerbating forest fire. The implication is that climate change driven by global warming reduces forest resources. As Obioh (2002) noted variations in global climate have impacted either positively or negatively on natural systems and environmental resources including forests. This study provides information on public perception of combative strategies on the impact of global warming on forest resources of Nigeria using Akwa-Ibom state as a case study. The specific aim is to determine gender

desegregated level of awareness of global warming impacts on forest resources of Akwa-Ibom state, identify the adaptation strategies and assess the efficacy of the strategies. Akwa-Ibom state was selected for this study because the state is a major forest resource state in Nigeria. It lies between latitudes 4°32" and 5°33" North and longitudes 7°25" and 8°25" East. It is located in the Southeastern 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 part of the Niger Delta region, and covers a land area of 6900 square kilometers (NPC, 2006). 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 to

29 degree centigrade. The area has a wet coastal climate with mean annual rainfall of 2750 mm. Most rainforest areas have one or more relatively dry months but droughts are relatively rare. Akwa-Ibom experiences about 1450 h /year 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 1500 to 1800 mm (Nnaji, 1999). There are generally two seasons in the year, the rainy and dry seasons. The rainy season lasts about 8 months. Maximum humidity is in July with a minimum humidity in January. There is a little dry season in between the rainy season called "August break" while rainy season starts in mid-March to end of November.

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 (*Irovia spp.*), others include *Mansonia*, *Xylopa*, 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: *Lycopersum 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. *Fromomium 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". *Iringia 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 fibers for fuel. *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. Tropical mangrove forest is regarded as one of the most endangered ecosystems especially in Africa because of its degraded environment and soil water condition (Adegoke, 2006). 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, while Njoku (2007) linked part of the lost to global warming through decreasing forest vegetal vigor. 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. South-eastern 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, example Njoku (2007) reveal the relationship between forest vegetal vigour and global warming as well as ascertaining the impact of rising temperature on degradation and depletion of forest cover in south-eastern Nigeria. Figures 1, 2 and 3 below show forest extent mosaic map of South-eastern Nigeria for three decades, 1980 to 1990, 1990 to 2000 and 2000 to 2010. Revealing that the forest cover was being progressively degraded and depleted.

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

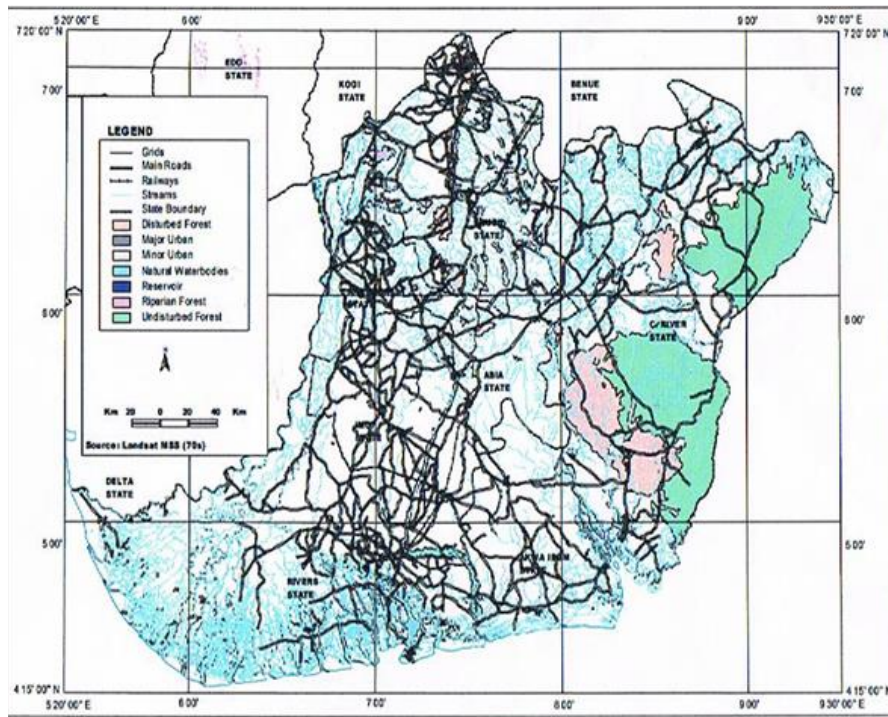


Figure 1. Forest extent mosaic map of south eastern Nigeria (1980 to 1990). Adopted from Njoku, 2007.

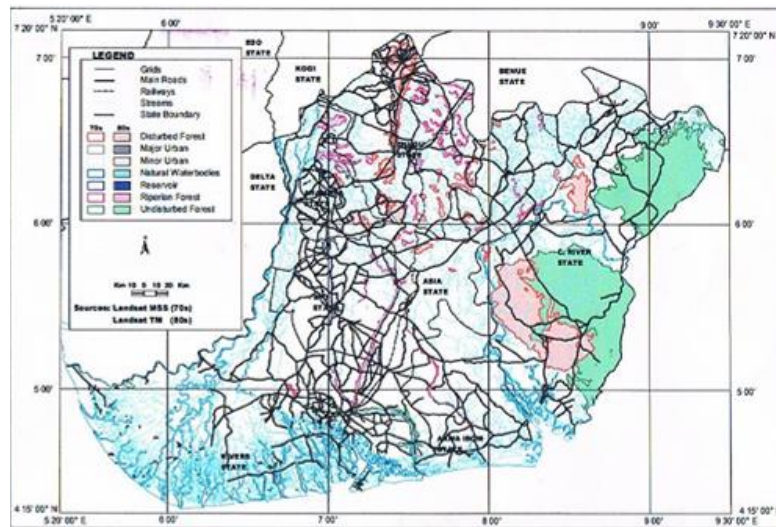


Figure 2. Forest extent mosaic map of south eastern Nigeria (1990 to 2000). Adopted from Njoku, 2007.

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, landslides/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. International Institute for Tropical Agriculture showed from its research findings 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 Guinea forest of West Africa and the subsequent emission of 1.4 billion

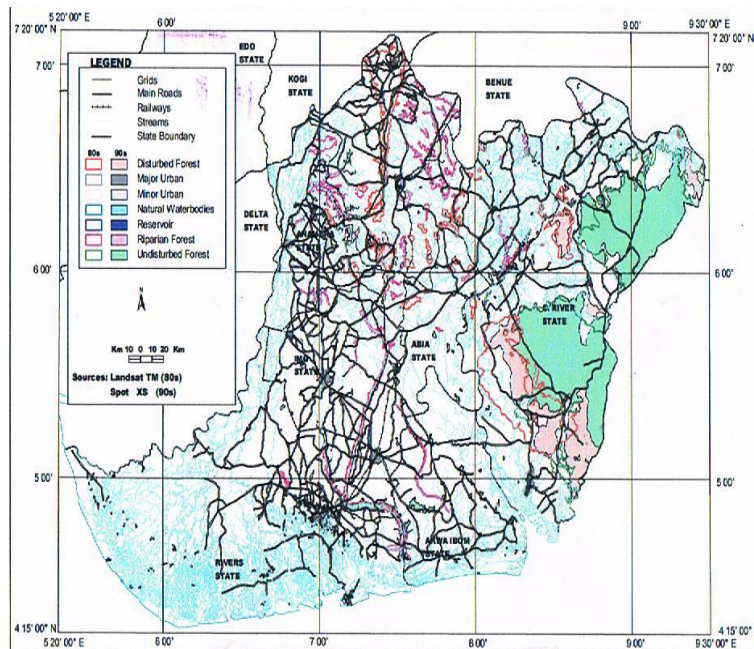


Figure 3. Forest extent mosaic map of south eastern Nigeria (2000 to 2010). Adopted from Njoku, 2007.

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). The Intergovernmental Panel on Climate Change (IPCC, 1990) predicted that if present rates of greenhouse gases emissions continue, the earth will experience a one degree centigrade warming by 2030 at the latest and 3 degrees centigrade increase in air temperature before the end of the 21st century. Ojo (1986), Dale (2000, 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. This study therefore accesses public perception of combative strategies on the impact of global warming on forest resources of Akwa-Ibom State, Nigeria.

MATERIALS AND METHODS

Five communities in Akwa-Ibom state were selected for the study. The study used primary and secondary data derived from questionnaires and literature, respectively. One structured questionnaire was developed for use. The questionnaire was original and prepared for this study. The questionnaire covered the demographic,

weather/climate change impact and adaptation/coping aspect of the study. 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 questionnaires used for data analyses were as follows: Ikot Ebom Itam 30 questionnaires, Ifiyong 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. A variety of analytical tools appropriate for each objective were used in analyzing the data collected in the study. These range from descriptive presentations and story lines to mean values and graphs. However, statistical analysis such as cluster analysis, principal component analysis, discriminant analysis, would be an option for statistical assessment.

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. Validity was

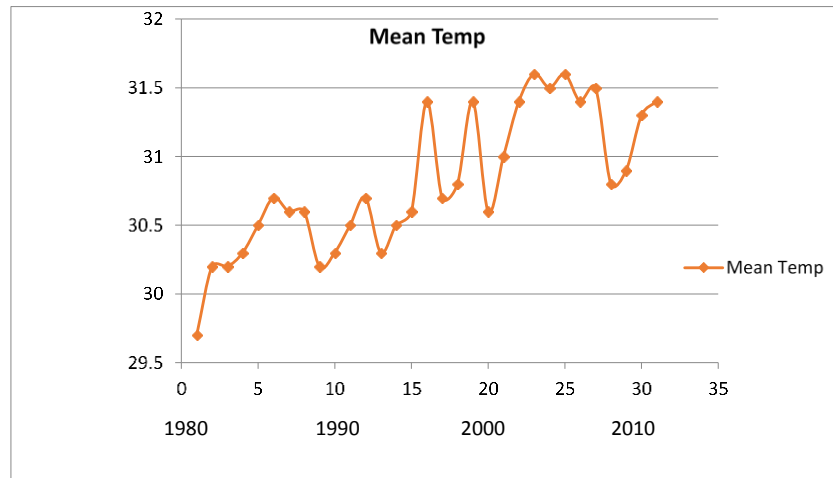


Figure 4. Time series of mean annual air temperature for 1980 to 2010.

ascertained by the project supervisor. 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 FGDs and IDIs. The data collected were analyzed using Statistical Package for Social Sciences. The questionnaire was analyzed 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.

RESULTS AND DISCUSSION

Meteorological data was collected and analysed. The mean ambient air temperature of Akwa-Ibom state for 1980 to 2010 (Figure 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 to 1989, 1990 to 1999, and 2000 to 2010 are 30.3°C, 30.7°C and 31.1°C, respectively.

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 have no formal education (5.6%). Respondents within the age group of 48 to 57 years recorded the highest percentage of (26.7%), while those within the age group of 58 to 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 were either civil servants or engaged in forest-related business or trade.

PARTICIPANTS' KNOWLEDGE OF IMPACTS OF CLIMATE CHANGE ON FOREST RESOURCES

Table 2 showed that all the listed variables are a result of climate change. Majority of the respondents agreed to the effects of climate change, intense rainfall, flood and erosion as well as incidence and spread of diseases and disease vectors were the effects most felt by respondents with a mean score of 4.34 each. This is 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 have been identified by respondents as the critical effects of climate change in the study area. Further investigation

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 to 27 years	38	21.1
	28 to 37 "	35	19.4
	38 to 47 "	41	22.8
	48 to 57 "	48	26.7
	58 to 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. Participants' 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	
Climate change causes intense Rainfall, flood and erosion	83	83	8	2	4	4.34
Rising temperature causes Loss of forest cover	72	98	9	0	1	4.33
Climate change causes sea level rise and storm surges creating overflow of banks	44	95	20	14	7	3.86
There is food scarcity and income loss due to reduction of forest resources	77	78	15	9	1	4.23
Climate change causes the weakening of power and equity Position of most vulnerable in forest-dependent communities	48	100	10	19	3	3.95
Climate change undermines the regenerative capacity of forests	65	101	9	2	3	4.24
Unabated deforestation by increased exploitation by communities	68	74	17	17	4	4.03
Loss of biodiversity and plant genetic resources as agricultural activities expands uncontrolled into forest areas	73	68	18	7	14	3.99
Spread of diseases and vectors due to changes in the environment	94	67	9	7	3	4.34

according to male and female responses with regards to their knowledge of climate change show that 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

Table 3. Distribution of respondents according to their appreciation of coping/combative strategies to climate change/global warming.

Coping strategies	Responses					Mean value of measures
	SA	A	U	D	SD	
	5	4	3	2	1	
Media awareness for causes and effect of climate change	72	78	20	5	5	4.15
Accuracy, timeliness and volume of coverage	1	1	8	80	90	1.57
Early warning systems	0	1	4	74	100	1.47
Participatory videos, workshop and TV to share experiences	5	7	25	80	63	1.95
Conserve biodiversity in the wild In the field to mitigate threats of declining agro-biodiversity for food	10	30	15	65	60	2.25
Coordination and enforcement of environmental policies	2	5	17	86	70	1.79
Stimulate afforestation, forestry mgmt., tree planting and forest reserves	90	85	3	1	1	4.46
Develop credit and savings schemes and climate insurance for rural people	1	2	7	80	90	1.58
Consider alternative business or occupation from forest dependency for household income and food security	50	65	40	40	35	4.15
Domesticate forest resources to reduce pressure on forests	75	68	15	10	12	4.02
Reduction in fuel wood demand through alternative energy sources	5	15	8	90	62	1.95

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. Generally, the researcher concluded that climate change effects have been felt in Akwa-Ibom state.

PARTICIPANTS’ KNOWLEDGE/APPRECIATION OF COMBATIVE STRATEGIES ON THE IMPACT OF GLOBAL WARMING

The Table 3 showed that all the listed variables were applied to combat or cope with climate change/global

warming. 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 is 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 is 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.

DISCUSSION 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. The mean ambient air temperature of the study area, Akwa-Ibom state, for 1980 to 2010 revealed that air temperature showed a sustained 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 to 1989, 1990 to 1999, and 2000 to 2010 are 30.3, 30.7 and 31.1°C, respectively. During this

period, the forest vegetal cover was progressively being depleted and degenerated. 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 which includes Akwa-Ibom state, while Njoku (2007) linked part of the lost to global warming through decreasing forest vegetal vigour. (Obioh, 2002) noted massive loss of forest resources in Nigeria as being traceable to climate change among other factors. International Institute for Tropical Agriculture showed from its research findings 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 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. The emission of billion tons of carbon dioxide into the atmosphere could have a significant global warming impact on forest resources in Nigeria.

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 is on forest resources which they are basically dependent upon. 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 18 years to a maximum of 67 years. The dominant age groups are 48 to 57 years and 38 to 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 are married (56.1). The occupation of the volunteers showed the predominance of forest related trade or occupation because timber sellers and firewood sellers make 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 volunteer's 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. Gender 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 are as a result of climate change.

This scenario is also observed on the question that climate change undermines the regenerative capacity of trees. Whereby all respondents from WASC/GCE to BSC/HND agree with this impact, all the females with FSLC, Adult education and No Formal education disagree with this impact or at best remained undecided. With regard to unabated deforestation, all respondents with No Formal education disagree with this impact. Educational level and gender 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. It is on the basis of such scenario globally, that a panel of climate experts known as the IPCC was assembled and instituted in 2001, to monitor and report on the state of global climate.

CONCLUSION

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 combative/ 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.

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