



## Climate Change Awareness and Adaptive Rural Livelihood Options by Renewable Natural Resources Dependent Communities of Delta State, Nigeria

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### Abstract

The study examined the level of climate change awareness and adaptive rural livelihood options among renewable natural resources-dependent communities in Delta State, Nigeria. Data were collected through the use of well-structured questionnaire administered on the respondents in the selected communities. The questionnaire was designed to collect information at community and household levels on understanding of activities leading to climate change, awareness of the effects and mitigation measures to climate change. The questionnaire also collected information on the relationships of these changes to environmental and other processes. The results indicated that majority (52%) of the respondents believed that collection and use of fire wood was contributing to climate change. Rural urban migration and increased ill health and sicknesses among farmers were the most obvious effects of climate change. Majority (3.3%) of the respondents were more aware of planting of shade and shelter trees as a mitigation measure against the effect of climate change. Appropriate use of agrochemicals and planting of shade trees were the most effective adaptation strategies known to respondents, with 7.7% and 1.8% of the respondents respectively. Common attributes to the adaptation process were identified across the study areas. It is recommended that rural communities should be encouraged to practice the adaptation strategies known to them and also, be informed by Forest Extension Officers on the various adaptation strategies available. These practices will not only lead to sustainable environment but also sustainable development.

**Keywords:** Climate change, Awareness, Adaptive methods, Shelter trees, Sustainable environment.

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### Introduction

According to IISD, (2009) and Dieudonne, (2001), climate change is posing a dreadful threat to the development and poverty reduction processes in the poorest and most vulnerable regions of the world today. It has been considered as one of the most serious threats to sustainable development, with its adverse impacts expected on the environment, human health, food security, economic activity, natural resources and physical infrastructure. Changes in climatic conditions have significant impacts on the capacity of the forest to provide vital ecosystem services and the well-being of people. African countries where there are low adaptation strategies and mitigation options are the most affected. Houghton (1991) noted that the estimates of carbon fluxes from deforestation, land cover change and other disturbances depend on knowing the forest carbon stocks before the disturbance. Watson *et*

*al* (2000) reported that the change in carbon storage in terrestrial ecosystems as a consequence of human land use was simplified in the Kyoto protocol to a forest – non-forest dichotomy, and its derivatives.

Huquet *et al.*, (2003) has postulated that the low adaptation capacity is due to the extreme poverty, frequent natural disasters such as droughts and floods and an agriculture that is heavily dependent on rainfall. As reported by Adekunle *et al* (2014), the greatest proportion of Nigerian population are rural dwellers and they depend solely on renewable natural resources for survival. They further noted that the daily activities of this set of people in the forest are culpable of leading to forest degradation and alteration in environmental conditions. Livelihoods in these areas are highly dependent on climate sensitive resources; agriculture in sub-saharan Africa of which 90% is rain fed

accounts for 70% of regional employment and 35% of gross national product.

Carbon dioxide is one of the greenhouse gases (GHGs) which affects the elements of climate like temperature, pressure, humidity etc., negatively, to bring about climate change if not sequestered by trees. Although the loss and degradation of tropical forest probably contributed only 30% of total net carbon dioxide emission (Houghton et al, 1992), and there is a central need to achieve a reduction in carbon dioxide level caused by deforestation. Carbon offset by reduced carbon loss or increased carbon sequestration as in Reduced Impact logging (RIL) or reforestation programmes are splendid example of global sharing of the financial burden of conservation. From a climate change perspective, this is eminently reasonable because CO<sub>2</sub> and other heat trapping gasses circulate globally. From a political perspective, carbon offset programmes should be acceptable in the tropics and elsewhere because they provide a mechanism for motivating the wealthy countries of the world to pay for a benefit of forest conservation that transcends national borders. It promotes the transfer of funds from industrialized countries to tropical countries as a commercial transaction, as opposed to charity (Marsh, 1992).

Carbon fixation through forestry is a function of the amount of biomass (i.e. trees) in a given area. Therefore, any activity or practice that changes the amount of biomass in an area will have negative effect on its capacity to store or sequester carbon. Forest management practices can be used to reduce the accumulation of greenhouse gases in the atmosphere through preventing or reducing the rate of release of carbon through planting of trees.

This work therefore assessed the climate change awareness and adaptive rural livelihood options by renewable natural resources dependent communities in three local government areas of Delta State. In Delta state

the forest area has seen depleted to its barest minimum, therefore, the relationship between timber exploitation and selective climate change parameters were also examined. The objectives of this study therefore are to identify and categorize all rural activities leading to climate change among the set of people that depend on renewable natural resources and rain fed agriculture, examine the level of awareness of rural communities to climate change, the degree and variability to climate change to test assertion that poorest inhabitants of developing countries are already struggling to cope with the current extreme weather conditions and climate change and identify all adaptation (minimizing the actual consequences) and coping strategies by rural communities in the study areas.

## **Materials and Methods**

### *The Study Area*

This study was conducted in Delta State. Delta State covers a land area of about 18,050 km<sup>2</sup> of which more than 60% is land while the remaining 40% is water bodies. The area of forest reserves is 74,910 hectares distributed in various locations in the state. The State lies approximately between longitude 5°00' and 6°45' East and latitude 5°00' and 6°30' North. It is in the South-South geo-political zone and rainforest ecological zone of Nigeria with rainfall ranging from 1500 mm to 1849 mm and a mean temperature of 28±6°C.

### *Method of Data Collection*

Data were collected from three randomly selected Local Government Areas (LGAs) in the state. The LGAs are Ndokwa West, Ukwuani and Warri South. Ndokwa West Local Government comprises of mangrove forest in its North Western part and freshwater forest in the remaining parts. Ukwuani Local Government Area comprises of mainly freshwater forest. Warri South Local Government Area comprises of mainly mangrove forest. One rural community was

selected in each LGA and ten (10) household heads were randomly selected for questionnaire administration in each community to obtain the household level information. A total of 30 questionnaires were administered for the study. A key informant was used in each of the selected rural communities for community level information. Focus group discussion was also held with community members to corroborate data collected with the questionnaire.

#### *Method of data analysis*

The data collected were screened and coded for analysis. Descriptive statistic that involves means, frequencies, percentages and figures and charts were used for data analysis.

#### **Results and Discussion**

Table 1 shows the socioeconomic characteristics of the respondents. The result shows that 56.7% of the respondents were males while 43.3% were females. Majority (52%) of the respondents were within the age bracket of 21-30 years. The results shows that many of the respondents had formal education with 30% completing primary school, while 34% completed secondary school and 36% completed tertiary education. Majority (53%) of the respondents were married while 47% of the respondents were single. The results further revealed that all of the respondents were of Christian faith.

The summary of the various activities carried out in these communities that contribute to climate change is presented in Table 2. The table shows that the majority (52) of the respondents believed that collection and use of fire wood contributes to climate change. This was followed by overgrazing (48) and cropping systems being practiced (47) by the respondents. This agrees with the finding of Adekunle *et al* (2014) who noted that the great proportion of rural dwellers depend solely on renewable natural resources for survival in Nigeria. Also, Ikojo, (2008) and Faleyin and Abinyemi (2010) reported that the destruction of

the world's forest (especially for fuel wood collection) accounts for nearly 30% of global greenhouse gas emission more than the entire global transportation sector- all cars, trains, and planes operating today.

#### **Extent of awareness of effect of climate change by rural communities.**

The result of the various indices of perceived awareness of the effects of climate change is shown in Table 3. The result indicates that erosion and flood were the most common effects of climate change as perceived by the communities. This is because it had the highest mean value of 3.7. This is followed by fluctuation in rainfall pattern with mean awareness score of 3.5 while the decline in availability of natural resources, had mean awareness score of 2.6. On the other hand, increase in the use of fertilizer had a mean awareness score of 3.0 while decrease in farm output and depletion of wildlife had a mean awareness score of 2.8 each. The least mean awareness score (1.7) was recorded for humidity and extensive dryness. The high values obtained for fluctuation in rainfall pattern, decline in availability of natural resources, increase in the use of fertilizer, decrease in farm output and depletion of wildlife agreed with the findings of IISD (2009) and Dieudonne (2001) and Adekunle, *et al* (2014). They reported that climate change had adverse impacts on the environment, food security, economic activity, natural resources etc. It can be deduced that the perceived effect of climate change issues were well known by the respondents.

#### **Effect of climate change**

The various effects of climate change in the study area are presented in Tables 4. Rural urban migration and increased ill health and sicknesses among farmers had the highest mean score of 3.4. This was followed by spread of infections and diseases with mean score of 3.1, farm land erosion and flood, and humidity and excessive dryness had the least mean score of

1.9 each. Since the mean awareness of issues of climate change is greater than the average mean (i.e. 2.5 mean), it therefore indicates that the respondents were aware of change in climate and its effects on livelihood. This finding agreed with Huqet *al.*, (2003); Zaki, (2008); Olowoyo et al., (2010); and Aluko et al (2008). These

authors postulated various effects of climate change to include extreme poverty, frequent natural disasters such as droughts and floods, increased ill health, humidity and excessive dryness leading to an agricultural system that is heavily dependent on rainfall.

**Table 1: Socioeconomic characteristics of respondents**

Variable	Frequency	Percentage
<b>Gender</b>		
Male	17	56.7
Female	13	43.3
<b>Marital Status</b>		
Married	16	53
Single	14	47
<b>Age</b>		
21-30years	15	52
31-40 years	7	24
41-50 years	6	21
51-60 years	1	3.4
<b>Formal Education</b>		
Completed primary school	15	30
Completed secondary school	17	34
Completed tertiary education	18	36
<b>Religion</b>		
Christian	<b>30</b>	<b>100</b>
Muslim	<b>0</b>	<b>0</b>

**Table 2: Activities carried out contributing to issues of climate change in communities**

S/N	Activities	Very severely	Severely	Fairly severely	Not severely	Score	Mean
1	Land/bush clearing	3(12)	7(21)	2(4)	6(6)	43	1.4
2	Cultivation techniques	2(8)	10 (30)	0 (0)	6(6)	44	1.5
3	Cropping systems	5(20)	7(21)	0(0)	6(6)	47	1.6
4	Improper application of fertilizers/agrochemical	2(8)	7(21)	2(4)	7(7)	40	1.3
5	Processing technique	2(8)	4(12)	2(4)	10(10)	34	1.1
6	Lumbering	6(24)	3(9)	2(4)	7(7)	44	1.5
7	Collection & use of firewood	7(28)	5(15)	3(6)	3(3)	52	1.7
8	Overgrazing	8(32)	2(6)	3(6)	4(4)	48	1.6
9	River drying up	3(12)	5(15)	0(0)	8(8)	35	1.2

**Awareness of mitigation measures against climate change**

The awareness of mitigation measures against climate change is shown in Table 5. Majority of the respondents are more aware of planting of shades and shelters (3.3). This was followed by soil conservation methods with 3.0 mean value. Awareness of planting of different crops and the use of irrigation had mean value 2.8 each. Since their mean value is greater than the average (which is 2.5), it implies that the respondents were much aware of these mitigation measures. The mean value of the other adaptation strategies were less than or equal to 1.7, which is less than the average mean. This

shows that the respondents were less aware of these mitigation measures. This is in agreement with the findings of Marsh, (1992) that reforestation programmes are splendid example of global sharing of the financial burden of conservation. Evans (1992); Nzegboule, (2006) and Agbogidi and Eshegbeyi (2008) maintained that forests are often called the lungs of the earth for their role in carbon sequestration and that forest management practices can be used to reduce the accumulation of greenhouse gases in the atmosphere through preventing or reducing the rate of release of carbon through planting of trees.

**Table 3: Extent of awareness of effect of climate change**

S/N	Perceived effects of climate change	Very much aware	Aware	Fairly aware	Not aware	Score	Mean
1	Fluctuation in rainfall	19(76)	10(30)	0(0)	0(0)	106	3.5
2	Decrease in availability of natural resources	5(20)	14(42)	6(12)	4(4)	78	2.6
3	Erosion and flood	23(92)	6(18)	1(2)	0(0)	112	3.7
4	Change in planting period	4(16)	13(39)	5(10)	8(8)	73	2.4
5	Drought and longer period of dry season	5(20)	11(33)	7(14)	7(7)	74	2.5
6	Extreme temperature	11(44)	10(30)	6(12)	3(3)	89	3.0
7	Humidity and excessive dryness	1(4)	6(18)	8(16)	14(14)	52	1.7
8	Increase in pest infestation on farm	5(20)	16(48)	3(6)	4(4)	78	2.6
9	Increase in soil depletion/nutrition	7(28)	10(30)	4(8)	7(7)	73	2.4
10	Harvesting period is being affected	5(20)	10(30)	8(16)	5(5)	71	2.4
11	Decreased in availability/sustainability	6(24)	5(15)	10(20)	8(8)	67	2.2
12	decreased in farm output	7(28)	11(33)	11(22)	0(0)	83	2.8
13	Decreased performance of livestock breeding & production	3(12)	7(21)	6(12)	13(13)	58	1.9
14	Increase use of agricultural in farm	8(32)	6(18)	2(4)	13(13)	67	2.2
15	Increase use of fertilizer	13(52)	8(24)	5(10)	3(3)	89	3.0
16	Increase in health & sickness of farmers	11(44)	6(18)	6(12)	5(5)	79	2.6
17	Labour efficiency & effectiveness	1(4)	10(30)	8(16)	9(9)	59	2.0
18	Lack of portable water	9(36)	10(30)	4(8)	7(7)		
19	Depletion of wildlife	10(40)	9(27)	7(14)	3(3)	84	2.8
20	Change in vegetation	8(32)	11(33)	6(12)	2(2)	79	2.6
21	Decline in forest resources	10(40)	7(21)	8(16)	3(3)	80	2.7

**Table 4: Effect of climate change issues**

S/N	Perceived effects of climate change	Very much aware	Aware	Fairly aware	Not aware	Score	Mean
1	Fluctuation in rainfall pattern	11(44)	10(30)	4(8)	3(3)	85	2.8
2	Decline in availability of natural resources	6(24)	11(33)	9(18)	2(2)	77	2.6
3	Availability of portable water	7(28)	9(27)	5(10)	7(7)	72	2.4
4	Farm land erosion & flood	12(48)	6(18)	4(8)	13(13)	57	1.9
5	Changing in planting period	3(12)	8(24)	4(8)	6(6)	80	2.7
6	Drought and longer period of dry season	4(16)	6(18)	8(16)	11(11)	61	2.0
7	Extreme temperature	8(32)	14(42)	5(10)	3(3)	87	2.9
8	Humidity & excessive dryness	4(16)	6(18)	3(6)	17(17)	57	1.9
9	High wind intensity	2(8)	8(24)	11(22)	7(7)	61	2.0
10	Increase pest & disease infestation on farm	8(32)	15(45)	4(8)	2(2)	87	2.9
11	Increase soil depletion/plantation nutrition	10(40)	8(24)	6(12)	6(6)	82	2.7
12	Change in harvesting period	5(20)	7(21)	5(10)	12(12)	63	2.1
13	Increased expenses on purchase of agrochemicals						
14	Increased use of fertilizers	11(44)	10(30)	6(12)	3(3)	89	3.0
15	Decreased in farm output						
16	Declining breeding and production performance of livestock	4(16)	8(24)	4(8)	14(14)	62	2.0
17	Increased use of agrochemicals in farm	5(20)	5(15)	6(12)	14(14)	61	2.0
18	Increased expenses on the use of fertilizers	6(24)	12(36)	5(10)	7(7)	77	2.6
19	Increased ill health and sickness among farmers	14(70)	7(21)	3(6)	6(6)	103	3.4
20	Decreased labour efficiency and effectiveness	5(20)	9(27)	11(22)	4(4)	73	2.4
21	Decline farm income	9(36)	14(42)	5(10)	2(2)	90	3.0
22	Rural-urban migration	18(72)	8(24)	1(2)	3(3)	101	3.4
23	Depletion of wildlife animals	9(36)	11(33)	7(14)	3(3)	86	2.9
24	Spread of infections diseases	14(156)	8(24)	4(8)	4(4)	92	3.1
25	Decline in livelihood system	4(16)	12(36)	9(18)	5(5)	75	2.5

**Extent of the adoption of some adaptation strategies**

Table 6 shows the extent of application of some adaptation strategies in militating against climate change adverse effects. Appropriate use of agrochemicals is the most effected adaptation strategies known to respondents, having a mean of score of 7.7

which is far greater than the average. Thus, other adaptation strategies are either not known by the respondents or not being adopted. This corroborates Apata (2008), and Phokele and Sylvester (2013). These authors affirmed that change in the use of agrochemicals is one of the most common adaptation strategies to climate change.

**Table 5: Awareness of mitigation measures against climate change**

S/N	Adaptation strategies	Very much aware	Much aware	Fairly aware	Not aware	Score	Mean
1	Planting of shade and shelters	20(80)	5(15)	0(90)	3(3)	98	3.3
2	Agro forestry practices	8(32)	11(33)	4 (8)	5(5)	78	2.6
3	Planting of different crops	11(44)	7(21)	3(6)	3(3)	83	2.8
4	Choosing different planting dates	3(12)	5(15)	5(10)	8(8)	51	1.7
5	Shortening length of planting growth period	3(12)	5(15)	6(12)	10(10)	49	1.6
6	Soil conservation method	11(44)	13(39)	3(6)	1(1)	90	3.0
7	Appropriate use of agrochemicals	6(24)	6	6(12)	8(8)	62	2.1
8	Increased water conservation method	3(12)	9(27)	9(18)	3(3)	60	2.0
9	Use of irrigation	9(36)	13(39)	3(6)	2(2)	83	2.8
10	Off-farm employment	2(8)	7(21)	7(14)	7(7)	50	1.7
11	Change of farm enterprise	2(8)	6(18)	5(10)	11(11)	47	1.6
12	Use of insurance	39(12)	2(6)	6(12)	129(12)	42	1.4
13	Moving to different site	4(16)	6(18)	59(10)	8(8)	52	1.7
14	Increase in farm size	3(120)	6(18)	8(16)	5(5)	51	1.7
15	Other adaptation strategies	1(4)	4(12)	1(2)	2(2)	20	0.7

**Table 6: Mitigation measures or extent of adaptation strategies**

S/N	Adaptation strategies	Very severely	Severely	Fairly severely	Not severely	Score	Mean
1.	Planting of shades and shelters	11(44)	3(9)	192)	0(0)	55	1.8
2.	Agroforestry practices	5(20)	4(12)	1(2)	2(2)	36	1.2
3.	Planting of different crops	6(24)	2(6)	2(4)	0(0)	34	1.1
4.	Choosing different planting dates	3(12)	3(9)	1(2)	1(1)	24	0.8
5.	Shortening length of plant growth and period	3(12)	1(3)	3(6)	1(1)	22	0.7
6.	Soil conservation method	7(28)	3(9)	1(2)	0(0)	39	1.3
7.	Appropriate use of agro chemical	4(16)	1(3)	2(4)	2(2)	23	7.7
8.	Increase water conservation methods	4(16)	2(6)	4(8)	0(0)	30	1.0
9.	Use of irrigation	3(12)	4(12)	1(2)	2(2)	28	0.9
10.	Change of farm	4(16)	3(9)	2(4)	0(0)	29	0.9
11.	Enterprise	0(0)	3(9)	1(2)	2(2)	13	0.4
12.	Use of insurance	2(8)	2(6)	2(4)	2(2)	20	0.6
13.	Moving to different sites	2(8)	4(12)	1(2)	1(1)	23	0.7
14.	Increase farm size	3(12)	3(9)	3(6)	0(0)	27	0.9
15.	Other adaptation strategies	1(4)	1(3)	192)	3(3)	12	0.4

### Conclusion and Recommendation

It can be concluded based on the results that human activities has led to climate change. Forest management has high potential of mitigating the effects of climate change, but only with support of insightful policy initiatives that take account of potential climatic changes. It is believed that continuing the practice of nationwide afforestation and reforestation projects could contribute significantly to global terrestrial C sinks and the mitigation of climate change. Adaptation strategies which include planting of shades and shelters, agroforestry practices, planting of different crops, soil conservation methods etc, should be intensively introduced to farmers through organized

Forestry extension services to replenish the vegetation of Delta State forest in order to curtail the menace of local climate change in the state.

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