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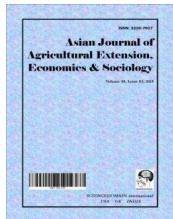
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Impacts of Climate Variability on Wetland and Fishing Households in the Niger Delta Region, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. All authors designed the study, author GSU wrote the protocol and supervised the work. All authors went to the field for data collection and participated in the statistical analysis. Author EJU managed the analyses of the study. Author GIO wrote the first draft of the manuscript. Author VAS managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

The study assessed the impacts of climate variability on wetland and fishing households in the Niger Delta region, Nigeria. Three hundred and twenty four respondents were selected using multi-stage sampling technique. Primary data were collected using questionnaire, in-depth interview and focus group discussion, while secondary data was collected from literature. Descriptive statistics including frequency and percentage were used for data analysis. Climate variability has brought about drought, flood, sea level rise and erosion. These have adversely impacted on farm households in various ways including loss of farmland and farm produce, displacement of residents and loss of property including residential buildings and fishing gadgets. Other adverse impacts include health

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problems, conflict, increased expenditure, poor yield and loss of income. Gender analysis of the impacts of climate variability shows that both men and women are equally impacted upon. Adaptation strategies should be developed to help in reducing the impact of climate variability on farm households.

Keywords: *Climate variability; impact; wetland; fishing communities; Niger Delta.*

1. INTRODUCTION

The Niger Delta region of Nigeria is a complex, yet fragile environment consisting of upland, wetland and fishing communities. Almost all oil production activities in Nigeria, with their attendant negative effects on the environment take place in this region. The area is highly degraded due to oil exploration and exploitation activities, oil spills and gas flaring. Farming and fishing are the major livelihood activities of inhabitants of the region. Records [1] and [2] reveal that not less than 70% of the population depends on agriculture and fishing for their livelihood, producing food and fiber for human consumption and industrial use respectively. Agriculture is largely rain-fed and crop cultivation as well as livestock production depend on the availability of water from rainfall. Thus, agriculture in the Niger delta region is highly influenced by annual and inter-annual variations in rainfall and other climatic factors.

While drought is a recurring problem in northern Nigeria, floods cause serious damages to livelihoods and agriculture in the Niger delta [3]. These problems are aggravated by climate variability and long-term climate change, posing serious threats to agricultural production and to the livelihoods of a great number of people [4]. Studies [5] and [6] have shown that farmers in the Niger delta region, particularly the wetland farmers operate between two extreme conditions-flooding and drought. These are associated with variability/changes in climatic conditions of the region and have grave effects on the timing of planting, pest and disease control, harvesting and crop yield.

The impacts of climate variability are cross-cutting, with several direct impacts on agriculture, water resources, and natural vegetation and indirect effects on health, the economy, and institutions. In the Niger Delta region, these are compounded by environmental degradation occasioned by seismic activities and their fallouts, soil erosion, water pollution, and deforestation. These activities have impacted negatively on the socio-economic activities and

health of the inhabitants of the region in various ways. Livelihoods are destroyed; where fish catch as well as crop yield is low. Various diseases like skin rashes and cancer are increasing, while acid rains are observed as destroying roofs of buildings. Variability in climatic conditions interact with other forms of stress associated with agricultural production and affect crop yields and productivity in different ways, depending on the types of agricultural practices and system in place [7]. In the Niger Delta region, these are impacted upon through direct changes in temperature, precipitation, length of growing season, and timing of extreme or critical threshold events relative to crop development [8].

It is therefore obvious that adaptive measures have to be taken to maintain agricultural production and productivity. According to [9] at the level of practice, adaptation is a continuum of practices which ranges from activities that are predominantly developmental to those that focus on reducing climate change. The study further asserted that no single measure is sufficient to adapt to climate variability or long term change, rather, a mix of measures is required which targets the various farm variables – water, soil, micro-climate, seeds and crops as well as labour and capital. It concludes that for adaptation to be sustainable, local knowledge should be combined with other knowledge systems.

Many proponents of climate change [10] and [11] argue that it is necessary to focus on current problems and adaptation to climate change in order to develop strategies that will adequately respond to anticipated changes in climatic conditions. The [10] for instance, maintains that adaptation to current climate variability and extremes often produces benefits as well as forming a basis for coping with future climate change. A fair knowledge of the impacts of climate variability and long term change on farming and fishing households in the region is therefore necessary. This is required for informed policy formulation, programme planning and implementation on adaptation and mitigation of the impacts of climate variability/change, not only

in the Niger Delta region and Nigeria, but in other regions with similar attributes as the area. However, information on the impacts of climate variability on farming and fishing households in the Niger Delta is scanty. To bridge the information gap therefore, the study assessed the impacts of climate variability in the Niger Delta, Nigeria.

The specific objectives of the study were to:

- i) Assess the effects of climate variability on fishing and wetland households in the Niger Delta
- ii) Examine ways by which men and women in the various communities are affected by impacts of climate variability in the Niger Delta.
- iii) Identify the sex most affected by climate variability related hazard among fishing and wetland households in the Niger Delta

2. MATERIALS AND METHODS

2.1 The Study Area

The study was conducted in the Niger Delta region of Nigeria comprising over 20 different ethnic groups which are spread over nine states. These states are Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Rivers and Ondo. It is located along the Atlantic Coast, occupies an area of over 70,000 Km² and is among the three largest wetlands in the world [12] and [13]. About 2,370 Km² of the Niger Delta area consist of rivers, creeks and estuaries, while stagnant swamp covers about 8600 Km² [13]. The region falls within the tropical rain forest zone and is characterized by two seasons: The dry and rainy seasons. The rainy season stretches from March to October and the rainfall could be as high as 3800 mm to 4500 mm. The dry season is only experienced for a few months in some coastal sections of the region.

The Niger Delta is richly endowed with mineral-rich sedimentary formations, with petroleum as the major mineral. Its exploitation accounts for over 90% of the federal government export revenue. Intense petroleum exploration and production in the Niger Delta region result in gas flaring, with adverse effects on the environment [14]. Crop farming, livestock rearing, fishing and petty trading are major livelihoods of the people.

Akwa Ibom, Rivers and Ondo States were selected for the study using simple random

sampling technique. Two wetland and one fishing communities from each of the 3 states were purposively selected making a total of 9 communities. Purposive sampling was used because not all the communities in the study area met the requirement of being a wetland or a fishing community. Disproportionate sampling technique was used to select 108 representative respondents from each of the 3 states, making a total of 324 respondents. Due to non-availability of documented information at the community level on climate variability/change related disasters, the study relied on personal observation, secondary sources and oral testimonies from participants in the Focus Group Discussions (FGDs) and In-Depth Interviews (IDIs) of key informants. A previously pre-tested and validated closed and open ended questionnaire was also used to obtain quantitative data. Having developed the questionnaire, the next step was to establish its validity. Validity was established using a panel of experts and a field test. Our focus was on the content, construct, criterion, and face validity. The following questions were addressed:

- Is the questionnaire valid? That is, does the questionnaire measure what it was intended to measure?
- Does it represent the contents?
- Is it appropriate for the sample/population?
- Is the questionnaire comprehensive enough to collect all the information needed to address the purpose and goals of the study?
- Does the instrument look like a questionnaire?

A reliability test was also conducted to enhance the questionnaire's validity. This was done through a pilot test. This was carried out by administering the questionnaire on 20 respondents in Nung Ukim, Ikono in Akwa Ibom State. Two Focus Group Discussions (FGDs) were conducted, one for men and another for women. 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 FGD and IDI guides. The data collected with the questionnaire were analysed using Statistical Package for Social Sciences (SPSS). Two key information pieces were obtained: a "correlation matrix" and "view alpha of item deleted". Statements and items were deleted until the reliability of the instrument was substantially improved up to a reliability coefficient of .90, which was adjudged adequate.

Data were analyzed using proportion, frequencies and percentages.

3. RESULTS AND DISCUSSION

3.1 Rainfall and Temperature Averages in the Region

Table 1 shows a summary of rainfall and temperature statistics in the region from 1971 to 2006. The rainfall variation during the period in the three states of Akwa Ibom, Ondo and Rivers were 1281.70 mm, 950.28 mm and 744.02 mm respectively while for temperature it was 1.3°C, 2.12°C and 1.20°C respectively. This collaborate the findings of [15]. In the NBS study, obvious variations in such climatic elements as rainfall and temperature were reported. For instance, mean annual rainfall in Akwa Ibom, Ondo and Rivers States was as high as 2,618.6 mm, 1,699.5 mm and 1,644.8 mm respectively in 1994. This went as low as 180.2 mm, 121.2 mm and 203.1 mm respectively in 2004 [15].

3.2 Effects of Climate Variability in the Niger Delta

Table 2 contains impacts of sea level rise in the Niger Delta [16]. The report reveals that 26-45 meters of land area is lost to erosion per year. This is 15% of the total area of the Niger Delta. A total of 50 villages are impacted and 0.15 million people are displaced. It is projected that 2-3 million people could be displaced by sea level rise. The implication is that unless practical steps are taken to check sea level rise, a large portion of the Niger Delta can be washed off and millions of people would be displaced. Such practical approaches to checking impact of sea level rise include construction of embankments to protect the coastal environment, tree planting and grassing of fields. Awareness creation and building the capacity of the farmers to take climate change adaptive measures can assist in reducing the impact of sea level rise.

Besides sea level rise, flooding has also impacted adversely on households in some communities in the area. The impacts come in different forms and severity and have been the subjects of concern and discussion in the print, electronic as well as social media. An example is the report of the impact of flooding in the newspaper quoted below. Again, flooding has taken new dimensions in the Niger Delta in recent years. Heavy down pour is more frequent, rainfall volume is unusually high and the impact,

devastating. Usually, the first to be affected is fresh water, followed by road transportation. Movement is usually grounded and economic activities adversely affected. All these show that individuals as well as institutions including the Ministry of Environment are yet to take adaptive measures to the impacts of climate change. This is collaborated by [17] where it was reported how displaced victims of sea level rise induced flooding in Itak Abasi community in Akwa Ibom state were yet to return home several months after the incident because no concrete steps have been taken by the government at different levels to reclaim the land and resettle them. About 4,000 fishing settlements were displaced in the area and some communities were cut off due to the flood.

Going by the testimonies of participants at the FGDs, the variations in climate have varying degrees of effects on the farmers as well as the fisher folks. Participants from farming communities noted that late onset of rains has brought about reduced level of sprouting/germination of seeds and poor yield. They also reported that high temperatures result in wilting and death of crops particularly banana and plantain. Yam tubers are also said to rot either in the soil or in storage due to extreme heat/temperatures. The overall effects of these are low crop yield, low farm income and food insecurity of farming households. Flooding is reported to "sweep off" farmland leading to loss of crops and income. Buildings, particularly thatch houses are often destroyed by flood and sea level rise in fishing and wetland communities. Livestock are not spared from the adverse effects of climate variability. Outbreak of livestock diseases are said to be common during periods of temperature extremes. Discussants in Amalem, Rivers State specifically reported appearance of new species of plants which is fast replacing indigenous ones. In addition, they also reported attack of coconut trees by non-indigenous species of bird which defecates on young coconut leaves. The leaves are said to wither and die and the entire tree follows suit subsequently.

Participants in FGDs in all the communities made the point that the health of households/families has also come under the adverse impact of climate variability. They reported that the population of malaria causing mosquitoes seems to have increased, leading to more cases of malaria attack on household members. Skin diseases are now more common and households

now spend more on medical bills. These, coupled with loss of income arising from climate related hazards have rendered households more vulnerable to poverty. Female respondents in Ifiayong Usuk, Akwa Ibom State observed that climate variability is affecting women's ability to procreate. They claimed that the number of children a woman can give birth to has reduced. In addition, new born babies are no more having characteristics that used to be identified with the

new born such as folding of the hands, rhythmic beating of the center of the head and the characteristic cry of babies. Both key informants and discussants at the FGD were of the opinion that the impact of climate variability is more severe on female headed households than the male headed ones. This is said to be engendered by women's limited sources of income and access to resources such as land and farm input.

Table 1. Summary of rainfall and temperature statistics in the Niger Delta region (1971- 2006)

Statistics	Rainfall (in mm)			Temperature (in °C)		
	Akwa Ibom state	Ondo state	Rivers state	Akwa Ibom state	Ondo state	Rivers state
Mean	2791.31	1274.85	2211.20	30.6	31.5	31.2
Maximum	3862.1	1966.4	2868.6	31.4	33.3	31.9
Minimum	2049.5	622.5	1816.4	29.6	30.3	30.2
Standard deviation	1281.70	950.28	744.02	1.3	2.12	1.20

Source: Authors' computation

Table 2. Impact of sea level rise in the Niger Delta

Type of impact	Unit of measure	Present	1m SLR	2m SLR
Erosion rate	m/year	10-15	16-19	20-25
Area lost to erosion	Km ²	26-45	55-120	130-230
Inundation and erosion	Km ²	3,000	7,000	15,000
Percent of area lost	%	15	35	75
Villages impacted	No	50	200	350
People displaced	Million	0.15	1-2	2-3

Note: Total area of Niger Delta is about 2 million hectares

Source: [16]



Fig. 1. Debris of brick building destroyed by sea level rise in Ibaka, Mbo LGA, Akwa Ibom state

3.3 Ways by Which Men and Women are Affected by Impact of Climate Variability/Change

The distribution of respondents based on their observations on ways by which men and women are affected by climate variability/change related hazards in wetland and fishing communities are presented in Tables 2 and 3.

3.3.1 Ways by which men and women in wetland communities are affected by climate variability

Respondents' views of the ways by which climate variability affects farming households in wetland communities (Table 2) in Akwa Ibom State differ between male and female respondents. While as much as 34% of the male farmers reported no effect, only 7.4% of the females reported same. Loss of income was reported by 55.6% of the female respondents, while only 15.1% of male respondents share in this opinion. However, conflict seems to be a common view of both male and female respondents (Table 2). Conflict as impact of climate variability is also common in Rivers State, but is less a problem in Ondo State. Another impact of climate variability that runs through all the States studied is loss of income. In Ondo State, 63% of the female and 50% of the male respondents are affected by loss of income. While more than a half (55.6%) of the female respondents in Rivers State are affected by loss of income, only 15.1% view this as one of the ways that they are affected by variation in climate. This means that men and women are not affected in the same way. Therefore, programmes designed for adaptation or mitigation of the impact of climate variability and long term climate change should consider these differences.

3.3.2 Ways by which men and women in fishing communities are affected by climate variability

Given the peculiar occupation of fisher folks, it would be expected that the ways by which variations in climate affect the fisher folks would be different from the wetland communities. Indeed, the result in Table 3 reveals an additional dimension which is the impact on the health of the respondents. In Akwa Ibom State, 30% of the female and 15% of the male respondents identified health problems as one of the ways

that they are affected by variation in climate. Moreover, 20% and 40% of the male and female respondents in Rivers State respectively singled out health problem as a way in which they are impacted upon by climate variability. On the contrary, respondents in fishing communities of Ondo State did not identify this as a problem. More than a half (56.3%) of the male respondents in Akwa Ibom State identified low catch as one way that they are affected by climate variability. Loss of income is also one of the ways by which fisher folks are affected by climate variability as a total of 60% of both the male and female respondents in the fishing communities observed that climate variability adversely affects their income.

These differences in the ways that fishing and wetland communities are impacted by climate variability implies that climate variability and long term climate change adaptation measures need to address these differences which may, to some extent, be influenced by the peculiarities of the livelihoods and the micro-environment of the respondents.

3.4 Sex Most Affected by Climate Change Related Hazards

Table 5 shows that both men and women are equally affected by climate variability. In Ondo and Rivers States, the opinion of both male and female farmers is that men and women are equally affected. The trend seems to be that both men and women are equally affected across the communities and states (Table 5). While the percentage of respondents taking this position differs across communities and states, this group still forms the majority in each location and state. The findings seem to differ from the popular opinion in climate change literature which suggests that the women are more vulnerable [9]. The result as obtained may be attributed to insufficient gender analysis skills of most rural people. Being gender blind makes it difficult for the respondents to see the specific gender divide of the impacts of climate variability, as a male discussant in Amalem, Rivers States euphemistically explained: *If I am affected, my wife is affected. And, if my wife is affected, I am affected. Therefore, both men and women are equally affected.*

However, most discussions on the gender dimensions of climate change impacts and vulnerability seem to be inferences drawn from

women's well known disadvantaged position in the society. For instance, [18] posited that in Ghana, women's livelihoods depended on areas that are vulnerable to impacts of climate change. [3] also painted a similar picture of gender dimension of climate change impacts and vulnerability in Nigeria. Citing example of water

and water-related impacts, [3] pointed out that "when water crises sets in, women and young girls will be the most vulnerable in view of their need for water and hygiene (compared to males)". It thus concluded that women continue to affect climate change and are most affected by it.

Table 3. Percentage distribution of respondents according to their views on ways men and women are affected in wetland communities

Ways households are affected	Akwa Ibom		Ondo		Rivers	
	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)
None	34	7.4	4.6	0	34.0	7.4
Loss of properties	11.3	0	13.8	35.7	11.3	0
Health problems	1.9	0	7.7	0	1.9	0
Increase expenditure	0	0	10.8	14.3	0	0
Loss of income	15.1	55.6	63.0	50	15.1	55.6
Loss of output & poor yield	9.4	3.7	0	0	9.4	3.7
Conflict	28.3	33.3	26.7	0	28.3	33.3
Total	100	100	100	100	100	100

Source: Field data, 2011

Table 4. Percentage distribution of respondents by their views on ways men and women are affected in the fishing communities

Ways households are affected	Akwa Ibom		Ondo		Rivers	
	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)
None	13.7	0	6.7	0	13.3	0
Loss of properties	0	14	33.3	80	0	0
Health problems	15	30.0	0	0	20	40
Increase expenditure	0	10.7	0	0	0	0
Loss of income	10	45.3	33.3	0	60	60
Low catch	56.3	0	0	0	0	0
Conflict	5	0	26.7	20	6.7	0
Total	100	100	100	100	100	100

Source: Field data, 2011

Table 5. Percentage distribution of respondents by their perception of the gender more affected by climate change hazards

Community type	Gender	Akwa Ibom		Ondo		Rivers	
		Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)
Wetland	Men	70.3	12.8	1.5	0	20.0	3.8
	Women	11.1	52.8	6.2	0	21.0	46.2
	Both Men & women	18.6	34.4	92.3	100	59.0	50.0
	Total	100	100	100	100	100	100
Fishing	Men	60	0	15.0	20	54.6	0
	Women	30	0	65.0	0	34.3	0
	Both men & women	10	100	20.0	80	11.1	100
	Total	100	100	100	100	100	100

Source: Field data, 2011

4. CONCLUSION

Communities in the Niger Delta are adversely impacted by climate variability and long term climate change. However, each community type tends to experience different kind of climate risks. Wetland farming households are vulnerable to flooding, drought and erosion leading to poor health, loss of property, poor yield and loss of income, while the wetland and fishing communities are, in addition to these climate hazards, exposed to sea level rise. Men and women are equally impacted upon by climate variability. Therefore policies and programmes to reduce the impacts and help farming and fishing households adapt to climate variability should be developed.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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