COMPARATIVE ANALYSIS OF VULNERABILITIES OF SELECTED COASTAL COMMUNITIES AND POPULATIONS TO CLIMATE CHANGE IMPACTS AND ADAPTATION STRATEGIES IN NIGERIA AND SENEGAL

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Abstract
A comparative analysis of differential vulnerabilities and adaptation strategies to climate change impacts of selected coastal communities in Nigeria and Senegal was undertaken. Nigeria's Niger Delta Coastal communities in Delta-Bayelsa States were selected as study area while along the Senegalese coasts, 3 areas were selected from the North to the South. A combination of different data acquisition methods was employed: field studies, documentation, literature reviews and other enriching enquiries. Beginning from an environmental and socioeconomic baseline description of the selected Niger Delta and Senegalese communities, the differential vulnerabilities to climate change impacts were well stated before an analysis of the different adaptation strategies employed to withstand the effects of climate change was undertaken. Some similarities and dissimilarities in adaptation strategies were observed. The study showed that, although the vulnerabilities of these coastal communities are almost the same, the adaption strategies employed are different, mediated as it were by differences in cultures, different environments and socioeconomic activities as well as different capacities to cope with observed climate change impacts. Given the disastrous environmental and socioeconomic impacts of climate change on coastal zone communities, the study recommends the building of proper and better adaptation strategies to reduce the vulnerabilities of these coastal communities to climate change and these require actions that must be undertaken from the Community level to the Regional, National and International levels.

Key Words: *Nigeria/Senegal, Climate Change, Coastal Communities, Differential Vulnerabilities, Adaptation strategies*

INTRODUCTION

Impacts on coastal systems are among the most costly and most certain consequences of a warming climate (Nicholls et al., 2007). Coastal shorelines will be eroded while low-lying areas will tend to be flooded more frequently or permanently, by the rising sea. Accelerated sea level rise (SLR) represents a significant planning and management challenge to coastal nations, especially in developing countries where vulnerability is high, adaptation options are limited, and spatial data and information are limited for planning purposes (Brown et al., 2014). SLR has already resulted in increased erosion and inundation of vulnerable areas, threatening both lives of people who inhabit coastal environments and property as well as marine resources. Sea levels are expected to rise around Africa, and impacts include flooding, saltwater intrusion, loss of beaches and recreational activities including tourism, loss of infrastructure, and changes to river flows and outputs on the coast. In Africa, data are generally missing on the present rates of sea-level change, coastal geomorphology, and socioeconomic trends (Hinkel et al., 2012).

With over 3,700 km of coastline, the West African Marine Eco-Region (WAMER) has a high percentage of its population concentrated in coastal settlements and cities which are vulnerable to sea-level rise. The Intergovernmental Panel on Climate Change (IPCC) estimates that by 2020, more than 50 million people will inhabit the coast from the Niger Delta in Nigeria to Ghana's capital city, Accra (Joiner et al., 2012). Adaptation to the changes that affect the daily livelihood is a big challenge for coastal communities who must put in place efficient strategies to face the adverse impacts of climate change CIESIN (2011).

This study emphasizes the utility of comparing the vulnerabilities and adaptation to climate change in two different geographical areas with different populations, different cultures, perhaps different environments and economic activities and different capacities to cope with changes. Spatial vulnerability assessments are useful tools for understanding patterns of vulnerability and risk to climate change at multiple scales (de Sherbinin, 2014).

METHODOLOGY

Our selected areas in Nigeria's Niger Delta area are local communities located along the coastlines of Forcados – Escravos-Ramos Rivers Estuaries in Delta and Bayelsa States. In Senegal, selected local study areas are located from the North to the south: Saint Louis, the Saloum Delta and the areas of Rufisque-Bargny (Fig.1).

Various methodologies were employed in the research. As a comparative study involving two countries, different means were adopted to get relevant data. The situational context of the areas, availability of resources and accessibility of selected study sites were all considered. Following the peculiarity and insecurity situation that prevailed in the Niger Delta at the time

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of study, a desktop study and reliance on available materials was utilized, drawn mostly from the environmental studies carried out by one of the authors. From the Senegalese axis, a set of field activities were organized and included: physical data collection using direct observation, transect walks, pictures and GPS coordinates of targeted sites.

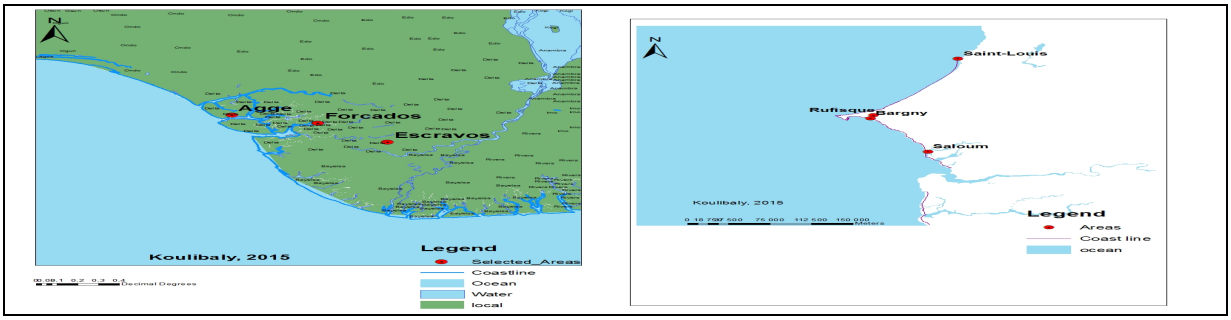

Figure 1: Selected Areas in the Niger Delta, Nigeria (left) and southern parts of Senegal

RESULTS AND DISCUSSION

Socioeconomic aspects of Nigeria's Niger Delta and Senegalese Coasts

The Niger Delta region is a low-lying area consisting of several tributaries of the Niger River and ending at the edge of the Atlantic Ocean. The region occupies about 112,110 km^2 and represents some 12% of the country's total surface area. With a coastline spanning about 450 kilometers terminating at the Imo River entrance, the region spans over 20,000 km^2 which has been described as the largest wetland in Africa and among the three largest in the world (UNDP, 2006, NDDC, 2006, CREDC, 2007). About 2,370 km^2 of the area consist of rivers, creeks and estuaries and stagnant swamp covering about 8600 km^2 (CREDC, 2007). With an annual growth rate of 2.9%, the region is home to over 37 million people (NBS, 2012). Nigeria's economy depends on oil and gas extraction from the Niger Delta as the main source of foreign exchange.

The Ijaws and Itsekiris predominate as ethnic groups in the coastal study area (Delta and Bayelsa State). Majority of the coastal habitations along the Forcados-Escravos-Ramos Rivers estuaries' are small settlements devoid of high concentrations of population because expansion is limited by a lack of dryland. The combined population of the group of coastal communities in the study area ranges from 100,000 to 150,000 with an average annual growth of 2.5%. Population densities are high in some areas and moderate in others; 116 persons per km^2 in Delta and 148 in Bayelsa axis and not uncommon to find communities of >500 persons /km^2. Economically, the livelihood of the coastal population revolves around fisheries and trading. The proportion of persons effectively engaged in fishery activities ranged from over 45% to over one half, although inhabitants of some of the coastal communities are 100% into fisheries (Ojile, 2014, 2013, 2008).

Six regions cut across the **Senegalese coastline**: *Saint-Louis, Louga, Thiès, Dakar, Fatick* and *Ziguinchor* and further divided into 4 large geographic areas: *Grande-Côte, Cap-Vert, Petite-Côte and Casamance.* The region was once estimated to house 3.45 million people in 1988, about 50% of the population (Niang-Diop, 1995; Hatziolos et al., 1996), but now thought to be inhabited by 60% of the country's population (7.8 Million) (World Bank, 2014). Some 10 different ethnic groups speaking different languages and dialects live along the coast. In Saint Louis area, the *Guet-Ndariens* and *Lebous* are the predominant communities; conducting artisanal fishing in its tributaries like their Delta counterparts in Nigerian coastline. In the Saloum Delta area, populations are the *Sereres Niomimkas*, who are also artisanal fishermen and farmers. Economically, the major livelihood of the Senegalese coastal communities is traditionally fishing, involving more than 600 000 individuals. Subsistent farming in form of gardening and paddy-rice cultivation also thrive.

Vulnerabilities of the Coastal Communities to Climate Change:

Several studies conducted over the years indicate that Nigeria's Niger Delta is very vulnerable to climate change impacts and particularly sea level rise, flooding, inundation and coastal erosion. Vulnerability indicators of topography, coastal slope, relative sea level rise, annual shoreline erosion rate, mean tidal gauge, population density and proximity to the coast testify to the vulnerabilities of coastal communities and population in the past, presently and into the future (Musa, et al., 2014; Rosmorduc, 2012; Oyegun, et al., 2016; French *et al.*, 1995; Folorunsho and Awosika, 2000; Ibe, 1986, 1988; Awosika et al., 1992). Many of the settlements are exposed to shoreline dynamics owing to distance from the shoreline. Bayelsa, Rivers and Delta States are almost 50% exposed with a mean distance of 16.10, 14.86 and 16.79km respectively. Some 349 communities are reportedly vulnerable to coastal dynamics with Bayelsa and Delta having 95 and 68 of their communities susceptible to climate change impact (Oyegun, et al., 2016). All of the settlements/communities situated along the Forcados-Escravos-Ramos Rivers Estuaries typically suffer from climate change impacts. River bank collapse, eroding coastline, submerged electric poles and loss of houses are proofs of the serious effects of coastal erosion in the area.

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The vulnerabilities in Senegal are not too different; a flat topography (<50m of elevation) of 75% of the territory makes it susceptible to inundation and coastal erosion. SLR in the Saint-Louis axis is predicted at about 20cm by 2030 and 80cm by 2080 while 3cm had been recorded between 1990 and 2010. In 1975 a beach retreat of 1.2m had been recorded while this number shifted to 3.2m in 1989. Positions of high water mark limit on aerial photographs and satellite images between 1954 and 2006, shows a significant regression of the beach of Rufisque from 0.4-1.5m per year (IUCN, 2010) and in the Palmarin coastal area, more than 200 meters of land has been lost; including loss of dwellings and economic assets. Saltwater intrusion is now more frequent in both the Saloum Delta region and Saint-Louis, threatening household water supply. In the Cape Vert peninsula, 1m of SLR will lead to losses of beaches and inundation with an estimated population of 847,000 – 11,807,000 at risk (Niang Diop et al, 2010)and in Bargny, about 300 buildings housing almost 2250 dwellers are estimated to be impacted (World Bank, 2014). Communities lying along sand spit of Langue de Barbarie in Saint-Louis area, are experiencing huge storm surges and 52 families were displaced or relocated in 2010 (Kane 2010). The total cost due to the damage caused by inundation is estimated about USD1,636 billion while the cost due to coastal erosion will reach USD24.6 million (USAID, 2012).

Adaptation Strategies in coastal communities

Nigerian and Senegal coasts are very strategic areas because of the relevant benefits they provide for their countries and resident populations. But, in both countries, the impacts of climate change have been observed and felt for decades by coastal communities but now require more concerted actions to arrest the situation.

For now, affected communities have developed some ingenuous local strategies to fight their problems. For the Nigeria's Niger Delta coastal communities, common adaptation techniques employed include: i) use of *Sand Bags* along the shore; ii) river embankments; iii) construction of canals and channels; iv) building of dwellings on stilts/raised platforms to prevent homes from being washed away by flood and rising sea water; and v) government interventions in form of construction of engineered walls/shore protection embankments.

Similar preventive and adaptation measures but broader in scope are employed in Senegal: i) Sand-Bags fortified with nets to bind together and improve resistance; ii) use of half-buried tires or logs of wood reinforced with sand bags; iii) use of cement blocks by households as walls to protect dwellings against waves and erosion; iv) use of empty sea shells (usually oysters) dumped and accumulated over time; vi) Mangroves reforestation campaigns as natural barriers against storm surges; and vii) high engineering projects of huge structural nature - Dykes, breakwaters, and walls.

CONCLUSION

Coastal zones are highly vulnerable to climate change and its impact. Settlements are eroded, flooded/inundated, and salinization of aquifers which highly impede livelihoods, quality of life and community development. The coastal communities have developed local but temporary adaptation strategies to protect their settlements/dwellings and sustain their livelihoods against climate change related disasters. Government interventions involve huge engineering construction of seawalls and dykes. Nigeria's Niger Delta coastal communities have long adapted to dealing with flood while the Senegalese coastal communities are more attuned to dealing with coastal erosion/regression. But better adaptation strategies to reduce the vulnerabilities of these coastal communities to climate change is now canvassed, requiring actions that must be undertaken from the Community level to the Regional, National and International levels.

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