

Flood Vulnerability Assessment of Niger Delta States Relative to 2012 Flood Disaster in Nigeria

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Abstract Flooding is recorded every year in all the states along the River Niger and its tributaries, frequently causing disasters but the magnitude of 2012 flood caught the country napping. Moreover, two thirds of Bayelsa State and Delta State are inundated by devastating floods for at least a quarter of each year. Communities along the River Niger-Benue system are also under threat of constant flooding. Vulnerability assessment which many regions of the world have commenced becomes the way forward. This paper investigates the vulnerability of communities in three of the Niger Delta States and found out that a total of 1,110 towns are at risk of being inundated and about 7,120,028 people risk displacement. The paper evolves a well thought-out mitigation and adaptation measures which can be adopted by all stake holders including Governments at all tiers, community leaders and the vulnerable population.

Keywords: vulnerability, flooding, population, displacement, Niger Delta, sea level rise, Risk, environment

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1. Background

Floods are common natural disaster occurring in most parts of the world resulting in damages and loss of human life and livelihood sources, deterioration of environment and retardation to development (Wizor and Week, 2014). In tropical regions, floods of high magnitude have resulted in serious consequences caused by heavy rainstorms, hurricanes, snow melt and dam failures (Jeb and Aggarwal, 2008). In terms of vulnerability, Asia and the Pacific regions has had its fair share affecting the social and economic stability of the countries in the region, some of the worst case scenarios for example include China when in 1998 it suffered a devastating flood that affected 223 million people, killing 3,004 people and rendering 15 million people homeless. The economic loss was over US\$ 23 billion for that year. Cambodia and Vietnam suffered similar fate in year 2000, when 428 people were reported killed and an estimated economic loss of over US\$250 million. Devastating floods have also occurred in India, Pakistan, Korea, Australia, USA, and Bangladesh with their agricultural field, residential areas, and sources of livelihood badly affected in the last 10 years.

In Nigeria flood occurrence is not new. There have been incidences of flooding (Flash flood, urban floods, channel floods, back-swamp floods, coastal inundation etc) in the last 40 years with its consequences but the flood of 2012 took the nation by surprise. The 2012 flood

according to the National Emergency Management Agency (NEMA) affected 30 of the 36 States of Nigeria, 7 million people were affected in these States, 597, 476 houses were destroyed, 2.3 million displaced and 363 death were reported with large track of farmland and other means of livelihood destroyed, animals and other biodiversity were also gravely impacted upon. The country also lost about 500,000 barrels of crude oil output per day due to the severe flooding. In terms of economic loss, the Punch Newspaper of May, 27th 2013 reported that The comprehensive Post Disaster Needs Assessment conducted from November 2012 to March 2013 with the support of the World Bank and Global Facility for Disaster Reduction and Recovery, United Nations, Development partners and relevant Ministries, Departments and Agencies put the estimated total value of infrastructure, physical and durable assets destroyed at \$9.6bn. The total value of losses across all sectors of economic activity was estimated at \$7.3bn. The combined value of these damages and losses was put at US\$16.9bn. No flood in the history of Nigeria has been so devastating. The severe effects of flooding are linked to poverty, lack of knowledge, low livelihood sources, lack of insurance, weak institutions and problems with emergency response and early warning preparation.

In addition to the challenges above is the threat from rising sea-levels with a global average of 3.2mm rise in sea level rise, Nigeria with over 853 km (530mi) of coastline with extensive low-lying areas, and heavily industrialized are more prone to flooding than ever before

and large numbers of people have become vulnerable to this threat and face being evacuated in the face of extreme flood events either astronomical or meteorological. In the 2012 flood event, more than half a million were evacuated as internally displaced persons from the Nigeria Delta Region which was submerged. The most recent and extensive studies of sea-level rise predicts that by 2100 there will have been a 1400mm rise in sea-levels; this would displace about 30 million people and lead to the permanent loss and abandonment of about one fifth of the land, most notably in the delta regions of the world. The event of 2012 is a sad reminder of the lack of vulnerability assessment and of preparedness for emergency response, there was no coordinated efforts in the evacuation of people to safe camps/settlement. Living conditions in these settlements were in many cases appalling: they were crowded and unsanitary, food and water were in short supply, insecurity was high, and livelihood opportunities were generally lacking, the challenges were enormous.

In recent years, concerns about the adverse effects of climate change and flooding have increased interests in vulnerability assessment and mapping because of its attendant problem in increasing internally displaced population (Udoh, J.C. and Aniefiok N, 2014). Vulnerability is described as the degree to which people and economic activity are susceptible to, and, unable to cope when exposed to the adverse effects of climate change (e.g. flooding). It is a function of the character, magnitude, and magnitude of flooding and variation to which a system is exposed, the sensitivity and adaptive capacity of that system (Wyman, 1998). Focus on vulnerability in recent has come because of the growing recognition of the need to prepare for and manage the effect of climate change induced disaster such as flooding (Wisner *et al.*, 2003). The Fourth Assessment Report of the IPCC has identified Africa as the most vulnerable continent to climate change - a situation compounded by a combination of low adaptive capacity and multiple stresses (O'Brien, 2008; Schneider 2007).

The focus of this paper is to assess the vulnerability of the Niger Delta (using three key States namely Delta, Bayelsa and Rivers, being the worst hit during the 2012 flood disaster) to climate change in terms of flood events and the likely effect on the displacement of the affected population, the implication and the strategies to adopt to minimize secondary hazards (health impacts, social conflicts, poverty and post traumatic stress disorders. etc) associated with IDF camps.

2. The Study Area

The Niger Delta is the largest in Africa and third in the world. It is a geographical area covering about 70,000km². It represents about 12% of Nigeria's total surface area. It lies in the southerly part of Nigeria stretching from the Nigeria- Cameroun boundary in the East to Ondo State in the West. The area is bounded in the north by Enugu, Ebonyi, Anambra, Kogi and Ekiti States, while the Atlantic coast forms the southern boundary. The whole area is criss-crossed by dense networks of rivulets, streams, creeks and rivers and consists of several ecological zones, the sandy coastal ridge barrier, brackish

and saline mangrove, seasonal and permanent fresh water swamp forest and low land rain forest.

The region comprises nine of Nigeria's constituent states; the population as at 2006 was over 28 million. The pattern of settlement in the Niger Delta Region is largely determined by the availability of dry land and the nature of the terrain. Low relief and poor ground drainage are the primary factors responsible for the low number of large settlements in the region. The larger settlements are found in the interior parts of the Delta, which has better drainage conditions and accessibility. In the mangrove swamp zone, the main settlements such as Port Harcourt, Sapele, Ughelli, and Warri, have developed on islands of dry land that intersperse the zone with settlements being located at the head of the navigable limits of the coastal rivers or estuaries. In total, there are 13,329 settlements in the Niger Delta Region. The average population of 13,231 of these (99% of the total) falls below 20,000 people. Settlements of fewer than 5,000 inhabitants constitute nearly 94% of the total number of settlements and only 98 settlements, that is less than 1% of the settlements, can be truly regarded as urban centres according to their population sizes, the predominant settlement type in the Niger Delta is small and scattered hamlets. The vast majority of settlements comprise largely rural communities in dispersed village settlements

The typical community consists of compounds, which are closely spaced groups of small buildings housing 50 to 500 people, most of whom are fisher folks or farmers. There are also larger settlements, which are usually separated from other clusters of rural residences by their outer rotational farmlands, oil palm or rubber plantation, bush, or stretches of secondary forest. At the time of the 1991 Census the total population for the Niger Delta Region was about 20 million, or about 23% of Nigeria's total population. Projections by Government Departments using an annual growth rate ranging between 2.0% and 2.9%, indicate that the total population in 2005 will be nearly 27million.

However the Niger Delta Master Plan Baseline sample survey, conducted in 2003, shows that the average annual rate of population growth in most communities, based on the household fertility and mortality data, is about 3.1%. This would mean that in 2004 the population of the Niger Delta Region Amounts to about 30 million. Projected to 2015, it is expected therefore that population will increase to between 41.5m and 48 million, depending on the growth rates applied (that is a high growth rate: 3.1%: or a low growth rate using a declining rate of between: 2.9 % - 2.5%).

3. Materials and Method

Administrative and topographic maps of Nigeria showing the Niger Delta State (scale 1:1000, 000) were acquired. These maps served as base map. Then from the Regional Centre for Training in Aerospace Survey (RECTAS) Ile Ife, Osun State; SPOT 5 satellite image with a resolution of 10m and Shuttle Radar Topography Mission (SRTM) data with a resolution of 30m were acquired. The base maps (which were in analogue form) were scanned and converted into raster image and imputed into ArcGIS version 9.3 geo-referenced to a universal

transverse Mercator (UTM) grid to allow compatibility and comparison with other data sets to enable the extraction of Delta, Bayelsa and Rivers States from the rest of Nigeria and their various drainage networks. Various data enhancement techniques image enhancement operations were carried out for better visual interpretation, to reduce noise distortion in the image. A buffer was created, then a spatial query initiated, the drainage system

maps were overlaid on settlement and buffer and spatial query was ran for communities at risk which are 500m away from water bodies, 1000m away from water bodies and 1,500m away from water bodies. The maps and imageries produced are presented below.

4. Results and Discussion

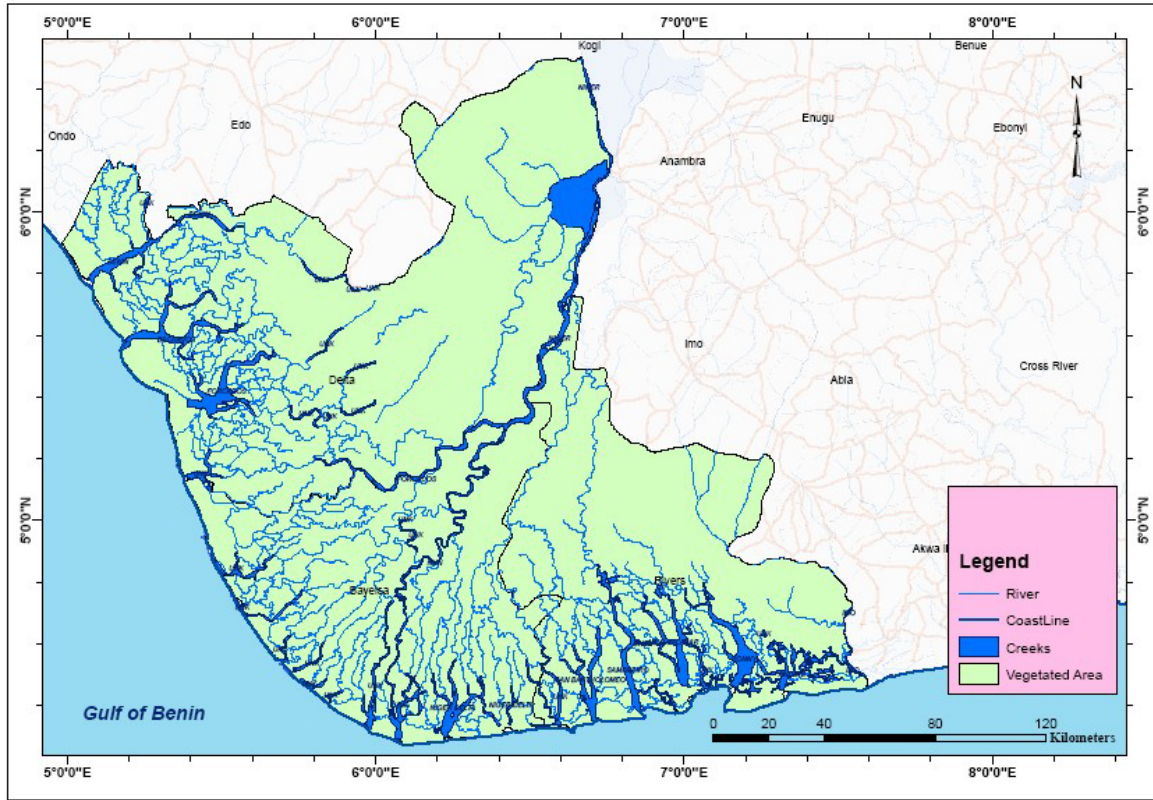


Figure 1. Showing the network of water bodies (rivulets, streams, rivers, creeks and the Atlantic Coast)

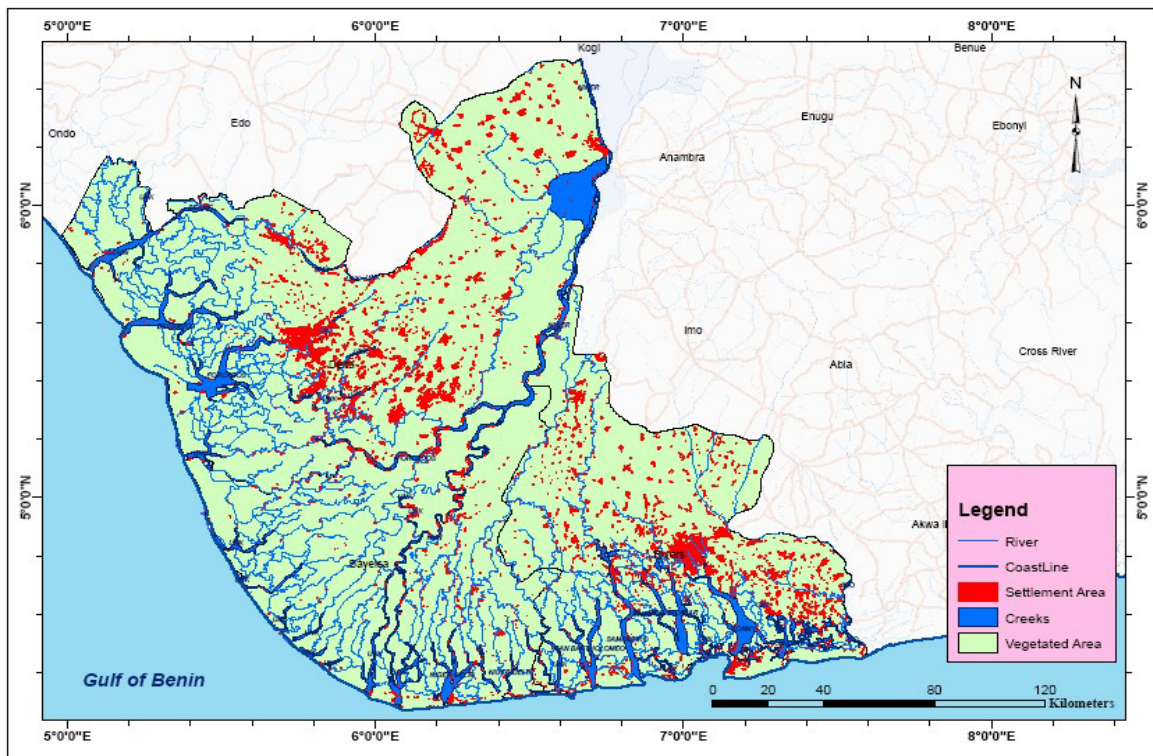


Figure 2. Map of Niger Delta Region showing water bodies and Settlements

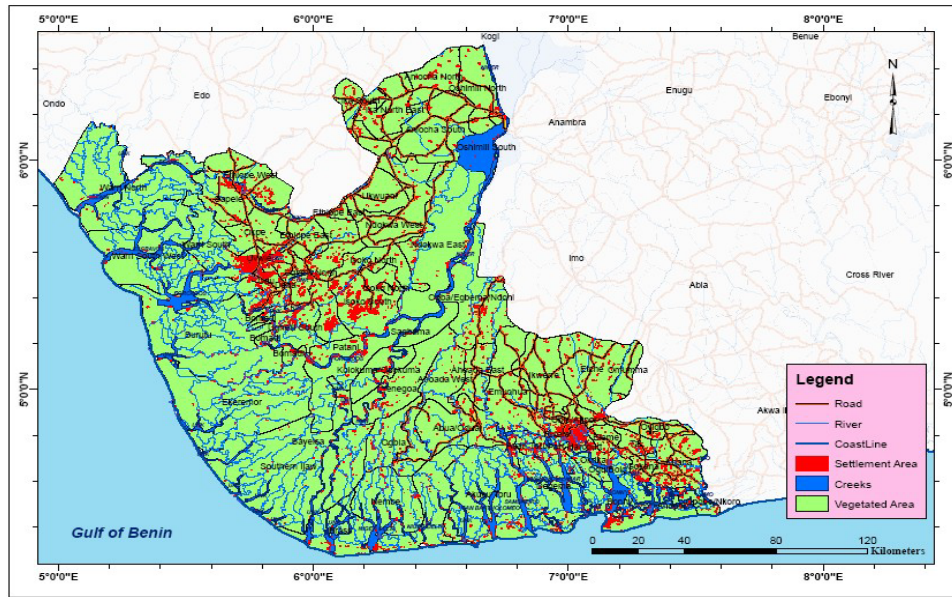


Figure 3. Map of Niger Delta showing networks of drainage systems, road networks and settlement

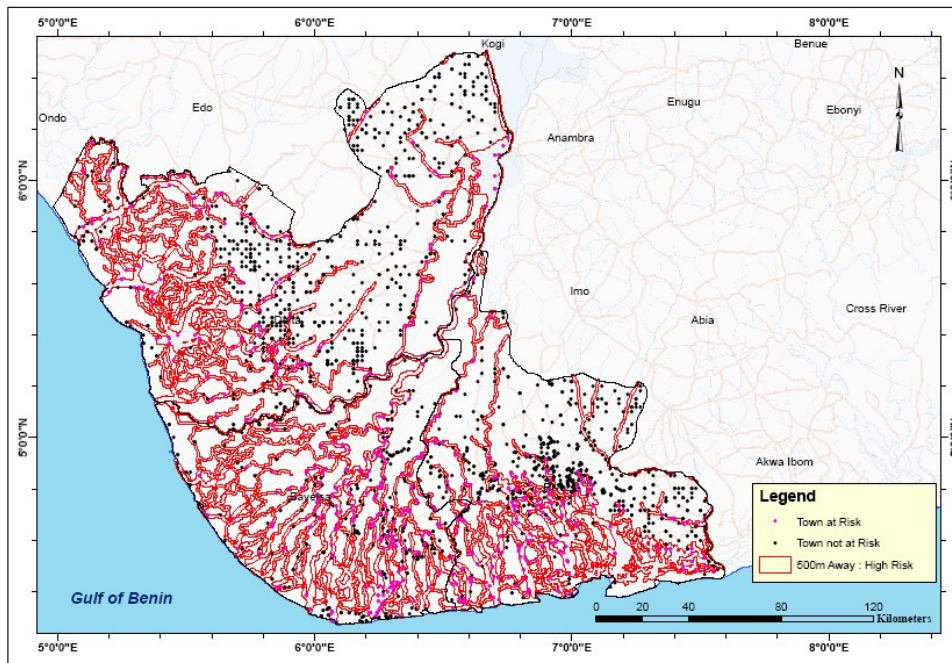


Figure 4. Map showing towns that can be flooded within 500m of the water bodies

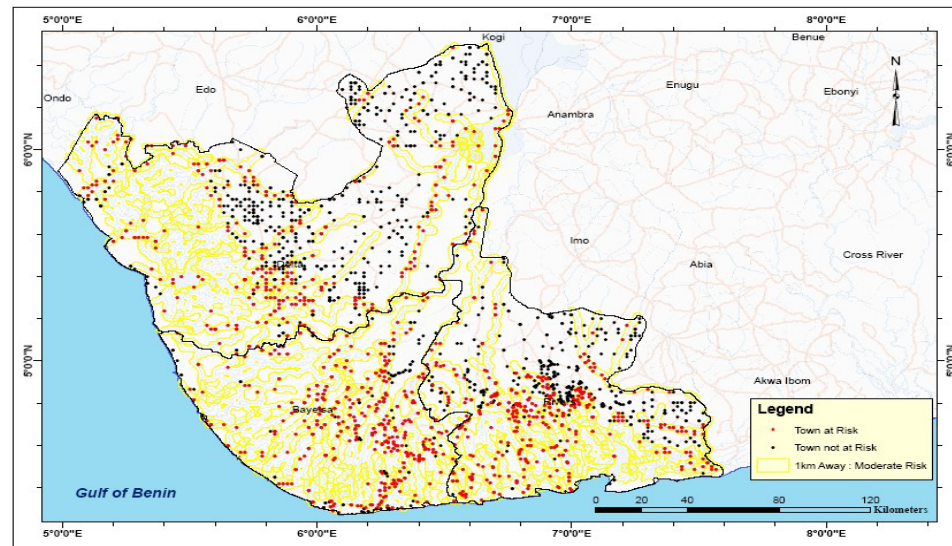


Figure 5. Map showing Communities at risk of flood within a 1000m from River systems

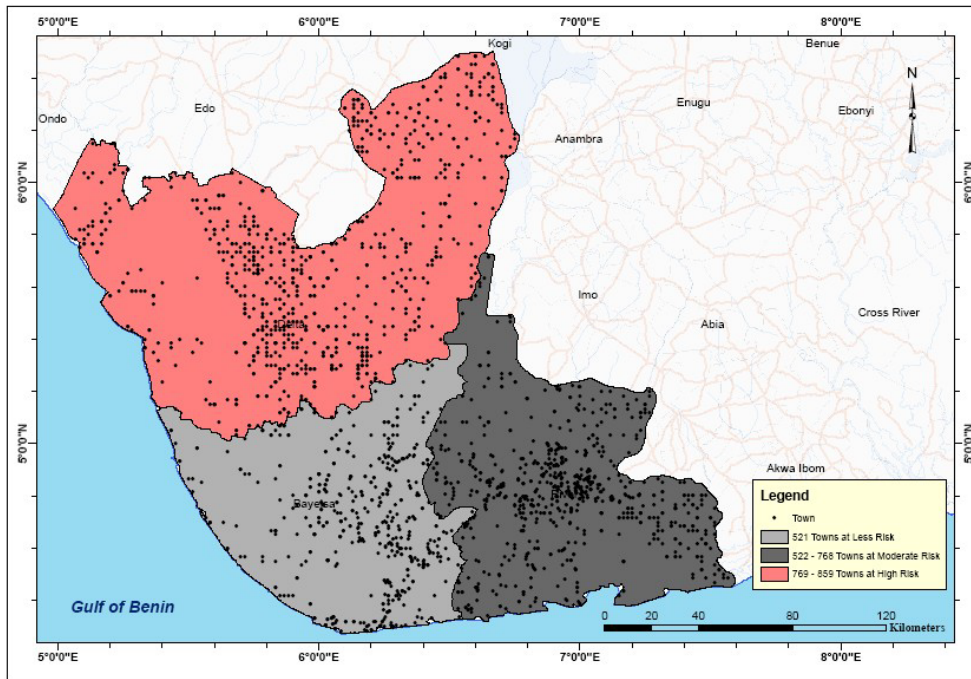


Figure 6. Flood Prone Communities in Delta, Bayelsa and Rivers States

From the Figure 4, Figure 5, and Figure 6 Table 1 and Table 2 are generated to give a summary of communities at risk.

Table 1. Number of Community at Risk of Flooding from different Distance from River Body

States	Number of Rivers identified	No of Towns Likely to be affected	1.5km Away (Less Risk)	1km Away (Moderate Risk)	500m (High Risk Towns)	Average risk/Town
Bayelsa	143	527	344	268	87	233.0
Delta	240	859	330	219	101	216.7
Rivers	197	762	436	307	56	266.3
Total	580	2148	1110	794	244	716.0

Table 2. Summary of Communities at High, Moderate & Low Risk of Floods

Risk Factors	No of Towns	Ratio	%
1.5km Away: Less Risk	1110	0.518	51.69
1km Away: Moderate Risk	794	0.369	36.96
500m Away: High Risk	244	0.113	11.35
Total	2148	1	100

Table 3. Population Figures and Growth Rate Based on 2006 National Census

States	Growth Rate	2011	2012	2013	2014	2015
Bayelsa	2.9	1,984,825	2,043,227	2,103,349	2,164,239	2,228,950
Delta	3.2	4,864,762	5,022,952	5,186,286	5,345,931	5,529,060
Rivers	3.4	6,214,664	6,429,596	6,651,961	6,882,016	7,120,028

Source: Fed Rep of Nigeria Gazethe Vol. 94 Jan, 2007 and Vol 96, Feb 2009.

4.1. Flood Occurrence

The Niger Delta is the recipient of over 90% of all the water the Niger-Benue River systems and 100% of all water from streams rising in the Delta Region. It is also bordered by the Atlantic Ocean, the terrain is flat and settlements are along the river systems so the region is exposed to high vulnerability of flood

From Figure 1 - Figure 6, Table 1 was generated and it shows that 580 rivers are prone to flooding and are likely to affect 2,148 towns. (1,110 towns can be flooded when water flows up to 1.5km. At 1000m, 794 communities will be flooded and at 500m away 244 communities will be

flooded. Table 1 furthered showed that Delta State have the highest communities at risk when water overflow their banks to about 500m. This is because the State has the highest number of rivers and many communities lie at the banks of these rivers. In Delta State, Ethiopie river, River Niger and its other tributaries, Benin River, Escravos River, River Forcados which splits into Okumasi River, Opkara River, Edor River, and Warri River as well as Ramos River which bifurcates into Enikorogha creek transverse the entire landscape of Delta State causing it to flood the State especially Asaba, Warri, Aniocha North and South, Oshimili North and South, Burutu, Patani, Bomadi, Forcados etc (Figure 7).

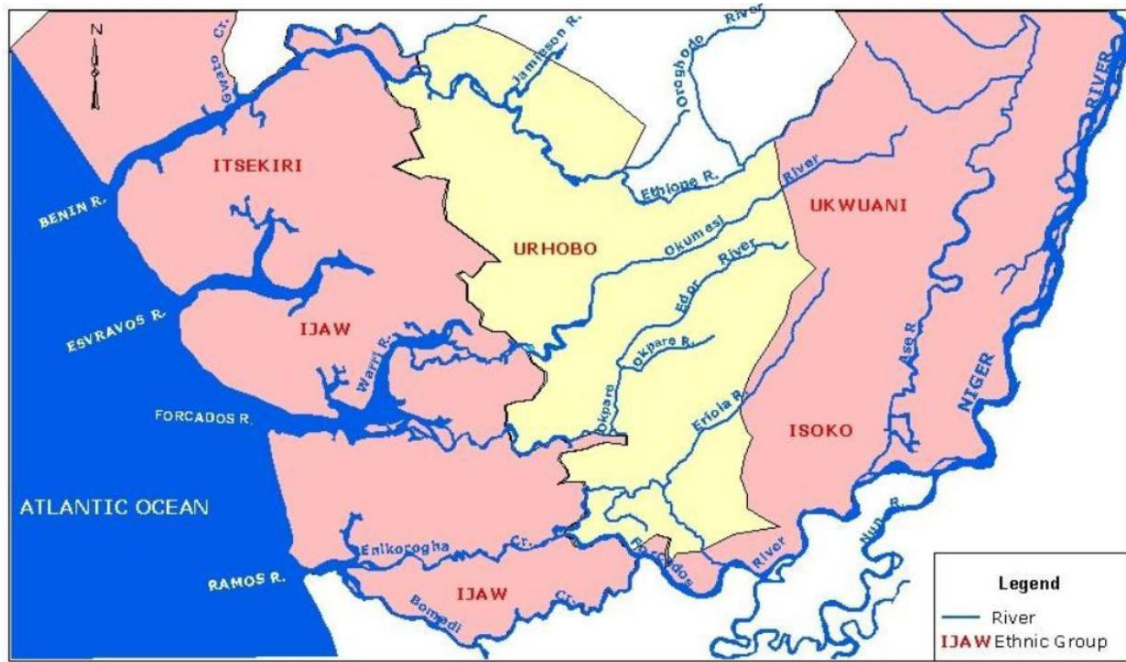


Figure 7. Map of Delta State showing the drainage systems

For Bayelsa State, 87 communities are at high risk this is because of the many distributaries of the Niger-Benue systems in the State, furthermore the Orashi River though not a tributary of the Niger-Benue systems, also over

flows its banks and drains part of Bayelsa where it bifurcate with Kolo Creek resulting in the floodings of Yenagoa, Opuama, Ovom, Opolo, Biogbolo Akaba, Otueke, Azikoro, Yenezue, Ekeke, Amarata, Onopa and environs.

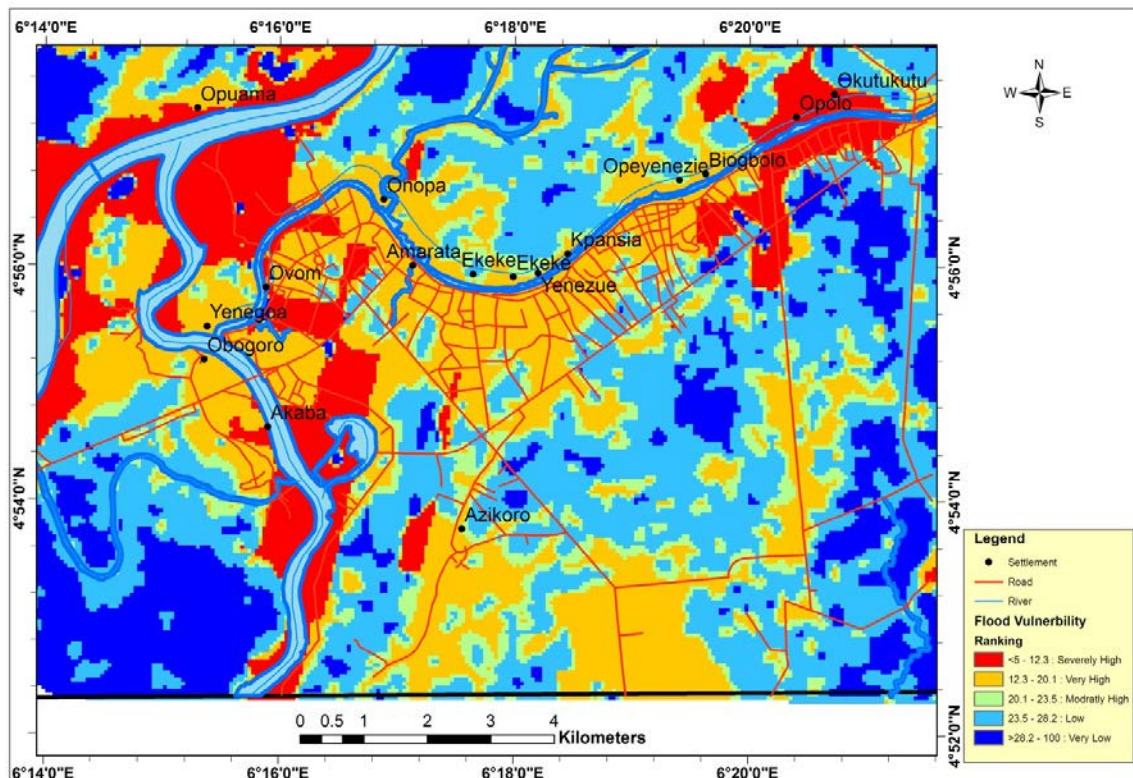


Figure 8. Flood vulnerability ranking for Yenagoa and Environs

4.2. Implication of Population Displacement

The implication of River overflowing their banks and flooding communities is high. According to (the International Federation of Red Cross and Red Crescent) the most vulnerable persons in times of disaster are the

children, women, physical challenged and the aged. Based on this assertion and from the National Census figures the following groups of persons are at risk of flood and likely to be displaced. Children, especially young children, are in a stage of rapid development and are less well equipped on many fronts to deal with deprivation and stress. Their more rapid metabolisms, immature organs and nervous

systems, developing cognition, limited experience and behavioural characteristics all contribute to their vulnerability.

Their exposure to various risks is also more likely than with adults to have long-term repercussions

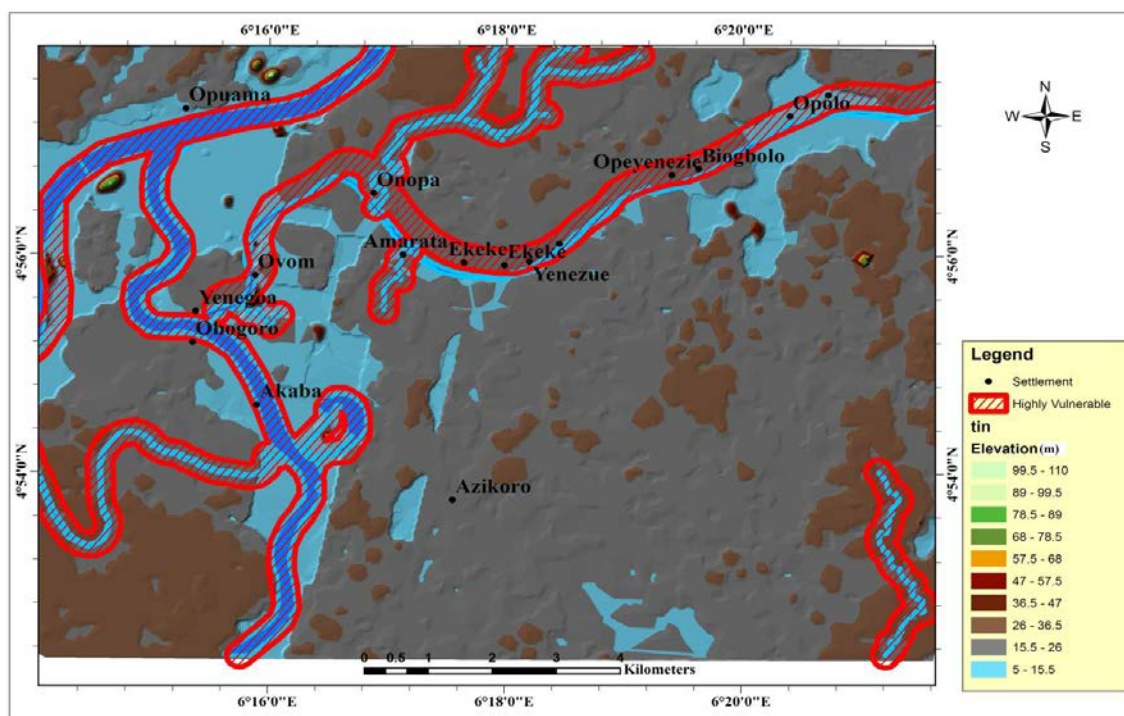


Figure 9. Showing Highly vulnerable Areas of Yenagoa and Environs

Table 4. Population at Risk in case of River Flood in Delta, Bayelsa and Rivers States

States	Total population @ Risk	Ages 0 – 14		Ages 60 – 79		Ages 80 & above	
		M	F	M	F	M	F
Delta State	1,785,180	79,5385	743,228	104,994	88,348	26,668	25,839
Bayelsa State	737,552	338,063	308,603	43,370	30,370	10,343	6,793
Rivers State	2,138,111	973696	898,256	125,780	90,337	28,773	21,239
Total	4,660,843	2,107,144	1,950,087	274,144	209,055	65,784	53,871

From Table 4, over four million people in three States of the Niger Delta are highly vulnerable to the impacts of flooding. Of this figure, over one million are female between the ages of 0 – 14 years, while the aged constitute about fifty three thousand, eight hundred and seventy-one female and these are conservative estimates.

Strategies to Adopt to cope with an outbreak of flood event and Population Displacement

From Table 4, the likely persons to be affected in the event of flood in three out of the nine Niger Delta State are about 4,660,843 comprising children and the aged. Planning to evacuate this large size is a prerequisite. Questions to ask include where the camps should be located, what is the evacuation method to be adopted, the camp facilities, and social order in the camps. Other questions to address include what are the social and psychological apparatus to address in the already traumatized internally displaced persons.

For the purpose of planning/evacuation/erection of camps, government should consider areas that has elevation of 110m. Planned relocation should be a major component of national strategies for disaster risk management, climate change, and development, says a recent report by the UN High Commissioner for Refugees (UNHCR). Key components of planned relocation, according to UNHCR, include a state-led, last-resort process to move populations in the face of potential hazards, including natural disasters as a result of climate

change. Significantly, UNHCR says planned relocation should be done in a way that “safeguards civil, political, cultural, social, and economic rights of individuals and communities.” The report provides recommendations for implementing effective planned relocation strategies, including developing guidance documents for governments, ensuring that decision-makers are held accountable to affected populations, and providing sufficient funding to operationalize, monitor, and evaluate relocation programs.

The International Panel on Climate Change (IPCC) WGII Fourth Assessment Report in 2007 is fairly typical in this respect, with perhaps the most profound statement on adaptation stating simply that “A wide array of adaptation options is available, but more extensive adaptation than is currently occurring is required to reduce vulnerability to future climate change. There are barriers, limits and costs, but these are not fully understood (Mimura et al., 2007) Issue of forced displacement caused by flooding, and even less, to the particular housing, land and property (HLP) dimensions of this form of displacement is considered very serious business. The need for sustainable and comprehensive resettlement - Because the mere provision of a new house is never sufficient to restore the lives and livelihoods lost as a result of involuntary resettlement, the comprehensive needs of those to be resettled should be structurally built into the plans (Leckie, no date) Provide displaced persons,

host communities and local populations in conflict-affected areas with life-saving protection and humanitarian assistance in the form of emergency shelter, non-food items (NFIs), water and hygiene kits, health care, nutrition, agricultural inputs and food security.

From previous experiences, many health infrastructure and access to health services were disrupted due to lack of planning. Where facilities exist and are functioning, most have been inundated with the influx of the displaced. Medical supplies Routine vaccination programmes were in short supply or inefficiently managed. Due to the complexity of the evolving crisis, it is imperative to maintain a smooth flow of information to maintain adequate stocks, identify transport needs so goods can be delivered in a timely manner, and negotiate access to affected communities. A coordination and information management mechanism will focus on identifying and maintaining supply chain corridors and strategically placed storage facilities. The Logistics Cluster will also provide transport and storage services for partners involved in the humanitarian response which either have no presence on the ground or have limited logistics capacity.

5. Conclusion

There is widespread agreement that flood damages are enormous and it is therefore necessary to plan ahead because the Niger Delta is the recipient of all waters of the River Niger-Benue systems and other Drainage systems within the sub region is vulnerable to flood. Planning should include those identified vulnerable communities and effective means of communication opened for adequate dissemination of information without bottlenecks. The time should be now to put in place an effective measure to curtail an impending danger.

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