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Research Paper

Climate change, peasantry and rural food production decline in the Niger Delta Region: A case of the 2012 flood disaster

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Abstract. The study examines peasantry and rural food crop production decline in the Niger Delta region of Nigeria following the 2012 flood disaster. It explored a fifteen year scenario and argues that the peasants who are the rural cultivators experienced recent decline in their food crop production resulting from the flood disaster. Using the production function model, it hypothesized that flooding negatively affected rural food crop production which had implications on the peasants whose subsistence relied on their production. The paper further benchmarked the primary and secondary data collated from households and farmlands in the two states in the region purposively selected for the study namely; Bayelsa and Delta to determine the effects of the flood on both the peasant households and their farmlands and observed that peasants in non-flood impacted areas are comparatively well off in food crop production than those in flood prone areas. The study calls for urgent policy discourse to mitigate against climate change vulnerability.

Keywords: Climate change, coastal region, peasantry, food crop, development, Niger Delta, Nigeria.

INTRODUCTION

The post global food price crisis of the 2007–2008 has given a novel relevance to food crop production across the globe. This twist on food crop production resonates both in the global north and south, as scholars look at models for sustainable food production in an increasingly globalizing world.

Empirical and theoretical debates in the developing countries attest to the under utilization of food production resources (Newton, 1992; FAO, 2012). However, a central challenge from recent study has been the ineluctable issues of climate change vulnerability and associated impacts on food crop production.

The Intergovernmental Panel on Climate Change (IPCC), a body set up in 1988 by the World Meteorological Organization (WMO) and the United Nations Environmental Program (UNEP 2011) to provide authoritative information about climate change phenomenon, produced enough evidence in their first report in 1990 to show that climate change is a reality. One of such vulnerabilities is flood disaster in the Niger Delta region of Nigeria. Floods are known to cause substantial damage through degradation of soil, destruction of crops, property, human life and livestock.

According to a report quantifying the scale of the flooding, “the usual large floods were predicted by the Nigerian Meteorological Agency (NIMET). Government at all levels failed to act on time resulting to the worst humanitarian crisis in Nigeria since the end of the civil war in 1967 to 1970. Communities in a record 30% of the country’s landmass were submerged by the floods affecting an estimated 7.7 million persons. Well over 300 people were killed while more than two million people were displaced from their homes, farmlands, and homes were inundated in 30 of the 36 states of Nigeria” (Social Action Report, 2012).

Where as a vast intellectual discourse has been launched

on climate change in Europe and America in the 1990s with models which include ecological and meteorological perspectives (European Environmental Agency, 1990; Stern, 2006; US Global Change Research Programme, 1989; Andreadis and Lettenmaier, 2006; Klotzbach, 2006). It was only in 2011 that the challenges Africa faces as a result of climate change were discussed during the Conference of Parties of the UN Framework Convention on Climate Change held in Durban, South Africa in December 2011, preceded by a meeting of the Intergovernmental Panel on Climate Change (IPCC) in Kampala, Uganda, in November 2011 which emphasised the need for disaster management in the event of floods and related climate change vulnerabilities. However, results have been minimal.

There is no clear empirical validation of flood disaster in the volatile Niger Delta region of Nigeria like most coastal regions in the periphery societies inundated annually. Although oil exploration and environmental degradation in the Niger Delta have been explored at various levels (Loolo, 1981; Ngemutu-Roberts, 1994; Welch, 1995; Osaghae, 1995b; Boele, 1995; Crow, 1995; Naanen, 1995; Birnbaum, 1995; Cessou and Fatunde, 1995; Kretzman, 1995; Olukoshi, 1995; Cayford, 1996; CLO, 1996; Rowell, 1996; Saro-Wiwa, 1992, 1993, Robinson, 1997; Skogley, 1997; Ibeanu, 1997, 1999; Na' Allah, 1998; Obi, 1997a, 1999 all cited in Obi, 2001), few are discussing the decline in peasant food crop production arising from flooding in the region. There are perhaps a handful of studies discussing contemporary displacement, migration, destruction of human lives, livestock, farmlands and impoverishment of the peasants as a result of massive flooding.

The dearth of studies on the inundation of the region does not match the actual importance of the oil-rich Niger Delta region nor address the magnitude of problems and issues on environmental disaster and management. Neither does the limited literature on the subject reflect the importance of the peasants whose subsistence relies on tilling the soil.

On the other hand, peasant food crop production plays a key role in world economy today. In about a dozen of middle and low income countries, it has accounted for more than 35% of the GDP and more than 70% of their total merchandizing exports. In many other developing countries such as Sub Saharan Africa (SSA), peasant food crop production constitute a substantial share and a leading position in their commodity exports and continues to be major economic resource as most of the economies are primary producers and largely agrarian. Thus, this attempt to create linkages between flooding and peasant food crop production decline is almost an unexplored terrain. Not a few studies are discussing the hydro-meteorological and related consequences of flooding in the region.

At the global level, Wise and Murphy (2012) in their study; "Resolving the Food Crisis: Assessing Global Policy Reforms Since 2007" at the post global economic recession, observed that the recent crisis has been a catalyst for important policy reforms, but they concluded that governments had yet to address its underlying causes. They warned that the international community was avoiding deeper structural reforms, leaving the world vulnerable to further crisis. The third devastating price spike in five years, triggered by the U.S. drought, is now the case in point".

In recent studies, attention of development experts has been increasingly drawn to rural societies of the so-called "peasant" type (Wolf, 1966; Saul and Woods, 1971; Gamst, 1974; Childs, 1978; Alavi and Shanin, 2003; Barkin, 2004; Scott, 2008; Akram-Lodhi and Cristobal, 2009). Concurrent with this interest in peasant societies, there has emerged a growing body of theoretical literature regarding the efficacy of the term "peasant". Krober (1948) made a rather cursory reference to "peasants", noting that Peasants are definitely rural - yet live in relation to market towns; they form a class segment of a larger population which usually contains urban centres, sometimes metropolitan capitals.

Several conceptual criteria have been used to explore a peasant society; most fashionable has been the neo Marxist notion of their asymmetrical position in the relations of production. Perhaps notable is the definition offered by Teodore Shanin which characterizes peasants as "subsistent producers" with the help of "family members" and "small implements" (Shanin, 1973) Equally relevant is Eric Wolf's view that peasants are "rural cultivators" (Wolf, 1969).

Moreover, the percentage of rural poor continues to be higher than urban poor: three-quarters of the world's poor today live and work in the countryside. Poverty is often associated with hunger, and in 2008 there were an estimated one billion hungry people in the world (FAO, 2008). At the height of the 2007-2008 food price crisis, the FAO announced that in order to meet the world's growing needs, food production would have to double by 2050, with the required increase mainly in developing countries where the majority of the world's rural poor live, and where 95% of the population increase during this period is expected to occur (FAO, 2008).

The need to meet this demand among the developing countries makes the study of peasant food crop production very important. In Niger Delta region, peasant production has been essential in the socio-economic wellbeing of the people. There are wide varieties of peasant production in the region such as fish, food crop production, vegetables, animal husbandry etc. However, peasant productivity has been on the decline at the post 2012 flood disaster in the region which we seek to substantially demonstrate in this study. For instance, the over flown river banks pose challenge to fishing. While on the other hand, the soil surface run off and its nutrients have been affected with growing flooding which affects soil quality and food production. Both Jaenicke and Lengnick (1999), and Andrews and Carroll (2001) have

agreed that soil quality is an important factor in explaining farm productivity. Although farm size, labour and other inputs such as fertilizer and mechanization are important factors to be considered in any explanation of variability in farm productivity, soil quality is indubitably the most significant (Bhalla and Roy, 1988; Das, 2013). Soil quality is also understood to play a role in ensuring the quality of groundwater and surface water (Doran and Parkin, 1994; Das, 2013).

In floodplains across the world, farmers have been using floods as a traditional mechanism to upgrade soil quality because they enable silt deposition (D'Souza, 2006; Mishra, 2001; Dixit, 2009; Das, 2013). Although floods are known to cause substantial damage through destruction of standing crops, property, human life and livestock, among the positive impacts of floods is the deposition of alluvium (or silt) which replenishes the productivity of soil. However, the magnitude of problems associated with flooding and the peasants that can have long term impacts on general food production is a less talked about phenomenon.

In Delta State, the flood affected eighteen out of the twenty five Local Government Areas (LGAs) in the State; while in *Bayelsa* six out of its eight Local Government Areas were affected (Social Action Report, 2012).

This study focuses on flooding and creates linkages with other vulnerability drivers such as food production decline, displacement, migration, poverty etc.

OBJECTIVES OF THE STUDY

The objectives of this study are:

(i) To explore the effects of flooding on peasant food crop production in the Niger Delta region.
(ii) To identify the level of governments' response to natural disaster and the plights of the rural poor in the Niger Delta region of Nigeria.
(iii) To provide policy discourse on mainstreaming climate change vulnerability and mitigation into national and international development planning among the poor societies.
(iv) To interrogate and establish innovative research trajectory in the fields of climate change vulnerability in the context of flooding and environmental sustainability discourse.
(v) To advocate for alternative mechanisms on improving peasant productivity for improved global food production and sustainable development.

RESEARCH METHODOLOGY

This study is a case analysis; it explored a fifteen year scenario which spans 1998 to 2012 to benchmark the incidence of flooding in the region. The case scenario under study is the most incendiary flood disaster in the Niger Delta region. Both primary and secondary data sources were used. The primary sources included direct interviews and questionnaires administered to literate peasant farmers and purposively select inundated households. Secondary data included reports by Nigeria Meteorological Agency (NIMET), National Emergency Management Agency (NEMA), Niger Delta Development Commission (NDDC), National Bureau on Statistics and local dailies.

A total of 355 samples were selected from Bayelsa and Delta States for our purposes. This is important because of the geographical location of both states in the coastline region and the enormity of flooding experienced in these areas. We collected the data in two stages. First, questionnaires were administered to purposively select literate peasant households within the area (1,099 households from both states). Of the 30 selected villages, we collected information on the mode of agricultural practices, agricultural land affected by flooding, the quality of pre and post flooding yield, flooding and land degradation, the displaced households and migration, implications for economic activities, and out-migration from the households.

Next, we randomly selected 30 farmlands from each of the 30 selected villages for the purpose of specifically obtaining more detailed information on the farmlands, size of land, mode of land tilling and cultivation practices, household characteristics, type of farm implements, farm input levels, access to credit, and extent of state support to peasant production etc.

The review which spans a ten year period as discussed (1998 to 2012) is important within the context of global clamour for environmental sustainability following the post 1992 UNCED summit and the Rio + 20 summit of 2012. More importantly, it encapsulates the period the World Meteorological Organization (WMO) and the United Nations Environmental Program (UNEP 2011) provided authoritative information about climate change phenomenon. It is also insightful on the triggers of global food production recession in 2008 and further captures pre and post 2012 flood disaster effects in the Niger Delta.

In exploring the empirics of peasant production, the study adopted the Production Function Approach which takes the environment as an input in the production of a marketable good (Vincent, 2011; Das, 2013) and estimates its potential positive or adverse effects (Kumar and Parikh, 1998; Das, 2013).

HISTORY OF STUDY AREA

The Niger Delta, the delta of the Niger River in Nigeria, is a densely populated region sometimes called the Oil Rivers because it was once a major producer of palm oil. The area was the British Oil Rivers Protectorate from

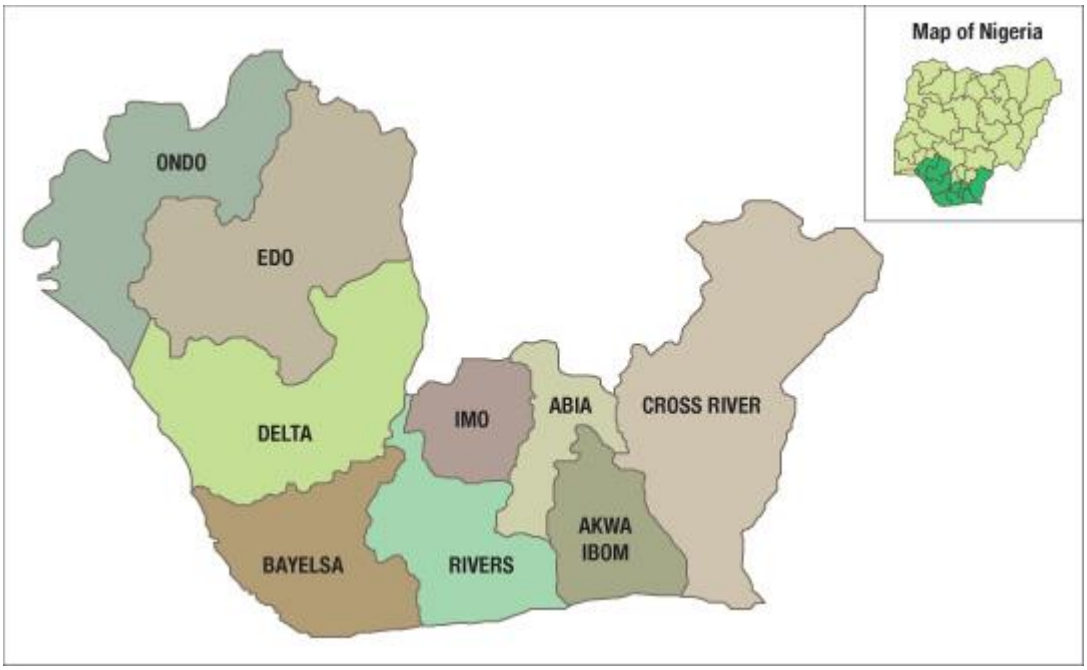

Figure 1. Map of Niger Delta Showing the States. Source: National Meteorological Agency.

1885 until 1893, when it was expanded and became the Niger Coast Protectorate. The Niger Delta, as now defined officially by the Nigerian Government, extends over about 75,000 km^2 and makes up 7.5% of Nigeria's land mass. Historically and cartographically, it consists of present day, Bayelsa, Delta, Rivers, Abia, Imo, Ondo, Edo, Akwa Ibom and Cross River States (Figure 1). The region had a total population of 31.2 million by 2006 Census. It has more than 40 ethnic groups including the Efik, Ibibio, Anang, Oron, Ijaw, Itsekiri, Urhobo, Kalabari and Igbo (Uyigue and Agho, 2007). The region is located in the southern part of Nigeria and bordered to the South by the Atlantic Ocean and to the East by Cameroun. The area is the 3rd largest wetland in the world. It has a coastline spread of over 540 km. All the oil and gas activities in Nigeria takes place in the Niger Delta. The area contributes over 80% of Nigeria's revenue (Uyigue and Agho, 2007). It has diverse vegetation belts from the largest rain forests in Nigeria to mangrove swamps, savannahs, mountains and waterfalls with rare animals, including endangered species and unusual plant families, making it one of the world's richest biodiversity centers.

RESEARCH HYPOTHESIS

In the light of our discourse, we hypothesize as follows:

$H_{1:}$ There is strong negative relationship between the presence of flood and peasant productivity.
$H_{2:}$ There is strong negative relationship between the impact of flood on productivity and additional independent variables such as soil quality, distance to the river, etc.

DATA ANALYSIS

Our estimates and regression analysis in this study adopts an approach in a similar study by Das (2013). It is common to study agricultural output variability with the help of a production function that links output with various inputs such as labour, capital, fertilizer, pesticide, irrigation, etc. Our data which derives from the administered questionnaires were further benchmarked with regression models based on the period already discussed, the locations included 30 villages from both states. The villages in Bayelsa include: *Yenagoa, Sagbama Ekeremor, Kolokuma/Opokuma, Ogbia, Southern Ijaw, Adagbabiri, Torugbene, Agbura, Aguadama, Epetiama, Oporoma, Ndoro, Tombia, Peremabiri, Elemebiri, Asamabiri*, others *are Angalabiri, Opokuma, Odi, Kaiama, Biseni, Gbarantonu, Tombia-Amassoma* while Delta State has *Umu-Ugbome, Umu-Uti, Afiankwo, Umuolu, Adiai, Utuoku, Oworubia, Wari-Irri and Onyah*. We conducted test and retest analysis and did not strictly delimit the study to the 30 villages for validity. 18 camps were opened in the state; three persons were reported to have lost their lives with over 400,000 persons displaced in 220 communities. Interactions with the refugees and displaced persons in the camp who shared their experiences, aided our research findings.

The Head of Public Relations of NEMA, revealed that 35,126 internally Displaced Persons (IDPs) were registered in six affected local government areas of Bayelsa State (Social Action Report, 2012).

It is now common also to include soil quality as an explanatory variable (Ekbom and Sterner, 2008; Das,

2013). While soil quality would be an environmental factor, the rest would be physical factors. Our main interest here is to examine the impact of flooding on productivity. Our underlying understanding is that productivity is a function of environmental and physical factors such as farmer effort.

The usual factors of production such as labour and fertilizer are likely to be endogenously determined and would give biased coefficients (Vincent, 2011; Das, 2013). Endogeneity emerges from the fact that farmers in flood impacted areas may either put extra labour to restore the soil or use less labour because they think it is not worth the effort. Thus, labour effort is correlated with flooding. We note further that, except manpower, other inputs in agriculture are not used in the study area. The uncertainty introduced by floods may compel peasant farmers to refrain from using inputs such as fertilizers which in turn affects agricultural yield.

The impact of different inputs on output is modelled as:

$Y = f$ (Land, Ph, Distance, HYV, Plot size)

Where
Y = Land output per hectare in kilograms
F = Proportion of flood in the farm lands
Ph = Deviation of pH factor from the ideal value of 7
Distance = Distance of farmlands from the river in meters
HYV = Adoption of HYV seeds (dummy variable)
Plotsize = Size of land plots in hectare

We attempt three different econometric specifications to test for the validity of the impact:

a) Linear version
$Yi = b0 + b1\ Xi + error$
b) Log-Log function in Cobb Douglas form
$Ln\ (Yi) = b0 + b1\ Ln\ (Xi) + b2\ Zi + error$
c) Tobit Model: In the 30 sampled farmlands, we recorded 26 farmlands with zero output in 2012. In order to ensure the validity of our OLS results, we also tested a Tobit model with left censoring at *0*. The standard Tobit model assumes that:

Let,
$Yi^* = b0 + b1Xi + error$
$y = 0\ if\ y^* < 0$
$y = y^*\ if\ y^* > 0$

The estimates presented here are tested for significance with robust standard errors in order to avoid problems of heteroskedasticity also in line with our hypothesis. For the Tobit results, we present only the marginal effects for comparison with the OLS results (Das, 2013; Social Action Report, 2012; Uyie and Agho, 2007).

Hypothesis 1: In which flood is regressed on peasant production yields, establishes the strong negative relationship between the presence of flood and productivity. This was noted both in *Asaba* areas in Delta State and *Amasoma* in Bayelsa State where peasant productivity dropped as crops and houses in the areas were submerged for a period of almost six months. Evidence provided by the Social Action Report (2012) supported this proposition, “Also migrant fishermen in both towns were kept out of their subsistence as the floodplains, vegetables and other staples such as cassava, yam, plantain, banana and cocoyam were equally submerged”.

Hypothesis 2: Estimates the impact of flood on productivity but add additional previously-discussed variables that may independently affect productivity. These include farmland size, soil quality, distance from river (or flood potential), displacement of the peasants etc. Large number of displaced farmers in *Ndokwa* East of Delta was found seeking refuge on the upland of *Ashaka* and *Utagba-Ogbe, Kwale* towns following the washing away of their communities, farmland and crops by flood from the River Niger and its tributary, *Ase* Creek. Our analysis revealed that additional negative impact of flooding was surface run off, soil logging and turbidity, where crops such as maize, okro and melon could rarely thrive.

RESULTS AND DISCUSSION

The data and findings showed 84% flood impact among the total cultivation area. The leasing of land for cultivation purposes and out-migration of family members in search of jobs from the households, which are indicators of distress (Nair and Ramanathan, 2007), have become significant phenomena in the study area. Results showed the absence of alternative cultivation mechanisms in nine of the 15 sample villages, this indicates that peasants are heavily dependent on their already existing modes of production mechanisms namely; family members and use of small farm implements.

Results show interstate and intra community impact variations**.** While the regression analysis in most of the specifications shows flood as significantly impacting on peasant production, the variation in output due to flooding is insufficient to explain the interstate and intra community-variation in output. It is important however to note that the yield in fish production which has been relatively high in previous years, dropped drastically during the period, the average yield of food crop production such as *Ugu* (green vegetable, dropped from 46 to 15% due to surface run off, other food crops such as cassava (*Manihot esculenta*), maize (*Zeamays*), melon (*Cucumismelo*), yam (*Dioscorea sp.*), plantain (*Plantagomajus*), banana (*Musa Spp.*) had low yields as several were ravaged by the flood. Sea foods such as fish, *Ngolo* (sea snail), periwinkle, crayfish, crabs etc. were in decline. In the relatively, low flood impacted

areas such as the upland areas like *Ikwerre* and *Eleme* in Rivers State, for instance, the average yield remained higher. Reports on the incidence and effects of sea level rise according to the IPCC (1990), working with records over the last 100 years, have shown that a strong correlation exist between greenhouse gases emission and climate change and between global temperature and sea level rise.

We discovered that for every unit increase in flooding concentration, peasant production per hectare decreases by 2.36 to 6.39 kg. This affected rice (*Oryza sativa*), cassava (*Manihot esculenta*), cocoyam (*Baraza*), Maize (*Zea mays*), Melon (*Cucumis melo),* Plantain (*Plantago majus*), Okra (*Hibiscus esculentus*), Yam (*Dioscorea* sp.) and Sugarcane (*Saccharum officinarum*) producing communities and fishermen. For instance in *Odi, Tombia* and *Epie* fishing communities in *Bayelsa* State, several fishermen lost their nets to flooding which were carried by the tide, others lost their traps and baits. Several rural women in the communities had their cassavas for fermentation by the river banks carried away. For a period of six months or more several rural women in *Ogbeijaw* and *Burutu* villages in Delta and Southern *Ijaw* areas in Delta State could rarely visit the river banks to pick periwinkles and related sea foods for their subsistence.

In a similar study, Uyigue and Agho (2007) and Das (2013), corroborated this evidence as they observed that labour is likely to be an endogenous variable. However, to better understand the effect of labour, we ran two additional regressions, with labour as an input. The regression results corroborate the possibility of endogeneity. When labour is included in the production function, the coefficients for flood are smaller relative to the rest of the models when labour is not included (Das, 2013). Thus, flood appears to have a direct effect on productivity and an indirect effect via labour. Further, the coefficients associated with labour are insignificant. Since, our primary interest is the overall effect of flood; we use the coefficient of flood without labour to value damage costs.

Additional regression was the log of peasant production per hectare on independent variables. Here, the coefficient of (log) flood concentration is not significant. This indicates that the elasticity of productivity with respect to flood concentration is not different from zero. This is possibly an indicator of such high flood concentrations that a relatively small change in flood concentration is not good enough to lead any change in output. Among the 30 farmlands with a variety of crops including beans, cassava, melon, yam, plantain, banana, wheat and palm trees, only two with palm trees were not fully submerged due to heavy stump of debris hedged to avert flooding, yet the palm trees were gradually regenerating after flooding.

The hypothesized effects of different independent variables on peasant yield are as expected. Distance between the farmland and river showed a positive correlation with the peasant yield. The further the plot was from the river side, the higher the productivity. It is possible that plots nearer to the river get repeatedly flooded while those further away have better chances of increasing organic concentration over time and recover soil productivity. These may also be closer to human habitations and so people spend more time in the soil recovery processes.

All the regression models show that the size of the farm land in hectares (plot size) has a consistent negative effect, implying that a large plot size leads to lower yield. As discussed earlier, farmers in the study area use largely family labour and small implements. Hence, in cases of larger plots, family labour may not be adequate for intensive tillage of the entire land.

Some non-parametric analysis were undertaken (that is, variety of crops and type of implements used) to further examine the relationship between flood and the decline in peasant productivity. This analysis, suggests that this relationship is not very strong.

This may be because traditional varieties of peasant production require longer gestation periods. Overall, it can be concluded that flood has a significant effect on peasant agricultural production in the Niger Delta region. However, our data does not allow us to rule out or examine other factors that may be contributing to the difference in peasant productivity between the study villages and non flood impacted areas in the state. Local people, however, consider flood as a major determinant of the poor condition of peasant production.

From our findings, the estimated damage cost was enamours. This was corroborated by a secondary quantitative data provided by the UN; “The United Nations says Nigeria will need $38 million (about ₦5.7 billion) in emergency aid to help 2.1 million people uprooted from their homes by flooding” (Channels Report, 2012; Social Action Report, 2012).

According to Jens Laerke the spokesperson for the UN’s Office for the Coordination of Humanitarian Affairs, explaining the aid plan said, “the plan includes help with food, water, shelter and schools mainly in farming and fishing communities along the Niger River” (Channels Report, 2012). In Delta State area, it was discovered that, “at least five people, including two children and a traditional ruler, have died as a result of continued massive flooding that has ravaged parts of Delta State in Nigeria’s oil-rich Niger Delta. In addition, the floods submerged a multi-billion naira *Okpai* Independent Power Plant (IPP) (Sahara Reporters, 2012). The extent of damage was further reported by a local daily in the area; “equally damaged were schools, hospitals, homes, ‘many of the social facilities provided by Total as part of its Corporate Social Responsibility (CSR) to its host communities were endangered. For instance, the health centre in *Ogborgu* stood submerged as at last week. The water scheme at *Akabuka* was itself under water and it

was not likely it was still giving good water to the community" (Guardian, October 27, 2012).

Above all, the existential realities and source of subsistence of the peasants namely; their farms were submerged. In Bayelsa State, eight camps where opened with some at Amasoma, PDGS, *Elebele, Igbogene* and *Tombia* with a non-indigene camp at *Upi* (Social Action Briefing, 2012). The *Asaba* experience speaks for several communities devastated by the ravaging flood especially in *Aniocha* North, *Ndokwa* land, *Isoko*, *Patani, Bomadi* and *Burutu* communities amongst others.

The case of *Ewulu* community in *Aniocha* South Council of Delta State was Pathetic in the sense that over 100 houses, were pulled down, and both elderly and the sick ones trapped as water from River *Umuoni*, a tributary of the Niger overflowed its bank, The *Ase* River, which traversed the *Ndokwa* nation was also a channel through which the rising Niger flood unleashed more troubles on inhabitants.

This is equally supported by reports foreshadowed by Uyigue and Agho (2007), the most important environmental problem facing the Niger Delta is coastal erosion. Although the World Bank has rated coastal erosion as needing moderate attention in the region, it is the most important impact of sea level rise in the region and should be given high priority attention. Flooding of low-lying areas in the region has been observed. Settlements in the coastal region have been uprooted by flooding. In some places, especially in Forcados, some oil wells have been lost to the ocean due to flooding. Coastal flooding poses serious problem for the economic activities in the Niger Delta especially natural sectors such as farming and fisheries (about 50% of the fishes consumed in Nigeria is from the Niger Delta). Coastal vegetation especially the mangroves have been lost to coastal erosion (Awosika, 1995; Awosika et al., 1992; Uyigue and Agho, 2007).

We found most affected communities along the River Niger to include, *Aballa-Oshimili, Utchi Communities of Okwumedo, Umuochi, Owelle, Obalu and Obeche, Okpai, Abalagada, Aboh, Abuato, Ugbene, Agwe-Iyom, Ise-Onokpo, Onuobiuku, Umu-Ugbome, Umu-Uti, Afiankwo, Umuolu, Adiai, Utuoku, Oworubia, Wari-Irri*, and *Onyah*.

In Bayelsa eighty percent of the state was covered with flood as six out of its eight local government areas were affected. These include *Yenagoa, Sagbama Ekeremor*, *Kolokuma/Opokuma, Ogbia* and Southern *Ijaw*, several communities in these local government areas were submerged (NIMET, 2012). Our data showed that farmlands and peasant food crops were destroyed by the flood. The results of the study reflected overall crisis in livelihood caused by flood induced decline in food crop production. It is evident that the near irreversible damage to the farms in the Niger Delta and poor agricultural yields from the impacted lands has compelled the peasants to look for alternative sources of income and means of livelihood.

Our regression models showed productivity losses which ranged between 92 and 246 kg per hectare with an average presence of 54% flood in the farms. Our survey indicates that some households in the region have migrated from the rural areas to urban centres beyond subsistence and more importantly for security of their lives. In others villages such as *Adagbabiri, Torugbene, Agbura, Aguadama, Epetiama, Oporoma, Ndoro, Tombia, Peremabiri, Elemebiri, Asamabiri, Angalabiri, Opokuma, Odi, Kaiama, Biseni, Gbarantonu, Tombia Amassoma*. In Delta State, several rural inhabitants in the area migrated to neighbouring villages with relatively low flooding incidence.

We found low agricultural incomes to be pushing people to seek non-farm jobs. Agricultural income now constitutes less than 30% of the total household income in more than 90% of the sampled households. Although some households had salaried jobs both in *Yenagoa, Asaba and Warri*, most relied on income from casual labour, road construction provided by Niger Delta Development Commission (NDDC), fishing, hunting and animal domestication. Salaried jobs included school teaching, most of the schools are dilapidated and others do not have a good number of students in attendance, there were petty employment in private sector services such as oil multinationals in some host communities such as Shell and Total which had the host communities to supply diesel and related petty services. Those with regular government jobs enjoyed higher incomes compared to the peasants who are rural cultivators.

This decline in agricultural income triggered hunger and large scale migration of residents to distant places especially to the urban centres for instance in Delta state flood ravaged communities such as *Akarai, Azagba, Ekpe, Ibedeni, Osafu, Ase, Asaba-Ase, Onogbokor, Iyede-Ame* and *Anyama*, had most people displaced. In fact, most out-migrations in the sample were either to destinations outside the Niger Delta region (26%) or to those outside the state (55%). The incidence of out-migration reported by households was more than 20% of the total 1,099 listed households. The proportion of out-migrants is significantly higher in the Niger Delta region.

We found that efforts were made to reclaim land for agriculture in some affected areas such as *Aballa-Obodo, Aballa-Uno, Inyi communities of Umu-Inyagbo, Obeche, Umu-Agwuyam, Isiolu, Umuoga, Ezinyi, Utuke, Ude, Ogigogwe, Ezeagba), Umu-Eche, Ogwasi, Umugwo, Umuazu, Ozala,* all in *Onuaboh* in Delta State but had a minimal success with roughly 76% of the households in the 15 villages most adversely affected. The survey data reveals that several crops were adversely submerged. Many farms were covered by the flood. For instance, fish farms, plantain farms, cassava farms, sugar cane farms and fruit farms were affected by the flood (Ayapere, 2012). Table 1; shows that an estimated total cost of N340m (Three hundred and forty million naira) damage was done on crops by the flood. "The accounting experience in this regard, involves cost elements, which are materials,

Table 1. Estimated cost of agricultural products destroyed by the flood.

Agric. farm crops	Agric. farm in Hec	Cost evaluation (₦)
Cereals/grains farm	200	40 m
Tubers farms	800	80 m
Plantain farms	100	150 m
Sugar cane farms	70	50 m
Fruit farms	50	20 m

Source: Ayapere (2012), modified with field data (2012).

Table 2. Food crops and natural resources in the Niger Delta.

Available in the region	
a. Agric products	
Tree crops	Cocoa, coffee, kolanut, timber, rubber, palm trees, raffia palms
Fruits	Pineapple, oranges, mangoes, pawpaw
Food crops	Yams, rice, plantain, banana, cassava, cocoyam, sweet potato, okro, tomato, etc
b. Mineral resources	Oil and gas, gold, uranium, tin ore (cassiterite), manganese, titanium, limestone, tantalite, mica (muscovite), iron ore (hematite), clay, tourmaline, amethyst, spring water, granite, bentonite, feldspar, quartz, baryte, diamond, graphite, pyrite, talc schist, salt, coal, kaolin, crude oil, galena (lead zinc) and rutile, bitumen, kaolin, tar sand, lead, zinc, stone, basalt, gypsum, copper etc.
c. Water Resources	Fishes, salt.

Source: Niger Delta Development Commission (NDDC) Report, 2012

Table 3. Ranking of environmental issues in the Niger Delta by the World Bank.

Category	High priority	Moderate priority	Lower priority
Land Resource Degradation	Agricultural land degradation Flooding (Moderate high)	Coastal erosion Riverbank erosion	Sea level rise
Renewable Resource Degradation	Fisheries depletion. Deforestation Biodiversity loss Water hyacinth expansion	Fisheries habitat Degradation	Mangrove Degradation Nypa palm expansion
Environmental Pollution	Sewage Vehicular emissions Municipal solid wastes Toxic and hazardous substances	Oil pollution Industrial effluents Industrial air emissions Industrial solid wastes	Gas flaring

Source: Agbola and Olurin (2003) cited in Uyigue and Agho (2007).

labour and expenses including variable and fixed costs as imputed costs in cultivating the food crops/aqua culture" (Ayapere, 2012). "In fact, the various expected farm produce against next year had been damaged. Thus, both the formal and informal sectors have a serious setback on accounting values in their respective industries. It requires serious attention on food production, most especially, in Bayelsa State" (Ayapere, 2012). So that acute supply of food stuff may not force low salary earners put much burden on the State government (Table 2).

Table 3 identified flooding as a high priority problem in the Niger Delta region.

CONCLUSIONS AND POLICY IMPLICATIONS

There is need for effective policy discourse to redress the problem of flooding in the Niger Delta. Our data and analysis reveals that this is not just an odd extreme event,

thus climate change represents a significant threat to Africa's development. Africa is a relatively dry continent and many of its people are dependent on rain-fed agriculture for both their food and much of their livelihood (Edwards, 2013). The challenges that Africa faces as a result of climate change were discussed during the Conference of Parties of the UN Framework Convention on Climate Change held in Durban, South Africa in December 2011. The conference was preceded by a meeting of the Intergovernmental Panel on Climate Change (IPCC) held in Kampala, Uganda, in November 2011, which pinpointed the need for disaster management in the event of floods, typhoons and other drastic weather events. While these two international conferences emphasized the significance of climate change and the very real concern of Africa's leaders on its consequences for their development strategies, very little was accomplished in terms of developing a practical action plan to address climate change (International Institute for Sustainable Development, 2011).

There is growing understanding that the attainment of optimum food production goes beyond the question of availability of improved production technologies (Oyekale, 2001). Rather greater consideration to climate change upon which crop production ultimately depends has become issues of importance as food production has in recent times become an environmental concern. A robust policy initiative aimed at "self reliant" other than "self provisioning" agricultural production could sustainably build the capacity and production mechanisms of the peasants. Government at all levels, policy makers and environmentalists have roles to play. Particularly, government should expedite action to build the capacity of rural farmers by providing effective strategies to mitigate flooding such as effective crop rotation practices. Also farmers should be provided with incentives such as funds, and planting materials to revamp the current distressed situation.

Without an effective policy response, climate change could serve as the proverbial "straw that broke the camel's back" in Africa's already difficult development context (Boko, 2007).

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