AGRICULTURAL PRACTICES VULNERABILITY TO FLOODS AMONG COMMUNITIES DOWNSTREAM OF KAINJI DAM, NIGERIA

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Abstract

Discharge from Kainji Hydro Electric Power Dam entail large water outflow which cause flooding to adjoining lands downstream of the dam. Rural settlements on the downstream flood plain of the dam are predominantly agrarian that depend on the water resources for their livelihood. Floods have not only threatened basic infrastructure but also destroyed farmlands and disrupt activities. Structured questionnaires and interview methods were utilised to generate data on the existing agricultural practices in the area and their vulnerability to floods. Digital Elevation Model (DEM) of the Study Area at 30meter resolution was utilised to depict the nature of the terrain, buffering analysis was carried out at 30meter, 50meter and 70meter respectively, leading to flood vulnerability mapping indicating highly vulnerable, moderately vulnerable and safe zones. The results indicate that crop, livestock and fish farming are the dominant agricultural practices. Farmers have also lost substantial amount of their products to flood. This is largely to their inadequate adaptive capacity to cope with floods. The DEM result shows elevation of the communities ranging between 81meters to 298meters above mean sea level. It is therefore recommended that the Dam authorities should issue flood warning to concerned communities at appropriate time and in a realistic manner.

Keywords: Vulnerability, Floods, Agricultural Practices, Downstream, Flood plain, Dam

Introduction

Flooding is one of the major environmental problems to contend with within the century. This is especially the case in most wetlands of the world. The reason for this is the general rise in sea level globally, due to climate change and global warming as well as the saturated nature of the wetlands in Nigeria. Periodic floods occur on many rivers, forming a surrounding region known as flood plain. Rivers overflow for reasons like excess rainfall. The good thing about river overflows is the fact that as flood waters flow into the banks, sand, silt and debris are deposited into the surrounding land. After the river water has subsided and goes back to its normal flow, the deposited materials will help make the land richer or more fertile. The organic materials and minerals deposited by the river water keep the soil fertile and productive making it suitable for agricultural purposes (Abowei and Sikoki, 2005).In Nigeria, flood has been the major natural disaster experienced from the time past till now, claiming lives and properties, inundating houses, rendering inhabitants homeless, causing health implication and socio-economic problems, destroying farm lands and economic crops and causing food insecurity to the people affected. (Ojigi, Abdulkadir and Aderoju, 2013).

Floodplain agriculture typically consists of three cropping systems, each adapting to the rise and fall of floodwaters rather than directly to the short rainy season. First, as floodwaters rise, rice is cultivated. Second, as the water recedes, crops such as sorghum or cowpeas are planted that are able to grow using only the residual moisture in the soil. Third, crops such as tomatoes, onions and peppers are planted

under irrigation in the dry season on the banks of rivers and where water lingers in the floodplain. These floodplain cropping systems are integrated economically (and often within one household) with dry land cultivation systems (typically of millet, sorghum and groundnuts) away from the river. They are also integrated in time and space with other economic activities inside and outside the floodplain, such as the seasonal movement of livestock and different kinds of fishing activity (David and William, 1999).

The operation of Hydro Electric Power dams often leads to environmental and ecological problems. When inflows are low, energy output from Hydro Electric Power sources is limited. Water may not be released in adequate quantities from the reservoir, a situation that can affect ecological balance of the river below the Hydro Electric Power dam. On the other hand discharge from Hydro Electric Power dams can entail large water outflow which can cause flooding to adjoining lands downstream of the dam. Where the flood plains are regions of economic, social and agricultural activities extensive damages will be incurred in the process. In Nigeria this is particularly so, as the riverbanks are used for farming and are inhabited by farming communities (David and Adebayo, 2010).

Globally, Riverine Communities are naturally susceptible to flooding. In recent times, the devastating effect of flood in Nigeria became so severe that it was seen as a national calamity. Rural settlements on the downstream of Kainji dam are predominately agrarian communities, who depend on the land and water resources for their socio-economic livelihood. Flood events in these communities not only threaten basic infrastructure but also have destroyed farmlands and economic trees (Musa, 2016).

Planners and decision makers in the agricultural sector in Niger State requires both current and historic information on these downstream communities to ensure sustainable agricultural production. The study therefore, examined the agricultural practices and the level of destruction, map the communities to determine their vulnerability with a view to create a better understanding to human management of the environment.

Study Area

The Study Area is the downstream communities of Kainji dam, located in Borgu Local Government Area of Niger State. The selected communities are; Fakun, Awuru Emighi, Awuru, Sabon Leaba, Chegun and Doko located between Longitude $04^{0}35$ 00" – $04^{0}38$ 00" meridian and Latitude: 09^{0} 45 00 – $09^{0}50$ 00".

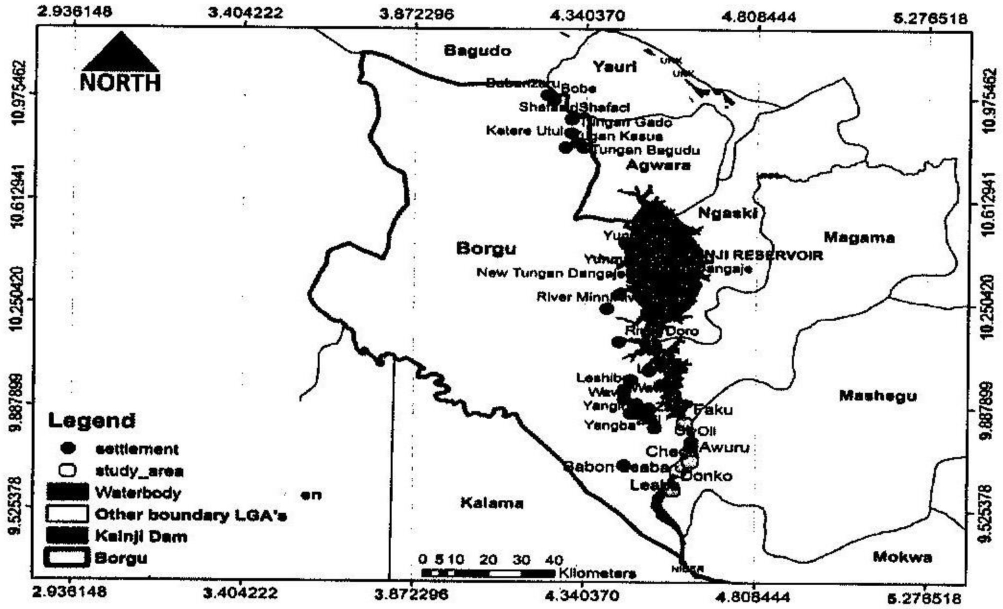

Figure 1: The Study Areas (Communities around Kainji Dam, Niger State, Nigeria)
Source: Ministry of Land and Housing, Niger State, 2015.

Drainage and Topography of the Study Area

The entire area is extremely drained by seasonal streams that are cut at the centre by River Niger which empties it water into River Benue at Lokoja. Highest elevation is around 799ft above mean sea level. The Middle and Southern parts form undulations with the lowlands for the most part making ways through which the river and streams empty their water (Salami and Sule, 2010).

Materials and Methods

The study utilised structured questionnaire, interview schedule, reconnaissance survey and Global Positioning System (GPS) receiver to obtain ground coordinate points of the different themes (classes). Thematic map of Niger State, Satellite Imageries obtained from Google Earth and Digital Elevation Model (DEM) of the Study area at 30m resolution. The image registration was executed with the ArcGIS 10.1 software from ESRI. The images were registered to the 1984 World Geodetic System Universal Transverse Mercator (WGS '84 UTM) in the Geographic Coordinate System. Although the images were already geo-referenced to the Geographic Coordinate System, they were re-projected to UTM '84 Zone 32 N so as to ensure that they are allocated their correct ground coordinates.

Buffer zones of specific distance were created along the drainage channel to determine the settlement vulnerability to flood. Flood vulnerability map of the area was developed to ascertain the degree of vulnerability of each settlement.

During the field survey, questionnaires were administered to 332 (5%) of the population, selected using purposive sampling, the questionnaires were administered only to people who had lived in the area for at least 10 years and above. Statistical Package for Social Sciences (SPSS) 17.0 and Microsoft excel window

7 version was used to analyze quantitative data. The results were presented in Tables, Figures and Charts. Maximum likelihood classification and area calculation in hectares was used to analyse the nature of the terrain.

Results and Discussion

Figure 2 shows the major agricultural practice in the study area with crop production accounting for 88.0%, Livestock farming 6.3%, Fish farming both Cultured and Captured 5.7%. Farmers integrate crop with livestock and fisheries with a high level of diversification of agricultural production, with about 45% of the population involved in other different vocations apart from farming. The study also discovered that there was decline in the number of fish farmers in the study area, which was attributed to seasonal uncertain and hardship in captured fishing.

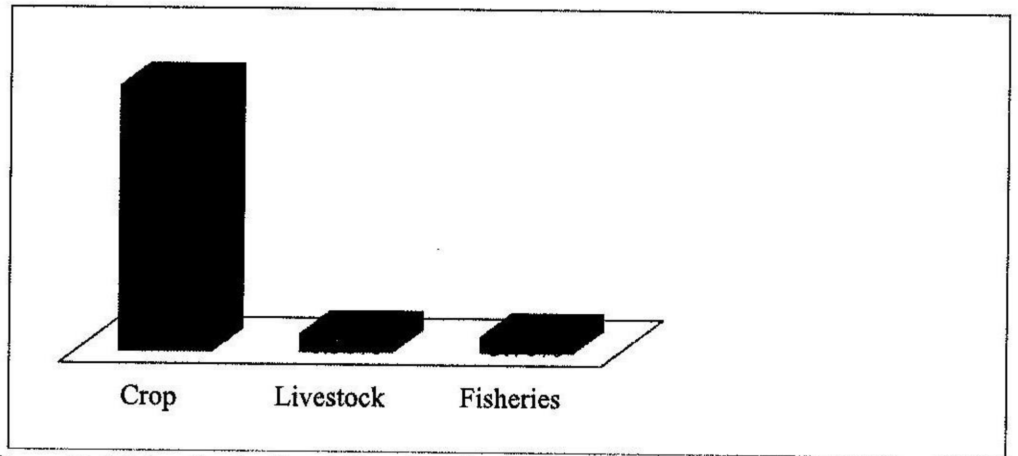

Figure 2: Major Agricultural Practices in the Study Area
Source: Authors Fieldwork, 2015

Figure 3 revealed that the most common commodities that farmers are involved in producing based on the frequencies of mention are maize, rice, groundnut, horticultural plants and millet. The less common commodities based on the frequencies of occurrence are yam, tree plants, melon, soya beans and sugarcane. The result shows an increase in cultivation of cereal crops than root and tuber crops, horticultural crops and tree crops.

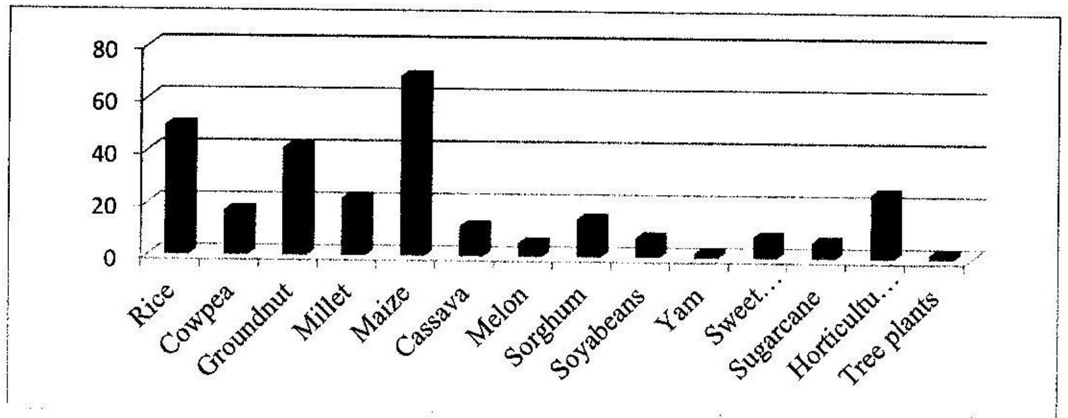

Figure 3: Distribution of Crop Cultivated
Source: Authors Fieldwork, 2016

Figure 4 shows that Goats are widely raised animals in the study area accounting for 76.6%, Sheep 66.5%, Poultry 55%, Cattle 22.0%. Pig, Donkey, and Dog all account for 0.5%, 1.9% and 3.3% respectively. Although most of the farmers are engaged in livestock production, they are mainly in small number usually kept at the backyard of houses. The farmer raise cattle (especially to provide draft power or farm operations), goat, poultry, sheep, and rabbits most to meet family nutritional needs, and used in market and exchange, the proceeds for procurement of fertilizers, payment of School fee.

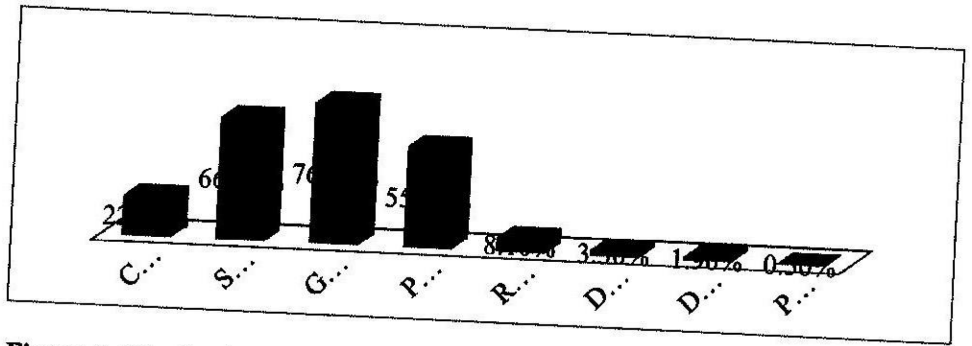

Figure 4: Distribution of Animals owned by Respondents.
Source: Authors Fieldwork, 2015.

Figure 5 indicates that 58.5% of the fish farmers practices only captured fisheries, 31.1% are into cultured fisheries while 10.4% practice the two.

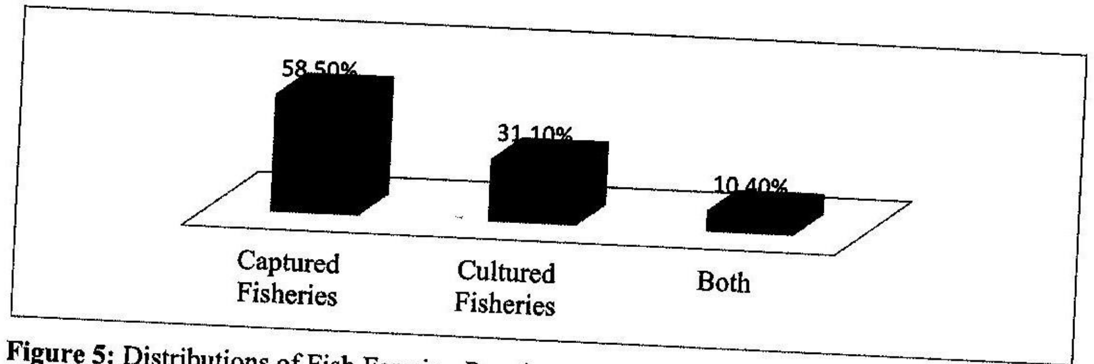

Figure 5: Distributions of Fish Farming Practices.
Source: Authors Fieldwork, 2015.

Figure 6, shows the distribution of sizes of farm lands affected by flood, 49% of the population indicates losses in the scale of less than 1 acres, 27% loss between 1 to 2 acres of farm size, 1.6% reported a loss of 2 acres and above while 23% affirmed not been affected by flood in the last ten (10) years.

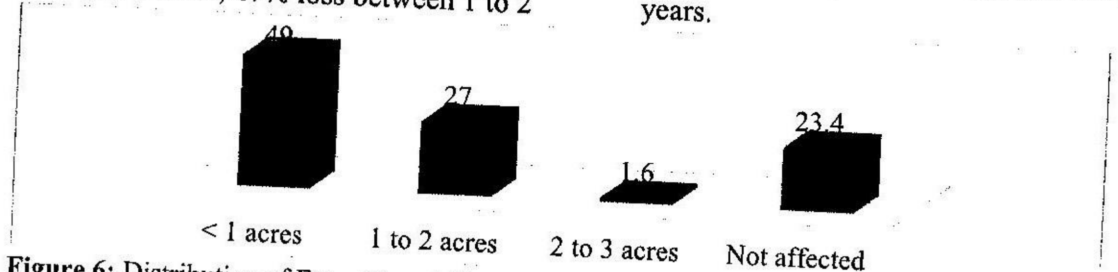

Figure 6: Distribution of Farm Sizes Affected by Flood
Source: Authors Fieldwork, 2015.

Figure 7, shows that about 73% of the population agreed that flooding affect soil nutrient negatively, as it washes away top soil, thereby reducing the nutrient level of the soil, without any alluvial deposit as the study area is in the vicinity of the Kainji dam,

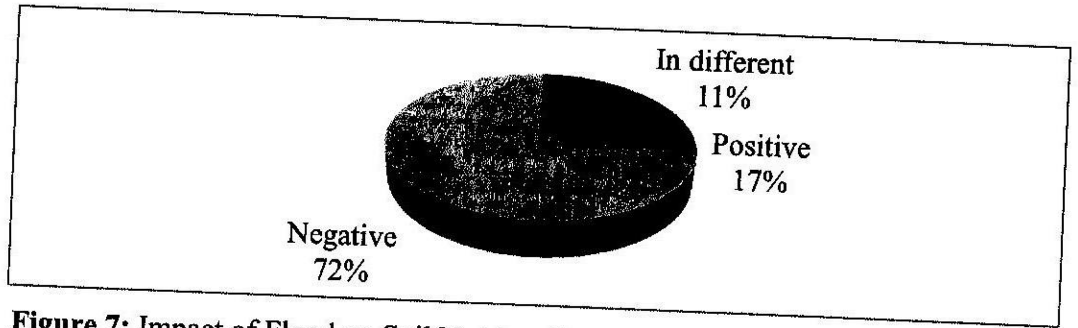

Figure 7: Impact of Flood on Soil Nutrient Status
Source: Authors Fieldwork, 2015.

Figure 8, summarizes the distribution of animal loss during the period under review, about 54% of the population confirm losing less than ten (10) animals, 8% loose between 10 to 20 animals, while 36% are not affected. Responses from the interview conducted with selected farmers reveals that apart from loss of animals to flood water, there is also a high rate of disease prevalence which mostly account for losses incurred by farmers.

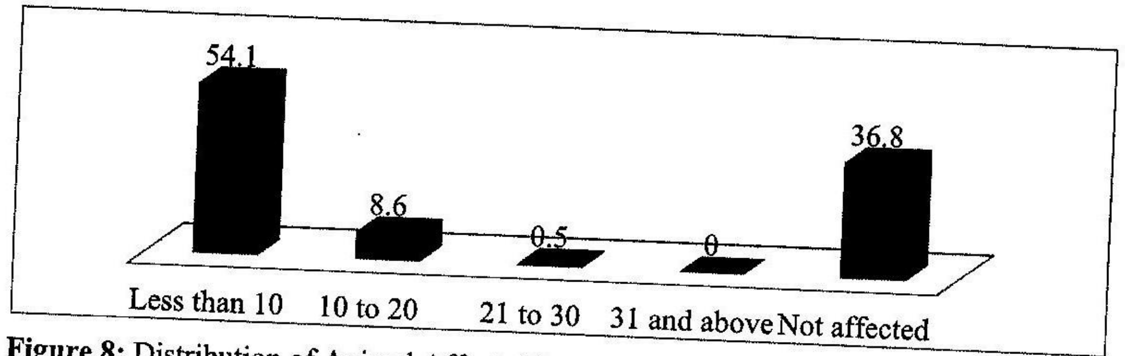

Figure 8: Distribution of Animal Affected by Flood
Source: Authors Fieldwork, 2015.

Figure 9, reveals that most (90.3%) of the captured fish farmers record less fish catch during flood period, 6.5% agreed that flood water comes with some advantages especially when the water recedes, harvest is mostly at increase. 3.2% indicates no challenge. From the interview conducted with selected farmers it was discovered that fishing equipment are mostly loss during flood period.

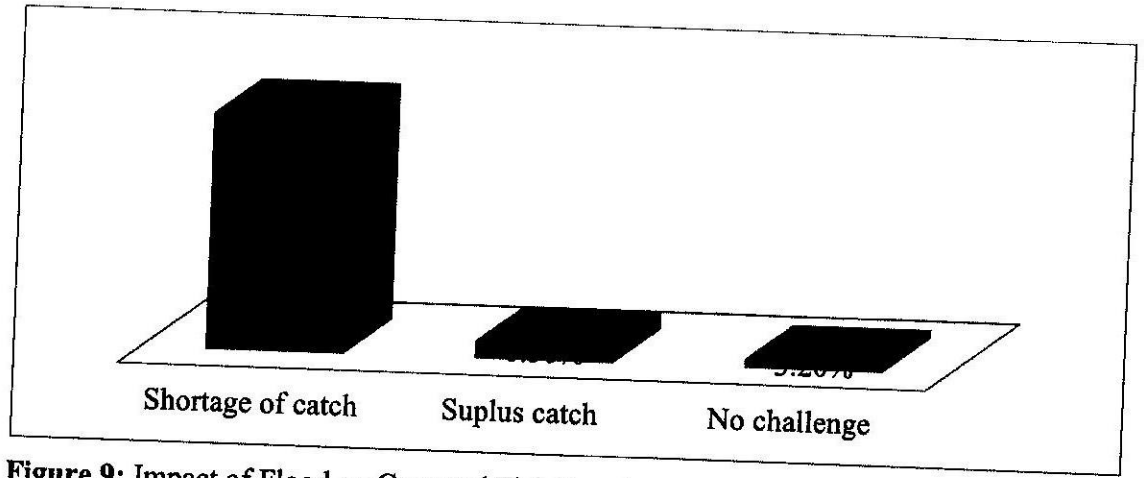

Figure 9: Impact of Flood on Captured Fish Farming
Source: Authors Fieldwork, 2015.

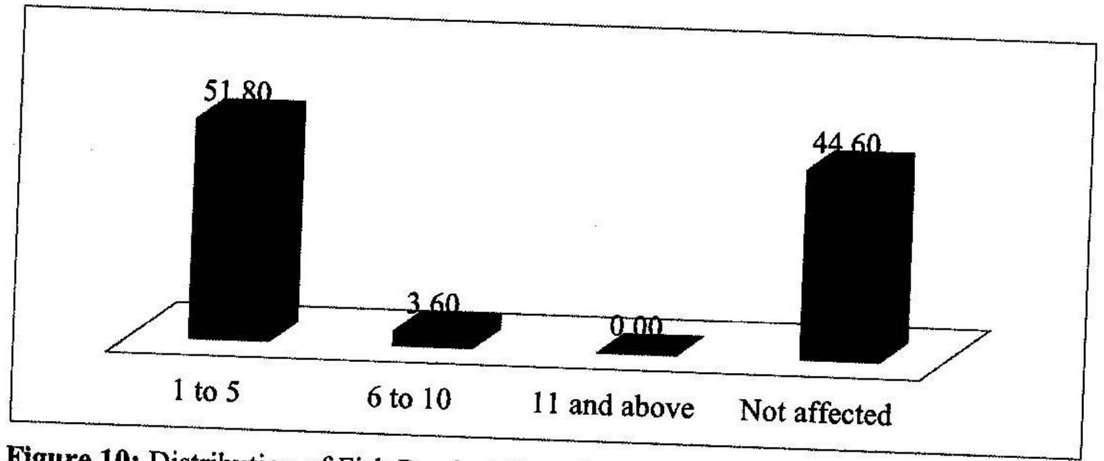

Figure 10: Distribution of Fish Ponds Affected by Flood
Source: Authors Fieldwork, 2015.

Figure 10, shows that 51.8% of the cultured fish farmers loss between 1 to 5 ponds during the period under review, 3.6% loss between 6 to 10 ponds to flooding. The result confirms that flooding is affecting activities of cultured fish farmers in the Study Area.

Figure 11, reveals that 71% of the population greed that water surplus is a major challenge during flood, 16% responded that high mortality rate is recorded during flood year, while 12% affirmed that prevalence of diseases is always at increase during flood event. The result shows that flood is having significant effect on the survival of cultured fish farming in the study area.

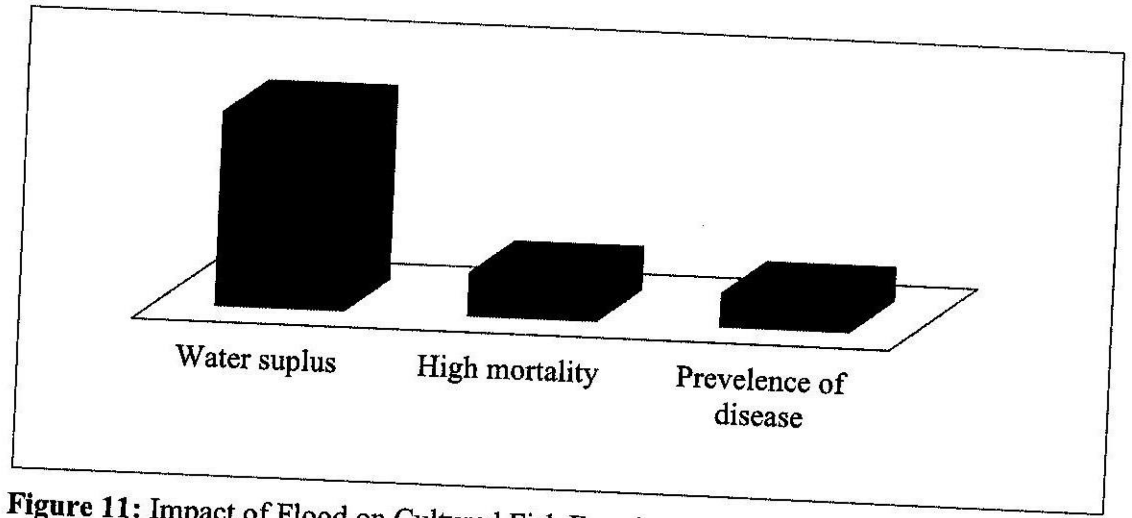

Figure 11: Impact of Flood on Cultured Fish Farming
Source: Authors Fieldwork, 2015.

The Digital Elevation Model (DEM) of the study area extracted from SRTM data of 30m resolution depicts the elevation of communities within the study area. The highest elevation is 298 metres while the lowest elevation is 81 metres above mean sea level (See Figure 12).

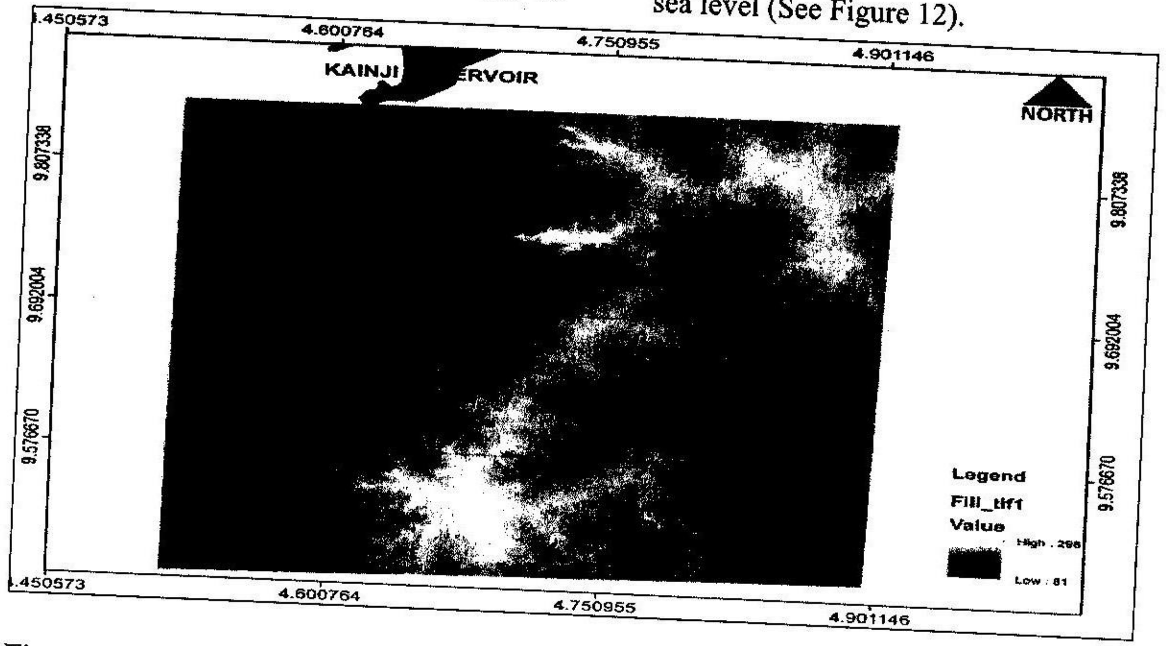

Figure 12: Digital Elevation Model of the Study Area.
Source: Authors Fieldwork, 2015.

Figure 13, shows the flood vulnerability map of the study area, the result depict settlements with low vulnerability, moderate vulnerability, high vulnerability and save zones respectively.

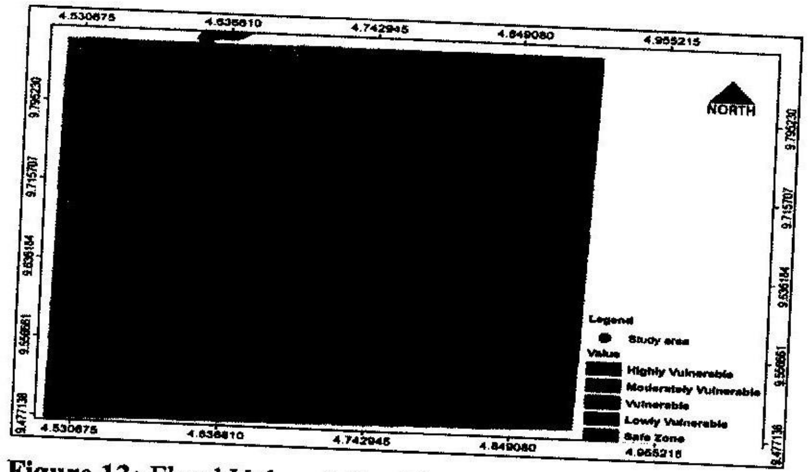

Figure 13: Flood Vulnerability Map of the Study Area.
Source: Authors Fieldwork, 2015.

Conclusion and Recommendations

It is evident that farmers in the affected communities experienced flood at varying degrees, more often when the spill ways of Kainji dam had to be opened during the peak of the rains. These have affected farming operations and thus, lead to low productivity, increased mortality, stunted growth and susceptibility of livestock and fish to diseases and death. Therefore, there is urgent need for a decision support system to alert stakeholders and the communities about the risk of farming along floodplains especially those that are identified as highly vulnerable to water releases. Continuous monitoring of the climate should be intensified to create awareness on flood regime.

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