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**MAPPING OF FLOOD PRONE  
AREAS IN OSISIOMA NGWA LOCAL  
GOVERNMENT AREA OF ABIA  
STATE**

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## ABSTRACT

Flooding is a very common and devastating environmental problem. Mapping of areas prone to flood disaster has not been given adequate attention in research especially in the developing nations, such as Nigeria. This study is therefore aimed at mapping flood prone areas in OsisiomaNgwa Local Government of Area of Abia State. In doing this, the base map of the study area was used in carrying out reconnaissance survey and field measurements. The Global Positioning System (GPS) was used to obtain coordinates and altitudes of flood prone areas in the study area. The various flood datasets were integrated and superimposed in a GIS environment (Arc GIS 10.1) for the mapping of flood prone areas. A digital elevation model (DEM) and flood vulnerability maps were generated for the area. The results obtained showed that most communities in the area are low-lying, with few exceptions at Umuaduru with an altitude of 83m, Okpuala, 82m and Aru-Ngwa, 80m. The implication is that the communities with the lowest altitudes such as Umuocham, Umuba and Amazu are often inundated by flood waters during the rainy season especially as they are located near natural water bodies such as the Imo River and Umuocham River. Consequently, this study recommends that, a flood mapping framework be established. This can guide the construction of sustainable drainage systems to enhance the evacuation of flood waters. Finally, the Federal and Abia State Fire Services and National and Abia State Emergency Management Agencies should always be placed on red alert in order to encourage safety standards in terms of exposure to risk of locals, properties and environment of the OsisiomaNgwa Local Government Area during the rainy season. The Town Planning Authority of the area should also enforce the necessary building laws.

**Key words:** Flooding, Mapping, GPS, GIS  
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## 1.0 INTRODUCTION

Flooding is a natural consequence of stream flow as a continual changing environment (Nelson, 2001). It has been described as unusually high rate of discharging, often leading to inundation of land adjacent to streams and it is usually caused by intense or prolong rainfall (Sada and Otermerho, 1988). Flooding is the most devastating natural hazard affecting the social and economic aspect of population (Hewitt and Burton, 1971) and claiming more lives than any other natural phenomenon. It is the most common of all environmental hazards and it regularly claims over 20,000 lives per year and adversely affects about 75 million people worldwide (Smith, 1996). About one third of all deaths, and one third of all damages from natural disaster are caused by flooding (International Federation of Red Cross and Red Crescent Societies (IFRC), 2008). This hazard has been linked to increase communicable diseases (Orji, 2010). Other health impacts of flooding are prevalence of communicable diseases, shortage of food supply, dispersion of household wastes into fluvial system and contamination of community water supplies and wild life habitation, with extreme toxic substances (Njoku et al., 2010).

The problem of flooding due to sea level rise and storm surges constitutes a significant source of threat to life, property, livelihoods and infrastructure in the riverine region (Ezirim, 2010). Large parts of the ground in urban areas are covered with pavements which obstruct sections of natural channel and builds drains that ensure water movement to river faster than it could under natural condition (Ojigiet al., 2013). Also, in Nigeria flooding has been known to be caused by a combination of excessive precipitation and inadequate flow channel capacity of sewer system (Soba, 2008). For some urban areas the disaster has also been attributed to land use and land cover in adjoining pre-urban areas, directions of slope and lack of drainage facilities as factors (Otermerho, 1988; Njoku et al., 2010; and Hardoyet al., 2001 ). Consequently, run offs



associated with increasing proportion of impervious surface are held back as pools on urban terrain.

Remote Sensing and Geographical Information System (GIS) have proved to be valuable tools to support effective early warning to disaster (Kivanga, 2004). Integration of Remote Sensing and GIS provides a very effective means of delineating disaster prone areas and for communicating this to decision – makers, emergency response team and the general public (Ojigi and Sheba, 2012). The use of this new technique captures the real topography in longitudinal cross – section and generates a 3D visualization of the area (for example, Wang *et al.* (2010))

Mapping of flood prone areas in Nigeria is not common though it is of great importance in planning and safety. This work therefore explores and produces map for flood prone areas in OsisiomaNgwa, Abia State.

### 1.1 STUDY AREA

The study area is OsisiomaNgwa of Abia State, southeastern Nigeria. It lies between latitudes  $5^{\circ}5'57''$  and  $5^{\circ}19'32''$ N and longitudes  $7^{\circ}15'49''$  and  $7^{\circ}25'23''$ E (Fig 1) with a land area covering about  $198\text{km}^2$  and a total population of 219,632 (NPC, 2006). The study area is within the humid tropical climatic zone and rain forest vegetation zone of southern Nigeria. The rainfall regime is bimodal with peaks in July and September. Between these peaks is the 'little dry season' commonly known as 'August Break'. The rainy or wet season of the area begins about March and lasts till October or early November. The length of the wet season is at least (7) seven months including the period of August break. The dry season lasts from November to March. The area has an annual rainfall total of about 2200mm; a mean annual temperature of about  $27^{\circ}\text{C}$ ; and an average relative humidity of about 80%

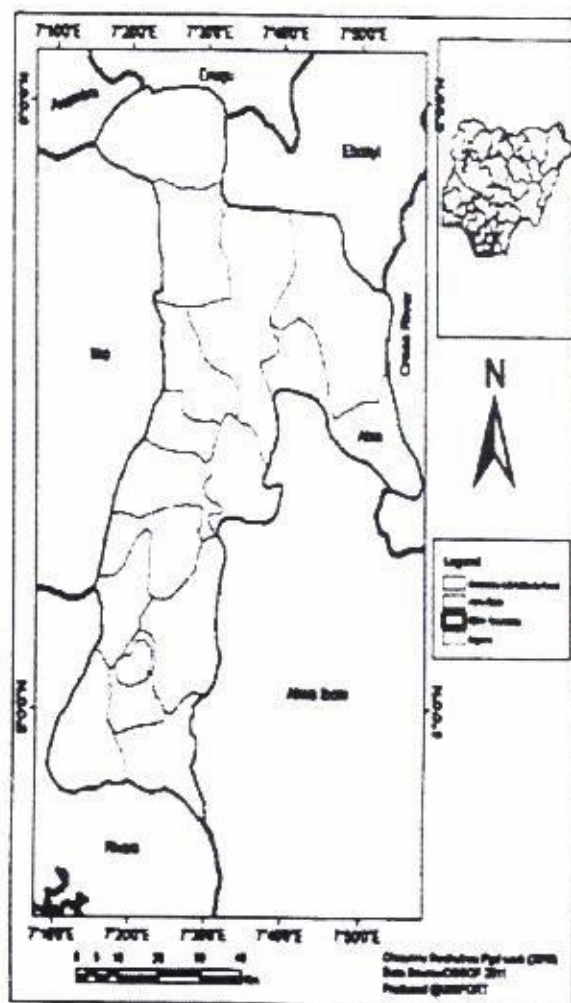


Fig. 1 Abia State Showing Osisioma LGA (Study Area)

### 2.0 MATERIALS AND METHODS

Reconnaissance survey of OsisiomaNgwa Local Government Area of Abia State was carried out in order to familiarize the researchers with the communities that make up the local government area. The survey also helped the researchers to determine the factors of flooding in the study area.

This study employed the use of both primary and secondary data. The primary data included the use of Global Positioning System (GPS) to geo-locate the flood prone areas. The secondary data included Base Map from the Town Planning Authority of the Local Government Area, flood related issues from



relevant literature, journals, magazines and newspapers.

Field data on coordinates and altitudes were obtained in degrees from flood prone areas in the study area, using the Global Positioning System (GPS).

Specifically, data were collected from Umuaduru, Ekeakpara, Umuarakpa, Umuimo, MbutuNta, Ibeku, Amazu, Umuoto, Amayo, Aru- Ngwa, Okpuaba, Umumba, Umuagbara, Umuagbai, Egbede, UmuOjima, Abayi, Umueze, and Umuocham. These locations were selected as a result of observed changes in terrain, elevation and slopes, and so, are critical to natural run off direction and identification of flood prone areas.

The base map obtained from the Town Planning Authority was imported and geo-referenced using Arc GIS 10.1. The co-ordinates and altitudes using the Global Positioning System were superimposed on the geo-referenced map of OsisiomaNgwa Local Government Area.

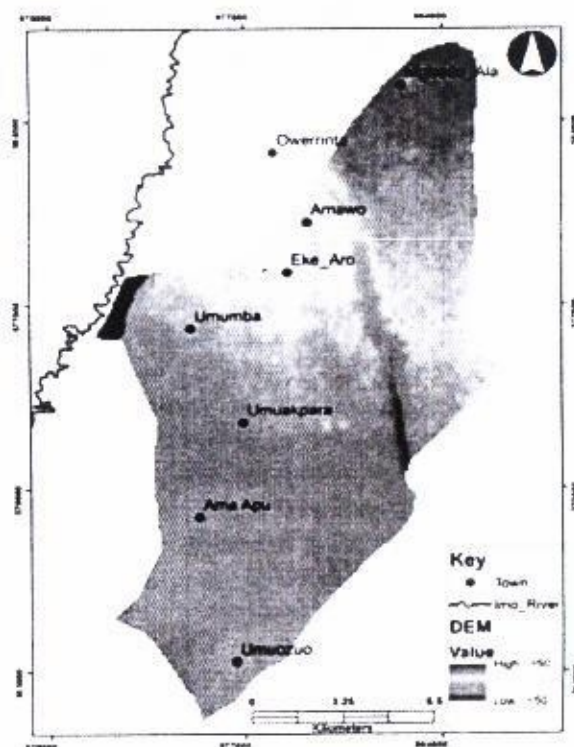
### 3.0 RESULTS AND DISCUSSION

The analysis of the altitudes of various locations in OsisiomaNgwa Local Government Area showed that the area is gently undulated. Table 1 shows data on the co-ordinates and altitudes of various locations in the local government area. The table helps to identify flood prone areas through the altitude of the various communities. Areas of low altitudes are more prone to flooding and vice versa. For example, Amazu, Umumba, Umuocham, are seriously prone to flooding because of their altitudes which are 66m, 66m and 44m respectively. This can be further explained visually by the Digital Elevation Map (DEM) and the Vulnerability Map (VM) i.e. figures 2 and 5 respectively.

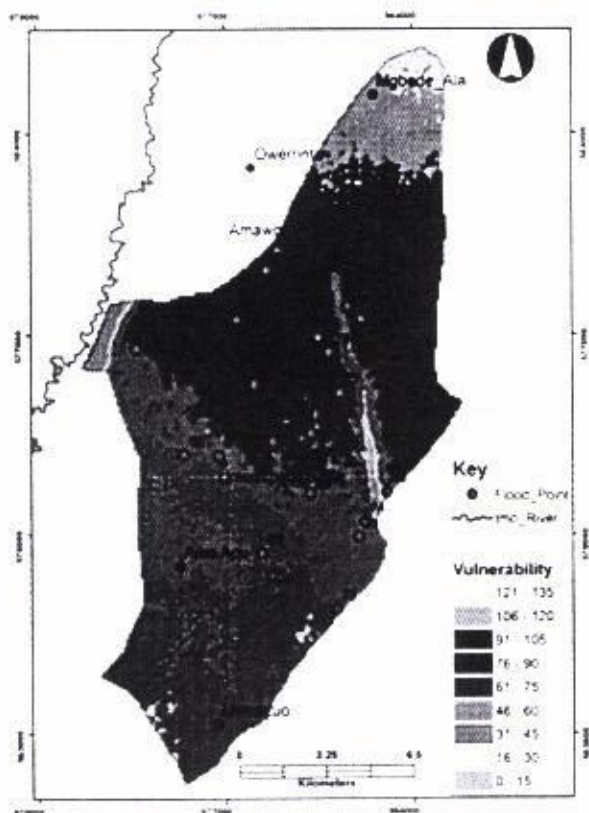
These maps show that communities with the lowest altitudes such as Amazu (44m), Umuocham (66m), Umumba (66m) are seriously prone to flooding, reason being that they are located close to natural water bodies water from these river bodies because of their low altitude such as the Imo River, and Umuocham River. During the rainy season, these areas are easily flooded with.

**Table 1: Identification of Flood Prone Areas in OsisiomaNgwa LGA**

S/N	LOCATION	LONGITUDE (N)	LATITUDE (E)	ALTITUDE (M)
1	Umuaduru	5° 9' 25.15"	7° 19' 35.94"	83
2	NNPC Depot Umuaduru	5° 9' 31.89"	7° 19' 24.71"	74
3	Ekeakpara	5° 10' 17.19"	7° 18' 57.50"	78
4	Umuarakpa	5° 10' 37.98"	7° 19' 14.05"	75
5	Umuimo	5° 11' 12.27"	7° 20' 18.63"	77
6	MbutuNta	5° 11' 58.22"	7° 20' 6.50"	73
7	Ibeku	5° 12' 15.84"	7° 19' 53.23"	77
8	Amazu	5° 12' 44.33"	7° 20' 32.82"	66
9	Umuoto	5° 12' 44.03"	7° 20' 44.99"	75
10	Amayo	5° 13' 53.44"	7° 19' 5.31"	78
11	Aru - Ngwa	5° 13' 31.51"	7° 18' 51.47"	80
12	Okpuaba	5° 12' 36.36"	7° 18' 16.14"	82
13	Umumba	5° 11' 48.04"	7° 18' 53.10"	66
14	Umuagbara	5° 11' 22.77"	7° 18' 35.34"	74
15	Umuabai	5° 10' 03.52"	7° 17' 9.98"	78
16	Egbede	5° 10' 01.90"	7° 17' 52.26"	69
17	Umuojima	5° 8' 10.70"	7° 20' 42.90"	69
18	Abayi	5° 8' 28.49"	7° 20' 40.00"	73
19	Umueze	5° 8' 45.11"	7° 20' 48.07"	74
20	Umuocham	5° 8' 31.98"	7° 21' 25.26"	44
21	Ariaria	5° 7' 06.15"	7° 20' 12.42"	75



**Figure 2: Digital Elevation Map of OsisiomaNgwa L. G. A.**



**Figure 3: Vulnerability Map of OsisiomaNgwa L.G.A.**

#### 4.0 CONCLUSION

Based on the above findings, OsisiomaNgwa Local Government Area is a relatively gently undulated land and it is without any good drainage system. Most of the communities in the area do not follow the Abia State Building Master Plan for the Local Government Area before erecting their structures. This combined with rapid urbanization and poor drainage system, the area generally is prone to flooding, most especially Amazu and Umuochoam communities which surrounding water bodies.

#### 4.1 RECOMMENDATIONS

Based on the above conclusion, it is strongly recommended that good drainage system should be constructed, especially in the very flood prone areas, such as Umuochoam with an altitude of 44m above mean sea level, Amazu 66m above mean sea level and Umumba 66m

above mean sea level, to help channel water away with greater ease during the rains.

Government should enforce town planning law in OsisiomaNgwa Local Government Area in order not to aggravate floods in the flood prone areas. This action is most expedient in view of the area's rapid urbanization.

Finally, the Federal and Abia State Fire Services, the National and Abia State Emergency Management Agencies and the OsisiomaNgwa Local Government Area Town Planning Authority should be made to be aware that some areas in the local government area are seriously flood prone to flooding through this study. This will make them always be on the alert and be ready to perform their duties.



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