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APPLICATION OF GEOGRAPHIC INFORMATION SYSTEM (GIS) IN ENVIRONMENTAL DEGRADATION CONTROLS

(A CASE STUDY OF FLOOD IN AKURE SOUTH LOCAL GOVERNMENT AREA ONDO STATE NIGERIA)

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Abstract: **Flood has been recognized not only within the rural but also in urban environment in Nigeria and in many other parts of the world as one of the environmental degradation problems causing serious loss to both human and the environment. The application of Geographic Information System (GIS) for monitoring and managing flood prone areas are very important in creating conducive environment for urban residents and in conformity with planning standards. The aim of this paper therefore is to delineate flood potential areas around Ala River in Akure south local government area of Ondo State for early warnings and planning, control and management using google earth imageries and capabilities of GIS.**

Keywords: **GIS, Flood, environmental degradation, physiographic locations, monitoring.**

1. INTRODUCTION

Flood is a natural environmental disaster which could be aggravated by man's unguided development. Floods cause damage to houses, industries, public utilities, agricultural land and crops resulting in huge economic loses, apart from loss of lives. Since flood is one of the environmental degradation problems which endanger both life and property, it becomes vital to know its extents and evolution. Though it is not possible to control flood disaster totally, by adopting suitable structural measures, flood damages can be minimized (Awosika et al, 2000).

Preventing river floods is important to prevent probable loss of life and to reduce damage to sites of high economic importance. Floods occur when soil becomes saturated and its infiltration capacity is zero; runoffs cannot be contained in stream channels, natural ponds and constructed reservoirs, and the land surface become submerged, sweeping away its content. Periodic floods, resulting from heavy rains, occur naturally on many rivers, forming an area known as the flood plain. The river floods often cause the rivers to overflow their banks, sometimes with a velocity and enormously destructive surge (Adetunberu, 2003). In Nigeria, we experience floods every year during the rainy season with farmlands getting inundated and destroyed, properties and buildings destroyed by standing water, coastlands washed and ravaged by floods emanating from storm surges, highways and roads in the cities and villages taken over by flood water and in several cases, loss of human lives. Flooding occurs as a result of intense rainfall along river banks, cities and from ocean storm surges which result in massive flooding of the low lying coastal areas (IPCC, 2007). The flood events in most southern cities of Nigeria are so prominent that some inhabitants in many of these settlements have often described it as "an act of God". However, apart from the Yobe's case in the Northern Nigeria, which was cause by breakdown of a dam,

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flood events in many southern capital cities in Nigeria are mostly due to the poor consciousness of the inhabitants on environmental information, inadequate (or sometimes absolute lack) spatial information on the flood prone areas, waste dump and construction of building (both commercial and residential, even public offices) on river channel without adequate measure of water flow (Etim, 2008). Many attempts have been made to control the annual flooding in Akure. Part of this includes channelization of river as well as making available succor for victims of the perennial disaster. The attempts seem unsuccessful as the situation keeps occurring and the inhabitants are rather helpless. It is thus as a result of this that this study has undertaken a survey of a planning methodology of the Geographic Information System for development control in the city, such that the problem of flooding would be minimised.Several studies have been conducted with integration of remote sensing and Geographic Information System to map and monitor flooding. Therefore the suitability of GIS as a mapping tool is derived from its characteristics of comprehensiveness, timeless, and reduced dependence on weather and improved cost-effectiveness (Adeoye et al, 2001). In other words, the use of Geo-information System is crucial to limit the damage caused by flooding and other environmental problems to the extent possible.

1.1 Study Area:

The study area is Akure which is the capital of Ondo State. Akure is situated on latitude 7° 15'N and longitude 5° 15' E. It is about 370 m above mean sea level. Akure is situated within a 48km radius to major towns in Ondo State, via Ondo to the South, Owo to the East and Iju/ItaOgbolu to the North. The easy access and geographical centrality of Akure to these towns have enhanced the growth prospects of the city. Figure 1.0 is a map of Ondo State showing the study area while Figure 2.0 shows the location of Ala River in the study area.

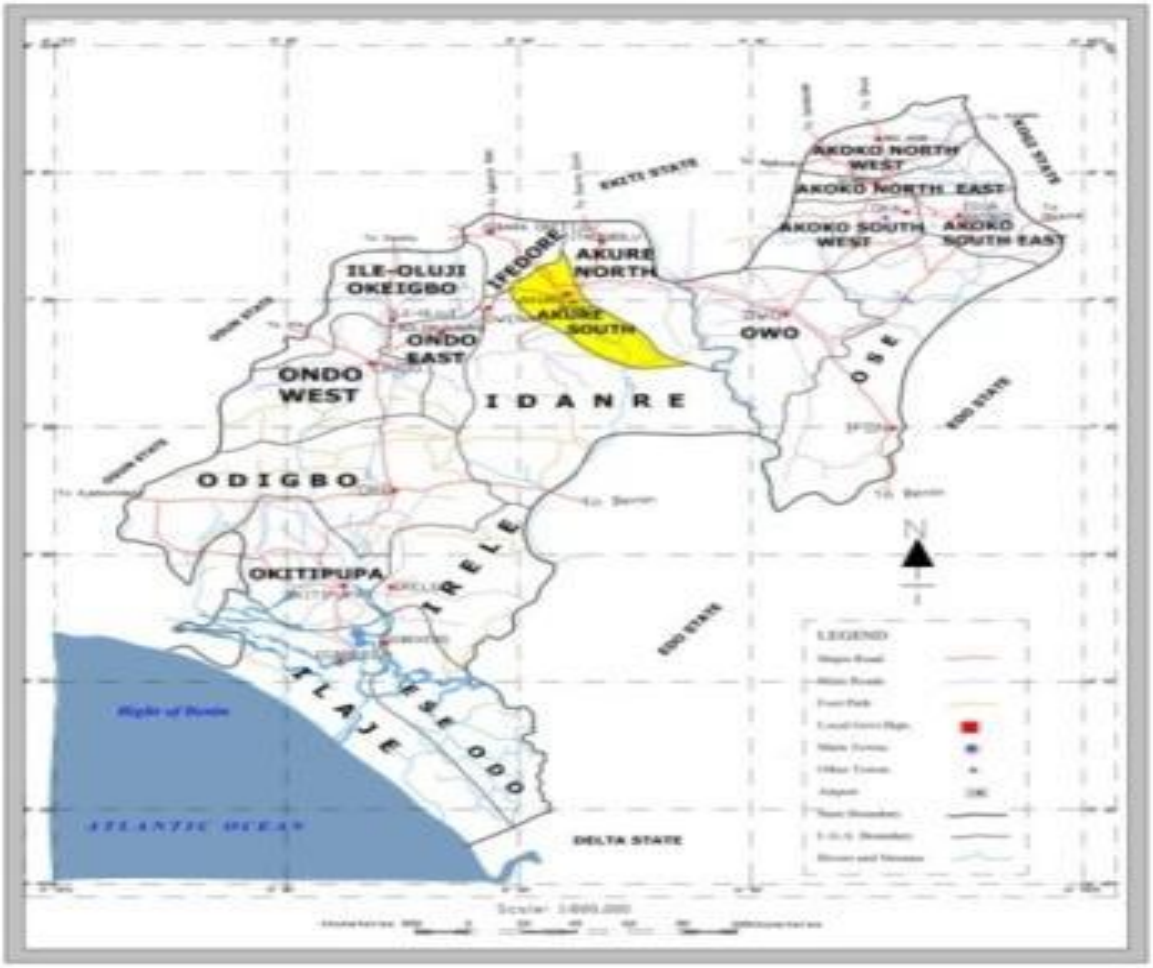

Fig.1. Map of Ondo State showing Akure south local government area

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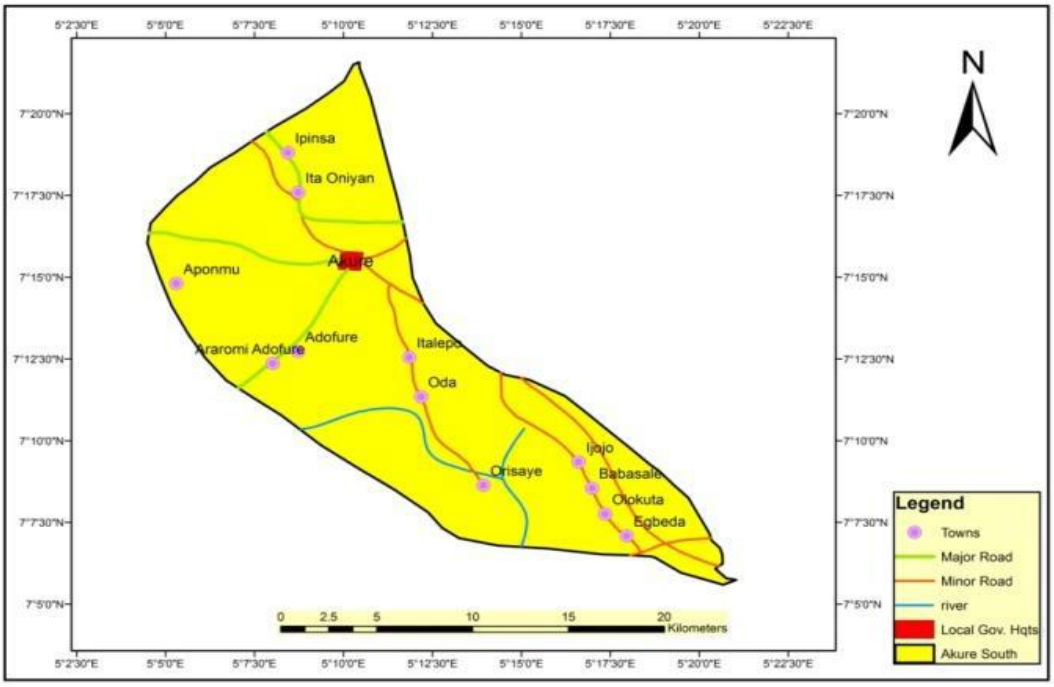

Fig.2. Map of Akure South showing Ala River

1.2 Aim and Objectives of the Study:

The aim of this paper therefore is to delineate flood potential areas around Ala River in Akure south local government area for early warnings and planning, control and management using the digital mapping capabilities of GIS.

The objectives of this study are to:

- To map out the terrain of Ala River using GIS techniques
- identify elements in the flood plain that are vulnerable to disaster using GIS techniques,
- Identify existing landuses within the floodplain, and devise a workable framework for managing flooding problems in the study area.

1.3 Hardware, Software & Data Requirements:

Data requirements include;

- Google satellite imagery covering the study area

Hardware requirements include;

- Pentium 4, 2.0GHz, 60GB, 512MB RAM

Software requirements include;

ArcGIS 9.2, 9.3 versions

2. METHODOLOGY

2.1 Data Acquisition:

The first step was the acquisition of the satellite imagery of the study area through google earth satellite imagery, A convenient scale was chosen on the Google earth, and at least 2-points coordinates were approximately identified on each saved scene of jpeg image such that island spaces are avoided or minimal. Each scene of the image was extracted and saved in a file. Possible points, line, polygonal features were identified and outlined during the process of cropping the images and this imagery was imported into GIS environment where further processing was carried out in order to make it useful for analysis. This image was able to show clearly the buildings and the main river (Ala River) in the study area.

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2.2 Geo-Referencing of the Raster Images:

Georeferencing is a process of allocating real time coordinates (i.e. ground coordinate) to points on the raster map or image., the raster image, in this case, the satellite imageries of the study area which was furnished with coordinates around the edges from Google Earth was imported into ArcGIS environment, where it was geo-referenced in the arcmap user interface. The add data tool was used to add the entire content of the feature dataset i.e. point, line, and polygon.

2.3 Vectorizing of the Raster Images:

The study area was digitized as appropriate.

3. RESULT ANALYSIS

The resulting imageries are shown below

A. Delineated Map of the Study Area

Figure 3.0 shows the delineated map of river Ala using ArcGIS 9.2 software.

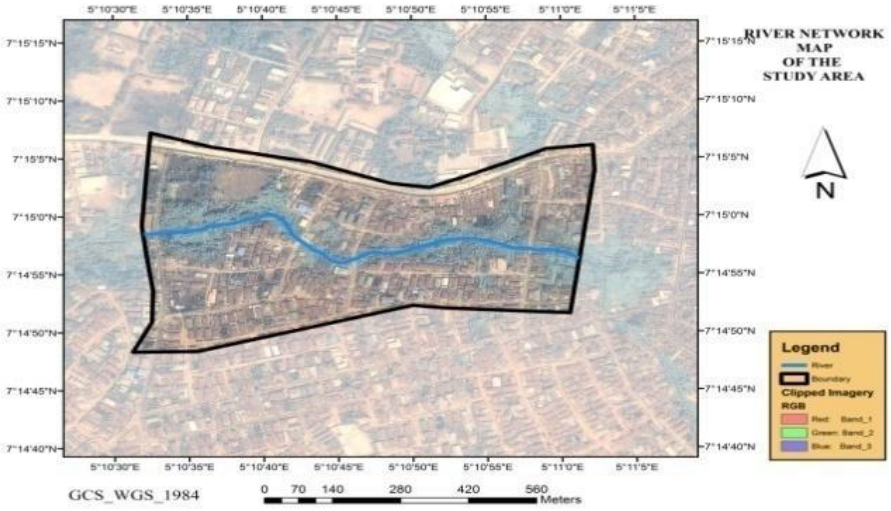

Fig.3. Map showing the river network of the study area

B. The Buffered Zone of at least 30 m setback of the Study Area

Figure 4.0 shows areas and settlements that fall within the buffer zone

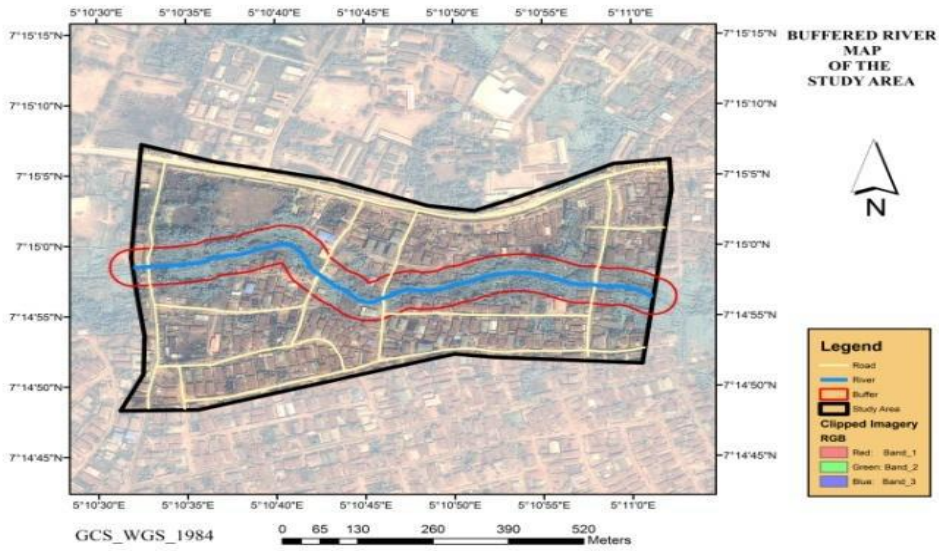

Fig.4. Map showing the buffered area of the study area

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Figure 5.0 shows the areas that are prone to flooding around river Ala. These encroaching areas fall within the range of 30m buffer zone which is the minimum standard setback and they are shown in colour yellow. This shows that these areas are at risk to flood. In fact, part of the newly constructed ultra-modern market by the government is at risk to flood.

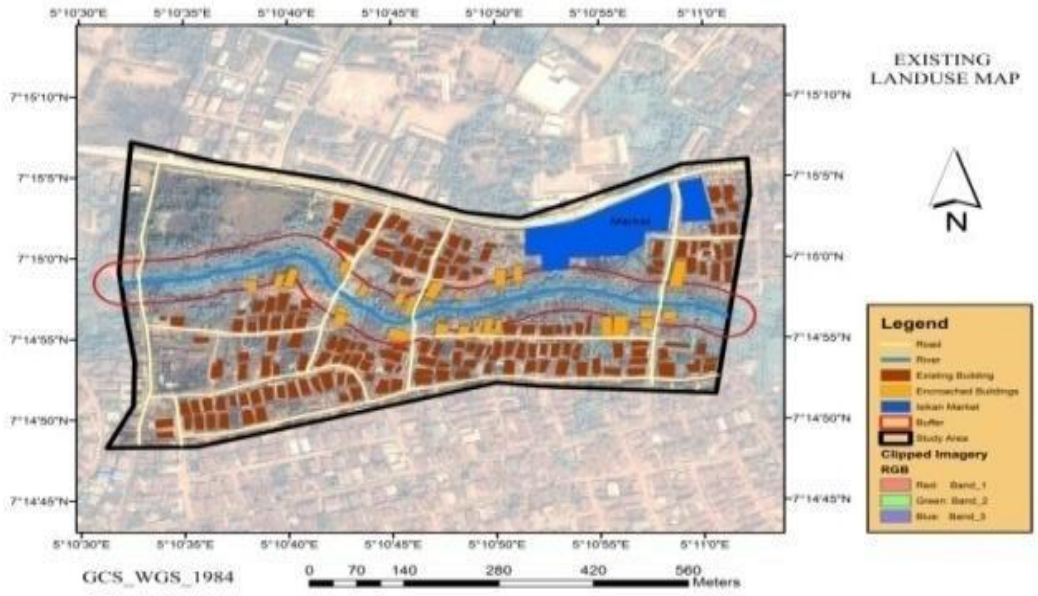

Fig.5. Map showing flood-prone areas of the study area

Figure 6.0 shows a proposed map for the study area. The proposed map indicated that all the buildings that are within the buffer zone must be relocated.

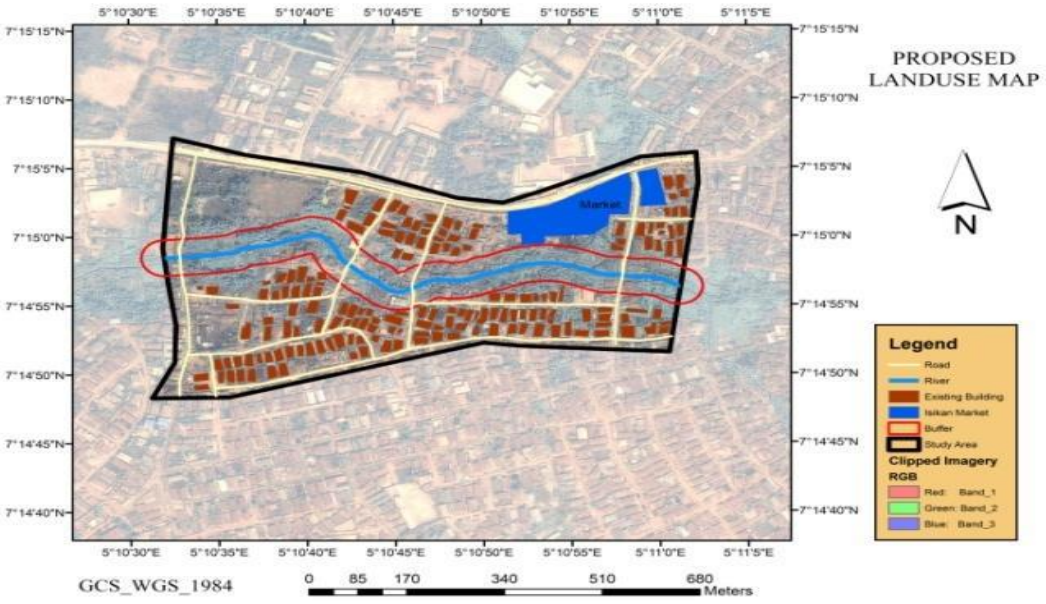

Fig.6. Map Showing Proposed map for the study area

4. CONCLUSION

Based on the results of this case study, it can be concluded that geospatial technology and Geoinformation system provide the best potential to analyze and provide results required for prompt and effective decision-making on floods. Therefore, GIS is an efficient tool for flood mapping and suitability analysis and can be useful for emergency response and disaster preparedness.

5. RECOMMENDATIONS

In view of these findings, this study advances some recommendations as a way of preventing the menace of flooding in the study area. These recommendations include the establishment of well equipped GIS Centre in Ondo State for real-time analysis; monitoring and control of environmental degradation problems. Also proper drainage channels should be constructed by the government to control solid wastes blockage of drainage channels; adequate setback to streams and rivers should be maintained and buffer strips should be maintained as open spaces;

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