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An Evaluation of Flood Disaster Control Management and the Environment using Remote Sensing and G.I.S: A Case Study of Apete River in Ido Local Government Area, Oyo State, Nigeria

Fatunmibi Oluwagbemiga¹, Gbopa Adetola²

^{1, 2}Department of Surveying and Geoinformatics, The Polytechnic, Ibadan, Nigeria.

Abstract: Disaster is a serious disruption to environmental functions that could lead to human, material or economic losses, and impact which exceeds ability of the affected community to cope using its own resources. This study attempts to evaluate causes as well as remedy to flood disaster among others that are of great hazard to the environment when not properly managed. Google earth satellite imagery was used to determine the spatial location and the course of the river, methods of proper flood control and management was thoroughly discussed. Satellite imagery covering the flood in action and some rescue exercise were also examined. Questionnaires were served and responses analyzed to determine the environmental and economic effects of the flood on the immediate environment. Considering the findings, the study suggests some methods to ameliorate impact on the immediate environment as recommendations to achieve safe environment.

Keywords: Flood Disaster, Control, Management, Satellite Imagery, Environment.

I. INTRODUCTION

Flood is a natural event or occurrence where a piece of land (or area) that is usually dry, suddenly gets submerged under water. Some floods can occur suddenly and recede quickly. Some may take days or even months to build and discharge. Flood as a temporal covering of land by water, not covered by water before the incidence. Though, flood may be temporal as believed by the European Union, but the effects may not be temporal on lives and properties. Meanwhile, flood usually occurs when there is a continuous downpour of rain for a long period, while resulted excess water has capacity beyond what available drainage can easily convey, due to its inadequacy or blockage of the drainage. [1]

Flood not only affects the victims, but also has a gross effect on the national economy of the country where poverty level rises due to the incidence. [2] Disaster is an aftermath of flood, while disaster is a sudden, calamitous event that seriously disrupts the functioning of a community's or society's ability to cope using its own resources. Flood is one of the major factors that prevent Africa's population from escaping poverty level [3]. Apart from the natural occurrences, abuse of the environment is one of the causes of flood. The abuses include poor planning of the physical environment, poor management of wastes, inadequate drains for the built up areas and others.



Fig. 1: showing Apete River Flood in action.

The effects of flood are not wholly negative as painted by many researchers, but also have its positive impact. Although flooding, generally, is a bane of most of the people, but it can be beneficial. Actually, nature benefits more from natural floods than from not having them at all [4]. Effect of flood, Disaster, its Control and Management in Apete Environment within Iddo Local Government Area, Oyo State, Nigeria shall be critically considered.

The poor in the society have been identified to be the most of the victims of the flood, by having no choice, but to end up living in the flood prone areas [5]. Stephen (2011) [6] opined that the loss of life due to flood is lower in the developed countries compared to the developing countries.

Here are few events that can cause flooding:

- 1) *Rain*: Each time there are more rains than the drainage system can safely pass, there will be flood.
- 2) *Rivers Overflow*: When there is more water upstream than usual to the adjacent low-lying areas (also called a floodplain).
- 3) *Strong wind in coaster areas*: When massive winds and hurricanes onto dry costal lands causing flooding, resulting to a tsunami, leading to damages.
- 4) *Dams breaking*: Sometimes, too much water held up in the dam can cause the Dam to break and overflow the area. For example, February 26, 1972 – Buffalo Creek Valley, West Virginia
- 5) *Ice and Snow-melt*: In many cold regions, heavy snow over the winter usually stays un-melted for some time. There are also mountains that have ice on top of them. Sometimes the ice suddenly melts when the temperature rises, resulting in massive movement of water into places that are usually dry. This is usually called a snowmelt flood.

A. Effects of Flooding In Apete

Floods can have devastating consequences and can have effects on the economy, environment, people and animals as it describe below,;

- 1) *Economic*: During floods, roads, bridges, farms, houses and automobiles are destroyed. People become homeless. This usually takes years for affected communities to be rebuilt and business to come back to normalcy.
- 2) *Environment*: The environment also suffers when floods happen, contaminates the water bodies, leakage in nuclear plants and high radiation in that area, killed animals and other insect, distorting the natural balance of the ecosystem.
- 3) *People and animals*: Many people and animals have died in flash floods. many more are injured and others made homeless. Water supply and electricity are disrupted, people struggle, suffer diseases, infections and fever causing a lot of havoc.
- 4) *Tourism, farming and livestock* can equally be affected. Vital infrastructure may also be damaged or disrupted. Road links, railways, canals, etc..., may be blocked causing disruption to the wide transport network [7].

The beneficial effect of flood is when the river overflows, and the flood water subsided and go back to its normal flow, the deposited materials will help to make the land richer or more fertile. The organic materials and minerals deposited by the river water keep the soil fertile and productive [4].

Flooding adds a lot of nutrient to lakes and rivers which leads to improved fisheries, also because of the suitability of a floodplain for spawning (little predation and a lot of nutrients). Fish, like the weather fish make use of floods to reach new habitats. Together with fish, also birds benefits from the boost in production caused by flooding [8].



Fig. 2: showing Apete Pedestal Bridge under construction

Figure 2 above showed students' of The Polytechnic, Ibadan among other community members working on wooden pedestal for accessibility over Apete River.

Flood control according to Bariweni et al (2012) [8] refers to all methods used to reduce or prevent the detrimental effects of flood waters. Some methods of flood control have been practiced since ancient times. These methods include: planting vegetation to retain extra water, the introduction of flood forecasting systems, the building of population awareness and preparedness, urban development of local institutional capacities. These actions can appreciably increase the societal capacity to cope with floods, thereby decreasing their overall impact [9]. In Europe, remembering the misery and destruction caused by the 1910 Great Flood of Paris, the French Government built a series of reservoirs called Les Grands Lacs de Seine (or Great Lakes) which helps remove pressure from the Seine during floods. In India, Bangladesh and China, flood diversion areas that are deliberately flooded in emergencies in order to protect cities [8]. Other methods of controlling the effects of flood include: dam construction and river defense. Dams and their associated reservoirs are designed completely or partially to aid in flood protection and control. Defenses as levees, bunds, reservoirs and weirs are used to prevent rivers from overflowing their banks. When these defenses fail, emergency measures such as sandbags or portable inflatable tubes are used. A weir also known as low head dam is most often used to create millponds, but on the Humber River in Toronto, a weir was built to prevent a reoccurrence of flood damage caused by hurricane. Therefore, this study assesses the Flood Disaster Control Management and the Environment Using Remote Sensing and G.I.S in Apete and its environment.

II. STUDY AREA

This study area is Apete Environment in Ibadan, southwestern Nigeria (see figure 4.0). It is located between latitude $7^{\circ}26' 38.48''$ N – $7^{\circ}32' 54.81''$ N and longitude $3^{\circ}52'50.18''$ E $3^{\circ}44'32.33''$ E and 3with average Height of 179m MSL. Climate is tropical i.e. wet and dry season. The amount of rainfall is adequate for all-year-round crop production. The mean monthly temperature range is from 25°C to 31°C . The hottest months are December to April. The Relative humidity is high in the state throughout the year and decreased slightly in the dry season.

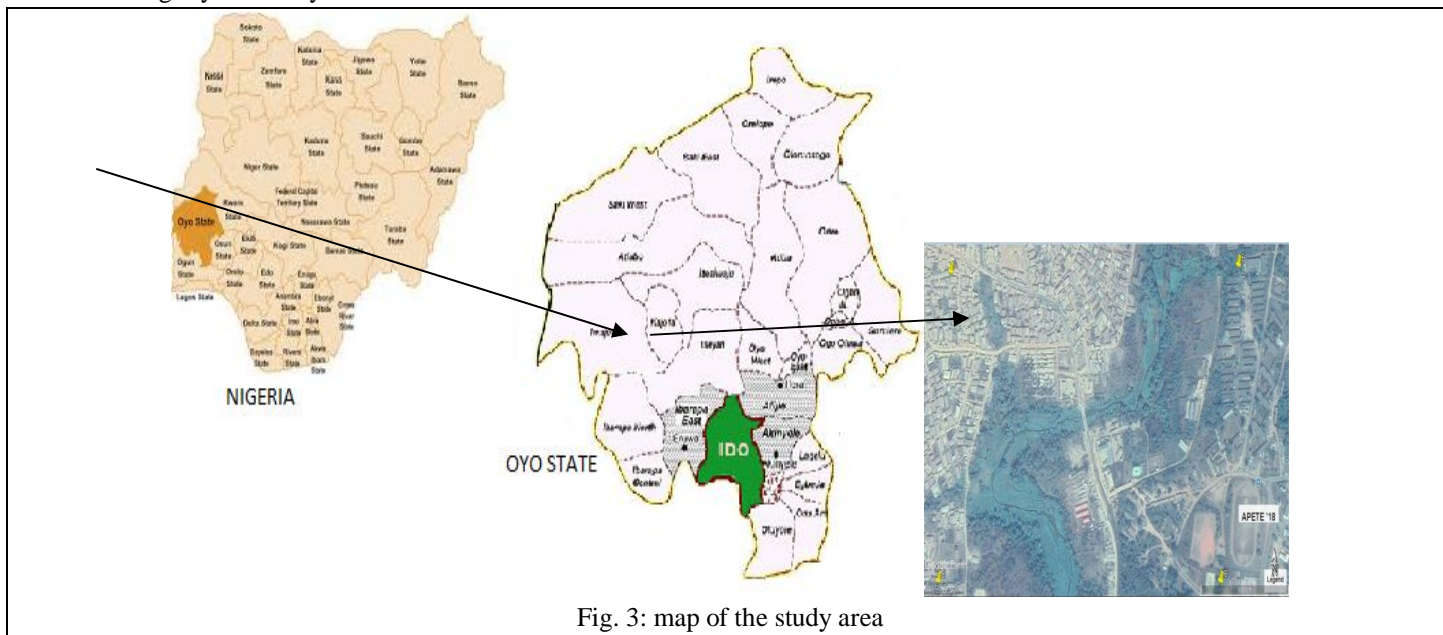


Fig. 3: map of the study area

Research Question

- A. How long have you resided in this place?
- B. Were you disturbed by the flood occurrence in 2011?
- C. Were their lost of lives during the flood?
- D. Was there any rescue operation?
- E. Do you think the rescue operation was adequate?
- F. What causes the flood in your own opinion?

III. MATERIALS AND METHODS

A. Material used

1) Hardware

- a) Handheld GPS
- b) PC laptop and accessories (HP),
- c) Ink jet printer (HP),
- d) Flash Drive.

2) The Software

- a) ArcGIS 10.2,
- b) Microsoft word,
- c) Windows Photo viewer
- d) Medium resolution satellite image

B. Methods

- 1) *Geo-Referencing*: Google earth imagery covering the area of study was acquired and geo-referenced. Digitization and Ground tuiting survey method were applied to map the river course and the associated natural and artificial features. One hundred and fifty (150) questionnaires were administered to residents and passersby of Apete and its environment. A feedback from ninety (90) respondents which is above 60% administered questionnaires were returned and analyzed to acquire more information on the effect of the flood on the community. The age range of the respondent ranges between 1-4years, 5-10years, 11-20years, and 20 years and above. Table below showed the geographic coordinate of the study area. Figure 4 below showed the imagery of the study area



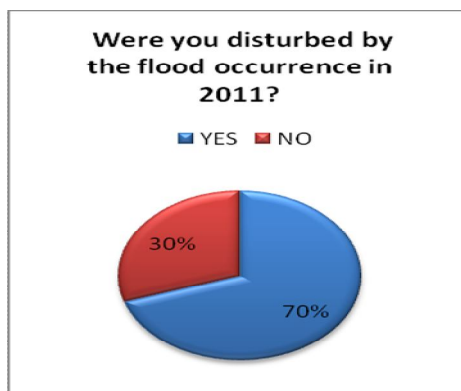
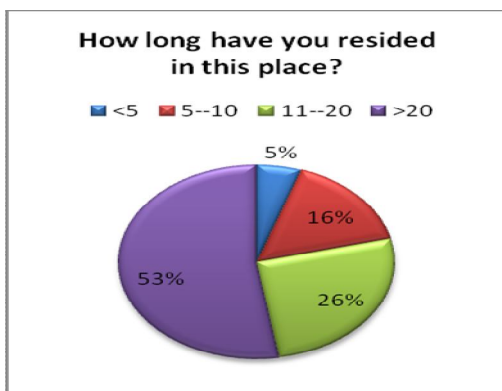
Fig. 4: Map showing 2012Google earth imagery of the bridge overblown by flood

TABLE I
GPS COORDINATES

Easting	Northing	Easting	Northing	Easting	Northing
596647	823287	596282	823359	596217	823367
596672	823337	596217	823367	596119	823355
596709	823368	596119	823355	596287	823299
596698	823376	596287	823299	596272	823280
596653	823419	596272	823280	596262	823239
596566	823385	596262	823239	596237	823192
596541	823385	596237	823192	596224	823161
596488	823378	596224	823161	596216	823147
596545	823352	596216	823147	596199	822997
596546	823339	596199	822997	596197	823020
596545	823312	596197	823020	596215	822913
596565	823316	596215	822913	596194	822959
596701	823125	596194	822959	596648	823248
596725	823076	596648	823248	596670	823190
596681	823035	596670	823190	596789	823397
596859	823084	596789	823397	596794	823418
596821	823060	596794	823418	596815	823465
596879	823075	596815	823465		
596931	823084	596282	823359		
596796	822964	596217	823367		
596687	822998	596119	823355		
596682	823014	596287	823299		
596887	823011	596272	823280		
596385	823374	596282	823359		

IV. RESULTS AND DISCUSSION

The results presented here was as a result of the data acquired from the field. From the analysis of the respondents, it showed that 5% of respondents are between 1-4 years of age, 16% of respondents are between 5-10years, 26% are between 11-20years, and 53% of respondents are 20 years of age and above resides in Apete area. 20% believe that the flood were caused by constant rainfall, 27% belief that the flood were caused by dumping of refuse, and 53% believe that the flood were caused by poor drainage system. 70% believe that all residents in Apete were disturbed by the flood in 2011 and 30% do not belief. From the analysis, 80% of the respondent said, there was no rescue operation on time and 20% said there was rescue operation. 90% believe that the rescue operation was adequate and 10% believe that it was not adequate. Information gathered shows that many lives were lost during flooding caused by factors such as poor drainage, dumping of refuse in the river, poor rescue operation, e.t.c. Statistical chart below showed the result:



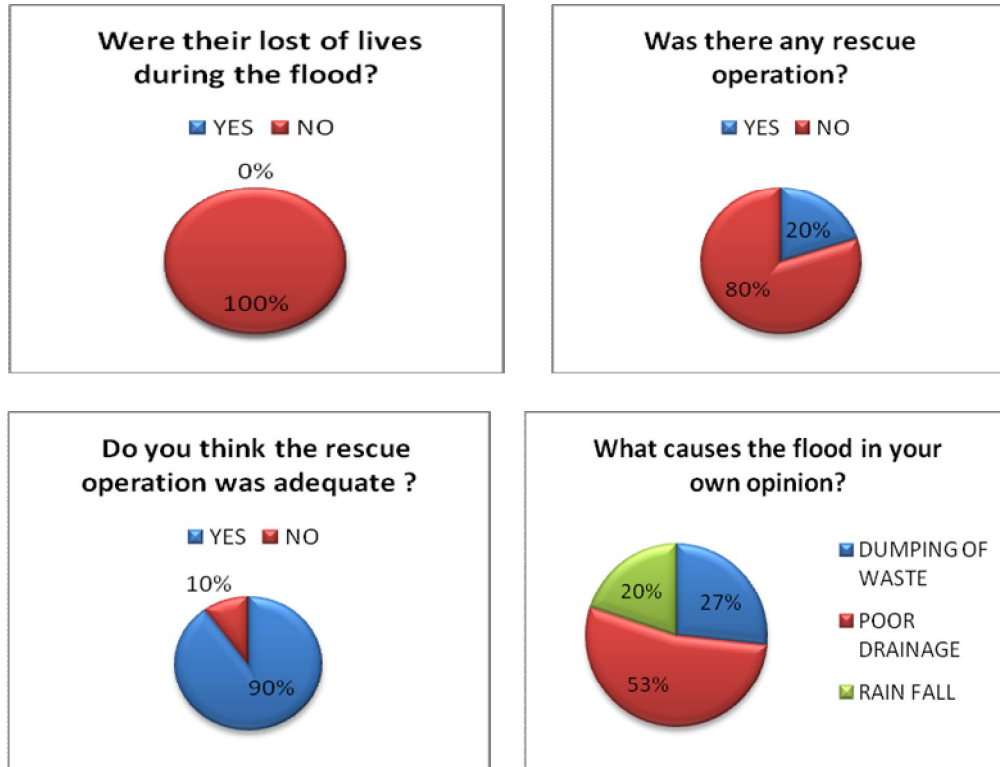


Chart 1: The results of questionnaire based on the research question to the respondents



Fig. 5: Apete Newly and enlarged bridge constructed by the State Government.

Figure 5 above is a newly constructed bridge by Oyo State Government constructed in order to ease the movement of people from their resident to their working place as well as easy transportation by the commercial and private vehicles to and fro. But this does not solve the entire flood disaster in Apete and its environment.

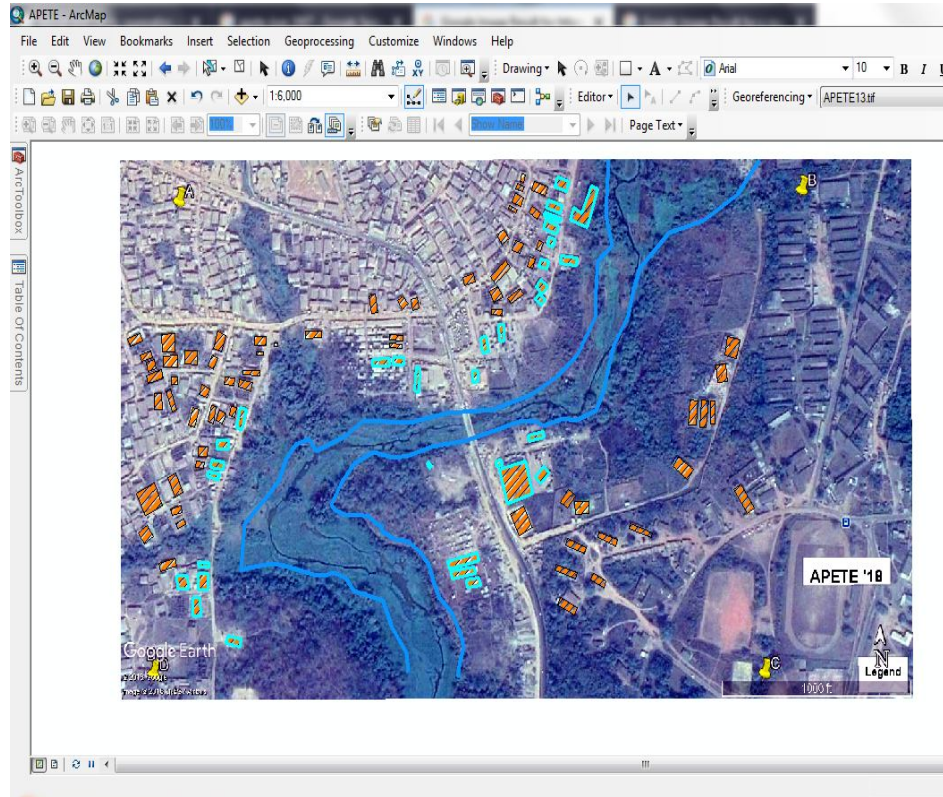


Fig. 6: showing scores of building that are still liable within the buffer zone.

Figure 6 above showed the buildings that are liable to flooding. Findings of this study still confirm that, danger would continue to loom as long as the issue of drainage is not addressed. It means that, in case of heavy rainfall during the season, lives and properties are still in danger.

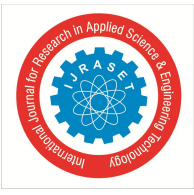
V. CONCLUSIONS

Flood disaster has been evaluated in this study using remote sensing and GIS application and questionnaire administered to respondent in Apete and its environment. The findings showed that response of the government to the cry of the masses; only solve a single problem based on the bridge construction which solved the problem of passage of the people and vehicles. It can be concluded that the problem of flooding will still persists, and people within the environment will still entertain fear whenever it is raining because the issue of drainage which remains unaddressed and proper dumping of refuse by the residents.

VI. RECOMMENDATIONS

This study therefore recommends that

- A. Government and Non-Governmental Organizations should set up various information programmes to enlighten the public on dangers of flood disaster.
- B. Government should plant trees and encourage citizens to plant as well along the river bank to forestall future occurrence.
- C. Indiscriminate dumping of wastes should attract stiffen penalty Channelization might be the best solution because Apete is now a big river within the community.
- D. Source of undue planning approval within the river setback should be looked into and good monitoring by the government agencies is very essential.
- E. Regular monitoring of disaster zones by development control agencies as well as reduction in building plan approval charges
- F. Adequate medical facilities should be provided for the treatment of various environmental diseases emanating from flood occurrence.
- G. Government should provide adequate funding for disaster management bodies and agencies.



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