FLOOD MODELLING USING MULTICRITERIA DECISION ANALYSIS AND ARCHYDRO TOOLS

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ABSTRACT

Flooding is one of the most dangerous natural dangers, causing billions of dollars in damage and deaths around the world. Geographic Information System techniques were used to analyze the areas of Ga South and Weija – Gbawe Municipalities to detect flood prone areas. Weighted Overlay Analysis reviewed the areas at very high risk, high risk, medium risk and low risk by assigning weights to the contributing factors; rainfall, slope, digital elevation model (DEM), flow direction, flow accumulation, soil types and land cover.

INTRODUCTION

Ghana experiences flood crisis every one to two years. The worst of the disasters take place in Greater Accra, particularly in the Accra Metropolitan, Ga West, Ga South, Weija- Gbawe and Ledzokulu Krowor Municipalities. Occurrences are not only subject to the capital city but also to all parts of the country.

Flood maps provide essential information such as the nature of the study areas, its characteristics and risks involved. For better results, GIS is used together with other models and techniques such as remote sensing hydrological model software to estimate flood profiles.

STUDY AREA

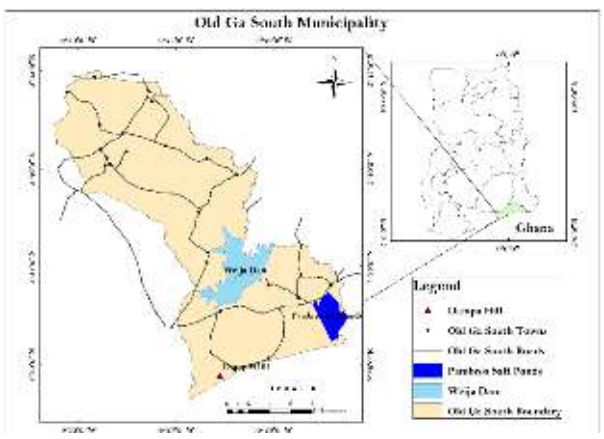
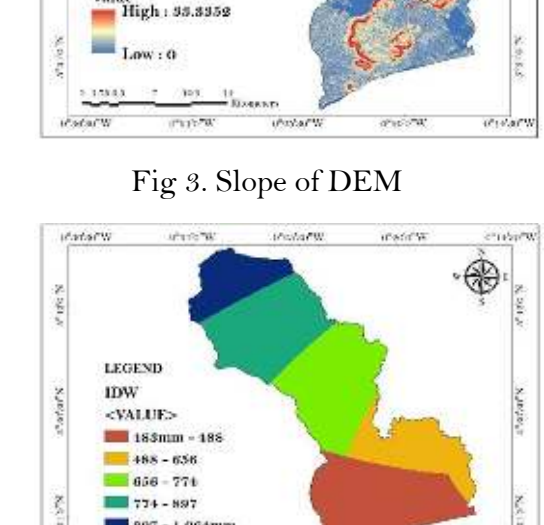


Fig 1. Study Area

METHODOLOGY

ArcMap 10.8 and Arc Hydro Tools were used for all processes and map creation. Data Source for inputs include; DEM from NASA, Slope, flow direction and flow accumulation from DEM, Rainfall Data from Ghana Hydro Database, Soil data from Where Geospatial, Landsat 8 from USGS and all shape files retrieved from Government of Ghana website.



ARC HYDRO PROCESS

Stream Order generated with Arc Hydro Tools

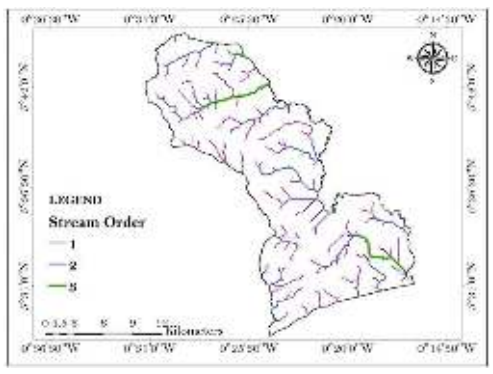


Fig.2 Stream Order

DATA PROCESSING with ARCMAP 10.8

Using the Surface tool, the slope of the study area was derived from the DEM. The rainfall point data was analyzed using a spatial interpolation method, Inverse Distance Weighted to produce the rainfall map. With band combinations of Band 4. 5 and 6 of Landsat 8, land cover was produced using the Supervised classification tool.

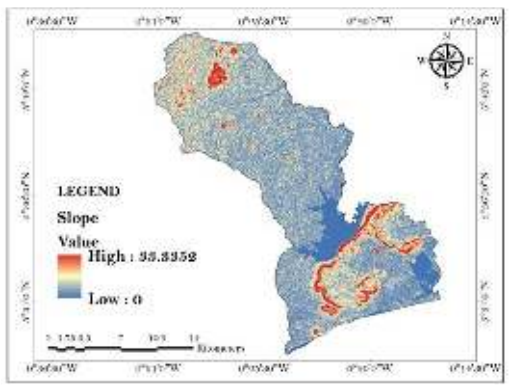


Fig 3. Slope of DEM

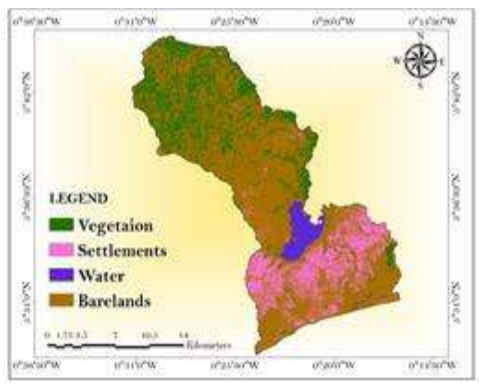


Fig 4. Land Cover

Fig 5. Rainfall

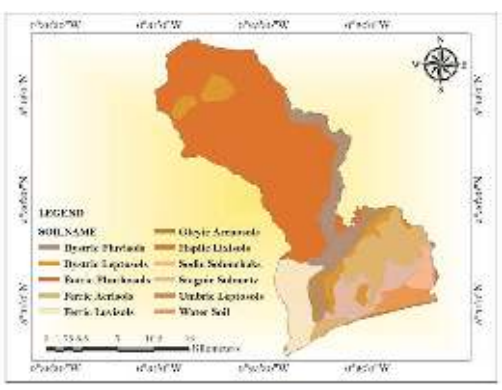


Fig 6. Soil

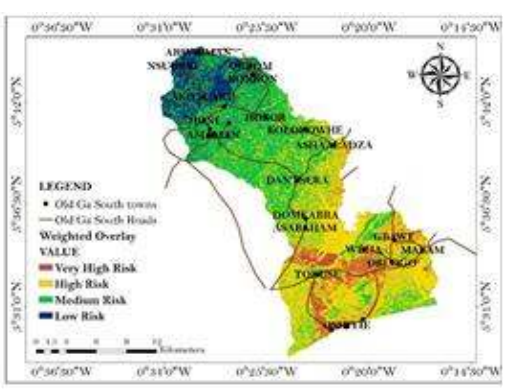


Fig.7 Flood Prone Map

RESULTS AND CONCLUSION

The Weighted Overlay Algorithm produced a flood prone map. The flood prone map was based on the five determinants introduced in the methodology. The five criteria affecting the occurrence of floods were amount of rainfall, flow accumulation, slope, and soil type and land cover. According to the map, 20.84% of the total area are at low possibility, 20.83% are at medium risk. 20.8% are at a high risk of flooding whiles the remaining 37.5%, are at a very high risk to flooding. At the end, it was revealed that built up areas, areas along the coast, and grasslands are all vulnerable to the occurrences of floods. Areas around the Weija Dam, Densu River and gulf of Guinea showed high possibilities of floods.