Flood vulnerability mapping using geospatial technique for controlling flood along River Yobe Basin in Nigeria

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ABSTRACT

In flooding, dry land capable for residential, agricultural and other economic activities is being submerged by overflow of water. This causes lost to life and property along the river basin. Effective management of these disasters by decision maker required accurate information about the vulnerable areas. Remote Sensing and GIS can be used for generation of flood vulnerability map. The method was capable of integrating the entire flood risk areas using GIS based model to provide rational and non-biased approach for making decisions in flood disaster. An attempt made to apply modern techniques like GIS and Remote Sensing for the mapping of flood prone zones risk areas. For this study, Satellite imagery was used to classify the study area into water body, open land, vegetation and built up areas while SRTM data was used for the production of slope map, drainage network, flow accumulation map, fill map and DEM of the study area from which the flood vulnerability map was produced. The contour map depicts the terrain nature of the environment has a low levelled ground and relatively flat terrain. Effective landuse planning, creation of a computerized GIS database for the flood prone areas and a detailed flood risk assessment and mapping are required to minimize the harmful effects of flood hazard.

Keywords: Flood, vulnerability, control, mapping, geospatial and Multicriteria

1. Introduction

Flood is an overflow of water submerging land which is usually dry (Mohammed et al. 2013). The European Union Floods Directive defines a flood as land area covered by water which is not normally covered by water. It occurs as an overflow of water from water bodies, such as a river or lake, in which the water overtops or breaks its levees, resulting in some of that water escaping its usual boundaries, or it may occur due to an accumulation of rainwater on saturated ground in an area.

For the past few years, River Yobe basin has been flooded, which results in destruction and loses. As a result of flood, residence of the area suffer from loss of houses, food, farmland, fishing area, and grazing land leading to migration, increased poverty and depreciation of human resources. After the flood disappears, towns will be covered with mud and waste. Flood vulnerability mapping can provide a means delineating of various areas frequently affected by this phenomenon. Hence, actions can be taken to reduce, prevent and provide solution to this problem.

Floods are natural phenomena, human activities and interventions in to the processes of nature, such as alterations in drainage patterns from urbanisation, agricultural practices and deforestation, have considerably changed the situation at the same time, exposing them to risk and vulnerability to flood in flood-prone zones mostly along riverine areas (Mohammed
et al. 2013). Flood risk is defined as the probability of occurrence multiplied by its impact (Osadolor and Henry 2013).

1.2 Problem

Floods happen in varying locations and at varying magnitudes giving them different effects on environment. Flood hazard comprises many aspects which include structural erosion damage, contamination of food and water, disruption of social and economic activity including transport, communication, loss of lives and property (Mohammad I., 2013). Flood is widespread, devastating and frequent natural hazard. Socio-economic activities are halted to some extent along River Yobe due to flooding. Flooding of abnormal magnitude submerging the surrounding flat fields or floodplains mostly located along the along the River basin. The problem of river flooding along river Yobe is increasing, and yearly the number of people affected is quite alarming. This leads for a demand to proper long-lasting solution for safety of lives, property and natural environment in the river basin. Flood vulnerability map of River Yobe has never been produced. Hence it is difficult to ascertain vulnerable areas that may be affected in any flooding event along the River basin. A flood vulnerability map is one of such resource to be used in providing alternative to flood situation.

2. Study area

Yobe State's was located approximately between latitudes 10° 35.509' and 13° 22.750' North, and longitudes 09° 39.993’ and 12° 03.176’ East, respectively.

Figure 1a: Map of Nigeria showing Yobe State. Figure 1b: River Yobe and its tributaries.

As shown in Figures 1a and 1b; Plates 1(a), and 1(b), River-Yobe Basin drains a catchment of approximately 8400 km2 in North-Eastern part of Nigeria before discharging into Lake Chad. It covers five Northern States, (Kano, Jigawa, Bauchi, Yobe and Borno). According to Muhammad et al, (2013) over 15 million lives are supported by the basin through agriculture, fishing, livestock keeping and water supply.
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