URBAN FLOOD VULNERABILITY MAPPING OF DHARWAD SUB-URBAN AREA

Project Reference No.:*46S_BE_5439*

College : Shri Dharmasthala Manjunatheshwara college of Engineering and Technology, Dharwad-580002

Branch : Civil Engineering

Guide(s) : Mr.Vishwanatha Bhat

Student(s): Ms. Vanishree S

Ms. Manasi A

Mr. Shreekantha M

Ms. Bhagya

Keywords:

Urban flood, Flood vulnerability, Multi-criteria evaluation, Vulnerability mapping, Flood hazard, AHP, Vulnerable zones, FVZ, NDVI (Normalized Difference Vegetation Index) Comprehensive flood risk assessment.

Introduction:

The present study identified the various zones vulnerable to urban flood in Dharwad suburban Area. Floods happen in varying locations and at varying magnitudes giving them markedly different effects on the environment. Flood hazard comprises many aspects that include structural and erosion damage. Urban floods as the name implies take place in urban areas especially in towns located on flat and low-lying terrain especially where drainages are not available or poorly built or have been blocked by disposed municipal waste and eroded soil materials. By using Remote sensing data such as satellite imageries, digital elevation model in a GIS interface, overlay analysis could be planned. At times, this approach proves to be a comprehensive method to yield picture of flood risk in a given area. The analysis and assessment of vulnerability was done through the application of multi-criteria evaluation approach in a geographical information system environment with inputs from remotely sensed images. Flood vulnerability mapping in the study area is fundamental in flood risk management.

Objectives:

The objectives of this work are:

- To map the urban flood risk areas in an urban environment of Dharwad

- To derive location specific flood risk index to understand the severity of flood

Methodology:

The methodology involves the investigation of geospatial data using overlay analysis. The rainfall causing urban flood is identified from frequency analysis. Rainfall data belonging to normal years are regarded for this purpose. It is believed that the urban flood is routed from some set of field conditions. lapsing for some minutes to hours. The urban flood, unlike the floods generated from riverine environment, arises due to a combination of conditions that could be understood from the weighted overlay analysis. The data used are rainfall variability, soil, road network, land use/ cover, slope and drainage layers. The weights are estimated based on the priority. The normalization of weights is performed before the estimation of vulnerable areas.

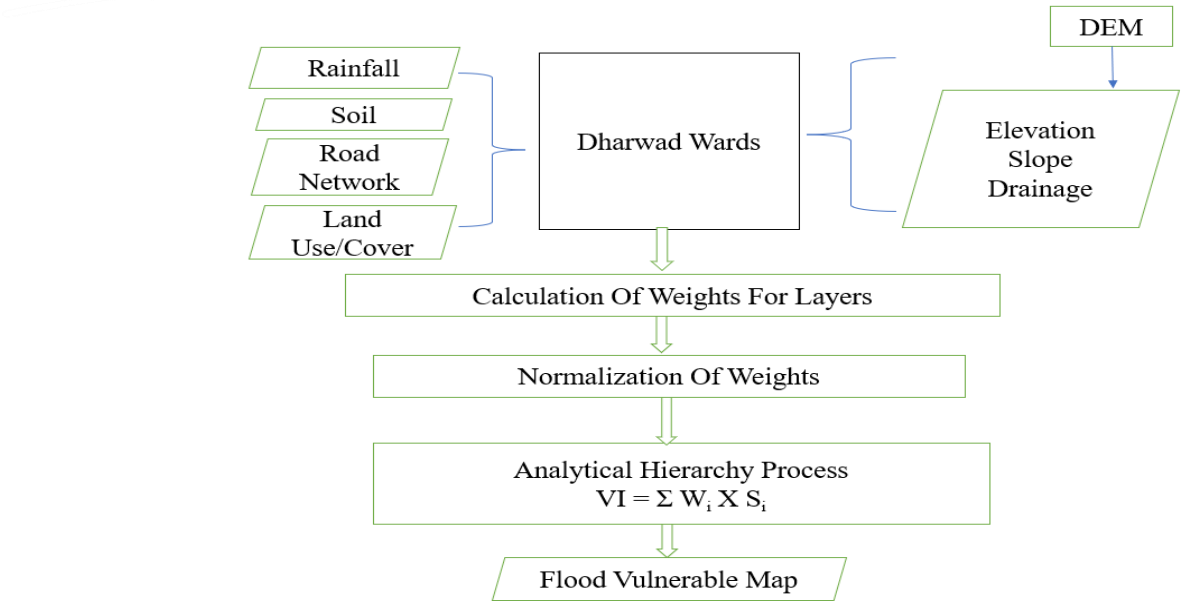


Fig:1.1 Flowchart Flood Vulnerability

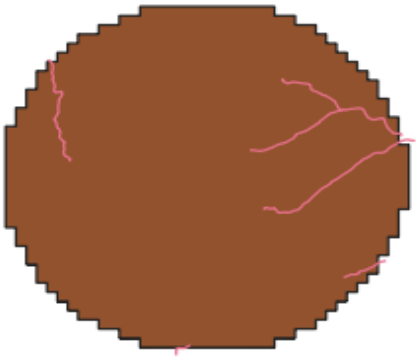
- For the analysis, the layers were being categorized as major and minor roads, lanes and by-lanes in addition to wards. The table of contents lists all the layers on the map and shows what the features in each layer represents. Although network analysis in GIS has been largely limited to the simplest routing functions, the recent past has seen the development of object,

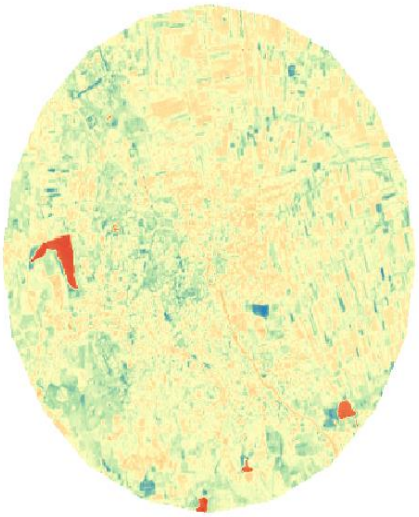
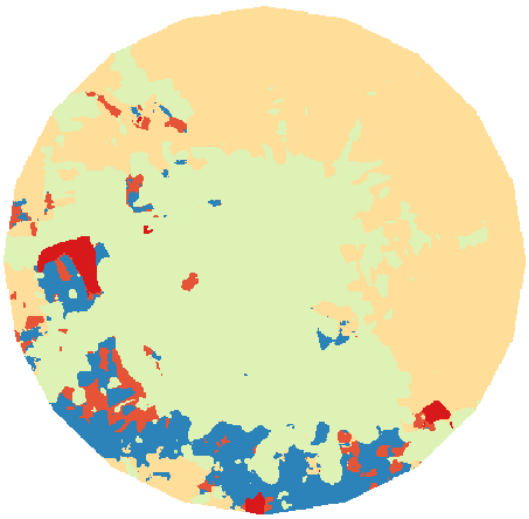
oriented data structures, the introduction of dynamic networks. Cumulative composite vulnerability Index called categorized highest and lowest. Vulnerability parameter intended to characterized the system heterogeneous landscape of India. Various basic thematic layers were created from different sources including reference maps such as Survey of India top sheets at 1:50,000 scale, corporation map, satellite images and field study. However, there remain challenges and limitations to the approach, such as issues related to data quality, accuracy, and interpretation. The review concludes with recommendations for future research and practice in this area.

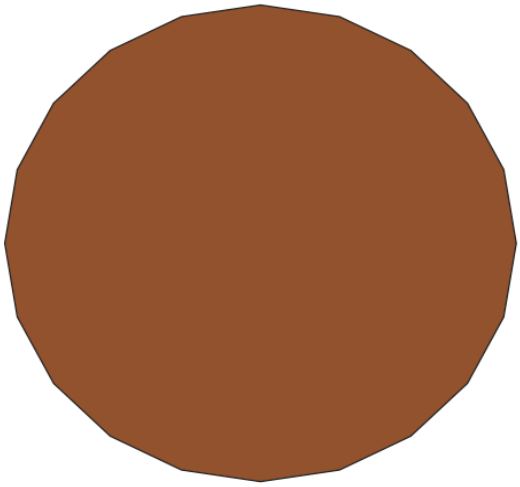
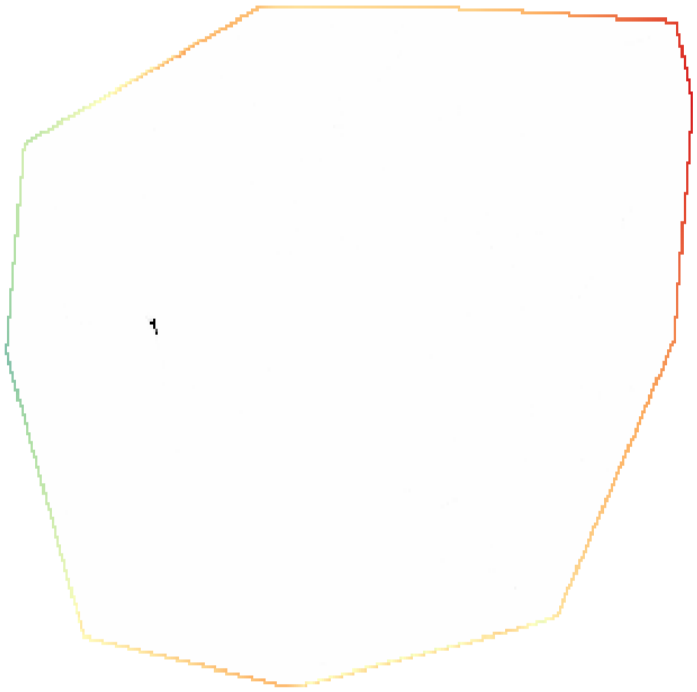
Result and discussion:

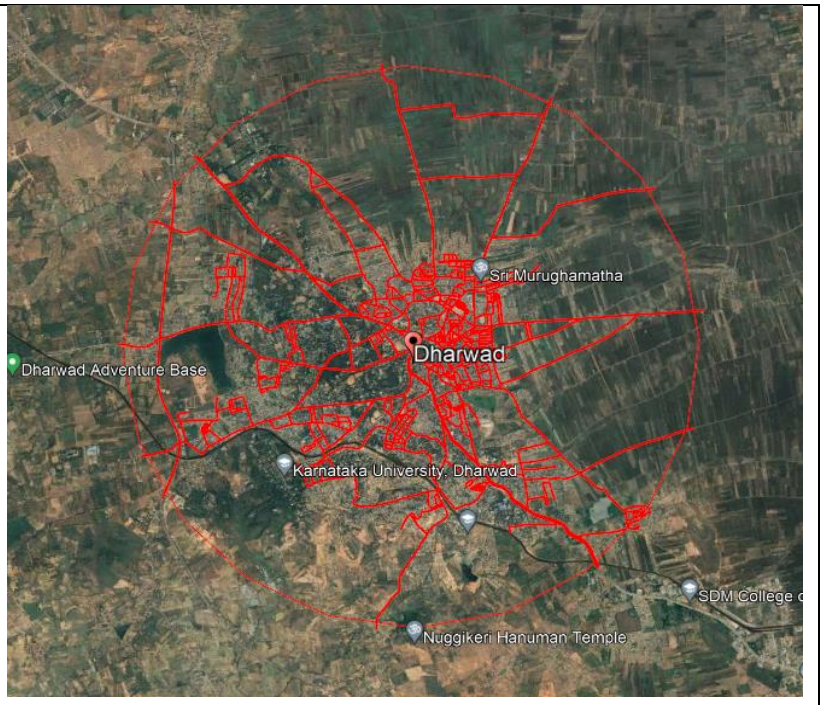
Thematic layers from remote sensing data

Implications of the physical factors that are responsible for groundwater movement and occurrence for NE region are discussed in the following sections:

Features of Drainage Density: Drainage density defines the closeness of the rivers in a watershed. It indicates the total length of drainage network per unit area and inversely Proportional to the permeability of lithological formations. This implies that the permeability will be less for dense drainage density. According to Strahler, low drainage density is favoured, where basin relief is low and vice versa. The drainage density of the study area was broadly characterized.	

Features of Normalized Difference Vegetation Index (NDVI): NDVI index detects and quantifies the presence of live green vegetation using this reflected light in the visible and near infrared bands. The method employs the multi-spectral remote sensing data technique to find spectral signature of different objects such as vegetation index, land cover classification, urban areas, The simulation results show that the NDVI is highly useful in detecting the surface features of the visible area which are extremely beneficial for municipal planning and management. The vegetation analysis can be used for the situation of unfortunate natural disasters to provide humanitarian aid, damage assessment and furthermore to device new protection strategies.	
Features of land use and land cover: The LULC broadly varies with the type of soil deposition, the vegetation cover and the distribution of residential areas; and depends on the climate conditions. The key objective in assessing the LULC is to classify the land surface into my many LULC units related to recharge	

Features of soil: Soil characteristic, such as texture and the related hydraulic characteristics, significantly control the infiltration and recharge potential. Clayey soil absorbs less water at a slow rate, resulting in higher surface runoff in comparison to sandy soil which allows faster infiltration. The soil type of the study area is presented and a significant portion of the study area is dominated.	
Features of slope: The slope of the area plays a vital role in the infiltration process of rainwater as it controls the rate of surface runoff. Infiltration rates and surface runoff rates are directly proportional to steepness. A higher slope favours surface runoff causes less infiltration very much through the topsoil to recharge the aquifer shows insignificant recharge potential. On the other hand, flat land surfaces get more time for infiltration and percolation of water that promotes groundwater recharge.	

Features of road networking: The attribute data of the road network is collected to develop the database of road network and an optimum route. Network analysis in GIS rests firmly on the theoretical foundation of the mathematical sub disciplines of graph theory and topology. Although network analysis in GIS has been largely limited to the simplest routing functions and the use of simulation methods to generate solutions to network problems. To run the analysis over the digitized road network, a network geo dataset was created which resulted in a layer consisting of the junctions and edges connected topologically to each other.	

Scope for future work:

Vulnerability map generated in this study will help to identify the various vulnerable areas and places and can be used to take various measures of pre- and post-disaster management in the Corporation area. The local governing body can identify and improve the preventive measures to urban flood. Flood risk management aims to reduce the impact of floods. This study can be taken as a primary baseline data for further detailed locale-specific risk management study of urban floods in Corporation. Provides flood risk assessment information on the probability of flood occurrence magnitude of the event location and depth of the inundation for flood management, most studies have applied hydrologic and hydraulic models to simulate flood runoff and runoff in low-lying and flood-prone areas. presented the technique for preparation of flood hazard maps which include development of digital elevation model and simulation of flood flows of different return periods. Local authorities and planners can use the information to complement and improve their land use policies and

practices and consider the vulnerability of areas such as coastal zones or locations with a high number of residents or tourists. GIS facilitates integration of spatial and non-spatial data such as rainfall and stream flows, river cross sections and profiles and river basin characteristics, as well as other information such as historical flood maps, infrastructures, land use, and social and economic data.