# FLOOD HAZARD ASSESMENT IN AMBIKA RIVER BASIN USING GIS

**1st Rathod Nandita, 2nd Gargi Rajpara**

[1]Post graduate student ,[2]Assistant professor
[1]Civil Engineering Department
[1] L.D.R.P institute of technology, Gandhinagar, Gujrat-India

**Abstract** - Flood hazard assessment and mapping is used to identify areas at risk of flooding, and consequently to improve flood risk management and disaster preparedness. Remote sensing and GIS provides a broad range of tools for determining area affected by floods and for forecasting areas that are likely to be flooded due to high water level in a river. GIS will be extensively used to assemble information from different maps, aerial photographs, satellite images and digital elevation models (DEM). Analytical Hierarchy Process (AHP) AHP and GIS has been used for the assessment of flood hazard map for Ambika river basin. parameters such as slope, soil, elevation, rainfall, land use and land cover, drainage and density. This method is used for finding the weights of the different parameters by doing survey which were than used to GIS to integrate the thematic maps and to developed flood hazard map.

**Index Terms** - Geographic information system, Remote sensing, flood forecasting

## 1. INTRODUCTION

In many parts of India, floods are a common occurrence. They kill people, destroy public property, and cause untold misery to the populace, particularly in rural areas. Floods have the potential to disrupt ship navigation, endanger human life, and cause damage to businesses, infrastructure, and property. There are many different kinds of flood, including flash floods, river floods, coastal floods, urban floods, and flooding caused by a dam or reservoir opening or breaking. Extreme floods have recently been significantly influenced by climate change. Climate-induced changes can have a significant impact on a region's flood risk. These changes may alter the pattern of land use and create an impervious surface, which may increase the flow velocity. A region's altitudinal characteristics, slope, elevation, distance from the main river channel, rainfall, soil, drainage density, land use-land cover, and numerous other factors may influence whether a flood occurs. This is in addition to the climate.

Utilizing highly comprehensive technologies like remote sensing and geographic information systems makes it possible to evaluate hydrological analysis and hazard management. Analytical hierarchy process (Saaty, 1980) is a popular method in the field of multi-criteria decision-making.

To analyze complex decision problems that frequently include data and incomparable criteria, multi-criteria decision analysis (MCDA) methods are required. The requirement to employ expert knowledge when determining weights is one of the major drawbacks of the AHP method.

## 2. Study area

Ambika is one of the major rivers in the Indian state of Gujarat. The river has its origins in Saputara Hill ranges in the Nasik district of Maharashtra.

The frequent flooding in Navsari city has become a recurrent phenomenon of last decade. The city has faced frequent flooding since long back. Major flood event occurred in year 1981, 1984, 1994, 1997, 2001, 2003, 2004, 2006, 2013 and 2014. At present, the carrying capacity of the river is approximately about 2.5 lakh cusecs. Assessment of flood hazard areas is required and its flood mapping takes a key role.

**Data collection**

| Parameter | Data Source |
|---|---|
| Elevation | Collected from Bhuvan portal in which Resourcesat-1/Resourcesat-2 : LISS-III was selected as Subcategory Resource sat. |
| Slope | Collected from Bhuvan portal. |
| Rainfall | Collected from India Meteorological Department for the year 2004. |
| Soil | Collected from the Food and Agricultural Organization. |
| Landuse-Landcover | Collected from the ESRI Landuse-Landcover data for the year of 2021. |
| Drainage density | Collected from Bhuvan portal. |

## 3. METHODOLOGY

In first stage, satellite image, conventional data for rainfall and shape file is collected to prepare the thematic map like elevation, slope, rainfall, land use/ land cover, distance from the Main River and drainage density. The maps are generated using the Universal Transverse Mercator (UTM) coordinate system and the WGS84 spatial reference system.

In second stage, ArcGIS software is used to digitise the Digital Elevation Model (DEM) and a slope map was created using Digital Elevation Model data. Drainage pattern from the DEM image to prepare a drainage density map and distance from main river map. A land use and land cover map is created using ESRI land cover and soil map is created using FAO soils portal. IMD Pune provided rainfall data and the spatial distribution was created using the IDW tool in ArcGIS.

## 4. PREPARATION OF THEMATIC MAPS

IN THESE WE HAVE TO CREATE DIFFERENT THEMATIC MAP SUCH AS SLOPE, DRAINAGE DENSITY, ELEVATION, LAND USE LAND COVER, SOIL, RAINFALL MAP OF AMBIKA RIVER IN ARCMAP 10.8 SOFTWARE.

**ELEVATION MAP**

Flood maps based on a DEM provide a better agreement with the baseline 1 m resolution map in terms of both flood extent and flood depth mainly due to the unchanged riverbeds compared with the uniform DEM approach. The elevation of the lower Ambika river basin varies from 73 to 326 meter

**Slope map**

The slope map was classified into mild, medium, high, and very high categories. The map was steep along the outline of the catchment area and at the source of the Ambika River.

**Rainfall map**

The rainfall is a prime determining factor in the flood hazard map. A high-intensity rainfall for a long duration tends to generate more amount of runoff. Hence, the probability of flood increases with the increase in the magnitude of rainfall.

**Soil map**

Soil map classes were made based on the physical properties of the soil present in the study area. The generated map was divided into five categories, namely laterite soil, deep black cotton soil, alluvial soil, sandy, loam.

**Drainage density map**

The drainage density is defined as the ratio of the total length of the streams of all orders from the basin to the area. High drainage density indicates the existence of one or more mature channel systems. Lower the value, coarser is the drainage density.

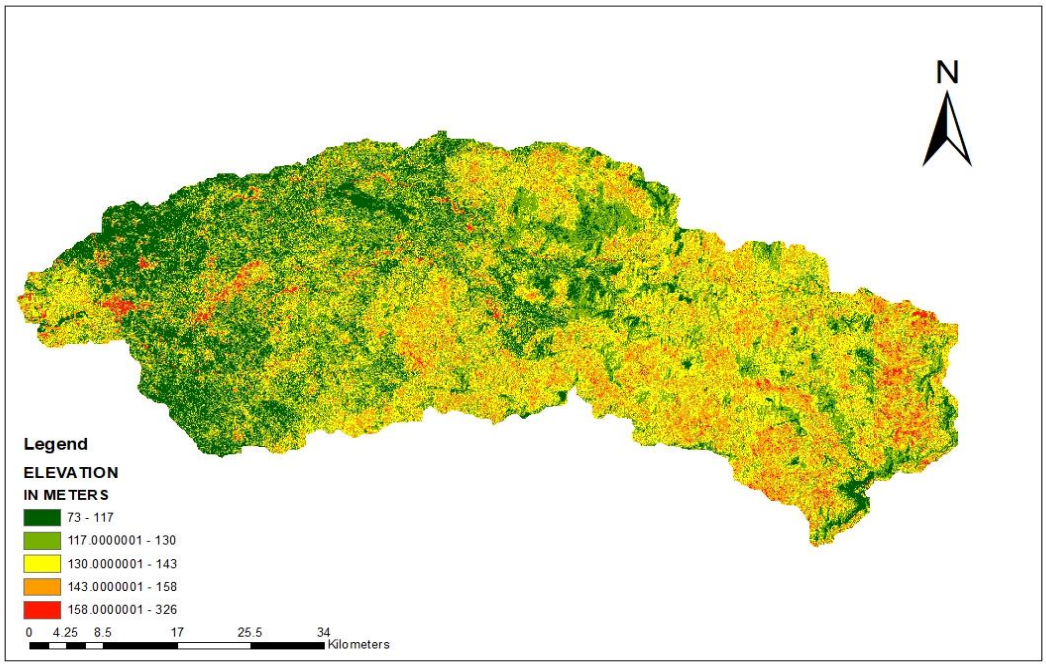


**FIGURE 1 ELEVATION MAP**

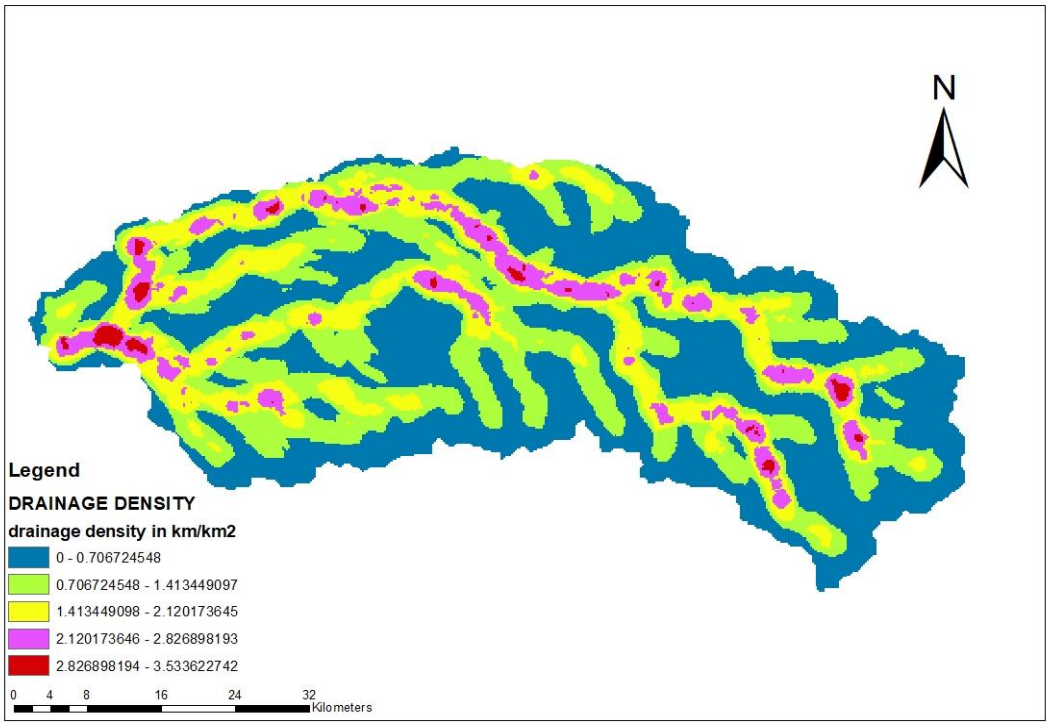


**FIGURE 2 DRAINAGE DENSITY MAP**

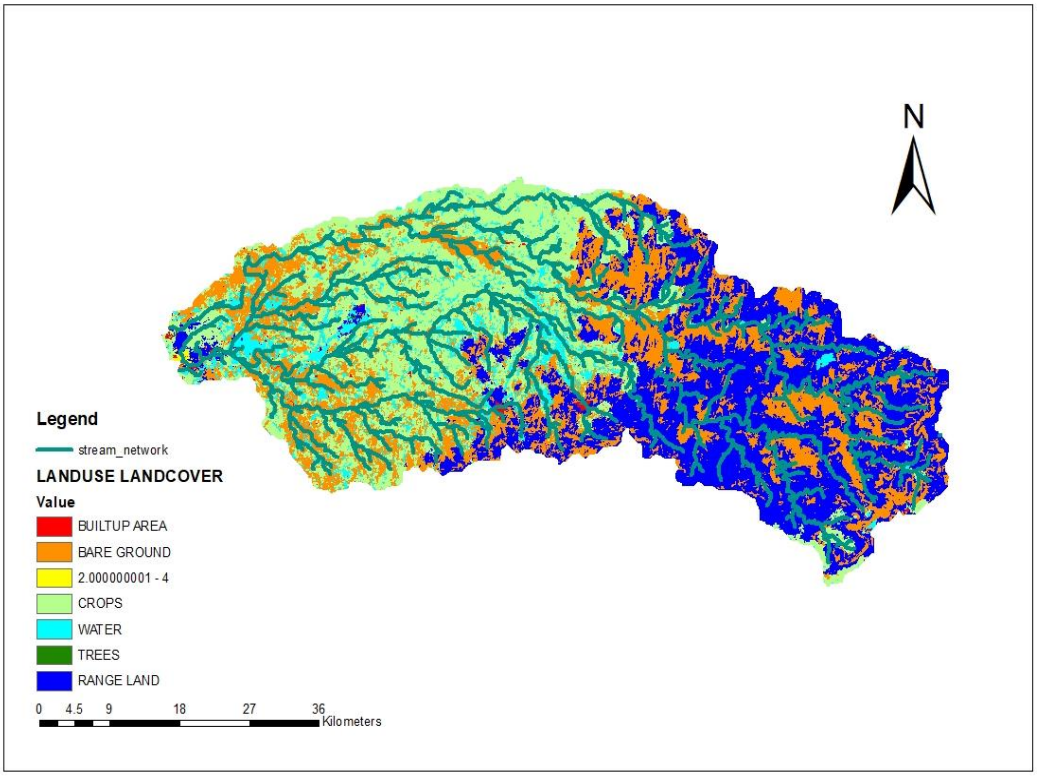


**FIGURE 3 LANDUSE LANDCOVER MAP**

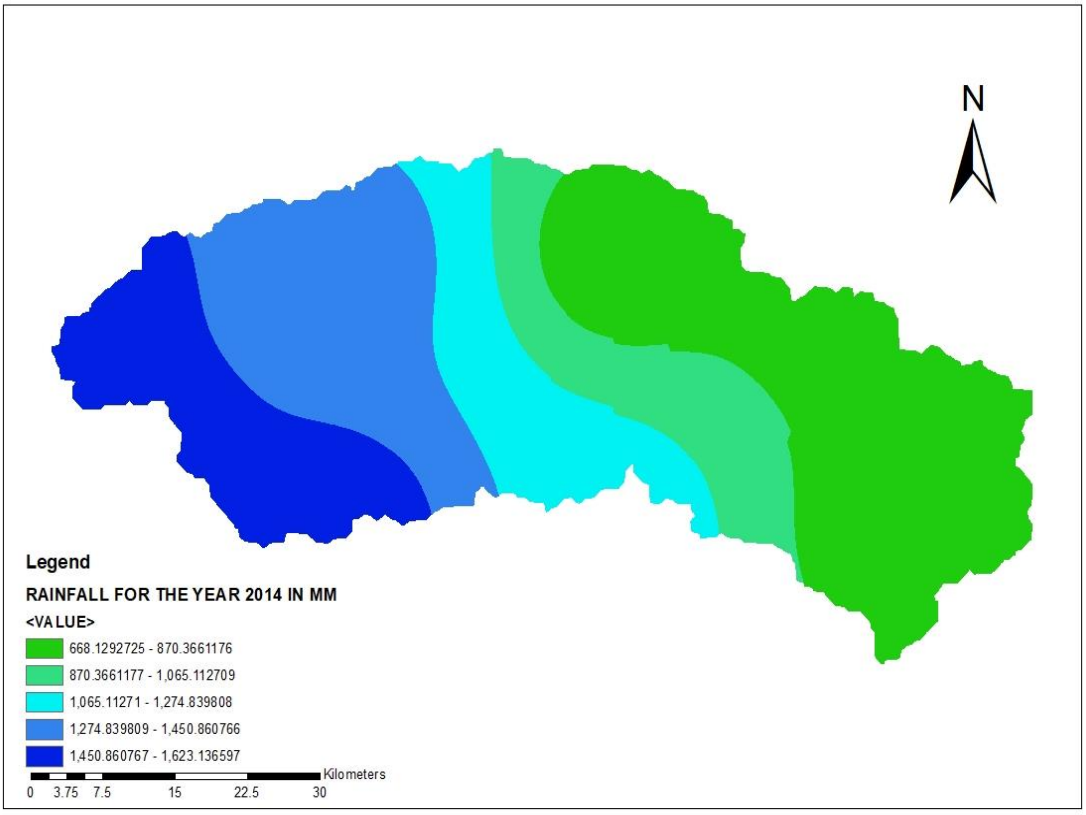


**FIGURE 4 PRECIPITATION MAP**

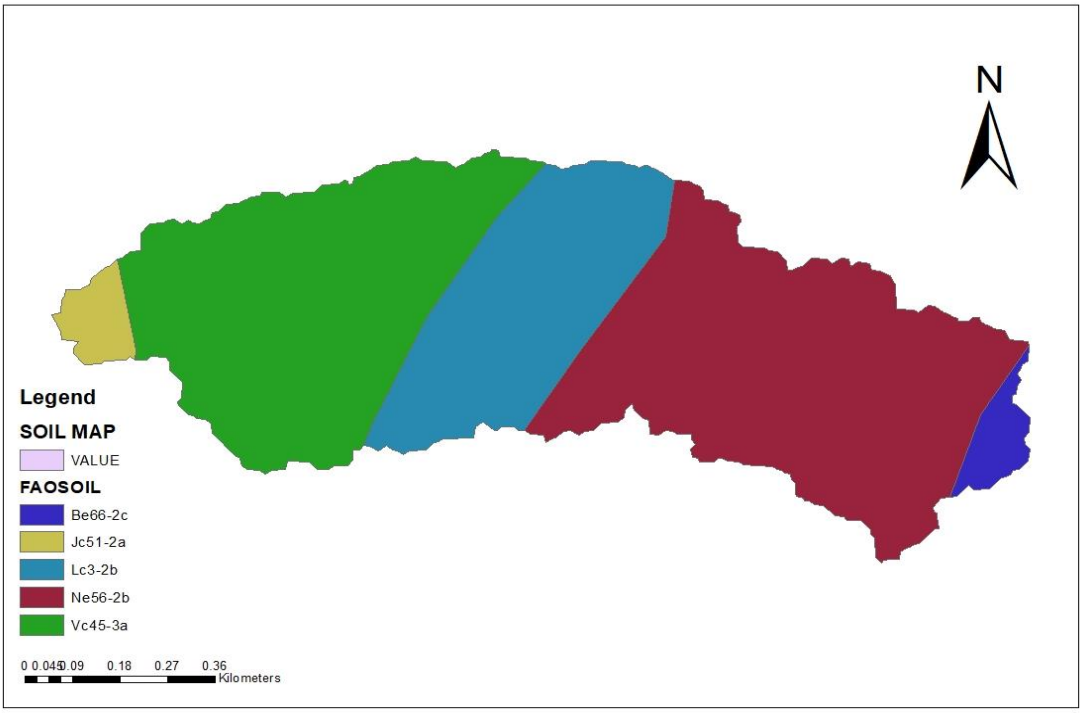


**FIGURE 5 SOIL MAP**

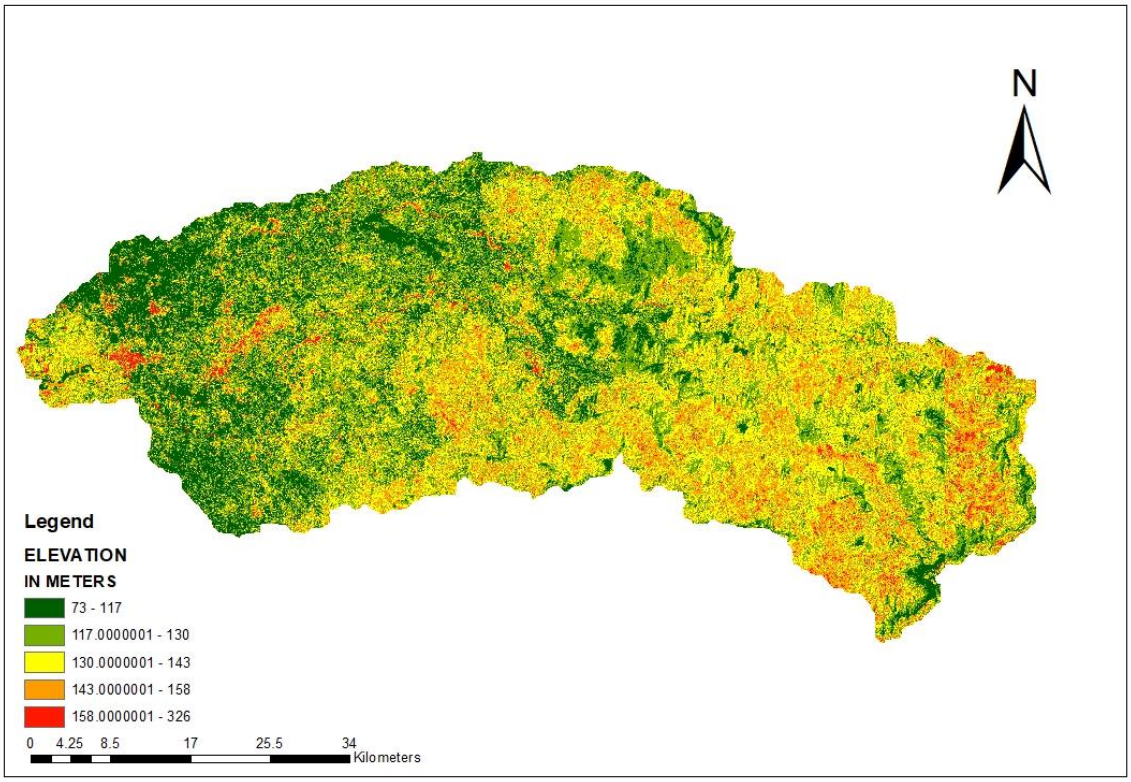


**FIGURE 6 SLOPE MAP**

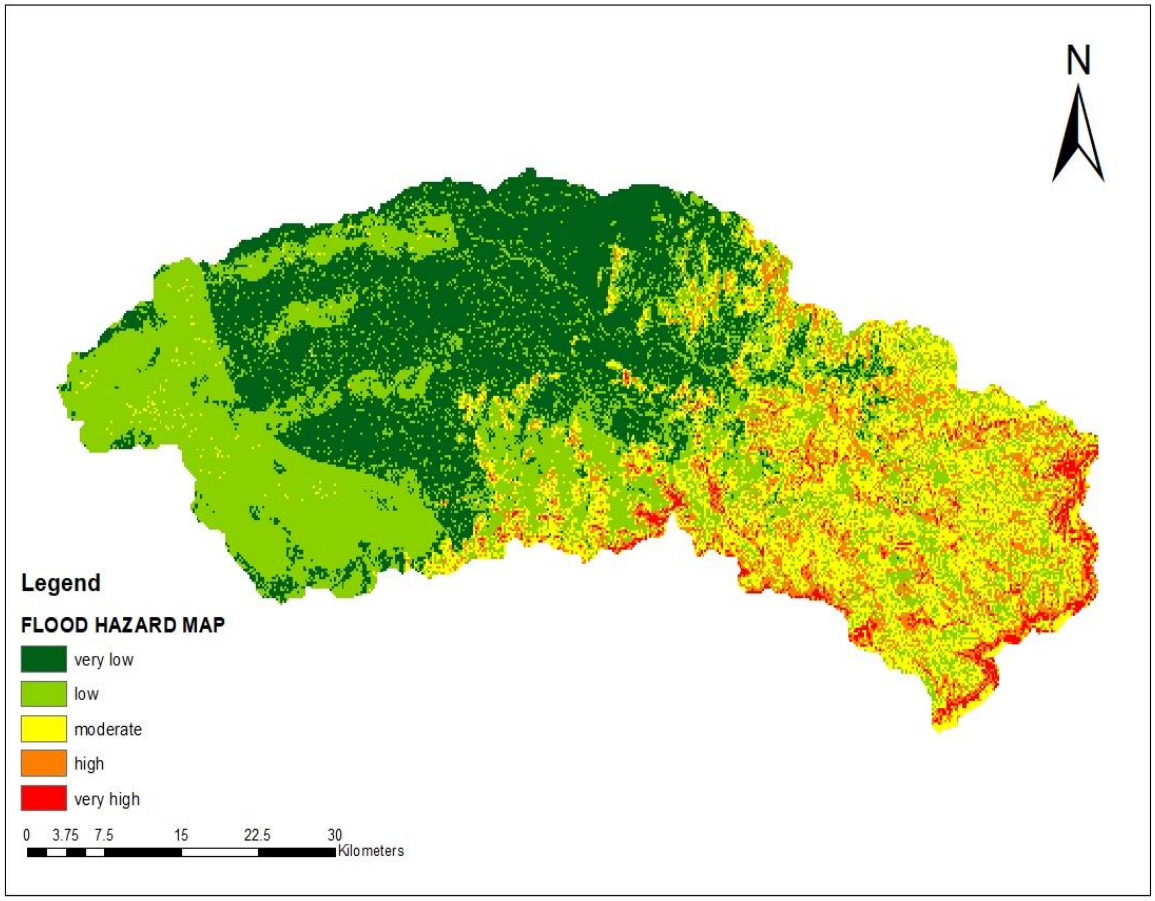


**Figure 7 flood hazard map**

## 5. CONCLUSION

In these paper I have created different thematic map by consider some parameter such as slope, elevation, drainage density, LULC, precipitation and type of soil of Ambika river basin by using ArcMap 10.8 software. Which is used for creating flood hazard map. In further study I have consider this parameter for finding out weights for analytical hierarchy process. using AHP process identified high risk zone of my study area.

## 6. REFERENCES

[1]. Das, S. (2018). Geographic information system and AHP-based flood hazard zonation of Vaitarna basin, Maharashtra, India. Arabian Journal of Geosciences, 11(19), 1-13.
[2]. Ramkar, P., & Yadav, S. M. (2021). Flood risk index in data-scarce river basins using the AHP and GIS approach. Natural Hazards, 109(1), 1119-1140.
[3]. Rahmati, O., Zeinivand, H., & Besharat, M. (2016). Flood hazard zoning in Yasooj region, Iran, using GIS and multi-criteria decision analysis. Geomatics, Natural Hazards and Risk, 7(3), 1000-1017.
[4]. Danumah, J. H., Odai, S. N., Saley, B. M., Szarzynski, J., Thiel, M., Kwaku, A., ... & Akpa, L. Y. (2016). Flood risk assessment and mapping in Abidjan district using multi-criteria analysis (AHP) model and geoinformation techniques, (cote d'ivoire). *Geo-environmental Disasters*, *3*(1), 1-13.