

Flood Mapping in Pathanamthitta District using QGIS Software

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Abstract—Floods are the most frequent natural disaster that occurs when an overflow of water submerges the land that is usually dry which not only causes damage to environment, natural resources and lives but also leads to economic losses. Past studies demonstrated that remote sensing and GIS are very useful and effective tools used in flood risk assessment and management. This project seeks to delineate the flood prone areas and to create a flood risk map for the Pathanamthitta District of Kerala, India using QGIS. Land use – Land cover map, rainfall, elevation, river network and soil are the predominant factors which are evaluated and their corresponding maps are developed in the QGIS software.

Keywords— Flood, QGIS (Quantum Geographic Information System), GIS, Mapping, LULC

I. INTRODUCTION

Kerala is described as the ‘God’s own country’ in India with magnificent natural landscapes and fertile valleys. However, the unprecedented summer – monsoon rainfall throughout June, July and August had left a wake of devastating flood across the state. The unprecedented flood in Kerala has brought havoc in Kerala causing a great destruction to human life, property and economy in general. Water inundation due to this disastrous event causes significant damage to human lives, properties, agricultural lands and infrastructure and in turn affecting the economy. This has affected the way of living of the people. Most of the low – lying areas of the state had been inundated. Heavy rainfall enhances the accumulation of water in the catchment and overflow of this water flashing beyond its normal confines are termed as flood. Flood mitigation planning and management requires good knowledge of land use as well as accurate identification and mapping of flood risk areas. This finds the importance of remote sensing and GIS in flood hazard mapping.

II. LITERATURE REVIEW

Arshad Ameen A, Muhammad Ameen, Malavika K V, Megha Manchakkal (2019) used GIS technique to map the flood in 2018 in order to analyze the impact of flood in Kalady village in Ernakulam district, Kerala. From the flood map it was clear that buildup areas and agricultural lands are more affected. **Rose Mary Xaviour, Anto Paul, Benila Raj, Kevin Joseph, Varsha Antony (2020)** has developed a flood vulnerability map of the Ernakulam district for the coming years by analyzing the flood map of 2018 and 2019. This predicted map can be utilized for proper planning and for taking precautions in the vulnerable areas during heavy flood.

Veni Gayathri, Sangeetha Sanal, Shobana Saji, Fathima Shajahan (2021) used ArcGIS and QGIS Software for mapping in Ranni area of Pathanamthitta district with respect to the physical, demographical and socio - economical vulnerability indicators and to analyze the flood risk factors and to provide the structures which will help to minimize the flood risk by ranking method.

George Gutjahr and Sachin Das (2019) prepared a flood model for the Chalakudy River to identify the safe routes during flood by using weighted method and by analyzing six factors. **Jean Joy, Shruti Kanga and Surya Kumar Singh (2019)** done flood mapping by Participatory GIS approach in Meloor Panchayat, Thrissur district, Kerala and was observed that landfill will increase the destruction in future flood events.

G Thilagavathi, S Tamilenthil, C Ramu and R Baskaran (2011) prepared a flood hazard erosion map of Thanjavur district, Tamil Nadu for public dissemination of flood map which will serve to increase public awareness.

III. OBJECTIVE OF THE WORK

The main objective of this project is to analyze the flood risk factors to reduce the impact of flooding and to identify low - lying areas and flood prone areas. It acts as an information system to enhance our understanding and awareness of flood risk to improve flood risk management and disaster preparedness.

III. MATERIALS AND METHODOLOGY

A. GEOGRAPHICAL INFORMATION SYSTEM

GIS is a type of database containing geographic data combined with software tools for managing, analyzing and visualizing Quantum Geographic Information System (QGIS) is a free and open source geographic information system (GIS) application that supports, viewing, editing and analysis of geospatial data. It supports both raster and vector layers. The software used for the work is QGIS 3.24.0.

B. STUDY AREA

Pathanamthitta District is a district in the southern part of Kerala, India. There are four municipalities: Thiruvalla, Adoor, Pathanamthitta and Pandalam. It is the third least populous district in Kerala. Total area is 2642 km². It is a landlocked district located at 9° 16' N 76° 47' E. Three important rivers flow through the district: Pamba, Achankovil and Manimala River. They together drain more than 70% of the total area of the district. Three rain gauge stations are selected (survey station) : Konni, Kurudamannil and Thiruvalla

C. DATA NEEDED

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1	Rainfall data	Indian Meteorological Department (IMD)
2	Soil Map	Soil Survey & Soil Conservation Department
3	Land Terrain Map	Digital Elevation Model (DEM)
4	Land use Landcover Map	Bhuvan (ISRO)

D. METHODOLOGY

1. Boundary map preparation of study area: The shape file of boundary map of the study area is prepared using QGIS software. Administrative and Political Boundary line of Pathanamthitta is downloaded using the plug-in Quick QS. The selected three rain gauge stations (survey station) are located and added to the map using the New Temporary Scratch layer. Thus the Boundary Map of Pathanamthitta is developed using the software and is given below.

2. Elevation map: Elevation data or DEM is downloaded from Bhuvan. Digital Elevation Model (DEM) is a three dimensional representation of elevation data to represent land terrains. These are often used in

geographic information systems and are the most common basis for digitally produced maps. And this DEM data is processed in the software using vector and raster tool to obtain shape file of DEM map.

3. Rainfall Map: It shows the rainfall distribution over an area. Rainfall data is collected from Indian Meteorological Department (IMD) from the year 2016 to 2020. The annual rainfall data has been collected from the three rain gauge station and are entered in the excel sheet and the map is created using interpolation analysis in QGIS.

4. Land use Land cover Map (LULC): Land use Land cover Maps are very useful in identifying different landforms on earth such as built-up lands, agricultural lands forest, water bodies, etc. it is directly downloaded from Bhuvan prepared by Indian Space Research Organization (ISRO).

5. Soil Map: It is a graphical presentation of the different types of soil in the study area.

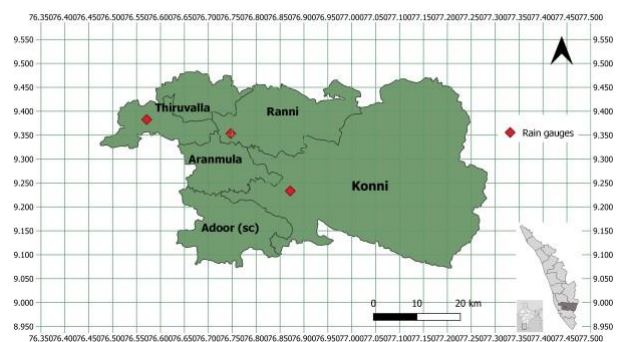
6. Stream Order Map: The same elevation map is used to create a stream map using Sinks (Wang & Lu) tool. The channel network and drainage basins are also added. A threshold value of 3 has been set to obtain a Stream Map of Order 3.

7. Flood Map: the same shape file of DEM map is used to create Flood map using Raster Calculator tool. A water level of 1m is raised above the sea level to obtain a Flood map of 1m rise.

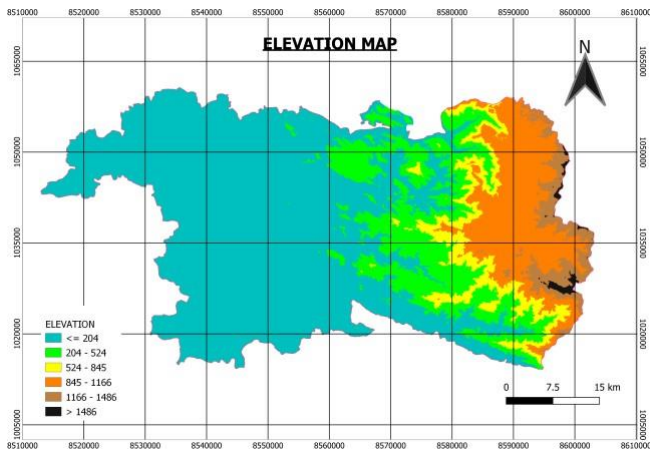
IV. RESULT

1. BOUNDARY MAP OF STUDY AREA

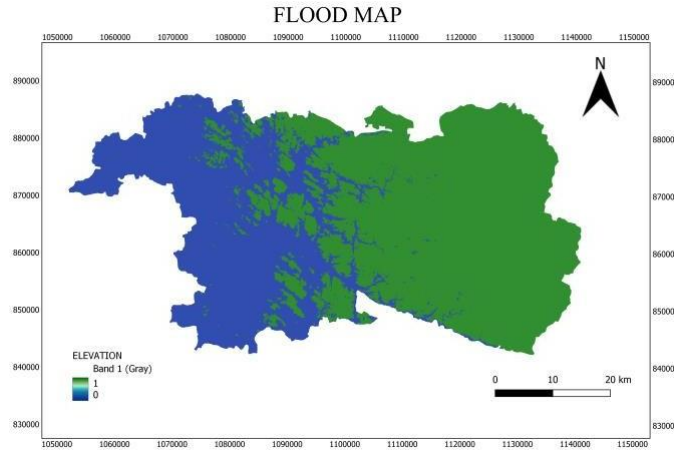
Rain gauges in pathanamthitta



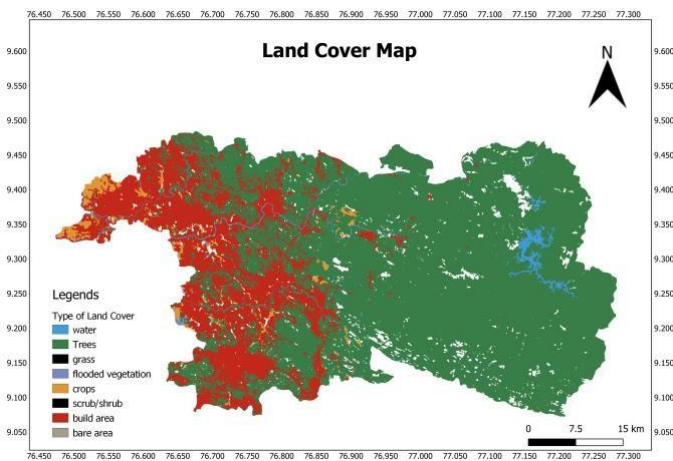
2. ELEVATION MAP



5. FLOOD MAP

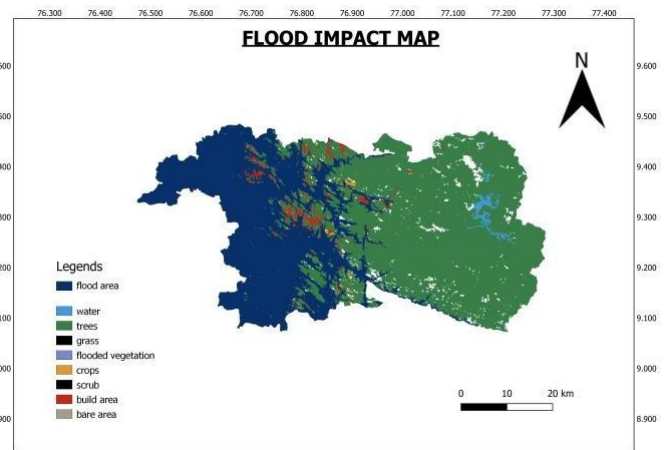


3. LAND USE LAND COVER MAP

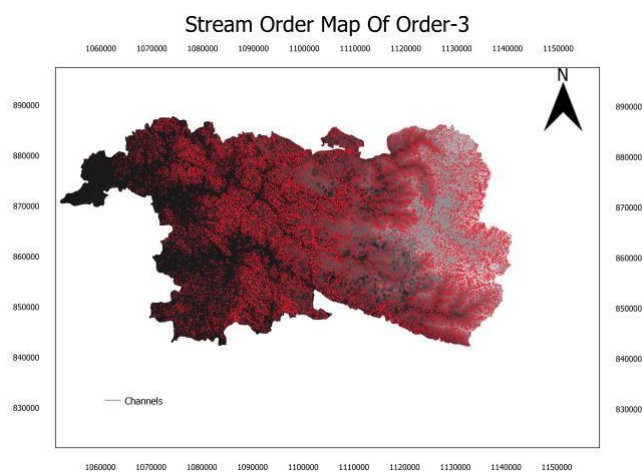


5. FLOOD IMPACT MAP

Flood impact map is obtained by overlaying the created flood map and land use map in the QGIS software. This map is used to study the changes that occur in the environment as a result of the flood. This map shows the flood affected areas in the study area with a water level rise of 1m above the sea level.



4. STREAM ORDER MAP



V. CONCLUSION

Flood map of Pathanamthitta district is created using the software. From the map it is evident that, most of the areas of the district were adversely affected by the flood with a water level rise of 1m above the sea level. So this map serves as an information system for the flood risk management and for the future uses in disaster preparedness and planning.

Flood impact map helps us to identify the flood affected land use areas with a rise of 1m water level. From the map it is observed that almost all built-up lands and agricultural areas are most affected by the flood. Therefore this map can be used to identify safer locations. It can be also used to find the safe routes between relief camps.

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