

Flood Mapping and Impact Analysis using GIS

Arshad Ameen A. A , K. M. Muhammed Ameen ,
Malavika K.V , Megha Manchakkal
Graduate Students, Department of Civil Engineering
Adi Shankara Institute of Engineering and Technology
,Kalady,Kerala,India

Anjali Ann Johnson
Assistant professor, Department of Civil Engineering
Adi Shankara Institute of Engineering and Technology
,Kalady,Kerala,India

Abstract—In August 2018, the state of Kerala in India witnessed its worst flood that occurred in nearly a century, after the great flood of 99 that happened in 1924. About one-sixth of the total population was affected. In this paper, Geographic Information System (GIS) is used to map the recent flood and to analyse the impacts of the flood. This study helps in better understanding of the flood that occurred and can be used as a reference to set up flood management plans and to help the government and other agencies to improve decision making plans in order to re-allocate resources as to help the population in need

Keywords— Flood; GIS; impacts; flood management

I. INTRODUCTION

A. Background

Floods are the most common occurring natural disasters that affect human and their surrounding environment. Floods are among the most recurring and devastating natural hazards, impacting upon human lives and causing severe economic damage throughout the world [1]. Most of the flood occur throughout the monsoon and are sometimes related to tropical storms, depressions and active monsoon conditions. Because of these conditions, flood occur in majority of water basins in India [2].

The recent climatic change in Kerala have got a significant impact on majority of the Districts in Kerala. The devastating floods in Kerala peaked in the month of August 2018. The major cause was Flash floods that occurred in less than 6 hours after the rainfall event. These lead to hazardous situations for people, thousands of people continued to remain marooned and caused heavy damage to property. And this caused difficulty in forecasting and in providing alerts. Almost 35 out of 54 dams in Kerala were opened during this time and it was clear that the major dams released water when the state was in the throes of heavy flooding and that added greater misery to the situation.

The exact reason for flash flood was the opening of major dams such as Idukki dam and Idamalayar dam which has live storage capacity over 1000 million cubic meters when the state was in the verge of heavy flooding. Kerala is a part of Western Ghats having great biodiversity and fragile ecology. The rivers in Kerala are relatively short in length with high slopes. In the Periyar Basin alone, there are about 20 dams and 17 reservoirs. These floods created greater devastation to the State. Ernakulam was one among those districts which were mostly affected during these floods. People living in Kothamangalam, Aluva and Paravur were the worst affected by the opening of shutters of Idamalayar and Idukki as the incessant rains continued to lash various part of Kochi.

Among which Kalady was among the worstly hit part in Aluva taluk.

B. Geographic Information system

GIS is a technology that offers radically different way in which we are able to produce and use the maps required to manage our communities and industries. It can create intelligent super maps through which sophisticated planning and analysis can be performed. GIS, GPS and remote sensing tools help in understanding, visualizing, integrating and quantifying research data. GIS assists environmental managers the production of GIS maps that can show how our natural resources respond to change over time including coastal, vegetation and geological. GIS operation is to improve the efficiency of flood disaster monitoring and management. Digital thematic maps namely Slope, Aspect, Landuse, Drainage density, Drainage etc are prepared using ArcGIS software. The availability of high sophisticated 3 D GIS software's continues to expand new possibilities for engineers to perform flood inundation analysis in conjunction with hydraulic models to represent water surface elevations, generated from hydrologic and hydraulic models, in a three dimensional terrain model [3].

II. STUDY AREA

Kalady is a town located in Angamaly, Kerala, India located at 10.02 east and 76.20 east on the right of the Periyar River. It is also a village in Aluva Taluk, Ernakulam district of Kerala. The panchayat comprises of an area of about 16.44 km² with a population of about 24,707 as per 2011 census. It consists of 17 wards.

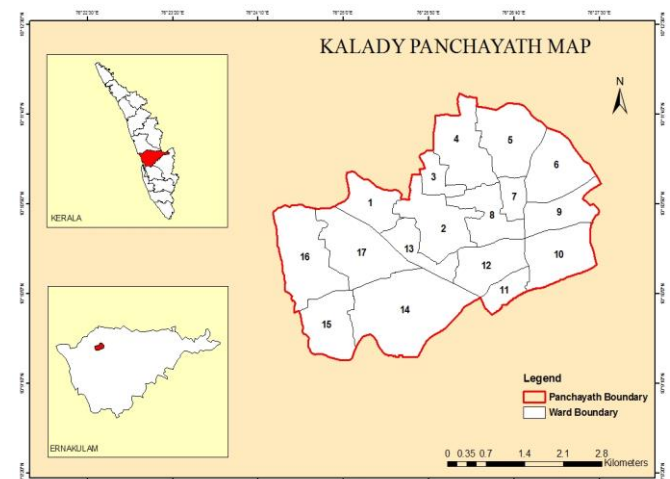


Fig 1. Map of study area

III. METHODOLOGY

A. Flood map

Flood maps will allow non-technical users to analyze what kind of facilities would be affected in flood hazard areas. A person can decide if his or her property will be at risk and he or she could identify safer locations [4]. For creating a Flood map, boundary map of the study area, Kalady has been collected from the Kalady Panchayat. This boundary was digitized based on Google Earth Pro. Surveys were carried out in all 17 wards of the Panchayat to collect latitude, longitude and approximate water levels. Latitude and longitude were collected using True Compass app and water levels were measured. These data are converted to excel sheets. Shape file of the study area is created in ArcGIS 10.3 software and all the surveyed points are added to the shape file of boundary using add data tool. Kriging tool available in the ArcGIS software is used to interpolate the points and thus create the flood map.

B. Flood impact map

Flood impact analysis can be study as changes likely to be occurring in environment characteristics that may results due to flood .For finding out the impact of flood on land use, a land use map have to be created in the software. For that a landsat image is downloaded and using the image classification tool in the software, a land use map have been created. The created flood map and land use map are overlayed in the software to obtain the flood impact map. Areas having water level more than 2.5m is clipped with the land use map

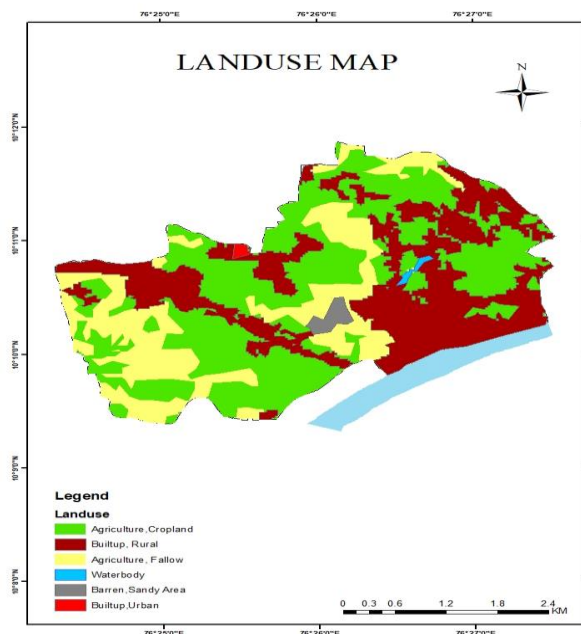


Fig 2. Landuse map of Kalady

IV RESULTS

A. Flood map

A flood map of the study area was created in the software which shows the water levels of 2018 flood.

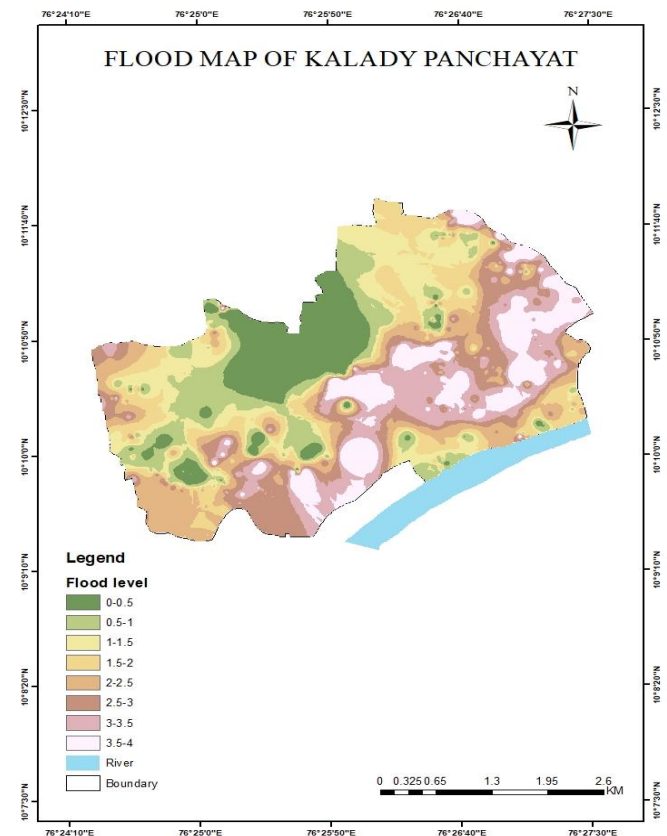


Fig 3. Flood Map of Kalady

B. Flood Impact map

A flood impact map was created in the software. This shows the flood affected land use with water levels above 2.5 m. Areas of each affected land use of the 2018 flood are shown, which reveals the impact of flood on these land use types.

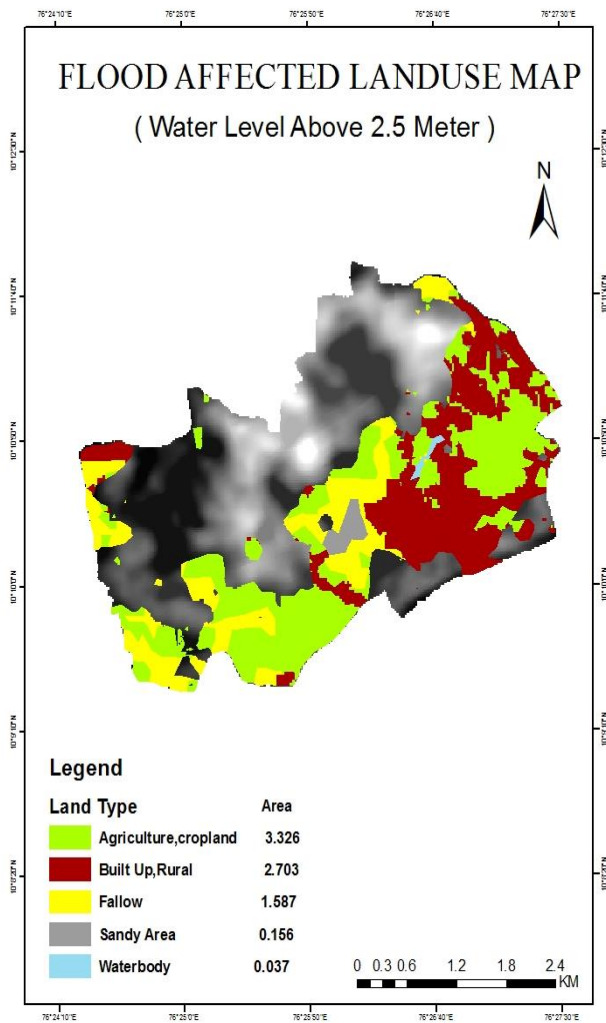


Fig 4.Flood Impact Map

V. CONCLUSIONS

- A flood map of Kalady showing the 2018 floods have been created. From the map it is clear that most of the areas of Kalady were greatly affected by flood with flood levels above 2.5m. This is to be presented to the Panchayat so that it helps in better flood management and emergency planning in future.
- Impact analysis helps to know the flood affected land use with water level more than 2.5 m. Areas showing the flood affected land use classes are also shown. From the map created, it is clear that built-up areas and agricultural lands are more affected. 2018 floods have a great impact on these land use classes of Kalady area.

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