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GIS BASED LANDSLIDE MAPPING: A CASE STUDY OF MAHABALESHWAR REGION OF SATARA DISTRICT

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Abstract - *Landslides are a massive natural and man-made calamity that destroys natural capital and human assets all over the world. Landslides brought on by steep slopes and mountainous terrain commonly occur in Maharashtra's Western Ghats. For this study, the area surrounding the previously occurring landslide at Mahabaleshwar in Maharashtra was considered. The most significant contributing element to landslide risk was discovered to be the geology. Technologies like Geographical Information Systems (GIS) have generated a lot of excitement as prospective tools for dealing with natural disasters like landslides. The mapping of landslide prone zones was done using the multi-criteria model and weighted overlay methods in ArcGIS 10.3 software. The final results of the study can be used by the engineers, planners, and administrators in this area of the region to help them implement the necessary mitigation and adaption measures.*

Key Words: **Man-made calamity, human assets, Maharashtra, western ghats, GIS, etc**

1. INTRODUCTION

Landslides are a geological calamity that happen frequently, especially in mountainous areas, and they can seriously harm both the environment and people's live. A significant number of lives are lost as a result of landslides every year, and they also cause significant damage to human communities, agricultural land, and forested areas, as well as to communication lines [1]. It happens as a result of several linked natural disasters or human-made activities such a seismic tremor, river floods, roadworks, deforestation, and mineral exploration. Around the world, landslides brought on by heavy and/or continuous precipitation were responsible for 89.6% of the fatalities. Without include snow-covered areas, approximately 0.42 million square kilometres or 12.6% of India's land area is at risk from landslides [2][3].

The mapping of the landslide vulnerability zone in this context makes effective use of remote sensing and GIS technology [4]. Though numerous studies were conducted to evaluate changes in rainfall, water levels, geoscience, geomorphology, and land use and cover in various areas of the Mahabaleshwar study area, few of these studies were fully integrated to determine the integrated strategy. The primary objective of this work is to use GIS, to analyse aerial photos and satellite photos, which is beneficial for locating landslide hazard zones on a wide scale. The usefulness of the satellites for landslide hazard zonation and studies of changes in land use and land cover is another major focus of the project.

2.STUDY AREA

At an elevation of 1353 m, the study location, Mahabaleshwar, is a township in the Satara District and is situated at 17°58' N and 73°43' E.

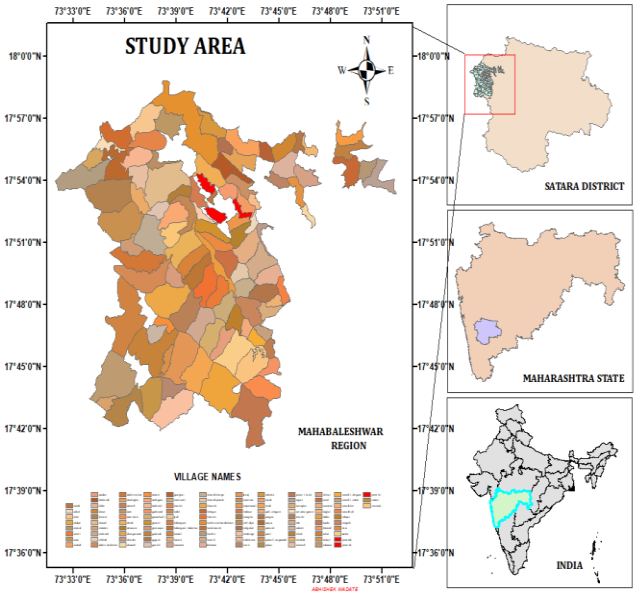

Figure 1 Study Area

3.NEED FOR THE STUDY

Landslides in the hilly area result in loss of lives and properties, harm to the environment, and destruction of roads, bridges, and telephone lines, power lines, etc. As a result, the items become immobile and services resulting in a significant loss of revenue.

4. METHODOLOGY

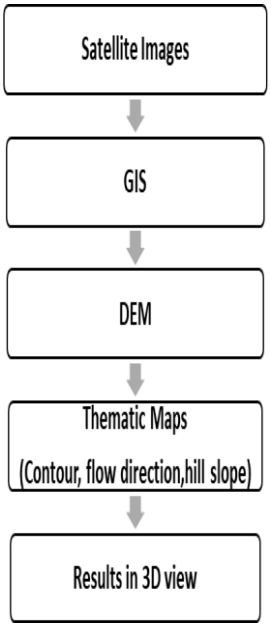

Figure 2 Flow chart of Methodology

By examining potential hazards and assessing current vulnerability conditions that could potentially provide a threat or harm to people, property, occupations, plus the ecosystem on which they depend, the current study uses LHZ methodology to determine the type and degree of risk. This section talks about data gathering and data processing. methods, the method for creating various thematic maps and the standards applied to removing and identifying the LHZ of the study area utilising GIS and image processing.

In order to develop the natural LHZ of Mahabaleshwar, Satara, Maharashtra, India, a variety of materials, procedures, and mapping techniques were used in the current study.

5. RESULTS AND DISCUSSION

ArcGIS software is used in the current investigation to build DEM files. The slope, stream, and hill shade maps were created using the DEM, which reflected spatial altitude variation. The slope serves as a gauge for height changes throughout time. When thinking about stability, slope is a crucial parameter to consider. Each pixel represents the slope angle at a particular location and is the first derivative of elevation.

In our study DEM shows steeper slope in darker colour and flatter slope in light colour. That means on the darker side of the DEM has high risk for landslide.

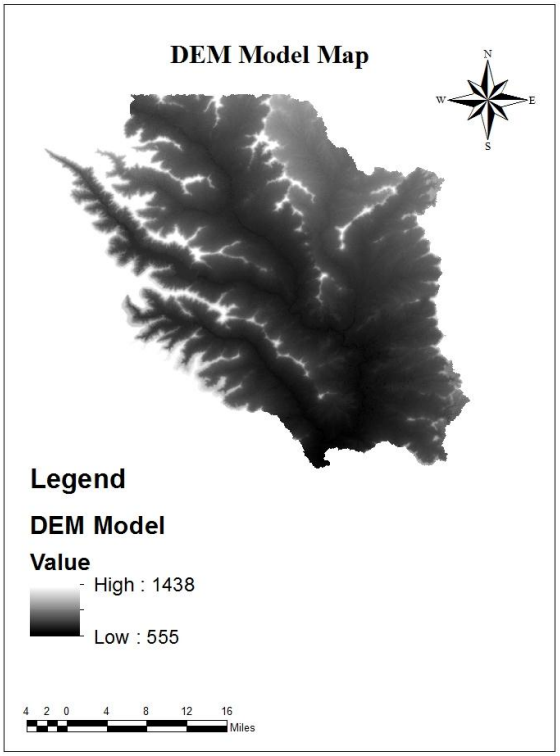

Figure 3 Digital Elevation Model

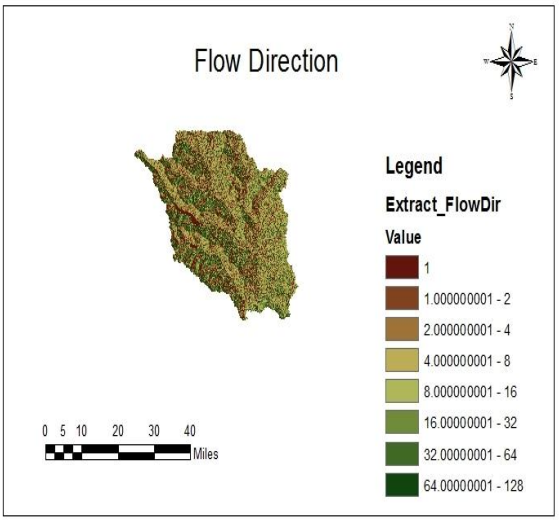

Figure 4 Flow Direction Map

The flow direction map shows the study area's flow direction. Eight possible directions for the precipitated water to flow are assigned to each pixel. By figuring out how many pixels are present from the upstream direction flowing

toward each pixel, the flow accumulation map is created. The flow accumulation map's prerequisite raster is this layer

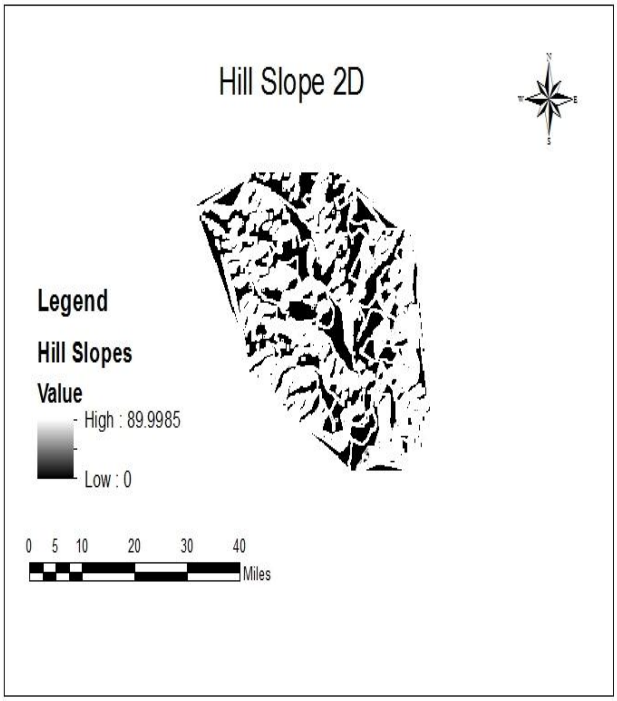

Figure 5 Hill Slope 2D Map

The slope angle is the most significant factor in landslide susceptibility mapping, despite the fact that it is directly related to landslides.

a. Landslide Hazard Zonation

The effect of several triggering conditions was considered when creating a map of the land slide hazard zones. The zoning map was separated into three landslide risk zones: low sensitivity to landslides, high susceptibility to landslides, and extremely high susceptibility to landslides.

The hazard planner is primarily concerned with the zonation map when dealing with landslide-hazard mitigation. Geology and structure only play a little part in landslide formation. Although it has little to do with landslides, the geology of the area affects the origin and types of soils.

The hard edge on the map shows risky zone of study area it also shows landslide vulnerability zone at previously occurred landslide hotspots.

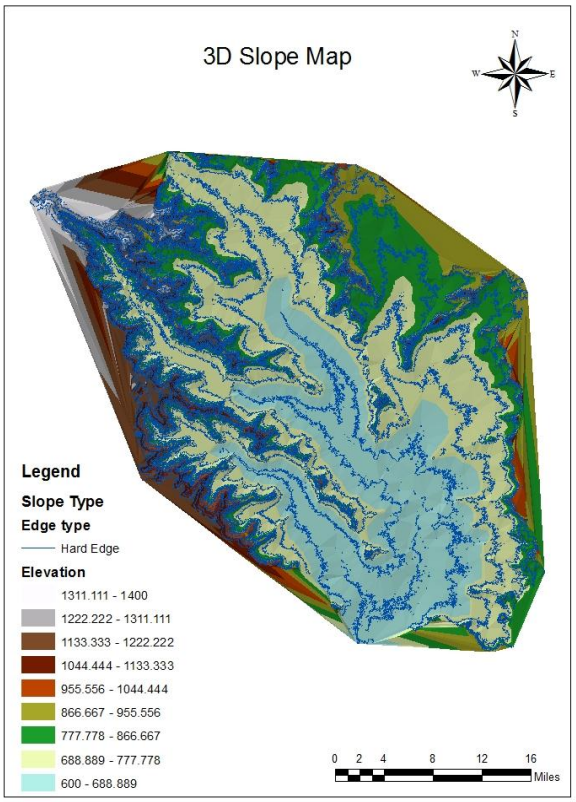

Figure 6 Landslide Hazard Zonation Map

6. CONCLUSIONS

Landslide-prone areas can be predicted using the physical elements linked to landslide activity, including bedrock, slope steepness, and hydrology. Even with the finest knowledge available, identifying when and where landslides will occur is impossible. However, it is feasible to locate places that are prone to landslides. The only sensitive zone has been defined in a subsequent phase of the research using the acquired hazard zonation map to concentrate on the riskiest zone.

GIS is a great tool for displaying the geographic distribution of landslides as well as their characteristics when used in conjunction with aerial photographs. Because of this, the landslide susceptibility models developed in the current work may help planners in reducing the risk of landslide damage.

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