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Landslide Analysis of Kodagu District Using Geotechnical Perspective and Remote Sensing

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Abstract

This project aims to study the causes of landslides in Kodagu district using Geotechnology and Remote Sensing. Kodagu received the highest rainfall ever in the year 2018 breaking the 87- year-old record set in 1931. And witnessed many natural hazards including landslides and floods and the area is becoming more susceptible for soil erosion. The soil physical properties such as Specific gravity, Liquid Limit,Plastic Limit,Sieve Analysis and Shear strength were estimated by using standard methods and detailed map analysis was done through Remote Sensing . It was observed that the landslide affected areas were predominant with sandy clay loam soils which was more vulnerable for land slide.

Keywords: Slope Failure,Landslide,Kodagu District, Remote Sensing,soil properties.

1. Introduction

Kodagu (Coorg), the thickly wooded grandeur on the Western Ghats, it is the most beautiful hill station of Karnataka. It occupies an area of 4,102 square kilometres (1,584 sq. mi) in the Western Ghats of southwestern Karnataka. As of 2001, the population was 548,561, 13.74% of which resided in the district’s urban centres, making it the least populous of the 30 districts in Karnataka.

The district enjoys typical tropical climate characterized by slight to medium humidity. Kodagu is known for its pleasant climate, heavy rainfall and cool summer. A major part the of year is accompanied with monsoon which starts in June and last till the end of September or October. The period from December to February is the cold season marked by a bright weather, foggy mornings and pleasant and cool night. The temperature during day begins to rise sharply during March. Generally, June, July and August are the months of heavy rainfall and the precipitation in July is in crescent and very heavy. The rainfall is found to be decreasing as one proceeds from the western part of the district to the eastern part. The land of Kodagu is blessed with exceptionally beautiful natural landscapes. The region is well suited for the cultivation of many high valued plantation crops like Coffee, black pepper and cardamom. Thus, the district is driven by a thriving rural agriculture-based economy, which is supplemented by incomes from tourism.

Fig 1 Karnataka & Kodagu Map

Much of Kodagu is used for agriculture. Characteristically and historically, paddy fields are found on the valley floors, with Coffee and pepper agro-forestry in the surrounding hills mainly near Madikeri. The most common plantation crop is coffee, especially Coffee robusta variety. Kodagu is the second coffee production region in India, after the Baba Budangiri hills in Chikkamagaluru district. Coffee revenue helped Kodagu to become one the richest districts in India. Kodagu is considered rich with wildlife and has three wildlife sanctuaries and one national park: the Brahmagiri, Talakaveri, and Pushpagiri Wildlife Sanctuaries, and the Nagarhole National Park, also known as the Rajiv Gandhi National Park. The Landslides are resulted due to variety of natural slope failure processes such as weathering, soil erosion, rainfall, high speed winds, earthquake or minor tremor, lack of vegetal cover along hill slopes and hydrostatic imbalance within the hill slopes.

Materials and Methodology

i. Soil

In this project we collected 4 soil samples from different places of Kodagu district like somwarpet, chowdlu, Madikeri and Monnageri. soil is oven dried before conducting the tests to remove the moisture content. The basic tests carried out on soil are specific gravity, liquid limit, plastic limit, unconfined test and sieve analysis. Testing of soil was performed as per IS codal procedures

The specific gravity test for soil involves determining the ratio of the density of soil to the density of water. It helps assess the quality and composition of the soil. The procedure typically includes weighing the soil sample in both dry and saturated conditions to calculate the specific gravity.

Fig 2 Density bottle

Liquid Limit Test Set (Casagrande Method) is used to determine the moisture content of soil transitions from plastic state to liduid state under standardized conditions.Procedure involves Mixing soil with water to form a paste, place the paste in a brass cup, create a groove in the paste, and drop the cup onto a hard rubber base.

The plastic limit test is used to measures the moisture content at which a soil transitions from a plastic to a semi-solid state. The test is performed by rolling a soil sample into a thread and observing when it begins to crack and crumble.

Fig 3 Casegrande apparatus

A sieve analysis test is a laboratory procedure that determines the size distribution of soil particles. The test is conducted by placing a series of sieves with progressively smaller mesh sizes on top of each other and passing the soil sample through the stacked sieve "tower". Therefore, the soil particles are distributed as they are retained by the different sieves.

ii Remote sensing

Remote sensing technology can collect data from spaceborne, airborne, or terrestrial platform sensors. The remote sensing data, sensor, and processing method is based on the unique characteristics of a given landslide or landslide-prone region. For example, an indicator of landslides in rainy areas is an increase in soil moisture content, which can weaken soil strength due to water pressure and lead to slope failures . Remote sensing, optical, thermal, or microwave images can record soil moisture content and indicate saturated areas with potential slope failure. Spaceborne sensors capture images with large area coverage due to orbiting the earth at high altitudes, and they provide repeating observations, sometimes almost daily. For landslide studies, obtaining high-resolution and reliable 3D data is necessary to extract the terrain's detailed and precise topographical and morphological variation over time Apart from providing direct information about flooding, remote sensing data can also be integrated with flood models or provide flood topography data.

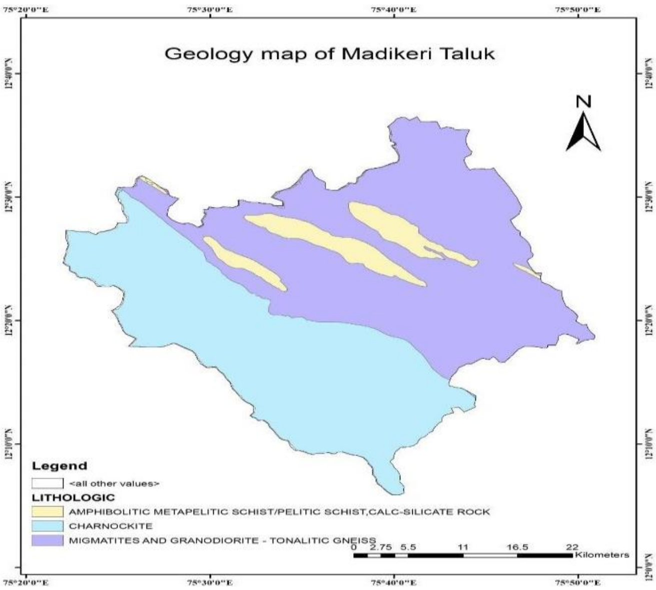

Fig 4 Geology map of Madikeri taluk

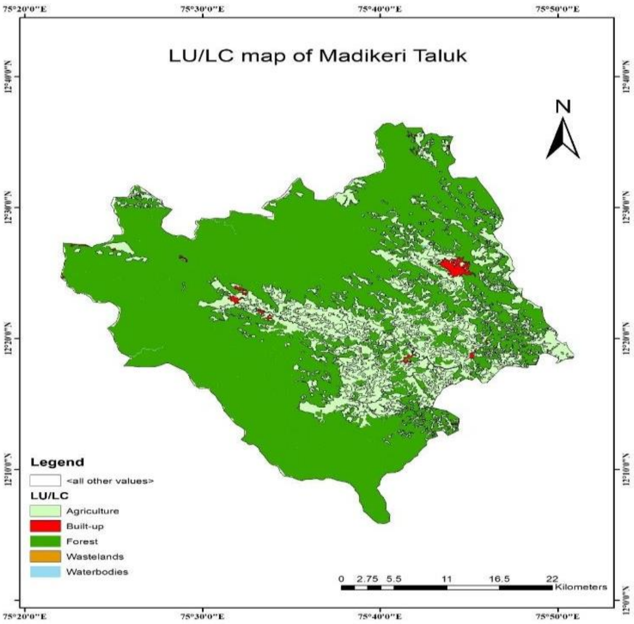

Fig 5 Lu/Lc map of Madikeri taluk

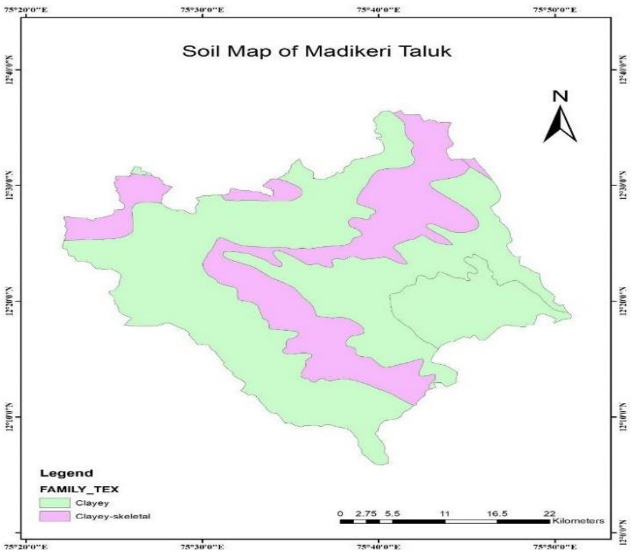

Fig 6 Soil map of madikeri taluk

Conclusion

- The north western and south western region of study area has higher percentage of slope Hence most vulnerable to landslides.
- The major factor which influences the slope failure are High intensity rainfall, high slopes,weak soils, geology, geomorphology, drainage, density, land use and land cover of the study area were found to be the major triggering factors for landslides.
- It is recommended that well designed drainage systems are required along the road in order to keep the slope well drained.

References

1. Alimohammadlou Y.,Najafi, A. and Yalcin.,A 2013. V.104:219-232.
2. GIS Praveen Kumar Rail, Kshitiji Mohan2 and Kumar2, “Remote Sensing and GIS”vol. 58, 2014
3. Qiang Xu, Bo Zhao, “Landslide Investigation’ vol 321, 2023
4. Warakorl Mairaing, 2006. “Landslide Research using Geotechnical ethod”
5. Melkamie Kinde, Murali than Jothimani, “Geotechnical and slope stability analysis” vo11 3,2024.