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DIGITAL SATELLITE DATA BASED GEOMORPHOLOGY INTERPRETATION AND ITS ROLE ON NILGIRI LANDSLIDES STUDY USING GPS AND GIS

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ABSTRACT

This paper deals with the assessment of landslides in Nilgiri using Digital satellite data base interpretation and its integration with topographic data source interpretation. The Satellite data LISS III were used for the preparation of geomorphology map of the terrain. The detailed geomorphology map was checked in the field during field validation. The historical data were collected from the secondary sources. Using GPS, the locations were visited in the field and taken in GIS. The SRTM data were downloaded and used for the generation of slope map of the terrain. Geographical Information System was used for the integration of Geomorphology and slope. The output was spatially linked with the point data in GIS to assess the number of landslides in various features. The result shows that most of landslides occurring the geomorphological feature of structural hills and slope angle of gentle slope.

Key Words: *Landslides, Geomorphology, Slope, Digital Satellite data, GIS and GPS.*

1. INTRODUCTION

In the mountainous regions, landslides constitute one of the major hazards that cause losses to lives and property. Landslide analysis is a complex analysis, involving multitude of factors and it needs to be studied systematically in order to locate the areas prone for landslides. Computer-based tool namely Geographical Information System (GIS) is found to be more useful in the hazard mapping of landslides. Hazard zonation map comprises of a map demarcating the stretches or areas of varying degrees of anticipated slope stability or instability. The map has an inbuilt element of forecasting and is hence of probabilistic nature. Depending upon the methodology adopted and the comprehensiveness of the input data used, a landslide hazard zonation map is able to provide the aspects of location of occurrence time of occurrence type of landslide extent of the slope area likely to be affected and rate of mass movement of the slope mass (Rajarathnam and Ganapathy, 2006). A study on Probabilistic landslide initiation hazard assessment along a transportation corridor in the Nilgiri. (Jaiswal and Van Westen, 2009). In the recent times causalities and damage due to landslides have increased in the Nilgiri Hills. More than 110 landslides were reported within five days from 10 to 15 November, 2009, and taken away about 80 human lives, also the vast damage reported on houses, roads and railway lines (Ganapathy et.al, 2010). Eastern

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Ghats, and Western Ghats, are affected by this hazard every year and suffer heavy losses in terms of life, infrastructure and property (Sharda, 2008). Vani said through her study that, landslides are the most frequently occurring events in the region of Nilgiris, especially during the monsoons for many decades. Such events are known for its damages that occurred on cut slopes or embankments alongside roads and highways in mountainous areas. Few landslides also occur in residential areas, causing death to human beings. So, it becomes highly essential to plan and mitigate the occurrences (Vaani, 2012). Subramani in his study said that, the study was carried out to know the application of geotextiles in slope stabilization. Ooty is one of the main areas in India which is prone to landslides. Many lose their life, property etc due to landslides every year (subramani, 2012). In the course of satellite imageries from different sources and in different types will be easy the view. Suganthi in her study explained that, investigates and demonstrates the state of Remote sensing techniques for detailed landslide hazard assessment applicable to large areas. Since the most common methods of landslide susceptibility assessment using weighted overlay are heavily dependent on 3dimentional terrain visualization and analysis stereo satellite image from the CARTOSAT1 high resolution imagery are used for this study (Suganthi,2010).

2. STUDY AREA

The Mettupalayam – Udhagamandalam ghat section of length 47 kilometers has taken as the study area to identify the landslide prone areas. The highway is an extension of NH-67 connecting the states Tamil Nadu and Karnataka. The study area lies between 76° 43’ 30’’ and 76°54’ 00’’ E longitudes and 11° 19’ 30’’ and 11° 30’ 00’’ N latitudes with Kerala on the west, Karnataka on the north. The area encompasses a total of 982 sq.km. It is situated at an elevation of 280 to 2620 meters above MSL.

3. MATERIALS AND METHODS

The survey of India toposheets 58 A/11 and 15 were used for the preparation of base work. The major roads in between Mettupalayam - Ooty were digitized and 10 km buffering were done to study the land slide cause (Fig 1). The historical data were collected from the existing source like the review of literature and from Geological survey of India. In the field, using Global positioning system the landslide regions were taken the geo coordinates. The satellite data were downloaded from the GLCF website. The digital data were converted in to img format in ERDAS imagine software. Using supervised classification, the data were classified with respect various landform features. The doubtful regions were checked in the field. SRTM data were used to deriving the slope of the terrain. These maps were overlaid in Geographic Information system platform to assess the cause behind the landslides. The landslide locations were taken as point data and spatial linking was used to join the data.

4. RESULTS AND DISCUSSION

Geomorphology

The Nilgiri hills rise abruptly from the surrounding plains to an elevation of 1370m amsl and it is surrounded by the Coimbatore plains in the southeast, Bhavani plains in the northeast, Moyar valley in the north and Gudalur Plateau in the northwest. The prominent hills are Ooty hills, Dodabetta, Kodaibetta, Bhavani Betta and Devabetta. Dodabetta is the highest peak in Tamil Nadu (GSI, 2000).The study area is a mountainous district of Tamilnadu with many hill ranges and broad valleys with slopping towards plain. The prominent geomorphic units were identified in the district through interpretation of satellite imagery are Denudational hills, Pediplain, Piedmont Zone, Structural hills, Water body (Fig 2). The study area is rise abruptly from the plains to an average elevation of 280-2620 m above MSL.

Slope

Slope is a very important parameter in any landslide hazard zonation mapping. If the slope is higher then there is a chance of occurrence of landslide. Shuttle Radar Topographic Mission (SRTM) satellite data has been used for the preparation of slope map. Using the Arc view 3D analyst for the study area is created from the satellite data. In the study area slope varies from 0° to more than 65°. The entire slope map (Fig. 3) is divided into five categories as follows:

Sl.No	Classification	Percentage
1	Denudational hills	0.9
2	Pediplain	20
3	Piedmont Zone	3
4	Structural hills	75.8
5	Water body	0.3

Table.1 Classification of Geomorphology with %

Sl.No.	Classification	Percentage
1	30°<	Very High sloping
2	21°-30°	High sloping
3	17° -21°	Steeply sloping
4	13°- 17°	Moderately sloping
5	0° - 13°	Gently sloping

Table.2 Classification of Slope

Sl.no	Slope	Geomorphology	LS Before 2009	LS After 2009
1	Very High sloping	Structural hills	2	2
2	High sloping	Structural hills	14	15
3	Steeply sloping	Structural hills	10	19
4	Moderately sloping	Structural hills	28	14
5	**Gently sloping**	**Structural hills**	**63**	**46**

Table.3 Slope and Geomorphology with landslide details before 2009 and after 2009

The overlaid study clearly expressed the relationship between the slope and geomorphology. Through the historical information on the landslides before and after 2009 in the area has clearly exposed the favored environmental condition for landslide in the area. According to slope and geomorphology overlaid study, most number of landslides were occurred in gently slope on the structural hills in before and after 2009.

The Geomorphology (Fig: 4) of the region reveals that, structural hills features were interpreted using image interpretation and geo technical knowledge. Among this, a Structural hills feature occupies 75.8 Percentages.

5. CONCLUSION

The land slide data base reveals that, there are large numbers of landslides were reported before 2009 (117) when compare to landslides after 2009 (96). With respect to Slope, landslides were reported in gently sloping regions in both the periods. Geomorphologically, all the landslides were occurred in Structural hill regions. GIS integration helps us to understand the combination of geomorphology and slope with number of landslides (Table 3). The present study concludes that with respect to Structure and Landforms, Gently sloping and structural hills domain control the landslides in Nilgiri regions.

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6. REFERENCE

Ganapathy.G.P, Mahendran.K and Sekar.S.K (2010), Need and Urgency of Landslide Risk Planning for Nilgiri District, Tamil Nadu State, India, International Journal Of Geomatics And Geosciences Volume 1, No 1.

GSI (2000), District Resource Map Series: Nilgiri District Tamil Nadu, published by Geological Survey of Indiaxplanatory Note.

Jaiswal, P and Van Westen C.J (2009), Probabilistic landslide initiation hazard assessment along a transportation corridor in the Nilgiri area, India, Geophysical Research Abstracts, Vol. 11, EGU20092854, 2009, EGU General Assembly 2009.

NDMA (2009), National Disaster Management Guidelines: Management of Landslides And Snow Avalanches, National Disaster Management Authority, Government of India, June 2009.

Subramani.T, (2012) , Application of Eco-Friendly Geotextiles for Landslide Mitigation in a Part of Ooty Hills, Tamil Nadu International Journal of Modern Engineering Research (IJMER) Vol.2, Issue.3, May-June 2012 pp-579-585 ISSN: 2249-6645 www.ijmer.com

Suganthi.S, Srinivasan.K (2010) Digital Elevation Model Generation and Its Application In Landslide Studies Using Cartosat1, INTERNATIONAL JOURNAL OF GEOMATICS AND GEOSCIENCES Volume 1, No 1, 2010, Integrated Publishing services, Research Article ISSN 0976 – 4380

Vaani N, Sekar S.K (2012), Regional Landslide Hazard Zonation and Vulnerability Analysis Using AHP and GIS – A Case Study of Nilgris District, Tamilnadu, India. Disaster Advances Vol. 5 (4) October 2012 (171)

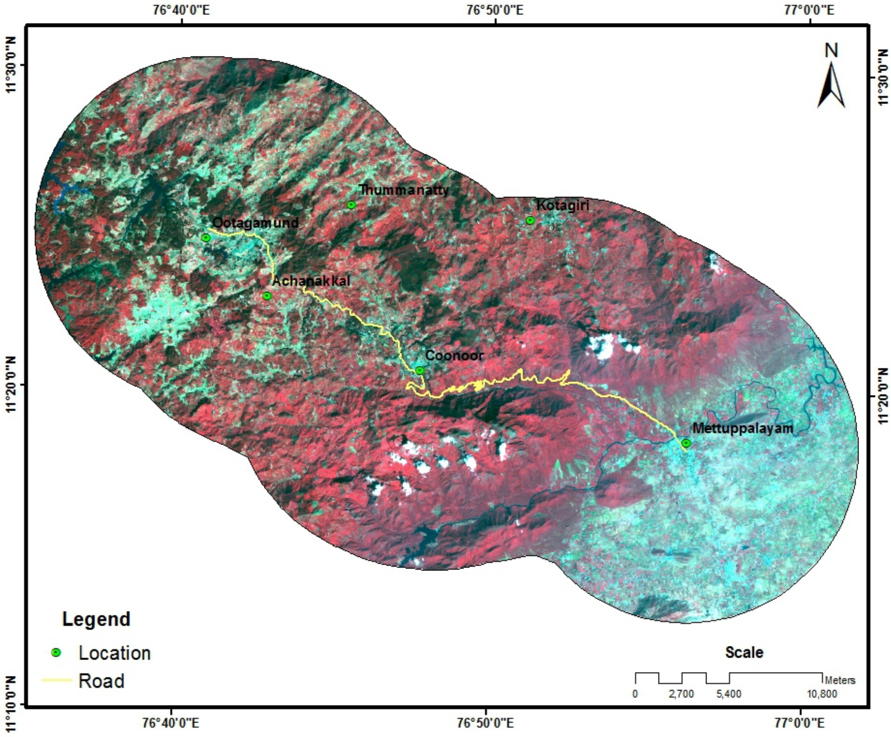

Fig. 1. Study Area Map

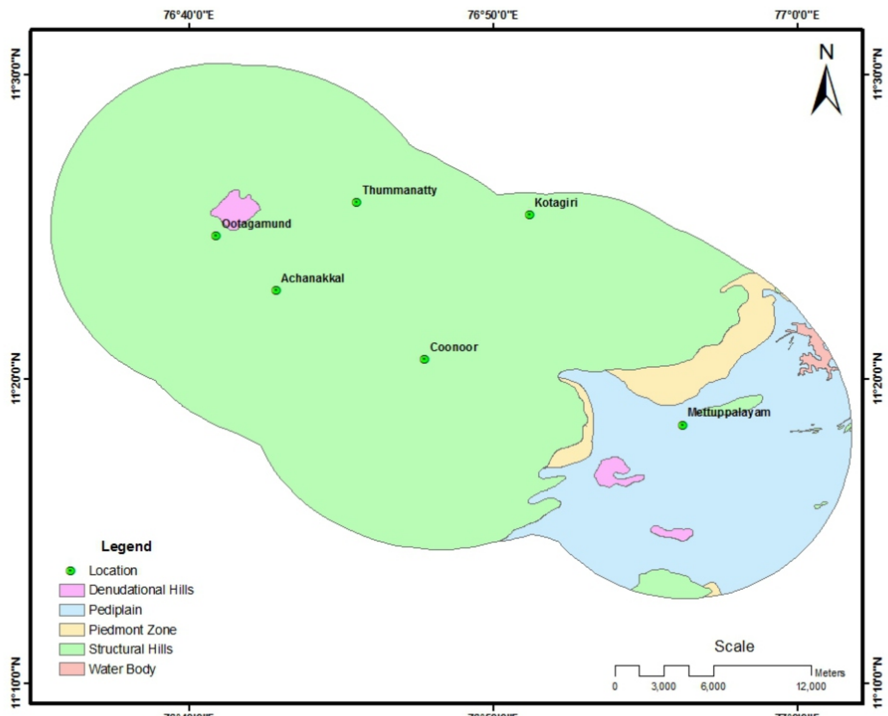

Fig. 2. Geomorphology Map

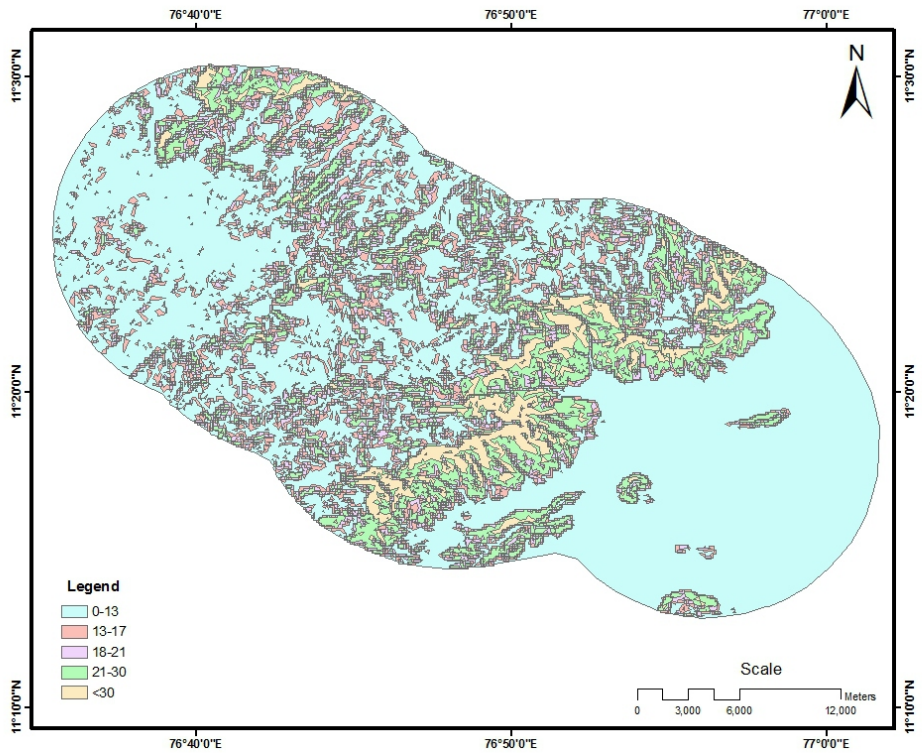

Fig. 3. Slope Map

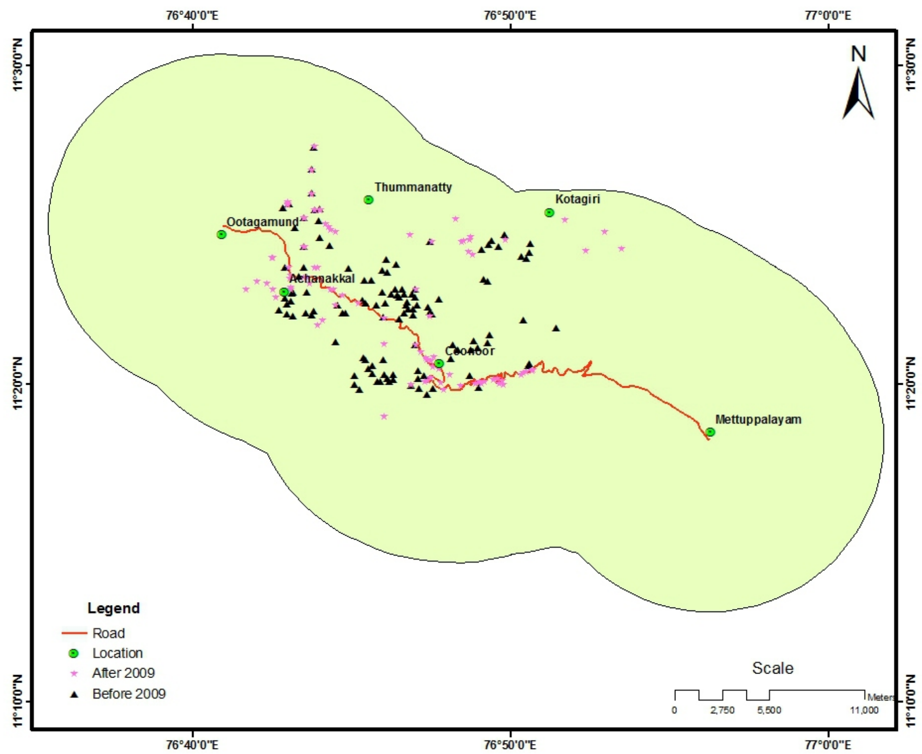

Fig. 4. Slope and Geomorphology with landslide details before 2009 and after 2009