Impact of Rainfall on landslides for Nilgiri District, Tamil Nadu, India

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Landslides are frequently occurring natural hazard in hilly regions like Nilgiris. The past historical events reveal that copious rainy days have caused landslides. Thus, in this present study, impact of rainfall on landslide occurrence has been studied during 1996-2013 from the rainfall database collected from Indian Meteorological Department(IMD) and history of past landslides from geotechnical cell Conoor Udhagamandalam, Conoor, Kothagiri blocks receives rainfall during North East Monsoon. While Gudalur from South West Monsoon. Even though only 30% of rainy days are during North East Monsoons with an average rainfall in a single day 90 — 150mm, landslides occurrence were 100% during November(North East monsoon). This is due to high pore water pressure in the soil due to prolonged rainfall from the month of June (south West monsoon) to November. The correlation coefficient for rainfall Vs landslides during the major landslide the year 2009 reveals 0.5 showing moderate relation between them.

Key words: Rainfall, landslide occurrence, North East South West Monsoon, correlation coefficient

Introduction

Landslide is one of the major natural disaster happening in hilly terrain all over the world (GP Gapanath, et.al, 2008)."The downward movements of consolidated soils and rock mass matter from any geomorphic features due to natural or manmade activity are termed as landslides" (GSI, 1982, C.J Vances et.al). a landslide is "the movement of mass rock, debris or earth down a slope" (Cruden D.M 1991) In India natural disaster ranked as 7th in the list of major natural disaster by number of deaths reported (OFDA/CRED,2010). Mathur (1982) estimated the annual loss of nearly US $1 billion for the total 89,000 km of road in the landslide prone areas of India. Himalayas, north-eastern hill ranges, Western Ghats, Nilgiri ranges of Eastern Ghats and Vindhyas are recorded with landslide incidences every year during the monsoon periods (Geological survey of India, P. Rajkumar, 2001). Building Materials and Technology Promotion Council (BMTC), Government of India has published landslide hazard zonation atlas of India, reveals Nilgiris District of Tamil Nadu as one of the severely to very highly affected landslide prone areas of India.

Trigger means single event that finally initiates landslides. The main triggering group of factors causing landslides are slope, geology, topography, soil, hydrology, geomorphology, land use and anthropogenic factors. Earthquake and volcanoes, weather and climate (J. Corominas et.al, Crostal et. al, 2012). Among all hydrological parameter namely rainfall is the most common trigger (Glade (1988) of landslides. Rainfall is a variable quantity which changes with respect to both location and time (A. Akbar, 2006), the critical rainfall condition inducing landslides is not the same for different types of landslides (J.L Zezere, et al, 2007, Rodrigues, 2002). Rainfall drives increase in pore water pressure within soil. This in turn causes surface run-off, infiltration, depth of the saturated soil and influence soil-moisture condition, cohesion and angle of internal friction causing slope instability. For rainfall induced landslide to occur a threshold value would indicate rainfall, soil moisture, or hydrological conditions that, when reached or exceeded, would trigger landslides (J.Corominas et al, David J Varnes). When hilly regions receives heavy rainfall, the water entering into the soil particles exerts high pore- water pressure due to which the soils losses its shear strength causing landslides due to slope instability (Crozier and Eyles (1980), Crozier (1999) and Glade et al. (2000)). At least 90% of landslide occurrence can be prevented once the real cause of the problem is indentified (Brabb 1993). In this paper an attempt has been made to study the correlation between rainfall and historical landslides at Nilgiris.

2. Study area:

Nilgiri district is located entirely on Western Ghats. It is geographically located between 76.14 and 77.02 east longitude and 11.10 and 11.42 north latitude (soil atlas). Nilgiris covers about 2452.50 sq km total area of which 56.6% is forest. It consists of six taluks and four blocks as administrative boundaries. It has Figure 1 study area two major roads NH67 connecting Nagapatinam — Udhagamandalam — Gudalur. It has minimum of 900 mts and maxinnun of 2636 meters of altitude. Landslide is frequently occurring phenomenon in this...