

Human Induced Landslides: A remote sensing study in the hills of Central Srilanka

Koel Roychowdhury¹, Srikantha Herath¹, Sarath Abayakoon²

¹*Institute of Sustainability and Peace (UNU – ISP)*

United Nations University, Tokyo, Japan, roychowdhury@unu.edu, herath@unu.edu

²*Department of Civil Engineering, University of Peradeniya, Srilanka, sbsa@pdn.ac.lk*

Abstract: A landslide is defined as the downward and outward flow of slope-forming materials composed of natural rocks, soils, artificial fills, or combinations of these materials. The major physical causes of landslides can be attributed to earthquakes, flash floods, heavy rainfall and slope failures. However there are also many human induced causes of landslides such as land use change, design errors, construction errors, poor maintenance system and ignorance of geological structures. Settlements located in these vulnerable areas are at the highest risk from the landslides. Srilanka had experienced large-scale landslides in the last two decades. In this research, the landslide in the Nuwaraeliya district in the Walapane division in central Srilanka was used as the case study.

The paper aims to meet the following objectives:

1. Can satellite images with moderate and coarse spatial resolutions be used to detect areas of landslides in central Srilanka?
2. What are the changes in the landuse pattern in the landslide prone areas over the last decade? Is there any significant change in any landuse?
3. Is there any impact of landuse change in aggravating/mitigating landslides in the areas?

The paper studied the unplanned expansions of the settlements in the hilly regions in the Nuwaraeliya district in the Walapane division in central Srilanka. Satellite images captured at night by the Suomi and the OLS sensors on board the DMSP group of satellites were used to detect the areas of human settlements. These sensors record the artificial lights from human settlements at night. The landuse of the areas surrounding these detected settlements were analyzed using images obtained from the Landsat from 2000 to 2011. The growth and spread of settlements and the density of transport lines were mapped. The results from the temporal analyses showed that there was a 10 – 20% increase in the built-up areas in the landslide prone zones over the last decade. Major landuses include houses, commercial areas, transport lines with some changes in vegetated areas (tea plantations and forests). Overlaying these areas with the landslide hazard maps, it was found that the landslide prone areas lie close to or overlap the areas of settlements and transport lines. The paper studied the mitigation steps implemented by the Srilankan government to prevent the landslides. These include building reinforcements and steps and construction of artificial drainage to prevent flash floods.

The research conclusively showed that remote sensing techniques can be successfully used to study the landslide areas. The merging of data from two satellite (DMSP - OLS and Landsat) facilitated the analyses. Lack of strong urban governance, availability of lands, inappropriate constructions (houses and transport lines) contributed to high disaster risks in the settlements. The findings implied that there was a definite need for developing warning systems in the landslide prone areas.

Keywords: Landslides, remote sensing, landuse change, mitigation