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Mapping of Geomatics based optimum Landslide using Remote Sensing & GIS approach

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ABSTRACT

Landslides are very often in mountain areas like Himalya region. Landslide causes loss to man, his properties and ongoing development projects. Landslides are majorly found after heavy rains when a lot of water penetrates into the soil resulting in inner pressure and landslide takes place.

Deforestation is considered as the big reason for the landslide as in empty soil, most of the rain water penetrates into the soil and pressure forces for landslide. However, some geologists considered the type of rock, nature of rock and other parameters like angle, tetonic deformation etc for the phenomenon of landslide and the inner structure of rock is analyzed. The current article highlights the mapping of geomatics based optimum landslide using remote sensing & GIS approach..

INTRODUCTION

In Indian sub-continent, the major landslides are observed in Western Ghat of Maharashtra and Himalyas. The reason of landsliding in Western Ghat of Maharashtra is observed due to heavy rains whereas landsliding in Himalyan region is observed due to active tectonic movements.

GIS and remote sensing techniques are very helpful in mapping of landslide vulnerability zone. To get the information regarding landslide, firstly the black and white photographs are used to locate the landslide and after that the mapping is done with the modern instruments like remote sensor and GIS.

Various image processing techniques are available to carry out this process. Some of these imaging techniques are Linear Stretching, Pseudo Color Composite and Density Slicing etc. After the task of image processing, a manual survey of the spotted region of landslide is performed. During the field survey, landslides and land slips are located.

For the purpose of mapping, Landslide Susceptibility Zonation (LSZ) methodology is used. This method is used to organize several parameters such as meteorological, geomorphic and geological factors. A slope failure is observed a collapsing in slope is found due to gravitational stress causing landslide.

Mapping of these vulnerabilities is performed so as to predict the future landslides and more precautions can be taken to avoid these things in the future. In most of Uttrakhand's peaks where the water level in rivers is increased during Monsoon and this high water level causes the movement in mountains leading to landsliding.

The following figure shows the landslides occurred in mountain region of Himachal Pradesh.

Figure 1: Landslides in Mountain area of Himachal

MAPPING OF GEOMATICS BASED OPTIMUM LANDSLIDE

LSZ mapping is created using the Weights of Evidence method, a statistical procedure for calculating risk assessment using training data, like an established inventory of previous landslides. This statistical approach allows for information retrieved from a geographic information system (GIS) and remotely sensed data to be integrated regionally.

The statistical approach provides consistency and confidence of regional LSZ maps because they can be interpreted using a common baseline.

The researchers hope that more precise mapping will help communities prepare for disasters such as the one that occurred in Uttarakhand in 2013. In a normal year, the monsoon rains soak Uttarakhand during the second week of July; however, in 2013, those rains arrived in June, a month earlier than expected, catching Uttarakhand off guard. During the spring months, water levels are high with snowmelt from rivers and glacial lakes. Combining monsoon rains with snowmelt during the spring can lead to devastating floods and landslides. As a result, 7,000 people and hundreds of animals lost their lives in a rainfall event on June 15th that took place in the Mandakini Valley, east of Nanda Devi National Park. Adding to the devastating losses, the Manadkini Valley is also home to the Kedarnath Temple, where Hindu pilgrims travel between the months of May to October. The high volumes of people paired with the early-activated monsoon resulted in increased losses.

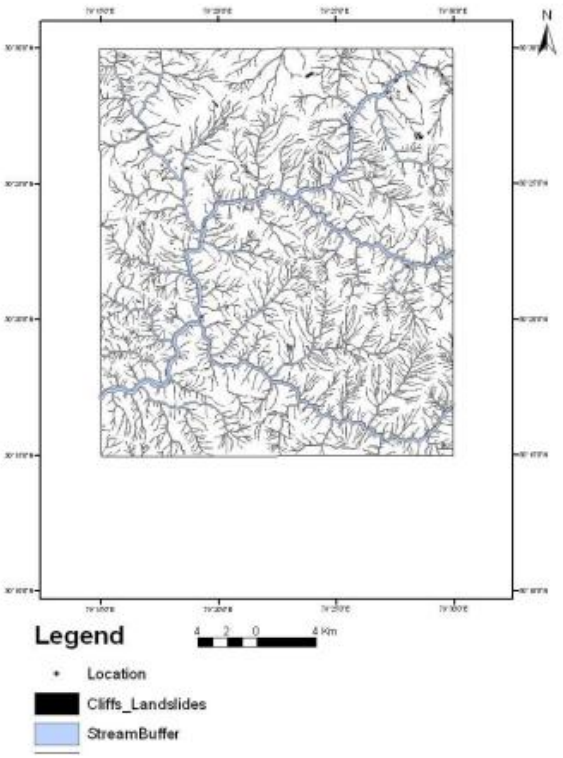

Figure.2 The figure shows cliffs and landslides in the region developed in proximity of drainage lines.

The LHZ maps could be made and shown in green to red colors depicting go to stop signals from safest to vulnerable slopes. These are though tentative but they are very informative and first order maps for planning stage. These can be used for land use planning as well as road alignments. However before entering into any land use, one has to check them in the field and find out in the area of study as to where such slopes are really susceptible for landslides.

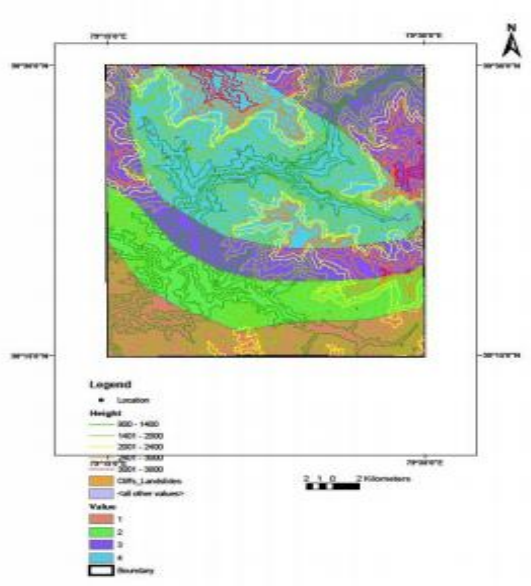

Figure. 3. Seismic zones of Chamoli

DISCUSSION

The advantages of a slope facet map are numerous. First they are easy to make and hardly any Software is required and no trained manpower is needed in this case. However if we insist for a software to do this than the Envi Image software for textures may be the useful ones. This facet map is made from contour data manually. However some argue that a DEM may be used to make such a slope map and that can be tried also. But the results are not the same.

The relationship between drainage lines and landslides or rather distance to landslides is a significant observation. This is due to the fact that drainages especially the first order drainages are often developed along fracture planes which become pathways for the rain water to follow.

It has been found that there is a fair coincidence between the slides and drainage lines which is reflected in the buffer zone analyses of drainage lines. The buffer zone of 200 meters is a good distance for accounting most of the cliffs and slides which suggests a downgrading and vertical cutting of rivers due to rise of Himalayas is a significant factor. This is a part of erosion process in Himalayas. A buffer zone can easily be generated using Arc Info and relationship of cliffs and slides found.

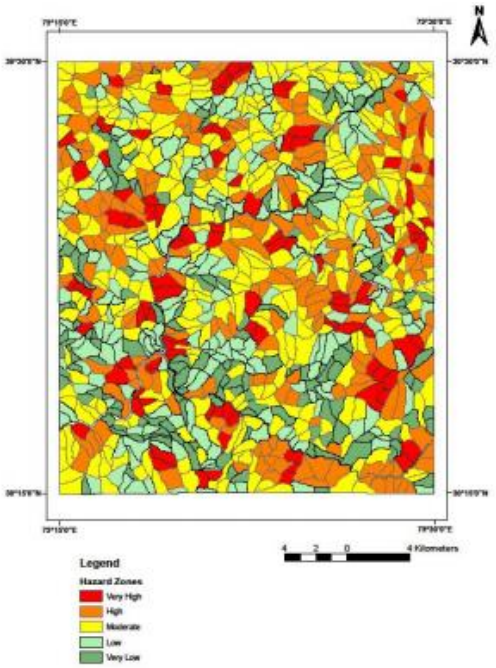

Figure 4. The Landslide Hazard Zonation map of the area based upon slope mapping and scores

LSV maps can also be derived from a knowledge-driven method that involves more human interpretation; however, this method is based on expert evaluations of a location. According to the article, the statistical approach is used more frequently because it lacks the subjective nature of the knowledge-driven method. When a location is evaluated by an expert, risks and interpretation of potential risks will differ based on the expert, leaving the risk of human error.

CONCLUSION

The zones are suggestive and show the method of assessment of landslide possibility. There is a possibility that very high hazard zones are the ones that require prior treatment and attention and that these slopes are more vulnerable to slides given the slope, rock type and other factors as established.

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