Analysis of vegetation recovery after shallow landslides: a comparative study between the Toyota City and the Shōbara City, Japan

*CHENXI ZHONG[1], Wei Yang[2], Akihiko Kondoh[2]

1. Graduate School of Science and Engineering, Chiba University, 2. Center for Environment Remote Sensing, Chiba University

Shallow landslides are instability events that lead to dramatic soil and vegetation mass wasting in sloping areas and are commonly triggered by intense rainfall episodes. Vegetation significantly affects hillslope hydrological and mechanical properties related to shallow landslides triggering. Vegetation recovery at shallow landslides sites not only plays an important role in reducing soil erosion and increasing land stability but also records the transformation of loose, exposed landslide surfaces into stable hillslopes during the post-landslide years. Therefore, it is important to evaluate the natural vegetation recovery processes and provide basic information on ecological aspects of the recovering environment after the shallow landslides. However, little is known about the vegetation recovery process or its influencing factors. The objective of this study is to clarify the relationship between vegetation recovery and topographic characteristics which include slope gradient and slope aspect after the shallow landslides, and to assess the influence of different geological structure on vegetation recovery. The comparative analysis was conducted at the shallow landslides areas of the Toyota City and the Shōbara City, which provide different geological structures of granite and rhyolite, respectively. With regard to monitoring of the vegetation recovery conditions, it is essential to develop the quantitative index coupled with remote sensing and Digital Elevation Model (DEM) for long-term assessment at shallow landslide sites. In this study we extracted the damage areas based on post-landslide and pre-landslide aerial photography. Using the long-term time series Landsat data, we calculated the post-landslide annual Fractional Vegetation Coverage (FVC), which was estimated from normalized difference vegetation index (NDVI). The FVC was then applied to determine the rate of vegetation recovery. We also evaluated topographic characteristics from DEM. Then analyzed the correlation between vegetation recovery rate and topographic characteristics in different geological structures. The results indicated that the vegetation recovery rate in the range of 10-20°on slope gradient presented an increasing trend while that in the range of 23-30° showed a decreasing trend. In terms of slope aspect, the vegetation recovery rate in north and northeast was lower than others. The conclusion in this study would enable decision-making and policy-planning in disaster rehabilitation work.

Keywords: Shallow landslides, Remote sensing, Vegetation recovery, Topography, aerial photography