

陳有蘭河流域山崩與植生狀態在颱風與地震事件中之對應關係

The relationship between vegetation and landslide-induced by typhoon and earthquake along the catchment of Chenyoulan River

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摘要

本研究嘗試利用 1996 年至 2004 年陳有蘭溪集水區流域的山崩及植生的分布狀態，來探討彼此間的相對應關係。研究方法主要是利用賀伯颱風、921 地震、桃芝颱風及敏督利颱風等四個事件的航照圖與 SPOT 衛星影像對於山崩，以及常態化差異植生指標進行數化分析與圈繪判釋，其中生物量的估算是以台大試驗林與林務局的林班資料為參考依據。地質材料的強度試驗結果，則主要是在探討岩性與山崩的相對應關係。一般而言，本研究區域內崩場地上的常態化差異植生指標為介於-0.2 至 0.2 之間，生物量的分布為介於 50t/ha 至 350t/ha 之間。當常態化差異植生指標增高 0.1，植生覆蓋率增加 20%，高程每升高 1000 公尺生物量增加 80t/ha 至 100t/ha 之間，此意義顯示集水區內的植生指標越高，植生覆蓋率越好，反之則為植生狀態不好的區域。

從山崩的判釋結果中發現，921 地震後之崩塌面積比 1996 年賀伯颱風後增加了 2.6 倍，生物量減少 3.4 倍，植生指標減少 0.08。2001 年桃芝颱風後崩塌面積比 921 地震後增加 2.1 倍，生物量減少 1.6 倍，植生指標減少 0.04。2004 年敏督利颱風後崩塌面積比桃芝颱風後增加 1.1 倍，生物量減少 1.2 倍，植生指標減少 0.09。就崩塌與植生狀態的對應關係來看，921 地震後崩塌面積與植生指標有逐漸減少的趨勢，彼此間呈現一個負相關的相對應關係。

就岩石強度及傳波速度與植生狀態的調查結果發現，本研究區域變質岩層的岩石強度介於 100MPa 至 150MPa 之間，是南莊層強度的 2 倍，傳波速度是 1.5 倍，不連續面密度為 2 倍，常態化差異植生指標為 0.5 倍，此結果顯示，常態化差異植生指標和岩石強度、傳波速度及不連續面密度有負相關之對應。

幾次颱風事件中估算之輸砂量為介於 0.3Mt 至 28.7Mt 之間，生物量為介於 9.4kt 至 97.4kt 之間，此意義顯示，陳有蘭溪在暴雨期間所攜帶大量的沉積物，主要仍以集水區內之地質材料為主，植生作物受沖蝕進入河流內之比例則大約佔有其中的 0.36%。

關鍵詞：陳有蘭溪、植生指標、山崩、生物量、921 地震

Abstract

In the study, we are trying to find out the relationship between landslide distribution and vegetation along the catchments of Chenyoulan River from 1996 to 2004. We use SPOT satellite images and air photos to map the landslide and analysis the Normalized Difference Vegetation Index of typhoon Herb, 921-earthquake, typhoon Toraji and typhoon Mindulle. We use both the Experimental Forest of NTU and Taiwan Forestry Bureau's data to estimate the biomass. Using the data from the test of geomaterial to discuss relationship between lithology and landslides. In general, the NDVI values of landslide area are between -0.2 to 0.2, and biomass is between 50t/ha to 350t/ha. When NDVI increases 0.1, vegetation cover rates will add 20%, and elevation increase 1000 meters, biomass add around 80t/ha to 100t/ha. It means when NDVI values increase and vegetation cover rates will add in the same time in this study area.

From the mapping of the landslide, we found that in 1999 921-earthquake's landslide areas are 2.6 times, flux biomass is 3.4 times, and NDVI values decrease 0.08 than typhoon Herb's. In 2001, typhoon Toraji's landslide areas are 2.1 times, flux biomass is 1.6 times, and NDVI values decrease 0.04 than 921-earthquake's. In 2004, typhoon Mindulle's landslide areas are 1.1 times, flux biomass is 1.2 times, and NDVI values decrease 0.09 than typhoon Toraji's. It is say that landslide areas have the negative relation with NDVI.

From the result of rock strength, sonic wave test and vegetation, we can find out metamorphic rock strength is between 100MPa to 150MPa. Rock strength and sonic wave test are 2 and 1.5 times than Nanchuang formation. Discontinuities and NDVI values are 2 and 0.5 times than Nanchuang formation. According to the result, NDVI values have negative relation with rock strength, sonic wave test and discontinuities.

In several typhoon events, sediment discharge is from 0.3Mt to 28.7Mt and biomass is from 9.4kt to 97.4kt. It means in rainfall most sediment is from the geomaterial rather than vegetation. Because vegetation is only 0.36% of sediment discharge.

Key words: Chenyoulan River, NDVI, landslide. Biomass, 921-earthquake