

摘 要

崩塌常帶來森林環境資源的破壞，是台灣地區常見的環境災害之一。傳統的崩塌災害調查與評估，耗費大量的人力、物力及時間，且僅能針對小區域範圍來進行相關研究。由於遙測技術具有即時、有效取得中、大尺度資料之特性，有助於監測和劃設崩塌潛在敏感區以及環境災害預防之用。台灣森林資源中之檜木被列為國家級保護的樹種，檜木老林更為國人所重視的珍貴「生物遺產」。棲蘭山林區目前仍存有面積不少的檜木老林，近年來該林區偶有崩塌情形發生，是否會影響檜木老林地區以及如何劃設崩塌敏感地予以保護，乃值得探討的課題。

本研究旨在應用遙測技術監測與劃設棲蘭山林區之崩塌潛在敏感區，提供棲蘭山林區林地規劃和災害預防之參考。研究方法係利用數值地形模型萃取崩塌潛在敏感區所需之分析單元(如集水區)和計算其坡度、坡向、及海拔高等地形資料，並以河川造成的崩塌作為主要的研究對象，然後利用平均坡度與蝕溝強度二因子，透過迴歸式求其相關性，並應用多變量統計之群落分析法，將集水區單元自動分群而求得崩塌潛在敏感區圖。研究結果指出，利用 107 個集水區單元之平均坡度(X)與蝕溝強度(Y)所求得的

迴歸式為 $Y=-0.069+0.108X$ ，其 $R\text{-square} = 0.82$ ，屬於高相關，將該迴歸式導入研究試區所萃取的 249 個集水區單元中，再藉由群落分析法歸併為三類，計有大蝕溝 110 個單元、中蝕溝 111 個單元、以及小蝕溝 28 個單元，該結果與衛星影像分類後的土地覆蓋型圖(包括檜木老林區和崩塌區)套疊，並透過空間分析技術發現大蝕溝及中蝕溝的分佈位置涵蓋到檜木老林區域，因此有必要加以規劃及保護。由本研究結果可得結論為，應用遙測技術探討崩塌潛在敏感區與檜木老林區之空間分佈區位關係和影響效應，確實可行，該結果可提供棲蘭山林區未來林地規劃和災害預防之參考。

關鍵字：檜木老林、蝕溝強度、崩塌、潛在敏感區

ABSTRACT

Landslide often brings destruction to forests and it is one the most common disasters seen in Taiwan. Traditional survey and evaluation method used on detecting landslide disasters often waste lots of human resources, capital and time. Also, the method can only conduct survey on small areas. Remote Sensing technique is both real-time and efficient in retrieving data of middle and large scale area. It is therefore helpful in monitoring and mapping out the potential landslide sensitive area in order to prevent environmental disasters. Among tree species in Taiwan, old-growth cypress is listed under national protection. It is treated as the most precious biological legacy. Many old-growth cypresses can still be found in Chi-Lan district right now. Yet, recent landslides in the district have aroused concerns over the protection on old-growth cypress and it is important for us to look into the mapping of the landslide sensitive area in order to conserve it.

The research focuses on the application of remote sensing techniques on monitoring potential landslide sensitive area in Chi-Lan district, in order to provide a better Chi-Lan forest map for disaster prevention. Digital Terrain Model, DTM, is adopted to extract the analysis units (ex. basins units) needed to determine the potential landslide sensitive areas. It is also used on calculating geographical data on slope, aspect, and altitude. The research target is the landslide created by streams. First, regression analysis is used to find out the relevance between average slope (X) and erosion degree (Y). Cluster

method of multivariate statistical analysis is then used to generate watershed cluster and map out the potential landslide area. The result shows that the regression formula retrieved from the average slope (X) and erosion degree (Y) of the 107 watershed is $Y=-0.069+0.108X$, with R-square = 0.82, which is highly relevant. Apply this regression formula to our target area of 240 watershed, and we are able to cluster the area into three categories: 110 high erosion units, 111 moderate erosion units and 28 low erosion units. Overlay this result with the land cover type map (including old-growth cypress area and landslide area) derived from the satellite images. Applying the spatial analysis technique we find that high erosion and moderate erosion areas overlay with old-growth cypress area. Therefore, it is necessary to map out the area for preservation. The research shows that the remote sensing techniques can effectively help mapping out the potential landslide sensitive area and it's correlation with old-growth cypress area. The result derived can use as reference for future forest mapping and prevention of disasters in Chi-Lan district.

Key Words : Old-growth Cypress 、 erosion degree 、 landslide 、
potential sensitive area