



## 摘要

本計畫運用多元尺度環境監測及調查，建置曾文水庫集水區監測資料及整治前、後之地形高程，以有效評估治理工程投入後曾文水庫集水區內保育治理及環境復育成效，供以後續保育治理措施規劃設計參考依據，並輔以進行集水區健康檢查與管理。茲就計畫成果所獲得重要觀察與具體結論，整理如下：

- (1) 由土壤厚度調查成果發現隨著邊坡坡度愈陡，所得土壤厚度值愈小，而另曾文溪主流坡面土壤平均厚度約為 60cm，支流坡面土壤平均厚度約為 74cm。
- (2) 經比較各期高精度數值高程分析顯示，大埔治理分區內子集水區於治理後土砂生產量皆已下降，降低為治理前土砂總產量之 5%至 97%。另就土砂攔阻率而言，集水區治理後大致優於治理前，現階段土砂攔阻率介於 4.9%至 37.8%，平均可達 19.5%。
- (3) 藉由沖蝕針監測成果推估得知，曾文水庫集水區內經人為整治後之邊坡，平均可降低 33.64%之土壤流失，顯示現階段各治理分區保育治理工程漸有成效。
- (4) 曾文水庫集水區山坡地範圍內植生覆蓋率，於莫拉克颱風後由 92.23%降至 77.48%；自 99 年整治工程進駐且陸續竣工至 100 年 9 月南瑪都颱風後，植生覆蓋率增至 90.05%，逐漸恢復接近整治前植生覆蓋程度。
- (5) 曾文水庫集水區於保育治理措施投入前(莫拉克颱風以前)，於 200 天至 300 天自然復育情況下，整體崩塌復育面積約為 220ha。莫拉克颱風後，因治理工程進駐，若同樣於 200 天至 300 天復育天數且無異常氣候變化下，推估每年曾文水庫集水區整體崩塌復面積可提高至 1,000ha，顯見水保治理措施投入確有加速崩塌植生復育成效。
- (6) 經分析評估 99 年至 100 年曾文水庫集水區內山坡地範圍坡面崩塌防治量及沖蝕防治量分別為 5,941,890m<sup>3</sup>、55,719m<sup>3</sup>；於河道防治量約為 286,092m<sup>3</sup>，前述三者總計防砂量計有 6,283,701m<sup>3</sup>，已達執行計畫曾文水庫集水區防砂目標之 45.53%。

**關鍵詞：**曾文水庫、土砂防治、保育治理、環境復育、集水區健康檢查。



## Abstract

Utilizing measurements obtained from multi-scale monitoring techniques, this study creates a database for the Tseng-Wen Reservoir watershed that includes digital topography measurements taken both before and after implementation of watershed remediation engineering. From these data sets, the conservation efficiency and environmental recovery are assessed. Results from this study can be incorporated into later remediative techniques, planning, watershed health assessments and management strategies. This study presents primary findings and draws specific conclusions from those findings. Results are summarized below:

- (1) A survey of soil depth relative to slope revealed that soil depths decrease with slope. Soil depths along the Tseng-Wen main river averaged 60 cm while soil depths along the tributaries of the Tseng-Wen river averaged 74 cm.
- (2) Analysis of multi-period, high-accuracy digital topography data sets reveals that after implementation of remediative works, sediment yields in the Dapu remediation area ranged between 5 to 97% of pre-remediation levels. Also, regarding trapped sediment, remediation has increased sediment trapping rates, which now range from 4.9 to 37.8% and average 19.5%.
- (3) Results from a soil erosion pin study reveal that soil loss due to erosion on remediated slopes has been reduced by at least 33.64%, indicating that remediation has very effectively reduced erosion-induced soil loss.
- (4) Vegetative cover on "mountain-slope" zoned areas dropped from 92.23% to 77.48% as a result of Typhoon Morakot. In 2010, remediation works were commenced and by September of 2011, shortly after Typhoon Nanmadol, vegetative cover reached a level of 90.05%.
- (5) Before Typhoon Morakot and subsequent soil and water remediation works, 200 to 300 days of natural re-vegetation in the Tseng-Wen reservoir watershed resulted in 220 ha of restored or re-vegetated landslides. After Typhoon Morakot, remediation works commenced. Given the number of days in which it took to naturally restore 220 ha using natural re-vegetation, in the same amount of time, assuming no extreme weather events, over 1,000 ha of land could have been restored using remediation techniques. This result shows that soil and water remediation does accelerate the re-vegetation of landslides.
- (6) Results of the Tseng-Wen Reservoir watershed sediment budget analysis reveal that between 2010 and 2011, the estimated landslide sediment retention volume for the "mountain-slope" zoned areas was 5,941,891 m<sup>3</sup>, the overall erosion suppression volume was 55,791 m<sup>3</sup> and the total river sediment suppression volume was 286,092 m<sup>3</sup>. In total, 6,283,701 m<sup>3</sup> of sediment was kept from entering Tseng-Wen River, which accounts for 45.53% of the sediment retention target for this project and demonstrates the brilliance and outstanding effectiveness.

**Key word : Tseng-Wen Reservoir, Sediment Retention, Conservation Efficiency, Environmental Recovery, Watershed Health Assessment.**