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91—96年度水土保持重要成果彙編(上)

行政院農業委員會水土保持局

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91-96年度水土保持重要成果彙編(上)

A Compilation of Soil and Water Conservation Important Reports from 2002 to 2007 (I)

行政院農業委員會水土保持局
Soil and Water Conservation Bureau, COA

中華民國九十七年十二月
December 2008

91－96年度水土保持重要成果彙編(上)

A Compilation of Soil and Water Conservation Important Reports from 2002 to 2007(Ⅰ)

編者　黃宏斌

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Soil and Water Conservation Bureau, COA

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序

水土保持局為求突破與創新，近 6 年來持續不斷投入經費，辦理水土保持及農村建設之研究計畫，至目前為止，所獲得之資料與研究成果相當豐碩，為能將水土保持及農村建設之研究成果廣泛分享給各界，本局篩選出近 6 年來各項委託辦理計畫之重要成果，並以能詮釋研究精髓之中、英文摘要編撰成冊，將冊本分送各水土保持相關機關、團體、學術單位、法人團體、技師公會及各大圖書館等參考，期能廣為宣導應用，並喚起大眾對水土資源保育之重視，俾利後續推動各項水土保持工作。

本計畫蒐集所有 91－96 年度之水土保持及農村建設研究計畫，邀請長期投入水土保持與農村建設研究發展領域之專家學者篩選出 200 篇以上，水土保持篇分為：土石流防災與宣導、工程技術、工程管理、生態工法、坡地管理、集水區規劃共六項，另農村建設一大篇，共將本彙編分成水土保持領域上冊、水土保持領域下冊及農村建設領域乙冊等共 3 冊。。

本計畫「水土保持及農村建設研究發展成果彙編」在收集資料中過程中，因資料取得不易，因難重重，能如期編輯完成付梓，感謝各計畫執行人之配合、編審委員的專業審閱，以及本局同仁之策劃與協調，方得以如期出版，謹此深致謝忱。

行政院農業委員會水土保持局

局長 吳輝龍 **謹識**

中華民國九十七年十二月

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計畫名稱	土石流危險聚落易致災因子調查與整治對策 **The Investigation of Vulnerability Factors of Debris Flow Nearby the Protected Villages and the Suggestion of Its Renovated Strategies**
主 持 人	鄭錦桐 **Cheng, Chin-Tung**
計畫年度	**96**

摘　　要

爲進行土石流潛在災害聚落之調查和評估，分析土石流可能致災狀況、規模及波及範圍，據以擬定疏散避難路線、避難處所及緊急救援聯絡系統等，儼然已成爲土石流災害防治中重要的課題。

本計畫之主要工作內容包括四大項：1.易致災因子調查與整治對策建議；2.研定防災地圖格式與 SOP；3.製作防災地圖以及 4.相關圖資列印。現地勘查之流程上首先採用 5m 網格之數值高程模型(DEM)，搭配 Flo-2D 軟體模擬土石流堆積範圍，初步劃設土石流優先指示撤離地區範圍，再經現勘後修正之。現勘時採用 3S(GPS、GIS、RS)技術，逐一檢核此範圍內之保全對象住戶、避難處所及警消醫療單位相關資訊並與村里長進行確認，擬定疏散避難路線，透過本計畫研定之 SOP 繪製成防災地圖，以有效疏散撤離此範圍內之保全對象住戶。另外現勘同時亦進行土石流易致災因子調查、評估鄰近保全對象住戶坡地災害、評估現有防治設施狀況以及研擬整治對策建議等工作，並區分治理權責單位及編列預算，所有成果以村里爲單位，編彙成爲村里報告詳述之，同時每一村里亦製作完成其防災地圖與 GIS 圖層。

本計畫以區域劃分爲四階段辦理，第一階段爲南投縣，第二階段爲屏東縣、桃園縣及新竹縣，第三階段爲台東縣及花蓮縣南部，第四階段爲花蓮縣北部及台中縣市。計畫期間共完成 274 村里，共 699 條土石流潛勢溪流之現地調查成果報告以及土石流防災地圖製作，並提出 282 件整治工程建議。本計畫之

成果已更新計畫範圍內各土石流潛勢溪流之易致災因子與保全住戶相關資訊，並提出適當之整治對策與疏散避難規劃，可提供土石流防災與救災單位規劃參用。

（關鍵詞：土石流、保全對象住戶、易致災因子、防災地圖、Flo-2D、3S(GPS、GIS、RS)技術、整治對策）

Abstract

Recently, there were several important hazard mitigation issues for debris flow hazard in Taiwan. They were estimation of the magnitude and the influence area of debris flows, designing the emergency evacuation routes, shelters and planning the emergency-response system for rescue operations. Hence, there are four major goals in this project, including, 1.investigation of vulnerability factors, 2.designing the Standard Operating Procedure (SOP) and formulate the hazard mitigation map, 3.producing the hazard mitigation map of each village for emergency evacuation planning, and 4.digitizing the GIS layers.

Before field survey, high resolution DEM (5m×5m) were adopted to be the input of Flo-2D to simulate the aggregation areas of debris flow. The aggregation areas were suggested to be the draft of priority evacuation area. Furthermore, the areas were modified after field survey. 3S (GPS, GIS, Remote Sensing) Techniques were not only applied to re-check the addresses of the people residing in potential debris flow areas, but also to relocate and to obtain the shelters, and emergency-response system information. Finally, whole the information were combined in hazard mitigation maps according to the SOP and recommended by the head of the villages. Hence, the maps could more effectively evacuate the people residing in potential debris flow areas.

The major work of Filed survey in this project were including investigation of vulnerability factors, estimation of hazard potential of the protected target nearby the landslides and torrent, evaluating the performance of established structures on torrent, suggesting the renovated strategies and calculating the budget for renovated construction. Whole the results of one village were combined in a field survey report and its hazard mitigation map. Additional, the spatial information is also all collected in GIS.

The study area of this project is divided into 4 Stages. Stage 1 includes Nantou County. Stage 2 includes Pingtung County, Taoyuan County and Hsinchu County. Stage 3 includes Taitung County and the southern Hualien County. Stage 4 includes northern Hualien County, Taichung City and Taichung County. Summarily, this project has finished hazard mitigation maps and field survey reports of 274 villages and including 699 potential debris flow torrent in Taiwan. 282 renovated strategies were suggested for 274 villages. Those results could provide debris flow hazard mitigation and emergency evacuation planning.

（**Keywords：Debris Flow, 3S(GPS, GIS, Remote Sensing), Flo-2D, Vulnerability Factors, Renovated Strategies**）

計畫名稱	土石流自主防災社區推動與輔導 **Promotion, and Advising for Self-Defense Communities of Debris Flow Disasters**
主 持 人	劉家男 **Liu, Chia-Nan**
計畫年度	**96**

摘　　要

本計畫對選定之三十六處社區進行土石流自主防災宣導推動、追蹤輔導土石流自主防災社區、培訓土石流自主防災社區種籽教師、以及辦理土石流自主防災社區推動經驗交流活動等。工作之內容包括土石流專業知識傳授、防災計畫大綱等專業講授，輔導社區民眾參與社區防災地圖製作程序、防救災對策研擬與組織分工、防救災計畫內容之校核等；邀集講師對進行土石流自主防災社區之基層人員，課程講授及專業訓練；追蹤輔導已往建立之石流自主防災社區之成效與自主推動情形、最後邀集土石流自主防災社區之社區代表，進行經驗發表與心得交流，透過本計畫之執行順利達成社區自主防災意識之凝聚、自主防災知識技巧之提升、以及土石流自主防災社區之建立。

（關鍵詞：社區自主防災、土石流、推動、輔導）

Abstract

Thirty six communities were selected as the targets to develop self-defense of debris flow disasters in this project. The works conducted include giving lectures of how to defense debris flow, and how to prepare disaster mitigation plans, and to prepare disaster self-defense map, cognizing and discussing of community self defense project, grouping of community self defense team and modification of community specific disaster mitigation and prevention project. A seminar of lecturing and training are given specially to the people of the grass-root level for promoting the community works of self-defense of debris flow disasters. Finally, a meeting was called to exchange their experience and thought of community works of self-defense of debris flow disasters. Through these approaches, the conscious, knowledge and techniques of community self defense is promoted and eventually to reach to the goal of the establishment of self-defense communities of debris flow disasters.

（Keywords：Self-Defense Communities of Disasters, Debris Flows，Promotion, Advising）

計畫名稱	土石流防災教育宣導與專員培訓 **Debris Flow Disaster Prevention Education, Publicity and Training Observer**
主 持 人	巫仲明 **Wu, Chung-Ming**
計畫年度	**96**

摘　　要

本團隊接受水土保持局委託辦理「土石流防災教育宣導與專員培訓」。工作項目包括 6 大項目：1.土石流防災宣導、2.土石流防災業務研習、3.土石流防災專員培訓、4.土石流防災專員裝備製作、5.土石流防災專員回訓、6.土石流防災專員分佈網之建立與回傳訊息分析，以上工作均已辦理完成。透過一系列的教育宣導與專業課程訓練，使民眾具備自主觀測雨量、環境設施檢查、協助災情通報與疏散撤離等專業能力，以達成落實土石流防災自主管理，並降低土石流災害之目標。亦使相關防災業務人員能瞭解演練辦理之相關知識與作業流程，及迅速熟悉基本知識，以有效推展土石流防災業務，達到推廣水土保持工作之目的。

（關鍵詞：土石流防災、教育宣導、專員培訓）

Abstract

Through a series of educational publicity and professional training courses, people have their own observation of rainfall, environmental inspection facilities to help with the evacuation of the disaster communications, such as the withdrawal of professional competence. In order to achieve implementation of the debris flow disaster prevention and self-management, and reduce the debris-flow hazards of the goal. Also let the related disaster prevention and business staff to understand the relevant knowledge and processes of handling training, and quickly familiar with the basic knowledge. Then promote debris flow disaster prevention business effectively to achieve soil and water conservation goal.

（**Keywords：Debris Flow Disaster Prevention, Education and Publicity, Training Observer**）

計畫名稱	土石流防災應變系統擴充與維護 **Upgrade and Maintenance on Debris-Flow Disaster Prevention System**
主 持 人	辜文元　**Ku, Wen-Yuan** 周天穎　**Chou, Tien-Yin** 衷嵐焜　**Chung, Lan-Kun**
計畫年度	**96**

摘　　要

土石流防災應變系統自 90 年建置完成後，歷經多年來持續的系統擴充及提昇，已成爲國內防救災機關重要防災資訊參考網站。本年度計畫除了配合水土保持局實際應變需求，修正系統功能外，同時也引入新的技術和觀念來增強整體災害應變的應變成效。

土石流防災應變系統依據應變小組標準作業程序建置電子化及自動化災害應變平台，藉由資訊技術強化災害應變整合機制，目前在即時觀測資料接收上，整合包含中央氣象局點對點傳輸系統與水土保持局土石流觀測站系統，自動接收即時觀測資料後經系統化分析處理提供土石流災害應變小組做爲土石流警戒區發布參考依據；在災情管理上，透過線上災情通報可掌握各工程所回報災情，掌握最新災情處置情形；在通訊聯絡上，應變系統整合了自動化語音廣播、簡訊及傳真系統，協助應變小組輪值人員處理大量處理通訊聯絡工作。

土石流防災應變系統除了提昇整體土石流災害應變效率並減少應變小組輪值人員工作量有著越成效，本計畫整合水土保持局在土石流應變、教育宣導、土石流防治與調查等相關研究成果，建置全國最完整土石流入口網站及知識庫，使水土保持局成爲全國重要土石流知識中心。

（關鍵詞：土石流、知識管理）

Abstract

Debris flow disaster prevention system keeps expansion and update for years since it has been completed in 2001. In Taiwan, this system has become an important website that provides comprehensive disaster prevention information. This year, in addition to function modification, new techniques and notions are also introduced into the system in order to enhance the whole efficiency of disaster response.

Formosa Emergency Management Action (FEMA) system establishes electronic and automatic disaster response platform according to Emergency Response Unit standard operating procedures, and strengthens disaster response mechanism by means of information technology. At present, for real-time data reception, FEMA system integrates both Central Weather Bureau' s point to point transmission system and Soil and Water Conservation Bureau' s debris flow observation stations that enable to automatically receive and process real-time observation data which serve as a reference for debris flow warning declaration. For disaster management, on-line disaster report system enables the response unit to manage the latest disaster situation; moreover, FEMA system integrates voice broadcasting, short message, and fax to facilitate dealing with a large number of communication works.

In addition to enhancing the whole disaster response efficiency and effectively reducing the workload of personnel shift, this year, Formosa emergency management action system has integrated various project results involving debris flow response, education publicity, disaster prevention and investigation. The Soil and Water Conservation Bureau has built the most comprehensive debris flow portal and knowledge base and become a major debris flow knowledge center in Taiwan.

（Keywords：Debris-Flow, Knowledge Database）

計畫名稱	后番子坑生態工法教學園區生態資訊整合及生態評估計畫 **The Integrated Eco-Information and Ecological Evaluation for the Houfantzkeng Ecotechnology Learning Area**
主 持 人	汪靜明 **Wang, Ching-Ming**
計畫年度	**96**

摘　　要

本計畫依水土保持局推動生態工法實務需要，以第一工程所（現爲台北分局）管理之生態工法教學園區（台北縣雙溪鄉上林村雙溪流域上游）爲核心，進行有關環境生態資訊整合及集水區治理工程之生態效益評估，作爲生態環境維護措施改善及台灣水土生態教育之生態基礎依據。

本計畫於執行期間（2007.05～2007.12），彙整教學園區成立前後 6 年（2002～2007）關鍵資訊，完成園區生態工程之生態評估指標研選及內涵分析、園區生態工程施工前中後之水域生態紀錄及對比分析、園區河溪棲地生態結構與功能特性分析、園區目標主體生態工程之生態保育措施分析、園區維護管理機制評鑑、園區環境生態保育行動參與程度分析、園區生態主體工程解說設施規劃、生態工法教學園區生態影像圖庫、生態工法教學園區簡報及網頁製作等九項工作。本計畫整合分析顯示，本園區成立後，成爲全國第一個生態工法教學園區，已積極增進官、學、研及社區居民、學校師生及地方保育人士之良性及溝通；而整合之資訊，亦透過官方網頁主動公開園區資訊，已達到現階段園區發展目標。

本計畫評估研究，已建立后番子坑溪整治工程前中後之評估流程與方法。目標主體生態工程之生態保育措施效益分析指出，在深切認知生態系統的結構與功能之生態特性後，而採取「因地制宜、就地取材、順應河川生態」的生態工程，有助於集水區水土保持與棲地生態保育。本研究小組近五年（2003－

2007）之生態調查及監測顯示，整治河段之水域及濱水岸之穩定及多樣化，均有助於原生種水生物之棲息及多樣性維護，值得持續追蹤評估及推廣。

本計畫完成之「后番子坑溪整治工程之生態評估報告」，已做爲水土保持局參加行政院公共工程委員會第八屆「公共工程金質獎」評選之生態基礎資料；而本整治工程獲得生態類優等獎，此標準作業流程及方法實證示例，可做爲今後集水區保育治理之理論與實務兼顧之推廣參考。

（關鍵詞：生態工法、生態資訊整合、生態評估）

Abstract

The Houfantzkeng Ecotechnology Learning Area, located in Taipei County, was established in 2003 and managed until now by Soil and Water Conservation Bureau, COA. For the eco-sustainable development, this project was to integrate ecological information of this watershed ecosystem, and to evaluate the ecological benefit through stream restoration by using ecotechnology. This study analyzed physical habitat components of watershed ecosystem structure and fish indicators related to local stream. The 5-year ecological survey and monitoring data were integrated to compare the habitat changes and indicated fish population dynamics "before and after" the watershed treatment by applying several ecotechnological methods. The evaluation demonstrated that the ecological engineering designed and constructed, based on the ecological basis, would provide more stable habitats for the inhabiting more diverse communities. The native fish populations returned to its original habitats with suitable habitat conservation practices. This study established a SOP of eco-information integration method for this project. The ecological evaluation report was practically applied by Soil and Water Conservation Bureau as the ecological basis for watershed conservation and management. The key eco-information was re-structurally compiled into government (SWCB, COA) network for Project SWEET (Soil & Water Eco Education for Taiwan).

（**Keywords：Ecotechnology, Ecological Information Integrity, Ecological Evaluation**）

計畫名稱	重大土石災區即時現勘與整治對策研擬 **Instant Field Investigation and Suggestion on Construction Measures for Serious Debris Disasters**
主 持 人	蔡文豪　**Tsai, Wen Hao** 蔡漢傑　**Tsai, Han Chieh**
計畫年度	**96**

摘　　要

政府近年來爲致力防救災業務，已先後完成相關應變措施，對於國內防治土砂災害已有顯著之成效。爲持續落實防災工作，需針對重大土石災區之水土保持進行檢視，對於重大土石災區之現場調查及資料蒐集，爲首要之基礎工作。因此，本計畫特針對土石災區即時現勘工作研訂標準作業程序，希冀藉由本程序之完成，使勘災作業機制具備統一之標準記錄格式及規範，以利災情彙整及災例蒐集。

本計畫所研訂之即時現勘標準作業程序主要區分爲「即時現勘工作開始」、「人員任務編組」、「現勘前置作業」、「災區現地勘查」、「災區資料收集」、「速報撰寫及提送」及「正式報告撰寫及提送」等六項工作。其內容分別包含外業現地勘查及內業技術支援應進行調查及資料收集之作業項目，並依據各項工作之作業內容訂定相關表格，另針對各類報告撰寫內容及格式亦加以規範說明。

此外，本計畫另針對水土保持局於 95 年度及 96 年度所提供之重大土石災害地點，依據上述所研訂之即時現勘標準作業程序進行即時現勘工作。總計於計畫期間共辦理完成 66 處之災例現勘，針對各處土石災害發生後之情況進行即時調查，並對其災害發生原因及既有治理措施進行初步分析及檢討，另依據現況提出相關之可行整治措施建議。

最後，本計畫於執行期間針對即時現勘標準作業程序及現勘作業要項，辦

理完成 6 場之教育訓練，並依據工作成果製作完成相關之災例海報，希冀藉由教育訓練及展示海報使相關水保人員對勘災作業內容有進一步之瞭解。

（關鍵詞：即時現勘、標準作業程序、土石災害、土石流災害、崩塌災害）

Abstract

Recently, Government devoted prohibit disaster pursuits, then the relation to the affair equal to the occasion is worked out and preventing any debris disaster is a great efficacy for the country. It’s going on study preventing disaster, we point to the serious disaster area in process of soil and water conservation to hold inspecting, also for the serious debris field we make an investigation and basic data collection are our main basic. Therefore the plan for debris disaster instantly investigation starting and make a study for prepare for S.O.P., so it can be united field investigation standard list and have an order for the purpose of disaster data and samples collection.

Instantly field investigation S.O.P we order it divided 6 items, such as follow: “starting”, “mobilization”, “preparation work”, “field investigation”, “basic data collection”, “field investigation report and submission”, “final report and submission” etc. All the intention included “field work” and “desktop study” according to the working items ordered kinds of list.

Otherwise we also advanced to do with the above procedure and S.O.P, so finished instantly disaster investigation that report by SWCB on the year of’06 and’07. Finally 66 disaster area field investigation finished, and made an analysis of damage causes and reliable report of suggestion on construction measures.

We completed a course of training and on the authority of the process has yielded good results, we used it to training co-works and show it on the poster announced forward to the partners have much knowledge of field investigation.

（**Keywords：Instantly Investigation, S.O.P, Debris Disaster, Debris Flow Disaster, Landslides Disaster**）

計畫名稱	**95 年度「水土保持局培訓原住民族參與山坡地防災公共工程知能」** **Aborigines Trained to Participate Slopeland Disaster Prevention and Knowledge of Public Construction by Soil and Water Conservation Bureau, 2006**
主 持 人	**巫仲明** **Wu, Chung-Ming**
計畫年度	**95**

摘　　要

爲激發原住民族珍惜水土資源及愛護鄉土情懷，提升辦理水土保持治山防災、環境景觀改善等相關公共工程知能，並提供就業機會，改善當地居民生活及維護鄉村生態環境，於 95 年度由本局培育訓練原住民族，使其了解並有意願參與政府公共工程相關工作，期透過此培訓使原住民族邁向自主自立營造實踐之路。其工作項目包括：辦理 15 場培訓班，課程涵蓋政府採購法及相關規定、參與公共建設採購應備知能、水土保持山坡地防災公共工程及環境景觀施作、財務管理訓練採購實例、戶外現場操作等課程。原住民族參與山坡地防災公共工程知能之培訓班已於 95 年 12 月 8 日完成，男性參訓人員佔 359 位、女性 197 位，參與培訓共有 556 人。在辦理期間與原住民族皆互動良好，建立良好之關係，不僅達到培訓之效益，也進而解決原住民族對參與山坡地防災公共工程之疑惑，更期待培訓完成之學員，可順利投入山坡地防災公共工程。

（關鍵詞：人力培訓、原住民族、山坡地防災工程）

Abstract

In aim of arousing the aborigines' sense of public construction, such as Water & Soil Conservation and the love and protection of ones native soil, improving the process of Water & Soil Conservation and Mountain Slope Disaster Prevention, and the upgrading of natural landscaping, as well as to supply job opportunities in order to improve local residents' livings and to maintain rural ecological environment, the institute has launched an educational program in 2006 for aborigines who are eager to understand and participate in governmental public construction work, through which, they are able to become independent and self-supporting. This program constitutes of 15 sessions, course content includes government procurement and related regulations, knowledge in public works involvement, Water & Soil Conservation and Mountain Slope Disaster Prevention, natural landscaping, practical financial management training, and outdoors practical sessions etc. This Aborigines Mountain Slope Disaster Prevention and Public Construction Educational Program concluded on 8 December 2006. Total attending learners counted 556, of which 359 are male learners and 197 are female learners. During training, the team maintained good interaction with the aborigines and established stable relationships, thereby achieving the aim of the educational program and also resolved the aborigines' concerns regarding the Mountain Slope Prevention and Public Construction. Moreover, we anticipate the concluded learners to readily participate in Mountain Slope Prevention and Public Construction.

（Keywords：Personnel Training, Aborigines, Slopeland Disaster Prevention Construction）

計畫名稱	土石流自主防災社區推動及考評機制研擬 **Promotion, and Scheming of Evaluation for Self-Defense Communities of Debris Flow Disasters**
主 持 人	劉家男 **Liu, Chia-Nan**
計畫年度	**95**

摘　　要

本計畫對選定之 30 處社區進行土石流自主防災宣導推動以及協助社區進行土石流疏散避難計畫之校核、擬定土石流自主防災社區之考評辦法、培訓土石流自主防災社區種子教師、以及辦理土石流自主防災社區推動經驗交流活動等。工作之內容包括土石流專業知識傳授、防災計畫大綱等專業講授，並輔導社區民眾參與社區防災地圖製作程序、防救災對策研擬與組織分工、防救災計畫內容之校核等；透過資料收集整理、問卷及專家會議等方式來擬定土石流自主防災社區之考評辦法；並且邀集講師對進行土石流社區自主防災社區之基層人員進行兩天的課程講授及專業訓練；最後邀集土石流自主防災社區之社區代表經驗進行經驗分享與心得交流，透過本計劃之執行順利達成社區自主防災意識之凝聚、自主防災知識技巧之提升、以及土石流自主防災社區之建立。

（關鍵詞：社區自主防災、土石流、推動、考評）

Abstract

Thirty communities were selected as the targets to develop self-defense of debris flow disasters in this project. The works conducted include giving lectures of debris flow related knowledge, and how to prepare disaster mitigation plans, and to prepare disaster defense map, cognizing and discussing of community self defense project, grouping of community self defense team and finally finishing with the modification of community owned specific disaster mitigation and prevention project. The regulation and the tables for evaluating the community works of self-defense of debris flow disasters are also drawn up through the methods of data collection and analysis, questionnaires, and expert meeting. A two-day seminar of professional lecturing and training are given specially to the people of the grass-root level for promoting the community works of self-defense of debris flow disasters. Finally, some representatives are invited to exchange their experience and thought of community works of self-defense of debris flow disasters. Through these approaches, the conscious, knowledge and techniques of community self defense is promoted and eventually to reach to the goal of the establishment of self-defense communities of debris flow disasters.

（Keywords：Self-Defense Communities of Disasters, Debris Flows，Promotion, Evaluation）

計畫名稱	土石流防災資訊網維護與更新 **The Maintenance on Debris Flow Disaster Prevention Information Platform**
主 持 人	周天穎 **Chou, Tien-Yin**
計畫年度	**95**

摘　　要

行政院農業委員會水土保持局對於土石流防災，扮演著山坡地守護者的角色，保護山區居民的生命財產安全，預防土石流災害發生，同時不斷推廣土石流防災教育，建置「土石流防災資訊網」資訊平台(http:246.swcb.gov.tw)，內容兼具「知識教育」、「觀念宣導」、「防救災政策傳達」三項功能，將土石流防災知識全面推廣。

本計畫以水土保持局的土石流防災資訊網爲基礎，更進一步增加土石流相關數位內容，規劃防災宣導主題，設計網路行銷活動，吸引民眾主動參與，提昇全民防災之意識。本計畫持續維護更新網站內容及定期檢閱防災資料庫，規劃親子學習館、全民教育館及防災業務館，以及清晰、深具設計感的三種瀏覽介面，再加上豐富圖文的解說、影音介紹，引導不同年齡層之民眾瞭解土石流防災知識。

此外，本計畫教育宣導全民有關正確的土石流防災資訊，規劃土石流防災數位教材，依國小學齡需求，設計教案及學習單，有效地向下紮根防災教育。同時也建立土石流防災宣導互動模式，以網站互動特性，將土石流防災知識，及環境保育概念，透過實體及虛擬活動參與，潛移默化傳達給民眾，達到防災全面宣導之效益。

綜合上述，本計畫以防災知識規劃與宣導推廣爲主要目標，其目的在於建立民眾正確的防災觀念，加強水土保持與環境保育概念，並訓練防災應變時自

救與救人的能力。

（關鍵詞：土石流、防災應變、防災宣導、坡地保育、水土保持）

Abstract

The Soil and Water Conservation Bureau (SWCB) plays the important role on the debris flow disaster prevention and protects people from the debris flow. To prevent the public from the natural disaster, SWCB keeps the efforts on propaganda and establish “Debris Flow Disaster Prevention Information” (http://246.swcb.gov.tw). The web contents target objectives including education, propaganda, and policy marketing.

This project is based on the Debris Flow Disaster Prevention Information website which continually accumulates related digital content, plans topics of disaster prevention and designs web campaigns to attract people’s attentions and raise consciousness of disaster prevention for the public. The project keeps maintenance to increase new content and review databases of disaster prevention. The information web site plans three themes including kids’ learning, the public education and the professional disaster prevention. This web site has been designed by three different user interfaces to lead people of all ages browsing the information.

In addition, this project has the great achievement on education of debris flow. To satisfy the learning requirement, the project plans and designs teaching materials and kids’ homework assignments, as well as online adult courses. This year, the project possesses the complete architecture of disaster knowledge and promotion framework. It will elaborate web campaigns and workshops to promote knowledge and reach effect of disaster prevention. In conclusion, the goal of this project is to integrate recourses, practice knowledge management and promotion of website brand name.

（**Keywords：Debris Flow, Disaster Prevention, Propaganda of Disaster Prevention**）

計畫名稱	土石流防災整備管理系統整合與維護 **The Preparation and Preventing for Debris Flow Calamities Administrative System Integration and Maintenance**
主 持 人	夏天祐 **Shia, T. Y.** 吳榮聰 **Wu, Wilson J. T.** 劉慧儀 **Liu, Terry**
計畫年度	**95**

摘　　要

以強化及落實土石流防災之災前整備工作爲目標，本計畫整合局內部有關「災前整備」之現有系統功能及圖資，建構出一套功能性完整之「土石流防災整備管理系統」，提供各級政府在災前整備工作中紀錄各項重要之資訊，整併爲防汛期前之各項管理作業與整備作業之共通平台。

本次計畫的工作內容首重於系統功能逐一整合，並將線上教學功能建置完成，以提供使用者線上學習系統操作的流程。加強系統中的 GIS（地理資訊系統）功能，結合防災基本資料的定位、查察與維護等相關服務。在防災圖資方面，本年度亦完成各項防災資訊，「影響範圍保全對象分佈」共計有 1,319 處，保全對象包括 31,706 人；「避難處所」共完成 806 處所、「重機械待命點」共數化 466 處及「防災專員」共 501 處；並將以上「GIS 相關圖資」製作成台灣二度分帶 67 與 97 座標系統的防災圖層，置放於水保局資料倉儲系統中，供其他單位申請使用。另外，利用這些 GIS 圖層與系統既有之地形圖資爲背景，提供線上圖形編輯能力，除加強了防災規劃、演練活動等之資料內容，亦提昇了地方自訂防災避難的能力。

由於本防災整備系統中的資料，在各方的努力下已逐漸充實完備，故有必要建置一套「土石流防災業務管理系統」提供局內便於管理各項防災整備資訊的內容，並可直接於其中進行各項防災整備資料的查詢與統計作業，便於防災業務承辦人員在資料搜尋與統計作業，並大幅減輕業務負擔及資料遺失的風

險。

延續以往防災的作業，提供使用者直接於系統中填寫「土石流防災疏散避難計畫」，不但大幅降低文書往來的時間及減少資源浪費，在資料的修正、補漏上都更加的方便，利用這些計畫內容來彙整編輯印製完整的「土石流防災疏散避難計畫書」，以回饋地方政府在防災整備中所做的努力。

系統的功用在於提供更大的工作效能，減輕使用人的業務負擔，降低資料遺失的風險，並可提昇資料查、讀、取、用的方便性；無論是地方的防災單位，或是中央的水保機關，經過了這兩年來的努力經營與現地調查，使得整備系統的資料更加的完整充實，在未來的資料取用及維護必定能更加地輕鬆容易。

（關鍵詞：土石流、保全對象、水土保持局、GIS（地理資訊系統））

Abstract

The plan combines the system data and digital maps. 'The preparation and preventing for debris flow calamities administrative system' to build a web set, offer the governments at all levels to note down every important information in work of reorganizing and outfitting before the calamity.

The first, the working content planned this time combines the system service. The on-line teaching service construction is completed, in order to offer the on-line procedure which studies system operation to users. Strengthen GIS (Geographical Information System) in the system, it combine and take precautions against natural calamities relevant services, such as localization of the basic materials. Take precautions against natural calamities and pursuing the digital map levels respect, finish every take precautions against natural calamities information in this year. 'Protected peoples distribute' is 1,319 points and 31,706 peoples; 'The refuge by place' is 806 places, 'The machines waiting place' is 466 sites; 'The precautions against natural calamities by commissioner' is 501 places. Make TM2 67 and 97 coordinate systems for other units to apply to use. In addition, utilize these GIS's digital maps and layers of topographic maps as the background, offer on-line plotting.

The system service can be offering greater working efficiency, lightening user's working pressure and reducing the data losing. It can promote the convenience that the materials of searching, reading, taking, using. The taking precautions against natural calamities in the local government, or the SWCB, manage and investigate now through over these two years' efforts. The system service powerfully, in the future it maintains to be can light and easy certainly.

（Keywords：Debris Flow, Protected Peoples, SWCB, GIS(Geographical Information System)）

計畫名稱	土石流防災應變系統維護與更新 **Maintenance and Update on Debris-Flow Disaster Prevention System**
主 持 人	辜文元　**Ku, Wen-Yuan** 周天穎　**Chou, Tien-Yin** 衷嵐焜　**Chung, Lan-Kun**
計畫年度	**95**

摘　　要

土石流防災應變系統自 90 年建置完成後，歷經多年來持續的系統擴充及提昇，已成爲國內防救災機關重要防災資訊參考網站。本年度計畫除了配合水土保持局實際應變需求，修正系統功能外，同時也引入新的技術和觀念來增強整體災害應變的應變成效，包括了：1.配合土石流警戒基準值之修定，修正應變系統土石流警戒分析模組，並提供流程化的警戒發布模式，指引應變作業人員能夠快速且正確的發布土石流警戒預報；2.整合手機相機功能，提供防災專員可將第一手災區照片回傳至應變小組，提供應變小組研判災損情形；3.整合網路新聞內容，協助應變小組蒐集即時網路災情資訊；4.運用歷史颱風路徑資料，並配合土石流災情回報及災例資料，分析路徑相似度高的颱風，並分析歷年來所造成的災情，提供災情研判人員評估可能造成的災害；5.配合水土保持局土石流資料管理與更新計畫成果，開發網路版土石流潛勢溪流管理系統，提供縣市政府、委辦調查廠商及水土保持局共同使用，可以確保資料管理一致性，亦可保存土石流潛勢溪流調查資料，做爲研究與分析土石流資料來源。

（關鍵詞：土石流）

Abstract

Debris flow disaster prevention system that keeps expansion and update for years since it has been completed in 2001 has become a key website providing disaster prevention information in Taiwan. This year, in addition to function modification, new techniques and notions are also employed to enhance the whole efficiency of disaster response. It includes: 1.modifying debris flow warning model and offering procedure declaration model directing response staff to announce warning forecast swiftly and correctly, 2.integrating phone camera allowing the staff to send photos of disaster areas by their cell phones, 3.integrating Web News to facilitate collecting real-time disaster situation, 4.making use of historic typhoon routes and disaster situation reports to analyze potential damage, 5.developing web-based management system for potential debris flow hazard torrents and enabling users of SWCB, county/city governments, investigators to use.

The updated system can not only assure the consistency of data management but also keep investigation information to serve as research and analysis sources.

（**Keywords：Debris-Flow**）

計畫名稱	台灣水土生態多媒體教材製作及教育推廣計畫 **Planning, Producing, and Promoting Instructional Multimedia of SWEET, Soil and Water Eco Education for Taiwan**
主 持 人	汪靜明 **Wang, Ching-Ming**
計畫年度	**95**

摘　　要

本計畫依水土保持局推動水土保持教育宣導的實務需要，於執行期間（2006.05～2006.12），彙整水土保持教育資源之關鍵資訊，完成水土生態教育課題與策略整合規劃研究、水土生態教育複合式多媒體教材研製、水土生態多媒體教材教法研習工作坊、水土生態教材概念內涵分析等四大工作項目。本計畫進一步提出強調整合的「台灣水土生態教育」(integrated Soil & Water Eco Education for Taiwan，簡稱 iSWEET)；界定在台灣水土保持、集水區環境、棲地生態保育與環境教育等範疇，係爲適用於台灣集水區水土生態保育的行動方案。

本計畫整合規劃研究，已完成台灣水土保持戶外教室及教學園區 SWOT 分析，並提出「台灣水土生態教育整合推動」(Soil＆Water Eco-Education for Taiwan Integrated Promotion，簡稱 SWEET IP)及「台灣水土生態教育規劃」(Soil & Water Eco-Education for Taiwan Plan，簡稱 SWEET Plan)架構圖，做爲水土生態教育宣導之策略行銷規劃。

本計畫已透過台灣水土生態教育專家學者，共同建立台灣水土生態教育概念階層架構，可做爲後續水土生態概念綱領發展、水土生態教育課程設計及水土生態活動規劃推廣之內涵依據與基礎。

本計畫從水土保持、生態工程、生態教育觀點，整合水土保持局關鍵成果與資源，編製「台灣水土生態教育」複合式多媒體教材、專冊及摺頁，發揮多

媒體教材資訊整合功能，已充分展現優質的台灣水土生態教育成果，其可作爲水土保持局與水土保持戶外教室或教學園區在教育推廣方面的簡報使用，亦可作爲台灣水土生態參與者教材之用。

（關鍵詞：台灣水土生態教育、多媒體教材）

Abstract

The project supported by Soil and Water Conservation Bureau, COA, was to plan and produce the instructional media as the teaching materials and aids of soil and water conservation education for public and teachers.

The project conducted SWOT analysis for the SWB outdoor classroom and learning area, and proposed the SWEET IP（Soil & Water Eco-Education for Taiwan Integrated Promotion）, SWEET Plan（Soil & Water Eco-Education for Taiwan Plan）as the integrated communication strategy for the government.

（Keywords：Soil & Water Eco Education for Taiwan, Multimedia Teaching Material）

計畫名稱	台灣水土生態教育 **Soil and Water Eco Education for Taiwan**
主 持 人	汪靜明 **Wang, Ching-Ming**
計畫年度	**95**

摘　　要

「台灣水土生態教育」複合式教學媒體，係由水土保持局委託「台灣水土生態多媒體教材製作及教育推廣計畫」（執行期間 2006.05～2006.12），由計畫主持人汪靜明結合台灣師大環境教育研究所、傳播媒體-漢笙公司與電腦公司－信諾公司完成之複合式平面及數位出版品（含專冊、摺頁、DVD 光碟整併編製於一本）。

本教材從水土保持、生態工程、生態教育觀點，整合水土保持局關鍵成果與資源，其內容涵括了地球環境生態概念、人類環境文化思潮、世界永續發展議題、台灣水土生態教育計畫及台灣水土生態教育多媒體，並規劃與水土生態教育相關之延伸閱讀等單元主題。摺頁的部分則是參考有關環境教育 7W 的基本課題等理論來進行編製，包括 Why SWEET（集水區水土保育新願景）、What SWEET（台灣～水・土・林・動・人）、knoW SWEET（水土生態概念）、Who SWEET（水土生態教育參與者）、hoW SWEET（台灣水土生態教育計畫）、Which SWEET（教材資源）及台灣水土生態教育地圖連結水土保持戶外教室與教學園區等戶外教學場域。

本教材以「多媒體平台開發」形式，整合水土保持局所提供的影像素材，側重多媒體互動及資料呈現功能，兼具影音聲光的搭配效果。在多媒體表現上，可直接使用 Flash 單一平台播放影片及圖片，可呈現良好質感及活潑介面。教材內容以探索（探索 SWEET－台灣水土與生態的相會影片）・瞭解（Know SWEET How SWEET Show SWEET）・迴響（相關法規、期刊年報、書籍出版品、影碟出版品、相關連結）做爲教材中心架構。

基於 e 世代的教育宣導，本教材製作著重多媒體資訊整合功能，以及廣泛

利用網際網路之服務。本教材依據「台灣水土生態教育」（integrated Soil & Water Eco Education for Taiwan，簡稱 iSWEET）以及「台灣水土生態教育整合推動」（Soil＆Water Eco-Education for Taiwan Integrated Promotion，簡稱 SWEET IP）之理念編製，以展現優質的台灣水土生態教育成果。本教材可作爲水土保持局與水土保持戶外教室或教學園區在教育推廣方面的簡報使用，亦可作爲台灣水土生態參與者教材之用。

（關鍵詞：台灣水土生態教育、多媒體教材）

Abstract

This project SWEET (soil and water eco education for Taiwan) integrated by Professor Ching-Ming Wang were supported by Soil and Water Conservation Bureau, COA, during the period May to December 2006.

The output of project produced the SWEET teaching materials compiled into a multimedia book with a brochure and DVD attached.

The contents of SWEET book includes 4 main concepts：earth ecosystem, environmental culture, world sustainable issues, and soil and water conservation.

（**Keywords：SWEET, Soil & Water Eco Education for Taiwan, Multimedia Teaching Material**）

計畫名稱	南投水里鄉上安水土保持教學園區 **Shangan Soil and Water Conservation Education Park**
主 持 人	張俊彥 **Chang, Chun-Yen**
計畫年度	**95**

摘　　要

上安村的地質鬆軟易崩落，每逢大雨後常造成土石流的災害。經歷民國 85 年的賀伯颱風、民國 88 年的 921 地震以及民國 90 年的桃芝颱風，接連而至的災難促成了土石流的發生。5 年 3 災的厄運，讓水土保持的重要性更爲明顯。

本計劃針對土石流的形成歷程、成災機制以及相關水土保持設施進行解說。除了設計五面解說牌與摺頁之外，也在上安地區，以當地居民爲對象，舉行解說教育訓練課程。希望可以達到以下三點效益：

1.串連各解說牌據點，增加遊客參訪之知識獲得。

2.結合解說中心與解說訓練課程，建立日後解說員人的培訓管道。

3.建議在適當聚點放置解說摺頁，提供民眾進一步了解相關知識。

最後，根據實地調查與評估，建議公共設施計畫包含解說中心設置、停車場配置、公共廁所設置以及休憩涼亭配置等部份，以利於日後園區發展運用。

（關鍵詞：土石流、解說牌設計、摺頁、解說教育課程）

Abstract

After every raining, the debris flow was forms due to geology of Shangan village is easily tumble down. The misfortune of three disasters in five year highlights the importance of soil and water conservation.

The focus of the plan is on the formation of debris flow and the interpretation of related soil and water conservation facilities. Expect the designs of five interpretation brand and manual, the interpretation education courses designed for locals was also held at Shangan. Three beneficial results were hoped to accomplish it's end:

1. To connect every site if interpretation brand in order to make tourists gain the related knowledge.
2. To link up interpretation center and interpretation education courses; to build up gateway of to train interpretation.
3. To suggest appropriate sites for the interpretation brand and manual in order to offer public to learn the related knowledge further.

Finally, according to the investigations and evaluations in site, public facilities plan is suggested to site interpretation center, parking lot planning, public lavatory planning, and pavilion planning in order to contribute the develop and operation for Shangan Soil and Water Conservation Education Park.

（Keywords：Debris Flow, Soil and Water Conservation, Interpretation Brand Design, Manual, Interpretation Education Courses）

計畫名稱	九十三年度流域聯合治理計畫－山坡地管理防災避難 **Slopeland Management, Disaster Prevention and Evacuation－Joint Management Plan of River Basin in 2004**
主 持 人	巫仲明 **Wu, Chung-Ming**
計畫年度	**94**

摘　　要

本計畫已於重建區苗栗縣、彰化縣、南投縣及嘉義縣等 30 個村里辦理社區示範演練，全部土石流防災疏散避難演練工作於 5 月 30 日已全數圓滿完成，藉由演練工作以提昇地方單位土石流防救災專業技能及民眾災害防救意識，本計畫所辦理之演練旨在讓土石流潛勢區域內之疏散避難編組成員瞭解本身之緊急應變時擔負之工作，以及讓當地居民熟悉疏散避難路線和避難處所之地點。演練過程中受災居民經引導前往疏散避難處所安置，妥善安排疏散避難處所的環境，維持一定的秩序，辦理受災人員的登記、維生物資供給，達到災時緊急避難處所的安全性。本計畫除了協助 30 處土石流潛勢地區居民完成社區自救防衛編組及疏散避難演練，並視當地居民實際防災需求，充實 10 萬元防救災相關設備及物資，其中補助之物資項目包括－組合式萬能手斧、折疊式擔架、雨衣、雨鞋、照明燈、發電機、手持式無線電、移動式中繼無線電、手持式喊話設備、……等 43 項，對當地社區之土石流防災工作將有極大的幫助。

（關鍵詞：流域治理、山坡地管理、防災避難）

Abstract

The local work units enhance the professional skills of debris flow disaster prevention and public awareness of disaster prevention and relief by training. The purpose of this drill is to let members in the region of potential debris flow area understand the tasks of their own in emergency, as well as being familiar with the evacuation route and the location of evacuation shelter. This project not only helps the inhabitants of potential debris flow area divide community into groups for self-defense and evacuation drill, but also enriches related equipment and materials as their actual needs for disaster prevention.

（Keywords：River Basin Management, Slopeland Management, Disaster Prevention and Evacuation）

計畫名稱	土石流自主防災社區建立及追蹤輔導 **Development, Monitoring, and Advising of Self-Defense Communities of Debris Flow Disasters**
主 持 人	劉家男 **Liu, Chia-Nan**
計畫年度	**94**

摘　　要

本計畫選定重點區三處建立「土石流自主防災社區」。另外追蹤水保局前期計畫所建立之三處土石流自主防災社區現況進行檢討與輔導。本計畫所採用的工作方法爲以「社區工作坊」、「操作訓練」、「專家講授」等途徑逐漸凝聚社區自主防災意識與提升自主防災之知識與技巧，建立土石流自主防災社區，工作之內容包括避難圖檢核繪製、航照圖判釋、土石流專業知識傳授、防災計畫大綱等專業講授，並輔導社區民眾參與現地踏勘與社區防災地圖製作程序、防救災對策研擬與組織分工、防救災計畫內容之確認以及防災演練等。

（關鍵詞：社區自主防災、土石流、建立、輔導）

Abstract

Three communities were selected as the targets to develop self-defense of debris flow disasters in this project. Furthermore, the current conditions of three communities which were developed as the self-defense communities of debris flow disasters were monitored. The approaches applied in this project include community group working, operating, training, experts lecturing. Through these approaches, the conscious, knowledge and techniques of community self defense is promoted and eventually to reach to the goal of the establishment of self-defense communities of debris flow disasters. The works conducted in this project include checking disaster mitigation and prevention map, giving lectures of how to read aerial map, debris flow related knowledge, and how to prepare disaster mitigation plans, grouping community members to field investigate locations of potential debris flow, landslide disasters, and to prepare disaster defense map, cognizing and discussing of community self defense proposal, grouping of community self defense team and conducting practice.

（**Keywords**：**Self-Defense Communities of Disasters, Debris Flows, Development, Advising**）

計畫名稱	土石流防災疏散避難演練 **Debris Flow Disaster Prevention and Evacuation Drill**
主 持 人	巫仲明 **Wu, Chung-Ming**
計畫年度	**94**

摘　　要

在防災整備的前提下，唯有居民具備居安思危、平日做好準備並熟悉疏散避難路線與避難場所，才能夠臨危不亂把握疏散先機，此正爲我們辦理防災演練及相關宣導活動之意義。日後防災工作的要務在於如何提高居民參與的熱情，並在活動辦理與居民生計之間取得平衡點，如此方能提高防災演練的效果，在本次活動中，工作團隊採用有獎徵答、在航照圖上尋找自己的家園等方式，加強雙方的互動讓防災宣導活動更加生動；另外，也由實地帶領居民熟悉疏散路線、分析當地土石流潛勢溪流可能發生的危害等，讓居民更瞭解社區內的土石流潛在危險，最後在活動結束後致贈與會人士乙份精美小禮品，爲雙方留下良好的印象也爲後續的接觸開啓了契機。

（關鍵詞：土石流防災、疏散避難演練）

Abstract

Only when residents have act on weekdays to prepare and are familiar with evacuation routes and shelters, they could remain unruffled and seize the opportunity to evacuate. That’s the reason why we need to handle disaster prevention drill and relational publicity activities. How to increase the sense of participation of residents is an important point. In this way, the disaster prevention drill will be much more effective. In addition, by leading the residents to be familiar with evacuation routes and analyzing the potential debris flow disaster that may occur, residents could understand the potential danger in their community.

（Keywords：Debris Flow Disaster Prevention, Evacuation Drill）

計畫名稱	土石流防災資訊平台整合與維護 **The Integration and Maintenance on Debris Flow Disaster Prevention Information Platform**
主 持 人	周天穎 **Chou, Tien-Yin**
計畫年度	**94**

摘　　要

水土保持局歷年來對於土石流災害管理及其各項相關資訊技術開發，已具備相當成效，爲整合並落實各項防災知識，將各層面資訊整合爲一防災資訊平台， 於 93 年度，開發土石流數位知識網(246.swcb.gov.tw)，後更名爲土石流防災資訊網，具備完整的防災知識規劃與推動架構。

今年度本計畫持續建構整合式數位內容，以土石流防災資訊網爲基礎，具備知識管理、資源整合、推廣行銷的概念；計畫範圍涵蓋土石流防災資訊網整合與維護，還有土石流防災宣導物製作與推廣。在土石流防災資訊網，提供不同使用需求的數位內容，親子學習館、全民教育館著重防災知識宣導及新聞資料彙整；針對防災業務人員，除了製作線上學習教材，便於人員進修外，並開發防災社群管理機制，以便管控專案進度及駐點勤務。網站使用效益，也規劃後端分析管理機制，記錄使用者行爲，做爲網站效益評估以適時調整單元內容。

另一方面，土石流防災宣導上，在網站上增加土石流 3D 避難路線 5 處，並搭配避難路線的電子地圖、互動避難路線之模擬提高民眾對疏散避難了解。而針對土石流知識向下紮根，製作開發 3 種互動遊戲，培育下一代防災及水土保育的意識。網站宣導，則採用數位宣傳媒體，製作土石流防災電子報，達到資訊快速全面宣傳之效。

綜合上述，本計畫以防災知識規劃與宣導推廣爲主要目標，其目的在於建立民眾正確的防災觀念，加強水土保持與環境保育概念，並訓練防災應變時自

救與救人的能力。

（關鍵詞：土石流、防災應變、防災宣導、避難路線）

Abstract

In the recent year, the Soil and Water Conservation Bureau (SWCB) has the great achievement on management of debris flow disaster and development of related information systems. In 2004, SWCB developed "Debris Flow Digital Knowledge Website" (246.swcb.gov.tw) to integrate debris flow disaster prevention information from different website or digital media which SWCB created before. The Debris Flow Digital Knowledge website has recently been renamed as "Debris Flow Disaster Prevention Information Website" and possesses the complete architecture of disaster knowledge and promotion framework.

This year, the scope of the project included integration and maintenance on Debris Flow Disaster Prevention Information Platform as well as propaganda of debris flow disaster prevention. The Debris Flow Disaster Prevention Information website provides different users' content such as kids, adults and officers of disaster prevention units. Moreover, this project creates e-learning materials and establishes project management of disaster prevention system as well as the website analysis system which records user behavior and evaluates the efficacy of the website content.

On the other hand, this project put lots of efforts on propaganda of debris flow disaster prevention. First, the website provides 2D map and 3D interactive simulation for evacuation routes of debris flow disaster prevention. As people surf the web site, they can see real scenery along evacuation routes by 3D simulation which can make people easier find the right way to get to refuges. 3D evacuation routes raise capabilities of disaster reduction. Secondly, this project creates 3 interactive games to raise consciousness of disaster prevention for kids. Finally, the most important thing is to promote the brand name of the website. This project adopts digital media and designs rich newsletter to spread knowledge of disaster

prevention.

In conclusion, the goal of this project is to integrate recourses, practice knowledge management and promotion of website brand name.

（**Keywords：Debris Flow, Disaster Prevention, Propaganda of Disaster Prevention, Evacuation Routes**）

計畫名稱	土石流防災整備自主檢查系統維護與更新 **The Precaution and Preparedness of Debris Flow Calamities by Self-Checking System Maintenance and Upgrade**
主 持 人	劉大維 **Liu, T. W.** 吳榮聰 **Wu, Wilson J. T.** 劉慧儀 **Liu, Terry**
計畫年度	**94**

摘　　要

台灣地區地形陡峭、河川湍急，地質岩層鬆軟，每逢颱風、豪（大）雨發生時，山區極易發生山崩、地層滑動及土石流等坡地災害。行政院農委會水土保持局自民國 80 年開始即積極進行土石流潛勢溪流調查，至民國 91 年桃芝颱風後，完成全省 1,420 條土石流潛勢溪流調查。爲降低土石流災害造成人民身命財產的損失，水土保持局持續針對 1,420 條土石流影響範圍內之居民進行疏散避難規劃及防災演練等工作，並希望藉由各項軟、硬體措施與資訊技術之協助，來達到防災、減災之目標。

爲能有效協助各級政府辦理土石流防災工作，本計畫即以 93 年度水土保持局所開發完成之「土石流防災整備自主檢查系統」爲基礎，進一步擴充並強化其相關功能內容，期望藉由系統之分析統計，更能即時瞭解在自主整備檢查工作上，尚有那些縣市需要協助，有那些檢查工作項目需要加強。此外，爲能有效地管理土石流影響範圍內之保全對象資料，本計畫亦提供乙套「土石流保全對象管理系統」，藉由共通的網際網路資訊平台機制，以協助地方政府建立保全對象基本資料，以及相關防災整備工作，而建置完成之資料成果，未來亦可提供相關防救災單位查詢使用。

（關鍵詞：土石流、自主防災整備檢查系統、保全對象、資料庫、防災整備）

Abstract

The geographic features of Taiwan are sharp and rivers are rapidly. Rock stratums are loose especially in the typhoon season or torrential rains happened. It caused accidents like landslide & debris flow in the mountainous area. The Soil and Water Conservation Bureau (SWCB) started to investigate the potential of debris flow streams since 1991 and there are 1,420 debris flow streams were identified after typhoon Toraji. In order to reduce the lost of people's life and wealth, the SWCB had the training and evacuation for the residents of those dangerous area. And hope through the help of workable software and hardware, it can reach the target of precaution.

In order to help the government to prevent the work on debris flow, this project has to use the field investigation system which finished in 2004 as a base. Through the related functions, the investigate report from the system and the internal self-check, it can easily understand which cities or counties need further assistance. This will find out which part of work need to be upgraded. Moreover, this plan has also provides a control system of debris flow for those parties that are under influenced. This is to help to maintain the data information through the internet workstation mechanisms and it will help the government to build up the related information and through the information, it can also provide the department of precaution for future research.

（Keywords：Debris Flow, Field Investigate, Database, Disaster Prevention）

計畫名稱	研擬土石流資料更新計畫 **Researching and Planning for Update and Feedback System of the Debris Flow Potential Database**
主 持 人	林美聆 **Lin, Meei-Ling**
計畫年度	**94**

摘　　要

台灣特有之地質、地形及氣象條件符合易誘發土石流的要素。行政院農委會水土保持局自民國 80 年起進行土石流潛勢溪流調查，民國 85 年公佈全省 485 條土石流潛勢溪流；921 地震後增列全省 722 條土石流潛勢溪流；民國 91 年桃芝颱風後，完成全省 1,420 條土石流潛勢溪流調查。近年來經由水土保持局、921 重建委員會、縣市政府及當地居民的努力，臺灣地區之土石流發生已有逐年降低之趨勢，但歷經七二水災及艾利颱風後，地形條件又再度變動，且保全對象亦有所更迭，因此在考慮保全對象及土石流發生條件之可能變動，定期辦理土石流潛勢溪流後續調查與演變趨勢觀測，及土石流潛勢溪流資料持續維護更新，成爲現階段土石流災害防救業務中極爲重要之經常性基礎工作。

本計畫首先探討國內外土石流潛勢溪流資料公開與更新方式，並進行各縣市政府提報之有疑義之土石流潛勢溪流現勘與評估。而後針對國內之土石流潛勢資料研擬一套土石流潛勢溪流資料更新與回饋機制，包含「土石流潛勢溪流現地勘查評估作業之判定基準」、「地方政府回報新增土石流及非土石流潛勢溪流機制基準」、「土石流潛勢資料常時維護作業基準」、「土石流潛勢資料常態更新作業基準」、「既有之土石流潛勢溪流解編基準」以及「新增土石流潛勢溪流編碼基準」，並進一步研擬土石流災害潛勢資料公開作業基準（草案）；最後彙

整更新與印製土石流潛勢溪流相關資料，藉由此計畫之成果，期使災害防救工作制度更完善而有效率。

（關鍵詞：土石流、潛勢資料更新維護、潛勢資料公開作業、災害防治）

Abstract

Due to the geological, topographical, and weather conditions, Taiwan is prone to debris flow hazards. The Bureau of Soil and Water Conservation, Council of Agriculture has conducted the investigations of debris flow torrents since 1991. In 1996, a total number of 485 potential debris flow torrents were published. In 1999, the Chi-Chi earthquake hit central Taiwan and induced severe landslides, a reconnaissance for potential secondary debris flow hazards was conducted with 722 potential debris flow torrents listed. After typhoon Toraji in 2002, the re-investigation was conducted for up-dating of the debris flow torrents information, and a total number of 1,420 torrents were listed. Due to the variation of geomorphologic conditions and frequent severe weather conditions, it is essential to perform the follow-up investigation of the debris flow torrent conditions constantly and properly maintain and up-date the fundamental data base of the potential debris flow torrents.

The objectives of this project are to review the methods of up-dating and publicizing hazard potential information and to device a mechanism for up-dating, maintaining, and publicizing of the debris flow hazard potential information. Field investigations of 61 debris flow torrents were performed and data base was up-dated. The operation procedures for publicizing of debris flow potential information were proposed, and the mechanism for up-dating and maintenance of data-base was also proposed based on the operation procedures. The results of this project would provide supports for decision-making related to debris flow hazard mitigation.

（Keywords：Debris Flow, Up-Dating of Potential Information, Publicizing of Potential Information, Hazard Mitigation）

計畫名稱	重建區內土石流災害防救業務教育訓練與宣導 **Education, Training and Publicity of Debris Flow Disaster Prevention Response Operation in Reconstructed Region**
主 持 人	巫仲明 **Wu, Chung-Ming**
計畫年度	**94**

摘　　要

本團隊接受水土保持局委託辦理「重建區內土石流災害防救業務教育訓練與宣導」。工作項目包含：辦理土石流災害防救業務實務研習（16 場）、土石流防災巡迴宣導（25 場）、土石流防災展覽（2 場）、土石流防災展示櫥櫃規劃、設計及製作（1 組）、土石流疏散避難宣導模型研發（1 座）共計五大個項目。16 場土石流災害防救業務實務講習於 2 月 23 日開始辦理於 5 月 24 日全數辦理完成，共計 689 人出席參加。25 場土石流防災宣導活動宣導地點廣含：桃園、新竹、苗栗、台中、南投、彰化、雲林及嘉義，宣導活動從 1 月 14 日開始辦理於 5 月 12 日已全數辦理完成，爲充實宣導車活動內容，完成土石流劇場教室「憂災悠哉」之製作。兩場以土石流防災專員爲主題之土石流防災展覽分別於高雄科學工藝博物館及南投縣立文化中心辦理，高雄展覽展期爲 94 年 4 月 25 日至 5 月 24 日，南投展覽展期爲 94 年 4 月 25 日至 5 月 29 日，並利用這兩場開幕時對水土保持義工進行導覽解說及土石流巡迴宣導車使用方法之訓練。土石流防災展示櫥櫃是以 5 座不同高度可以獨立使用也可以組合擺設之正六角型木櫃。土石流疏散避難宣導模型則是以土石流防災疏散避難規定爲藍本進行規劃設計製作。

（關鍵詞：重建區、土石流災害防救、教育訓練、宣導）

Abstract

The project content includes: 1.Disaster prevention and Relief for debris flow study business practices. 2. Make a circuit of publicity for debris flow disaster prevention. 3. The exhibition of debris flow disaster prevention. 4. Planning, design and production for display cabinets of debris flow disaster prevention. 5. Research and development of promoting model for debris flow disaster evacuation shelter. In addition, to enrich the content of the advocacy car, the debris flow theater classroom, "Care about Disaster and Carefree" was produced completely.

（**Keywords**：**Reconstructed Region, Debris Flow Disaster Prevention Response, Education Training, Publicity**）

計畫名稱	**規劃水土保持教育宣導e化及義工轉型培訓計畫** **Planning the Electronically Soil and Water Conservation Education and Promotion and Volunteers Transform Educational Program**
主 持 人	**林俐玲** **Lin, Li-Ling**
計畫年度	**94**

摘　　要

山坡地水土災害的預防與應變措施是多方面的，需要結合地質、水利及水土保持專家共同研擬防治方法，除了防治土砂災害發生的各項工程之外，更需在地民眾的共同努力來做好水土保持工作及土砂災害防治措施，以減少土石流及其所帶來之災害。爲有效運用社會人力資源參與公共事務，提昇生活品質並帶動社會志願服務風氣，以激勵民眾培養愛鄉愛土之價值觀與助人最樂之高貴情操；復運用義工人力、建立志願服務體制以提昇水土保持工作之效能，藉以減少水土災害發生，水土資源永續經營。

本計畫招收已受過水土保持義工培訓之義工們，再授予 12 小時的志工基本課程。水土保持志工培訓將結合地方資源與在地特性，落實在社區防災工作上，擴大加強宣導提醒全民注意，以防範災害於未然，養成國土保安人人有責。

（關鍵詞：教育宣導、志工）

Abstract

Preventing soil and water disaster is all-around and that combining geology, hydraulic, soil and water conservation experts to study manage methods. Except for calamity engineering that preventing soil disaster, local people is an important resources to join the soil and water conservation work. In order to utilize the social human resources to join public things and promote quality of life and promote voluntarily atmosphere. Utilizing the volunteer power to establish voluntary mechanism in order to promote the efficiency of soil and water conservation work is the main purpose of this project.

The plan recruits voluntary people that had accepted soil and water conservation trains. 12 hours basic courses were provides. Soil and water conservation volunteer training was combined local resource and local characteristic, enhanced the people to notice and prevent the disaster. T

（**Keywords：Educational Promotion, Volunteer**）

計畫名稱	落實推動山坡地保育工作－土石流防災專員教育計畫 **Debris Flow Disaster Prevention Observer Education Plan to Implement and Promote the Slopeland Conservation**
主 持 人	巫仲明 **Wu, Chung-Ming**
計畫年度	**94**

摘　　要

本計畫舉辦四梯次之教育訓練，培訓「土石流防災專員」。期透過專業課程訓練，使與訓人員具備自主觀測雨量、環境設施檢查、協助災情通報與疏散撤離等專業能力，以達成落實土石流防災自主管理，並降低土石流災害之目標。

各梯次教育訓練時數爲 16 小時；完訓者授予「結訓證書」及高級防災裝備，並聘任爲「土石流防災專員」，任期 2 年，實際投入未來土石流防災工作。

（關鍵詞：土石流防災專員、社區自主防災）

Abstract

Debris flow disaster observer training program is held in 4 training sessions. The program anticipates, under specialty training courses, the trainees would acquire the ability to measure rainfall self-sufficiently, to look over environmental equipments, assisting disaster notification and evacuation. The outcome is to fulfill self disaster management objective and minimize potential damages.

Concluding the 16 hour training session, overall trainees achieved completion and was appointed as the Observer of Debris Flow Disaster for the period of 2 years; they will take part in disaster prevention activities.

（**Keywords：Debris Flow Disaster Observer, Community Empowerment**）

計畫名稱	土石流災害防救業務計畫教育訓練與宣導 **Education, Training and Publicity of Debris Flow Disaster Prevention Response Operation Plan**
主 持 人	巫仲明 **Wu, Chung-Ming**
計畫年度	**93**

摘　　要

爲落實土石流防災知識宣導，降低土石流災害損失及提升各級政府與土石流防救災人員之應變能力，增加工作效率，行政院農業委員會水土保持局委託逢甲大學營建及防災中心團隊辦理一系列土石流災害防救教育訓練與宣導工作，項目有：辦理土石流災害防救業務計畫教育講習、土石流災害防救業務實務研習、國際土石流學術與技術交流、土石流防災知識論壇、土石流災害防救巡迴宣導車、博物館土石流防救宣導特別展覽、土石流災害防救教育種子教師研習及偏遠山區中小學土石流災害防救教育宣導活動。土石流災害防救業務計畫教育講習分別於 6 月 28、29 日、7 月 7 日及 11 月 24 日在台中逢甲大學第八國際會議廳、宜蘭縣縣史館、高雄國立科學工藝博物館及台北林業試驗所森林保育大樓國際會議廳辦理完成總計 211 人參加。土石流災害防救業務實務研習分別於 10 月 27－29 及 11 月 10－12 日在台東娜魯灣飯店辦理完成共有 54 人參加。國際土石流學術與技術交流已於 9 月 5－12 日前往日本進行考察行程，此次本團隊將日本目前防救災方面的最新成果帶回台灣，提供國內做爲推動對土石流災害防救業務方面的參考， 將有莫大的幫助。土石流防災知識論壇於 11 月 30 日辦理完成邀請土石流專家學者、政府相關單位及業界等代表一起探討國內土石流災害防救工作，並刊登於中國時報達到教育宣導的目的。土石流災害防救巡迴宣導車已於 8 月底製作完成，並前往三所偏遠山區國小進行教育宣導，透過巡迴宣導車可以將資訊行動化，深入山區進行土石流防災知識宣導縮小山區及都市教育之城鄉差距。土石流災害防救業務計畫教育訓練與宣導

摘要博物館土石流災害防救教育宣導特別展覽已於 7 月份在高雄科學工藝博物館舉行爲期一個月的特展，7 月份正值學校放暑假期間，館方湧入 81,517 人參館平均每天都有多達 3,000 人參觀。土石流災害防救種子教師研習在 8 月 2 日於土石流災害防救教育宣導特別展覽期間，假高雄國立科學工藝博物館場地舉行共計 106 人報名參加，培訓土石流潛勢溪流地區之中小學校土石流防災教育種子師資，透過學校教育灌輸學童正確之防災觀念，把土石流災害防救的觀念深植到每一個角落偏遠山區中小學土石流災害防救教育宣導活動已於 8 月 31－9 月 1 日於台東縣金峰鄉賓茂國小、10 月 4－5 日於南投縣鹿谷鄉內湖國小及 10 月 7－8 日於南投縣信義鄉潭南國小辦理完成。

（關鍵詞：土石流災害防救、教育訓練與宣導）

Abstract

The project content includes: 1.Debris flow disaster prevention and relief business education program workshop. 2. International academic and technological exchanges of debris flow. 3. Knowledge forum for debris flow disaster prevention. 4. Tour promoting car of debris flow disaster prevention. 5. The special exhibition of debris flow disaster prevention publicity in museum. 6. Seeded teachers study of debris flow disaster prevention. 7. Debris flow disaster prevention publicity for primary and secondary schools in remote mountains. Narrow mountains and urban education gap between urban and rural areas, and let disaster prevention and relief of the debris-flow concept deeply rooted to every corner of the country.

（**Keywords：Debris Flow Disaster Prevention Response, Education, Training and Publicity**）

計畫名稱	土石流防災知識庫開發建置（第二年） **Development and Establishment of a Knowledge Bank for Preventing Debris Flow Natural Disasters (Second Year)**
主 持 人	馬俊強 **Ma, Jin-Chung**
計畫年度	**93**

摘　　要

爲建立土石流災害防救資訊網路系統以利防救科技研究成果之應用，農委會水土保持局於民國 92 年辦理「土石流防災知識庫開發建置」委託專業服務計畫，計畫期程爲 3 年。本第 2 年計畫爲延續第 1 年土石流防災知識庫建置之成果，接續辦理「土石流防災線上學習系統開發建置」。

本計畫先規劃線上學習系統之硬體及網路架構，再建置「土石流防災線上學習系統」平台，並對水土保持局同仁辦理線上學習平台之使用及數位教材製作之訓練。同時蒐集土石流防災專家之經驗與智慧，經由生動活潑的多媒體呈現方式製作成土石流防災相關線上學習之數位教材，以使水土保持局同仁可以藉由網路遠距教學方式，打破時間和空間的限制，有效地吸收知識、應用知識、分享經驗，達到經驗共享、知識共用的目標。

（關鍵詞：土石流、知識庫、線上學習、教育訓練）

Abstract

In order to establish the Information Network System of Preventing Debris Flow Natural Disasters, The Soil and Water Conservation Bureau (SWCB), Council of Agriculture, started a three-year project of “the Development and Establishment of a Knowledge Bank for Preventing Debris Flow Natural Disasters” in 2003. This second year (2004) project is to follow the previous year’s achievement, and focus on “the Development and Establishment of the e-Learning System for Preventing Debris Flow Natural Disasters”.

We start the project by planning the hardware and network structure for an e-Learning system. We then install “the e-Learning Platform for Preventing Debris Flow Natural Disasters” on the system. We also carry out a series of training classes for the colleagues of SWCB to learn how to use e-Learning platform and how to produce a digital e-Learning materials. In the mean time, we collect experts’ views and experience in their domain of the debris flow prevention to produce digital e-Learning materials in multimedia format. It is believed that with the e-Learning training system, all SWCB colleagues can learn effectively, apply and share their knowledge and experience any time, any where.

（**Keywords：Debris Flow, Knowledge Bank, E-Learning, Training**）

計畫名稱	土石流疏散避難教育軟體開發及土石流防災開放式資訊平台決策支援系統建置 **Debris Flow Disaster Prevention & Evacuation Software Development and Decision Support System Development of Debris Flow Disaster Prevention**
主 持 人	周天穎 **Chou, Tien-Yin**
計畫年度	**93**

摘　　要

水土保持局歷年來對於土石流災害管理及其各項相關資訊技術應用，已具備相當成效，如土石流應變中心組成、土石流潛勢溪流的劃定、土石流疏散避難路線的規劃與演練等。爲整合並落實各項防災知識，並保持業務管理的創新優勢，應將各層面資訊導入並整合爲一防災資訊平台，具備完整的規劃與推動架構。

本計畫以水土保持局相關業務使用之空間資料庫及防災資料庫爲基礎，延伸既有線上學習技術，建構開放式資訊平台，可具備對內土石流應變知識學習，以及對外可導入民眾避難路線及相關防災知識的累積。此外，結合立體化的空間視效資料，可模擬真實之土石流疏散避難路線之場景，將可提升避難演練之效益。

本計畫尚包含以駐點方式支援水土保持局進駐災害應變中心之各項應變作業、國外技術移轉土石流防災政策與法令之研究以及推廣教育等工作範圍。另一方面研發單機版颱風預報路徑輔助土石流警戒決策支援系統，提供土石流災害應變小組使用。

（關鍵詞：土石流，土石流警戒，土石流疏散避難路線，決策支援系統）

Abstract

Soil and Water Conservation Bureau (SWCB) has accumulated outstanding achievements on debris flow disaster management and related application technologies, such as establishing emergency operation center of debris flow, dividing potential debris flow torrent areas, planning debris flow evacuation drills, and so on. To integrate debris flow knowledge and announce disaster prevention information for the public, as well as keep creative advantages for disaster prevention administration, the project would make the entire plan and executive architecture to integrate various aspects into the disaster prevention platform.

The project was based on spatial information and disaster prevention databases of SWCB administration, further using e-learning technologies to develop open platform where the debris flow knowledge could be delivered to other government units as well as the public. In addition, the combination of 3D spatial information can simulate evacuation routes of debris flow, then raising effectives of debris flow evacuation drills.

The scopes of the project also include on-site support for a variety of emergency operation issues in the emergency operation center at SWCB, researches on international debris flow disaster prevention policies and regulations which can be applied on the references of domestic execution. On the other hand, it developed the decision support systems to make debris flow warning with forecast of typhoon routes for debris flow emergency operation team.

（Keywords：Debris Flow, Debris Flow Warning, Debris Flow Evacuation Drills, Decision Support systems）

計畫名稱	土石流自主防災示範社區建立及推動計畫 **Establishment and Impetus for Demonstration Community of Hazard Mitigation on Debris Flows**
主 持 人	張達德 **Chang, Dave Ta-Teh**
計畫年度	**93**

摘　　要

爲能落實土石流防災規劃成果與提升社區的自主防災意識，積極推動防災示範社區的建立與推動，本計畫擇定埔里鎮內埔社區、國姓鄉南港村、水里鄉玉峰村三座社區進行一系列土石流防災宣導與自主防災演練活動。

依據水土保持局規劃的避難路線與避難處所，於各個示範社區內設立緊急疏散避難路線告示牌，使居民熟悉避難場所位置。藉由防災活動宣導與社區座談，建立社區居民對土石流應有的防災觀念，及共同的防災意識，成立自主防災社區應變小組，規劃各組任務分工與建立災情通報系統。透過舉辦土石流自主防災疏散演練活動，讓各示範社區具備實質的防災能力。另於計畫期間，正逢兩個颱風，社區居民依據防災演練之規劃，防災應變小組即進行監控、疏散以及搶救等工作，使家園及生命財產安全無虞，由此可證明自主防災社區的建立能有助於社區達到防災、減災的實質成效。

（關鍵詞：土石流、自主防災社區）

Abstract

In order to implement the achievement of hazard mitigation program and Improve the awareness of independent hazard mitigation for community, actively promote hazard mitigation demonstration community. In this project, the three communities, Puli Township Nei-Pu community、Guo-sing township Nan-Tou country、Shueili township were selected to, carry on a series of propaganda and maneuvers activities for independent hazard mitigation.

Basing on route and place of refuge by the Water and Soil Conservation-Bureau pre-assigned, the billboards of the route of taking refuge promptly in every communities have set up for the residents familiar with the position of refuge. Through the discussion and propaganda, hazard mitigation senses for the residents has been built up. And the independent hazard mitigation handling team was also established in each community. The dividing work contents and notify warning system were clearly defined.

Through the hazard mitigation maneuvers activities, each demonstrated community was able to gain the essence of hazard mitigation ability. In addition, two typhoons were touched down in the period of this project. The independent hazard mitigation handling team has carried on the monitoring, evacuating and rescuing work immediately started up for the safety of life and property.

（Keywords：Debris, Hazard Mitigation）

計畫名稱	國民中小學校園水土保持巡迴宣導計畫－北區 **Soil and Water Conservation Campus Promotion Tour and Program Aimed at Junior High Schools and Elementary Schools －Northern Area**
主持人	黃國鋒　**Huang, Kuo-Feng** 王佩蓮　**Wang, Pei-Lein**
計畫年度	**93**

摘　要

本研究透過專題演講、體驗活動、分享及宣誓的步驟，在北區（台北市、縣、基隆市、宜蘭縣、花蓮縣、桃園縣、新竹縣市等 8 個縣市依各縣市的學校數目做爲錄取比例，北區中、小學選出 33 所學校，舉辦校園水土保持宣導活動。每個學校宣導後並實施問卷以了解宣導的效益，並請老師、學生寫出心得。經過一年的宣導有下列發現。

（一）問卷分析（教師）

接受宣導的學校教師對本次宣導活動內容在學生能力達 80.0%、對水土保持教育意涵達 75.0%、對結合其他領域課程達 82.0%、對具有創意達 82.0%、對學生能熱烈參與達 85.0%、對教師與學生互動情形良好達 90.0%、對教師之肢體語言自然豐富達 86.0%、對教師之口語表達能力清晰流暢達 91.0%、對教學情境掌控良好達 90.0%、整體氣氛表現等皆達 83.0%以上認爲符合。

（二）訪談結果（學生）

1.今天學校舉辦水土保持宣導活動，讓我們了解土石流、水土保持的重要，與現實生活息息相關。

2.如何做好水土保持？

(1)做好水土保持是大家的責任，應多種樹木及少吃高山蔬菜和水果

等。

(2)大家共同努力，不濫墾，不爛伐，不破壞山坡地。多種樹，不種淺根植物，珍惜水土資源。

(3)做海報宣導貼在森林入口處、不踏草地、把草地的垃圾撿起來、不把垃圾丟進水裡、不丟廢水、跟親朋好友宣導。

(4)每次颱風就有些災害，爲什麼？沒做好水土保持工作嗎？違規、人民不守法？氣候變遷？

(5)希望大家能配合政府的各種水土保持政策，並且確實做到，保護水土資源。

3.參加水土保持宣導後一直思考人類如果缺少了水土資源，不知道會有什麼樣的生存環境？因此怎麼可以不保護水土資源呢？我立誓做個保護水土的勇士。

從教師與學生心得可以知道校園中水土保持宣導之效益良好，假以時日可以做好往下紮根的教育宣導工作。

（關鍵詞：水土保持、校園、體驗活動）

Abstract

This research is made through the steps of conducting speeches, experiment activities, sharing experience and making vows, with 33 schools chosen according to the proportion decided based on the number of schools in northern area (the eight considered cities and counties are: Taipei City and County, Keelung City, Yi Lan County, Hua Lien County, Tao Yuan County and Hsin Chu County etc.) to conduct campus soil and water conservation promotion activities. After the promotion activities, surveys were conducted to find out the efficiency of the promotions. Teachers and students were invited to write down their thoughts toward those activities. Below are the findings collected after one year of promotion:

1.Survey Analysis (teachers)

Those teachers participating the promotions expressed their agreement on the following survey result: students' ability reaching 80% or above; soil and water conservation education achievement reaching 75% or above; connecting to other fields of curriculums reaching 82%; creativity reaching 82% or above; students' enthusiastic participation reaching 85% or above; good interactions between teachers and students reaching 90% or above; teachers' vivid body language reaching 86% or above; teachers' oral expression ability reaching 91% or above; good control of each scenario reaching 90% or above; and good overall atmosphere reaching 83% or above.

2.Interview result (student)

(1)The school holds water and soil conservation to guide an activity and lets us understand the importance of Debris Flow, water and soil conservation, is vitally related with real life today.

(2)How to properly maintain soil and water conservation?

a. It is everyone's responsibility to help maintain soil and water conservation.

More trees should be planted and less alpine vegetables and fruits should be consumed.

b. we should all strive against deforestation and slope land destructions. We should grow more trees but avoid growing plants with short roots. Soil and water resources should be treasured.

c. Promotion posters should be pasted at the entrance of each forest. We should not tread on grass, and when we find litters on the grass, we should pick them up. Do not throw garbage into waters, and do not dump waste water. Promote the concept to our friends and relatives.

d. To reserve natural resources and to prevent occurrences of disasters, as well as to reduce the loss of lives and properties, we must maintain soil and water conservation.

e. We hope that everybody can observe and put into effect the government's various soil and water conservation policies so our soil and water resources can be protected.

3. After participating the soil and water conservation promotion, I have been thinking and wondering if soil and water resources were removed from our lives, what would our living environment look like? Thus, how can we not protect our soil and water resources? I vow to be a warrior protecting soil and water.

Through the expressions of teachers and students, we know that soil and water promotion has good efficiency. In the near future, more promotional activities can be conducted for further education.

（Keywords：Soil and Water Conservation, Campus, Experimental Activities）

計畫名稱	土石流防災知識庫開發建置計畫 **Development and Establishment of Debris Flow Hazard Mitigation Knowledge Management System**
主 持 人	李萬利 **Lee, Wan-Li**
計畫年度	**92**

摘　　要

爲累積行政院農業委員會水土保持局於土石流防災上的經驗與智慧，透過資訊及網路技術，經由周延的分類與方便的索引，幫助工程人員有效的吸收知識、應用知識、分享經驗，進而使個人經驗得以化爲組織經驗、群體經驗，以有效整合並落實土石流防災知識。

土石流防災知識管理計畫共分爲三期：第一期以建置知識文件管理平台，以作爲知識文件收集管理的工具；第二期以建置 e-learning 線上學習系統爲主；第三期以知識管理於決策支援的應用爲主。本期專案主要的工作內容即針對第一期工作需求建置知識管理平台。

透過系統的開發與初期知識庫的內容建置導入，讓工程師實際運用於水土保持及防災專案的輔助設計，檢驗其執行的成效以爲系統後續知識管理相關工作項目推動的參考。

本期專案主要完成之功能有：

1.系統操作界面採用WEB架構。

2.以樹狀結構建立知識管理架構，除基本架構外，系統可由使用者無層次限制的增加新目錄。

3.內容包括聲音檔、影像檔及其他新增的文件資料（可爲任何格式的檔案類型）。

4.提供圖資基本資料建檔、檢索與維護的能力，使用者可透過查詢進行資料

的選取。

5.提供圖資資料上傳、增刪及整合的功能，使用者需透權限管理以利用管理資料庫。

6.提供資料下傳的功能，以及全文數位文字查閱、複製及列印。

7.知識庫管理功能，包括權限、檔案分類及文資管理。

（關鍵詞：土石流、防災、知識管理、線上學習）

Abstract

In order to attain more knowledge and experience about Debris Flow Hazard Mitigation for the Soil and Water Conservation Bureau, we used advanced information & internet technology to help engineers gain information more efficiently, put knowledge to use, share experiences and develop personal practice so as to combine their information resources into the organization and integrate the knowledge and applications of Debris Flow Hazard Mitigation.

There are three phases of the Debris Flow Hazard Mitigation Knowledge Management System project:

Phase one: Setup the Knowledge Document Management Platform as a tool in order to collect and manage information.

Phase two: Setup an e-learning system.

Phase three: Use the knowledge management platform to help develop various application strategies.

The project at this stage mainly focuses on phase one – setting up the Knowledge Management System.

Setting up the knowledge management system will not only help engineers learn how to apply this system to the design of soil and water conservation and hazard mitigation projects, but at the same time will provide a valuable reference of its results for future applications.

The main functions of the project at this stage are as follows:

1.User- web-structure interface

2.Tree-structure as the basic framework of this knowledge management system, and users may add more folders without limitations.

3.Formats of this system include sound files, image & video files and other document types of information files.

4.This system provides raw-data creation, searchable and easy-to-maintain function for users' advanced selection.

5.This system provides the functions of uploading, deletion and integration of images and information data, and users may manage the database through the authority management function.

6.This system provides the functions of data download, data copy, data print and data search.

7.Knowledge Management functions include authority management, file-category management and document management.

（**Keywords：Debris Flow, Hazard Mitigation, Knowledge Management, E-Learning**）

計畫名稱	土石流災害境況模擬、災害規模及災損之推估範例 **Demonstration of Scenario Simulation, Scale and Loss of Debris-Flow Disaster**
主 持 人	黃宏斌 **Huang, Hung-Pin**
計畫年度	**91**

摘　　要

921 地震後，台灣地區土石流災害頻傳，由於土石流發生時，常因不同降雨形態造成不同程度之影響，爲提昇土石流災害防救應變能力，減輕災害損失，本計畫選定二維數值模式 FLO-2D 在不同之雨量狀況下模擬南投縣國姓鄉南港村九份二山、南投縣水里鄉上安村郡坑村二部及三部地區、南投縣信義鄉豐丘地區、花蓮縣光復鄉大興村及花蓮縣萬榮鄉見晴村等 5 個工作範圍之土石流成災情形。

爲求模擬結果之準確且能符合現狀，本計畫蒐集現有之最新地文、水文資料，並透過現地測量及泥砂採樣的方式，更新過於老舊及缺漏之資料，以輸入模式中。在 FLO-2D 模擬完成後，本計畫亦完成各工作範圍之保全對象 GIS 資料庫，將模式運算之結果和 GIS 整合， 利用圖層套疊的方式，找出位於土石流可能淹沒範圍中之保全對象，建立土石流災損評估系統，評估不同成災範圍可能之直接及恢復工作災損規模和金額。

爲使各級防災單位即時參考模擬結果做爲災情推估、災害規模之推估範例，本計畫利用網路資料庫程式語言(ASP)撰寫土石流境況模擬即時與預測分析系統之網頁，將各工作範圍在不同雨量狀況下之基本資料、3D 成災範圍圖（利用 GIS 軟體 ArcView 8.1 製作）、直接災損及恢復工作災損推估成果表放在網際網路上和水土保持局土石流防災應變系統(http://fema.swcb.gov.tw)整合，供使用者查詢。其中，預測分析系統爲各工作範圍預先使用 FLO-2D 運算出各工

作範圍在 25 頻率年、50 頻率年、0.2 倍、0.6 倍及完整桃芝颱風等 5 種雨量狀況下之成果，而即時分析系統，則爲展示本計畫利用 FLO-2D 模擬累積雨量 300mm 至 50mm 之成果，除此之外，系統操作人員亦可抓取中央氣象局即時傳輸至土石流防災應變系統中之雨量資料，將利用 FLO-2D 及 ArcView 8.1 等軟體即時求得之災損結果及 3D 成災範圍圖上傳至即時分析系統所在伺服器中，供使用者查詢。

本計畫目前已完成上述工作做爲各土石流潛勢溪流預估成災範圍及初步災損評估之參考，祈能發揮功效，能在未來的時日保護民眾及家園的安全。

（關鍵詞：二維數值模式、FLO-2D、3D 成災範圍圖）

Abstract

After 921-earthquake, debris-flow disaster occurred frequently in Taiwan. During the debris flow occurred, different rainfall type results in different ranges of losses. In order to enhance the disaster reduction power of debris flow, this study selected two dimensional model, FLO-2D, to simulate the disaster maps at Chiu-fen-erh-shan, Erh-pu and San-pu, Fung-chiu in Nantou, Ta-hsing, Chien-ching in Hualien, respectively.

This study collected hydrological, topographical data, associated with field surveying, grain sampling, as well as updating and supplementing data, as an input data for FLO-2D. After operation of FLO-2D, Geographical Information System, GIS, was used to find out the safeguard area in the debris-flow disaster map. And, the estimation system of debris-flow loss was set up to get disaster area and reconstruction budget.

As a reference of disaster- loss and disaster-scale estimation, this study set up a homepage, connected with http://fema.swcb.gov.tw, to show elementary data of rainfall, 3D disaster map, direct loss and reconstruction budget. In which, the five results of 25 years and 50 years reoccurrence frequency rainfall, and 0.2, 0.3 and full typhoon Toraji were presented. Moreover, with the rainfall data of Central Weather Bureau being transferred directly, the disaster loss and map can be searched by public users with FLO-2D and Arc View 8.1.

This study presented debris-flow disaster map and disaster loss estimation to hope to protect life and property.

（Keywords：Two-Dimensional Numerical Simulation, FLO-2D, 3D Disaster Map）

計畫名稱	山坡地天然災害宣導計畫 **The promotion of environmental hazards**
主 持 人	林俊全 **Lin, Jiun-Chuan**
計畫年度	**91**

摘　　要

本計畫提供有關於台灣地區天然災害的資訊，一方面可以進行環境教育的資料整理，另一方面則是可以達到防災與減災的宣導，讓我國國民可以多接觸有關於天然災害方面的資訊，解決目前防災教育深度與普及度不足的問題。再者，本研究擬針對地理教師針對近幾年的天然災害問題，舉辦研討會，並說明如何納入教材內容，以達教育宣導與扎根工作。計畫目的如下：

1.收集台灣地區近年來所發生天然災害的資料，加以整理、分析。

2.將災害資料以書面與圖面方式呈現。

3.將過去相關資料加以更新。

4.以所收集的資料爲基礎，進行天然災害的宣導工作。

5.除了宣導之外，更可以記錄近年來台灣地區所遭受的重大天然災害，可進行歷史回顧。

6.進行教師的有關天然災害教育宣導，期望能由教師做起有關天然災害的教育推廣。

（關鍵詞：臺灣、天然災害、宣導、山坡地、環境教育）

Abstract

This project provides the information about natural hazards in Taiwan, proceeding data collection and arrangement of environmental education, achieving and promotion of prevention and reduction of hazard. Let our nation get in touch with information of natural hazards, to dissolve the problem of the lack of hazard prevention education. This project also holds the conference to geography teachers, to illustrate how to bring hazards occurred in these years to our teaching materials. There are aims of the project：

1.Collect and analysis data of natural hazards these years in Taiwan.

2.Display data of natural hazards by documents and maps.

3.Renew data of natural hazards.

4.Based on those data, to do the promotion and guidance about natural hazards.

5.Record history of hazards occurred in these years.

6.Promote our teachers to do the education about natural hazards.

（**Keywords：Taiwan, Natural hazard, Promotion, Slope land, Environmental Education**）

第二篇：工程技術
Part Ⅱ：Engineering Technology

計畫名稱	土石流特定水土保持區長期水土保持計畫治理效益評估與運用 **Manage Benefit Valuation and Usage of The Long-Term Water and Soil Conservation Plans in The Debris-Flow Particular Water and Soil Conservation Area**
主 持 人	連惠邦 **Lien, Hui-Pang**
計畫年度	**96**

摘　　要

根據水土保持法第三章特定水土保持之處理與維護得知，對於極需水土保持處理與維護地區劃定爲特定水土保持區，予以優先治理和較嚴格之土地管制作爲，此乃有別於一般水土保持，特定水土保持區特別強調劃定公告、保育重點、管制措施及保護帶設置與補償等事項。經劃定爲各類特定水土保持區之土地使用行爲，除非是攸關水資源之重大建設、不涉及一定規模以上之土地改變、經環境影響評估審查通過之自然遊憩區及農牧使用行爲等不受開發限制外，其他任何開發行爲均被禁止，這使得推動特定水土保持區劃定工作相當不易，即便由管理機關提報劃定者，亦因保護對象爲公共設施或人數較少之區域，使其劃定需要性大爲降低，而失去立法之原意。據此，爲了提高特定水土保持區劃定之績效，除了規範必要的特定水土保持區劃定準則外，對於其廢止計畫中如何證明其存置之必要亦應同時考量，以營造有利於劃定特定水土保持區之社會環境，而特定水土保持區長期水土保持計畫就成爲實現廢止計畫之重要途徑，其對推動特定水土保持區劃定工作之影響相當深遠，不可忽略。本計畫擬針對「土石流特定水土保持區」長期水土保持計畫內容進行檢討及補充建議，期建立其標準內容與範本，尤其是計畫效益評估部分應能提出具體量化之評估模式，以利後續廢止土石流特定水土保持區之依據；此外，本計畫亦擬建

立長期水土保持計畫成果資料庫與地理資訊系統，以提供主管機關和管理機關查詢、統計和分析之用。

（關鍵詞：土石流特定水土保持區、環境影響評估、計畫效益評估、地理資訊系統）

Abstract

According to the water and soil conservation method chapter 3, processing and maintenance of particular water and soil conservation know for needing water and soil conservation processing and delimitation in the maintenance region as particular water and soil conservation area very much and have the initiative to manage with stricter land control Be. This is differing from general water and soil conservation and the particular water and soil conservation area particularly emphasizes that the delimitation announce, raises a point and control measure and protection to bring items such as constitution and repair etc.. The delimitation is the land of each kind of particular water and soil conservation area usage behavior, unless is the major construction concerning water resource, don't involve the certain scale above land change, through environment influence natural recreation area and agriculture that evaluate reviewing pass herd usage's behavior's etc. to be free from development to limit outside, any other development behavior all are forbidden. This makes to push a particular water and soil conservation area delimitation work rather not easy. Even if is delimited by the management organization, also because protection the object make its delimitation needed sex for the district of public facilities or number less greatly in order to reduce, and lose the original intention of lawmaking. On these grounds, for raising the results of particular delimitation of the water and soil conservation area, in addition to the particular water and soil conservation area delimitation standard of standard necessity, abolish a project to it how to prove that it saves to place of the necessity should also consider in the meantime. Be advantageous to delimit the social milieu of the particular water and soiling conservation area by construction. The particular water and soil conservation ward chief expects a water and soil conservation project to become the important path that the realization abolishes a project. Its influence in pushing a particular water and soil

conservation area delimitation work is rather profound, can't neglect. This project draws up to aim at the content that "the mudslide particular water and soil conservation area" long-term water and soil conservation plans to carry on self-criticism and adds a suggestion. Build up its standard content and copy. Particularly the valuation mode that plan that the part of the benefit valuation should can put forth concrete quantity's turning, with benefit follow-up abolish the basis of the mudslide particular water and soil conservation area. In addition, the origin plans to also draw up to build up long-term water and soil conservation project result database and geography information system to provide the supervisor with the organization and management organization search, covariance and analysis of use.

（**Keywords：The Debris-Flow Particular Water and Soil Conservation Area, The Environment Influence Evaluates, Plan Benefit Valuation, Geography Information System**）

計畫名稱	土石流現地影像分析判釋之研究 **Feasibility Study on Automatic Event Understanding of Debris Flow Surveillance Video**
主 持 人	王家祥 **Wang, Jia-Shung**
計畫年度	**96**

摘　　要

現有土石流監測影片中可能含有重要的事件發生特徵，如河水變化、土石流發生徵兆等；或者是可供分析的水文資訊，如河水流量、流速等。這些資訊對了解土石流行爲與防治有相當大的助益；但要從全省各地的攝影鏡頭中，取出富有意義之影像片段或分辨出特殊事件變化需耗費大量的人力，且極不符合經濟效益。本研究從視訊分析的角度切入土石流防災監測應用，擬針對土石流監視影像進行事件判釋及水文資料萃取之可行性分析，並嘗試發展分析工具來探討自動化判釋土石流影像事件之可行性。儘管我們已成功運用運動向量及背景模型分析技術建立許多土石流影像事件判釋策略，要使用現有影像處理技術自土石流監控影片來萃取水文參數或是進行高階的土石流事件判釋工作，仍有相當大的困難，許多戶外複雜環境的干擾因素仍待克服。本報告摘要了我們應用現有技術所能判釋的影像事件，並整理出目前造成無法得知水文資訊及成功判釋事件之關鍵困難因素。

（關鍵詞：土石流、影片判釋、事件判釋、運動向量、動態背景模型分析）

Abstract

This work aims to study the feasibility of understanding debris flow surveillance video and to explain the detected events meaningfully. Motion estimation and MoG (Mixture of Gaussian) background modeling techniques are used to develop related event detection strategies. Some major results are summarized in this report including: 1.Event detection strategies for existing surveillance videos, 2.Motion based video characteristics extraction, 3.MoG based video characteristics extraction, and 4.An event analysis tool set and video management system. As the experimental results demonstrate, we conclude that current video processing technologies are still far away to achieve understanding of meaningful hydrology parameters. However, video understanding is still a useful tool to raise early alarms for certain event scenarios, such as debris flow, flood, and landslide without knowing the actual hydrology parameters in advance.

（**Keywords：Debris Flow, Event Detection, Motion Estimation, MoG, Mixture of Gaussian**）

計畫名稱	土石流潛勢區之雨量估計與即時預報技術發展研究（第三年） **A Study on the Development of Rainfall Estimation and Nowcasting Techniques at Debris Flow Potential Areas (3)**
主 持 人	李清勝 **Lee, Cheng-Shang**
計畫年度	**96**

摘　　要

本計畫爲 3 年計畫之第 3 年研究，過去 2 年在土石流潛勢區域雨量估計精度需要提升的前提下，本研究利用 QPESUMS 雷達高時空解析雨量資訊，整合即時地面自動雨量站觀測，進行台灣山區或地形降雨的合理估計。

根據前二期計畫的成果（李等，2005，2006），本計畫發展的雷達-雨量站降雨整合技術已可描述土砂災害個案發生的降雨特徵，在 2005 年海棠颱風在高雄縣之個案分析，顯示雷達-雨量站降雨估計法的優越性。而本年度（2007 年）則對於屏東縣霧台鄉好茶村之個案進行雷達-雨量站降雨估計分析，透過雷達－雨量站整合估計降雨和傳統雨量站之逐時降雨比較，顯示雷達-雨量站整合法可提供土砂災點之客觀降雨資訊，未來可做爲土砂災點之研究分析使用。

另外，由於未來降雨趨勢對土石流預警相當重要，本年度利用目前已廣泛應用之氣象中尺度動力預報模式(WRF)，初步進行颱風期間土石流潛勢區的實時(real time)局部區域降雨預報，以了解中尺度動力模式之降雨預報，應用在示範區土石流潛勢警戒的可行性。所分析之個案有：2005 年海棠(Haitang)、2006 年碧利斯(Bilis)與凱米(Kaemi)，以及 2007 年聖帕(Sepat)、韋帕(Wipha)和柯羅莎(Krosa)颱風個案。結果顯示，由於颱風路徑預報的準確與否，將左右降雨分布的預報結果。另外，在降雨的分布方面，WRF 模式可大致掌握較大降雨發生的位置，但對於降雨量則多爲低估。最後，在降雨歷程方面，WRF 模式可

掌握未來降雨趨勢及較大降雨發生時間點。綜合上述之結果，顯示 WRF 模式應用於防災預警作業將可提供一定程度的資訊。

（關鍵詞：雷達-雨量站整合降雨、氣象中尺度動力模式、QPESUMS、WRF）

Abstract

This year is the 3rd year of the 3 years project. We summarized the 3 years studies into two parts. First, we focus on the development of radar-raingauge integrated rainfall estimation scheme, and the application at local area during typhoon strikes. Second, we try to access the feasibility of the forecast 0-3hr rainfall by dynamical model (WRF) at typhoon landslide or debris flow events.

According to the first and second year of the results (Lee et. al, 2005; 2006), the radar-raingauge integrated scheme that developed by this project has showed high performance at the local area rainfall estimation. Integrated rainfall estimation scheme can describe heavy rainfall characteristics well at local area when no surface raingauge covered. And the traditional interpolated estimation by surface raingauge shows inaccuracy at the same case. We also use the integrated method to exam the heavy rainfall event that happened at Hao-Cha village in 2007. It showed reasonable in the rainfall estimation.

In order to have an early warning of debris flow occurred, 0－3 hr predicted rainfall is an important issue. The project of this year accessed the WRF rainfall prediction at local area in 2005－2007 typhoon events. The preliminary results show the rainfall accuracy highly depended on the accuracy of the track prediction. When predicted typhoon track is reasonable, the predicted rainfall distribution show highly closed to the surface raingauge observation, but the estimated rainfall amount showed less than the observation. On the other hand, it showed reasonable rainfall time sequence in the model prediction.

Using advanced radar observation and coupled with model simulation will give more rainfall information to determine the occurrence of debris flow or landslide. This study show that the quality of QPESUMS estimated precipitation is superior to interpolated precipitation by surrounding raingauge especially when rainfall

concentrated at local area and surrounding raingauge is few, and WRF model can offer rainfall time sequence when predicted typhoon track is reasonable.

（**Keywords：Radar-Raingauge Integrated Scheme, Meteorological Dynamical Model, QPESUMS, WRF**）

計畫名稱	土石流潛勢溪流資料管理與更新(II) **Update and Management of the Potential Debris-Flow Database (II)**
主 持 人	林美聆 **Lin, Meei-Ling**
計畫年度	**96**

摘　　要

臺灣特有之地質、地形及氣象條件符合土石流的基本發生條件，導致土石災害相當頻繁，自民國 85 年賀伯颱風至民國 93 年 7 月 2 日敏督利颱風與 72 水災，造成台灣多處土石流及坡地災害。這些土石災害，不僅僅是財產損失，當地居民之生命亦飽受威脅。行政院農業委員會自民國 80 年起開始調查，民國 92 年對全台 1,420 條土石流潛勢溪流持續進行現勘現況調查及影響區劃定，並於 94 年度由本計畫團隊完成國內之土石流潛勢溪流資料更新與回饋機制草案。

本計畫之目的爲強化地方政府對於未來土石流潛勢溪流資料進行自主管理及運用能力，並配合各地方政府回報資料更動進行土石流潛勢溪流現地調查。本年度計畫延續第 1 年之計畫，持續針對地方政府回報有疑義之溪流進行現地勘查與評估，並將第 1 年擬定之草案進行實際案例驗證與探討，使土石流資料管理與更新作業程序能更符合實務作業需求。

此外，現有之土石流潛勢溪流影響範圍劃定方法，係以池谷浩公式初步劃定，再依據現地調查之實際地形修正而成，但池谷浩公式對於土石流之漫流長度傾向高估，影響現地修正。有鑑於此，本計畫研擬本土化之土石流潛勢溪流影響範圍劃定方法，其模式爲先由主流長度和溪床平均坡度經相關經驗公式推估土砂總流動長度和流動高程差，再估算土石流流出體積，建議取流出體積不被超過機率 85%爲基準，估算扇狀堆積長度，以此長度爲半徑，由谷口頂點向

下游展出 105 度即爲影響範圍預估初稿。

針對第 1 年以南投縣的初步探討土石流潛勢分級之警戒區發佈方法成果，第 2 年計畫進一步擴大至台北地區與花蓮縣 2 縣市，以地文、水文、地質等因子，利用費雪區別分析可達約 80%之土石流溪流正判率，此外，分工程地質區之分析正判率則略高於不分工程地質區之分析結果。利用所得之潛能指數，可將土石流發生潛勢分爲高、中、低三級，提供土石流警戒發佈區域參考。

本計畫成果針對自然環境條件之土石流潛勢加以分級，及土石流出影響範圍之初稿劃設方式加以檢討，並未考量影響範圍內之保全危害及危險等級，故不適用於「土石流高潛勢溪流影響危險地區」判定。

（關鍵詞：土石流、台北、花蓮、區別分析、影響因子、現地調查）

Abstract

The geological settings, geomorphology, and climate conditions in Taiwan deemed the frequent occurrences of debris flow hazards. From typhoon Herb in 1996 to typhoon Mindulle in 2004, significant number of debris flow hazards and landslide occurred in Taiwan, not only caused properties loss but also threatening the lives of local residents. The Soil and Water Conservation Bureau of Council of Agriculture, Executive Yuan, has launched the investigation since 1991, and continued the site investigations and delineation of affected zone of 1,420 potential debris flow torrents in 2003 for debris flow hazard mitigation. In 2005, the drafting of information renovation and feedback system for potential debris flow torrents was completed for continuing up-dating of the database.

The objective of this project is to enhance the local government's abilities of management and application of debris flow torrents potential data, and to precede the site investigations according to feedbacks. This is the second year of a two-year project. During the previous year, site investigations and evaluations for torrents reported were conducted, and procedures for information renovation and feedback system were modified. In addition, the potential analysis of debris flow torrents was performed using Nan-Tou County as the pilot study area. In this year study, the further up-dating of debris flow torrent database were conducted, and further potential analysis and the delineation method of the affected area were conducted.

For the current delineation of debris flow affected area, the Ikeya (1980) equation is used for initial radius of a deposition fan, and modified according to field topography. However, the Ikeya's equation tends to overestimate the run-out distance of debris flow and affects the subsequent modification. An empirical equation is established using the flow distance and elevation difference of the debris flow torrent, length, and average gradient of the torrent. The total run-out volume

was then estimated. Through verifications of field cases, it is suggested that a non-exceeding probability of 85% of total run-out volume be used for estimating the run-out distance, and the initial deposition fan can be developed for field modification.

Following previous year study of debris flow potential in Nan-Tou County, the debris flow potential of the Taipei metropolitan area and Hua-Lien County were analyzed this year. By using the similar procedures of the Fisher discrimination analysis, 80% accuracy rate was reached for debris flow torrents. Further improvement of the accuracy rate might be achieved by taking into account the classification of engineering geology. Based on the results, the potential occurrence of debris flow can be classified as high, intermediate, or low, corresponding to the probabilities of larger than 70%, from 30~70%, and smaller than 30%, respectively. Such information could be applied to support issuing warning of potential debris flow areas.

（**Keywords：Debris Flow, Taipei, Hua-lien, Discrimination Analysis, Influence Factors, Field Investigation**）

計畫名稱	土石流潛勢範圍數值模擬之研究 **Numerical Simulation for the Influenced Area of Debris Flows**
主 持 人	劉格非 **Liu, Ko-Fei**
計畫年度	**96**

摘　　要

本計劃是要爲國立台灣大學所研發的土石流模擬程式 DEBRIS-2D 建立使用者介面，期使一般工程師都能利用此程式模擬土石流運動現象及可能的影響範圍，並據以規劃未來整治工程的配置及評估其整治效益。模式本身已經經過學術與實務上的嚴格驗證，本計畫工作執行項目主要分爲基本理論加強、模組化、模式的前處理、主程式的執行、模式的後處理與模式的測試六個部分，統合並完成應用程式介面化，也完成由水保技師的測試工作，相信使用者在熟悉操作的程序之後將可以很快的使用本應用模式。

模式介面雖然完成，但是因爲多重使用者版權問題，我們無法將目前商用軟體加入程式之中，讓使用者可以直接透過介面程式操控產生後處理的圖形，因此後處理部份只有將執行步驟詳述，此部份爲未來首先努力方向。

未來的急迫需要，一個是加入參數參考資料庫，好讓使用者減少輸入的困難，還有加入經濟評估模式，以便讓應用程式能夠更符合工程人員實際應用的需求。

（關鍵詞：土石流、數值模擬、工程整治分析）

Abstract

This project is to establish the Graphic User Interface (GUI) for the numerical program Debris 2d. This work should help engineers to use Debris 2D in understanding characteristics of debris flows so that they can obtain an estimated influenced area of debris flow. The program itself had been verified by theoretical and practical cases. Major works includes reinforcing the basic theory by adding modification of from the boundary layer, modulating the program, adding pre-preprocessing and post- processing modules. After programming, we ask professions to test the final product. Users are believed to be able to use the program after spending an initial short time to study the program.

The project is successfully finished. However, due to copy write issues, we can not automatically combine commercial software in our program to produce after process figures. Only the step by step explanation is included.

The future work will include construction a data base for inputting parameters and assessment module for real money evaluation.

（Keywords：Debris Flows, Numerical Simulation, Assessment of Engineering Mitigation）

計畫名稱	土石流整治與生態工法應用之研究（第三年） **Applications of Eco-Engineering for the Debris Flow Treatment (The Third Year)**
主 持 人	黃宏斌 **Huang, Hung-Pin**
計畫年度	**96**

摘　　要

水土保持局近年來在針對土石流潛勢溪流進行整治規劃時，致力推動以生態工法之精神進行規劃設計，除有效防災以外，生態復育之功效達成與否爲一重要課題。本計畫延續前 2 年之計畫成果，探討土石流整治工程規劃如何同時符合防災與生態工法之精神，並檢討現行應用生態工法之土石流整治工程之成效，期能建立適用於台灣土石流潛勢溪流之生態評估模式，以作爲土石流整治工程應用生態工法之參考，提升技術人員在辦理有關土石流潛勢溪流整體治理規劃設計時應用生態工法之專業技能。

（關鍵詞：生態工法、土石流、溪流狀況指數）

Abstract

The conservation of water and soil bureau aimed at the potential brook of debris flow control in recent years, devotes to impel the spirit of eco-engineering in carrying on the plan design. Besides disaster prevention, limited information in whether eco-engineering preserves biodiversity and restores ecosystems is an important topic. This project extends the result of the projects in the pass two years, discusses that how to fit in with the spirit of disaster prevention and eco-engineering at the same time in debris flow control, and examine the effectiveness of using eco-engineering on debris flow control. This project tries to establish an estimate mold of potential brook of debris flow in Taiwan, and be reference of using eco-engineering on debris flow control. This research will not only provide useful information to the reconstruction project but also facilitate relevant personnel's expertise.

（Keywords：Eco-Engineering , Debris Flow, Index of Stream Condition）

計畫名稱	台灣土石流堆積特性之研究 **A Study on the Characteristics of Debris-Flow Deposition Zone in Taiwan**
主 持 人	陳晉琪　**Chen, J. C.** 李明熹　**Lee, M. S.**
計畫年度	**96**

摘　　要

本研究收集台灣歷年來曾有土石流堆積特性紀錄之現場調查資料，包括：土石流流出砂土量、土石流堆積長度、土石流堆積寬度及相關地文與水文特性資料（如集水區面積、降雨等）。根據這些資料，建立：1.土石流堆積砂土量與集水區面積及機率關係、2.土石流堆積砂土量與土石流堆積長度關係、3.土石流堆積長度與堆積寬度之關係、以及 4.土石流堆積砂土量與土石流推估流量之關係等，四種可用以描述台灣土石流堆積砂土量特性之經驗關係式。最後，並以土石流溪流編號南投 023（扇狀堆積）及花蓮-A112 （非扇狀堆積）之溪流爲研究案例，利用本研究所建立之土石流堆積性之經驗關係式來評估土石流可能的堆積長度與寬度，進而推估土石流之堆積範圍，並與現場推估值做比較。

（關鍵詞：土石流、堆積砂土量、堆積長度、堆積寬度）

Abstract

In this study, several topographical and hydrological parameters, including the deposited length of debris flow *L*, the deposited width of debris flow *B*, the debris flow deposited volume *V*, and the watershed area *A* and the rainfall intensity, for debris flow events that occurred in Taiwan from 1985 to 2004 are collected. Based on such collected data, four empirical relations, the probabilistic relation between *V* and *A*, between *L* and *V*, the relation of *L* versus *B* as well as the relation of the debris-flow discharge against the deposited volume *V*, are formulated using a statistical analysis. The empirical relations developed in this study are applied to evaluate the deposition zones of debris flow gullies which are located in Dilee village in Nantou county and Fanlin village in Hualien county, respectively. The deposition zones evaluated by the empirical relations are also compared with that from the field investigation.

（**Keywords：Debris Flow, Deposited Volume, Deposited Length, Deposited Width**）

計畫名稱	地震對崩塌地變遷之影響評估 **Potential and Warning Criterion of Post-earthquake Landslide on Pingtung and Taitung Area, Taiwan**
主 持 人	陳天健 **Chen, Tien-Chien**
計畫年度	**96**

摘　　要

台灣於 921 集集地震後，山區地層因受到地動作用，除於地震當時造成大量崩塌外，於震後接踵而來的颱風豪雨中，崩塌持續擴大也引致眾多土石流的發生。本計畫爲配合山區土石防災之需要，以台東與屏東山區爲主要研究區，考慮其於恆春及台東地震所產生之鬆動土石，在豪雨作用下引致之崩塌趨勢，並進行該地區於地震後崩塌警戒空間與崩塌潛勢分級研究，崩塌趨勢之評估分爲地震後短期（1－2 年）與震後較長期（3－5 年）兩階段。本研究首先以 921 地震地表加速度配合震後 1 年之桃芝納莉颱風全台崩塌資料，建立震後近期崩塌評估準則，而後應用此一準則推估屏東及台東地區短期之可能崩塌情況。震後較長期階段則以民國 93 年七二水災造成全台崩塌之狀況，建立震後較長期崩塌評估準則，並進一步擬訂台東及屏東山地鄉鎮之崩塌警戒基準。

研究成果包括完成台東與恆春等地震研究相關資料收集，進行國內外地震震後崩塌研究文獻蒐集與分析，分析台東與屏東地區震後崩塌之潛勢分級，與完成台東與屏東地區震後崩塌警戒空間與基準研究等項工作。崩塌之潛勢分級成果，分別以恆春地震及台東地震計算出之最大崩塌面積、最大崩塌點數及最大面積百分比，區分崩塌警戒潛勢等級，最後綜合前三項因子，將屏東與台東山區各鄉鎮分別爲高、中、低三等級崩塌潛勢。再者，藉由彙整颱風及豪雨之

崩塌準則，本研究進一步提出各鄉鎮近期與長期之崩塌警戒雨量基準，以供各單位參酌。

（關鍵詞：崩塌、恆春地震、台東地震、潛勢、警戒基準）

Abstract

The study focuses on post-earthquake landslide potential analysis and warning criterion development to two earthquakes, Taitung earthquake and Heng-Cun earthquake. Two stages of potential were considered that the period in 1 to 2 years after earthquake regards as the short term stage and period in 3 to 5 years after earthquake to be as the long term stage. For the short term period, the landslide inventory of Toraji and Nari Typhoon (2001) event, which attacked Taiwan about one year after Chi-Chi earthquake, was introduced to the potential analysis. Alternatively, the landslide inventory of July 2nd flood (2004) was applied to evaluate the landslide potential of long term period. Besides, the landslide warning criterion for the study areas were drafted as well.

The achievements of the study included the database development on geomorphology, geology, landslide event, and etc.; literate review on the characteristic of post-earthquake landslide; landslide potential analysis on Pingtung and Taitung areas; and drafting landslide warning criterion for study areas. Factors selected in potential analysis were the possible maximum landslide area, the possible maximum landslide number, and the possible maximum landslide rate. Based on above factors, the landslide potential for towns in the study area were classified into high, medium, and low of 3 grades. Moreover, the rainfall warning criterion, the accumulation and intensity of rainfall, for both short term and long term periods were drafted for all of town.

（**Keywords**：**Landslide, Heng-Cun Earthquake, Taitung Earthquake, Potential, Warning Criteria**）

計畫名稱	防砂工程之安全設計研究（第二年） **Safety Design of Sediment Control (The Second Year)**
主 持 人	黃宏斌 **Huang, Hung-Pin**
計畫年度	**96**

摘　　要

臺灣地文、水文條件特殊，不能直接引用國外之設計公式情形下，目前第一線工程設計人員在進行梳子壩及防砂壩設計時，皆發現目前規範不足或是不合理之情形。因此，本計畫擬整合國內外相關理論與技術，進行梳子壩土石流巨礫撞擊力模式、防砂壩壩翼斜度之導流研究、防砂壩下游消能設施探討等三項基礎研究，以提升現行工程設計人員之技術。希冀藉由此研究計畫能對臺灣集水區治理及強化治山防災構造物設計技術有進一步之貢獻。

本年度計畫初步結論與建議：

1.由試驗可知，胎面紋路磨損之廢輪胎其緩衝情形較優於胎面紋路完整，推測其原因爲撞擊動量僅在2000N・S以內，而在此範圍內並未達到過度凹陷的狀態，使得胎面磨損之廢輪胎表面較爲胎面完整之廢輪胎軟化，凹陷量明顯增大，致使緩衝效能較佳。若是撞擊動量遠超出2000N・S時，胎面完整之廢輪胎所呈現之緩衝效能將較胎面磨損之廢輪胎佳。

2.彈性理論撞擊力相較其它撞擊力模式力量最大，因爲該理論式係假設在空氣中進行，且未考慮任何摩擦或能量損失。本計畫之鐵球撞擊力範圍介於17.2～41.8(ton)之間，僅符合妙高高原土石流修正式及巨礫撞擊力公式（賴紹文2005）中，0.6m粒徑巨礫以速度3m/s所造成之撞擊力。而土石流巨礫試驗換算現地之最大撞擊力18.4ton，在比對妙高高原土石流修正式 $F=50U^{6/5}R^2$ 及巨礫撞擊力公式 $F=30.8U^{6/5}R^2$ 時，皆未達到0.6m粒徑巨礫

以速度3m/s所造成之撞擊力。

3.由實驗結果知，壩翼斜率的設計對其土砂過壩時之運輸具有束縮效果，唯其僅能降低土砂越壩之量，並不能完全有效抑止土砂越過壩翼上方。當溢洪道斷面不足時，土砂仍會越過壩翼擴及至下游面，其差異僅是越壩土砂量之多寡，壩翼對影響範圍之窄縮非常有限，因此，若欲保障下游地區保全對象安全時，建議設計足夠之溢洪道斷面以宣洩土石。

4.沖刷坑深部分，建議使用會產生最大沖刷坑深情況的壩體上游未淤滿之修正理論式式 $r = 0.9732 y^{0.0436} \left(\frac{3F_y}{2\pi\rho'} \right)^{1/3}$ ；

在護坦設計長度部分，水舌沖擊之水平位置建議使用會產生最大長度的壩體上游淤滿之修正理論式

$$x = H_0 \times \left(\frac{y}{-0.4981 H_0} \right)^{1/1.7006}$$ 。

（關鍵詞：土石流、衝擊力、廢輪胎緩衝材料、沖刷坑）

Abstract

This project is to solve some common and practical problems when engineers design sediment disaster treatments.

1.When the impact momentum under 2000 N · S, cushion efficiency on attrition tire-surfaces is better than complete tire-surfaces.

2. Impact force from elastic collision theory is bigger than the other theory. The maximum impact force of debris flow experiment convert to field is 18.4 ton. Compare with $F = 50U^{6/5}R^2$ and $F = 30.8U^{6/5}R^2$,the maximum impact force is smaller than R=0.3m、V=3m/s.

3. According to the result of experiment, the wing slope of check has concentrate effect for the movement of sediments, but it just reduce the volume of disaster, it can't completely prevent disaster overflow the top of check dam.

If the spillway has not enough cross section, the debris flow would overflow the check dam and spread to downstream. The best way to protect the occurrence of disaster, we suggest to design enough cross section.

4. To calculate the depth of scour hole, we suggest to apply the modified equation with undeposited upstream of the dam to get the maximum depth of scour hole.

Depth of scour hole: $r = 0.9732\,y^{0.0436}\left(\frac{3F_y}{2\pi\rho'}\right)^{1/3}$

Regarding the length of apron, we try to figure out the horizontal position of the over-fall flow based on the modified equation with the silt-up upstream of the dam to get the larger.

Length of apron: $x = H_0 \times \left(\frac{y}{-0.4981H_0}\right)^{1/1.7006}$

（Keywords：Debris Flow, Impact Force, Used-Tire Cushion, Scour Hole）

計畫名稱	坡地監測及防災宣導推廣應用 **Promotion and Application on Slopeland Monitoring and Disaster Mitigation**
主 持 人	張英暉 **Chang, Ying-Huei**
計畫年度	**96**

摘　　要

行政院農委會水土保持局爲推廣在坡地防災監測上的成效，參照相關業務製作遙感探測之應用及土石流警戒監測等二項主題多媒體 DVD，並製作相關防災宣傳品與宣傳摺頁，讓來訪之專家學者與各界來賓能清楚明瞭水土保持局在坡地防災方面之具體成果。

（關鍵詞：土石流、遙感探測、多媒體）

Abstract

To promote the effectiveness of slope land monitoring and precaution against natural calamities, the Council of Agriculture's Soil and Water Conservation Bureau of Executive Yuan designs not only 2 DVDs related to remote sensing application and debris flow monitoring but also publicities and brochures to let professional scholars and visitors to understand its effectiveness clearly handled by Soil and Water Conservation Bureau.

（**Keywords：Debris Flow, Remote Sensing, Multimedia**）

計畫名稱	崩塌坡面緊急監測方法應用研究 **Study of New Method for Monitoring Landslide Movements**
主 持 人	尹承遠 **Yin, Chen-Yuan**
計畫年度	**96**

摘　　要

本研究引進日本土木研究所研發的監測技術，該技術係以十字弓箭裝設反射漆容器，利用十字弓發射至欲進行觀測之崩塌坡面，當十字弓箭射至崩塌坡面，致反射漆容器破裂，在崩塌坡面上留下記號，利用其反射特性做爲觀測點，再以雷射全測站經緯儀進行觀測作業。該監測技術經觀測距離、降雨、及不同材質測試後，發現雷射反射強度會隨著觀測距離增加而降低；而在 250m 觀測距離，且降雨強度超過 10mm/hr 的情況下，雷射反射強度降低約 5%。材質表面粗糙程度亦會影響雷射反射強度，表面愈光滑者，反射強度愈高，但在塗上反射漆後，反射強度均明顯增加，其中以石塊及混凝土（粗糙表面）反射強度增加幅度較爲明顯。另經現場實測結果發現，石塊（岩石）上之反射漆形成觀測目標後，在約 200m 的觀測距離，雷射反射強度均能達到 3%以上，能有效觀測距離，做爲崩塌坡面的位移觀測點。且在超過雷射全測站經緯儀測距範圍之觀測目標(293m)，也能有足夠反射強度，進行距離觀測。在具有岩盤之崩塌坡面，以反射漆著點做爲觀測目標，確實可可增加雷射反射強度，做爲可靠的崩塌坡面監測觀測點，未來可利用全測站經緯儀之追蹤模式，自動觀測及位移量解算分析，可應用於潛在崩塌災害發生前之預警。

（關鍵詞：崩塌、監測、十字弓）

Abstract

This study is to use new method for landslide monitoring based on setting up targets for a total station (laser range) remotely. The target is a glass capsule containing paint and grass-beads which is attached to an arrow and installed by crossbow. Some experiments were performed to test the effects of rainfall, observation distance and different materials. According to data of field experiments, the laser reflection intensity of installed target decreased with distance and rainfall. Laser reflection intensity of targets was greater than 3% at a distance from 42～293m. Based on data of experiments, it is shown that the targets installed at some specific locations in the potential landslide area are suitable for monitoring by using total station (laser range). It is possible to use auto-tracking function of total station for monitoring potential landslide area automatically.

（**Keywords：Landslide, Monitoring, Crossbow**）

計畫名稱	**無線感測網路系統應用於坡地災害監測之研究** **Wireless Sensor Networks and their Applications in the Monitoring of Landslide Hazards**
主 持 人	**盧明智　Lu, Ming-Chih** **王偉彥　Wang, Wei-Yen** **許陳鑑　Hsu, Chen-Chien**
計畫年度	**96**

摘　　要

在近幾年來，因地球暖化現象，而使得氣候有極大的異常變化。地處地震頻繁的台灣島，必須承受颱風和地震的雙重威脅和考驗，坡地滑動及土石流相繼發生。國內相關單位及學術研究，均對大地防災投入極大的人力與物力，也有相當豐碩的成果與經驗，然因量測儀器昂貴、架設及保養不易、量測數據傳輸因監測環境惡劣而無法順暢等因素，使得大面積坡地災害監測未能全面施行。本年度由本團隊所執行之水保局坡地防災資訊應用研究計畫，乃投入全部的資源、能量與技術，期盼能把電子、電機領域的技術及近年來研究成果，轉置到坡地災害監測領域應用。執行本研究計劃初期，係以本團隊原設計架構作爲量測裝置開發的依據，並依據期初及期中審查會委員所提意見及建議，修正爲適合台灣本土所使用的量測裝置，共開發出光電式地滑位移量測裝置、磁簧式地滑位移量測裝置、影像式地滑位移量測裝置與無線感測網路之地滑監測系統等，期使坡地滑動監測之裝置，擁有穩定、準確且造價低、架設容易的優點，進而促成「行動式」坡地滑動偵測系統之早日實現。

（關鍵詞：坡地滑動監測、光電式、磁簧式、影像式、無線感測網路）

Abstract

Because of global warming effect, abnormal change of whether is constantly occurring over the past years. Taiwan, an island situated in an earthquake active zone, has to endure challenges from typhoons and earthquake consistently attacking this island. As a result, prevention of landslide hazards including landslide and debris flow due is a serious topic deserving further investigation. Over the past years, vast amount of resources from both academic and government institutions have been poured into the disaster prevention. Reasonable progress and valuable experience on the prevention of landslide hazards have been obtained over the past years. Hindered by the significant amount of costs, however, including costly monitoring instruments, high set-up and continuous maintenance cost, in addition to problems associated with rigorous environments under monitoring, large-scale monitoring of potential landslides is not fully and successfully implemented. To solve this problem, we have applied the research results that we have accumulated in the fields of electrical and electronic engineering over the past years into the areas of landslide hazards monitoring. In this project, we have investigated the original designs based on the research results of academic papers published and patents granted to the research team members, and have them revised to design apparatus and means suitable for local use in Taiwan, taking account of the examiners' comments raised in the initial and mid-term reviews. Currently, several devices have been developed by our research team, including electro-optical type landslide movement measuring device, reed-switch type landslide movement measuring device, image-based landslide movement measuring device, and wireless sensors network, etc. Effort is currently being made toward the establishment of reliable, accurate, and low-cost devises to realize the objective of a mobile monitoring system for landslide hazards prevention.

（**Keywords**：**Landslide Hazards Monitoring, Electro-Optical Yype, Reed-Switch Type, Image-Based, Wireless Sensors Network**）

計畫名稱	遙測技術應用於坡地地表覆蓋判識之研究 **Application of Land-Cover Classify by using Satellite Remote Sensing Technology**
主 持 人	范正成 **Fan, Jen-Chen**
計畫年度	**96 年**

摘　　要

台灣地區之地形變化顯著，土地利用密集而多變。其中，集水區山坡地均範圍廣大且地勢陡峭，以現地調查方式於人力物力上較不經濟，此時若利用具有廣景攬要、方便迅速特性之遙測影像，即可取而代之，亦符合經濟效益。

肇因於全球氣候變化劇烈之影響，天災頻仍，台灣地區尤以坡地受創最爲嚴重，而坡地災害主要爲崩塌、地滑、土壤沖蝕及土石流等型態，影響之因素眾多且雜，對於集水區經營管理與坡地水土保持實務而言，土地利用/地表覆蓋(landuse/landcover, LULC)之資訊尤其重要，惟傳統上之大類別（如美國地質調查局 USGS level-I 之類別）分類，顯然已不符合需求。爰此，本計畫擬應用遙測影像大範圍、迅速確實之優勢，根據不同地表覆蓋物對入射太陽光具有不同反射之特性，作爲坡地地表覆蓋判釋之依據，配合光譜、紋理特徵(Texture Feature)萃取，整合時間、空間、光譜與感測器特性之多季節、多光譜、多尺度、多感測器分類方法(MultiSeasonal, MultiSpectral and MultiScale classification method, M3S classification method)，以求達到細部分類之高精確分類結果。另外，並利用多時期影像偵測坡地土地利用之變遷(Change Detection)，應用統計檢定理論，探討前後期多光譜影像光譜輻射量之聯合機率分布，並以前期影像光譜輻射量已知之狀況下，後期影像光譜輻射量之條件機率分布，偵測不同顯著水準下之地表變遷像元。

最後經由判釋坡地植生種類及植群分佈後（如竹林、草地、淺根性植物等），進一步結合地形條件、地質狀況、地下水位、降雨量及相關土地利用等資料，分析坡地災害與地表覆蓋之關聯性，以提供相關單位於坡地災害警戒、應變、管理與規劃時之參考。

（關鍵詞：地表覆蓋判釋、變遷偵測、坡地災害潛勢評估、艾莉颱風）

Abstract

Land use / land cover (LULC) is one of the main issues of river basin management. Traditional investigation of LULC is time and manpower consuming. Therefore remote sensing is one of best way to monitor LULC.

This project utilize satellite imagery to classify Sule basin into eight classes including broad-leaf, conifer, bamboo, fruit farm, paddy area, bare soil, building up and water. To make preciously and accuracy classify, we use band spectrum information, texture and vegetation index which integrated multi-seasonal, multi-spectral and multi-scale (M3S). Furthermore, multi-date change detection also applied to monitor land cover change result from typhoon event (AERE).

Results show that LULC classified of SPOT-5 imagery have high overall accuracy and kappa statistics. Change detection can effectively detect real change area. Finally, integrated with LULC, geology, underground water level, rainfall amount and relative information, the relation between hillside debacle and land cover type is analyzed and discussed.

（**Keywords：Land Use/Land Cover Classify, Change Detection, Landslide Potential Assessment, AERE Typhoon**）

計畫名稱	利用遙控無人載具技術進行空拍與視效模擬 **Using Remotely Piloted Vehicle Technology to do the Photography and 3D Simulation**
主 持 人	周天穎　**Chou, Tien-Yin** 葉美伶　**Yeh, Mei-lin**
計畫年度	**95**

摘　　要

遙控無人載具技術(Remotely Piloted Vehicle；RPV)具有機動力強、即時迅速、時效性快及較寬鬆天氣條件即可操作之優勢，因此本計畫根據水土保持局之需求，利用遙控無人載具技術完成 20 處地點之空拍與加值處理作業。根據拍攝地點區域特性可區分爲「環境災害區」、「工程治理區」與「農村建設發展區」等三種類型。「環境災害區」主要拍攝標的物爲崩塌、土石流等災害；「工程治理區」指爲原爲環境災害區，藉由工法施行而使其回復自然生態風貌之地區；以及另外的「農村建設發展區」，乃指近年來水土保持局與轄下各工程所積極推動富麗農村建設地區。此等空拍資訊可有效提供水土保持局即時、廣域之環境輔助資訊，並進行基礎坡地環境資訊蒐集與整體變遷監測分析。

另一方面，爲有效宣導無人載具技術之特性與成效，本計畫以主體性呈現方式製作多元視效動畫，模擬地區以石門水庫集水區爲主，藉由 3D 視效模擬技術，融合多元的知識領域與多類型的媒體元素（如靜態照片、動態影片等資訊），製作出兩式主題知識宣導動畫，此等動畫未來可有效成爲水土保持局防災應變教育之參考資訊。

最後，鑑於水土保持局應用遙控無人載具之技術行之有年，故本計畫爲提供遙控無人載具空拍影像資訊流通之機制，即建置「遙控無人載具技術成果網頁」，此網站資訊除呈現豐富之遙控無人載具技術之應用介紹外，另可提供水

土保持局與各工程所人員便利之影像查詢與下載機制，進而達到資訊共享、流通之效益。

（關鍵詞：遙控無人載具技術、山坡地、視效模擬）

Abstract

Remotely Piloted Vehicle (RPV) technology possesses advantages of mobilization, instant response and non-limitation by strict weather condition. In this project, we used RPV technology to collect the environmental information of 20 hillside areas managing by the Soil and Water Conservation Bureau. According to environmental properties in the 20 hillside areas, it could divide into three types such like “Environmental Disaster Areas”, “Engineering Construction Areas” and “Village Development Areas”. Environmental disaster areas meant collapsed areas or debris flow disaster areas. Engineering construction areas meant SWCB used engineering technology to rebuild and recovery the disaster area. Village development areas meant SWCB managed the village construction region actively. These RPV images could provide SWCB with Instant and wide environmental information, such as, the foundation information collection of the sloping fields and the whole analyses of change and monitor.

On the other hand, to promote the characteristics and achievements of the RPV technology effectively, we made 3D animation which simulated the area called SHI MEN watershed. We used 3D simulation technique and many media elements to make topic 3D animation. The 3D animation can become the educational reference of the disaster prevention effectively.

Finally, SWCB implements RPV technology to build environment information for many years. This project collected the RPV images to establish the “Remotely Piloted Vehicle information system”. The system could show the introduction of RPV technologies and applications. It also provides convenient functions about RPV images query and download for SWCB officers to reach benefits of information sharing and distribution.

（Keywords：Remotely Piloted Vehicle, Slopeland, 3D Simulation）

計畫名稱	九份二山崩塌地觀測計畫（第四年） **Chiu-Fen-Erh-Shan Landslide Monitoring Project**
主 持 人	尹承遠　**Yin, Chen-Yuan** 錢正明　**Chien, Jeng-Ming** 顏厥正　**Yen,Chieh-Cheng**
計畫年度	**95**

摘　　要

根據歷年來之觀測結果，崩塌區裸露岩坡受地表受風化侵蝕及撓曲滑動褶皺之影響，位移呈不規則變動，而地表風化侵蝕迅速，部分區域達 10cm/yr；地層則無明顯位移情形，但可能受撓曲滑動褶皺之影響，地層間產生裂隙，成爲地下水流通之管道，致地下水位對降雨之反應迅速。

九份二山崩塌區殘留土塊，歷年來受颱風豪雨（敏督利、艾利、碧利斯）之影響，發生規模不一的土塊崩移；本(95)年度因碧利斯颱風，崩塌地頭部部分殘留土塊下滑，停留在坡面上，估計土方約 200,000m^3，對龍南道路通行人車造成威脅。頭部尚未崩塌的殘留土塊，以及位於崩塌區西側（樁號 C2A），及東側（樁號 D7、E7）之土層，在颱風豪雨期間也有崩落之可能。龍南道路上、下邊坡，仍殘留超過 500 萬方之土層，土層與岩層間之界面形成潛在滑動面，呈不穩定之狀態，致龍南道路在碧利斯颱風後，修復路段有龜裂現象，日後維護經費高。

堆積區 BH-3 鑽孔之地下水位，對受降雨之反應較爲遲緩，在多次大、豪雨或颱風帶來超大豪雨之後，沒有明顯之上升現象，而在無降雨情況下水位昇高現象，初步研判 BH-3 地下水位應屬岩層之地下水變化，推測一部分受堰塞湖影響外，應另有補注來源。BH-1 鑽孔之地下水位則與降雨之關係則較爲密切，在多次颱風豪雨，地下水位上升幅度均在 1m 以上，且均有有 4～6 日之延遲效應。水位變化屬於較爲鬆散之崩積土層內之地下水變動現象。

堰塞湖湖面水位除直接受降雨之影響，尚有來至其韭菜湖溪所匯集之地表水。在多次颱風豪雨期間，水位會隨降雨強度之大小而迅速上昇；降雨緩和或停止後，水位呈指數曲線下降，顯示溢洪道發揮功效。而湖面水位高程575.25m，似可做爲九份二山崩塌地堆積區警戒之參考水位。

根據前後期 LiDAR 資料，及崩塌前後地形圖之比較分析，溢洪道兩側崩塌位置，大部分發生於地震崩塌前，韭菜湖溪與其支流之匯流處，由於溢洪道大致沿舊河道開挖，但許多堆積土砂之山谷仍是地表水匯集之處，因此颱風豪雨期間，堆積土砂之滲流，導致溢洪道兩側崩塌加速，進一步會造成整個堆積區之不穩定。

龍南道路上、下邊坡，仍有大量殘留土層，建議當中央氣象局於南投山區發布大雨特報後（預測 24 小時累積雨量達 50mm 以上，且其中至少有 1 小時雨量達 15mm 以上），以及大雨過後一週內，龍南道路應管制人車通行；且日後龍南道路若再次崩塌毀損，亦不宜予以修復。另石門觀景台西南側水塘雖已施設填土工程，但於溢洪道邊坡坡腳仍有滲水現象，建議在韭菜湖溪與其支流匯流處，宜進行地下排水工程，以免崩塌持續擴大。

（關鍵詞：九份二山、崩塌地、觀測）

Abstract

According to the results of observation since 2003, there are anomalous surface displacements in the failed area, induced by weathering and surface buckling, and no significant subsurface movement. The fluctuation of groundwater in the BH-4 sensitively responds to rainfalls. Its water level may have less fluctuation at the depth of 1 m during continuous raining. It is inferred that there is a groundwater conduit connecting with a nearby recharge area on the upper part of this unstable slope.

A large block of weathered rock overlaying a slip surface forms the uppermost part of the failed slope. The weathered rock slid down the slope induced by heavy rainfall during Mindulle Typhoon in 2004 and Bilis Typhoon in 2006. The volume of the weathered rock slip down the slope during Bilis Typhoon is about 200,000m^3, it moved down 180m away from the scarp and remains on the upper slope of Lung-Nan Road. The risk of the interested slope remains high because several cracks distribute on the crown, most parts of this failed slope are still unstable.

There are two groundwater observing wells, BH-1 and BH-3, at the deposited area of the landslide. The water level in the BH-3 is often found at the depth of about 39 m; it appears slight variations with rainfall, indicating that the groundwater detected occurs in bedrock and is little recharged from landslide dams. The variation of groundwater level in the BH-1 is closely related to the rainfall; the water level rose up 1~2 m during the typhoon seasons. The time lag for the response of the water level was about 4~6 days. The observed results suggest that the groundwater in the BH-1 occurs in colluviums and is partly recharged from a nearby small landslide dam.

In addition to rainfall, the surface water from stream affects the water level of the landslide dam observed. After heavy rainfall, the water level of the landslide

dam decreased rapidly and generally at the elevation of 575.25 m, it can be used as reference of disaster warning at deposited area.

Locations of collapse at both sides of the spillway are related to the confluence of Jiu-thai-hu stream and its branches, masses of debris on the valley become the path of subsurface flow, and it leads to continuous collapse at both sides of the spillway.

Since most parts of this failed slope are still unstable, especially during the heavy rainfall period, the relative authority should forbid people to pass through Lung-Nan Road after heavy rain forecast announced by Central Weather Bureau, and within one week after heavy rain. Drainage works are also recommended at the locations of confluence of Jiu-thai-hu stream and its branches to maintain stability of deposited area.

（Keywords：Chiu-Fen-Erh-Shan ,Landslide, Monitoring）

計畫名稱	土石流特定水土保持區長期水土保持計畫治理效益評估與運用 **Manage Benefit Valuation and Usage of The Long-Term Water and Soil Conservation Plans in The Debris-Flow Particular Water and Soil Conservation Area**
主 持 人	連惠邦 **Lien, Hui-Pang**
計畫年度	**95**

摘　　要

根據水土保持法第三章特定水土保持之處理與維護得知，對於極需水土保持處理與維護地區劃定爲特定水土保持區，予以優先治理和較嚴格之土地管制作爲，此乃有別於一般水土保持，特定水土保持區特別強調劃定公告、保育重點、管制措施及保護帶設置與補償等事項。經劃定爲各類特定水土保持區之土地使用行爲，除非是攸關水資源之重大建設、不涉及一定規模以上之土地改變、經環境影響評估審查通過之自然遊憩區及農牧使用行爲等不受開發限制外，其他任何開發行爲均被禁止，這使得推動特定水土保持區劃定工作相當不易，即便由管理機關提報劃定者，亦因保護對象爲公共設施或人數較少之區域，使其劃定需要性大爲降低，而失去立法之原意。據此，爲了提高特定水土保持區劃定之績效，除了規範必要的特定水土保持區劃定準則外，對於其廢止計畫中如何證明其存置之必要亦應同時考量，以營造有利於劃定特定水土保持區之社會環境，而特定水土保持區長期水土保持計畫就成爲實現廢止計畫之重要途徑，其對推動特定水土保持區劃定工作之影響相當深遠，不可忽略。本計畫擬針對「土石流特定水土保持區」長期水土保持計畫內容進行檢討及補充建議，期建立其標準內容與範本，尤其是計畫效益評估部分應能提出具體量化之評估模式，以利後續廢止土石流特定水土保持區之依據；此外，本計畫亦擬建

立長期水土保持計畫成果資料庫與地理資訊系統，以提供主管機關和管理機關查詢、統計和分析之用。

（關鍵詞：土石流特定水土保持區、環境影響評估、計畫效益評估、地理資訊系統）

Abstract

According to the water and soil conservation method chapter 3, processing and maintenance of particular water and soil conservation know for needing water and soil conservation processing and delimitation in the maintenance region as particular water and soil conservation area very much and have the initiative to manage with stricter land control Be. This is differing from general water and soil conservation and the particular water and soil conservation area particularly emphasizes that the delimitation announce, raises a point and control measure and protection to bring items such as constitution and repair etc.. The delimitation is the land of each kind of particular water and soil conservation area usage behavior, unless is the major construction concerning water resource, don't involve the certain scale above land change, through environment influence natural recreation area and agriculture that evaluate reviewing pass herd usage's behavior's etc. to be free from development to limit outside, any other development behavior all are forbidden. This makes to push a particular water and soil conservation area delimitation work rather not easy. Even if is delimited by the management organization, also because protection the object make its delimitation needed sex for the district of public facilities or number less greatly in order to reduce, and lose the original intention of lawmaking. On these grounds, for raising the results of particular delimitation of the water and soil conservation area, in addition to the particular water and soil conservation area delimitation standard of standard necessity, abolish a project to it how to prove that it saves to place of the necessity should also consider in the meantime. Be advantageous to delimit the social milieu of the particular water and soiling conservation area by construction. The particular water and soil conservation ward chief expects a water and soil conservation project to become the important path that the realization abolishes a project. Its influence in pushing a particular water and soil

conservation area delimitation work is rather profound, can't neglect. This project draws up to aim at the content that "the mudslide particular water and soil conservation area" long-term water and soil conservation plans to carry on self-criticism and adds a suggestion. Build up its standard content and copy. Particularly the valuation mode that plan that the part of the benefit valuation should can put forth concrete quantity's turning, with benefit follow-up abolish the basis of the mudslide particular water and soil conservation area. In addition, the origin plans to also draw up to build up long-term water and soil conservation project result database and geography information system to provide the supervisor with the organization and management organization search, covariance and analysis of use.

（**Keywords：The Debris-Flow Particular Water and Soil Conservation Area, The Environment Influence Evaluates, Plan Benefit Valuation, Geography Information System**）

計畫名稱	土石流潛勢溪流資料管理與更新(I) **Update and Management of the Potential Debris-Flow Database (I)**
主 持 人	林美聆 **Lin, Meei-Ling**
計畫年度	**95**

摘　　要

臺灣特有之地質、地形及氣象條件符合土石流的基本發生條件，臺灣的土石災害相當頻繁，自民國 85 年賀伯颱風至民國 93 年 7 月 2 日敏督利颱風與七二水災，造成台灣多處土石流及坡地災害。這些土石災害，不僅僅是財產損失，當地居民之生命亦飽受威脅。行政院農業委員會自民國 80 年起至民國 92 年對全台 1,420 條土石流潛勢溪流進行研究調查及現勘現況調查，並於 94 年度由本計畫團隊完成國內之土石流潛勢溪流資料更新與回饋機制草案。

本計畫之目的乃爲強化地方政府對於未來之土石流潛勢溪流資料進行自主管理及運用能力，而爲配合土石流潛勢溪流現地調查時程與各地方政府回報資料更動需要，本計畫預定爲 2 年計畫，本年度爲第 1 年度計畫。本年度以水保局 94 年已完成之土石流潛勢溪流資料更新基準（草案）實際落實於地方政府上，並針對現行之土石流潛勢溪流資料更新與回饋機制草案，予以研擬修正成爲更適合地方政府將來回報新增或解除土石流潛勢溪流之作業；另外重新檢討土石流潛勢溪流之判定方法，並分析土石流潛勢溪流之潛勢等級，以提供作爲將來警戒區域之發布參考。藉由此計畫成果，期使土石流災害防救工作更制度化而有效率。

本計畫重新檢討土石流潛勢溪流之判定方法，利用科學統計方法，選取易取得之土石流地文因子進行分析研究，得到由溪流長度及集水區面積建立之判定模式流程，初步判識率約 62%其餘加上形狀係數及檢核後，判識率可達

68%。另外，土石流潛勢溪流潛勢等級分析，係選取南投縣 101 條現勘後確定爲土石流災害溪流之各項地文、水文、地質等因子，以費雪判別分析，可得土石流危險溪流之潛勢分級，將土石流發生潛勢分爲高、中、低三級，提供土石流警戒發佈區域參考。

（關鍵詞：土石流、南投、區別分析、影響因子、現地調查）

Abstract

The geological settings, geomorphology, and climate conditions in Taiwan deemed the frequent occurrences of debris flow hazards. From typhoon Herb in 1996 to typhoon Mindulle in 2004, significant number of debris flow hazards and landslide occurred in Taiwan, not only caused properties loss but also threatening the lives of local residents. The Soil and Water Conservation Bureau of Council of Agriculture, Executive Yuan, has launched the investigation since 1991, and continued the site investigations and delineation of affected zone of 1,420 potential debris flow torrents in 2003 for debris flow hazard mitigation. In 2005, the drafting of information renovation and feedback system for potential debris flow torrents was completed for continuing up-dating of the database.

The objective of this project is to enhance the local government's abilities of management and application of debris flow torrents potential data, and to precede the site investigations according to feedbacks. This is the first year of a two-year project. During this year, site investigations and evaluations for torrents reported were conducted, and procedures for information renovation and feedback system were modified. In addition, the potential analysis of debris flow torrents was performed using Nan-Tou County as the pilot study area.

The potential analysis of debris flows was conducted using statistics of influence factors, including geology factors, geomorphologic factors, and hydrological factors. The discriminant model was accordingly. The results yielded accuracy rate of 62% and reached 68% by adding shape factor for the 101 debris flows in Nan-Tou County. The results of the Fisher discrimination analysis appeared to be satisfactory for identifying the potential debris flow, and the torrents were classified as high, intermediate, or low potential, corresponding to the accumulated probabilities of larger than 70%, from 30～70%, and smaller than 30%, respectively.

Such information could be used supporting decisions of issuing g warning of potential debris flow areas.

（**Keywords：Debris Flow, Nan-Tou County, Discriminant Analysis, Influence Factors, Field Investigation**）

計畫名稱	土石流整治與生態工法應用之研究（第二年） **Applications of Eco-Engineering for the Debris Flow Treatment (The Second Year)**
主 持 人	黃宏斌 **Huang, Hung-Pin**
計畫年度	**95**

摘　　要

水土保持局近年來致力推動以生態工法之精神進行規劃設計，除要能有效防災以外，生態復育之功效達成與否即爲一重要課題。本計畫整合國內外相關理論與技術，如以 HEC-RAS 進行一維水理演算；以二維之 FLO-2D 模擬土石流流況，瞭解整治工程在水理、泥砂輸送方面發揮之效益，並採用溪流狀況指數評分模式進行土石流防治工程對水域生態影響之檢討，以瞭解現行應用生態工法之土石流整治工程之成效，期能建立適用於台灣土石流潛勢溪流之生態評估模式，作爲土石流整治工程應用生態工法之參考，提升技術人員在辦理有關土石流潛勢溪流整體治理規劃設計時應用生態工法之專業技能。

（關鍵詞：生態工法、土石流、溪流狀況指數）

Abstract

The conservation of water and soil bureau aimed at the potential brook of debris flow control in recent years, devotes to impel the spirit of eco-engineering in carrying on the plan design. Besides the disaster prevention, limited information in whether eco-engineering preserves biodiversity and restores ecosystems is an important topic. This project plans to conform domestic and foreign correlations theory and technology, discusses that how to fit in with the spirit of disaster prevention and eco-engineering at the same time in debris flow control, and examine the effectiveness of using eco-engineering on debris flow control. This project tries to establish an estimate mold of potential brook of debris flow in Taiwan, and be reference of using eco-engineering on debris flow control. This research will not only provide useful information to the reconstruction project but also facilitate relevant personnel's expertise.

（Keywords：Eco-Engineering , Debris Flow, Index of Stream Condition）

計畫名稱	本土型魚道之效益評估 **The Benefit Assessment of the Local Fishway**
主 持 人	郭金泉 **Gwo, Jin-Chywan**
計畫年度	**95**

摘　　要

兩年(1995、1996)共計查勘之魚道數量超過90座，佔台灣魚道總數之69%。就兩年來之調查資料，魚道已經損壞無法運作者，佔有調查資料的34.2%。依據調查資料可知魚道損壞有以下四種情形：一、防砂壩整個遭土石流（或洪水）沖毀，二、魚道本身結構體受損，三、魚道遭土石或樹枝雜物等阻塞，四、河床遭沖蝕，導致魚道基礎懸空無法運作。對於魚道設計有以下幾點建議：1.設在坡度較陡河川上之防砂壩，魚道之設置與否，應該就其效益仔細評估。若需要魚道，設計上建議採用階段式轉折型，2.在較平緩之河川建議採用全斷面階梯式魚道。

爲瞭解台灣本土魚類究竟能否利用魚道順利上溯，本計畫選擇台南縣六重溪的 3 座魚道進行現地的魚類溯游試驗。本年度於六重溪調查河段共記錄到 5 科 9 種 341 尾魚類及 2 科 2 種蝦類。6 號壩魚道溯游試驗結果顯示有 8 種水生生物利用魚道成功上溯至壩上，六溪國小水路式與舟通式魚道溯游試驗結果顯示，水路式魚道僅有鱸鰻、明潭吻鰕虎與粗糙沼蝦 3 種物種成功攀爬上溯。舟通式魚道則有 5 種魚類成功上溯。水路式魚道較適合粗糙沼蝦、明潭吻鰕虎、鱸鰻等攀爬性生物上溯，較適合游泳性的鯉科魚類上溯。就水生動物的溯游而言，水路式魚道與舟通式魚道存在著互補關係，對於不同游泳行爲的生物亦提供了更多樣性的溯游選擇。

回顧日本在推動營造魚類容易進入的河川之模型事業(1991)以後，在日本防砂學會上發表與魚道有關的講演和論文。根據有限制性條件的溯上實驗，推

斷有效果的魚道占大半數。屬於大水庫的小牧水庫之魚道，雖然可能可以讓魚溯上，但最後還是失敗以終，該情形暗示除了要讓魚溯上外，還與各式各樣的要素有關。彙集現有魚道技術之精華而興建的長良川河口堤壩的魚道，據調查魚道效果和堤壩的影響研究者們的意見，均認爲堤壩對香魚、5 月鱒等的生態影響很大，因此對魚道的效果給予嚴苛的評價。以往許多對魚道的評價都是依據限制性條件下的魚類溯上實驗，這是不完備不周延的做法。基於保證讓原本棲息在那裡的魚類不須特別的保護手段，就能有個可完成世代交替的環境之理念，需要有個考量魚道對魚類的生活會帶來什麼樣的影響之綜合性的評價。建議應該要開發依據族群生態學的調查之指針，掌握水系魚類整體的分佈、季節性的分佈與移動、年齡構成和性別比率等，綜合性地評估水庫和魚道的影響。

溪流中的防砂壩是爲了要控制河川侵蝕及砂底之堆積作用而設的，但會使魚類棲地惡化。惡化的主要過程有二：防砂壩阻斷了魚類的通路，而引水溝渠（工程）則減少了魚類棲地環境的多樣性。因此，以一連串低矮壩群結合簡單水池式魚道的方法是很值得採用的。執行適當的溝渠工程，並維持住溪流的自然狀況是可能的，也可同時滿足預防災害，以及保育魚類棲地的共同需要。此外，爲了避免過多的防砂壩工程，去了解防砂壩工程，以及對集水區的運當處理是很重要的。

低矮壩群工法是藉由低落差的構造物來帶給自然環境衝擊最小的工法。日本北海道知床半島藉由設置低矮壩群，增強其周邊土地的安定性，固定植被，然後固定經常水路。此外，因爲是低落差的構造物，對魚類的溯上也不易造成障礙。透過觀測設置於知床半島的低矮壩群工法，進行了與魚道機能有關的查證，整理出問題點與檢討要適用當地時應留意及改良的地方。

（關鍵詞：台灣、魚道、低矮壩群、評估、生態）

Abstract

We field investigated the status of 90 (69%) Taiwan fishways for two consecutive years (1995 and 1996). Near one third (34.2%) of the existing fishway was damaged and can no longer be used. Four different damage types of fishway were found. The first type is the major dam structures were destroyed by debris flows of floods. The second type is the fishway's structure was damaged. The third type is the conduit of fishway was buried by large rocks and/or broken woods. The last one is due to the riverbed erosion. We suggest two recommendations for the future fishway design. First, we should carefully consider and evaluate the feasibility to build fishways in the rivers with steep slopes. Once the fishway should be built, the step-and-turn type is recommended. When the slopes of rivers are mild, the whole section step type fishway should be considered.

In order to understand whether the native fishes of Taiwan were able to utilize fishways for upstream migration, we conducted the experiments on fish migration, using three types of fishways at Liuchong creek. It was found that eight species were able to utilize the no.6 dam fishway for upstream migration, three species at the simple plane type fishway and five species at the Larineir type fishway beside BaiHe township liuxi elementary school. The functions of simple plane type and Larineir type fishways are complementary, they could provide migrant species with multiplicate upstream ways.

Related domestic and foreign documents especially Japan were researched and compiled to gather the latest fishway designs and establish essential references for building sustainable fishways in Taiwan. Fishways (since 1991) in Japan were reviewed and some proposals were made on their improvement. A major problem was lack of a holistic view in the role of fishways. Most fishway evaluations were based on experiments using stocked fish in the fishway to examine possibility of

their upstream movement. In the case of the fishway of Koroaki dam with 79.2 m in height, fish passing through the dam were few in number in spite of the effectiveness of the fishway itself. Several scientists have examined the monitoring data on the fishways of the Nagara Rivermouth Barrage and arguments on the environmental influence of the barrage were made based on their evaluation. The function of fish passage is not the purpose of a fishway but a part of conservation of fish population. We should include dam effect estimation in a fishways evaluation program, for this purpose required are approaches from fish population ecology such as investigation of longitudinal distribution and seasonal pattern of migration in each age of the fish population. Practical guidelines for the method of evaluation should be developed.

Fish habitat in streams is made worse by sabo works which are control of erosion and sedimentation, through two major processes: dams obstruct fish passage and channel works eliminate the environmental multifariousness of fish habitat. Adoption of combination of the method of low dams series and simple pool-type fishway is recommended. Grasping nature of a stream and performing proper channel works in accordance with the nature possibly enables desirable channel works that satisfy both prevention of disaster and conservation of fish habitat. In order to avoid excessive sabo works, it is important to understand sabo works and proper treatment of watershed.

Function of low dam’s series was studied in Shiretoko Peninsula, Hokkaido, Japan. In three sets of the low dams series, pool depth, head (vertical drop between top of a dam and surface of pool formed just below the dam) and total fall (sum of the depth and the head) were measured. Total fall varies in accordance with fluctuation of streambed elevation nearby. When total fall is constant, pool depth and head greatly fluctuate. Low dam’s series thereby can be a barrier to upstream passage for fish. Installing a trapezoid notch to a low dam is efficient for reducing

head temporarily. However, degradation of the streambed possibly causes expansion of total fall and head. In order to ensure fish passage, structure of dam should be modified as follows. Fixation of channel course by making a cut with enough width and depth for flood passage is required. Installation of auxiliary dam is still effective where the next downstream dam prevents excessive degradation of the streambed. Making downstream slope of a dam gentle and extending into the streambed would help fish passage.

（**Keywords：Taiwan, Fishway, Low Dams Series, Evaluation, Ecology**）

計畫名稱	防砂工程之安全設計研究（第一年）－95 年度加強集水區治理及治山防災技術之研究計畫 **Safety Design of Sediment Control (The First Year)－The Study of Enhancing Watershed Management, watershed Protection and Disaster Prevention Technology**
主 持 人	黃宏斌 **Huang, Hung-Pin**
計畫年度	**95**

摘　　要

梳子壩是土石流攔阻構造物中常被採用的方法。台灣目前施做的梳子壩大體上可分爲重力式與懸臂式兩種，本研究由收集資料進行分析，在兼顧安全、攔阻效率及經濟目的，提出懸臂式梳子壩設計上應考量之項目。爲使壩體保持安定，本文針對梳子壩面臨河道中 4 種不同狀況，經由合理之力學計算，分析壩體穩定性。4 種狀況分別爲：空壩時土石流推擊、淤滿後靜土石堆積+最大設計地震、壩體上游土石流淤滿後土石流溢流、壩體上游土石流近淤滿時巨礫撞擊。

由於部分防砂構造物或橋樑橋墩雖依規範設計，仍可能擋不住巨大之土石推移力或衝擊力，所以本研究進行衝擊試驗，模擬防砂構造物前加置廢輪胎緩衝材料，是否能有效地消減撞擊時之能量，以保護結構物之安全。結果顯示，於坡度 40～130 時，皆可降低 93%之最大衝擊力，若於廢輪胎內填充砂石（或細砂）者，則可降低 95%或以上之最大衝擊力。因此廢輪胎緩衝材料具有很好的緩衝、消能效果，可達保護結構物安全之效能。

（關鍵詞：土石流、梳子壩、衝擊力、廢輪胎緩衝材料）

Abstract

Slit dam, is usually adopted to intercept debris flow and thus reduce its impact on downstream areas. There are two main types of retaining structures used for the slit dam design in Taiwan, namely, gravity type and cantilever types. In this study, we collected various design data of slit dams in Taiwan to study the safety issue and the efficiently on blocking debris and building costs as well. To investigate the stability of the cantilever type slit dam, four different conditions were analyzed as follows. 1. Empty dam impacted by debris flow. 2. Full filled dam with normal flow under maximum designed earthquake. 3. Full filled dam with maximum flow. 4. Nearly full filled dam stricken or impacted by huge rock at the top of the dam.

Owing to the fact that certain structures may not survive the impact due to huge falling rocks even when they were designed by codes. It is intended to carry out impact tests on the proposed used-tire cushion materials to evaluate the effectiveness of such devices on reducing the maximum impact force. The results indicate that used-tire cushion material can significantly decrease the maximum impacted force about 95% or higher for slopes between four to fourteen degrees. It is then concluded that these use-tire cushion materials may have excellent potentials to be applied to maintain the safety of retaining structures. As a result, it seems more economically efficient to design retaining structures with used-tire cushion systems than those without used-tire cushion systems.

（Keywords：Debris Flow , Slit Dam , Impacted Force , Used-Tire Cushion）

計畫名稱	建置石門水庫多元尺度環境資源網絡 **Building the Multi-Scale Environmental Network in Shi-Men watershed**
主 持 人	洪本善 **Hung, Pen-shan**
計畫年度	**95**

摘　　要

民國 93 年 8 月的艾莉颱風，由於夾帶豪大雨重創石門水庫集水區，導致石門水庫集水區境內發生多處崩塌災害，緊接而來 94 年的 7 月海棠颱風、8 月馬莎颱風等豪雨事件，繼續淘深與擴大境內原有崩塌區域，誘發更多土石流入大漢溪流域，造成石門水庫因泥沙淤積、溪水混濁，以致無法正常供應自來水，造成經濟影響與災情相當慘重。故鑑於此等災害因素，水土保持局立即積極投入整治工作，但由於石門水庫集水區前期環境資訊較少、以及近年環境變遷遽增，故針對石門水庫集水區地區最新環境資訊之需求亦升高，因此衍生本計畫之概念，建置全面化之環境資訊，以能提供最新環境資訊予治理、復育之有效輔助資訊。

爲能輔助水土保持局進行短、中、長期之水土保持治理計畫，本計畫整合遙感探測、航空測量、雷達測量、全球定位系統等技術，於今年建置多元尺度環境空間資訊，包括有兩期 SPOT5 衛星影像資訊（地面解析度爲 2.5 米與 10 米）、兩期航空照片影像與數值高程資訊、兩期遙控無人直昇機影像、一期空載 LIDAR 技術測得之高程資訊。另外，本計畫利用今年蒐集、建置之衛星影像與航空照片，進行崩塌地判釋與植生復育評估等作業，其判釋成果與前期成果比較，發現石門水庫集水區整體崩塌地有減少趨勢，六大優先治理區也漸有植生復育之成效，可進而顯現水土保持局近期之治理績效。

未來建議將持續性、週期性建置多元尺度遙測影像，並可針對重點區域之

局部地形高程變遷，利用空載 LIDAR 技術進行高程資訊建置，藉以推估土砂量資訊，邇後可將此等資訊整合成多元資訊網絡，並建立集水區坡地格網式監控機制，以提供水土保持局深入分析石門水庫集水區環境，達到全面性環境整治復原之目的。

（關鍵詞：多元尺度空間資料、LIDAR、數值高程、航空照片、遙控無人載具影像、石門水庫）

Abstract

The AERE Typhoon was carried heavy rainfall to Taiwan on August, 2004 and was resulted in a lot of collapsed areas in Shi-Men watershed. Then HAITANG Typhoon and MATSA Typhoon came on 2005 and also eroded collapsed areas deeply and widely. Because those reasons, there were caused more soil and stone flow into the Da-Han river and let the river became muddy with the result that can't supply running water normally. Owing to such kind of disaster factor, SWCB immediately proceeded the recovery work. Because there is no earlier environmental information and the environmental changed quickly in recent years, we built full-scale environmental information in order to provide the effective reference to SWCB.

In order to support SWCB to carry on short, medium and long-term of the water and soil conservation manage project, we integrated remote sensing, aerial survey, LIDAR, GPS to establish multi-scale environmental information. There was including two periods SPOT5 satellite images, two periods aerial photo and DEM, two periods Remotely Piloted Vehicle images, one period LIDAR information. Besides, we used these satellite images and aerial photos to landslide discrimination and estimated the recovery of vegetation. Compared the result with the earlier information, we discovered the landslide already getting less and that approved SWCB good management.

In the future, we suggest there will must build multi-scale remote sensing image cyclically and we can also use LIDAR technology to produce DEM information in some important area to estimate the landslide volume. Then we can integrate these data into diversified information network and built Grid Monitoring

system to assist SWCB to reach full-scale management in Shi-Men watershed.

（**Keywords：Multi-Scale Spatial Information, LIDAR, Digital Elevation Model, Aerial Photo, Remotely Piloted Vehicle Image, Shi-Men Watershed**）

計畫名稱	衛星影像變異點查證網際網路管理系統維護 **Maintenance of Changed Point Areas Inspection and Management System**
主 持 人	蔡明璋　**Tsai, Ming-Chang** 張英暉　**Chang, Ying-Hui** 周天穎　**Chou, Tien-Yin**
計畫年度	**95**

摘　　要

爲有效監測山坡地地表現況之變遷，遏止山坡地違規開發行爲之發生，水土保持局導入現代化的遙測技術、衛星定位系統及地理資訊系統技術，輔助監測山坡地之開發使用行爲，並與違規查報管理資訊系統緊密結合，歷年來衛星變異點輔助山坡地開發行爲監測之計畫已獲致良好之成效。

本計畫爲常態性之系統維護計畫，計畫目的在確保系統能正常順利之運作，並依據使用者建議提升系統功能，計畫執行方向主要在協助水土保持局彙整衛星變異點資料，並透過各種輔導上線機制，提供使用者系統操作使用等各方面之咨詢服務，另一方面進行系統功能提升計畫及建立系統安全性維護機制，務使「衛星影像變異點網際網路資訊系統」能正常穩定之運作，全面提升查證業務效率，達到行政作業電子化及遏止山坡地違規開發行爲之目的。

（關鍵詞：遙測、地理資訊系統、網際網路）

Abstract

Multiple disciplines including RS, GPS, GIS and MIS data survey are used for data collection, retrieval, and analysis in order to efficiently monitor and manage slope land by the Soil and Water Conservation Bureau.

The main goal of this project is to guarantees the system to be stable. Mean while, the functions of Changed Point Areas Inspection and Management System are upgraded and released to every local government units. The inspection efficiency man be increased by the generally participation of every members on slope land management system. All these efforts are used to reach the goal of e-government and to hold back the illegal behaviors in slope land areas.

（Keywords：Remote Sensing, GIS, WWW）

計畫名稱	邊坡穩定生態工程圖冊建置、穩定性分析及效益評估 **Establishing and Development of the Graphic Displays of Ecological Engineering Methods on Slope Stability, Slope Stability Analytical Method and the Appraisal of Effects**
主 持 人	范正成 **Fan, Jen-Chen**
計畫年度	**95**

摘　　要

本研究報告收集各種國內外邊坡穩定生態工程，篩選出台灣本土地區適用之工程進行圖冊之彙編，並將適用於台灣本土地區邊坡穩定植生物種予以分析及分類，針對適用於邊坡穩定各種生態工程之植生物種提出建議。邊坡穩定相關生態工程之穩定性分析及效益評估方法分析部分，以實際之工程案例，進行穩定性分析及效益評估。

邊坡穩定生態工程圖冊彙編部分，報告中收集國內外常用之邊坡穩定生態工程，區分爲邊坡坡面、邊坡坡趾及邊坡排水共三大類 30 種；邊坡穩定生態工法之植物物種分析及分類方面，此部分收集並分析現行台灣地區適用於邊坡穩地生態工程之植生種類，並依其植生物種之特性加以分類。坡地生態工程之穩定性分析方面，區分爲表層穩定分析及淺層穩定分析兩部分探討；在效益評估部分，採用層級分析法做研析，並對於二叭子生態植物公園的實際工程案例，進行現地之穩定性分析及效益評估。

（關鍵詞：生態工法；邊坡穩定；效益評估）

Abstract

In this project, various ecological engineering methods for slope stabilization are to be collected from various countries, compared and suggested to be used in Taiwan. Graphic displays of the methods are to be established and developed, species of the plants which are suitable to be used in Taiwan for slope stabilization are to be analyzed and classified, so that for each ecological engineering method, suitable plants are to be recommended. Practical engineering cases are used to do the slope stability analysis and the appraisal of effects of the ecological engineering methods.

In the compilation of illustrations of this report, thirty ecological engineering methods for slope stability which are commonly used in Taiwan and abroad are collected and clarified into three major categories: slope surface, drainage for the toe of slope, and drainage on the slope. In regard to species analysis and classification of plants used in ecological engineering methods for slope stability, suitable native plants species in Taiwan are collected, analyzed and classified according to their characteristics. For stability analysis, shallow and deep failures are investigated. The analytical hierarchy process is used for the evaluation of benefit, and the practical engineering case of Er-Ba-Tzu ecological arboretum is used to do the slope stability analysis and the appraisal of effects of the ecological engineering methods.

（Keywords：Ecological Engineering Method, Slope Stabilization, Appraisal of Effects）

計畫名稱	土石流防災應變系統維護及推廣計畫 **Maintenance and Promotion on Debris-Flow Disaster Prevention System**
主 持 人	周天穎　**Chou, Tien-Yin** 衷嵐焜　**Chung, Lan-Kun** 辜文元　**Ku, Wen-Yuan**
計畫年度	**94**

摘　　要

台灣位處亞熱帶地區，平均每年遭受 3.5 個颱風侵襲，是全球易遭受颱風災害地區之一。颱風不僅夾帶狂風同時帶來豐沛降雨，且因台灣地區遭逢 921 大地震後使得山區土石鬆動，更容易發生土石流及崩塌災害。有鑑於此，水土保持局於民國 90 年建置土石流防災應變系統並與中央氣象局建立點對點傳輸系統即時接收中央氣象局氣象資料，氣象資料經由系統化分析處理提供土石流災害應變小組做爲土石流警戒區發布參考依據。

土石流防災應變系統歷經 3 年發展，除了提昇整體土石流災害應變效率並減少應變小組輪值人員工作量，並整合水土保持局歷年來所執行土石流災害相關計畫成果，例如：土石流潛勢溪流調查成果、土石流防災疏散避難路線成果…等，提供民眾及國內防災單位完備土石流災情資訊。 除了持續維護應變系統功能確保系統穩定上線使用，爲了使土石流災情管理技術能夠持續往上提昇，本計畫導入資料探勘技術，運用歷次災害之土石流災情查報資料發展土石流災情評估模式；更將導入最新行動電話技術，發展行動式土石流災情查報系統；此外，爲了加強應變小組之應變能力，亦發展線上演訓系統定期施行線上演練，提昇水土保持局與工程所指通管能力。

（關鍵詞：土石流）

Abstract

Taiwan is located in the Asian Torrid Zone, and it is one of the disaster zones of typhoon in the worlds because Taiwan averagely experiences the damages of 3.5 typhoons every year. Besides, after 921 earthquakes in Taiwan, debris became loose and easily happened debris-flow disasters. Thus, SWBC set up the Debris-Flow Disaster Prevention System in 2001 and built up a transmissive system with CWB to receive the instant information from CWB so that SWBC can refer to the information which is analyzed by system to prevent the debris-flow disasters.

The Debris-Flow Disaster Prevention System has experienced three years, including rising up the efficiency of Debris-Flow Disaster, saving time for duty people of Prevention team group, and intergrading the recent achievements of SWBC for Debris-Flow Disaster. This project will use the records of every disaster to estimate the condition of disaster; also, adding the technology of cell phone to develop a system of Debris-Flow Disaster check. In order to enhance the ability of disaster group, it also develops a system for drill online regularly and raise up the abilities of people in SWCB.

（**Keywords：Debris-Flow**）

計畫名稱	以衛星影像進行山坡地變異點判釋 **Identification of Land Use Changes in the Slope Lands Using Satellite Imagery**
主 持 人	陳錕山　**Chen, Kun-Shan** 梁隆鑫　**Liang, Long-Shin** 朱昶任　**Chu, Chang-Renn** 吳沛儒　**Wu, Pei-Ru** 葉明鑫　**Yeh, Ming-Shin**
計畫年度	**94**

摘　　要

台灣地狹人稠，在平地開發漸趨飽和後，已往山坡地區發展；如新社區的開發、農業用地的拓墾、高爾夫球場的設立、新道路的延伸…等，均已改變原有相對較穩定的地貌。由於台灣本島的特殊地質與陡峻的地形條件，在山坡地地區土地之利用及覆蓋開發初期，若水土保持施工不良，則暴雨或夾帶大量降雨的颱風來襲時，表土容易因土壤的含水量超過負荷而產生表土沖蝕，甚至發生崩坍的現象。88 年 921 大地震後，部份地區的表土因地震的搖晃而鬆弛，此現象在暴雨來襲時若山坡地區有非法或不當的新開發區，則更容易造成土石流現象；93 年 72 水災，即造成新竹以南嘉義以北等縣市之災害；本(94)年度海棠、馬莎、泰利等颱風，加上 502、512 及 612 豪雨肆虐，亦讓部分縣市受災嚴重，淹水、土石流、邊坡崩落、交通間斷。因此掌握現有山坡地地區的土地利用變異，以減少非法或不當的開發利用爲當務之急的工作。

本計畫係爲延續水土保持局衛星影像變異點比對之政策，監測山坡地變異情形，以 2 個月爲 1 期，利用 SPOT 系列衛星及福衛二號衛星影像，配合水土保持局提供的輔助圖資，進行變異點比對，並將比對結果輔助縣市政府進行查核，以瞭解山坡地違規使用情形。本(94)年度計畫，共使用六期影像，資料獲取與判釋圖幅數皆符合水土保持局要求。

（關鍵詞：土地利用監測、衛星影像、土地管理）

Abstract

Taiwan Island is of mountainous with high density of population concentrated on a narrow belt of western plain. Human activities are forced to move toward slopping area and even mountains after an overdeveloping of flat plain. These include establishment and construction of local community, agricultural zone, golf course, and road network, among others. The competition of land use with nature leads to landscape change to dramatic degree. The complex geological setting is prone to landslide and soil erosion triggered by torrent storms if soil and water conversation are not well cared. The 921 great earthquake in 1999 further made the soil even more vulnerable to slide and collapse. It has been seen from 2004 “72” Flood event which caused large scale damages from Hsin-Chu to Chai-Yi counties. There are total of 5 Typhoons in this year (2005), including: Haitang (07/16), Matsa (08/03), Talim (08/30), Khanum (09/09), and Longwang (09/30). These Typhoons adversely raged against some counties. Hence, monitoring of land-use change to reduce or prevent illegal and over developments becomes critical for effective and efficient land management.

This project continues the efforts of land-use monitoring carried out by Soil & Water Conservation Bureau (SWCB). Land-use changes were analyzed from SPOT satellite and FORMOSAT-2 images with ground truth and other GIS data provided by SWCB. Reports are then issued every two months to city government for in-situ checks. It is demonstrated that the use of satellite imagery through the current Project substantially enhances the monitoring of land-use change and improves the detection rate.

（**Keywords：Land-Use Monitoring, Satellite Images, Land Management**）

計畫名稱	崩塌地源頭處理技術之研究 **Study on the Treatment Measures in Landslide Source Areas**
主 持 人	林信輝 **Lin, Shin-Hwei**
計畫年度	**94**

摘　　要

本計畫主要針對崩塌地源頭治理之應用事例進行調查，以瞭解崩塌地坡面、堆積區及外緣等環境現況及植被情形，並評估各種應用工法之適用性，建立完整之崩塌地處理相關資料及技術。

本計畫重點工作項目包括：

一、崩塌地環境特性之彙整評估

（一）崩塌地外緣不同之植被類型

（二）崩塌地裸坡面植生處理

（三）崩塌地堆積區植生處理

（四）崩塌地源頭環境特性評估及工法成效評量

二、崩塌地源頭處理工作應用事例調查

（一）簡易型擋土構造物之應用調查

（二）打樁編柵工法之應用調查

（三）播種工法(含噴植工法)應用技術之調查分析

（四）栽植工法應用技術之調查

三、崩塌地源頭處理技術之研發

（一）應用資材之開發研究

（二）協助辦理國內外治山防災暨植生工法應用資材之技術交流

（三）崩塌地處理工法圖說之建置

（關鍵詞：崩塌地、源頭治理、崩塌地處理技術、工法圖說）

Abstract

In order to understand the existing environmental characteristics and vegetation conditions on bare slope, deposit areas and the purlieus of landslide area, this project is mainly focuses on the investigation and analysis of treatment cases in landslide source areas, evaluate the suitability on different engineering methods to establish integrated information and techniques to handling problems in landslide areas.

The main items of the project includes：

1. Compilation and evaluation the environmental characteristics of landslide areas.
   (1)The different vegetation types on the purlieus of landslide areas.
   (2)The vegetation treatment techniques on bared slope of landslide areas.
   (3)The vegetation treatment techniques on deposit areas of landslide areas.
   (4)The environmental character evaluation of landslide source areas and efficiency evaluation of construction in landslide areas.
2. The investigation and analysis of existing treatment cases in landslide source areas.
   (1) The effect investigation of simple retaining structures.
   (2) The effect investigation of staking and wattling techniques.
   (3)The investigation and analysis of spreading seeds (including spurting seeds) techniques.
   (4) The investigation of planting techniques.
3. The development and innovation of treatment techniques apply in landslide source areas.
   (1)The development and exploitation of utilized materials.
   (2)To provide opportunity for technical exchange on utilized materials of domestic and international landslide management and disaster mitigation methods and vegetation techniques.

(3)Compilation of construction drawings of landslide treatment.

（**Keywords：Landslide Areas, Erosion Source Management, Treatment Measures and Techniques, Construction Drawings**）

計畫名稱	落實遙控無人載具技術進行環境監測與災情分析 **Using Remotely Piloted Vehicle to Monitor and Analyze the Environmental Disaster**
主 持 人	周天穎　**Chou, Tien-Yin** 葉美伶　**Yeh, Mei-lin**
計畫年度	**94**

摘　　要

遙控無人載具技術具有機動力強、即時迅速、時效性快及較寬鬆天氣限制條件即可操作之優勢。故本計畫利用遙控無人載具技術，在平時根據水土保持局各工程所指定的重點治理區域，進行基礎坡地環境資訊蒐集。

首先於台中縣松鶴地區、花蓮縣瑞穗鄉舞鶴村、花蓮縣富里鄉安通溪、台東縣鹿野鄉加拿水、台東縣東河鄉都蘭村北郡界、雲林縣古坑鄉華山等區域共執行 7 次任務。期能將此資訊提供後續治理規劃、減災復舊之有效參考依據。

另一方面，由於石門水庫集水區自從去年艾莉颱風，上游地區發生多處崩塌災害，今年又因爲海棠颱風、馬莎颱風相繼侵襲，進而發生民生用水短缺問題。故本計畫同樣利用遙控無人載具技術進行現況拍攝，針對石門水庫集水區境內羅浮、三光、巴陵、玉峰、田浦、下文光、泰平溪、抬耀溪等區域共執行 10 次任務。並將取得影像資料經鑲嵌、幾何校正程序後，進行崩塌範圍判釋與災情量化作業，以提供水土保持局即時、有效之災情資訊。

而後續災況評量中，爲有效呈現土石流災害對真實環境影響情形，本計畫以南投縣水里鄉三廍坑溪爲示範地區，從土石流發生時、土石流災害發生後至現今整治現況，作一整體性模擬呈現，運用 3D 模擬、多媒體包裝等相關軟體，製作一套多媒體教材，可將此成果作爲後續水土保持局進行教育宣導之重要傳播工具。

（關鍵詞：遙控無人載具技術、石門水庫集水區、崩塌地、3D 模擬）

Abstract

Remotely Piloted Vehicle (RPV) possesses advantages of mobilization, quick response, timeliness, and non-limitation by strict weather condition. In this plan, we use PRV to collect the basic environmental information of hill of assigned managing areas according to the Soil and Water Conservation Bureau.

We carry out seven tasks in Central and Eastern Taiwan and expect that the information can be treated as a reference to follow-up management and disaster mitigation.

On the other hand, Typhoon Aere struck the upstream area of Shihmen Reservoir last year causing collapse in many places. This year it attacked by Typhoon Haitang and Matsa in succession, and further caused water shortage. Therefore, we also make use of Remotely Piloted Vehicle to shoot the status in 10 areas within Shihmen Reservoir. After image mosaic and geometric correction, we proceed the collapse range judgment and disaster status qualification to provide the Soil and Water Conservation Bureau a real-time and effective disaster information.

In the follow-up evaluation, for effectively demonstrating the impact on the real environment by debris flow, San-bu-keng in Nantou County is designated as a sample area. In this area, an overall simulated display from the beginning of debris flow disaster to the renovation situation will be made by 3D simulation The result can be used as a multimedia teaching material, which is an important medium of publicity for the Soil and Water Conservation Bureau and the public.

（**Keywords：Remotely Piloted Vehicle, Shin-Men Watershed, Landslide, 3D Simulation**）

計畫名稱	七二水災崩塌地判釋與分析 **Identification and Analysis of Landslide Areas Triggered by Typhoon Mindulle**
主 持 人	陳鯤山　**Chen, Kun-Shan** 梁隆鑫　**Liang, Long-Shin** 朱昶任　**Chu, Chang-Renn** 吳沛儒　**Wu, Pei-Ru** 葉明鑫　**Yeh,Ming-Shin** 陳盈如　**Chen, Yin-Ru**
計畫年度	**93**

摘　　要

台灣地區地勢陡峭，颱風豪雨又多，93 年敏督利颱風及七二水災肆虐後，導致中部地區災情慘重，爲能了解中部 7 縣市崩塌地分布狀況及面積，乃藉由衛星影像判釋崩塌地調查，研判其危險度及建立屬性資料庫，並與水土保持局 93 年度調查成果比較分析，以了解各集水區及土石流潛勢溪流之崩塌地變化狀況及演變趨勢。

依據判釋成果，總崩塌面積 23,748.37 公頃，其中崩塌面積增加之縣市爲：苗栗縣、台中縣、南投縣、嘉義縣；崩塌面積減少之縣市爲：台中市、彰化縣、雲林縣。崩塌地中屬於山坡地範圍之面積佔 2,607.23 公頃，佔總崩塌面積的 10.98%；屬於林班地範圍之面積佔 21,141.14 公頃，佔總崩塌面積的 89.02%。以崩塌規模而言，崩塌處數量最多介於 0.1～0.5 公頃，佔 33.4%；崩塌面積最多介於 2～10 公頃，佔 33%。以坡度而言，數量最多介於 30°～45°，佔 53%；面積最多介於 45°～60°，佔 51.8%。以崩塌地頂部海拔高而言，面積最多在 1,500～2,000 公尺之間，佔 25%。就縣市崩塌之崩塌面積，以南投縣崩塌面積最多的是 13,270 公頃，增加 1,792 公頃；崩塌面積減少最多的是雲林縣，減少 204 公頃。

（關鍵詞：崩塌地、變遷監測、衛星影像）

Abstract

Taiwan Island poses very rough and steep terrain along the Central Range to east coast with only about 30% of plain area along the west coast. It suffers from strikes from typhoon and flushes storms almost every year. The Mindulle typhoon in 2004 July carried heavy rainfalls and raged viciously to the several counties in Middle Taiwan. The aim of this project was to understand and document the caused landslides in the seven counties by means of change detection using satellite images in order to assess the potential risk, to build up the attribution properties, and to compare with the past analysis result by Soil and Water conservation Bureau (SWCB) in earlier this year. It is hoped that we may improve our understanding about the status and trend of the catchments, drainage network, and watersheds.

From the analysis results, it was found that the total landslide area was 23,748.37 hectares. Among them, the increased counties were Miaoli, Taichung, Nantou, and Jiayi, while the decreased counties were Taichung city, Zhanghua, and Yunlin; only 11 %(2607.23 hectares) belong to mountainside range, the others were part of forest area. In terms of the scale by numbers of landslide, mostly were fallen between 0.1 to 0.5 hectares, or about 33.4% in total; if terms of area, areas between 2 to 10 hectares had 33% of the total; gradient at most number is 53% between 30 with 45 degree. It was also found that most landslides were in between 45 to 60 degrees and 25% of them were between 1,500 to 2,000 meters in altitude. It was worth mentioning that Nantou County, the 921 great earthquake sites, wrap up a total of 13,270 hectares, increasing 1,792 hectares from previous report, while the most area decreasing county was Yunlin, amount to 204 hectares in reduction.

（**Keywords：Landslide, Change Detection, Satellite Image**）

計畫名稱	**七二水災災情資訊建置與控管機制提昇** **Building the 72 Flood Disaster Data and Promoting the Management Mechanism**
主 持 人	**楊龍士　Yang, Lung-Shih** **周天穎　Chou, Tien-Yin** **雷祖強　Lei, Tsu-Chiang**
計畫年度	**93**

摘　　要

民國 93 年 7 月 1 日敏督利颱風自花蓮地區登陸後，引進強烈之西南氣流，並造成連日豐沛雨量，進而引起台灣多處山區發生土砂災害，尤以中部地區的台中縣及南投縣等地最爲嚴重。本計畫爲能有效瞭解此次七二水災所造成的災損規模、災害影響範圍等資訊，即運用遙控無人載具技術調查、監測山坡地環境變遷情形與災區現況之即時資訊，以即時推估崩塌面積與土方量資訊。同時蒐集有效災情資訊，並利用 3D 模擬技術將土石流特性擬真化，作爲後續水土保持局教育宣導之重要傳媒工具。

另一方面，爲能提升土石流應變小組人員之作業應變之能力，開發「災害應變主管資訊系統」，利用此系統使得主管級人員能迅速取得災情資訊以進行決策之制訂，減低應變人員操作之負擔。再者，爲能有效即時進行災後復舊之業務，建置「緊急工程控管系統」，此系統功能爲在緊急應變時期迅速進行緊急工程發包，並且能隨時控管監測，提高災後救災之效率。

綜合上述，本計畫配合災害緊急整治之理念，進行各項應變程序資訊蒐集與主要系統建置，其效益爲能提升水土保持局整體應變能力、降低災害所造成之影響。

（關鍵詞：七二水災、土石流、遙控無人載具、應變）

Abstract

MINDULLE Typhoon attacked Taiwan on first July 2004 and took a lot of rainfall to cause the flood, landslide and debris flow disaster, especially in the Nantou county and Taichung county. In order to figure out the range of disaster and count the collapsed areas and quantification, we used the Remotely Piloted Vehicle technology to get the real time images about the collapsed land. And then we collected a lot of effective information to simulate the debris flow state to build the animation which becomes the educational media tool in the future.

On the other hand, we developed the Executive Information System for improving the ability of response. The commander can use this system to make the decision quickly and deduce the pressure of the operators. And then in order to speed up the restored working, we also build the Spatial Engineering Management System. The system can assign the works in the real time and monitor them in anytime.

To sum up, we completed the work projects and could bring the benefit of improving the response ability and reducing the effect of disaster.

（Keywords：72 Flood Disaster, Debris Flow, Remotely Piloted Vehicle, Response）

計畫名稱	九份二山崩塌地觀測計畫（第二年） **Chiu-Fen-Erh-Shan Landslide Monitoring Project**
主 持 人	王文能 **Wang, Wen-Neng** 尹承遠 **Yin, Chen-Yuan** 吳建宏 **Wu, Jian-Hong** 錢正明 **Chien, Jeng-Ming** 顏厥正 **Yen,Chieh-Cheng**
計畫年度	**93**

摘　　要

根據地質鑽探岩心研判結果，推測龍南道路下邊坡有一潛在滑動體，滑動面深度約爲 8～23m，滑動面約略沿著層面發育。但根據孔內傾斜位移之量測結果，至 93 年 10 月截止，尚未發現有明顯位移滑動之現象，有待日後持續觀測來驗證。

九份二山順向坡之地下水位，在降雨過後，地下水位均有上昇之現象，後即呈緩慢下降，而以 BH-4 現象較爲明顯，且水位亦較高，若持續降雨，其水位維持在地表下 1m 上下變化。堆積區 BH-1 鑽孔之地下水位，除受與降雨之影響外，推測應與石門觀景台之堰塞湖水位有關。在敏督利颱風之前，其水位高程之變化在 513.57m～512.28m 間；敏督利颱風帶來超大豪雨，使水位上昇 1.75m；艾利颱風期之超大豪雨，水位上昇 1.0m，兩次超大豪雨均有 5 日之延遲效應。

堰塞湖湖面水位除直接受降雨之影響，應尚有來自韭菜湖溪所匯集之地表水，在敏督利颱風之前，其水位變化不超過 0.6 m；敏督利颱風期間，累積雨量達 1,107.5 mm，水位升高 1.08m，降雨緩和後，水位下降 0.5m，推測可能是溢洪道發揮排水之功效。艾利颱風期間，累積雨量達 542.5 mm，湖面水位升高 0.43m，惟在觀測期間，水位從 93 年 3 月的 589.0m 昇高至 93 年 10 月的 589.51m。

利用現地地形、潛在滑動面位置、地下水位高程資料，藉由極限平衡法(Limit Equilibrium Method, LEM)反算出滑動面強度後，配合上岩盤內不連續面的特徵，導入非連續變形分析法(Discontinuous Deformation Analysis, DDA)模擬九份二山崩塌區順向坡沿潛在滑動面，可能發生的破壞情況，及其影響範圍，模擬結果發現不論是僅考慮到下邊坡的滑動或是全邊坡的滑動時，接近表層岩塊的移動速度與水平距離會較底層岩塊爲大。僅考慮下邊坡的破壞時，鄰接坡趾的窪地足以擔當滑落岩塊的緩衝區，另一方面，塊體間的碰撞、摩擦與邊坡前方的窪地，均可能阻止塊體的前進，而此窪地也正好提供容納崩落塊體的空間。當考慮到全邊坡發生滑動時，滑落土塊的衝擊力會較僅考慮到下邊坡者大，且滑落土石量預計會超過鄰接坡趾窪地的容量，使得土石有機會越過土丘，到達距坡址約爲坡高 2～3 倍處的另一個窪地，此時，崩塌的土石便會影響到觀景台與紀念公園的安全。此外，在探討不連續面強度參數對於破壞行爲的影響時，不論是僅考慮到下邊坡的滑動，還是全邊坡的破壞，凝聚力的改變並不會對邊坡破壞過程產生明顯的影響；然而，內摩擦力的降低則會造成影響區域的擴大。

據位移觀測樁測量結果，D4、E5、E4-1、F5-2、及 F7 等觀測樁，水平位移方向呈較一致性連續性變化，累積變動趨勢較爲明顯，可能爲連續滑動現象。其他各測點之位移變動方向較不一致，位移累積趨勢較不明顯。

堆積區 G1～G5 等觀測樁，於敏督利颱風後水平位移量均超過 10mm，其中又以 G3 位移量達 36mm 最爲明顯，其次爲 G4 的 26mm 次之；垂直位移量亦以 G4 最大，下陷達 18mm。由於 G4 與 G5 係鄰近溢洪道南側邊坡，受敏督利颱風之洪水沖刷，已有局部崩塌之情形。

由於敏督利颱風及艾利颱風期間，位於崩塌區之殘留土石，已有部分滑落，除造成觀測設施之毀損，亦導致龍南道路路基崩落中斷。根據崩塌區殘留土方測繪資料的計算結果，龍南道路上邊坡之殘留土方約 4.6×10^6 m^3，下邊坡之殘留土方約 1.3×10^6 m^3，總計崩塌區之殘留土方約 5.9×10^6 m^3；由於崩塌區頭部與西南側裂隙密佈，其崩落潛在危險仍然存在。有鑒於邊坡穩定性會因不連續面內地下水所產生的水壓或地震所產生的外力而降低，而由 DDA 解析結果得知，當剪力強度因受地震力降到甚低時，滑動塊體的影響範圍便會增大。由

於地震的發生目前尚無法準確預測，不過在豪雨時及雨後至少 5 日內，應禁止人車進入本區，以防止災害發生。

（關鍵詞：九份二山、崩塌地、觀測）

Abstract

The major working items of the second year project (FY93) are including as follows: 1.set-up groundwater monitoring stations; 2.monitoring ground water fluctuation; 3.investigating landslide surface; 4.analyzing slope stability; 5.simulating the post-failure behavior and 6.exploring the ground movement of the Chiu-Fen-Erh-Shan landslide slope.

In the first year project (FY92), an inferred sliding surface was found at the depth of 8 to 23 m below surface in the lower slope near the road named Lung-Nan, which is based on the local landform and boring cores investigations. From the results, the inferred sliding surface developed in parallel with the bedding plane, but not yet to confirm by the monitoring data of inclinometer.

In all monitoring wells, groundwater level was rising after the rainfall and went down gradually. In those wells, BH-4 variation is significant and changes within 1 m below surface when has heavy rainfall. The groundwater level of BH-01 in the deposit area may be affected by the combination of rainfall and the landslide small dam’s leakage. Its groundwater level elevation variation during the values of 513.57 and 512.28m before Mindulle and Aere Typhoons, but after the heavy rainfall caused by two typhoons mentioned before, groundwater levels were rising about 1.75 and 1.0 m, respectively. The response is about five days delay.

The small dam’s surface water level could be affected directly by the rainfall, but also influenced by the Chiuchaihu creek. Its water level change is usually smaller than 0.6 m before the coming of Mindulle Typhoon. After that, the water level was suddenly rising up to 1.08m contributed by the 1107.5mm cumulative rainfall of Mindulle. Then, the water level drawdown about 0.5m drainage from the spillway. During the date of Aere Typhoon coming, its water level was rinsing again up to 0.43m contributed by the 542.5mm cumulative rainfall of Aere.

The post-failure behavior and impact area of Chiu-Fen-Erh-Shan slope along the inferred sliding surface were investigated by using the method of Discontinuous Deformation Analysis (DDA). Simulation results indicate that the depression in front of the toe of the Chiu-Fen-Erh-Shan slope offers a place to trap the sliding rocks acting as a buffering zone when only the failure at the lower slope is concerned. However, the full slope failure involves larger amount of rocks and generates more violent impacts to have further movement than the case concerning only the lower slope. The depression closely in front of the slope toe can no longer have enough space to trap all the sliding rocks, and these sliding rocks have opportunity to damage the memorial park, which is at the distance 2-3 times of the height of the slope. The angle of internal friction of the discontinuities affects the failure behavior significantly, but the cohesion does not. The affected area increases when the angle of internal friction of the discontinuities decreases.

The displacement monitoring results show that the horizontal displacements at points of D4 and F7 presenting individually continuous changes in the same directions and significant trends of cumulative movements. Hence, continuous sliding may occur at these positions but not available at other points.

Horizontal displacement exceeding 10 mm was measured at the monitoring points G1 to G5 individually at the deposit area after the attacking of Mindulle Typhoon. The significant horizontal displacement at G3 and G4 were measured reaching to 36mm and 26mm, respectively. In addition, the largest vertical subsidence, 18mm, occurred at G4. Local failure was found at G4 and G5, which locates at the south slope of the spillway, and was caused by the flood during Mindulle Typhoon.

Part of deposits on the sliding area failed during the Mindulle and Aere Typhoons and damaged the monitoring devices on the slope and the base course of the highway resulting in the interrupting of Lung-Nan Road. The deposit volumes

remain hanging on the upper slope and the lower slope are 4.6×10^6 m^3 and 1.3×10^6 m^3 calculated from the field survey data. The risk of the interested slope remains high because several cracks distribute on the crown and the southeast part of the sliding area.

Part of deposits on the sliding area failed during the Mindulle and Aere Typhoons damaged the monitoring devices on the slope and the base course resulting in the interrupting of Lung-Nan Road. The water in the discontinuities generating water pressure decreases the stability of a slope, especially in the heavy rainfall period caused by typhoons. The DDA simulation results show that the relative authority should prohibit any activities in that sensitive area during or even few days later after heavy rainfall.

（**Keywords：Chiu-Fen-Erh-Shan, Landslide, Monitoring**）

計畫名稱	土石流現地資料蒐集暨觀測示範站維護計畫（第一年） **Maintenance Project of Exemplar Stations of on-site Data Gathering and Monitoring of Debris Flow (Year one)**
主 持 人	李秉乾 **Lee, Bing-Jean**
計畫年度	**93**

摘　　要

自民國 52 年葛樂禮颱風引發台東萱野土石流之後（有記錄之第一場），台灣山坡地的土石流災害層出不窮，使山區民眾生命財產、整體產業經濟、觀光產業及交通運輸等備受土石流的威脅和考驗。民國 79 年歐菲利颱風造成花蓮縣銅門村及榕樹村土石流，釀成重大損傷，引起了產、官及學界的高度重視。尤其是民國 85 年賀伯颱風瞬間誘發南投縣新中橫公路（台 21 線）沿線幾十處規模不一的土石流災害，突顯出台灣本島土石流問題的嚴重性。在民國 88 年 921 集集大地震的助長及民國 90 年桃芝及納莉颱風相繼襲台，在台灣中部及東部地區分別引發空前的土石流災害，使得土石流儼然成爲臺灣本島山坡地土砂災害的代名詞。土石流危害影響層面正逐步擴大，勢將牽動台灣區域經濟環境及山地生態系的平衡發展，故加強土石流各相關課題之研發，以提升土石流預防能力，有其急迫性。其中，土石流現場觀測系統(Debris Flow Observation System)因具有即時掌握土石流發生前預兆和發生時之流動動態，不僅有助於土石流各項學理之發展，在防災應變方面，尤能在災害未發生前即時獲得現場可能變異的即時資訊，可以大幅提升防災應變之減災避災能力。爲此，行政院農業委員會水土保持局已陸續完成十處土石流觀測示範站（九份二山站、郡坑站、上安站、豐丘站、神木站、白布帆東坑站、大粗坑站、鳳義坑站、射馬干站及華山

站）建置計畫，鑒於該項計畫成效優良，且於防汛期間將土石流潛勢溪流地區即時資訊整合於水土保持局土石流防災應變系統，提供各級防災單位決策參考，頗受各界好評，爲期於 93 年度防汛期間能順暢運作，持續進行土石流現地觀測資訊蒐集，以提昇土石流防災應變能力及災情警戒通報效率，並擬於嘉義縣阿里山鄉豐山村及花蓮縣光復鄉大興村等地增設兩處土石流觀測示範站，以增加土石流觀測資料蒐集地點，因此爰成立本計畫，藉由先進量測儀器和高效率傳輸系統，即時追蹤掌握溪流土砂生產、土石流發生及其動態等資料。

（關鍵詞：土石流、土石流觀測站、土石流觀測系統）

Abstract

Since Typhoon Gloria caused debris flow in Shuenyie, Taitung in 1963 (the first of recorded ever), the debris flow disasters on Taiwan's slopelands have never ceased to happen, causing threats and trials to the life and property of mountain residents, overall industril economy and tourist industry and transportation. In 1990, Typhoon Ophelia caused debris flows at Tungmen Village and Jungshu Village in Hualien County, resulting in severe damages which caught the attentive eyes from industries, governments and academy. Typhoon Herb in 1996, particularly, highlighted the seriousness of the debris flow problem in the island of Taiwan by inducing a few dozens of major and minor debris flow disasters along the New Central Cross-Island Highway (Tai-21 Route) in Nantou County. Nurtured by the 921 Major Earthquake in 1999 and the back to back strikes of Typhoon Taroji and Typhoon Nari in 2001, the debris flow disasters took place in central and eastern parts of Taiwan to an unprecedented extent that debris flow became the synonym for earh disasters on slopelands in the island of Taiwan. The affected scope of the hazards of debris flow is gradually spreading, which is likely to shake the balanced development of the economic environment and the mountainous ecosystem in the region of Taiwan; therefore, it is urgent to enhance the research in various issues in relation to debris flow in order to upgrade the ability of debris flow prevention. Among the approaches, the Debris Flow Observation System, which is aware of both the signs before a debris flow and the changing situations during it, is helpful in the development of theories about debris flow, and particularly capable of acquiring the instant information about the possible changes in situ prior to the happening of disasters in regard to disaster prevention and response, so it can elevate the ability of the prevention and response by far. Consequently, the Soil and water conservation bureau of Council of Agriculture, Executive Yuan, has completed the deployment

project of ten exemplar debris flow monitoring stations (Chiufenerhshan, Chunkeng, Shang-an, Fengchiu, Shenmu, Baibufan East Pit, Da Tzukeng, FengYi Pit, Kasavakan and Huashan stations). While this project yields good effects, it also integrates the real-time information on the areas of potential debris flow torrent into SWCB's Debris Flow Disaster Response System during flood-protection periords for the disaster prevention agencies of all levels to use as a reference in decisions, which receives appraisals from many sectors. In view of smooth operation and continuation of on-site observation and information gathering of debris flow to enhance the ability of debris flow disaster response and the efficiency of disaster warning reporting during the flood-protection period in 2004, it was planned to deploy another two such exemplar stations at Fengshan Village of Alishan Township, Chiayi County and Dahsing Village of Kuangfu Township, Hualien County, to increase the sites of debris flow observation and data gathering. Therefore, this project is set out to employ advanced measuring instruments and high-efficiency transmission system to keep track of information like soil and sand production in rivers, and occurrences and changes of debris flow in a real-time manner.

（**Keywords：Debris Flow, Debris Flow Monitoring Station, Debris Flow Monitoring System**）

計畫名稱	**以 SPOT 衛星影像進行山坡地變異點比對判識** **Identification of Land Use Changes in the Slope Lands Using SPOT Imagery**
主 持 人	**陳錕山　Chen, Kun-Shan** **梁隆鑫　Liang, Long-Shin** **朱昶任　Chu, Chang-Renn** **吳沛儒　Wu, Pei-Ru**
計畫年度	**93 年度**

摘　　要

台灣平地狹小人口稠密，在平地的開發逐漸飽和後，人爲的開發利用漸往山坡地區發展；如新社區的開發、農業用地的拓墾、高爾夫球場的設立、新道路的延伸…等，均會改變原有相對較穩定的地貌。由於台灣本島的特殊地質與陡峻的地形條件，在山坡地地區土地之利用及覆蓋開發初期，若水土保持施工不良，則暴雨或夾帶大量降雨的颱風來襲時，表土容易因土壤的含水量超過負荷而產生表土沖蝕，甚至發生崩坍的現象。921 大地震後，部份地區的表土因地震的搖晃而鬆弛，此現象在暴雨來襲時若山坡地區有非法或不當的新開發區，則更容易造成土石流現象；民國 93 年 72 水災，即造成新竹以南嘉義以北等縣市之災害。因此掌握現有山坡地區的土地利用變異，以減少非法或不當的開發利用爲當務之急的工作。

本計畫係爲延續水土保持局衛星影像變異點比對之政策，監測山坡地變異情形，以兩個月爲一期，利用 SPOT 衛星影像，配合水土保持局提供的輔助圖資，進行變異點比對，並將比對結果輔助縣市政府進行查核，以瞭解山坡地違規使用情形。本年度計畫，共使用六期影像，資料獲取與判釋圖幅數皆符合水土保持局要求；縣市政府已回報五期共 1,134 處變異點資料（至 93 年 12 月

20 日），其中 136 處確定違法，違規率達 12%，由此證實本計畫對於國土保護與水土保持方面具有相當程度之效果。

（關鍵詞：土地利用監測、水土保持、土地管理）

Abstract

Taiwan is an island with a high population density concentrated on a narrow belt of western plain. Human activities are enforced to move toward slope land areas and even mountain regions due to the overdevelopment of flat terrains, which house the major social-economic activities. The competition for land leads to a drastic landscape change. The complex geological setting is prone to landslide and soil erosion triggered by torrential storms if soil and water conversation measures are not well implemented. Unfortunately, the 921 great earthquakes even ~~further~~ made the mountainous terrain more vulnerable to slope failure and soil erosions. This has been witnessed by 72 major floods in 2004 which created serious damages across Hsin-Chu to Chai-Yi counties. Therefore, it's critical to regularly monitor land-use changes and to prevent illegal developments over slope land areas.

This project continues government efforts on land-use monitoring carried out by Soil & Water Conservation Bureau (SWCB). Land-use changes were monitored regularly by SPOT satellite images and supplemented GIS data provided by SWCB. Reports are released every two months to city government for in-situ validations. A total of 1,134 changed areas were identified, with 136 sites (12 %) confirmed illegal. It is demonstrated that the use of satellite imagery substantially enhances our ability to monitor land-use change and improve the detection rate.

（**Keywords：Land-Use Monitoring, Soil and Water Conversation, Land Management**）

計畫名稱	松鶴土石流現地資料蒐集計畫 **Project of Debris Flow on-site Data Gathering at Songhe**
主 持 人	李秉乾 **Lee, Bing-Jean**
計畫年度	**93**

摘　　要

松鶴部落位於台中縣和平鄉博愛村，爲大甲溪流域內的泰雅族部落社區之一，此部落地區位居土石流潛勢溪流台中 003 及台中 004 下游處。在 921 大地震之前，松鶴社區亦爲重要旅遊行程景點之一，而地震雖未對松鶴地區帶來嚴重的傷害，但在地震後卻使得松鶴地區產生部分土石崩落，每逢豪大雨，便在松鶴地區造成土石流情形及地層滑動現象。而今年（93 年）7 月更在敏督利颱風所挾帶的豪雨之下，當地遭受土石流嚴重肆孽，造成多間民宅被掩埋，居民約 8 百多人移至博愛國小避難。因此行政院農業委員會水土保持局爰成立本計畫，冀望藉由先進量測儀器和高效率傳輸系統，即時追蹤掌握松鶴地區溪流土砂生產、土石流發生動態等資料，其功能有：

1.採用各項先進觀測儀器及傳輸系統即時觀測掌握土石流的發生及動態資料。

2.以觀測並紀錄累積土石流動態資訊，以作爲日後各項警戒值訂定之參考。

3.具有 ADSL 或衛星傳輸等穩定通訊傳輸方式，可以即時將現場影像及其他物理量傳回應變中心，提供各級決策單位擬定有效的應變措施，以避免土石流致災。

（關鍵詞：松鶴、土石流、土石流觀測站）

Abstract

Songhe Tribe, situated in Bo-ai Village, Ho-ping Township of Taichung County, is one of the Atayan tribal communities within the Dajia River basin. The area around the Tribe is in the downstream of potential debris flow torrents Taichung 003 and 004. Before the 921 Major Earthquake, Songhe community had also been among the important tourist sites; the Earthquake did not cause serious damages to it, however, the area of Songhe was brought some earth avalanches after the quake, which have caused debris flow and rock slide in this area whenever there is extremely heavy rain. In this July (of 2004), the excessively heavy rain brought about by Typhoon Mindulle struck the same area severely, causing a multiple of residences buried and about eight hundred residents relocated to Bo-ai Elementary School for shelter. Consequently, the Soil and water conservation bureau of the Council of Agriculture, Executive Yuan set forth this project, hoping to keep track of information like soil and sand production in rivers, and occurrences and changes of debris flow in Songhe area in a real-time manner via advanced measuring instruments and high-efficiency transmission system. The project has the following functions:

1.observing and comprehending the occurrences and dynamic data of debris flow in a real-time manner by using advanced monitoring instruments and transmission system;

2.observing and keeping record of dynamic information of debris flow as future reference for setting warning values;

3.incorporating stable transmission methods of communication such as ADSL or transmission via satellite, capable of sending on-site images and other physical measurements back to the reaction center real-time for decision units of all levels to formulate effective responsive measures with so as to prevent debris flows from causing disasters.

（**Keywords：Songhe, Debris Flow, Debris Flow Monitoring Station**）

計畫名稱	野溪水理模式之建立與驗證（第二年）

	Development and Validation of Hydraulic Models for a Nature Creek (2)
主 持 人	**李鴻源** **Lee, Hong-Yuan**
計畫年度	**93**

摘　　要

野溪水理演算常以曼寧公式進行設計，曼寧公式較適於定型渠道與等速流，無法計算複雜斷面與水工結構物之水理。本計畫選定台北縣雙溪鄉丁子蘭坑溪整治工程爲計畫範圍，採用 HEC-RAS 模式進行水理演算。該模式因其具備完善之水工結構物水理計算功能，更能有效且實際地模擬分析計畫河段之相關水理因素。

本計畫已在第 1 年度成果證明 HEC-RAS 模式水理模擬之優異性與正確性，本年度延用第 1 年度所建置的不等比模型，試驗河段除了丁子蘭坑溪第一、二期整治工程之各水工構造物之外，新加入丁子蘭坑溪第三期整治工程與櫻滿橋。並利用水工模型，進行拱型固床工局部半動床試驗，測試拱型固床工製造深潭之能力，亦利用水工模型河段進行顆粒起動實驗。

50 年頻率洪水流量下，水工模型實測值與 HEC-RAS 計算趨勢接近，並利用 HEC-RAS 模式，配合現場量測地形，進行其他三條野溪之水理演算。

此外，研究範圍內共架設五處洪痕水尺，作爲無水位資料處水位資料之補強，另於研究範圍內設置一自記雨量計測站，並移動第三號水位計至櫻滿橋上游適當地點持續進行水位觀測。計畫期間內並進行模式之技術研討參訪及教育訓練，並編撰「野溪水理演算應用手冊」以爲野溪水理計畫與設計之參考。

（關鍵詞：水理模式、水工模型、自然野溪）

Abstract

Manning's equation can be employed for hydraulic routing for a nature creek. However, it is suitable only for uniform flow and not for a compound channel even with a hydraulic structure. This project used Din-Ji-Lan Creek located in the Taipei County as an example to simulate the flow conditions using the HEC-RAS model.

Three gauge stations' rating curves of water level and flow discharge were established. Several critical parameters and phenomena including the bed slope, particle size of substrate, conveyance contraction, water fall, and flow meandering were also investigated step by step. In addition, from a mobile-bed point of view, the incipient velocity of riverbed substrates was derived from Shield's diagram.

For the case study of a 50-year return period flood simulation, results were close between physical and numerical modeling.

On the study site, we set up five water level rulers and an auto-recorder to measure rainfall intensity and capacity. On the other hand, the third gauge station was moved upstream of Yin-Man Bridge to take down the water surface elevation. The "Handbook of Hydraulic Modeling for a nature creek" will also be written for the training course before this project concludes.

（**Keywords：Hydraulic Model, Physical Model, HEC-RAS, Nature Creek**）

計畫名稱	集水區整體治理規劃作業研究及土砂生產量推估模式之建立

	Research Among Integral Watershed Management Engineering and Sediment Production Estimation Model Setup
主 持 人	**連惠邦 Lien, Hui-Pang** **林昭遠 Lin, Chao-Yuan** **周天穎 Cho, Tien-Yin**
計畫年度	**93**

摘　　要

由於集水區整體治理規劃不論在內容、演算或分析方法等因欠缺統一的標準和格式，經常造成業務單位之困擾。此外，集水區土砂生產量推估和土砂管理或分配爲表徵集水區整體治理之設計規模，是集水區整體治理規劃工作的首要課題之一，惟因推估不易，且驗證困難，長期以來備受忽視或草率估算。爲此，本研究擬針對「集水區整體治理規劃內容與標準建置」、「集水區整體治理規劃成果資料庫與地理資訊系統建置」、「集水區土砂生產量推估模式之建置」及「河溪泥砂運移監測站建置」等四項課題進行探討。

1.集水區整體治理規劃內容與標準建置

包括集水區概況、水文環境分析、集水區問題分析、治理對策研擬及預期效益評估等五項課題。

2.集水區整體治理規劃成果資料庫與地理資訊系統建置

計畫以業務導向爲考量，整合水土保持局內已有之集水區治理規劃相關資料，包含各類基礎資料、現況資料等，即希望藉由完整之治理規劃成果資料庫，能建立有效率且正確之資料提供機制。

3.集水區土砂生產量推估模式之建置

集水區泥砂生產係指坡面、崩塌地及河溪等三部分之總合，而本研究將採用傳統水土保持技術規範所建議使用之 USLE 公式評估坡面土壤沖蝕量，並再結合本研究團隊先期研究成果所建立之集水區自動劃分技術與衛星影

像獲得之 NDVI 轉換植生覆蓋 C 值之技術，以利坡面土壤沖蝕評估架構科學化及系統化之計算分析，以獲取有效且即時之計算資料。

4.河溪泥沙運移監測站之建置與監測

利用三維地面雷射掃描技術，配合監測站適當觀測位置，並結合控制點佈標與 GPS 測量，將多測站掃描的高精度資料予以連結，獲取災後上游源頭河道整治區的地形資訊，進行點雲資料模型化以提供災前、災後的地形變化分析及水文模擬之輸砂模式驗證用。

（關鍵詞：集水區、治理規劃、標準建置、資料庫、地理資訊系統、集水區管理、土砂生產量推估模式、泥砂、監測站）

Abstract

The estimation of watershed output sediment amount and sediment

management or distribution all symbols the design scale of integral watershed treatment, and also an important work in watershed management, hence it is hard to verify and been roughly estimate in the past. For this reason, this research deals with the standard setup of integral watershed treatment, result database and GIS system for watershed management, sediment output estimation model of a watershed, and finally establish sediment transport monitoring station, and discuss thorough the above four topics.

1.Integral watershed treatment standard setup content

This research basis on field practice needs, and address the fallowing content, including five topic among the general situation of the watershed, hydrological environment analysis, watershed problem analysis, treatment draft and expectation beneficial assessment. Furthermore, this research's main goal includes debris flow disaster prevention, normal sediment disaster, construction maintenance, ecological engineering and environment landscape afforestment, and will classify into many management items.

2.Watershed Renovation Planning Database and Geographic Information System Establishment

This project was design for watershed renovation professional work, the purpose of this project is to build a well database that have highly efficiency and accuracy data providing rules to store and output renovation result data, let undertakers can acquired related reference data any time in future.

3.Establishment for Watershed Sediment Yield Estimation Model

The sediment yield for watershed includes sources from slope land, landslide, and channel bed. Major works for this year focused on collecting and comparing commonly used sediment yield estimation models. For the slope land erosion, the principal theories used in this study are based on USLE equation suggested by Soil and Water Technical Regulations for soil erosion

estimation. From our former research results, the NDVI values derived from satellite images were transformed to C factors. The systematic evaluation was established to quantify calculation processes coupled with watershed delineation. The effective and real-time data can be acquired.

4.The transportation of river sediments and their monitoring

3D laser scanning techniques were applied to two areas of in the watershed, and five scanning stations were set up with geodetic controls as well as GPS measurements. The point clouds generated in these stations were further processed to merge all views into one 3D point model and then converted to the local geodetic coordinate system of TM2.The special and unique feature of 3D laser scanner is the capability of obtaining large amount of accurate discrete 3D points in a very short time. By using a series of datasets taken before and after events, topographic changes can be quantified.

（**Keywords：Watershed, Standard Setup, GIS System for Watershed Management, Sediment Output Estimation Model, Sediment, Monitoring Station**）

計畫名稱	橫向構造物之改良對溪流水理特性影響探討 **Effect of Stream Flow Hydraulics Caused by Improvement of Transverse Structures**

主 持 人	**吳嘉俊** **Wu, Chia-Chun**
計畫年度	**93**

摘　　要

本研究第一年的現場調查與室內資料分析，整體觀之，可得到以下初步結論：

一、泥岩地區野溪整治採用緩降洩水道固床工設計，或於橫向構造物下游基礎加設箱籠內填土袋包，是一項不錯的設計理念。除可以減低溪水越頂的投潭效應、抑止結構物下游淘刷坑的發展外，內裝土袋之箱籠可自然形成濱水植物復育的基地，增加水域的多樣，也提供濱溪生態生存的環境。

二、複式斷面或淺碟式固床工設計在現勘溪流中出現相同的問題，那就是左右兩翼牆上下游的局部淘刷，最深淘刷深度可超過 1m。此乃因爲左右兩翼牆將來水水位提高，徒增結構物上下游間的落差，提供了投潭的機會。可考慮採用「低水水制」設計理念，巧妙地誘導水流流向，束水導流，而拋石改變了整治後溪床斷面的整齊化一單調外觀，使溪流流況更行多樣。

三、橫向構造物因其有效高度的不同，所涉及的水躍現象亦不同。潛流水躍(submerged hydraulic jump)、似投潭水流(pseudo-plunged flow)、水躍等不同水力現象，將於橫向構造物下游產生不同程度的局部淘刷。因此在橫向構造物間距的合理配置上，不建議混合論之。

四、若針對固床工或帶工等低矮的橫向構造物而言，本研究認爲，合理的橫向構造物間距，應以消災減災爲第一優先考量。當溪流因爲整流工程的存在而達到穩定時，才有足夠的條件爲水棲及濱水生態營造復育繁衍的環境。

（關鍵詞：橫向構造物、溪流水理特性、固床工、帶工）

Abstract

Preliminary conclusions can be drawn from the first year field survey and indoor data analysis. They are listed as follows:

I. Low-gradient spillway attached to the apron of groundsills or gabion at the downstream foundation is an effective design to control streambed downcutting in mudstone area. Either method not only helps reduce the energy of plunging flow, control scour at the downstream of the transverse structures, but also create a foundation for aquatic plants to establish that improves the biodiversity.

II. Local scour at up- and down-slope of the wing walls of compound cross-section or shallow-dish groundsill was found in field survey. The maximum scour depth could reach 1m. The main reason was because wing walls helped raise the water stage which in turns increased the drop height and promoted plunging flow to occur. Low-stage groyne could be an option for flow training. Riprap could be another option which created diversity in stream appearance.

III. Different forms of hydraulic jumps can be initiated by different effective height created by transverse structures. The forms of hydraulic jump included submerged-hydraulic jump, pseudo-plunged flow, and typical hydraulic jump.

IV. The migration of disaster should be considered as the highest priority when designing low-drop transverse structures like groundsills; especially when determining the proper spacing between structures.

（**Keywords：Transverse Structures, Stream Flow Hydraulics, Groundsills, Belt Works**）

計畫名稱	土石流防災應變系統擴充提昇（第二年） **Upgrade and Promotion on Debris-Flow Disaster Prevention System (second year)**
主 持 人	周天穎 **Chou, Tien-Yin**

	衷嵐焜　**Chung, Lan-Kun** 辜文元　**Ku, Wen-Yuan**
計畫年度	**92**

摘　　要

行政院農業委員會水土保持局土石流防災應變系統(fema.swcb.gov.tw)於民國 91 年完成第一次提昇後，歷經了當年度颱風豪雨的考驗，使土石流應變作業邁入資訊化、系統化與自動化之里程。爲使本系統得以持續發揮其作用，故需進行維護與提昇部分功能，以增進土石流防災應變能力，達到保護國土及保障全民生命財產安全之目的。由於本計畫工作性質極其專業，因限於人力及專業能力，故委託國內具優良信譽及工作實績之專業服務廠商辦理，本計畫爲求日後系統整合及維護需要，將定爲 3 年計畫。

由於第 1 年計畫主要針對局內防災應變之應用，爲能讓各階層使用者（如中央災害應變中心、地方災害應變中心、一般民眾與土石流潛勢村落民眾）都能夠即時即地(any time, everywhere)獲取最新訊息，因此本年度除繼續擴充應變中心主系統，更強化地方災害應變中心之適用性與行動化(mobilized)之需求。

（關鍵詞：土石流）

Abstract

After finishing the fist upgrade system, SWCB immediately experience the typhoon and torrential rain in the same year. This experience made Debris-Flow

emergency process enter IT-based, systematized and automated. Owing to this project is operating under the specialists and limited human resources and professional abilities, it is a three-year project for the future maintenance need. This year is the second year project.

The first year project aims to the application of bureau prevention; therefore, except for keeping upgrading the system in Prevention Center, the project in this year will put focus on enhancing the application and mobilized request. Also, the usual people could easily get the instant news from SWCB anytime and anywhere.

（**Keywords：Debris-Flow**）

計畫名稱	土石流現地資料蒐集計畫（第一年） **Maintenance Project of Exemplar Stations of on-site Data Gathering(Year one)**

主 持 人	李秉乾 **Lee, Bing-Jean**
計畫年度	**92**

摘　　要

水土保持局目前已完成土石流警戒分區與發生基準值訂定，爲了瞭解土石流地區之實際雨量、現象及發生時間等相關資料，設立土石流觀測示範站，冀能獲得土石流發生之相關資料，做爲基準值訂定與調查之參考依據。土石流觀測系統內容包含潛勢溪流現場架設之觀測儀器、資料接收中心、通訊傳輸、災害應變中心土石流防災應變系統等。

（關鍵詞：土石流、土石流觀測站、土石流觀測系統）

Abstract

The Soil and Water Conservation Bureau has already formulated the thresholds

of the debris flow occurring rate and the phases for debris flow alert. To learn more about the related information such as rainfall, phenomenon, and occurring time, the debris flow monitoring stations are set up to obtain these data when the debris flow occurs. All these data are used as references for investigating, modifying, and defining the thresholds. Debris flow monitoring station consists of monitoring equipment, data-receiving center, communication transmission, and network demonstration system. All the information is offered for decision-making in each grade of disaster prevention units.

（**Keywords：Debris Flow, Debris Flow Monitoring Station, Debris Flow Monitoring System**）

計畫名稱	土石流觀測示範站建立與系統維護工程（第二年） **Maintenance Project of Exemplar Stations of**

	on-site Data Gathering and Monitoring of Debris Flow (Year two)
主 持 人	**李秉乾** **Lee, Bing-Jean**
計畫年度	**92**

摘　　要

水土保持局目前已完成土石流警戒分區與發生基準值訂定，爲了瞭解土石流地區之實際雨量、現象及發生時間等相關資料，設立土石流觀測示範站，冀能獲得土石流發生之相關資料，做爲基準值訂定與調查之參考依據。土石流觀測系統內容包含潛勢溪流現場架設之觀測儀器、資料接收中心、通訊傳輸、災害應變中心土石流防災應變系統等。

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Abstract

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the debris flow occurring rate and the phases for debris flow alert. To learn more about the related information such as rainfall, phenomenon, and occurring time, the debris flow monitoring stations are set up to obtain these data when the debris flow occurs. All these data are used as references for investigating, modifying, and defining the thresholds. Debris flow monitoring station consists of monitoring equipment, data-receiving center, communication transmission, and network demonstration system. All the information is offered for decision-making in each grade of disaster prevention units.

（**Keywords：Debris Flow, Debris Flow Monitoring Station, Debris Flow Monitoring System**）

計畫名稱	以 SPOT 衛星影像進行山坡地變異點比對

	（第一年） **Chang Detection of Landuse for Slope Land Using SPOT Satellite Images (1st Year)**
主 持 人	陳良健　**Chen, Liang-Chien** 陳錕山　**Chen, Kun-Shan**
計畫年度	**92**

摘　　要

本計畫係爲延續水土保持局衛星影像變異點比對之政策，監測山坡地變異情形，以兩個月爲一期，利用 SPOT 衛星影像，配合水保局提供的輔助圖資（基本圖、土地利用圖、道路圖層、縣市鄉鎮邊界圖層、地籍圖等），找出變異區域，進行變異點比對，並將比對結果輔助縣市政府進行查核，以瞭解山坡地違規使用情形。本年度計畫共使用八期影像，資料獲取與判釋圖幅數皆符合水保局要求；縣市政府已回報六期共 1,117 點疑似違規變異點資料，其中 139 點確定違法由此證實本計畫對於國土保護與水土保持方面具有相當程度之效果，可以取締與嚇阻違法開挖，並使山坡地管理方式科技化、數位化與網路化。

（關鍵詞：衛星影像，山坡地，變遷偵測）

Abstract

Complying with the policy of Soil and Water Conservation Bureau (SWCB), this project monitors the landuse changes for slope lands using satellite images. The detection span is two months. SPOT satellite images and the supporting data including basemaps, landuse map, road maps, administration boundary maps, and cadastres are integrated to locate the changed areas. Those areas are then sent to county governments for in situ checks. In the project, eight periods of satellite images have been analyzed. Those eight sets of data meet the SWCB requirements. County governments have reported six periods, where 1117 points were verified on site. One hundred and thirty nines points are assured to be illegal. It has been proven that the proposed scheme is effective in preventing the illegal developments for slope lands. The slope land management could thus be more scientific and digital in the internet environment.

（**Keywords：Satellite Images, Slope Land, Change Detection**）

計畫名稱	野溪水理模式之建立與驗證 **Development and Validation of Hydraulic**

	Models for a Nature Creek
主 持 人	**李鴻源** **Lee, Hong-Yuan**
計畫年度	**92**

摘　　要

野溪水理演算常以曼寧公式進行設計，曼寧公式較適於定型渠道與等速流，無法計算複雜斷面與水工結構物之水理。本計畫選定台北縣雙溪鄉丁子蘭坑溪整治工程爲計畫範圍，採用 HEC-RAS 模式進行水理演算。該模式因其具備完善之水工結構物水理計算功能，更能有效且實際地模擬分析計畫河段之相關水理因素。

爲瞭解 HEC-RAS 模式水理模擬之正確性，本計畫建置一水平比 60、垂直比爲 30 之不等比模型。試驗河段包括丁子蘭坑溪第一、二期整治工程之各水工構造物。水工模型加糙後與 HEC-RAS 之計算結果平均水位高程差低於 0.01m。本團隊並針對斷面敏感度進行分析探討，以了解縱斷面間距與橫斷面測點疏密度對於水理演算之影響。

本年度計畫於研究範圍內架設三支水位計並配合流量量測繪製率定曲線，並針對野溪之陡坡、粗大礫石、跌水、橋樑束縮、渠道蜿蜒效應做一檢討。亦以泥砂啓動之觀點，輔以 Shields' Diagram 建議最大安全流速之設計流程。最後進行模式之技術研討及教育訓練。

本計畫全程 3 年，本年度爲第 1 年。後續年度將以模式修正、最大安全流速、生態工法水工模型、教育訓練爲主要目標。

（關鍵詞：水理模式、水工模型、自然野溪）

Abstract

Manning's equation can be employed for hydraulic routing for a nature creek.

However, it is suitable only for uniform flow and not for a compound channel even with a hydraulic structure. This project used Din-Ji-Lan Creek located in the Taipei County as an example to simulate the flow conditions using the HEC-RAS model. The HEC-RAS model has a complete routing function for hydraulic structure simulation and can therefore present a good estimation of flow conditions such as water depth and flow velocity.

A distorted physical model, with a horizontal scale of 1:60 and a vertical scale of 1:30, was constructed to calibrate and verify the simulation results of HEC-RAS. The variation in water level between physical and numerical models was less than 0.01m after consideration of the riverbed roughness. Sensitivity analysis of hydraulic parameters was also examined to understand the influence of distance of each bathymetry point.

Three gauge stations' rating curves of water level and flow discharge were established. Several critical parameters and phenomena including the bed slope, particle size of substrate, conveyance contraction, water fall, and flow meandering were also investigated step by step. In addition, from a mobile-bed point of view, the incipient velocity of riverbed substrates was derived from Shield's diagram.

（**Keywords：Hydraulic Model, Physical Model, HEC-RAS, Nature Creek**）

計畫名稱	野溪生態調查及棲地改善模式之建置 **Establishment of Ecological Survey and Habitat Enhancement Model for Creeks**

主 持 人	**林信輝　Lin, Shin-Hwei** **蔡志偉　Tsai, Chih-Wei**
計畫年度	**92**

摘　　要

本計畫選取台中縣頭汴坑溪、台北縣牡丹溪及台南縣六重溪集水區爲主要研究範圍，就其生態工法之主要構造物或治理規劃類型，及影響所及之生物群相、景觀結構單元等進行實地分析研究，並建立野溪棲地改善設計參考圖冊及彙整野溪生態調查資料，以作爲生態工程之研究發展及業務推廣之參考。

計畫報告之主要章節包括：

1.野溪自然生態工法應用課題與對策

內容包含落實推行自然生態工法之相關問題分析及野溪混凝土構造物對棲地影響探討。

2.野溪棲地生態調查模式之建置

包含棲地環境與生態調查、野溪生態調查結果與應用及野溪棲地環境自動測站之建立等項目。

3.野溪自然生態工法棲地改善模式與規劃設計

包含野溪河段棲地改善規劃設計、構造物改善設計類型分析、棲地改善規劃設計成果模擬之展示及野溪自然生態工法棲地改善試驗實例。

4.自然生態工法個案彙編

蒐集包括日本 8 篇、德國 2 篇、國內 11 篇，共 21 篇國內外自然生態工法相關案例。

5.研討會與國外考察

包含舉辦國內自然生態工法研討會及國外自然生態工法考察。

（關鍵詞：野溪、生態調查、設計參考圖冊、棲地改善模式、生態工法個案彙

編）

Abstract

There are three sites were chose for ecological related study, which are Tou-Bien-Ken creek in Taichung county, Mu-Dan creek in Taipei county, and

Liou-Chung creek in Tainan county. Base on the types of major structure in creeks, landscape structure analysis around the areas, and field survey data compiled, the habitat enhancement design was drawn which could be modified as reference material for further ecological engineering study and promotion.

1.The issues and countermeasures of the applications of ecological Engineering Method in Stream

Relevant problem analysis of ecological engineering promotion, and the effects of concrete structure in stream habitat.

2.The establishment of stream habitat ecological investigation model

Included the results and the application of ecological investigations outcomes, the establishment of auto-instrumentation station for habitat environment monitoring around Stream.

3.Habitat enhancement model, planning and design of ecological engineering method

Included the categorization and analysis of structural enhancement types, Illustration and simulation of habitat enhancement design works.

4.Compilation of ecological engineering works

There are totally 21 case histories of ecological engineering works were compiled as a handbook. In which, there was 8, 2 and 11 case studies from Japan, Germany and Taiwan respectively.

5.Conference and field trip abroad

A field trip to Germany has been scheduled during 2003, August, 10~August, 21.

（**Keywords：Creek, Ecological Survey, Design Reference Handbook, Habitat Enhancement Model, Compilation of Ecological Engineering Works**）

計畫名稱	土石流觀測示範站建置與系統整合（第一年） **Deployment and System Integration of Exemplar Debris Flow Monitoring Stations**

	(Year one)
主 持 人	**李秉乾** **Lee, Bing-Jean**
計畫年度	**91**

摘　　要

本計畫結合了資訊、通訊、GIS和土石流等專業，建構六處土石流觀測示範站（白布帆東坑、九份二山、上安三部坑、郡坑二部坑、豐丘野溪、神木出水溪），除了採用雨量計量測雨量資料外，亦將地聲檢知器、鋼索檢知器及紅外線攝影機等設備納入土石流前端觀測系統中，以偵測土石流發生前和發生時的動態規律，同時設置地面小型衛星發射/接收站，利用衛星無線傳輸方式將現場觀測資料即時、安全、真實地傳回農委會水土保持局應變中心，提供相關權責單位作爲防救災之參考，亦可提供學術單位進行研究分析。

觀測系統經由不斷測試過程，本團隊依據每一次不正常的訊號進行測試與修正，測試綜合結果如下：

一、影像傳輸的穩定度提昇：爲求CCD穩定品質，本計畫執行期間本團隊已進行多次Video Server軟體修正，目前已趨近穩定。

二、儀器擷取訊號程式的修正：因各觀測站安裝儀器的環境條件不同，因此擷取程式需不斷進行測試與修正擷取靈敏度的參數，達到最佳的訊號擷取效果。

三、衛星通訊傳輸截至目前傳輸非常穩定，堪稱山區較爲穩定的傳輸工具，GSM模組因位於山區傳輸品質較差，某些時候需重複撥接，但仍可撥接傳輸。

四、備援電力截至目前豐丘、上安、白布帆、郡坑、九份二山皆有停電紀錄，備援電力皆可即時供應，目前運作良好。

爲使觀測系統能持續運作發揮功用，本團隊在計畫執行期間將針對觀測儀

器進行定期與不定期的維護工作，定期維護又分爲現地維護及室內作業維護，現地維護是指定期至各觀測站進行雨量計、地聲檢知器、鋼索檢知器、攝影機及資料接收中心維護工作，並詳實紀錄各儀器運作狀況，若遇觀測儀器損壞時，如可以立即修復者，應即刻進行修復，如無法立即修復者，亦應儘速安排時間修復，並通知水土保持局進行會勘工作；室內作業維護內容爲進行內部系統運作整體測試，包含觀測儀器、通訊傳輸、資料接收中心機器及後端整合系統是否正常運作等，若遇儀器或系統有任何不正常的訊息，則即赴現地進行維護或進行系統修改等作業。而不定期維護是將在計畫執行期間每遇颱風警報訊息發布時，即刻進行整個系統測試與維護，以維持正常運作狀態。

（關鍵詞：土石流、土石流觀測站、土石流觀測系統）

Abstract

This project constructed six exemplar debris flow monitoring stations (at Baibufan

East Pit, Chiufenerhshan, Shang-an Triple Pits, Chunkeng Double Pits, Fengchiu Wild Creek and Shenmuchushuei Creek), incorporating the specialties like information, communication, GIS and debris flow. Apart from rain gauge used to measure the rainfall data, geophone, wire detector and IR camera and other instruments are incorporated in the remote-end monitoring system to detect the dynamic rules of debris flow prior to and during its occurrence. Small surface satellite transceiving stations are also set up which send the on-site monitored data back to the Emergency Operation Center of the Soil and water conservation bureau, Council of Agriculture, real-time, safely and in fidelity by radio transmission through satellites. The data are used as reference for disaster prevention and rescue by relevant authorities as well as used in analyses by academic institutions.

The monitoring system are constantly under test. This team has conducted test and correction according to each abnormal signal, and the test results are summarized as follows:

1.Elevation of image transmission stability: seeking stable quality of CCD, this team has made multiple times of correction on Video Server program during the project execution; presently the quality is closer to stable.

2.Correction on signal capturing programs for instruments: due to the difference in environmental conditions for the instruments installed at each monitoring station, the capturing programs require constant tests and corrections on the parameters for capturing sensitivity to achieve the best signal capturing effects.

3.The transmission of satellite communication has been very stable so far, literally the stable transmission tool in mountainous areas. In contrast, the GSM module has inferior transmission quality in mountainous areas, sometimes requiring repeated dialing, yet is still capable of transmission by dial-up.

4.Backup power has kicked in real-time at Fengchiu, Shang-an, Baibufan, Chunkeng and Chiufenerhshan at time of power failure, and is currently working

well.

In order that the monitoring system can maintain in operation and do its work, this team will carry out regular and casual maintenances on the monitoring equipment during the execution of the project. Regular maintenances are divided into on-site maintenances and maintenances of indoor operation; the former refers to periodical visits at each monitoring station to maintain rain gauge, geophone, wire, CCD and data reception center, to keep detailed track of their working conditions, and, in case of damaged monitoring instruments, to repair them at once if allowed, or otherwise to set schedule for repair as soon as possible and notify the Bureau for joint inspection. Maintenances of indoor operation consists of the overall test on the internal system operation, including whether the monitoring instruments, communication transmission, machines at data reception center and rear-end integration system are working normally. In the event of abnormal message in the instrument or system, an on-site maintenance or operation like system modification is taken immediately. Casual maintenances means to carry out the test and maintenance on the entire system upon an announcement of typhoon warning during the execution of the project, so as to remain in a condition of normal operation.

（**Keywords：Debris Flow, Debris Flow Monitoring Station, Debris Flow Monitoring System**）

計畫名稱	梨山地滑地區管理基準值訂定（四） **Establishment of the Criterions for Safety Management of Li-Shan Landslide Area**

主 持 人	**蘇苗彬** **Su, Miau-Bin**
計畫年度	**91**

摘　　要

由於地滑地的安定程度受許多因素影響，也隨著治理工程的進行而會有所改變，爲了有效掌握梨山地區的安全性，避免突發的狀況，造成人民生命財產的損失，應用地滑監測站的即時觀測結果，研擬有效的基準值，作爲長期安全維護的依據，因此實施本梨山地滑地管理基準值訂定的計畫。

本計畫經由現場水文地質調查結果、模式分析、各種地滑監測資料之整理、分析以及各種地滑預測方法之探討，制定梨山地滑區地滑管理基準及監測系統管理方法，提供管理權責單位或工程人員在接收到現地觀測結果時，可據以研判現地的情況，災害是否緊急，而擬定相關之處理對策及有效的長期管理整體監測系統，並經由即時系統顯示警示與研判的結果，供作各級人員於反應與處置時有所依循。計畫歷經 4 個年度，每年依調查分析結果，訂定了適用的管理基準值，並對實施之工程處理與監測系統做成評估與建議，順利完成了施工期間的任務。最後一年度的工作，則集中於整體工程成效的評估與管理準則的確立，除了加強深入對全程施行成果作檢討外，並應與相關單位協商，就長期的整體管理準則與實施方法，及其權責畫分作協調與確立的工作，終而能建立完善的管理體系。

（關鍵詞：建立、管理基準值、梨山地滑）

Abstract

Degree of safety for a landslide area is influenced by many factors. It will

change with the proceedings of remediation work. In order to predict area's safety condition and avoiding accident to occur, establishment of the criterion for safety management purpose is needed. Field monitored data were analyzed to judge the status in regards to safety.

In this project, results of hydrogeological survey, failure mechanism based on analyzed information were put together to be the foundation for the management system. Real time monitoring data are put into the judging rules to predict current safety degree to provide suggestion to response. This was a four years work. Criterion for safety management was set based on monitoring result. At the end, cooperation and information between different departments of the government were suggested to make the system more effective.

（**Keywords：Establishment, Criterion for Safety Management, Li-Shan Landslides**）

第三篇：工程管理
PartⅢ：Engineering Management

計畫名稱	**水土保持局九十五年度工程品質委託抽驗** **Water and Soil Conservation Bureau the Engineering Quality Entrusts to Take out to Check in 2006**
主 持 人	**連惠邦** **Lien, Hui-Pang**
計畫年度	**96**

摘　　要

本計畫預定執行工程品質抽驗件數總計 420 件（含混凝土鑽心檢驗、AC 厚度檢視及外觀尺寸檢視等），其中如有適當工程可以執行塊石及厚度檢測時，亦應於 420 件中分別實施鑽孔檢測塊石計 24 件，厚度穿透檢視計 67 件。惟因受到圈選工程進度落後、土地取得、因故取消工程、道路交通、..等影響，致使實際完成工程品質抽驗件數僅達 412 件，其中混凝土鑽心計有 366 件，外觀尺寸檢視計有 46 件，鑽孔檢測塊石計 22 處，厚度穿透檢視計 75 處。因此，在混凝土鑽心檢驗完成率僅達 98%，鑽孔檢測塊石完成率達 91%，而厚度穿透檢視完成率達 100%。

經抽驗結果顯示，在全部 412 件完成工程抽驗中，有 366 件施作混凝土鑽心試體抗壓強度，抗壓強度不合格工程計有 10 件，合格件數達 356 件，合格率高達 97.26%；而 22 處壩體含塊石鑽心檢測計有 1 處不合格，75 處厚度穿透檢視有 2 處不合乎設計規定（本處亦爲混凝土抗壓強度不合格之工程）。因此，統計本年度所有工程品質抽驗結果得知，412 件抽驗工程中，不合格件數 12 件，合格件數達 400 件，合格率高達 97.08%。

（關鍵詞：工程品質、工程抽驗）

Abstract

The performance engineering quality of this project default takes out to check an amount total 420. (Contain the examination of the size of examination and appearance that concrete drills a heart examination, AC thickness etc.) Among them, if is fit while canning use to carry out to have the examination of the rock and thickness, the engineering should choose 24 to carry on in 420 whether have a piece of examination of stone, choose 67 examinations that carry on thickness. The end physically completes of the engineering quality take out to check of the amount is total 412. Have 366 among them is carry on concrete to drill heart. Having 46 is the examinations of size that carries on appearance. Having 22 is the examinations that carry on having rock. Having 75 is the examinations that carry on thickness. The concrete drills the completion rate of heart examination to reach to 98%. The completion rate that has a stony examination reaches to 91%. And the completion rate of the examination of thickness reaches to 100%.

The whole examination shows as a result. After completing 366 examinations that the concretes drill heart to try a body anti- to press strength. The anti- presses the strength unqualified ground to totally have 10. The qualified amount contains 356.After completing 22 to have a stony examination. There is unqualified one. After completing 75 examinations of thicknesses. There are unqualified 2ses.By all accounts, in 412 pieces take out check the engineering. The unqualified number of items is total 12. The qualified number of items is total 400. The qualified rate is 97.08%.

（Keywords：Engineering Quality, The Engineering Takes out to Check）

計畫名稱	永續生態村規劃與效益評估 **Planning, Design and Benefit Evaluation of Sustainable Eco-Village**
主 持 人	歐聖榮 **Ou, Sheng-Jung**
計畫年度	**96**

摘　　要

近幾年來，台灣多數的農村社區面臨轉型的議題，未來如何發展才能同時兼顧永續與社區居民需求是所有社區追求的目標。根據國外成功的案例與相關研究的結果，本計畫倡導以「生態村」(Eco-village)的理念，作爲社區發展的指導原則，以求得社區之自然資源永續利用、居民生活需求的滿足與品質的提升，並且使社區產業經濟得以獲利均衡。

本計畫之規劃目標，係以農村社區爲單位，制定社區發展之上位計畫，本計畫延續 95 年度完成之成果，選擇具生態村發展潛力的台南縣龍崎鄉牛埔社區與雲林縣林內鄉的湖本社區作爲今年度之示範操作地點，根據目前已建構完成之指標與示範操作模式進行規劃。此外，透過指標效益評估分析瞭解居民對生態村概念的接受程度、居民對各面向的配合度、實際執行時困難度較高的面向…等，以作爲面向指標修正的依據，並建立適用於鄉村地區的分期分區執行計畫。

實質示範操作分爲七大面向，針對牛埔社區及湖本社區的現況提出規劃建議。土地計畫方面，建議社區就現有開發區進行開發，並盡可能分出生活、生產、生態區以減少對自然環境的干擾。居家環境方面，建築部分應宣導改用省能環保形式與資材，並使用省能省水之家電設施，環境部分建議使用生態性綠化改善私人庭院。資源利用方面，應鼓勵環保行爲，並推行替代能源使用。交通運輸部分，創造舒適的候車空間並推行共乘制度，盡可能減少汽機車使用

率。生態環境部分，劃設出具潛力的棲地與廊道，並營造多孔隙之生物棲息空間。社區發展部分，透過活動舉辦增加居民情感，鼓勵居民參與社區各項事務。經濟產業部分，運用社區固有之自然及人文資源開發社區特色產業，並透過專業包裝行銷推廣，使特色產業成爲社區經濟來源。透過上述規劃手法，來形塑能與環境共生、永續發展的健康社區。

效益評估結果顯示，居民對於生態村政策的執行多願意配合。結果亦顯示生態村的七大面向是適合用來指導台灣鄉村聚落的發展。指標的檢驗則指出：居民對於經濟產業有極大的期許，可能原因是一級產業已無法提供鄉村社區足夠的工作機會，因此居民希望尋求替代產業增加社區工作機會。這部分結果與國外生態村狀況不同，若要在台灣發展生態村概念，經濟產業的提供成爲一項重要的關鍵因子，故本研究在經濟產業面向加入「社區特色產業」這項指標。

雖然結果指出居民對七大面向的配合度都很高，但土地計畫與交通計畫的分數相對較低。所以在推動生態村的建構時，應將土地計畫與交通計畫列爲需長期經營的面向。實際推動生態村的建構時，各面向執行期程如下：1.短期—著重社區發展、居家環境、資源利用與土地計畫四大面向：2.中期—著重社區發展、資源利用、交通運輸、生態環境和土地計畫與經濟產業六大面向。長期—對七個面向做通盤全面的考量。

（關鍵詞：生態村、效益評估、綠建築）

Abstract

In the past few years, most of rural communities in Taiwan faced the issues of economic restructuring. The major goals of the rural communities are to create a sustainable development and satisfy residents' living demand simultaneously. According to the successful projects and relational researches, we initiated that the concepts of ecovillage could be used to plan the rural communities in Taiwan. Two major tasks were done in this study. First, the study selected two sites, Niu-Pu community and Hu-Ben community, for operating practical planning based on the indicator system and the planning model built last year. Second, we assessed the benefits of indicator system by residents' questionnaire survey contents. The contents of questionnaires included cognition of ecovillage, attitude of participate in ecovillage's planning, and the motive of participation. Based on residents' responses, we added the "feature industry of community" in economic industry dimension. At the same time, we built a process for practicing planning that suits the condition of rural communities.

（**Keywords：Eco-Village, Benefit Evaluation, Breen Building**）

計畫名稱	**行動式土石流觀測站維運管理暨功能提升計畫** **Operating Management and Updating Capability of Mobile Debris Flow Monitoring Station**
主 持 人	**李秉乾** **Lee, Bing-Jean**
計畫年度	**96**

摘　　要

行動式土石流觀測站維運管理暨功能提升計畫乃針對水土保持局現有之 2 組行動式土石流觀測站進行維護管理工作，包括提升行動式土石流觀測站的功能以達自主行動營運的目標，同時持續針對全台土石流潛勢溪流進行調查及現勘，提出 20 處可架設行動式土石流觀測站的潛勢溪流；此外本計畫建立了衛星定位回報展示圖台系統，藉由 GPS 資料即時傳回並展示行動式土石流觀測站的位置以提供後端管理人員掌握行車動態。爲確保觀測工作順利進行，執行期間反覆進行多次儀器設備測試工作以及模組化儀器的運作，並於颱風、豪大雨來臨前後，積極調整儀器設備及檢測作業，務必使得各觀測儀器能於惡劣天候下仍能正確無誤的完成土石流事件觀測工作，期間並配合水土保持局災害應變中心開設作業，在本年度完成 0604 豪雨、帕布暨梧提颱風、聖帕颱風、韋帕颱風及柯羅莎颱風等災害期間的觀測工作，尤其針對雲林縣林內鄉坪頂村的邊坡崩塌執行行動式觀測站的派駐，嚴密監控當地降雨量及現地影響，提供防災疏散決策參考的指標。目前行動式土石流觀測站所蒐集到的雨量資料、地聲資料及影像資料皆已回傳至水土保持局儲存，且完成資料蒐集分析工作以利政府及相關學術研究單位進行台灣地區土石流現象研判與分析，研發防範土石流災害之學理依據。

（關鍵詞：土石流、行動式土石流觀測站）

Abstract

The plan title "Operating management and updating capability of mobile debris flow monitoring station" is set forth for Soil and Water Conservation Bureau's 2 mobile monitoring stations. The key tasks of the plan include updating capability to reach mobile operating purpose independently of mobile monitoring system. We continually survey and investigate on all the high potential debris flow hazard streams spread over Taiwan and decide the 20 high potential debris flow hazard streams which can set-up the mobile monitoring station. The plan also build the internet map system with GPS and by sending back the real-time GPS data to display the position of mobile monitoring station and handle mobile station for manager.

For ensuring the task smooth going, we carry on numerous operations of instrument, repeatedly test instrument function and equipment of mould during observations. Before and after the torrential rain and typhoon, we adjust and maintain instruments to ensure the event of debris flow task is correct and finishes during the emergency response center alert period.

We finish the observation of 0604 torrential rain, PABUK-WUTTP, SEPAT, WIPHA and KROSA Typhoons in this year. In Yun Lin County's Ping Ding Village of Lin Nei, we especially carried out the landslide disaster of mobile monitor. We collect rainfall and images to provide the government with reference of disaster emergency, evacuation, and refuge.

The mobile monitoring station collect the rainfall, geophone and CCD camera data had sent back and stored up in SWCB. The data will be provided to government agencies and academic organizations in order to develop the theoretical base for debris flow prevention countermeasures.

（Keywords：Debris Flow, Mobile Debris Flow Monitoring Station）

計畫名稱	治山防洪綱要計畫研擬與規劃決策系統建置 **Watershed Management and Flood Mitigation Policy and Developed of the Decision Support System**
主 持 人	**譚義績 Tan, Yih-Chi** **林永峻 Lin, Yong-Jun** **張源修 Chang, Yuan-Hsiou** **邱昱嘉 Chiu, Yu-Jia**
計畫年度	**96**

摘　　要

台灣於民國 88 年之 921 大地震造成山區地質鬆動影響地質穩定，常於颱風或豪雨造成山區土石流與崩塌問題，造成山地部落之交通中斷甚至整個山地社區安全之威脅，故山區之治山防洪早已成爲我國國土復育與發展重心之一。本計畫主要內容爲治山防洪綱要計畫研擬與規劃決策系統建置，可分爲四個部分，一、治山防洪規劃資料庫建置；二、治山防洪綱要；三、管理決策支援系統建置；四、教育訓練。

治山防洪規劃資料庫建置部分，本計畫已完成治山防洪規劃資料庫之擴充，作爲後續資料交換平台之基礎，同時已將現有治理規劃成果之文數字資料轉入擴充後之資料庫內。另外，資料交換平台之登錄上傳模組已開發完成，並透過「水保局現有集水區規劃成果彙整」工作項目進行測試修正，資料完整性檢核機制已完成規劃設計作業。同時也以完成水保局現有集水區規劃成果彙整、水土林資料庫整合作業、治理規劃與水土林資料展示模組與協助河川界點劃分檢討作業等工作。

台灣地區治山防洪綱要草案，草案內容包括：緣起與願景、災害概況及原因分析、需要性及迫切性、綱要原則與目標、綱要實施策略及措施、配合措施與預期效益共七大項。並建議分四期實施，前三期配合「水患治理特別條例」

第一至三階段實施，第四期時間由民國 103 年至 106 年。各期實施應配合「國土復育條例（草案）」及「國土復育策略方案暨行動計畫」精神，以「水患治理特別條例」爲「治山防洪綱要草案」研擬之依據與修正基準。此綱要草案建議修正以往「工程萬能」的迷思，配合非工程方法，並強調生態保育並重，可爲建立災害治理時之指導方針。

本計畫建立之管理決策支援系統建置部分，在集水區治理土壤沖蝕方面，不只可以將目標放在鎖定的次集水區，更可以聚焦在某個特定的小範圍區域上，達到事半功倍之效。也藉集水區土壤中銫 137 的空間分布，可判讀出集水區土壤沖蝕與河道泥砂產量的來源，減少現場暴雨量測的危險性，提供另一個探討土壤沖蝕量的方法；而土壤沖蝕率的空間分布圖，可作爲集水區保育的參考依據。在崩塌地產砂量推估上，主要利用坡面的數值高程資料來估算崩塌體積，並找出影響崩塌地體積變遷的因子，然後再進行迴歸分析。使用決策支援系統，可簡化圖層分析處理流程，量化決策方針，眾方案間之比較，幫助決策者有效率地發揮及運用已有各種地理空間資訊，充份利用系統內相關空間圖層，並歸納出有意義之資訊協助決策者判斷狀況，使決策者在有限整治經費、人力、物力或時間下，可參考決策支援系統之模擬結果做到最佳判斷。

本年度之「治山防洪綱要計畫研擬與規劃決策系統建置」主要研究範圍爲 30 個原住民山地鄉爲主要標的，相關工作已順利完成，而未來建議繼續以原住民平地鄉爲主要研究方向，完成全台灣治山防洪綱要計畫的研擬。

（關鍵詞：治山防洪綱要、地理資訊系統、決策支援系統）

Abstract

After the 921 Earthquake, with a Richter magnitude scale of 7.3, struck central Taiwan on September 21, 1999, the fragile soils, frequent floods and debris flow made homeland resources even weaker. The dense population of Taiwan has forced the inhabitants to use mountain hills for agriculture and development in the past. Flood 92, which entailed vast monetary losses and casualties in 2004, caused the government to rethink its strategy for land use. This project content four parts, first, database construction of plan for flood control of transforming mountains; Second, Watershed Management and Flood Mitigation Policy; Third, manage the construction of DSS; Fourth, education and training.

The Database of watershed management and disaster prevention is established as the basis for data exchange platform. All Alphanumeric data of achievements is imported into the database. Besides, the data upload module of data exchange module is developed, tested and fixed while the planning and design of data integrity auditing mechanism is completed. Otherwise, the work items include collecting the planning results of existing reservoirs, integrating database from different sources, building demonstration module of planning and management, and the delimitation and review of river boundaries are all carried out in this project.

The watershed management and flood mitigation policy, In order to use land in a more efficient and eco-friendly manner, the Council for Economic Planning and Development (CEPD), Executive Yuan, proposed the “Land Recovery Strategy and Action Plan” in 2006. The core concept is: “To respect Nature and to adapt to Nature”. To achieve this goal, a hillside watershed management and flood mitigation policy in Taiwan was proposed. Safety, economy and ecology issues are included in the policy. The strategies and measures of the new policy combine in a chart for

better understanding and can be referenced by other countries with similar conditions. Along with the efforts and cooperation of different countries and sharing information and techniques, we have a responsibility to help the earth to restore itself and allow sustainable development for all living things.

A decision support system (DSS) for watershed management was developed to decide the management priorities for landslides and soil erosions in the Yufeng watershed. Based on the soil redistribution map from isotope 137Cs technique, we can focus on the specific area to save the time and manpower, identify the sediment sources, avoid the dangerous field work during typhoon events and supply an alternative to estimate soil erosion rates. In addition, we estimate landslides volume by using Digital Terrain Model (DTM) from the total station measurement on the slope and find out the key factors to lead to landslides volume changes from the regression analysis. At last, a DSS is therefore developed to help planners analyze the hot spots in a faster way instead of time-consuming field checks for all the landslides. In the DSS, the distances between landslides and the buildings or the roads, sediment yields from landslides and the sediments delivery ratio are the factors to consider. The DSS which produces scenarios can help managers design the strategies to save the manpower and time, especially with applications to the larger spatial scale. The priority map of watershed management with the budget calculation can save the managers' time by focusing on important areas. The combination of using GIS and field data can successfully identify the priority areas to managers.

This "Watershed Management and Flood mitigation Policy in Taiwan" the research range to be in the mountain region township of 30 aboriginals, it already finishes smoothly to work relevantly, and propose continuing regarding aboriginals level land township as the main research direction in the future, finish the watershed

management and flood mitigation policy.

（**Keywords：Watershed Management and Flood Mitigation Policy, Geographic Information Systems, Decision Support System**）

計畫名稱	集水區植生群落調查與應用手冊 **The Manual of Watershed Vegetation Survey and Application**
主 持 人	林信輝 **Lin, Shin-Hwei**
計畫年度	**96**

摘　　要

本手冊依據水土保持技術規範之說明，「植生群落調查」應包括定性描述及定量分析植物及植物社會在環境梯度上之分布情形。由於植生及其生育地之資料可做爲植物資源調查樣點的基本單位，故記錄植物群落可供集水區進行植生導入作業時，選取符合經營與管理決策之適用植物；同時可做爲未來植物或植物社會變動的參考依據，提供集水區調查植物群落之評估因子。

基於上述植生群落屬性對集水區經營管理上之重要性。本手冊就植生群落調查之定義與類型、調查工具準備與應用及調查分析流程，介紹調查之步驟等。而後針對集水區植生群落之特性進行分析並說明台灣地區植生群落之分類，本應用手冊之內容將提供相關工作人員重要之參考。

（關鍵詞：集水區、植生調查、植生群落分析）

Abstract

According to the technical specification of soil and water conservation, vegetation community survey should include quantitative analysis and qualitative description, and the distribution of vegetation communities in specific environmental gradient. The data collected from vegetation survey can not only used to establish data base of vegetative resources, but also useful in native planting selection processes to assure proper extraction which match up with management strategies. Further, the data base can be used as base line for the differentiation of transformation of vegetation community, and the basic materials in the selection of vegetation community evaluation factors in watershed.

Due to the importance of the characteristics of vegetation community in watershed management, the study start on the categorization and definition of vegetation survey, preparation of survey tools and operation instructions, and follow up with survey and analysis procedures in details. In addition, the analysis on the characteristics of vegetation community, and the interpretation and categorization of vegetation community in Taiwan has been proceeded in this study, thus to provide referable materials for further use.

（**Keywords：Watershed, Vegetation Survey, Vegetation Association Analysis**）

計畫名稱	**95 年現地資料蒐集暨觀測站維護計畫** **2006 Maintenance Project of on-site Data Gathering and Monitoring Stations**
主 持 人	李秉乾 **Lee, Bing-Jean**
計畫年度	**95**

摘　　要

95 年現地資料蒐集暨觀測站維護計畫係針對水土保持局現有之全台 13 處土石流觀測站、2 部行動式土石流觀測站以及模組化觀測系統等設備，工作重點包含加強進行水土保持局及各觀測站系統設備保養與管理維護、中英文雙語解說設施新設、行動式土石流觀測站與模組化觀測系統整合、觀測平台提升調整、通訊傳輸方式軟硬體維護修正以及儀器設置損壞修復及升級等工作項目；此外爲確保觀測工作順利進行，執行期間反覆進行多次儀器設備測試工作，並於颱風、豪大雨來臨前後，派遣工程師前往現場進行儀器設備調整檢測作業，務必使得各觀測儀器能於惡劣天候下得仍能正確無誤的完成土石流事件觀測工作，期間並配合水土保持局災害應變中心開設作業，將全省 13 處土石流觀測站與行動式土石流觀測站於現場所蒐集到之各項現地觀測成果，立即回傳水土保持局提供作爲防災應變之參考依據；而災後則進行現場勘查與現地觀測資料蒐集分析工作，提供觀測站現場各項觀測數據以利政府及相關學術研究單位進行台灣地區土石流現象研判與分析，研發防範土石流災害之學理依據。

（關鍵詞：土石流觀測系統、行動式土石流觀測站、模組化觀測系統）

Abstract

The 2006 maintenance project of on-site data gathering and monitoring stations was intended for all current facilities belonging to the Soil and water conservation bureau, including the 13 debris flow monitoring stations, two mobile debris flow monitoring station, module monitoring systems that are all over Taiwan. Key tasks of the project comprise the reinforcement of servicing, management and maintenance of the systems and equipments in the Bureau and at the stations, deployment of new Chinese-English explanatory facility, integration of mobile debris flow monitoring station and module monitoring systems, elevation and adjustment of monitoring platforms, maintenance and correction on hardware and software of communication transmission type, and the repairs and upgrading of instruments. In addition, to ensure smooth monitoring works, tests on instruments and equipment will be repeated during the execution of the project, plus the adjustment and tests on them to be conducted by engineers sent to the sites before and after a typhoon or extremely heavy rain, such that all monitoring instruments guarantee to do their job completely and accurately under bad weathers. Also, in line with the deployment of the Disaster Emergency Operation Center of the Bureau during the project execution, the on-site observational results gathered at the 13 debris flow monitoring stations and the mobile debris flow monitoring stations across Taiwan will be sent back to the Bureau as reference for disaster prevention and response. After the disaster, on-site investigation will be carried out and observational information be gathered and analyzed to provide the observational data on-site at the stations to governments and relevant academic institutions, to facilitate them to study the debris flows in Taiwan and to serve as the theoretic basis for developing debris flow disaster prevention.

（Keywords：Debris Flow Monitoring System, Mobile Debris Flow Monitoring Station, Module Monitoring System）

計畫名稱	土石流潛勢區之雨量估計與即時預報技術發展研究（第二年） **A Study on the Development of Rainfall Estimation and Nowcasting Techniques at Debris Flow Potential Areas (2)**
主 持 人	李清勝 **Lee, Cheng-Shang**
計畫年度	**95**

摘　　要

台灣山區或地形降雨的合理估計，一直是坡地災害警戒或預警的重要指標，本計畫利用 QPESUMS 雷達高時空解析雨量資訊，整合即時地面自動雨量站觀測，發展局部區域定量降雨估計技術。

根據前一期計畫的成果（李等，2005），本計畫發展的 Kriging 差值修正技術已可描述土砂災害個案發生的降雨特徵，在與傳統雨量站內插法的比較結果上，也顯示其降雨估計的優越性。本年度進一步改進與評估其適用性。另外，2006 年至今並無重大颱洪事件發生，故選定之前災害點作爲示範區（高雄 A031 和 A032），進行颱風個案研究；並利用雷達-雨量站整合雨量估計方法，評估示範區土石流潛勢溪流附近雨量站在災害警戒的代表性。

在海棠颱風（2005 年）個案研究成果顯示，在 7 月 19 日 1400－1900 LST 之劇烈降雨資訊中，雷達－雨量站整合雨量可表現示範區災害發生的降雨特徵。此外，整合雨量利用代表雨量站（新發和大津）所推估的雨量爲佳；但雷達－雨量站整合法仍受地形阻擋影響，較高山區的估計雨量仍有相當的改進空間。

另外本年度也利用持續法發展颱風侵襲期間的定量降雨預報技術，我們利用 1989-2002 年的個案，針對全台 365 個雨量站，以 3 小時爲持續值，利用持續法進行未來 1 小時與 3 小時之降雨預估，所得結果與實際降雨的相關係數皆

爲 0.6；此結果顯示，利用持續法對未來 3 小時以內的降水，可有相當程度的預報能力。

（關鍵詞：QPESUMS、雷達整合雨量站降雨、差值校正法、持續法）

Abstract

How to estimate rainfall reasonably in the mountain region is the key issue to improve the early warning of slopeland disaster. In order to get the real-time rainfall information at the high potential area that debris flow occurred, especially in the mountain area, the project use CWB QPESUMS radar reflectivity observation (the time interval is 10 minutes, and the spatial resolution is about 1 km) and surface gauge data (the time interval is 10 minutes, and the spatial resolution is about 20-30 km) to develop quantitative precipitation estimation and forecast (QPE/QPF) techniques during typhoon period.

On the previous study of this project (Lee et al., 2005), it has demonstrated that the quality of integrated radar-gauge precipitation is superior to the interpolated precipitation by surrounding gauges. Especially typhoon rainfall is concentrated at local area and surrounding gauges is few. In the study of this year, the integrated radar-gauge rainfall is verified in local debris flow event of typhoon Haitang (2005). We analyzed the integrated rainfall and compared with the observation of representative raingauges Shin-Fa and Da-Jin. The results show that the integrated rainfall is a reasonable index to explain the occurrence of debris flow, and representative raingauges present fewer characteristics.

In the study of typhoon 0-3 hours QPF by the integrated radar-gauge rainfall, we use the1989-2002 typhoon case to develop a 3 hours persistent method to forecast the rainfall in local region. The result showed that the persistent method show better forecast compared with the climate model forecast, and the correlation coefficient between forecast rainfall and raingauge observation is about 0.6－0.7.

（**Keywords：QPESUMS, Integrated Radar-Gauge Rainfall, Persistent Method**）

計畫名稱	水土保持與國土復育計畫之經濟效益評估 **Economic Appraisal of Soil and Water Conservation Projects**
主 持 人	鄭蕙燕 **Jeng, Huei-Yann**
計畫年度	**95**

摘　　要

本研究建構適用於水土保持與國土復育計畫之益本分析架構，彙整適用於水土保持計畫之資料庫資料，計算出具有單位一致性的參考值，並建立效益移轉之流程與方式，並提出適合架構及方法，提供水保局評估國土復育及水土保持工作之效益。實證分析測試區有二：國土復育計畫之石門水庫集水區整治計畫、易淹水地區整治計畫之旭海溪計畫。經實際試算確認實務可操作性。

結果顯示水土保持計畫對整個社會有正面的淨效益，且由於不同水土保持計畫所實施的地點特性差異，所凸顯的效益重點亦有所不同，例如石門水庫集水區計畫以減少土石淤積爲目標，其所能達成之有形效益亦以此爲重要評估指標。而在旭海溪計畫則是以造就當地的休閒遊憩人潮爲主要效益，因此對當地的有形效益是以產值效益爲重。此結果可引伸出不同計畫著重目標的評估結果與決策上的關連性。兩個案例都可顯示出，單單考量水土保持計畫對於有形效益的貢獻已足以達到經濟可行性的準則，如果再納入實施此公共計畫對於地方與區域外民眾生活上之貢獻，更能驗證水土保持計畫的正當性。能通過益本分析準則的水土保持計畫，不僅在計畫實施所衍生之有形效益（如遊客人潮所帶來之地方產業產值）舉足輕重，其所帶給社會在生活與生態上的效益（如居民的生命財產與安全感）亦相當重要，無形效益更在計畫決策過程中需納入重要考量。

建議未來應建立完整的水土保持計畫受益者數量資料庫並持續記錄之。另外需考量單價因素，由於各效益項目之單價將因實施計畫之性質、地點、與時期而由所變動，更有待進行系統性的分類評估，以建立各類別水土保持計畫全面性完整的效益移轉估算值，進而提供更詳盡精確的水土保持計畫之決策參考。

（關鍵詞：水土保持計畫、國土復育計畫，成本效益分析，效益評估，效益移轉法）

Abstract

The purposes of this research are: 1.to constructs a cost-benefit analysis framework for soil and water conservation projects and national land restoration plan in Taiwan and 2.to carry out two case studies on Shihmen Reservoir and on Shehigh Creek Projects.

Results show that the analytical framework is workable. Both two cases resulted positive social economic values. The benefits on the two cases also showed different characteristics of the projects. Shihmen project focused heavily on benefits of reducing sedimentation, while Shehigh project highlighted on benefits of recreational activities. Both cases are justified in accordance with the criteria of cost-benefit analysis. Among the evaluated items, the intangible benefits play the key role in both projects, confirming that the goal of improving environmental quality has been fulfilled through the both projects. These results also suggest that the economic appraisal of such projects should bring the intangible benefits into the decision making process of soil and water conservation projects in the future.

（Keywords：Soil and Water Conservation Projects, Cost and Benefit Analysis, Benefit Evaluation, Benefit Transfer Method）

計畫名稱	施政智慧運算平台建置計畫 **The Project of Administrative Wisdom Operation Platform Establishment**
主 持 人	高治中 **Kao, Zhi-Zhong**
計畫年度	**95**

摘　　要

本計畫依據「水土保持工程管考系統」5 年來凝聚之工程基本資料、執行狀況、預算額度等資訊，將水土保持工程原始資料以 Cube 方式建構決策者所需資料模型，運用線上分析(OLAP)技術對資料進行分析，最後以管理儀表板模式提供管理者多維度資料查詢、樞紐分析表、紅綠燈等視覺化工具，輔助管理者在操作資料及分析上有更多元化的選擇；另一方面，擴充手機功能並延伸手機使用層級至承辦人員，提供工程現勘人員透過智慧型行動裝置即時回報或查詢工程相關資料，達到隨身智囊乃至隨身決策能力。

（關鍵詞：資料模型，線上分析，行動裝置）

Abstract

The SWCB Engineering Management System has collected huge information such as engineering foundation data, implemented progress and budget amount etc. for five years. One major mission of his project is to build up a data model for decision makers' demand with cube data concept and also applied the Online Analytic Processing (OLAP) technology to analyze the engineering data. Then making the system provide more diverse visional functions for managers to manage data through the management dashboard model , as multi-dimension query, axis analyst table, red-green light etc., The others of this project is to expand the functions of PDA Phone platform for the undertakers to record and update the investigation data via the mobile device.

（**Keywords：Data Club, Online Analytic Processing, Mobile Device**）

計畫名稱	農路調查與修建環境衝擊評估及其審議機制之擬定（1/3） **The Agriculture Road Investigates and Build up the Environment Pound at Valuation and the Draw-Up of its Review Mechanism (1/3)**
主 持 人	連惠邦 **Lien, Hui-Pang**
計畫年度	**95**

摘　　要

本計畫針對影響農路正面和負面之因子進行分級與權重，建立農路修復工程之評估模式，以評估分級農路之重要性程度，作爲其修復工程優先順序或必要性之決策依據。根據研究結果，農路重要性可由其效益指標、環境衝擊面指標和管理指標之評估指標予以分級，其中效益指標包括單位長度農業受益面積、單位長度林業受益面積、富麗農村效益、受益住戶數、公共設施數、替代道路功能及唯一聯外道路等七項參數，而環境衝擊面指標包括非農業土地使用比、生態敏感度、地質災害敏感度、崩塌面積比及土石流潛勢溪流數等五項參數，由上述兩大指標（12 項參數）給予「重要性評定（分）」，再以「管理指標」作爲災後受損農路報審之時，由中央主管機關成立『審議小組』除依據本計畫所提供農路現況資料（照片）之外，並考量當時之社會民情給予「管理指標評定（分）」。權重分析的部分，採用階層程序分析法(AHP)（發送 78 份問卷，有效回收共 37 份問卷）訂定各指標之絕對權重，再配合其他相關基本資料，完整建構農路修復環境衝擊評估模式，以提供災後農路受損修復與否決策之參採依據。

本計畫今年度首先以台中縣、市以及南投縣作爲調查範圍，根據既有「網際網路農路地理資訊系統」裡三個縣市共 819 條農路著手進行現地調查，根據本次調查結果得知，已完成台中縣、市以及南投縣 819 條農路之現場調查資料

中，部分農路現已併入公路系統者或有現場查無該路之情形。

必須從既有「網際網路農路地理資訊系統」中予以剔除之農路計有 113 條，然此僅爲現已併入公路系統者或現場查無該路之情形尚不包括農路長度錯誤或農路位置錯誤者，這顯示農路地理資訊系統現有保存的資料有必要加以更新，提高管理維護之效率。

（關鍵詞：修建環境衝擊評估、階層程序分析法、審議機制）

Abstract

This project aims at anode and anode factor of influence agriculture road to carry on ratings and power to weigh. Build up the valuation mode of the agriculture road repair engineering to evaluate the importance degree of ratings agriculture road. It is the basis that its repair engineering has the initiative sequence or necessity. According to study a result, agriculture road importance can basis benefit index sign, the environment impact faces index sign and manage the valuation index sign of index sign. Basis this 3 index signs then ratings. Among them, the benefit index sign includes: The unit length agriculture is subjected to benefit area, the unit length forestry is subjected to benefit area, abundance village benefit, Be subjected to the advantage inhabitant's amount, the amount of public facilities, act for the function of road and the only connective road etc. The environment impact faces index sign to include：The non- agriculture land uses a comparison, ecosystem sensitive comparison, geology disaster sensitive comparison, collapse a comparison, and debris flow amount etc. The above-mentioned two greatest index signs (12 parameters) give "the importance assess (cent)")". Use "management index sign" as again when the after-calamity damaged agriculture road report reviews is established "review group" by central supervisor's organization, in addition to according to originally plan provide the agriculture road the current conditions data(photograph), and consider at that time of the social people live and feel gave" management the index sign assessed(cent)".The power weighs analytical part and the procedure of the adoption stratum analysis method(AHP) (send out 78 questionnaires, effectively recall 37 total questionnaires) establishes the absolute power of each index sign to weigh. Again match with other related basic data, integrity construction agriculture road repair the environment pound at valuation mode. With provide the damaged repair of the after-calamity agriculture road or not the reference of the decision

basis.

In this project, use Taichung County, city and Nantou County as to investigate scope first. Begin to carry on investigating now according to current "internet agriculture road geography information system" inside 819 total agriculture roads in three county City. Know as a result and have already completed the inquisitions of Taichung County, city and Nantou County according to this time inquisition, in 819 agriculture roads of the scene the inquisition the data, parts of agriculture roads have already merged into highway system, or have no the situation of that road on the scene.

In this project, have to the agriculture road of deletion totally has 113 from current "internet agriculture road geography information system". However, only for have already merged into an of the highway system or check to have no the situation of that road on the scene, don't include the agriculture road length mistake or the agriculture road position false situation. This data that shows the agriculture road geography information system existing conservancy has a necessity to take in to renew and raises the efficiency of management maintenance.

（**Keywords：Build the Valuation of the Environment Impact, The Analytical Method of Stratum Procedure, The Mechanism of Review**）

計畫名稱	適用僱工購料之景觀及生態設施 **Landscape and Ecological Facilities Suitable for Local Labor Employment and Construction Material Procurement**
主 持 人	馮正一 **Feng, Z. Y.** 胡田田 **Hu,T. T.**
計畫年度	**95**

摘　　要

本研究內容包括與雇工購料相關之法令、權責機構與實施方式進行探討，並列出適用僱工購料的對象與範圍，包括：

1.經政府核准之各類型災害緊急性工程的協助性防救作業，

2.偏遠地區或無承包商投標的地區性小型工程，

3.符合地方建設或環境美化的社區小型工程，

4.地方或社區爲改造環境以自建方式申請之工程，

5.地方社區自願或義務性配合，並可降低雇工酬勞者，

6.企業回饋地方社區或認同社區總體營造之企業捐款者，

依據上述原則提出適用之工項，包括苗木栽植、草皮鋪植、箱籠護坡、打樁編柵、草溝、客土包溝、石材鋪面、紅磚鋪面、木製欄杆圍籬、木製平台、階梯、矮牆，並分別就各項工程進行施工步驟說明與圖冊之編製。

爲協助未受過專業工程技術訓練的在地人，能於短時間內瞭解圖說內的施工步驟，本研究將施工作法發展爲漫畫圖解的圖解手冊，並增加「常用手工具介紹」、「竹木料接合方式」、「工料分析手冊」三部份。在地人可利用常用的手工具照片介紹增加工作開始前的入門暖身動作；對於常用到的竹木料，則利用電腦模擬接頭接合，提供多樣的材料搭接方式；在僱工部分則依據圖面各工項

內容，編製淺顯易懂的施工說明與工料分析，將其分爲單純的「項目」、「規格」、「數量」、「單價」、「複價」等，提供使用者清楚的步驟完成施工作業。

（關鍵詞：僱工購料、景觀、生態設施）

Abstract

The main subjects of this study include the analysis of related regulations, authorities and operation processes. The target groups and scopes which are suitable for “local labor employment and construction material procurement system” were itemized as following:

1. The cooperate tasks of emergency rehabilitate construction which been approved by government authorities.
2. Small construction works which are in remote areas or no contractor is interested to bid.
3. Small scale local infrastructure constructions or community beautification works.
4. Living environmental enhancement works which are applied to be constructed by the community themselves.
5. Local communities can participate the works voluntarily and the salary can be reduced.
6. Enterprise donators who are willing to feedback the local communities or identify themselves with the integrated community works.

According to the principles mentioned above, the suitable construction items can be accomplished including planting, lawn covering, slope protection gabion, stakes and wattling, grass ditch, soil bag ditch, stone pavement, brick pavement, wooden railings and fences, wooden deck, steps, short wall, etc. The shop drawings and construction instructions of each item were provided in details in this study.

In order to help the local communities’ residents who are amateur in construction skills to understand the working drawings and construction steps in a short time, the study adopts caricature to interpret the construction processes. Three parts of the references were compiled including the “introduction of handwork tools

in common use", "the joint method of wooden and bamboo structures", and "cost estimate handbook". The local communities' residents can warm up before actual working by viewing the pictures of hand tool usage. To the most common used wood and bamboo materials, the computer simulations of joints provide different ways of connection for users. For the amateur local communities' residents, the quantity estimation sheets, including labor and material requirements, were categorized using "item", "standard", "quantity", "unit price", "total price" and compiled with easy to understand considerations. This is to provide users for explicit steps to complete construction works safely and successfully.

（**Keywords**：**Local Labor Employment and Construction Material Procurement, Landscape, Ecological Facilities**）

計畫名稱	九十三年度各項計畫工程品質委託專業服務廠商辦理抽驗 **Various Project Engineering Qualities Entrust a Professional Service in 2004 the Manufacturer Carry out to Take out to Check**
主 持 人	連惠邦 **Lien, Hui-Pang**
計畫年度	**94**

摘　　要

行政院農業委員會水土保持局針對所屬各工程所及各縣市政府進行 93 年度各項計畫工程品質抽驗工作，包括混凝土抗壓強度抽驗、防砂壩或潛壩含塊石鑽心檢測、混凝土結構物厚度穿透檢測及工程外觀品質檢視評量等。經抽驗結果顯示，在 578 件完成受檢驗工程中，不合格工程計 15 件，合格件數達 563 件，合格率高達 97.40%，各項工程品質抽驗結果優於 92 年度（合格率 93.7%），顯示本年度工程品質已有顯著進度。其中，混凝土抗壓強度低於規定而被評爲不合格者，計有 13 件，工程外觀及尺寸有嚴重缺失而被評爲不合格計有 2 件，工程外觀缺失比例過高，被評爲中等缺失者 1 件（註：本工程亦屬混凝土抗壓強度不合格者），而 17 處壩體含塊石鑽心檢測及 103 處厚度穿透檢視均合乎設計規定。

（關鍵詞：工程品質、工程抽驗）

Abstract

The Council of Agriculture water and soil conservation bureau aims at each engineering carry on with each counties and cities various engineering qualities of projects examine in 2004, include a concrete anti- to press strength to take out to check, whether have the examination of the stony examination, the concrete structure thing thickness and the examination of the engineering appearance etc.. By all accounts, in 578 engineering's that accept a check. The unqualified amount is total 15.The qualified amount is total 563 and the qualified rate is 97.40%.Take out to check a result is better than 2003. This representing this annual engineering quality has already had notable progress. Among them, unqualified total 13 in the concrete anti- press the examination of strength. Unqualified total 2 in the appearance and the size. And 17 pieces whether have stony examination and 103 examinations of thicknesses to wear to deeply examine all qualified.

（**Keywords：Engineering Quality, The Engineering Takes out to Check**）

計畫名稱	行政院農業委員會水土保持局第二工程所、第三工程所、第四工程所混凝土抗壓實驗室設備擴充及辦理中華民國實驗室認證體系(CNLA)認證成果報告 **Accomplishment of The Soil And Water Conservation Bureau 2nd&3rd&4th Engineering Office Construction Materials Laboratory Expanding Equipments & Accreditation(CNLA)**
主 持 人	蕭新祿 **Hsiao, Hsin-Lue**
計畫年度	**93－94**

摘　　要

行政院農業委員會水土保持局爲建立第二工程所、第三工程所及第四工程所混凝土抗壓實驗室品質系統及混凝土圓柱模製試體與鑽心試體抗壓強度試驗兩項目通過CNLA之認證，經93年10月25日評選後，遂委託正道科技檢驗股份有限公司辦理輔導計畫工作。

計畫之四大項工作：

1.實驗室空間規劃。

2.實驗室設備擴充。

3.實驗室品質保證系統建立及認證輔導。

4.編製水土保持局常用試驗項目及檢驗標準手冊。

輔導計畫於93年11月4日開始推動，二所及三所於94年10月11日正式通過認可；四所於94年10月25日正式通過認可，均取得混凝土圓柱模製試體及鑽心試體抗壓強度試驗兩項目之CNLA認證。

（關鍵詞：認證、評鑑、稽核、能力試驗）

Abstract

To establish the quality management system and have the registration by Taiwan Accreditation Foundation (TAF) (CNLA) for the compressive strength treat of cylindrical and drilled cores of concrete specimens, The Soil And Water Conservation Bureau 2nd&3rd&4th Engineering Office has subcontracted the project to Cheng-Dow Technology Testing Company Ltd. for consulting and planning works after selecting by evaluation on October 25, 2004.

The project contains following four major works:

1. Planed the space arrangement for test laboratory.
2. Expand the necessary equipments for test laboratory.
3. Establish quality management system and provide consulting and assistant services for the registration from TAF (CNLA).
4. Establish the standard test manual for routine works.

The project begins on November 4, 2004, the 2nd& 3rd Engineering Office have got the registration from TAF(CNLA) on October 11, 2005, also has the 4th Engineering Office on October 25, 2005.

（Keywords：Accreditation, Assessment, Audit, Proficiency Testing）

計畫名稱	災害現勘動態整合系統研發 **Disaster Investigation Dynamic Integration System Implementation**
主 持 人	穆青雲 **Mu, Cing-Yun**
計畫年度	**94**

摘　　要

本案針對「快速反應災害損害情形」及「提昇勘災效率」，進行示範性之「災害現勘動態整合系統研發」，人員可攜帶設備至受災地區，即時將現地影像及資訊回傳局內，除利用一般 GPRS 通訊方式外，並購置攜帶式衛星電話，一般行動電話通訊無法到達之地點，可利用衛星電話克服一般通訊或圖片及資訊回傳之功能。

災害現勘動態整合系統研發包含兩部份，一爲工程人員外出使用之設備與現地勘查輔助系統、一爲局內接收工程人員回傳資訊之攝錄影像回報系統。

工程人員外出使用之設備包含防水防震之平板電腦、攝影鏡頭、影像擷取設備、無線藍芽 GPS 接收器、衛星電話等，人員可利用平板電腦進行工程資料查詢、治山防災勘查、天然災害查報…，於平板電腦查詢或輸入現場資料，並自 GPS 取得坐標及使用電子地圖，毋需像以往手持地圖紙圖及勘查表單進行現場勘查，以往人員以紙圖於現地對照位置，並以人工書寫表單，回至局內後輸入電腦。往後人員只需於現場直接以平板電腦替代紙圖功能外，現地輸入相關勘查表單後，即可回到局內上傳。

攝影鏡頭具紅外線攝影功能，天候不佳、天色較暗或夜晚時，均能發揮夜間攝影功效，攝錄的影片可直接存入平板電腦、而影像擷取設備則可自影片中擷取單張影像回傳至局內，達資訊即時傳輸之目的。

局內接收工程人員回傳資訊之攝錄影像回報系統，可瞭解人員回傳之資訊

（如勘查路線、軌跡、影像顯示、人員管理、設備管理、勘查表單管理等），作爲當下決策之參考。

（關鍵詞：災害勘查、災害通報、影像傳輸）

Abstract

Our project is proposed to research and develop disaster investigation dynamic integration system to increase the investigation efficiency and quickly response the disaster damage situation in real time. The engineer can carry the portable equipments to the damage area and use them to transfer the land image and data into operation center. We implement our system with the satellite phone. It is used to extend the coverage area with GPRS. The satellite phone can transfer the image, communication data and information back. There are two parts in our system: one is for engineer who use the equipment outside and the acid system to investigate the real environment. Another one is for the engineer who is in the operation center to receive the return information, such as video image.

The equipments for engineer outside include waterproof and shockproof Tablet PC, CCD, image capture, Bluetooth GPS receiver, satellite phone etc. The user can use the Tablet PC to search the engineering data, investigate disaster and report the nature disaster immediately. When the user inputs and searches the data in the real locality, the system can get the coordinate via GPS and load the digital map directly. After finishing the information access, the user can submit the information with Tablet PC. The system will transfer the information back to the operation center automatically. It improves the traditional operation with paper work.

The infrared CCD can take a picture at night or under bad weather condition. The video or image can save into the Tablet PC directly. We use the image capture equipment to capture the picture and transfer into operation center. It achieves the goal to transfer the real time information.

The receivers in operation center can understand the information, such as the investigation path, route, image display, human management, equipment management or investigation form management etc. This information can be the reference for decision making at the moment.

（Keywords：Disaster Investigation, Disaster announcement, Image communication）

計畫名稱	再生粒料應用於水土保持工程之推動研究與輔導試驗工程 **Applications of Recycled Aggregates on the Soil and Water Conservation Engineering and Guidance of Trial Engineering**
主 持 人	陳豪吉　**Chen, How-Ji** 顏　聰　**Yen, Tsong** 林政毅　**Lin, Cheng-I** 彭獻生　**Peng, Hsien-Sheng** 蔡文博　**Tsai, Wen-Po**
計畫年度	**93**

摘　　要

本研究配合水土保持局辦理再生粒料使用於水土保持工程中，並輔導局內工程人員之再生粒料相關基本理念，另外，爲兼顧生態保育概念，本研究開發符合生態工法之高透水性再生粒料混凝土之產製技術，以達順利推動再生粒料應用於水土保持局土木構造物之目的。

（關鍵詞：再生粒料、水土保持工程、再生粒料混凝土）

Abstract

This research aims to guide the Soil and Water Conservation Bureau applying recycled aggregates to the soil and water conservation engineering and to teach the essential conceptions of recycled aggregates to the engineering staffs. Besides, for giving consideration to the ecological protection, the manufacture technology of high permeable recycled aggregate concrete that fit in with the idea of ecological engineering is developed.

（**Keywords：Recycled Aggregate, Soil and Water Conservation Engineering, Recycled Aggregate Concrete**）

計畫名稱	整合式水土保持工程管考暨決策支援系統建置 **The Establishion of Integrated Engineering Management and Dicision Supporting System for Soil and Water Conservation**
主 持 人	周天穎 **Chou, Tien -Yin**
計畫年度	**93**

摘　　要

本計畫將原水土保持工程管考系統提昇至施政計畫管考層次，在業務運作層面，依本局各相關單位之使用情況及建議，對使用介面進行新增、擴充及業務單位導向之修改，包含工程勘查作業、品質管理、會計管理、預算書審查管理等作業流程，配合各業務單位之作業特性，所有作業流程崁入系統以達到自動化工程控管目的理性，另一方面配合行政院主計處 92 年 6 月上線之政府歲計會計資訊管理系統（簡稱 GBA）進行會計系統整合，簡化工程管考之會計流程，提昇系統之完整性。在決策支援方面，結合客戶關係管理(CRM)及資料探勘(Data Mining)等資訊管理技術，一方面，依據使用者層級的不同提供符合所需的系統介面，另一方面，提供各單位主管人員決策相關模組，以提供各單位主管人員作爲工程效益評估及施政控管之依據。

（關鍵詞：工程管考，客戶關係管理，資料探測）

Abstract

This project is to upgrade the service efficiency and manage functions of SWCB Engineering Management System. In the operation client to improve the operation automation and make the UI more friendly based on the operation procedures such as Engineering vestigation work, qulity management, account management, budget examination management etc. This project also upgrate this system to operate in coordination with the Goverment Budgetting and Accountion Management system(GBA) built by Directorate General of Budget, Accounting and Statistics of Executive Yuan since June of 2003. In the dicision supporting client, the technologies of Customer relationship Management and Data Mining have applied on the UI varied with the user manage level and the dicision supporting modules provided for superintendents of the government agencies to manage the Engineering benefit estimation.

（**Keywords：Engineering Management, Customer Relationship Management, Data Mining**）

計畫名稱	整合性網際網路地理資訊系統建置計畫 **The Establishment of Integrated Internet Geographic Information System (1rst year project)**
主 持 人	周天穎 **Chou, Tien-Yin**
計畫年度	**93**

摘　　要

水土保持局 90、91 年度連續推動坡地、農路及坡地監測之地理資料整合與網際網路系統建置工作，將坡地等水保相關地理資訊初步提供到網路上供各界查詢瀏覽，本計畫一方面將以開放式空間資料庫之概念建置坡地網際網路地理資料庫，以爲未來水保局坡地地理資料倉儲中心建置之先驅作業，並針對坡地資訊圖層建置詮釋資料，以提升資料的流通性與可利用性。另一方面將整合原有坡地、衛星影像變異點及農路地理資訊系統之功能，建立一個整合性的地理資訊網站；針對展示、查詢、權限管理及介面的設計全面提昇，以求擴大系統應用層面並符合各業務單位的需求。

（關鍵詞：網際網路，地理資訊系統，資料倉儲）

Abstract

Soil and Water Conservation Bureau has promoted the establishment of GIS Database and Internet application systems for the slope land, farm road and slope land monitoring from 2001 to 2002, which also provide the information queried and browsed by vary users. There are three major goals for this project. The first one, to set up an integrated database from the three application systems: Slope Land Management system, Satellite Image Variation Management system and Farm Road management System. The second one, to build up an integrated Geographic Information System to combine the all functions of the above-mentioned systems to provide more widely application service needed. The third one, the open spatial database concept was used to build the slope land web GIS database for a foundation of Spatial Data Warehouse Center establishment for Soil and Water Conservation Bureau. The metadata for slope foundation maps have also been planed built to raise the circulation and usability for slope land information.

（**Keywords：World Wide Web, Geographic Information System；Data Warehouse**）

計畫名稱	九十二年度土石流災害及濃漁村環境改善計畫工程品質委託專業服務廠商抽驗 **The Engineering Quality of the Project of the Environment Improvement of Mudslide Disaster and Village and Fishing Village Entrusts a Professional Service in 2003**
主 持 人	連惠邦 **Lien, Hui-Pang**
計畫年度	**92**

摘　　要

行政院農業委員會直接補助鄉（鎮、市）公所由水土保持局控管之擴大公共建設計畫工程，核定由 166 鄉（鎮、市）公所執行。

爲確保及提昇水土保持工程品質，行政院農業委員會水土保持局特別針對直接補助的鄉（鎮、市）公所等單位，委託專業服務廠商辦理 92 年度土石流災害及農漁村環境改善計畫工程品質抽驗工作，包括混凝土抗壓強度抽驗及工程品質缺失評量等。原委託抽驗契約件數爲 270 件，部分計畫工程因發包、施工進度落後、用地問題及辦理變更等問題致只抽驗 260 件工程。260 件被抽驗工程中，合格件數 214 件、不合格件數 46 件，包括混凝土抗壓強度不合格者計有 38 件及工程品質缺失評量不合格 14 件（其中 6 件同時具混凝土抗壓強度及工程缺失不合格），合格率爲 82.3%。

（關鍵詞：工程品質、工程抽驗）

Abstract

For ensuring and promoting the quality of water and soil conservation engineering. The Council of Agriculture water and soil conservation bureau particularly aims at country...Wait for unit. Entrust a professional service the manufacturer carry on the project of the environment improvement of mudslide disaster and village and fishing village of the engineering quality take out to check. Include a concrete anti- to press strength to take out to check with various examinations. Always take out to check an engineering amount total 260. Among them, the qualified number of items is total 214.The unqualified number of items is total 46. Include a concrete anti- to press the strength unqualified amount to contain 38. The engineering quality has the unqualified number of items of imperfection total 14. The qualified rate is 82.3%.

（**Keywords：Engineering Quality, The Engineering Takes out to Check**）

計畫名稱	水土保持工程管考維護提昇 **The Maintenance and Upgrade of Soil and Water Conservation Engineering Management System**
主 持 人	周天穎 **Chou, Tien -Yin**
計畫年度	**92**

摘　　要

水土保持局爲能有效控管工程執行進度及經費支用情形，已於 91 年度建置「水土保持工程管考系統」，由各工程所及縣市政府透過網際網路線上即時更新工程之預算額度、執行狀況、每月進度、實付數等資料，同時整合會計作業流程以提供工程相關之經費資料匯出至主計處會計事務系統(ACT)，減少人員重覆登錄作業，達到業務流程一貫化之目的。爲能提供各執行單位登錄作業之便捷及提供各級長官行動化資訊，本計畫一方面整合 PDA 之功能，提供外業現地調查人員於治山防災工程勘查時，進行坐標定位及相關圖形及屬性資料查詢、記錄，並可將外業調查之相關資訊成果上傳至資料庫伺服器，便於提供災害資料庫更新及維護方便之途徑，另一方面運用手機與 GPRS 結合上網查詢功能，提供各級長官目前最新執行進度，以期提升坡地災害管理查報之效率。

（關鍵詞：工程管考、PDA、行動化）

Abstract

Soil and Water Conservation Bureau(SWCB) have set up a SWCB Engineering Management System to manage the rate of the engieering executable progress and expense situation since 2002. This application system integrated the SWCB engineering operation procedures and account management via the internet online updated from the local government and angencies. The mobile technology also have been integrated with Personal Digital Assistant (PDA) funtions to provide the information queried and recorded for investigators at the local site investation for slop treatment and management. The disaster database can be updated through the field investigation data upload to the database server. The mobile phone via GPRS application could provide the latest information of engieering executable progress and expense situation for the superintendents of government angencies to rise effeciency of the slop disaster mangement.

（**Keywords：Engineering Management, PDA, Mobile**）

計畫名稱	水土保持局九十二年度各項計畫工程品質委託專業服務廠商辦理抽驗 **Water and Soil Conservation Bureau Various Project Engineering Qualities Entrust a Professional Service the Manufacturer Carry out to Take out to Check in 2003**
主 持 人	連惠邦 **Lien, Hui-Pang**
計畫年度	**92**

摘　　要

爲確保及提昇水土保持工程品質，行政院農業委員會水土保持局特別針對所屬六個工程所、各縣、市政府及鄉、鎮、市公所等單位，委託專業服務廠商辦理 92 年度各項計畫工程品質抽驗工作，包括混凝土抗壓強度抽驗、防砂壩或潛壩含塊石鑽心檢測、混凝土結構物厚度穿透檢測及工程品質缺失評量等。原委託抽驗契約件數爲 800 件，因部分年度計畫於 9 月底方核定，發包施工進度延緩致只抽驗 608 件工程中。經統計 608 件受驗工程中，合格件數 570 件不合格件數 38 件；其中，混凝土抗壓強度不合格者計有 24 件，壩體含有塊石者有 3 處，混凝土結構物厚度不足者 2 處，外觀尺寸與設計不符者有 8 件，其他原因而遭列管追蹤者 1 件(依查驗成果表缺失比達 40%以上)，合格率爲 93.7%。由抽驗合格率高達 93.7%，可看出水土保持局所屬執行單位之施作工程品質尚稱良好。

（關鍵詞：工程品質、工程抽驗）

Abstract

For ensuring and promoting the quality of water and soil conservation engineering. The Council of Agriculture water and soil conservation bureau particularly aims at engineering, the county government, city hall and the country male entrust a professional service the manufacturer carry on various engineering qualities of projects to take out to check a work in 2003 and include a concrete anti-to press strength to take out to check, whether have the check of stony check, the concrete structure thing thickness etc.. The amount that accepts a check's allying amount is 608 engineerings. By all accounts, the qualified number of items is total 570. The unqualified number of items is total 38. Among them, concrete anti-'s pressing the strength unqualified amount is 24 and the unqualified amount that has rock is 3, the concrete structure thing thickness unqualified amount is 2, and the size unqualified amount of appearance is 8. The qualified rate is 93.7%. By all accounts, the quality of the engineering carried out by water and soil conservation bureau isn't bad.

（**Keywords：Engineering Quality, The Engineering Takes out to Check**）

計畫名稱	行政院農業委員會水土保持局混凝土抗壓實驗室設備擴充及辦理中華民國實驗室認證體系(CNLA)認證成果報告 **Accomplishment of The Soil And Water Conservation Bureau Construction Materials Laboratory Expanding Equipments & Accreditation(CNLA)**
主 持 人	蕭新祿 **Hsiao, Hsin-Lue**
計畫年度	**91－92**

摘　　要

行政院農業委員會水土保持局爲建立混凝土抗壓實驗室品質系統及混凝土圓柱模製試體與鑽心試體抗壓強度試驗兩項目通過CNLA之認證，經91年5月10日評選後，遂委託正道科技檢驗股份有限公司辦理輔導計畫工作。

計畫之三大項工作：

1.實驗室空間規劃，

2.實驗室設備擴充，

3.實驗室品質保證系統建立及認證輔導。

輔導計畫於91年5月10日開始推動，營建材料實驗室於92年5月6日正式通過認可，取得混凝土圓柱模製試體及鑽心試體抗壓強度試驗兩項目之CNLA認證。

（關鍵詞：認證、評鑑、稽核、能力試驗）

Abstract

To establish the quality management system and have the registration by Taiwan Accreditation Foundation (CNLA) for the compressive strength treat of cylindrical and drilled cores of concrete specimens, The Soil And Water Conservation Bureau has subcontracted the project to Cheng-Dow Technology Testing Company Ltd. for consulting and planning works after selecting by evaluation on May 10, 2002.

The project contains following three major works:

1.Planed the space arrangement for test laboratory,

2.Expand the necessary equipments for test laboratory,

3.Establish quality management system and provide consulting and assistant services for the registration from TAF(CNLA).

The project begins on May 10, 2002, the Construction Materials Laboratory has got the registration from (CNLA) on May 6, 2003, the two items are compressive strength treat of cylindrical and drilled cores of concrete specimens.

（**Keywords：Accreditation, Assessment, Audit, Proficiency Testing**）

計畫名稱	農路調查及地理資訊系統建檔 **Investigation and Computerized Management of Farm Road in Taiwan**
主 持 人	周天穎 **Chou, Tien-Yin**
計畫年度	**92**

摘　　要

自民國 88－92 年，水土保持局逐年進行全省之農路調查建檔作業，全省共計 21 縣市（除台北市及高雄市外），農路圖形資料建置近 6,000 筆，農路工程資料建置共約 1 萬 8 千筆。水土保持局並於同時開發「農路調查及地理資訊系統」、「網際網路農路地理資訊系統」及「農路展示光碟」，除可以資訊化方式有效控管農路工程，並可藉由網際網路版之農路地理資訊系統及展示光碟將農路建置成果提供一般民眾進行查詢、瀏覽，確實落實農路管理資訊化之理念。其計畫效益包含：

1.以資訊化方式確實掌握農路動態資訊，有效提升道路工程管理效益。

2.健全農路資料庫可提供災害發生時之即時資訊。

3.完整資料庫可提供協助環境決策支援。

（關鍵詞：農路、地理資訊系統、道路管理）

Abstract

Soil and Water Conservation Bureau investigate the farm road in Taiwan since 1999 to 2003. The total amount of farm road is about 6000 with 18,000 engineering data. The web-based GIS management system, intranet-based GIS management system and demonstration system are established to manage the farm road through computerized way and to query or review by general users. The benefits of this project include:

1. Manage the farm road information in computerized way and enhance the efficiency of engineering management.
2. Offer the complete information of farm road when disasters occurred.
3. Offer auxiliary information for DSS by complete farm road database.

（**Keywords：Farm Road, Geographic Information Systems, Road Management**）

計畫名稱	遙測技術在崩塌地、土石流量化分析及坡地管理之應用計畫 **The Application of the Technology of Remote Sensing on Collapse, Debris-Flow Quantification Analysis and Slope Management**
主 持 人	周天穎　**Chou, Tien-Yin** 衷嵐焜　**Chung, Lan-Kun** 郭靜怡　**Kuo, Ching-Yi**
計畫年度	**92**

摘　　要

台灣地區絕大部分地區均爲地形陡峭、地質脆弱的山坡地地形，河短流急，加上平地土地利用漸趨飽和，山坡地乃成爲國民生活、產業活動及農牧發展的重要土地資源，不僅山坡地超限利用情形日益嚴重，非農業之開發使用亦紛紛湧向山坡地，導致土壤沖蝕現象嚴重，因而每逢颱風、暴雨，甚至是遇到雨量偏多的季節，遂常傳出如山崩、地滑、土石流、淹水等災害，危及人民生命財產安全。

本計畫擬根據水土保持局以往已發展之「山坡地違規開發監測」、「無人遙控飛機在山坡地土地利用變遷及災區監測之應用」計畫及延續 91 年度之「遙測技術在崩塌地、土石流量化分析及坡地管理監測之應用委託研究計畫（2/4）」之研究成果，除了根據研究區之特性整合建置完整集水區環境基本資料庫，並選取適當遙測影像資料，對山坡地土地利用現況及崩塌地、土石流災區進行變遷之監測與土石流流出量之計算，進而建置一套土方量化標準作業程序，以作爲災害管理單位於災情發生時有效參考之處理程序。

（關鍵詞：遙測、土石流、坡地）

Abstract

The landforms of mountains in Taiwan are mostly steep and frail geology; the short river and jet stream, the saturated lands made the lands of mountainside overuse. Over-exploitation causes severe soil washout, therefore, it occurs serious disasters such as landslide, debris-flow, flood, etc to endanger people’s life as long as typhoon or rainstorm coming.

This project is based on “Monitoring for the Illegal Mountainside Development”, “The Application of Unmanned Ariel Vehicles in Mountainside Change and Sensing” and the research result of “The Application of the Technology of Remote Sensing on collapse, Debris-Flow Quantification Analysis and Slope Management (2/4)”, which is in 2000. To intergrades a complete data and choose appropriate remote sensing data into calculate the use of lands and the change of debris-flow areas as a process of disaster management.

（**Keywords：Remote Sensing, Debris-Flow, Land**）

計畫名稱	野溪自然生態工法評估指標及設計參考圖冊之建置 **The Establishment of Ecological Engineering Evaluation Index and Compilation of Design Reference Book for Creeks**
主 持 人	林信輝　**Lin, Shin-Hwei** 蔡志偉　**Tsai, Chih-Wei**
計畫年度	**91**

摘　　要

本計畫重點工作項目說明如下：

1.自然生態工法文獻資料蒐集彙整

包含國外之文獻資料應用及國內自然生態工法之現況與發展探討。

2.現有治山防災構造物現況調查

3.研究區域自然生態環境改善功能調查與分析

包含微氣候與環境、植生特性、河溪流況與水質調查、護岸結構安全性及生物相特性調查分析。

4.構建陸地生物與河道水棲生物可連續活動交流通道之研究分析

包含自然生態工法應用構造物之棲息地特性分類、河川野溪生態棲息地之分析、棲地生物與構造物相關性、水陸環境交流通道之應用設計。

5.自然生態工法效益評估指標之建立

包含植生、生物相及水理調查與評估。

6.自然生態工法資材調查及單價分析

包含自然、人造資材調查與評估及自然生態工法單價分析表之建立。

7.新增自然生態工法之分析檢算與參考類型

包含穩定分析與應力檢算、工程構造物設計原則及河床質之承載力分析及有限元素數值分析。

8.自然生態工法之教育訓練

於民國 91 年 10 月完成「野溪自然生態工法教育訓練研習班」之學員訓練。

（關鍵詞：野溪、自然生態工法、防災構造物、效益評估指標）

Abstract

The key points and related contents of this study narrate as follow：

1.Collection and categorization of ecological engineering related documents and materials, including the application of foreign documents and materials, and the exploration of native existing conditions and development of eco-engineering works.

2.Field survey of current conditions of hillside stabilization and disaster mitigation infrastructures.

3.The investigation and analysis of the functions of natural ecological environment enhancement in study areas，which including field survey and analysis works in aspects of micro-climate, vegetation, river conditions and water quality, safety of revetment structures, as well as the characteristics of biological characters of the study areas.

4.The study on the establish of inter-communicate corridors for both land and aquatic species, which covers the categorization of habitat characteristics of eco-engineering structure sites, the habitat condition analysis of rivers and creeks, the relationships between biological species and eco-engineering structures, and design principles of amphibious inter-communication corridors.

5.The composition of efficiency evaluation index of eco-engineering works, including the survey and analysis of vegetation, biological and hydraulic characters.

6.The categorization and cost estimate of construction materials for eco-engineering construction, which contain natural and artificial materials.

7.Stability and stress analysis, design principles of eco-engineering structures, riverbed material bearing capacity analysis, and finite element analysis.

8.A practical training course of creek eco-engineering was completed on October 2002.

（**Keywords：Creek, Ecological Engineering Method, Disaster Mitigation Structure, Efficiency Evaluation Index**）

計畫名稱	梨山地滑地區資料庫建置及監測分析運用 **Establishment and Application of Data Base and Monitored Results for Li-Shan Landslide**
主 持 人	蘇苗彬 **Su, Miau-Bin**
計畫年度	**91**

摘　　要

梨山地滑區於民國79年4月間發生地滑現象。水土保持局自民國84年度起實施「坡地災害整治」計畫。現地整治施工與監測工作於91年底完成初步之治理工程。爲有效整治本滑動區及維續當地居民之生命財產安全與交通順暢及觀光事業經濟體系之運作，有必要建立地滑區綜合管理系統之資料。

本計畫經由現地監測之執行，結果彙整，終至建立本地區之地滑地綜合資料庫，以供分析作業所需與現行施工整治成果的檢討與評估。監測資料之分析整理及運用，爲監測系統效能有效發揮之重要步驟，藉由長期監測資料測讀分析整理，不但可瞭解各監測儀器位置滑動土體活動情形，更可透過分析而瞭解其滑動型態，以進一步預測其變動狀況而防患於未然。透過各監測站數據分析及運用並結合全區的測量作業，可以掌握全區滑動土體由線而面及空間活動情形，以期建立地滑與地下水位、雨量等各種相關性，提供監測管理，而達成全區整體監測網之目的，並可做爲長期監測管理系統依據。

（關鍵詞：梨山地滑、資料庫、監測系統、分析）

Abstract

Landslide area in Li-Shan village occurred a major sliding in April 1990. Soil and water conservation bureau proceeded a contingent project for renovating the landslide. The project named “Investigation and renovation planning for landslides in Li-Shan area” was accomplished at the end of 2002. In order to keep tracking the local safety, that is needed to set up a management system for the landslide area.

This project included execution of field monitoring work, data reduction, and data base establishment. By long term monitoring the sliding blocks, safety of this area can be predicted and action needed can be proceeded. Surveying work together with monitoring data for groundwater level charge, rainfall intensity, ground deformation etc., were put together to the evaluation work.

（**Keywords：Li-Shan Landslide, Data Base, Monitoring System, Analysis**）

計畫名稱	農路調查及地理資訊系統報告書 **Investigation and Computerized Management of Farm Road in Taiwan**
主 持 人	周天穎 **Chou, Tien-Yin**
計畫年度	**91**

摘　　要

自民國 88－92 年，水土保持局逐年進行全省之農路調查建檔作業，全省共計 21 縣市（除台北市及高雄市外），農路圖形資料建置近 6,000 筆，農路工程資料建置共約 1,8000 筆。水土保持局並於同時開發「農路調查及地理資訊系統」、「網際網路農路地理資訊系統」及「農路展示光碟」，除可以資訊化方式有效控管農路工程，並可藉由網際網路版之農路地理資訊系統及展示光碟將農路建置成果提供一般民眾進行查詢、瀏覽，確實落實農路管理資訊化之理念。其計畫效益包含：

1.以資訊化方式確實掌握農路動態資訊，有效提升道路工程管理效益。

2.健全農路資料庫可提供災害發生時之即時資訊。

3.完整資料庫可提供協助環境決策支援。

（關鍵詞：農路、地理資訊系統、道路管理）

Abstract

Soil and Water Conservation Bureau investigate the farm road in Taiwan since 1999 to 2003. The total amount of farm road is about 6,000 with 18,000 engineering data. The web-based GIS management system, intranet-based GIS management system and demonstration system are established to manage the farm road through computerized way and to query or review by general users. The benefits of this project include:

1.Manage the farm road information in computerized way and enhance the efficiency of engineering management.

2.Offer the complete information of farm road when disasters occurred.

3.Offer auxiliary information for DSS by complete farm road database.

（ **Keywords ： Farm Road, Geographic Information Systems, Road Managemen**t）

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