Soil and Water Conservation Bureau

Submitted by: Chinese Taipei
Outline

1. Comprehensive Strategies for Slopeland Management and Rural Development
2. Debris Flow Disaster Management
3. Integrated Watershed Protection for disaster Prevention
4. Integrated Planning and Development for Rural Communities
Council of Agriculture
Soil & Water Conservation Bureau
Organization Chart

Director-General
Deputy Director-General
Chief Secretary

Planning Division - 3 Sections
Watershed Conservation Division - 4 Sections
Rural Reconstruction Division - 4 Sections
Monitoring & Management Division - 4 Sections
Debris Flow Disaster Mitigation Center - New

Secretariat
Personnel Office
Accounting Office
Government Ethics Office

6 Regional Branches - 4 Sections

Taipei
Taichung
Nantou
Hualien
Taitung
Tainan
Land Resources Distribution in Chinese Taipei

- Mountain forest lands: 46.99%, 1,656,520 ha
- Plains: 26.70%, 961,933 ha
- Hillslopes: 27.31%, 983,653 ha
- Slope land: 73.30%, 2,640,173 ha
Comprehensive Strategies for Slopeland Conservation

Water, Soil, Vegetation, Ecology, Human

Close serves

Expand Social Participation

MIS
GIS
GPS
RS

Slopeland Conservation
Watershed Protection
Slopeland Management
Rural Restoration

Water, Soil, Vegetation, Ecology, Human
Expand Social Participation

Old

New

Task Loading

Expand Social Participation

Better Achievement

Unable Loading

☺☺☺
Recent Debris Flow Disasters

- 2008.9.11 Sinlaku Typhoon
- 2008.7.21 Kalmaegi Typhoon
- 2004.9.10 911 Flood & Haima Typhoon
- 2004.7.25 Aere Typhoon
- 2004.7.02 72 Flood & Mindulle Typhoon
- 2001.9.17 Nari Typhoon
- 2001.7.29 Toraji Typhoon
- 1996.7.30 Herb Typhoon
Effect of 921 Earthquake

Landslides after Mindulle Typhoon in Tachia River Watershed

2004.07.10

Debris-flow disasters after Toraji typhoon, 2001-8-1
Factors Governing Slopeland Disasters

- Global climate change
- Heavy rainfall with high intensity
- Effect of 921 Chi-Chi Earthquake
- Channels encroachment
- Over-developed hill-slopes
- Landslides and debris flows

Annual Rainfall of Chinese Taipei

Year

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<tr>
<td>Rainfall (mm)</td>
<td>2,914</td>
<td>2,534</td>
<td>1,840</td>
<td>1,572</td>
<td>2,332</td>
<td>2,500</td>
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世界年雨量平均973mm

Distribution of Annual Rainfall
The Island Most Exposed to Multiple Hazards in the World.

World Bank report (2005): *Natural Disaster Hotspots- A Global Risk Analysis*

- **2005 World Bank disaster high-risk zone assessment report**

- The Island Most Exposed to Multiple Hazards in the World.

- **Natural disaster hotspots:** Earthquakes, typhoons, floods, drought, etc., four types of natural disasters.

- In the past 20 years, global natural disaster deaths exceeded 150,000 people, economic losses averaged US$6.599 billion per year, an increase of 5 times.

- **Countries:**
  - 160 countries were affected by one type of disaster.
  - 90 countries were affected by two types of disaster.
  - 35 countries were affected by three types of disaster.

- **Percentage:**
  - 25% for one type of disaster
  - 10% for two types of disaster
  - 5% for three types of disaster
  - 90% for two types of disaster

- **Chinese Taipei:**
  - 73% affected by three types of disaster
  - 90% affected by two types of disaster
Global increasing trend of natural disasters in recent 30 years (1975-2006)

No. of natural disasters

Year


1999 921 Chi-Chi earthquake

30年來全球天然災害趨勢
There are 4 typhoon events averagely within 100 years (1900~1999). The highest is 8 events and only 2 years occurred.

However, there are 7.3 events averagely since 2000~2006. And over 8 events got 3 years.
Risk Management

Risk → Chance

- Change
- Challenge
- Chance

Human Activities
Disaster

Risk & Water Conservation Bureau
Hazard Preparedness

**Debris Torrents & Landslides**

- **Potential Debris Flow Torrents**: 1,420 Torrents
- **Landslide Areas**: 43,570 ha

**Potential Debris Flow Torrents**

**Historic Landslides Distribution**
Contingency Response during Disasters

- Rainfall monitoring: **Every 10 min.**
- Typhoon: Cloud satellite image
- Announce: Debris Flow Warning
- Inform emergency messengers
- Heavy equipments standby at dangerous areas

Debris Flow Disaster Response Center
Alarm of Debris Flow Warning

Rainfall of Debris Flow Warning: 250~550mm

Sea typhoon alarm

Sea & land typhoon alarm

Yellow alarm

Red alarm

Predict Rainfall > Warning

Real Rainfall > Warning

Advise Evacuation

Enforce Evacuation
**Formosa Emergency Management Action**

http://fema.swcb.gov.tw

**Potential Debris Flow Torrents**

**Debris Flow Precaution Routes**

**Inform Emergency Messengers**
Debris Flow Disaster Standard

- Confirming the level of disaster preparedness in every village
- Strengthening the weakest item in disaster preparedness
- Planning short, medium and long term disaster preparedness for village

Scores for villages in disaster preparedness

High Index for disaster preparedness
Mid Index for disaster preparedness
Low Index for disaster preparedness

Scores for environment of villages in disaster package

Debris Flow Disaster Standard

High Index for disaster preparedness
Mid Index for disaster preparedness
Low Index for disaster preparedness

Scores for villages in disaster preparedness
Serious Debris Flow Disaster Scene Investigation

- Scene Investigation SOP and related form and report template, making the disaster process complete

- Disaster Occurred

- Fastest Report
  - In disaster scene, carefully record
  - Show the real condition by photos

- Faster Report
  - Collect disaster area meteorological and hydrological data
  - Discuss the cause of disaster

- Complete Report
  - Collect the disaster info
  - Analyze the cause of disaster and suggestion
Set up Debris Flow Disaster Emergency SOP

Disaster Warning & Info

Prevent secondary disaster & recovering/reconstruct

Precaution Evacuate Drill

Disasters info collection

Education for Hazard Preparedness
颱風豪雨發布後，於土石流危♡
險區先進駐重機械待命。

台南縣南化羌礦坑緊急搶通
嘉義縣中埔鄉東興村緊急搶通

Contingency Response

Heavy Equipments Standby at Potential Hazardous Spots
Debris Flow Monitoring Stations

- Field Monitoring
- Data Transmission
- Information Display

Debris Flow Disaster Response Center

Monitoring Vehicle

Real Time Image
Kalmaegi Typhoon
Debris flow warning and evacuation example

Potential debris flow torrent

13 houses destroyed by debris flow, but no one got hurt

13戶民宅受損，人員已事前疏散，無傷亡

台27線 2008.7.21 16:30 Aerial Photo
Promote the Disaster Prevention on Local Communities

**Pre-Disaster**
- Reinforce the system of disaster prevention
- Enhance the ability of emergency response
- Discover source of disaster

**Disaster**
- Rescue cooperation
- Emergency response
- Decrease the loss of disaster

**Post-Disaster**
- Rehabilitation and reconstruction

Coexist with nature
Disaster management
Sustainable communities
Risk Mapping  Warning Simulation of Debris Flow Disaster Condition

downstream river left bank residents are at higher risk

rainfall intensity, rainfall return period

FLOFLO --22 DD

Risk Mapping

GIS

map

Warnings Simulations of Debris Flow Disaster Condition

Map of affected areas and risk level
Evacuation Routes and Drills for Debris Flow Disaster Mitigation

- 416 Evacuation routes planned
- 410 debris flow evacuation drills held
Rainfall Cones DIY

- Distribute **21,000 DIY rain gauges to people.**

DIY rain gauges

72水災遭土石流淹沒但人員平安撤離

義工親送雨量筒

2004.5.24
Community Development vs Community Precaution

- Local independence
- The concept of Precaution

Community Development

Safe Community

Preparedness Community

Emergency rescue

Via community’s participation, movement, thinking to build up a better environment.

Combine safe with disaster precaution.

Aim to large-scale disaster, ex: earthquake, fire accident to become autonomy community precaution.

The emergency work when disaster occurred.
Overview of Shang-An village, Shui-Li Township

三部坑集水區面積 368.6 公頃
上安村計 14 鄰 494 戶 1560 人
台 21 線

Overview of Shang-An village, Shui-Li Township

Overview of Shang-An village, Shui-Li Township
Jul. 31, 1996 – Typhoon Herb
賀伯颱風造成省道21線受土石流埋沒。

Sep. 21, 1999 – Chi-Chi Earthquake
九二一大地震造成民房全倒15棟，半倒23棟。

Jul. 30, 2001 – Typhoon Torji
桃芝颱風三部坑爆發土石流，造成死亡9人，失蹤5人，民宅沖毀26戶，埋沒29戶，農田流失80公頃等災情。
Before and after debris flow
in Shan-An, Shui-Li, Nantou County

Discharge of debris flow can be approached \( \geq 10 \text{ times of clear water} \)
Advance omnibearing planning of watershed control

- Disaster prevention
- Rural development
- Slopeland conservation
- Environmental greening and beautification
- New community environmental improvement
- Debirs flow real-time
整治率接近60%，可視為最理想或適宜的整治率目標值。

截至96年，台灣集水區整治率為37.7%。
Comparison Between Landslide and Preparedness in Japan

- **1982**: 7,300
- **1987**: 9,800
- **1992**: 13,300
- **1997**: 17,200
- **2002**: 20,500

完成整備：113,557
整備率：25%

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整備率：25%
Watershed Conservation & Management Project in Shihmen Reservoir

Because the typhoon rainfalls resulted more feculent water in reservoir.
Integrated Reservoir Watershed Conservation Project in Su-Le

Debris flow disaster 2005.2.26 15:01

After returns 2006.6.09 storm

Before

After recovery
Su-Le Real-Time Monitoring Pictures
Landslide Vegetation Recovery in Sa-Luen-Zi
Debris Flow situation in Hwa-Shan Area

- Chi-chi Earthquake in 1999 – upper stream severely collapsed.
- Torrential Rain in 2000 – large number of sandstone moved down and overflowed the check dam.
- Typhoon Nari and thunder shower in 2001, debris from Da-Chien Mountain flowed down and damaged villages and three bridges.

Debris Flow overwhelmed houses
on Sep. 16, 2001

Debris Flow changed roadways
on Sep. 16, 2001
Integration of Debris Flow Disaster Mitigation and Rural Development
in Hua-shan, Ku-keng, Yunlin

Villagers participation
Emerging Business & Ecology

Community Empowerment
After Typhoon Nari, 2001

Debris flow monitoring
After Treatment

Soil & Water Conservation Bureau
SWOT Analysis of Post-Disaster Community Recovery

**Strengths & Weakness**

(優勢、劣勢) (內部)

- Natural environment
- Property features
- Local culture
- Human resources
- Tourism & Recreation
- Traffic
- Public facilities
- Land utilization
- Natural disaster

**Opportunities & Threats**

(機會、威脅) (外部)

- Major transportation
- construction
- Agriculture land release
- Development policy
- 2-day weekend
- WTO
- Economic recession

社區共識
領導向心力
文史工作室
人才培訓

整體評估
發展導向

公部門投入
導入專業
相對競爭力
地區知名度

規劃方針
921地震、豪雨、土石流，雲林縣以古坑鄉受災最嚴重，而華山地區亦受到嚴重的損害，住宅倒塌、公共活動場所毀損

契機

山坡地農村重建首重安全
本區以土石流整治為基礎
進而促進社區整體發展

社區事務由社區重新以積極的態度打造屬於新的文化地景
將家鄉改頭換面迎接新生命的開始

- Community serves as a standard.
- Safety orientation
- Drive community disaster prevention
- Transform to rural development
抽藤坑溪緩衝綠帶
Improvement of Engineering Environment

Simulation of Buffer Zone After 10 years
Outdoor Classrooms for Soil & Water Conservation

Integrating communities with outdoor soil & water conservation classrooms

22 locations
535,990 visitors/yr
Rural Development with Various Scales

- **National-wide**
  - Prospective of sustainable development

- **County / District**
  - Balanced development

- **Community**
  - Rural restoration
Integration of community construction and ecological engineering

- Combine human, landscape, and industries.
- Obtain materials from local resources.
- Start from local industries and tourism.
- Utilize natural ecology and meet community’s requirements.
Future Prospects

- Plan Hua-Shan a new life circle as four main areas and ten sub-areas where possess different
- Integrate the business operation of Hua-Shan community and debris flow outdoor classrooms to bring a renovation concept to the public.

Coffee shop

Debris flow learning park
Promote Rural Restoration Communities

Promote 4000 Communities for Rural Restoration
Future Perspective for Slope Land Conservation & Rural Development

— T.H.I.N.K —

- **Technology**: Research, development and practice.
- **Human management**: Improve people’s knowledge of precaution against disaster.
- **Investigation**: Investigate the potential locations to cope with disasters.
- **Notice**: Accurately control possible occurring time and give a declaration.
- **Knowledge**: Information and database as well as expert decision-making system.
Thank You for Attention

Soil and Water Conservation Bureau
Always Working with You