Asia-Pacific
Economic Cooperation

2008/TFEP/WKSP3/009

Soil and Water Conservation Bureau

Submitted by: Chinese Taipei

Workshop on Large-Scale Disaster Recovery in APEC
Taipei, Chinese Taipei
22-23 September 2008

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

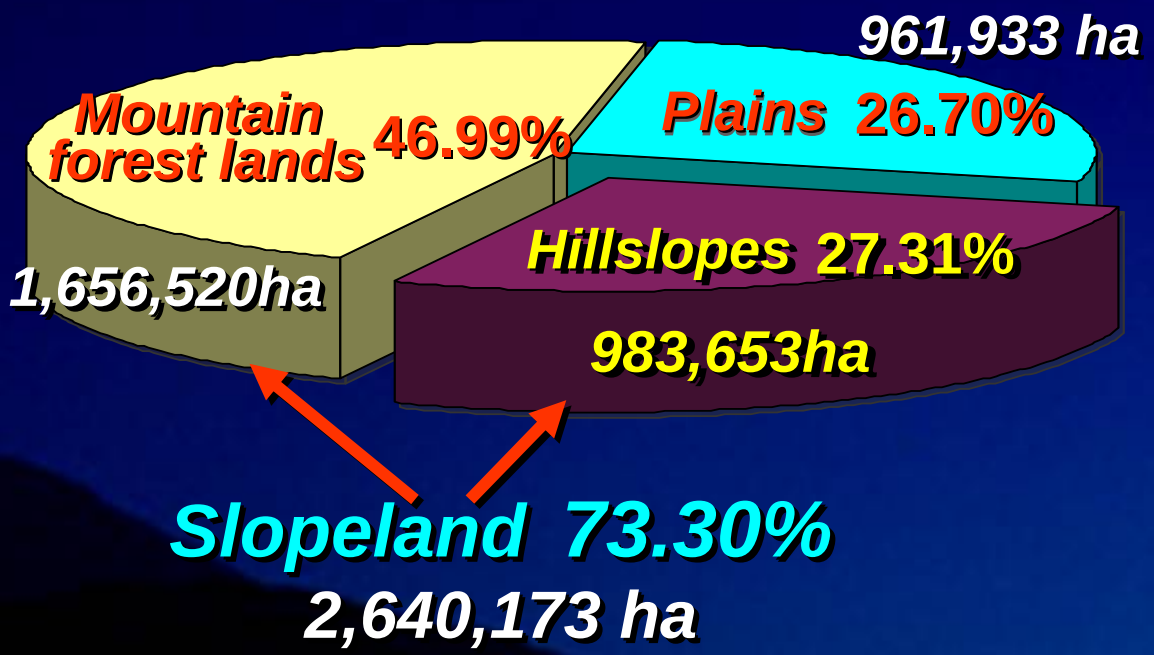
Council of Agriculture

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

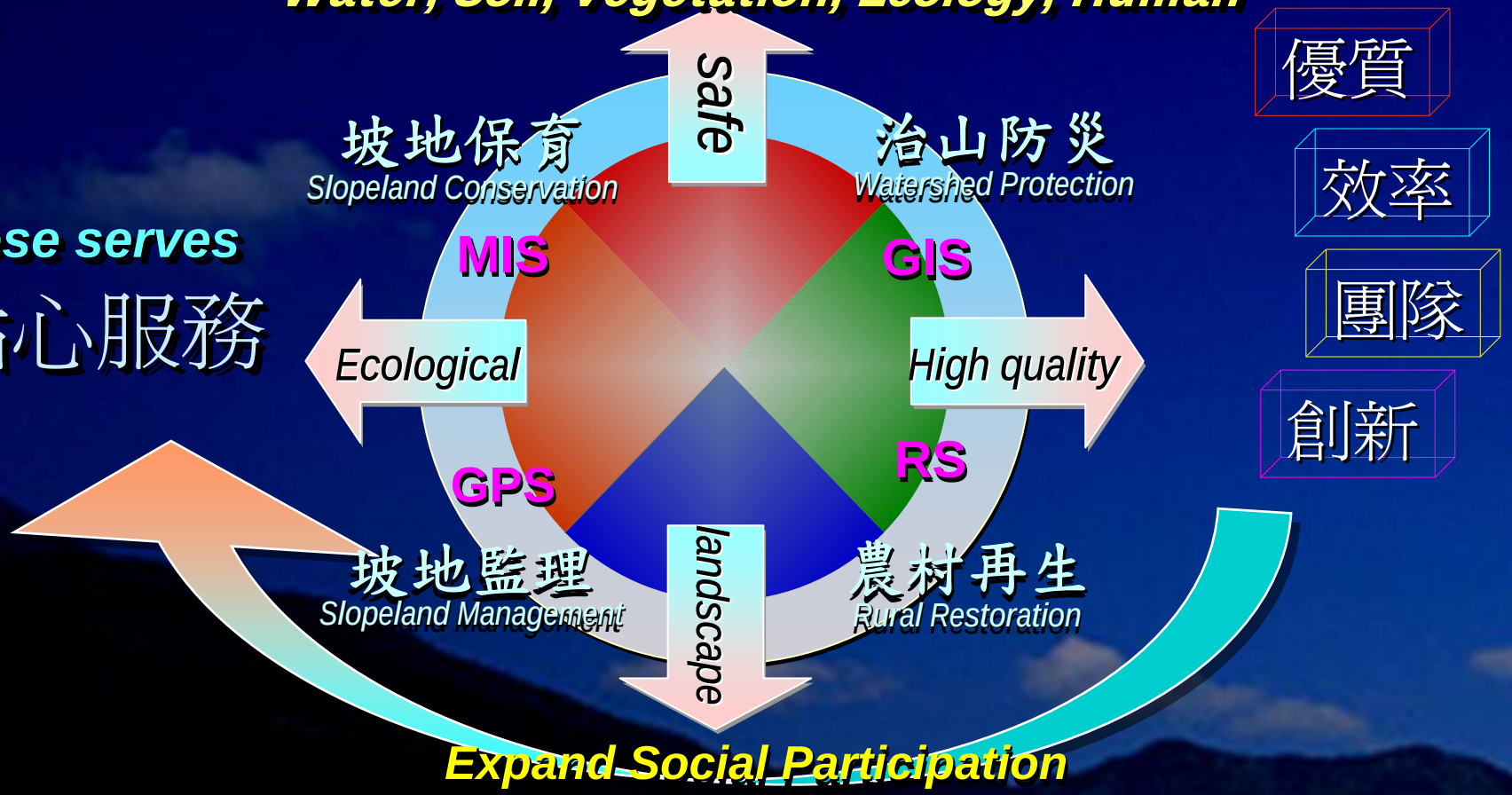
Land Resources Distribution in Chinese Taipei



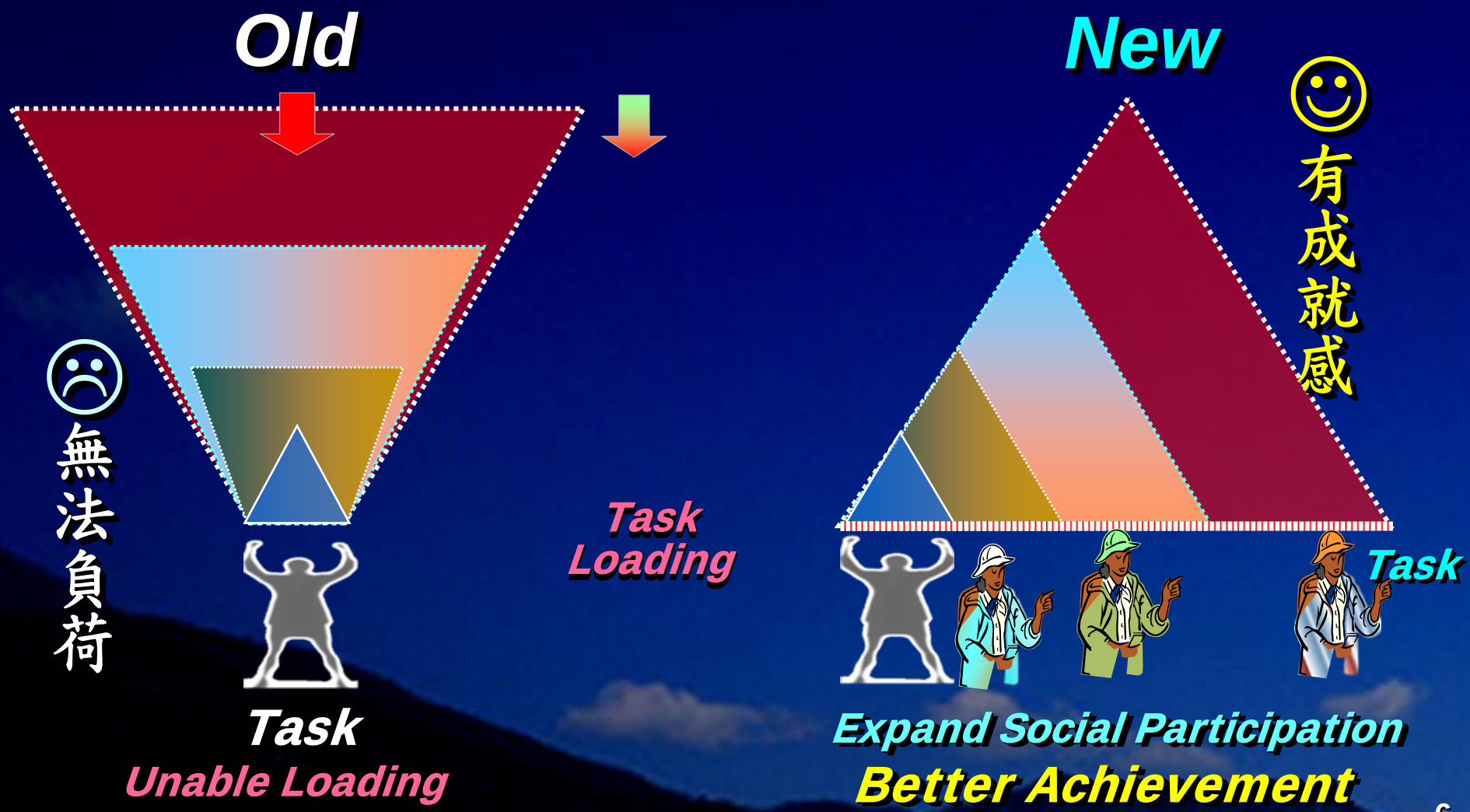
Comprehensive Strategies for Slopeland Conservation

水 土 林 動 人

Water, Soil, Vegetation, Ecology, Human



Expand Social Participation



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

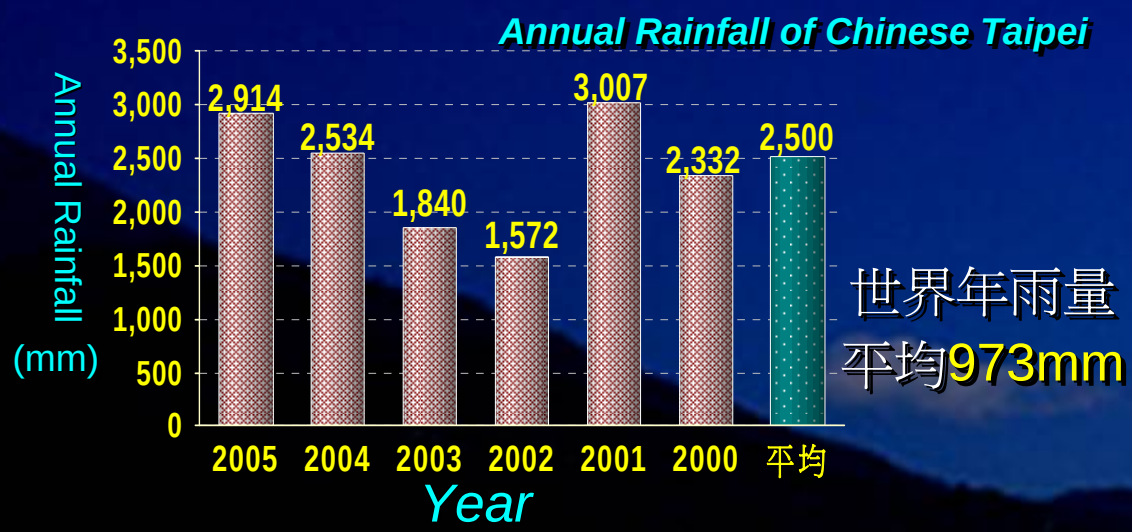
大甲溪上游地質破碎

陳有蘭溪

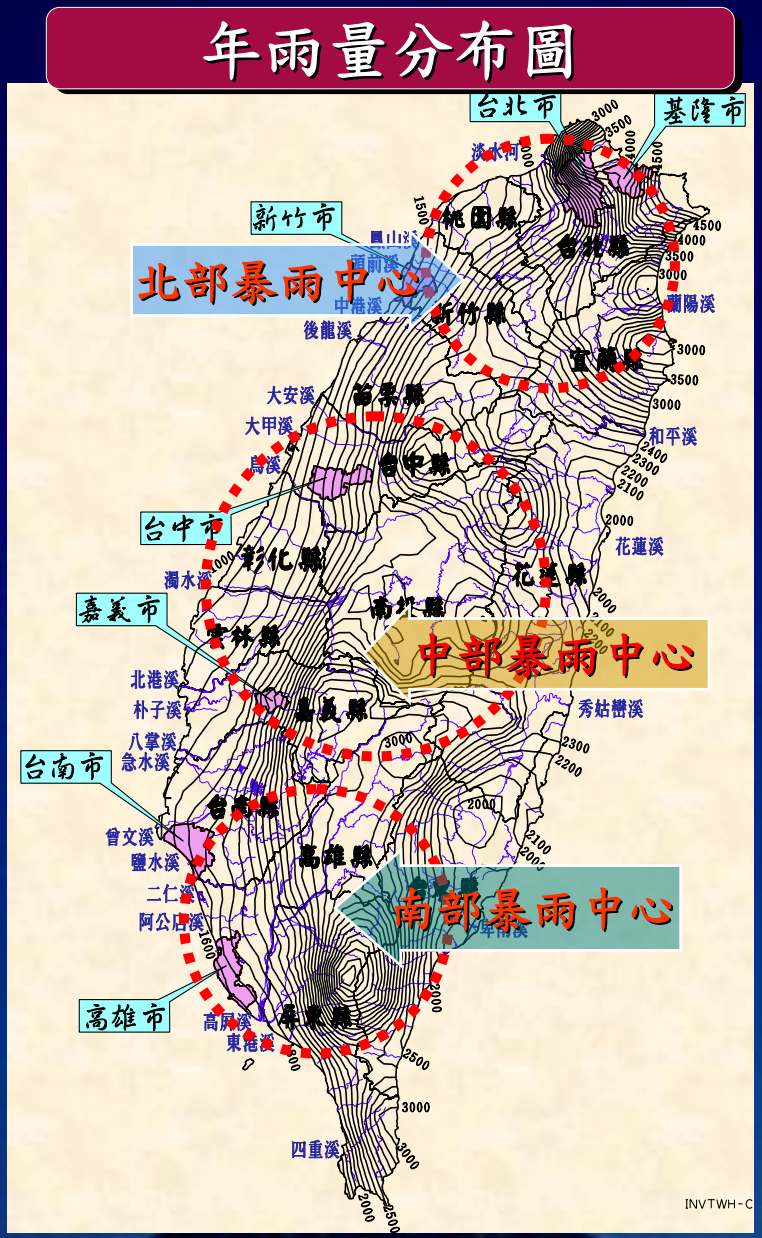
Debris-flow disasters after Toraji typhoon, 2001-8-1

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



世界年雨量
平均973mm



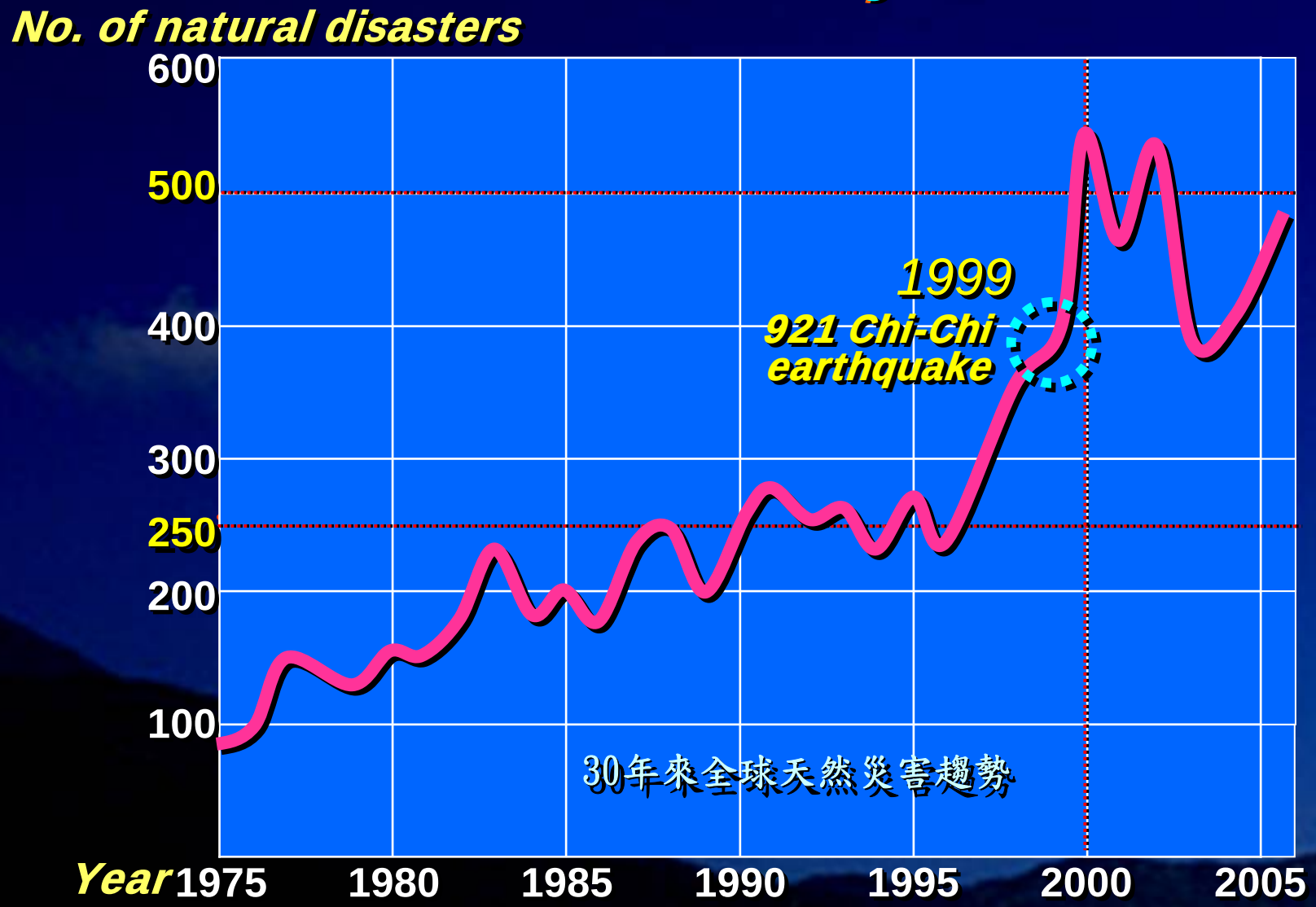
Distribution of Annual Rainfall

世界銀行報告(2005)：*Natural Disaster Hotspots- A Global Risk Analysis*

2005世銀災害高風險區評估報告

✓**The Island Most Exposed to Multiple Hazards in the World.**

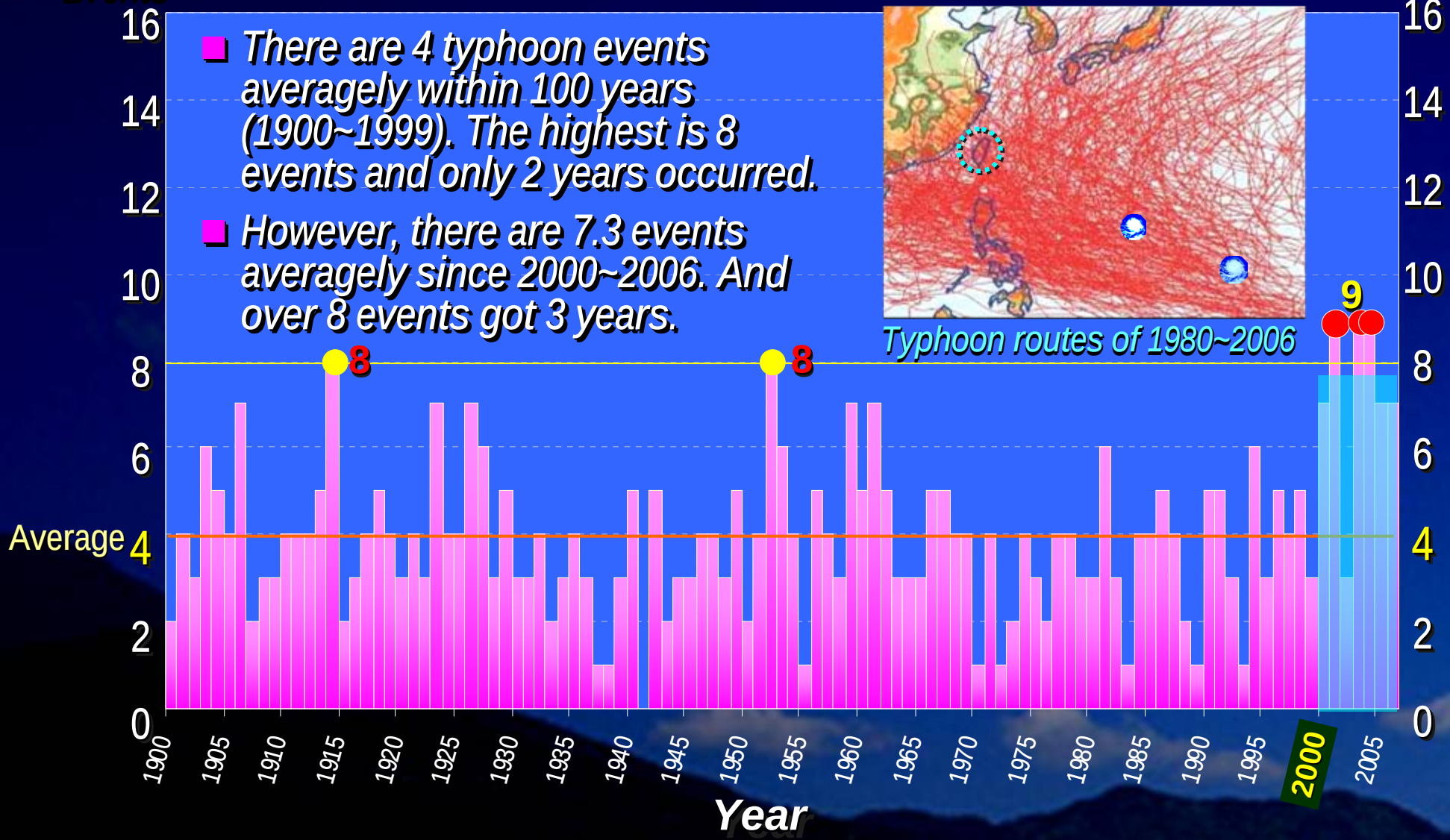
Global increasing trend of natural disasters in recent 30 years (1975-2006)



Increasing Trend of Typhoon Events (1897~2006)

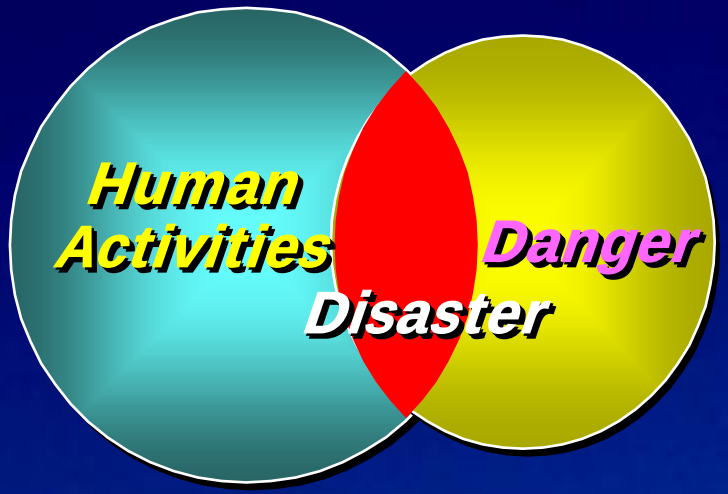
- There are 4 typhoon events averagely within 100 years (1900~1999). The highest is 8 events and only 2 years occurred.
- However, there are 7.3 events averagely since 2000~2006. And over 8 events got 3 years.

Typhoon routes of 1980~2006



Risk Management

Risk ➡ Chance



- Change
- Challenge
- Chance

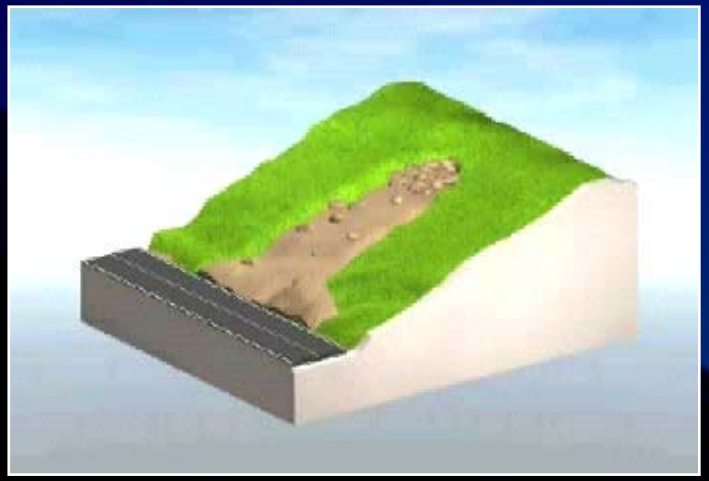
Hazard Preparedness

Debris Torrents & Landslides

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

Potential Debris Flow Torrents

Historic Landslides Distribution

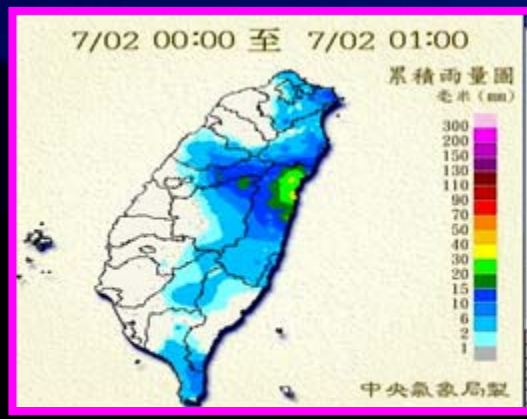


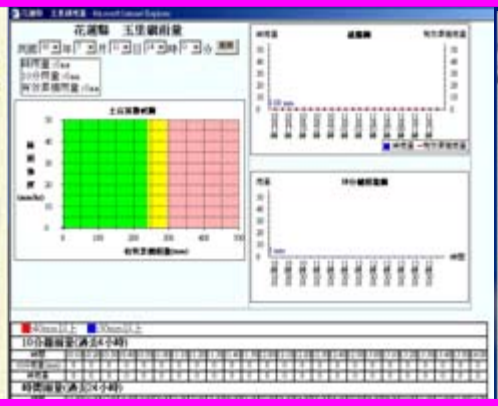
Contingency Response during Disasters

0800-246-246
（土石流-土石流）

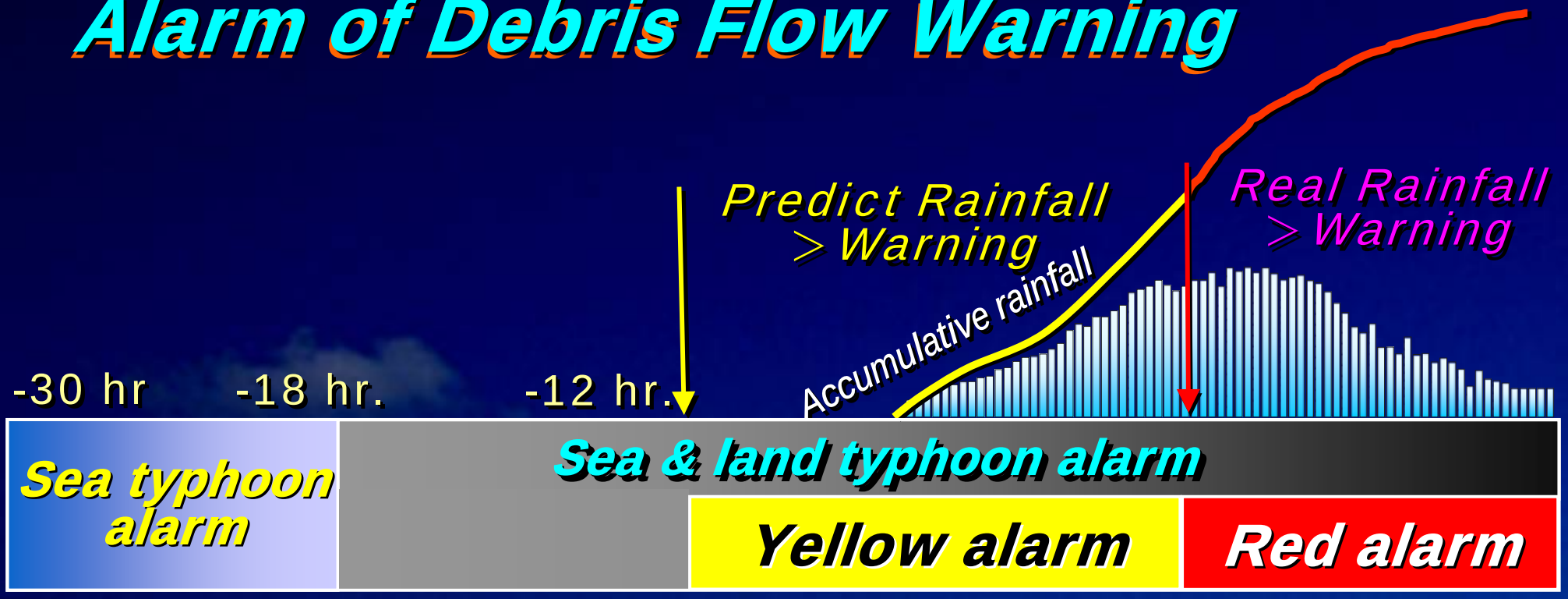
- Rainfall monitoring: **Every 10 min.**
- Typhoon: Cloud satellite image
- Announce: Debris Flow **Warning**
- Inform **emergency messengers**
- **Heavy equipments** standby at dangerous areas

Cloud Satellite Image





Alarm of Debris Flow Warning



Rainfall forecast

Predict Rainfall ＞Warning

Advise Evacuation

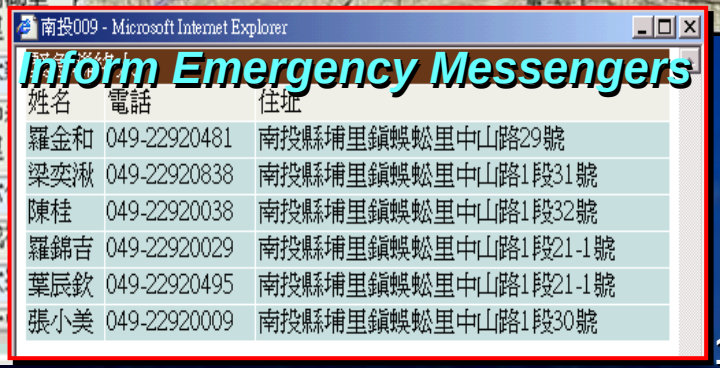
Real Rainfall ＞Warning

Enforce Evacuation

- **Rainfall of Debris Flow Warning: 250～550mm**

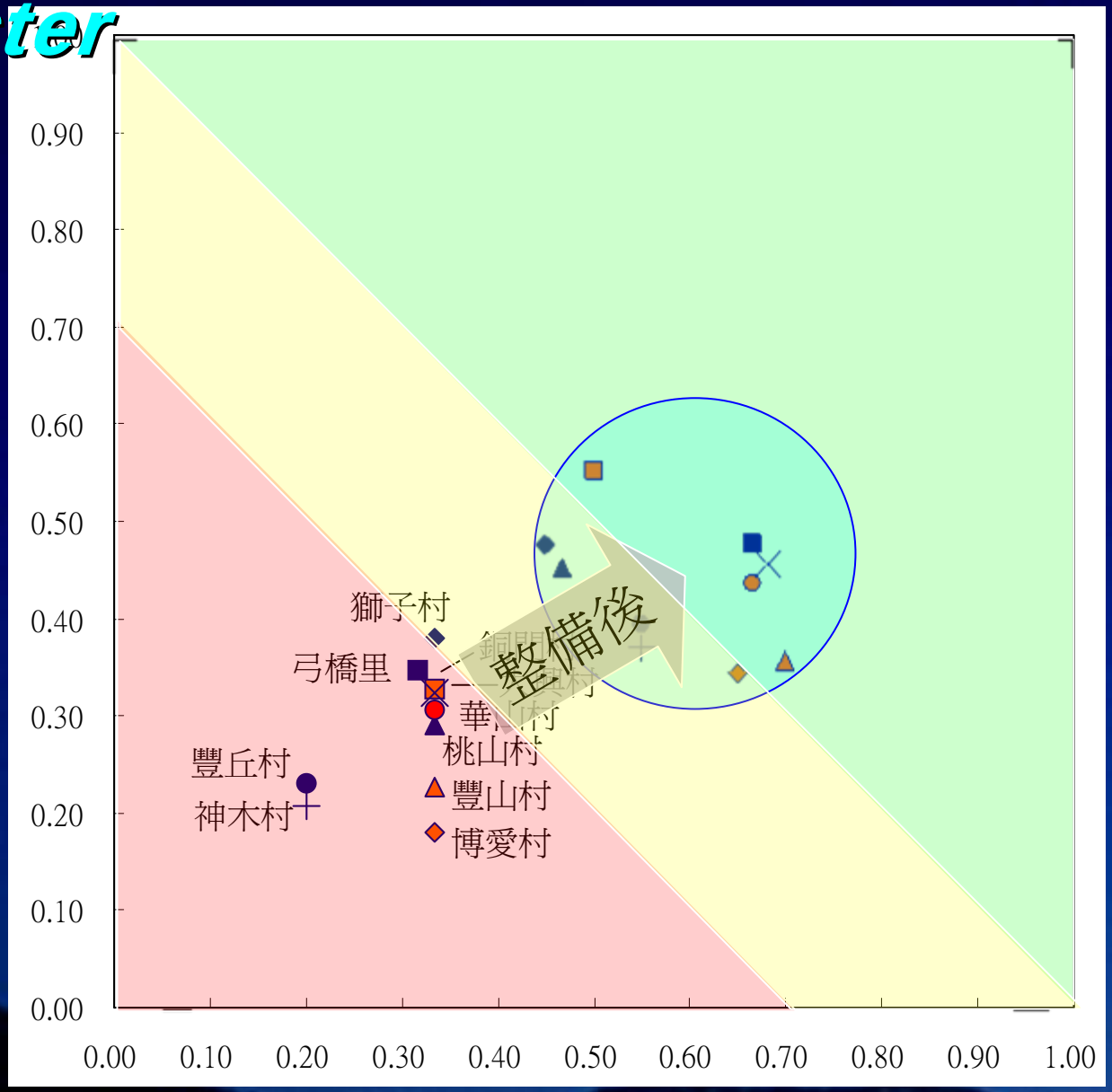
Formosa Emergency Management Action

http://fema.swcb.gov.tw



Debris Flow Disaster Standard

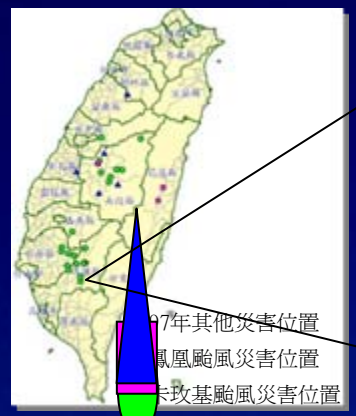
- ✓ Confirming the level of disaster preparedness in every village
- ✓ Strengthening the weakest item in disaster preparedness
- ✓ Planning short, medium and long term disaster preparedness for village



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

Instant News
- In disaster scene, carefully record
- Show the real condition by photos

Faster Report

Real Record
- Collect disaster area meteorological and hydrological data
- Discuss the cause of disaster

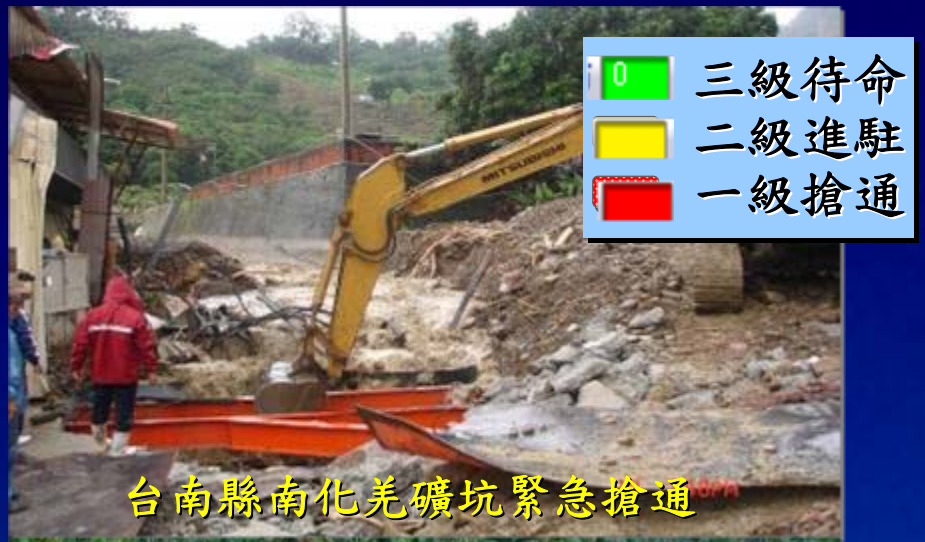
serious Debris Flow Disaster Scene Investigation

Complete Report
- Collect the disaster info
- Analyze the cause of disaster and suggestion

Set up Debris Flow Disaster Emergency SOP

Contingency Response ➡ Heavy Equipments Standby at Potential Hazardous Spots

- 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修通

Debris Flow Monitoring Stations

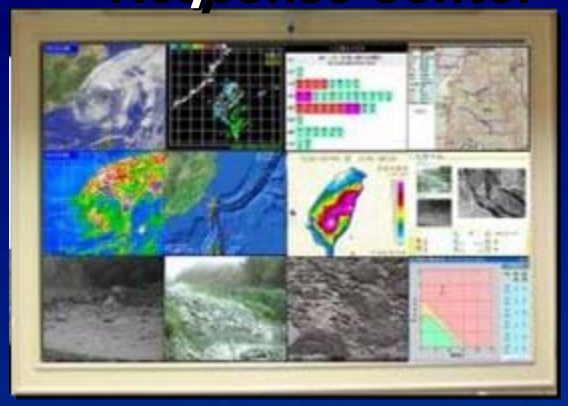
Field Monitoring

Data Transmission

Monitoring Vehicle

Information Display

Debris Flow Disaster Response Center



Real Time Image

Kalmaegi Typhoon

July 18, 2008

Debris flow warning and evacuation example

Promote the Disaster Prevention on Local Communities

Pre-Disaster

- **R**einforce the system of disaster prevention
- **E**nhance the ability of emergency response
- **D**iscover source of disaster

Disaster

- **R**escue cooperation
- **E**mergency response
- **D**ecrease the loss of disaster

Post-Disaster

- **R**ehabilitation and reconstruction

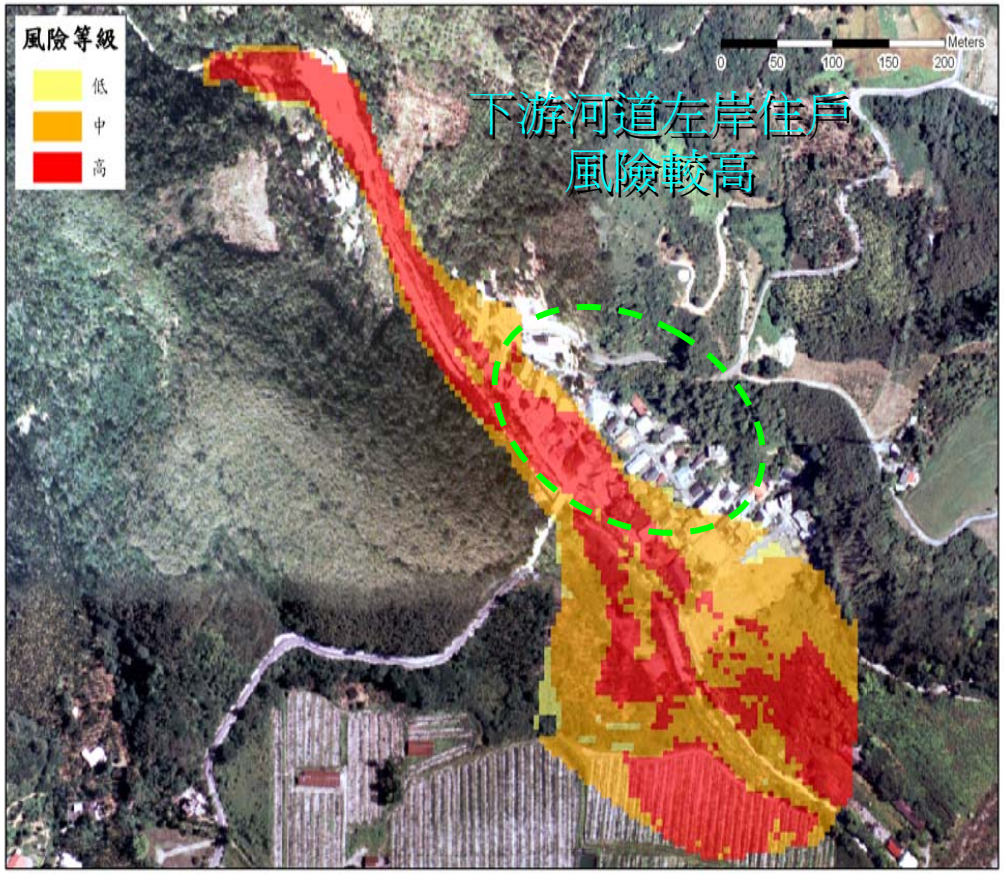
Sustainable communities

Disaster management

Coexist with natur

Risk Mapping

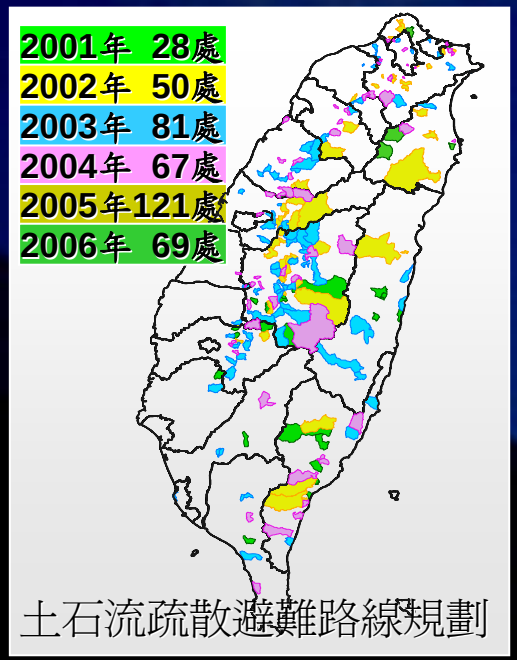
Warning Simulation of Debris Flow Disaster Condition



Evacuation Routes and Drills for Debris Flow Disaster Mitigation

土石流防災專員及簡易雨量筒

- 416 Evacuation routes planned
- 410 debris flow evacuation drills held



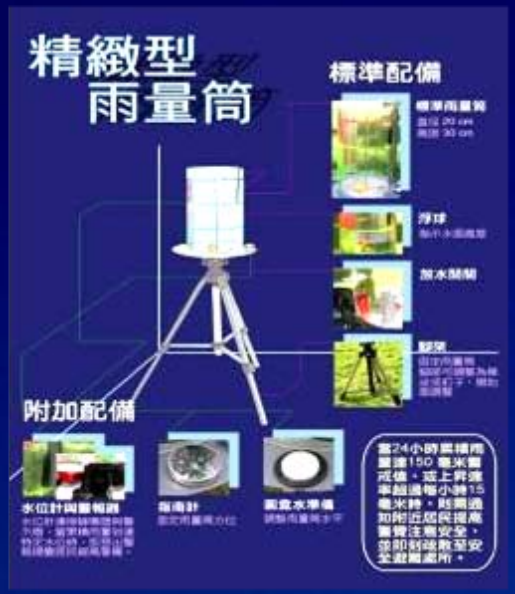
土石流疏散避難路線規劃

土石流防災演練

Rainfall Cones DIY

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

DIY rain gauges

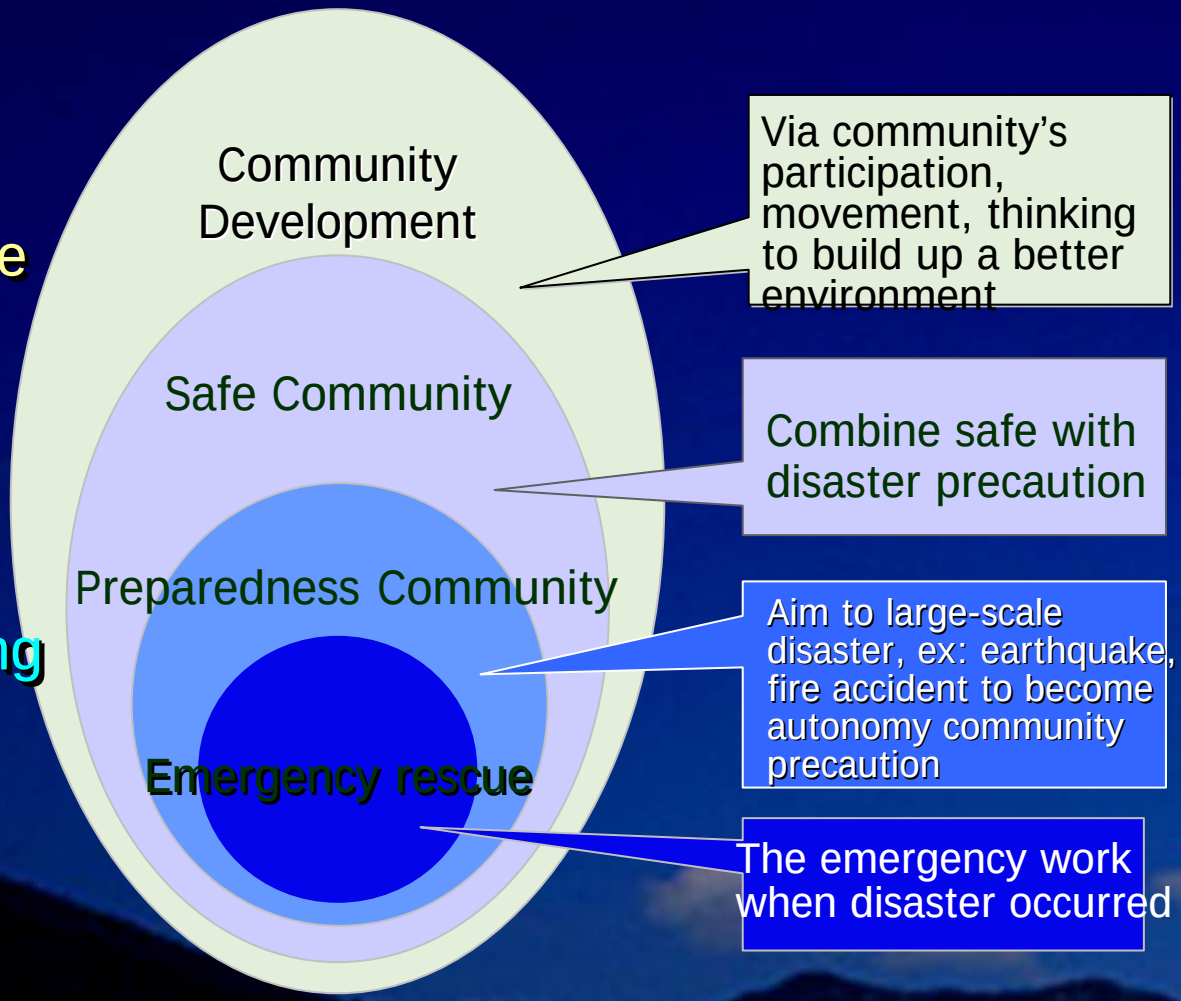


義工親送雨量筒
2004.5.24

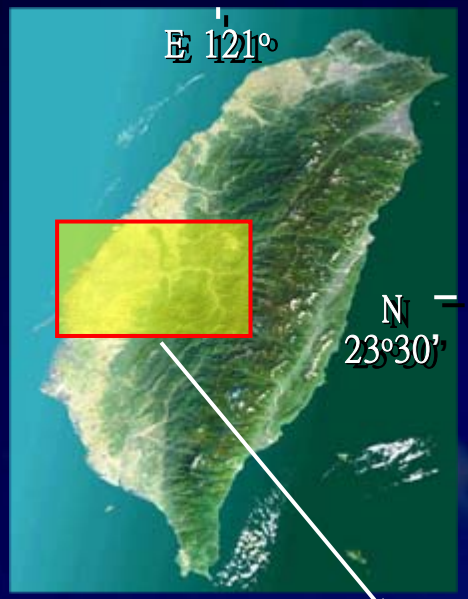
72水災遭土石流淹沒
但人員平安撤離

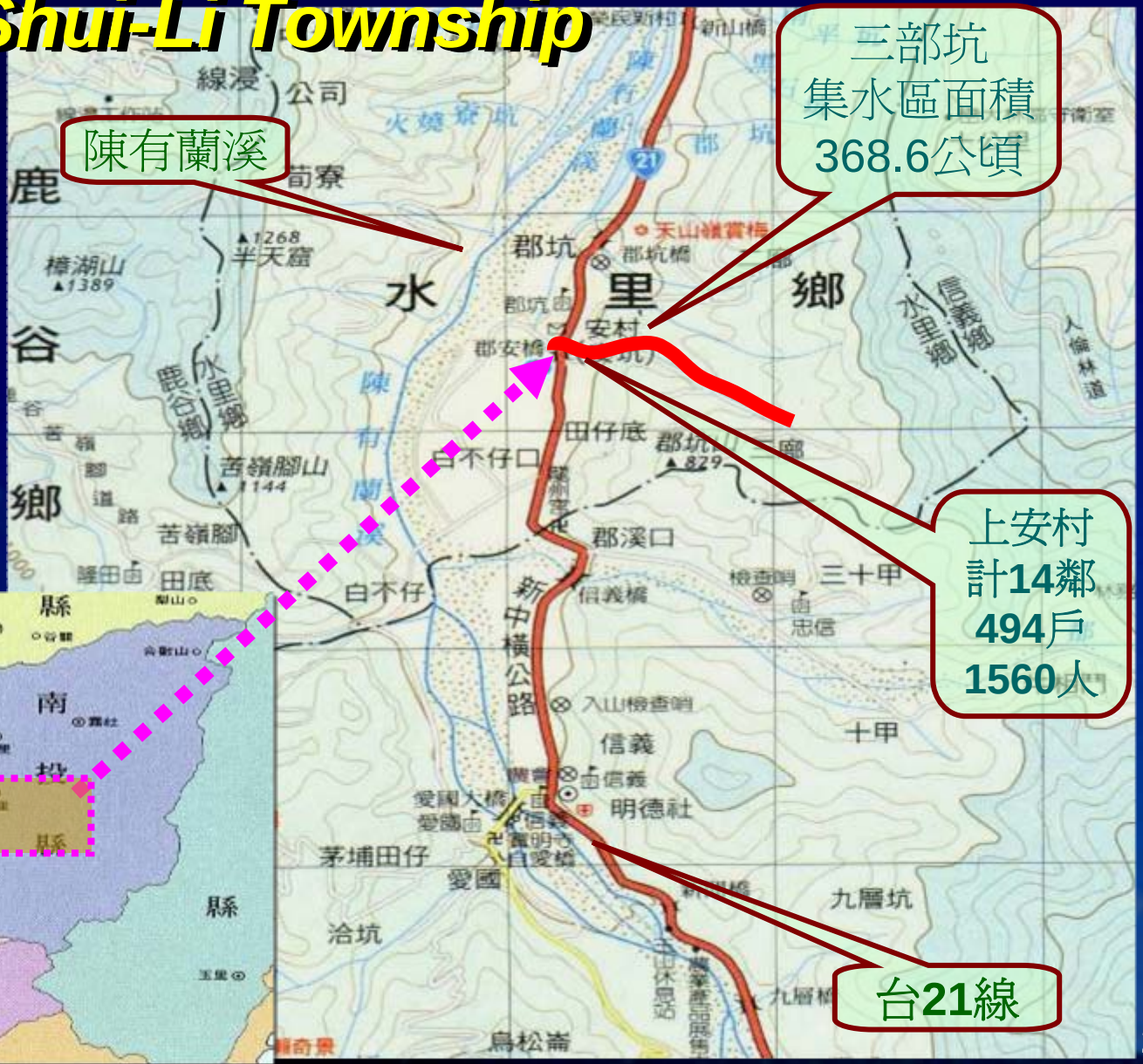
Community Development vs Community Precaution

- Local independence Community Development
- The concept of Precaution Community entering Community Development



Overview of Shang-An village, Shui-Li Township





HISTORY

- *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。

Typhoon Torji hit Shang-An Village

Typhoon Torji hit Shang-An Village

Before and after debris flow

in Shan-An, Shui-Li, Nantou County

Pilot less plane film the disaster

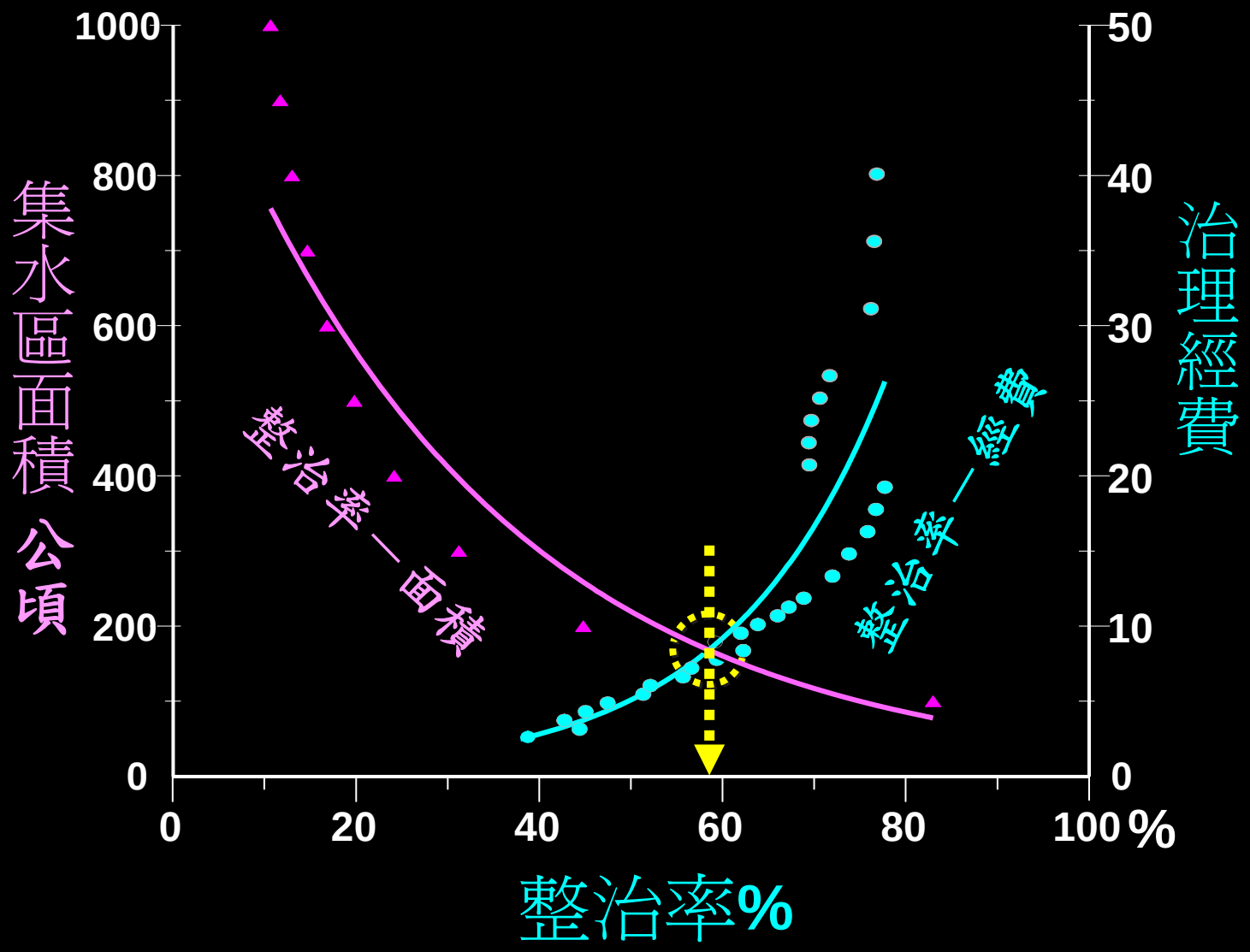
discharge of debris flow can be approached ≧ 10 times of clear water

Advance omnibearing planning of watershed control

Integration

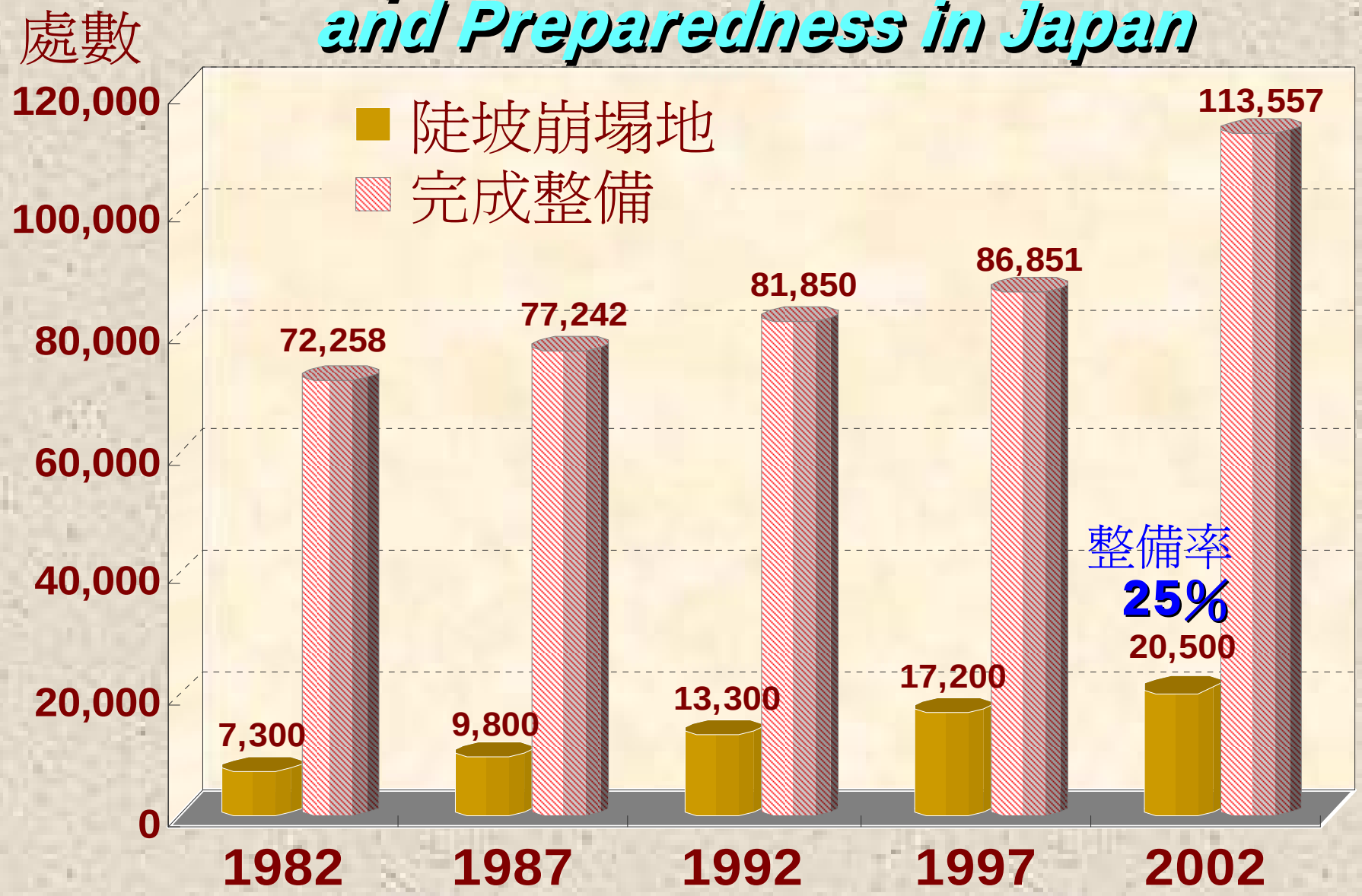
- ❖Disaster prevention
- ❖Rural development
- ❖Slopeland conservation
- ❖Environmental greening and beautification
- ❖New community environmental improvement
- ❖Debirs flow real-time

Estimation of Watershed Completion Ration



- 整治率接近60%，可視爲最理想或適宜的整治率目標值。
- 截至96年，台灣集水區整治率爲37.7%。

Comparison Between Landslide and Preparedness in Japan



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

公路局復興工務段提供

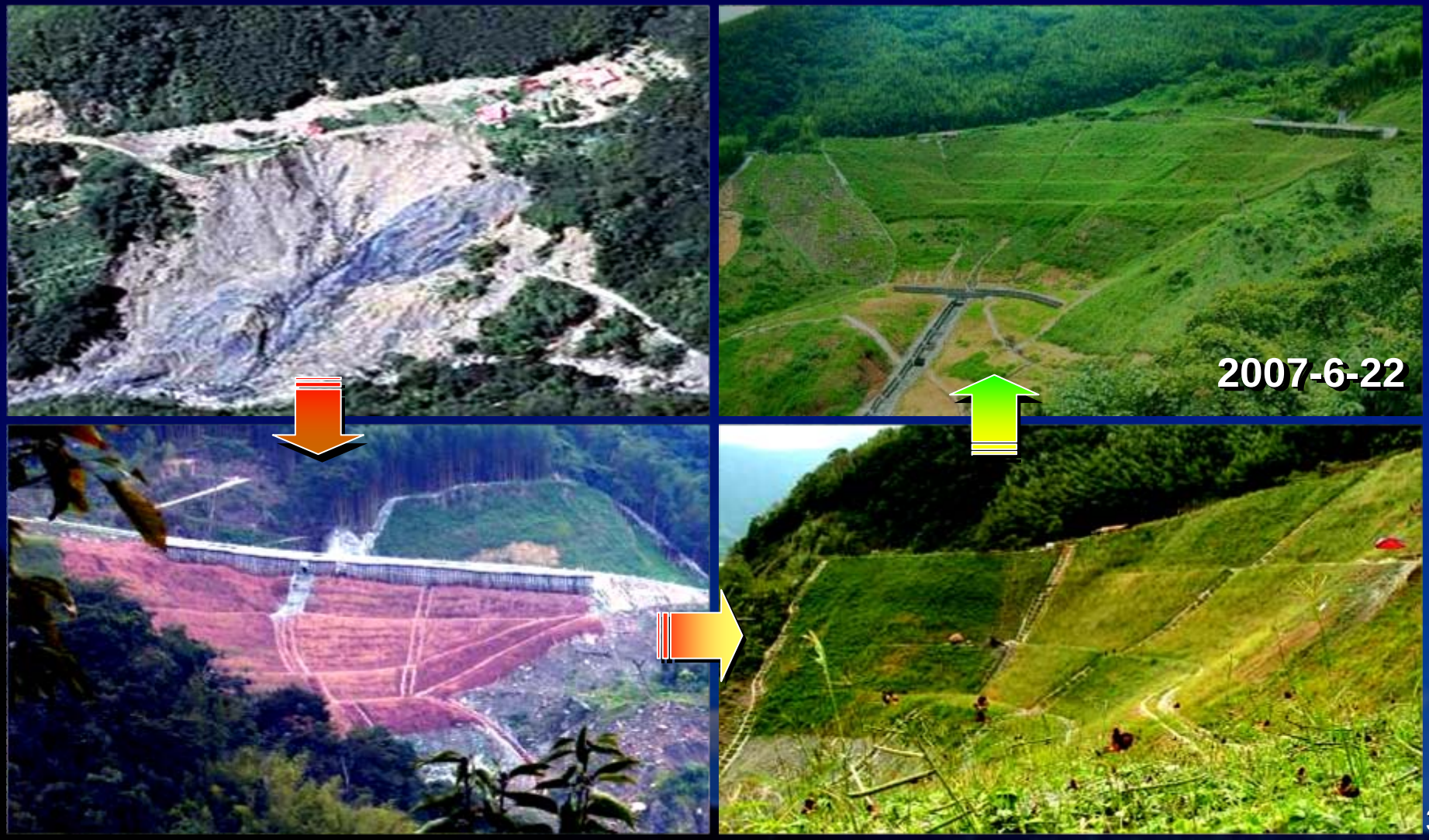
Before

After Restoration 2006.6.09 storm

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 vaillages and three bridges.

Debris Flow overwhelmed houses on Sep. 16, 2001

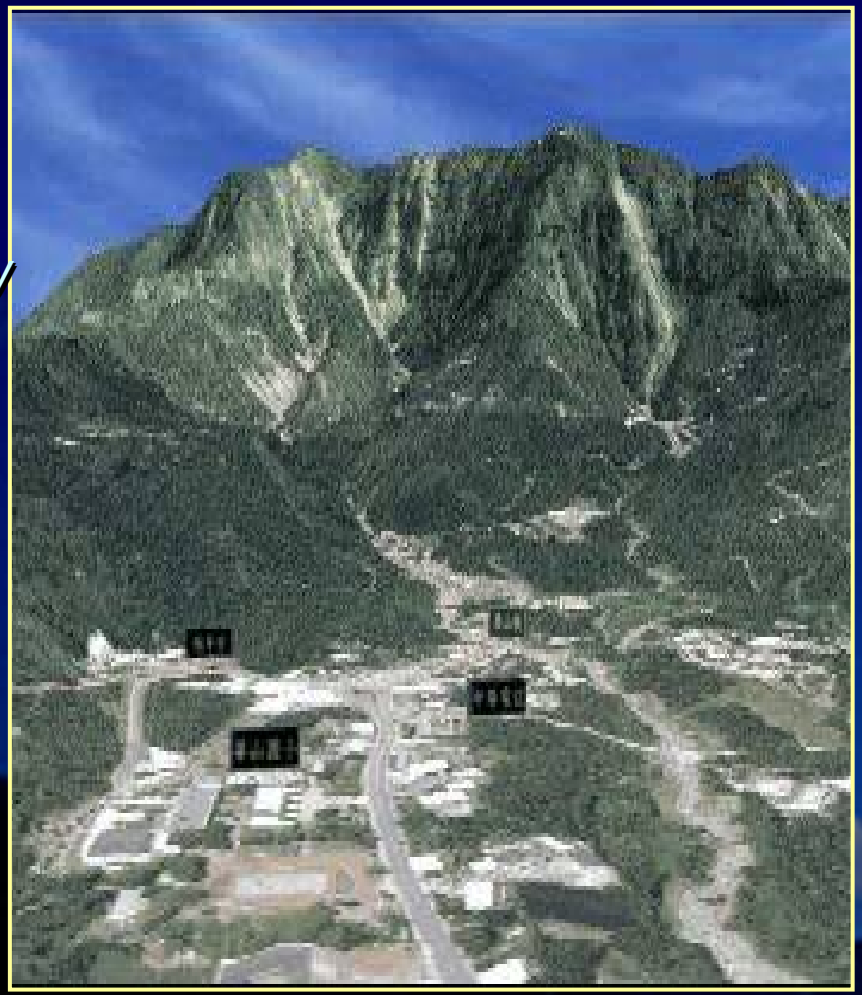
Debris Flow changed roadways on Sep. 16, 2001

華山

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

After Treatment

Debris flow monitoring

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

公部門投入
導入專業
相對競爭力
地區知名度

整體評估
發展導向

規劃方針

Concept of Development

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

- 山坡地的農村重建首重安全
- 本區以土石流整治爲基礎
- 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

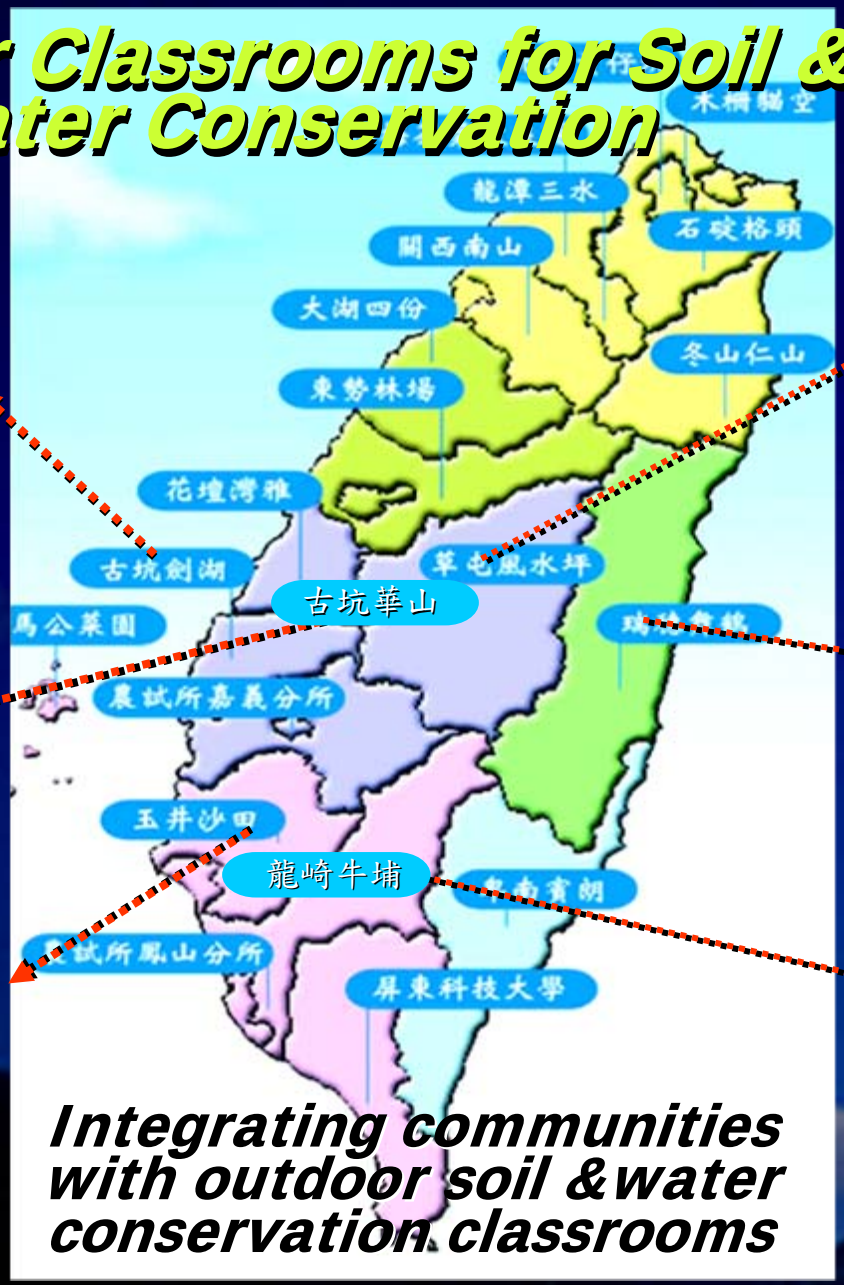



抽藤坑溪緩衝綠帶


Improvement of
Engineering Environment
Simulation of Buffer Zone
After 10 years

Outdoor Classrooms for Soil & Water Conservation

22 locations
535,990 visitors/yr



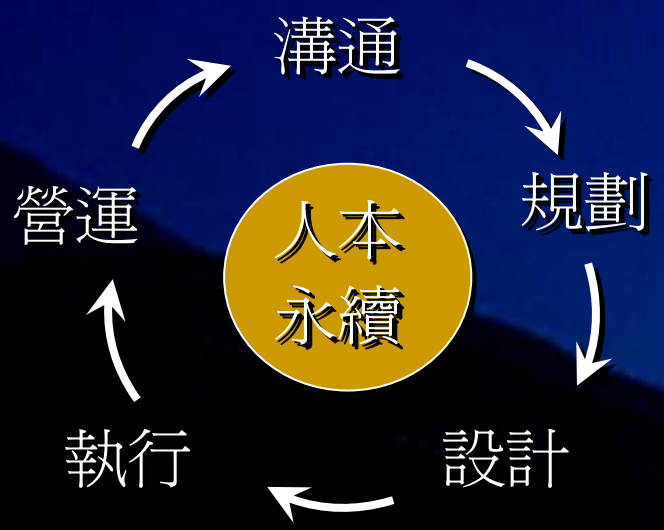
Integrating communities with outdoor soil &water conservation classrooms

Rural Development with Various Scales

National-wide | **County / District** | **Community**

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

營造富麗新農村

Promote Rural Restoration Communities

- Promote 4000 Communities for Rural Restoration

Future Perspective for Slopeland Conservation & Rural Development

—T.H.I.N.K—

- **T**echnology：Research, development and practice.
- **H**uman management：Improve people's knowledge of precaution against disaster.
- **I**nvestigation：Investigate the potential locations to cope with disasters.
- **N**otice：Accurately control possible occurring time and give a declaration.
- **K**nowledge：Information and database as well as expert decision- making system.

優質、效率、團隊

Thank You for Attention

Soil and Water Conservation Bureau
Always Working with You