



**Asia-Pacific
Economic Cooperation**

2012/EPWG/WKSP2/006

Natural Disaster Impact on Business and Communities in Chinese Taipei

Submitted by: Chinese Taipei



**Developing Governments' Capacity to
Promote and Facilitate the Effective Use of
Business Continuity Planning for Disaster**

**Resiliency
Singapore**

22-23 November 2012

Natural Disaster Impact on Business and Communities in Taiwan

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NCDR
Chinese Taipei

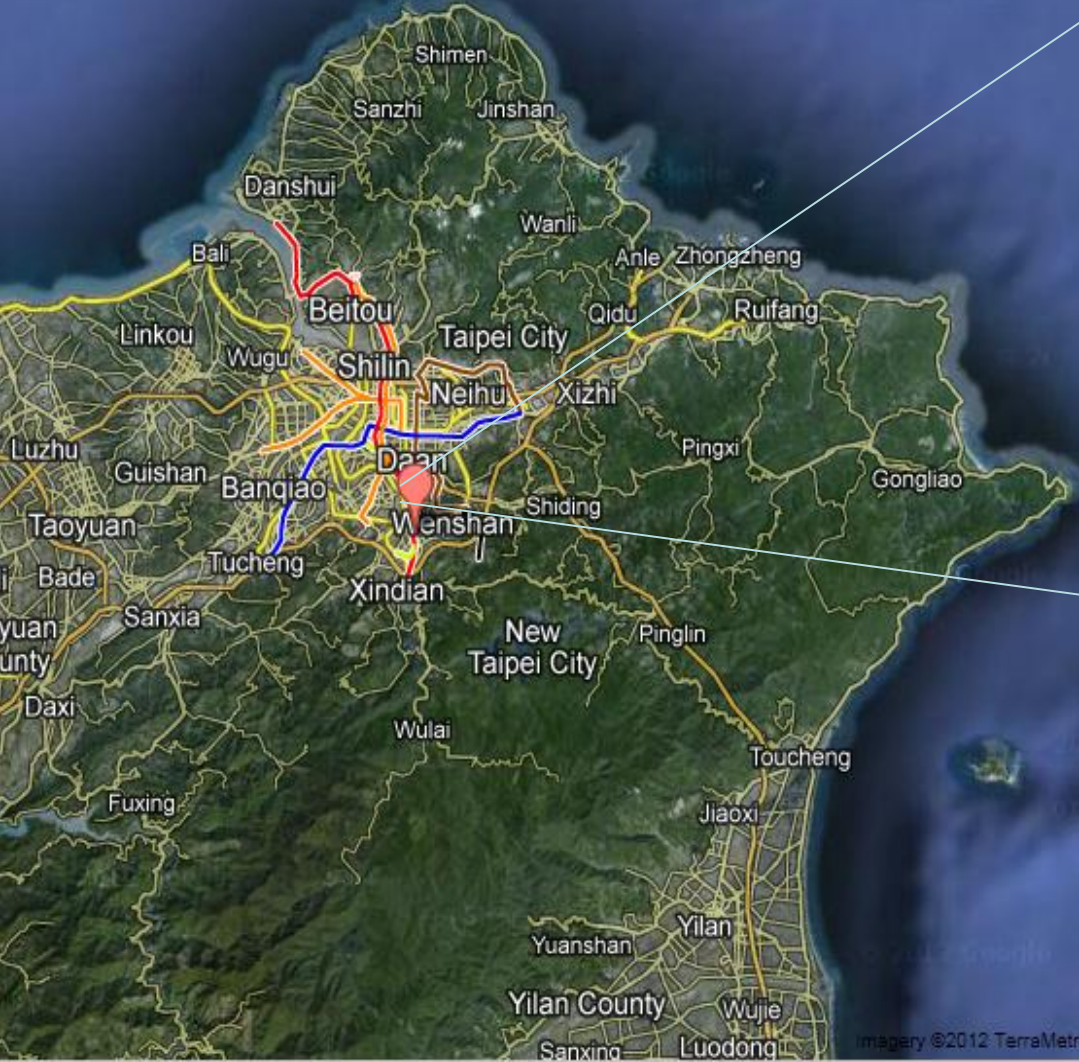
Brief Introduction of NCDR



www.ncdr.nat.gov.tw



Map



Organizational Chart of NCDR



www.ncdr.nat.gov.tw

NDPPC & NSC

NDPPC: National Disaster Preparation and Prevention Center

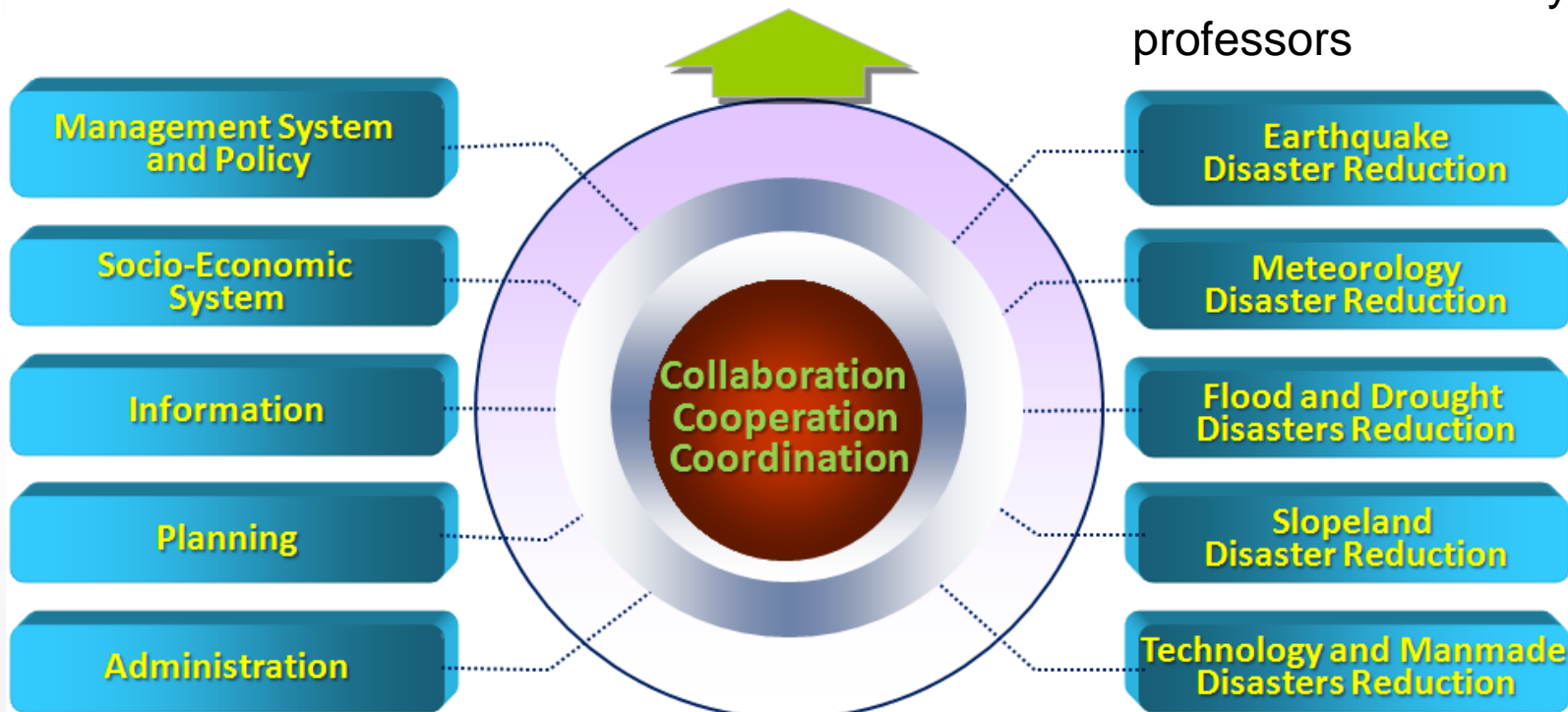
NSC: National Science Council

Director

Deputy Director

Executive Secretary

- NSC funded, budget \$5 million
- Founded in 2004
- 93 full-time staff, 80% with graduate degrees
- Divisions assisted by academic professors



Major Topics at NCDR

Typhoons and Floods

- Risk assessment
- Survey, evaluation and strategy of highly vulnerable areas
- Decision support for emergency response
- Watershed Management

Earthquakes

- Risk assessment and emergency response
- Earth Early Warning system

Supporting Platform

- Information
- Policy
- Socio-Economic
- Risk assessment
- Post survey

New Issues

- CCA and DRR
- CIP
- Compound Disaster

CCA: Climate Change Adaptation
DRR: Disaster Risk Reduction
CIP: Critical Infrastructure Protection

Application and implementation

- Methodology for implementation
- Mechanism improvement
- Education
- Laws and regulations
- Review and evaluation
- Community-based policy

NCDR's Role in Emergency Response



NCDR runs scientific analysis

NCDR

- **Internal Meeting every 3hrs**
- **Provide Analysis**
 1. Rainfall estimation
 2. Flood potential
 3. Debris flow potential
 4. Precaution notice



NCDR summons the meeting

CEOC

- **Assessment Meeting every 3hrs**
- **Generate Suggestions**
 1. Warning zones
 2. Evacuation
 3. Reinforcement
 4. Bulletin to local government



NCDR reports to commander

CEOC

- **Working Meeting**
- **Overall Review**
 1. Situation reports
 2. Readiness report
 3. Assistance and deployment
 4. Emergency response

Technology



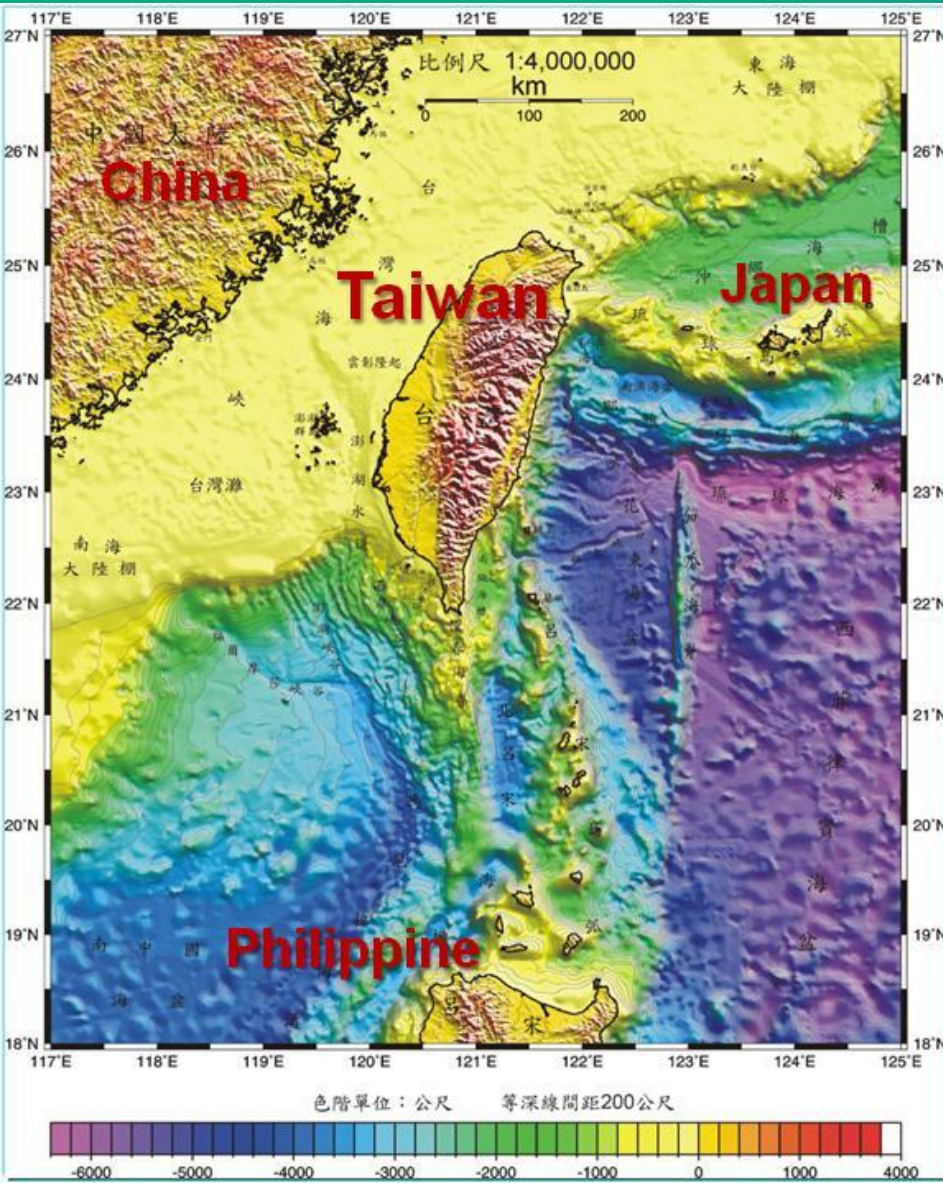
Policy



Implementation

Basic Information of Taiwan

Basic Information of Taiwan



- **Geographic features**
 - 400 km from north to south
 - 145 km from east to west
 - Area: 36,000 Km² **over 70% in slope land**
- **Population (Jan, 2012)**
 - 23,230,506 in total, **67.70% in urban areas**
 - **Density: 641/ Km²** , (but 40,674 in highest district)
- **Tectonic Conjunctions:**
 - **Philippine Sea plate**
 - **Euro-Asia Plate**
- **High risk of tropical cyclones**
 - **3.5 typhoons/year**

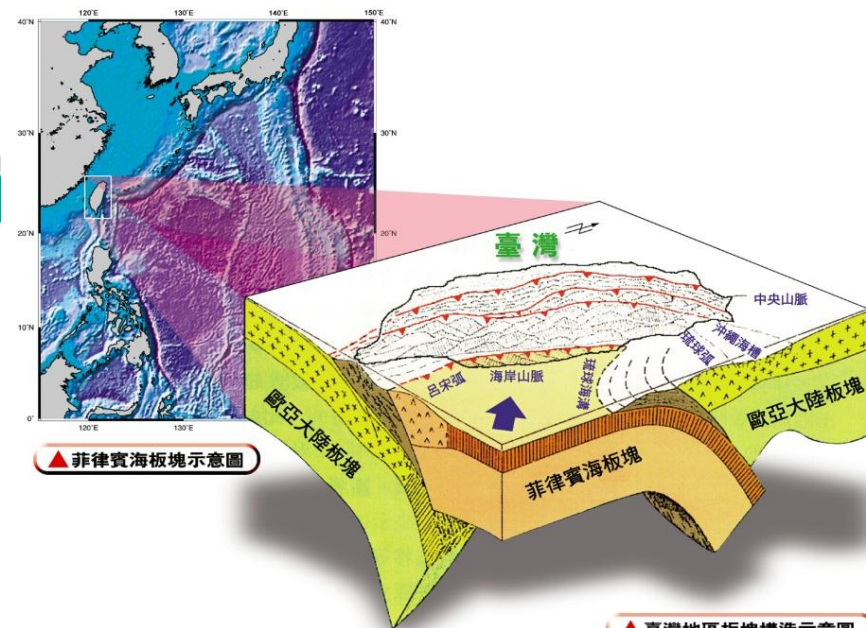
Taiwan Seismicity

• Taiwan

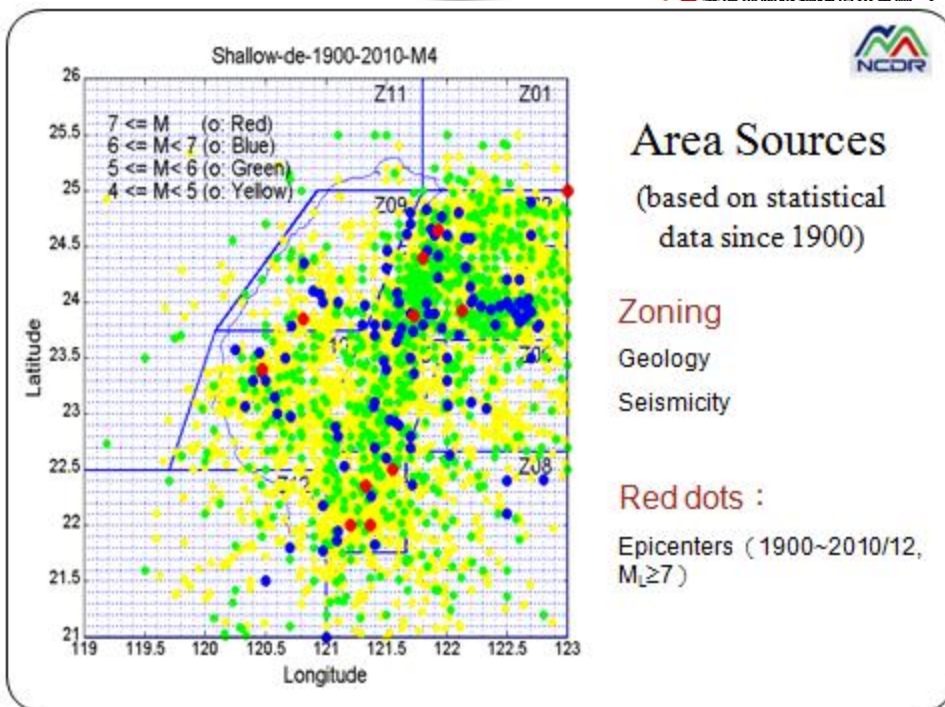
- Located in the Ring of Fire
- Since 1900, 96 fatal quakes occurred
- Every 10 year could have one destructive quake

• History

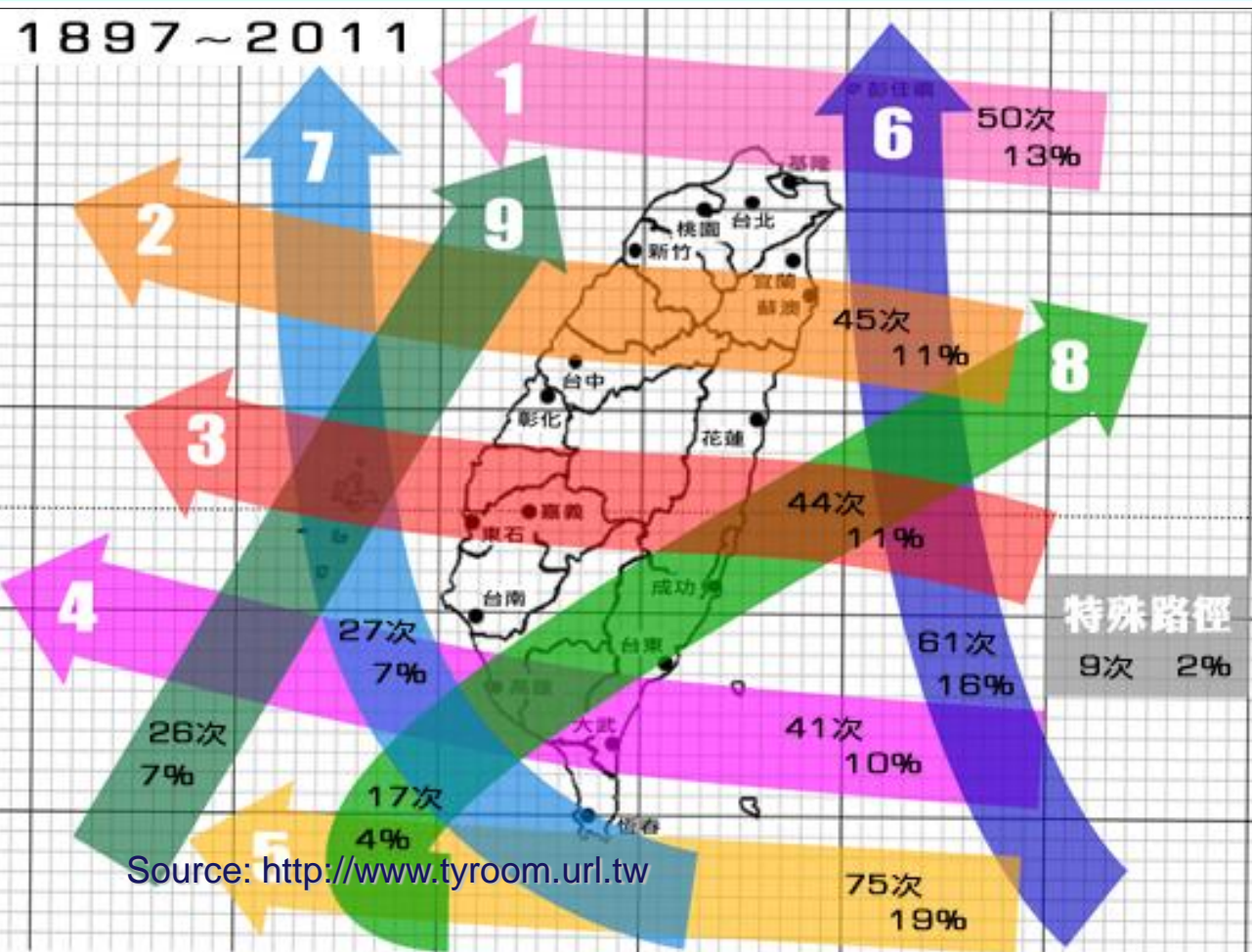
- 1999, the Chi-Chi Earthquake
 - Death toll: 2,500 more
 - Direct loss: over 24 billions NTD
- 2002, the 331 Quake
 - Crane falling from Taipei 101
- 2006, the 1226 Quake
 - Destruction of the intercontinental optic-fiber cables



▲臺灣地區板塊構造示意圖

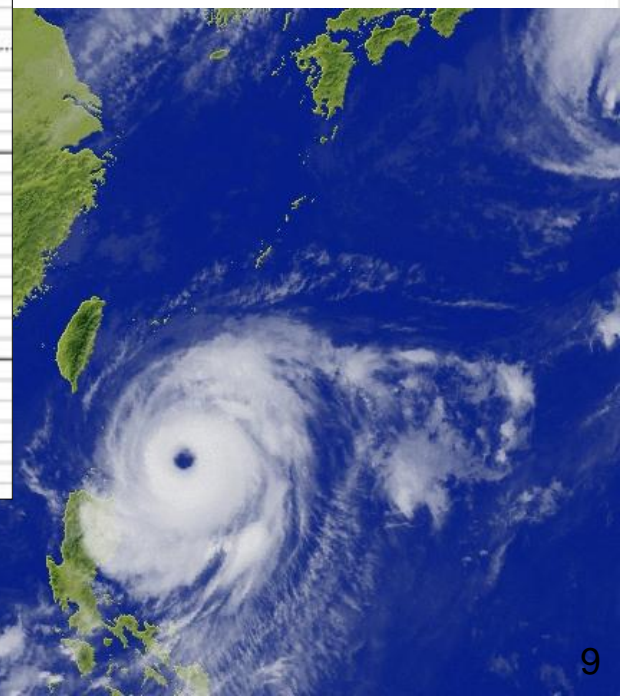


Typhoon Statistics



Total: 395

Ave: 3.5 / year



In 2009, record in history, Typhoon Morakot



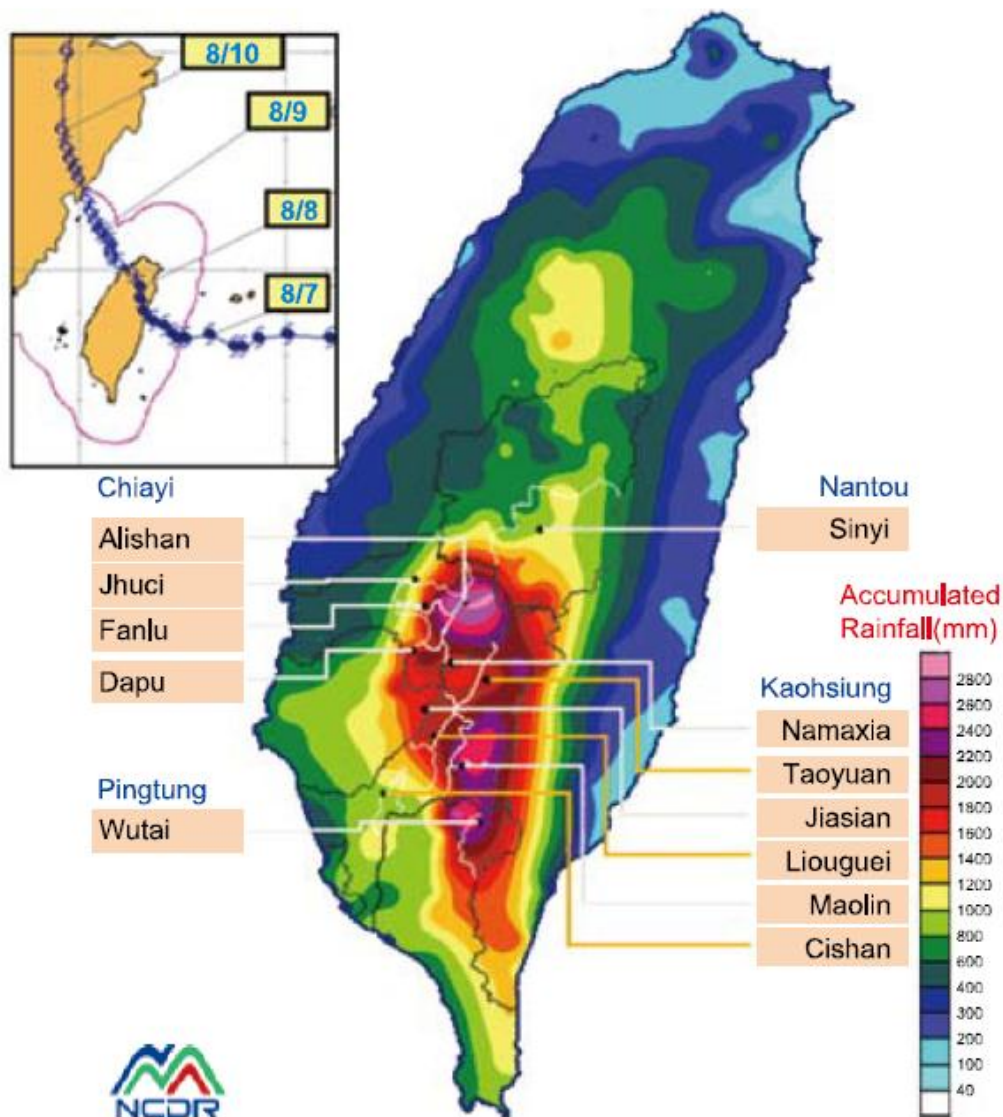
www.ncdr.nat.gov.tw

Natural disasters by number of deaths⁽¹⁾ - 2009

Earthquake, September	Indonesia	1 195
Flood, July-September	India	992
Typhoon Morakot (Kiko), August	Taiwan	630
Typhoon Pepeng (Parma), October	Philippines	539
Tropical storm Ondoy (Ketsana), September	Philippines	501
Extreme temperature, January-February	Australia	347
Flood, September-October	India	300
Earthquake, April	Italy	295
Hurricane 'Ida', November	El Salvador	275
Extreme temperature, May-August	Peru	274

(1): Includes the reported missing persons

Source: UN/ISDR



Major Natural Challenges



Earthquake (1999)



Landslide



Typhoon (2009)

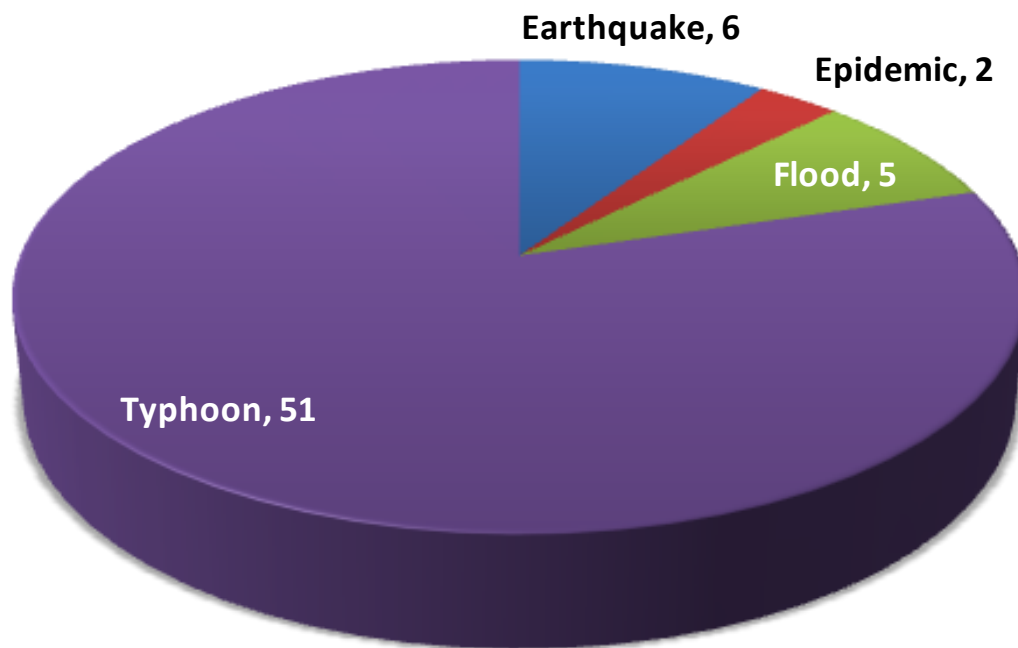


Flood

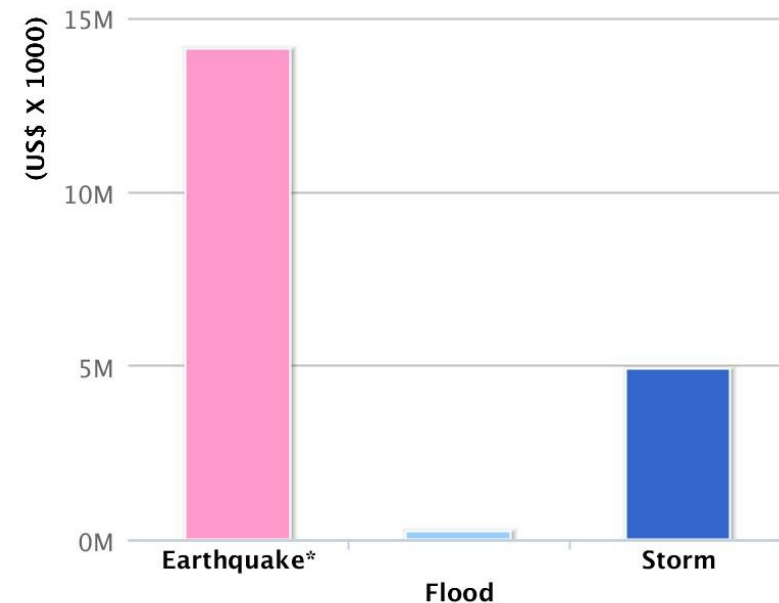


Debris flow

Natural Disasters from 1980 - 2010



Average Loss per Natural Disaster from 1980 - 2010



Taiwan Suffers More than Others

Countries Most Exposed to Multiple Hazards

Three or more hazards (top 15 based on land area)

Country	Percent of Total Area Exposed	Percent of Population Exposed	Max. Number of Hazards
Taiwan	73.1	73.1	4
Costa Rica	36.8	41.1	4
Vanuatu	28.8	20.5	3
Philippines	22.3	36.4	5
Guatemala	21.3	40.8	5
Ecuador	13.9	23.9	5
Chile	12.9	54.0	4
Japan	10.5	15.3	4

Source: World Bank, 2005

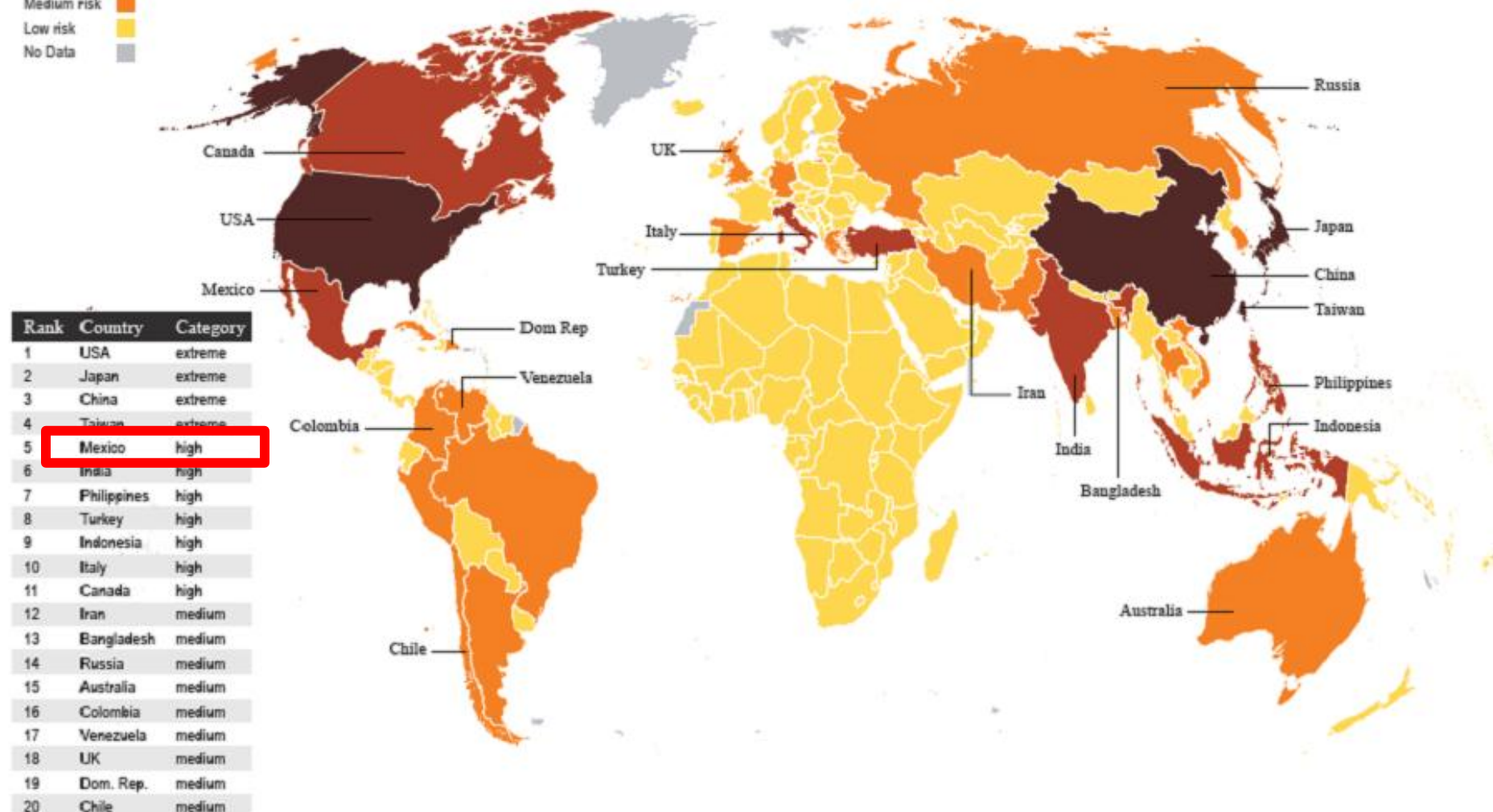
Recent Report by Maplecroft, 2011



Natural Hazards Risk – Absolute Economic Exposure Index 2011

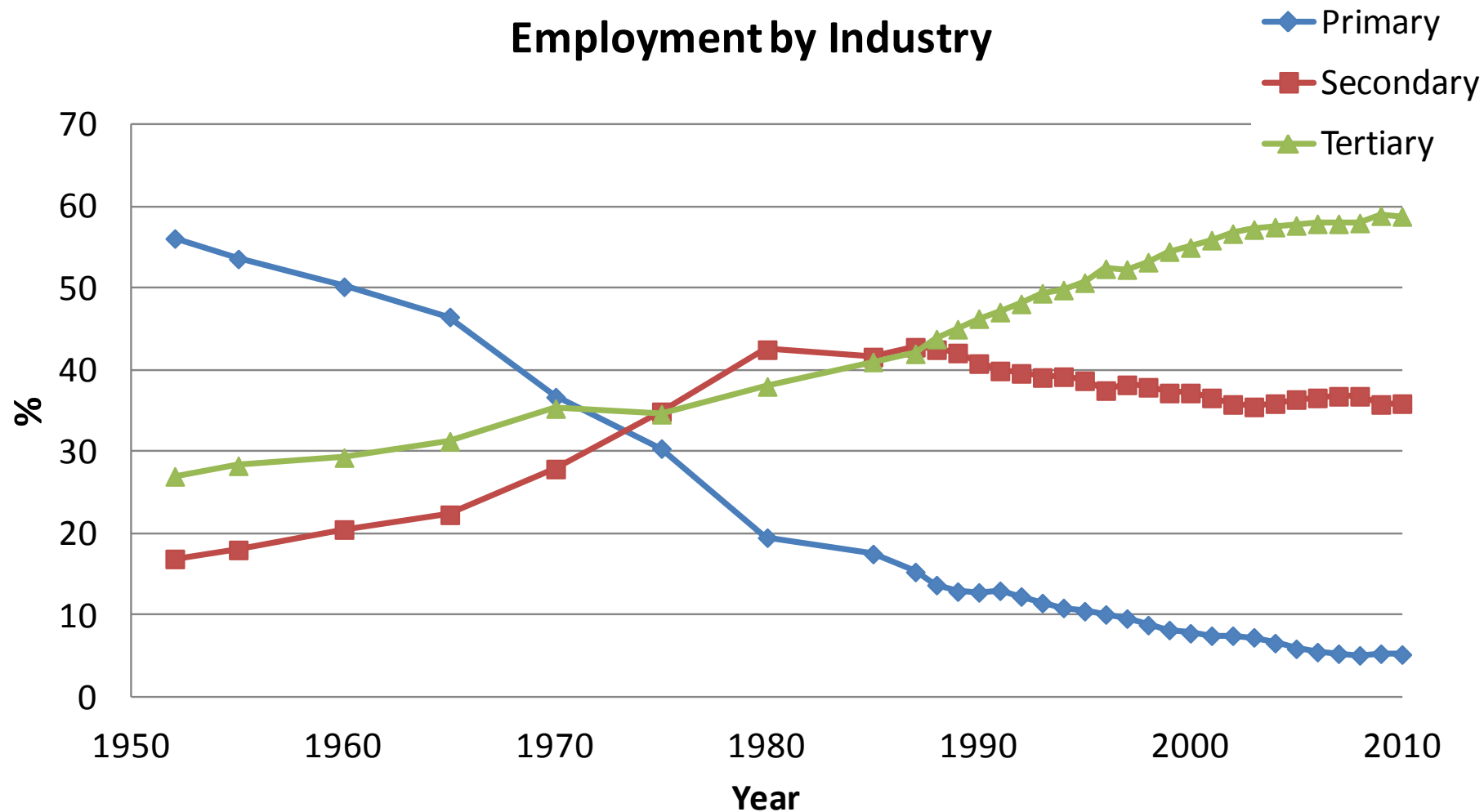


Extreme risk
High risk
Medium risk
Low risk
No Data



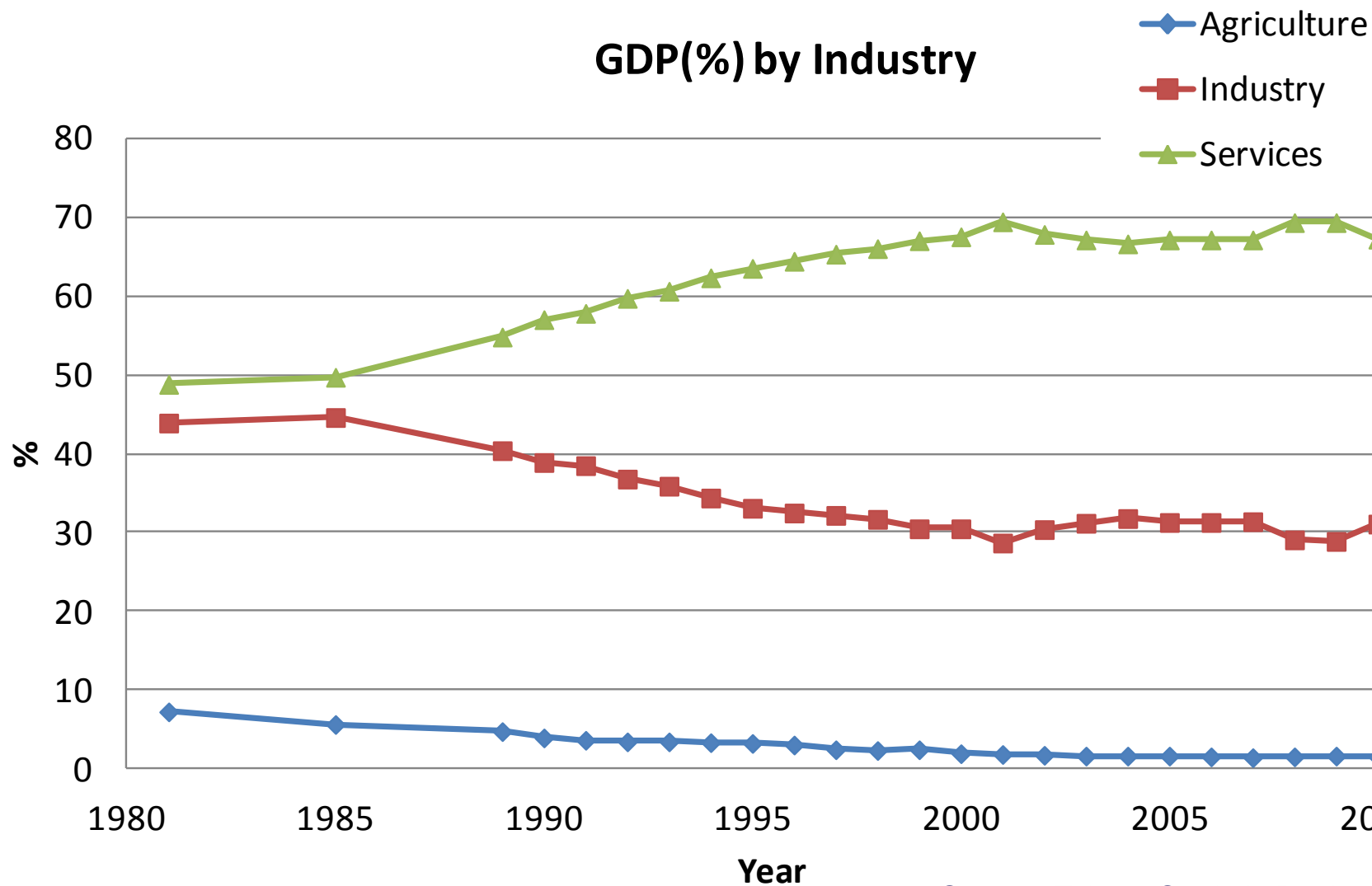
Natural Disaster Impact on Business and Communities in Taiwan

Percentage Employment by Industry



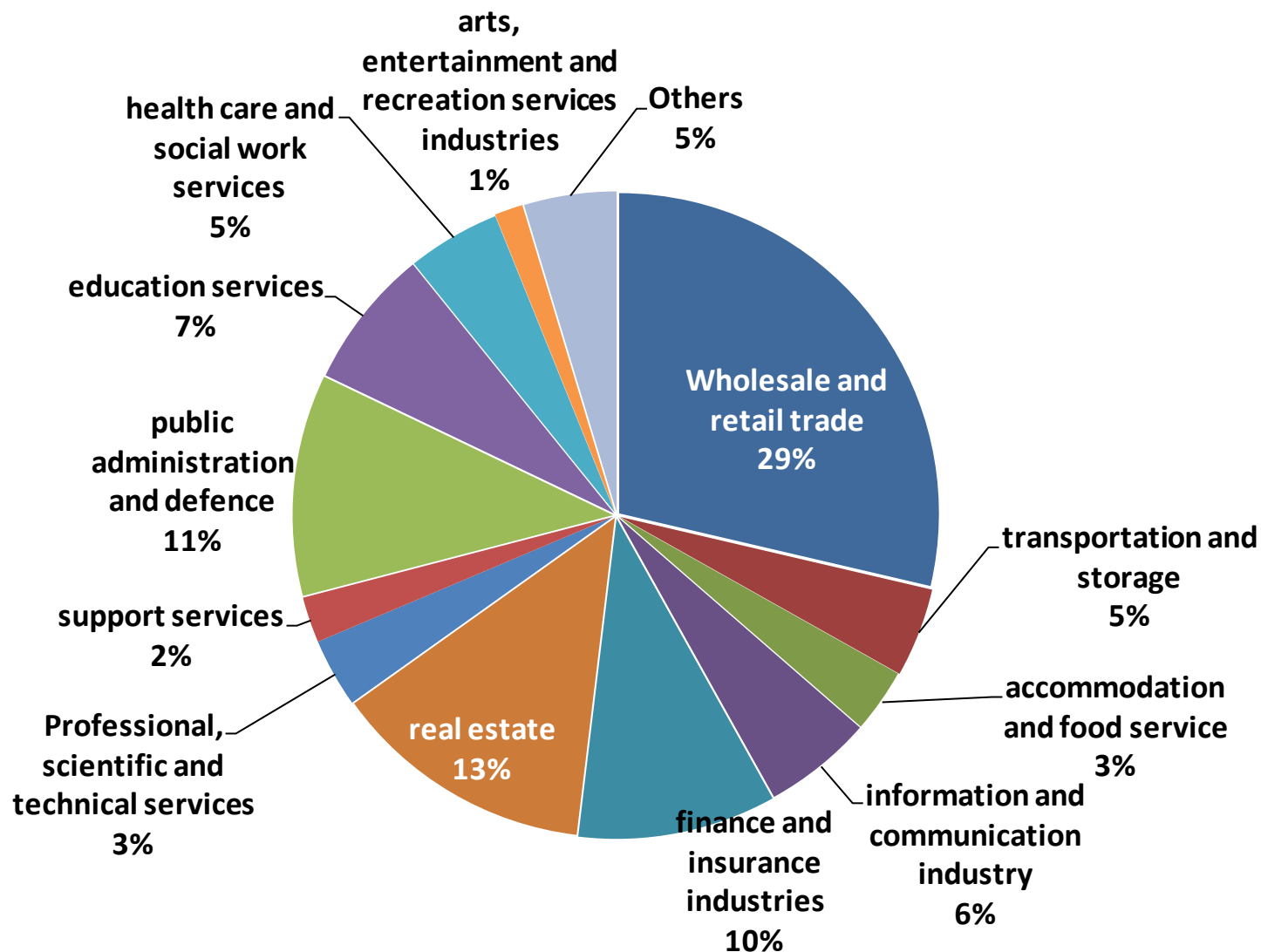
Source: Taiwan Statistic Book of 2012

Gross Domestic Product (%) by Industry



Source: Taiwan Statistic Book of 2012

Structure of Service Industry



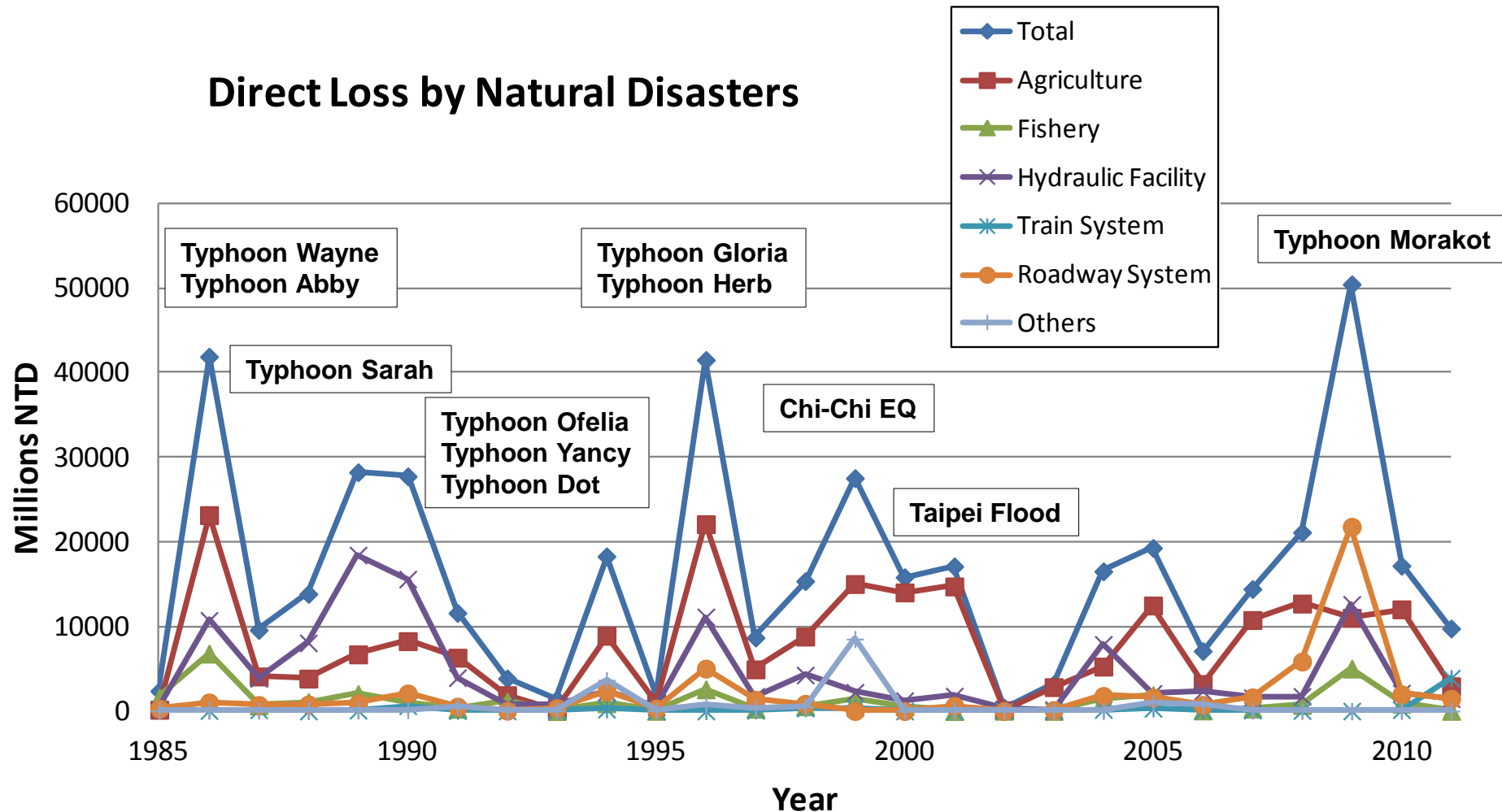
Land Use Patten in Taiwan



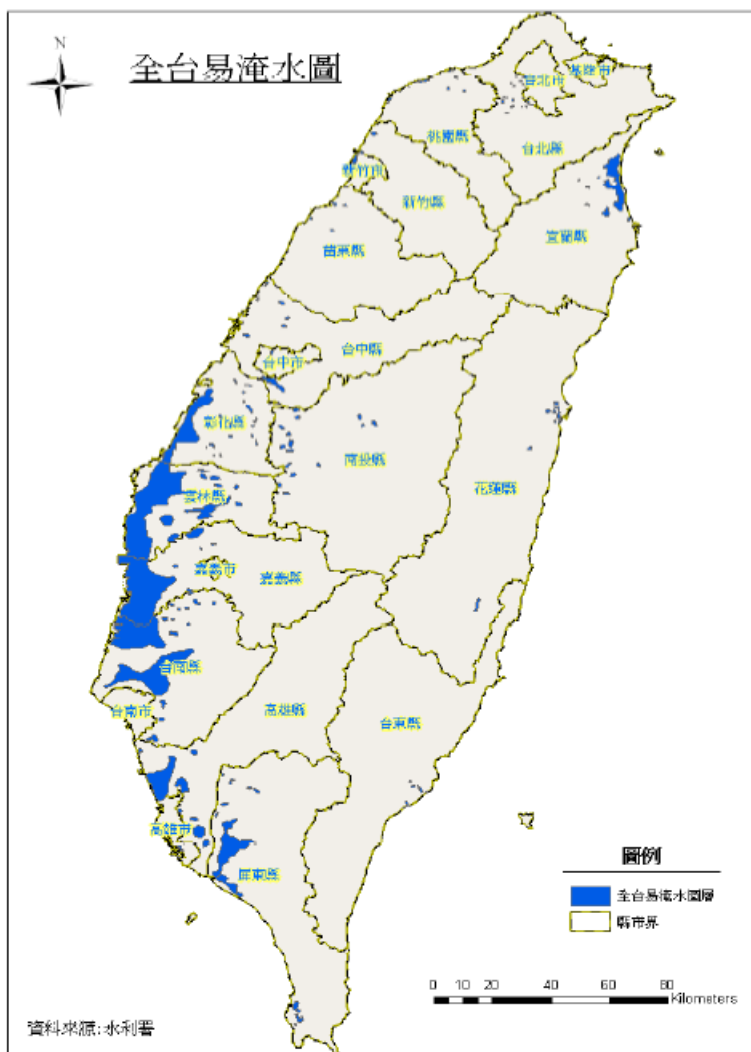
Source: Ministry of Interior, 2005

Direct Loss by Natural Disasters

Direct Loss by Natural Disasters



Disaster Prone Area in Taiwan

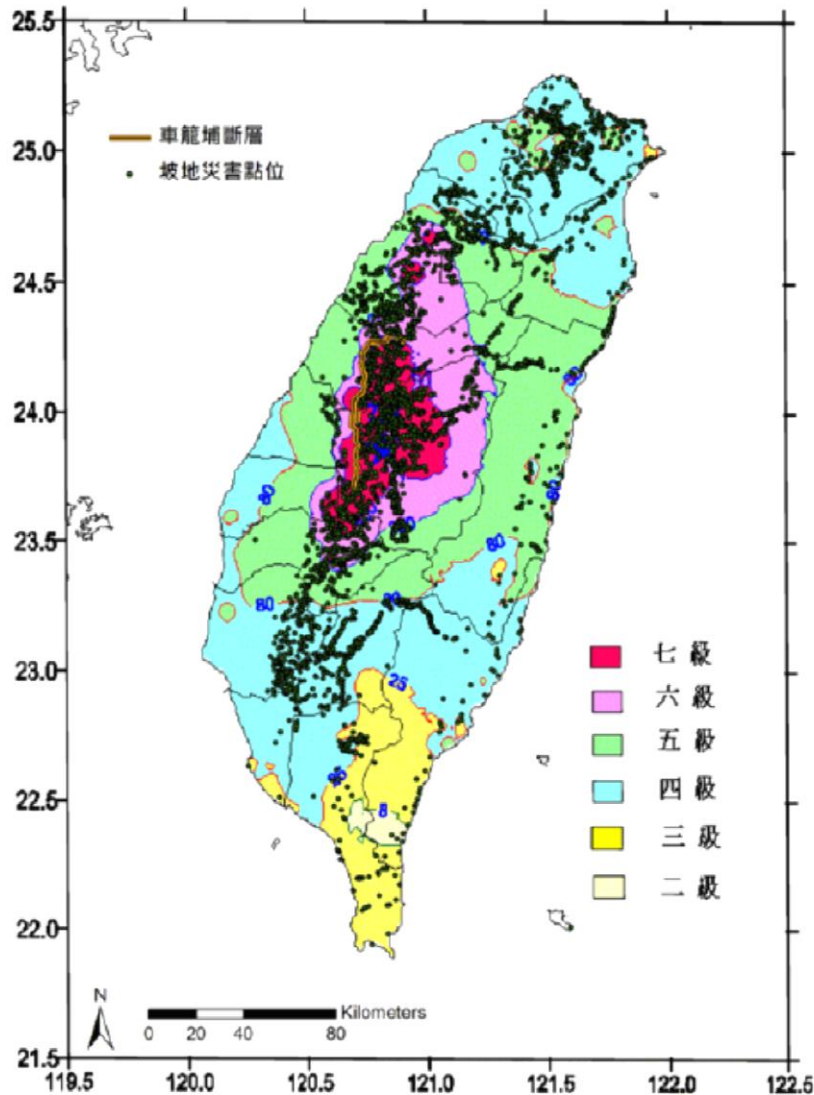


Flood-prone Area

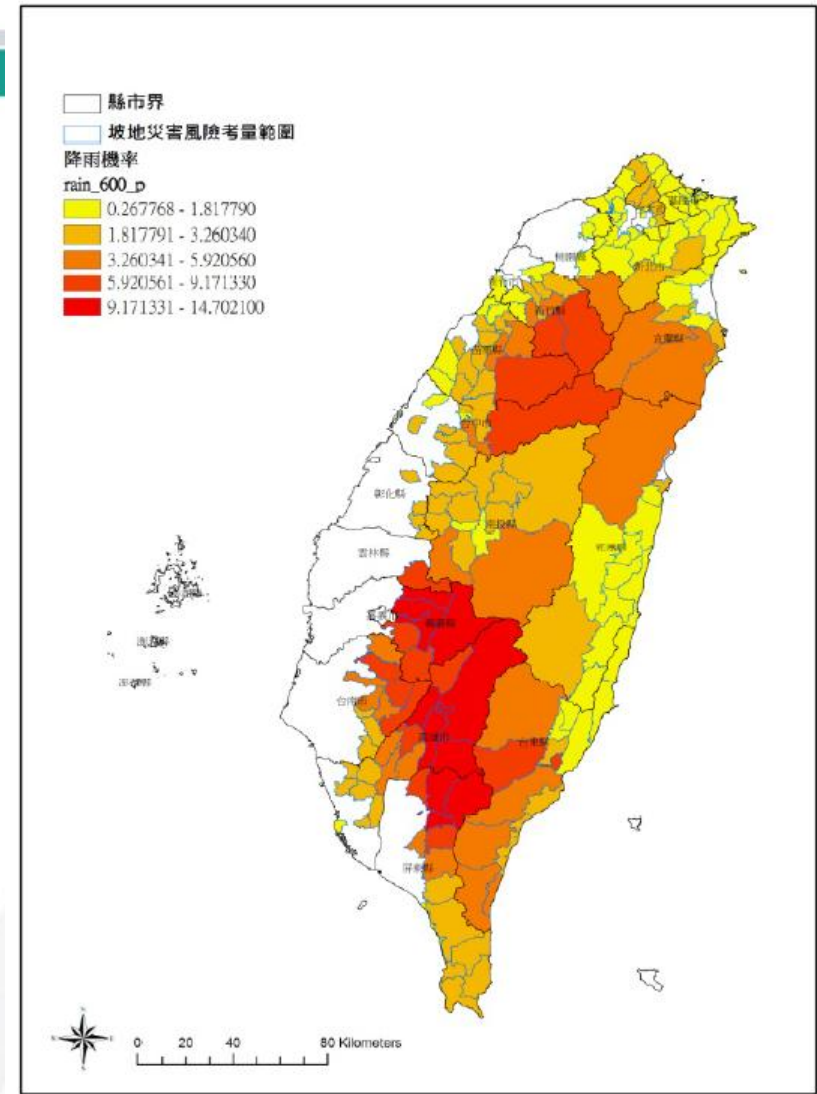


Vulnerable Roadway (1990~2007)

Disaster Prone Area in Taiwan

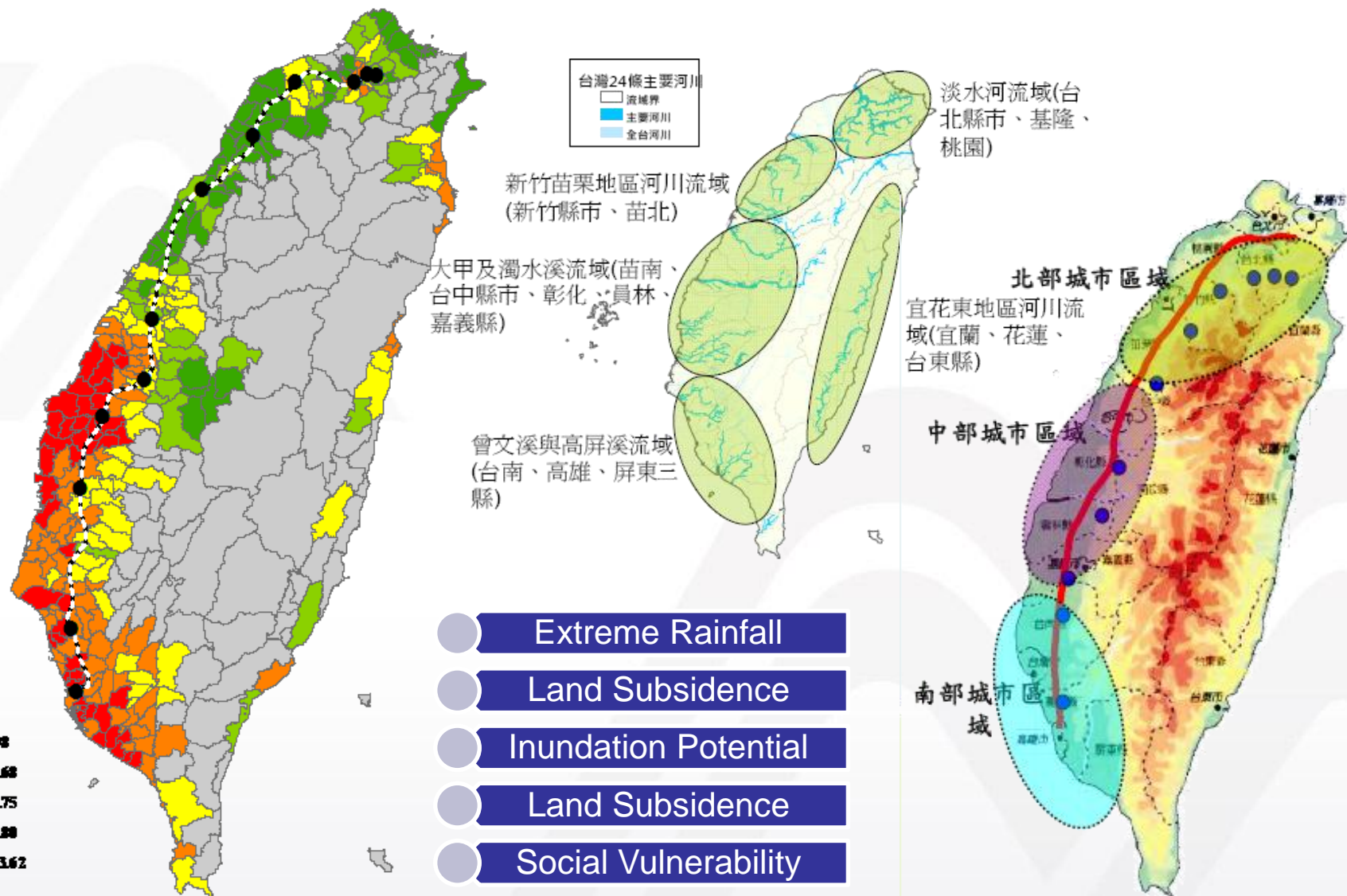


Landslide-prone area due to earthquake



Landslide-prone area due to rainfall

Climate-Related Flood Risk Map



Natural Disaster Risk Management on Business and Communities in NCDR

Issue 1: Scenario-based disaster risk management for large-scale compound disasters



Hurricane Katrina



Typhoon Morakot



Great East Japan EQ

- **Cases of large-scale compound disasters in recent years (Black-Swam Event)**
 - 2005 Hurricane Katrina, 2009 Typhoon Morakot, 2011 the Great Tohoku Kanto Earthquake and Tsunami
- **Problems founds**
 - 1) “Unprecedented and complicated” impacts, 2) continuously developing situations, 3) simultaneous urgent demands, 4) challenges to engineering-based measures, 5) lacks of information integration....
- **Demands for disaster risk management**
 - Tools to build up scenarios for planning and drills
 - Design of information system to provide situation awareness
 - Estimation of urgent relief demands after large-scale compound disasters
 - Study of evolutionary characteristics of compound disasters

Issue 2: Climate change adaptation strategies with disaster risk reduction

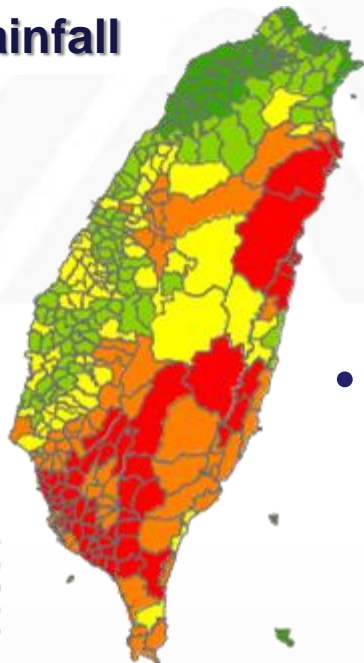
- **Challenges of climate-change-related disasters in Taiwan**

- Direct impacts: 1) Higher temperature; 2) Sea level; 3) Rainfall distribution change; 4) More extreme rainfall events; 5) Typhoon and storm surge
- Evolving impacts: 1) Slope land disasters; 2) distribution of water resource; 3) investment on new development projects.....

- **Demands for develop CCA and DRR**

- Download scaling techniques to produce scientific projection for coming decades
- Risk map to identify risk potential based on impacts by hazards like flood, slope land, land subsidence, vulnerability of costal areas

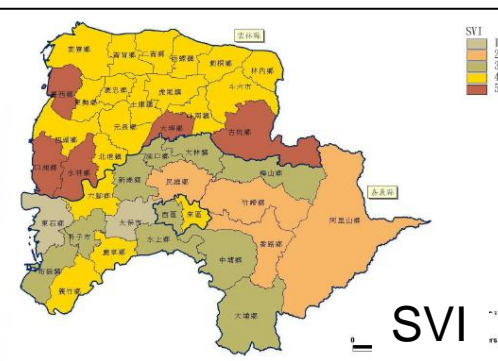
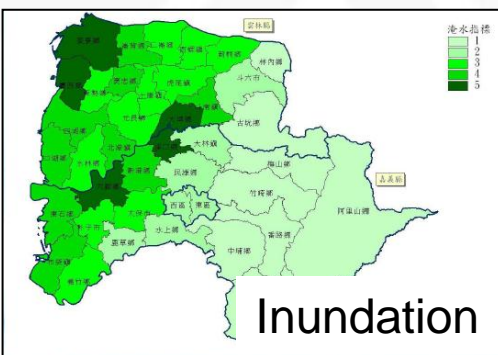
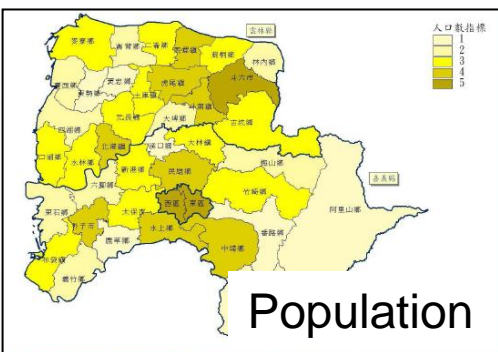
Extreme Rainfall



Legend



Issue 3: Social risk vulnerability assessment



- **Overlapping of hazard map and population exposure to identify “hot spots”**
 - Considered social factors: 1) population density and structure, 2) education and income, 3) economic activities, 4) past events and perception, 5) social support, 6) insurance
- **Problems founds due to social development**
 - 1) Rapid urbanization, 2) land use management, 3) aging society, 4) vulnerability of indigenous tribes, 5) tools for risk communication, 6) disaster resilience at community level
- **Products to be delivered**
 - Models for loss estimation
 - Establishment of Social-economic Vulnerability Index (SVI) and Human Development Index (HDI)

Issue 4: Critical infrastructure protection under threats from natural hazards

- **Threats**

- According to the World Bank's report, exposure rate of land is over 90%, considering at least two natural hazards likewise CIs.

- **Problems founds due to CI's failures**

- National security
- Government and business operation continuity
- Basic civil protection
- Direct impacts to people's livelihood.

- **Current developments for improving critical infrastructure protection**

- Failure modes to individual hazards by risk assessment
- Impact evaluation of system(s) failure
- Status indicators for monitoring system satiability



Typhoon Aere, 2004



Chi-Chi Earthquake,
1999



THANK YOU!