

# Past , Today and Future of Science and Technology for Disaster Risk Reduction in China

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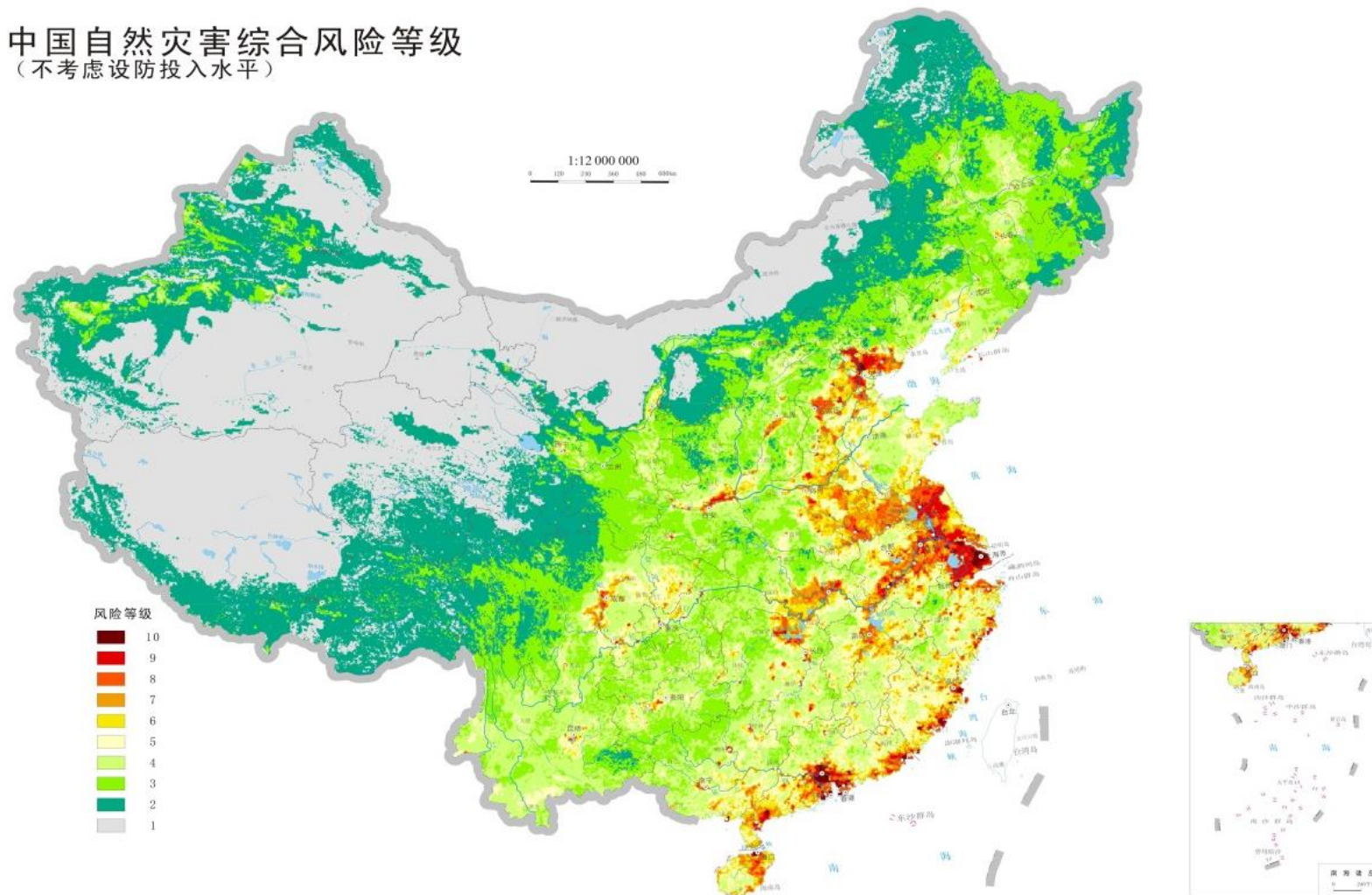
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# Risk Level of Integrated Natural Disaster of China

中国自然灾害综合风险等级  
(不考虑设防投入水平)

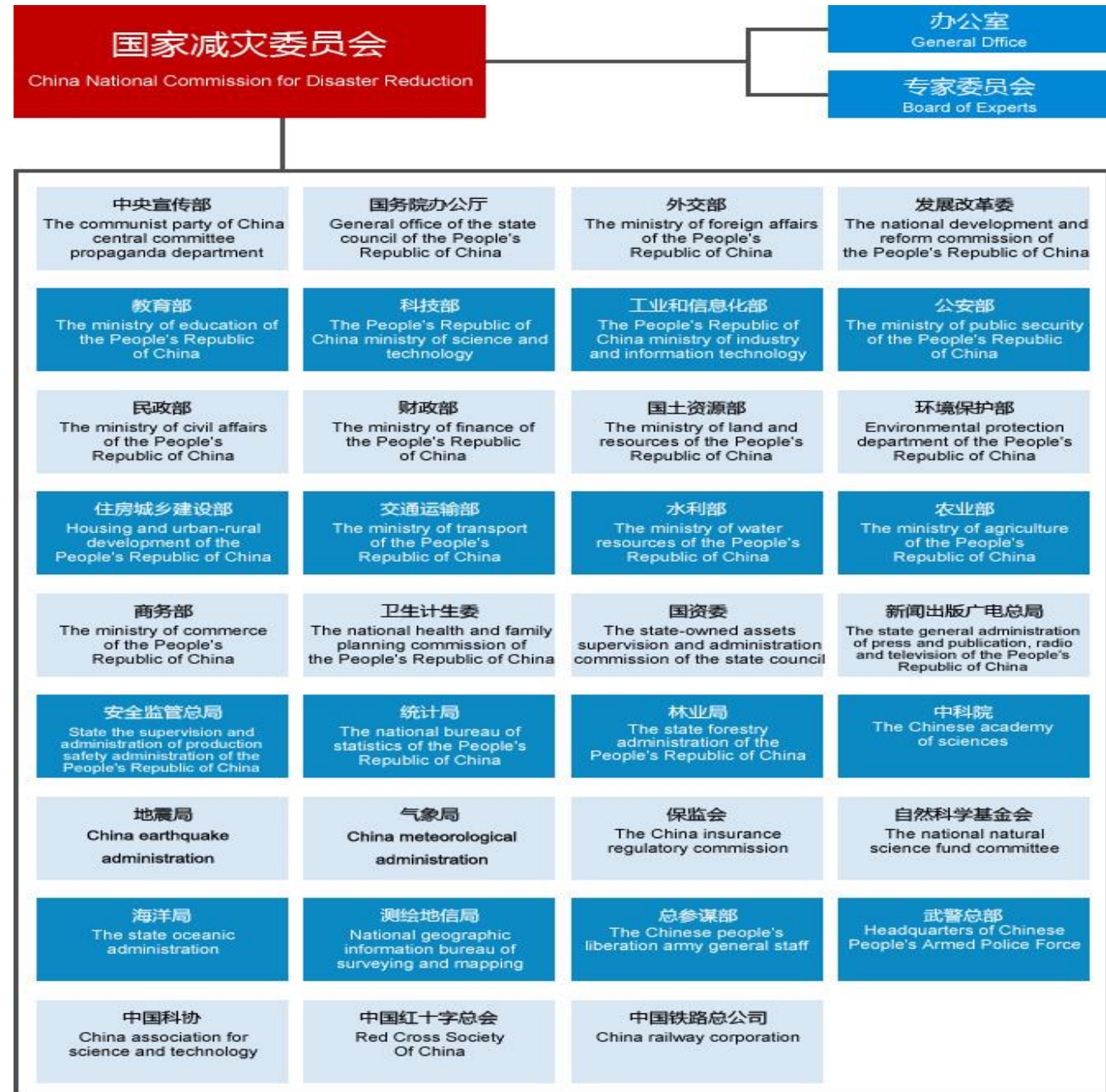


# 1 Past of Science and Technology for Disaster Risk Reduction in China

# 1. PROFILE / CONTEXT

China has experienced some of the most destructive natural disasters in the world's history. China's natural disasters have the features of diverse range, wide geographic distribution, high frequency, significant damage and high disaster risk. As an inter-ministerial coordinating mechanism under the State Council, **the National Commission for Disaster Reduction (NCDR)** is responsible for drafting key disaster reduction policy and plans, coordinating major disaster reduction across the country, and to guide local government in this regard.

**The Expert Committee under the NCDR has been actively providing S&T support and mobilizing S&T forces at all levels in the all phases of national and local disaster risk reduction, particularly emphasizing the concept of comprehensive disaster reduction which looks at the overall picture of disaster prevention and reduction from research to decision-making, from policy to practice, and from national to local.**



## 2. SCIENCE AND TECHNOLOGY IN DECISION MAKING

- The **Expert Committee** under the China NCDR consists of over 100 board members and experts from all fields related to DRR. This committee **is the key policy support body to national government including policy consultation, scientific guidance, technical support and S&T research.**
- The Expert Committee has direct channel to provide policy and implementation suggestion to the national major decision making and planning processes, emergency response and relief to major disasters, and post-disaster recovery and reconstruction. The committee also takes actions of reviewing and evaluation on major DRR engineering and research projects, investigating and assessment of major disasters, suggesting on strategy planning of national DRR, and participating in national and international S&T DRR cooperation. All these activities make significant influence in national and local decision making on DRR. **This committee has direct route to reach Prime Minister and state council members for urgent and important issues.**
- National Disaster Reduction Center of China** (NDRCC) under Ministry of Civil Affairs is the main body linking DRR S&T with government administration and decision-making at all levels. The provincial and city governments have also established their disaster reduction centers which strengthened S&T utilization and implementation at local levels.
- In case of large-scale disaster, Chinese government has the mechanism of establishing expert panel to ensure proper and timely decision-making.**

### 3. INVESTMENT IN SCIENCE AND TECHNOLOGY

- To ensure the sufficient investment in scientific and technological innovations in disaster prevention and reduction, the Chinese government compiled the **Twelfth Five-year Special Planning for the National Science and Technology Development for Disaster Prevention and Reduction in 2012**. This national S&T plan has not only identified the priorities of actions in DRR but also ensured sufficient investment to meet the national target. All provincial and local government uses this national plan to set up their 5-year targets and action plans.
- Research and innovation programs in the field of DRR have been set-up to ensure S&T advance and implementation. **These programs include natural science foundation program, S&T pillar program, high technology program, and fundamental research program. The national and provincial financial input, along with industrial matching funds, has become the main S&T research investment.**
- A series of critical technologies in DRR has been developed and implemented during the S&T research. The improvement of disaster information collection, database development and construction of national emergency platform has been achieved. A series of science and technology demonstration bases for disaster prevention and reduction and a number of state key laboratories and engineering and technology research centers for disaster prevention and reduction have been established.

## 4. LINK OF SCIENCE AND TECHNOLOGY TO PEOPLE

- Thirteen disaster information officer evaluation centers have been set up at central and provincial levels. By the end of 2013, **more than 650,000 disaster information officers** had been established across the country. These disaster information officers become the linking points between government and the people.
- The Chinese government has strengthened its community-based disaster risk reduction management and has encouraged communities to set up disaster reduction mechanisms. **Community disaster risk maps have been created and the government has improved residents' survival skills for disaster prevention and reduction.** Communities have also been familiarized with various disaster risks, emergency shelters, evacuation routes, and the use of facilities. **By the end of 2013, a total of 5408 “national disaster reduction-prepared communities” had been established,** which has significantly increased the disaster prevention and reduction capacities at the local community level in urban and rural areas.
- The Chinese government has established a complete **early warning disclosure system,** and uses over 650,000 disaster information officers, cell phones, TV, radio stations to disclose and update information during a disaster in a prompt and timely manner. A national disaster information management system has been established and provided coverage to all county-level administrative units to ensure information full coverage to all people.

## 5. LESSONS / ISSUES FROM PAST MAJOR DISASTERS

- It is crucial to adopt and insist the concept of comprehensive disaster prevention and reduction in strategies and reform governance structure accordingly. **S&T should pay more attention to the integrated risk governance.**
- It is necessary for national and local government to set up goals for comprehensive disaster prevention and reduction in national and local DRR plans. However, **the compilation of plans need substantial S&T support.**
- **Disaster assessment and information release requires further coordination**, particularly a scheme to ensure rapid reporting and release of disaster information.
- Research focusing on **multi-hazards and disaster chains** and their risk management is needed.
- Climate change uncertainties lead to greater environmental risks, and **S&T should be advanced to build better understanding the relationship between climate change and disaster risks.**
- Sustainable development is facing challenges from emerging risk and **DRR S&T should expand the scope to link resource safety, ecological safety and food safety.**
- The challenges from globally networked disasters is identified, **and S&T should seek better solutions for integrated risk governance of large-scale disasters that have global impacts.**



## 6. SHORT AND LONG-TERM GOALS (3 SPECIFIC ACTIONS FOR BOTH SHORT AND LONG-TERM GOALS)

- Promote the integration of coping with climate change and disaster prevention and reduction through national research programs and international forums.
  - Improvement on the precision and timeliness of disaster and risk assessment for large-scale disasters.
  - National Forum on Comprehensive Disaster Reduction and Sustainable Development is to be held in May, which includes four sub-forums: Institutional System, Integrated Risk Governance, S&T Innovation and Implementation, and Social Participation.
- 
- Promote financial innovation on disaster risk transferring mechanism and establish a diversified protection system to strengthen national and local disaster resilience.
  - S&T advance to encourage and motivate public to participate actively in DRR actions and to contribute more in disaster preparedness and emergency response.
  - Enhance national integrated risk governance capacity for large-scale disasters and develop a national system to monitor DRR progress to achieve Sendai Framework targets.

## 7. HIGHER EDUCATION STATUS

- **China's higher education** is administered by first-level disciplines. Each discipline has a few majors. The majors directly addressing DRR include Natural Disasters under Geography, Disaster Prevention and Mitigation Engineering under Civil Engineering, Public Safety under Safety Science and Engineering, Emergency Management under Public Management etc.
- There is no specific major named DRR or Disaster Risk Management (DRM), but there are some **Master level programs (under the majors listed above) which focuses on DRR and DRM.**
- Some universities (such as Beijing Normal University) have been offering **Master of Science programs to young professionals from Ministry of Civil Affairs, insurance industry etc.**
- Institutional cooperation (such as joint institutions) between universities and government is crucial to ensure the **true linkage between S&T innovation and governance.**

# China Comprehensive Disaster Reduction – Achievements (1)

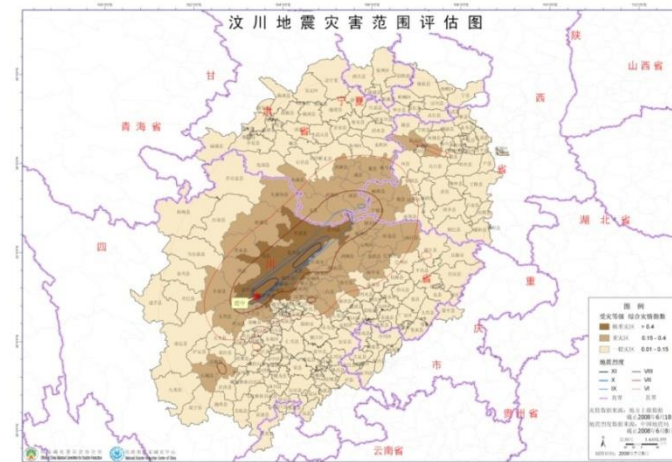
1. Ensure that disaster risk reduction (DRR) is a national and a local priority with a strong institutional basis for implementation

- DRR institutional mechanisms (national platforms); designated responsibilities
- DRR part of development policies and planning, sector wise and multisector
- Legislation to support DRR
- Decentralisation of responsibilities and resources
- Assessment of human resources and capacities
- Foster political commitment
- Community participation

## ○ Establishment of regime, mechanism and legal systems for disaster prevention and reduction

- ✓ The state law and policy framework for disaster prevention and reduction is issued to identify the responsibility of central and local governments .
- ✓ Establishment of government-led disaster prevention, reduction, and relief system and mechanism.

# The Response to the Wenchuan Earthquake



# China Comprehensive Disaster Reduction – Achievements (2)

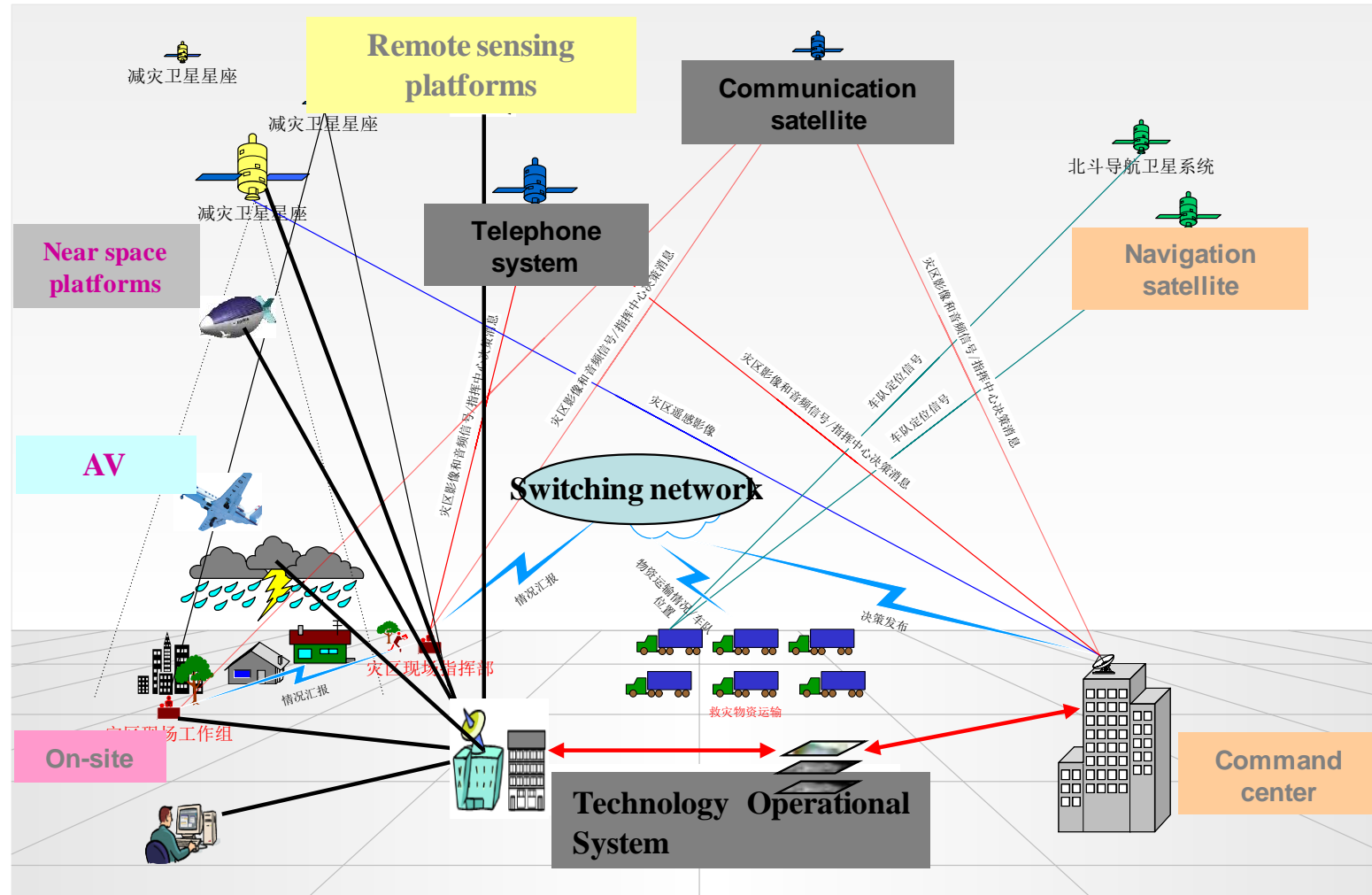
## 2. Identify, assess and monitor disaster risks and enhance early warning

- Risk assessments and maps, multi-risk: elaboration and dissemination
- Indicators on DRR and vulnerability
- Data & statistical loss information
- Early warning: people centered; information systems; public policy
- Scientific and technological development; data sharing, space-based earth observation, climate modeling and forecasting; early warning
- Regional and emerging risks

## ○ Improvement in monitoring, early-warning, and risk assessment system

- ✓ The systems for monitoring and early-warning for major natural disasters have been established.
- ✓ The early-warning system for major natural disaster has provided cover and service to local communities
- ✓ Risk assessment on different types of disasters in major industrial sectors have been strengthened.

# Case II: China's natural disaster monitoring and early-warning system



# Case IX Compiling Series Atlas of Natural Disaster to support national and local comprehensive disaster prevention and reduction



Series Atlas of Natural Disasters in China

# China Comprehensive Disaster Reduction – Achievements (3)

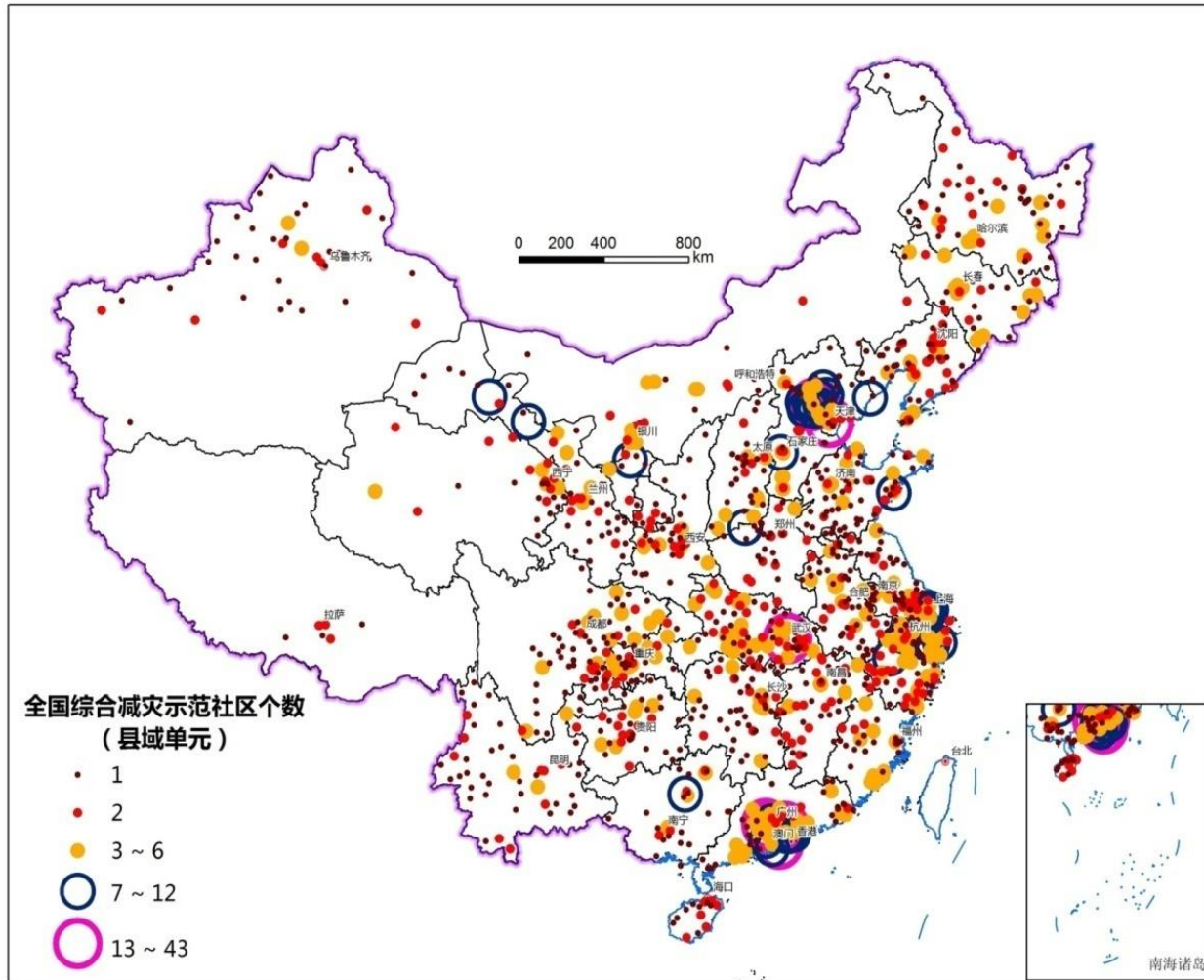
3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels

- Information sharing and cooperation;
- Networks across disciplines and regions; dialogue
- Use of standard DRR terminology
- Inclusion of DRR into school curricula, formal and informal education
- Training and learning on DRR: community level, local authorities, targeted sectors; equal access
- Research capacity: multi-risk; socio-economic; application
- Public awareness and media

- Disaster Information sharing service and public campaign on Disaster prevention and reduction has been set up
- ✓ Carry out the National Comprehensive Disaster Reduction Demonstration Community Building.
- ✓ Propagation and Education of Disaster Prevention and Reduction have been Promoted
- ✓ Promote inter-sectoral Disaster Information Sharing and Public Service for the Society.



# Comprehensive Disaster Reduction Demonstration Communities campaign



# China Comprehensive Disaster Reduction – Achievements (4)

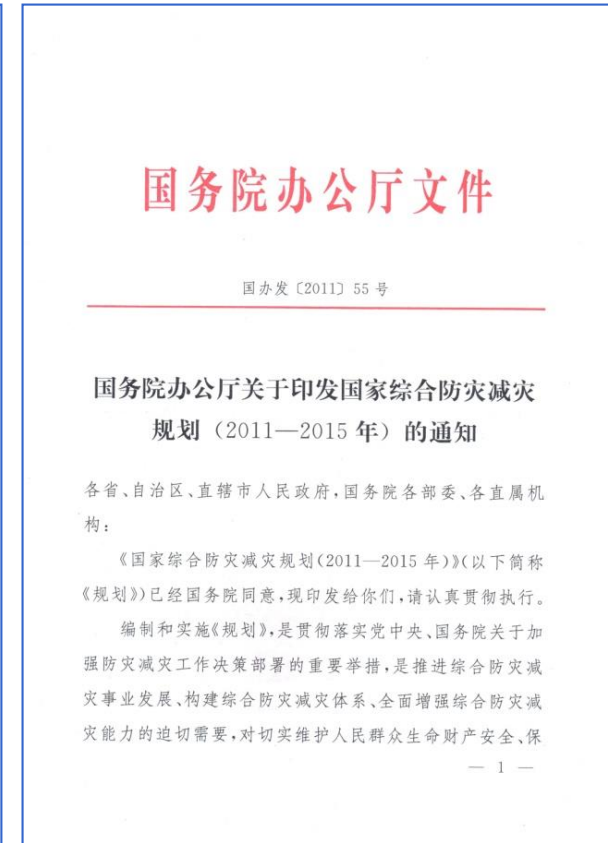
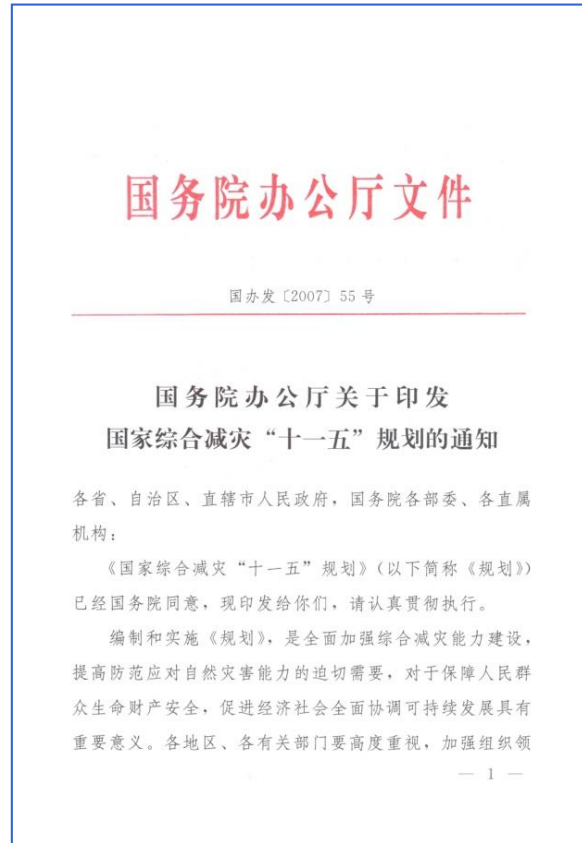
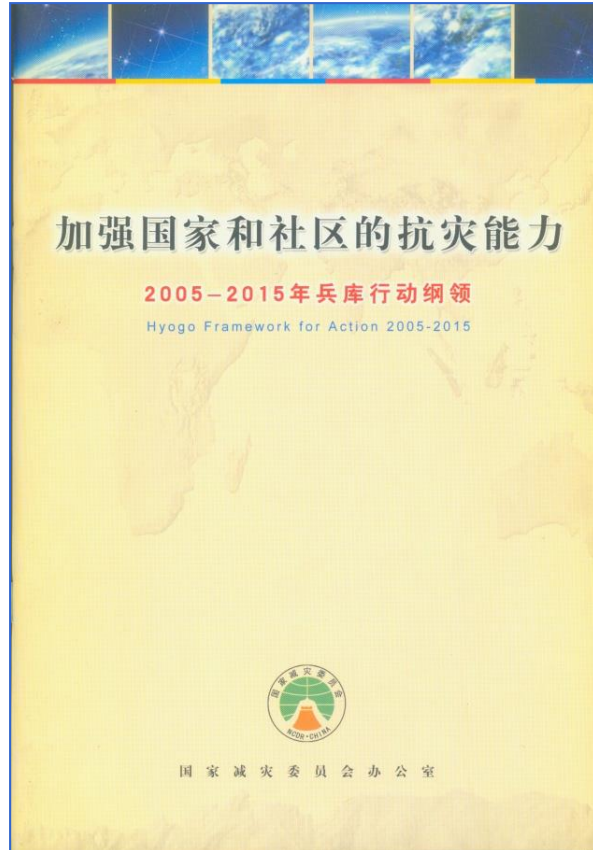
## 4. Reduce the underlying risk factors

- Sustainable ecosystems and environmental management
- DRR strategies integrated with climate change adaptation
- Food security for resilience
- DRR integrated into health sector and safe hospitals
- Protection of critical public facilities
- Recovery schemes and social safety- nets
- Vulnerability reduction with diversified income options
- Financial risk-sharing mechanisms
- Public-private partnership
- Land use planning and building codes
- Rural development plans and DRR

## ○ Climate Change Response and Disaster Risk Governance have been strengthened

- ✓ The Disasters and Environmental Risks induced by Climate Change has been recognized
- ✓ Disaster Risk Evaluation has been Incorporated into the Environmental Impact Assessment of Construction Project.
- ✓ Emphasizing disaster prevention and reduction projects in post-disaster reconstruction plan.

# Case VIII Work United to Implement the CDPR Plan



China promulgated the Hyogo Framework for Action 2005-2015 and the CDPR Plan

# China's Desertification Prevention and Control Project



Key Projects*	Government investment (X10 <sup>8</sup> Yuan)	Chief benefits of different projects
<b>3NSDP</b> 1978-2010	128	26.47 million ha of afforestation land
<b>CCFP</b> 2002-2010	2332	9.26 million ha of cropland was converted into forest land
<b>NFPP</b> 2000-2010	784	forest area increased by 14.00 million ha, timber production reduced by 220 million m <sup>3</sup>
<b>SSCP</b> 2001-2010	412	6 million ha of cropland was returned to forest
<b>GBGRP</b> 2003-2010	203	518.66 million ha of grassland was protected with fence and 12.40 million ha of severe degraded grassland was reseeded

# China Comprehensive Disaster Reduction – Achievements (5)

## 5. Strengthen disaster preparedness for effective response at all levels

- Disaster management capacities: policy, technical and institutional capacities
- Dialogue, coordination & information exchange between disaster managers and development sectors
- Regional approaches to disaster response, with risk reduction focus
- Review & and exercise preparedness and contingency plans
- Emergency funds
- Voluntarism & participation

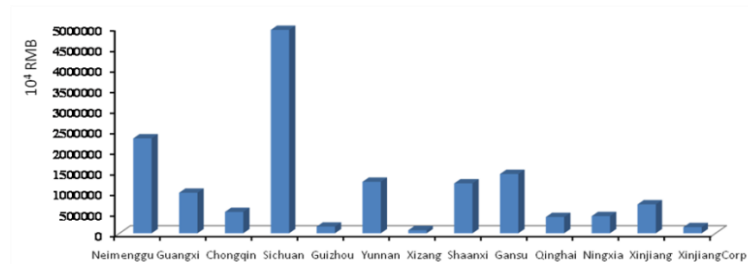
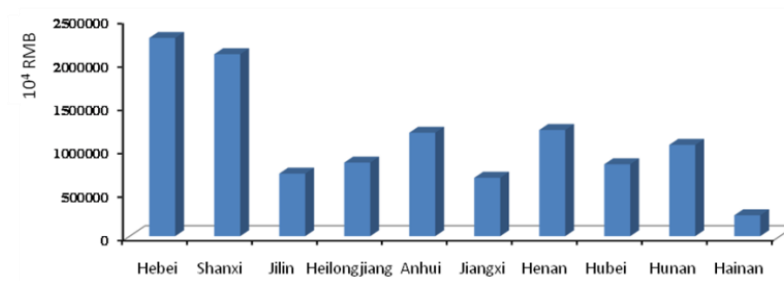
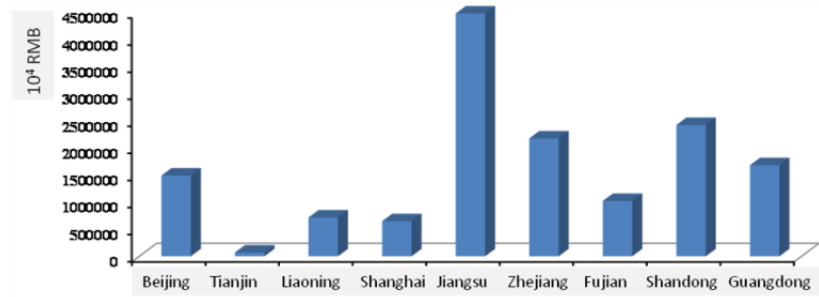
- **Disaster Preparedness Capacity significantly promoted**
- ✓ The emergency response plan system has been initially set up .
- ✓ Disaster Relief Funding and agricultural insurance subsidy mechanism are being improved
- ✓ Disaster relief material reserves system initially established
- ✓ Implement the Mid and Long-term Plans on Developing Human Resources on Disaster Prevention and Reduction.

# Prioritized National Investment in Enhancing Comprehensive Disaster Prevention and Reduction Capacity



Source: <http://www.flickr.com/photos/44048265@N00/3979877454/>

# Ensure the Safety of Primary and Middle School Buildings

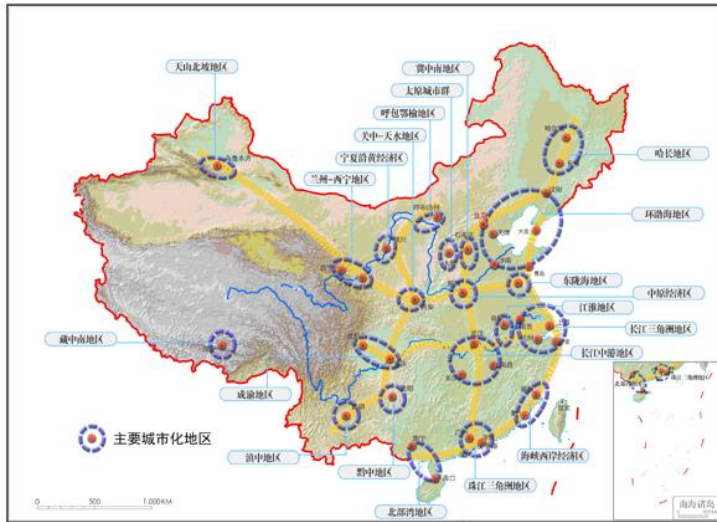


(Source: PRC Ministry of Education)

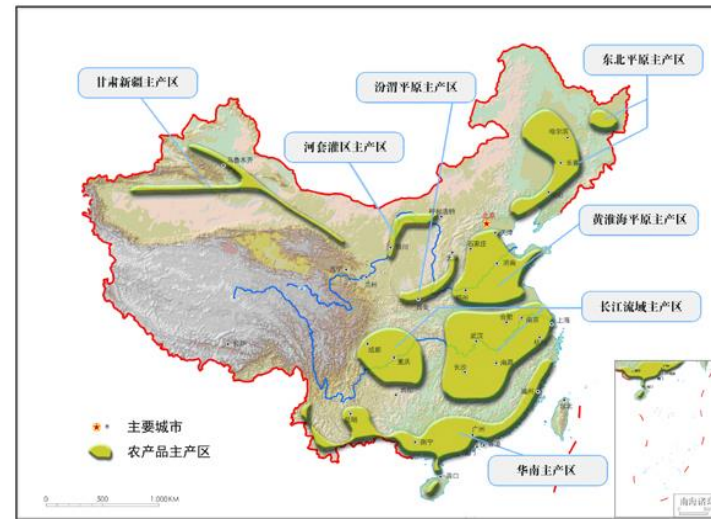
# Experience and Lessons Learned from Comprehensive Disaster Prevention and Reduction (CDPR) in China

## ○ Experience

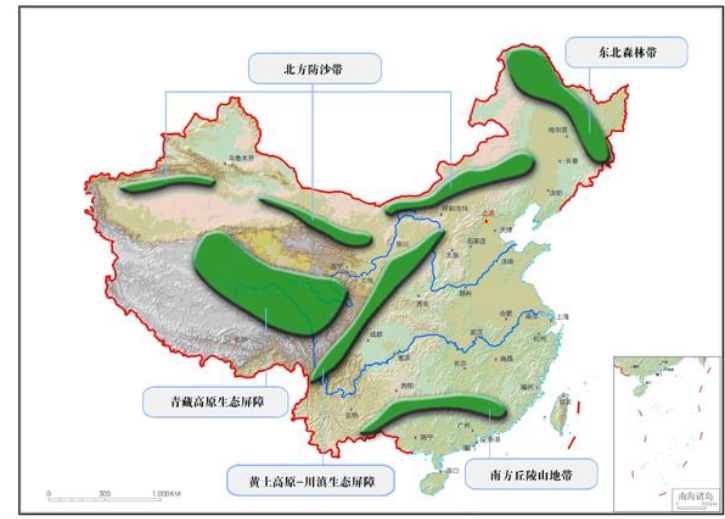
✓ Identify the concept of CDPR in strategies



urbanization strategic layout



agricultural production base



ecological security layout



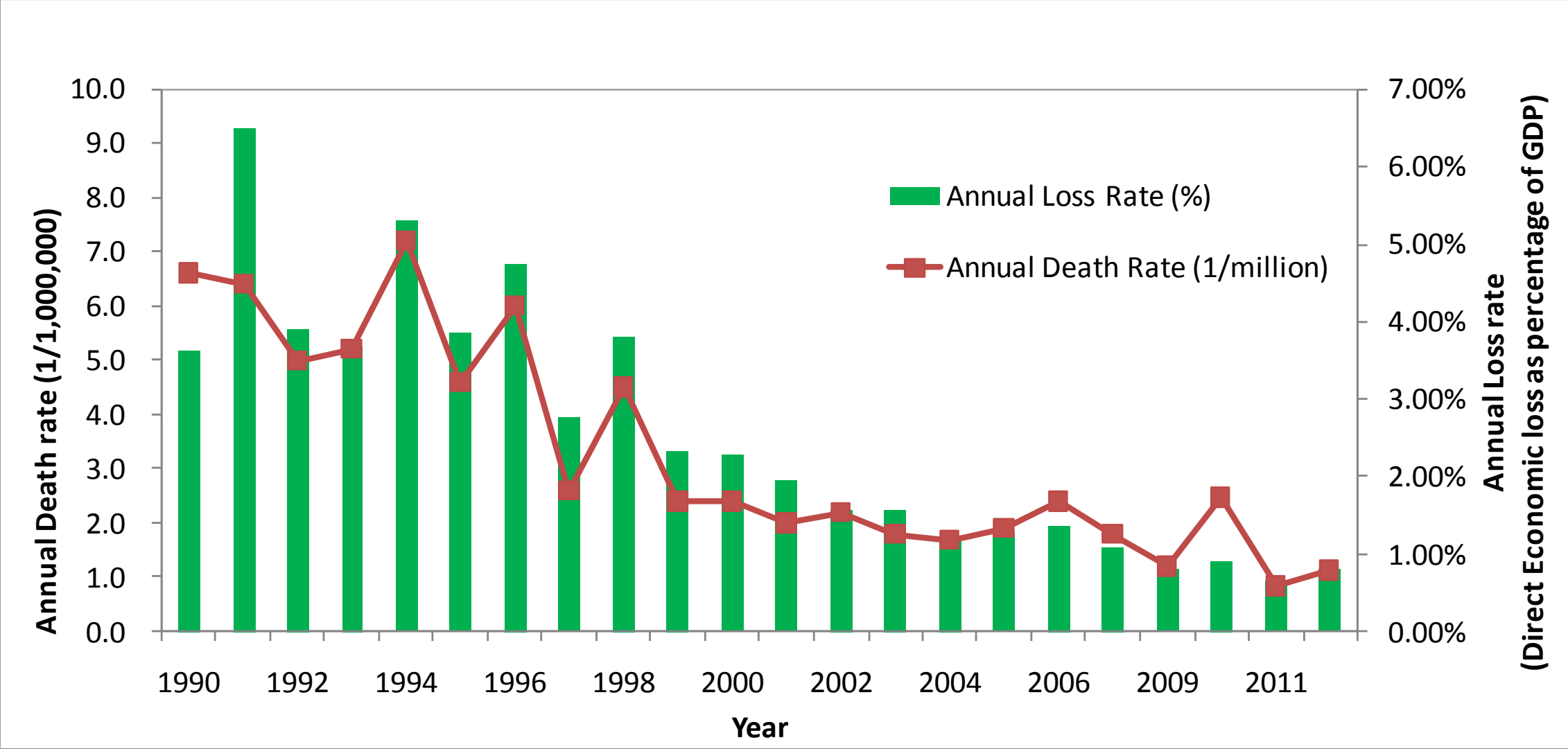
# Experience and Lessons Learned from Comprehensive Disaster Prevention and Reduction (CDPR) in China

## ○ Experience

- ✓ **Specified the goals of CDPR in national plans**

**National Comprehensive Disaster Prevention and Reduction Plan (2011-2015)** refined the targets of the plan and put forward **8 specific targets**, including basically mapping situation of natural disaster risks in key regions, significant drop of casualties caused by natural disasters under comparable disaster intensity from the Eleventh Five-year Plan period and **limiting the proportion of direct economic loss from disasters to GDP within 1.5%**.

# The Effect



# Experience and Lessons Learned from Comprehensive Disaster Prevention and Reduction (CDPR) in China

## ○ Experience

✓ **Strengthen the Technological Support of Comprehensive Disaster Prevention and Reduction through Actions**

## ○ Lessons Learned

✓ **The synergy between central and local governments needs further improvement.**

✓ **The synergy between urban and rural areas should be further strengthened.**

✓ **The synergy between government and the public still lacks of institutional guarantee**

## 2 Today of Science and Technology for Disaster Risk Reduction in China

# Challenges and Opportunities for China's Disaster Prevention and Reduction (1)

- Challenges-- **Climate change uncertainties lead to greater environmental risks**

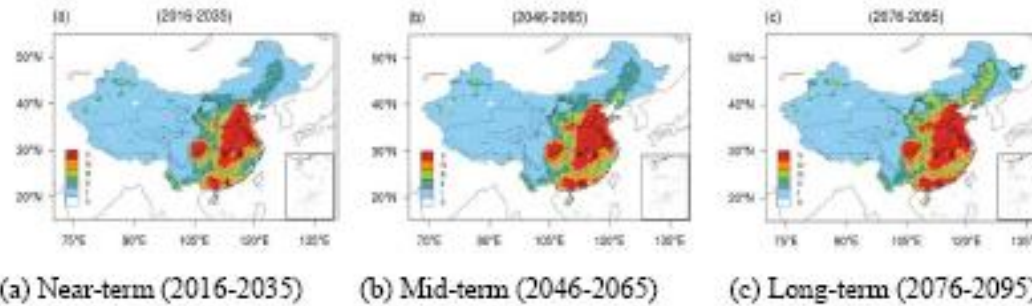


Fig. 23 Distribution of high-temperature risk levels in China in the future in scenario RCP 8.5

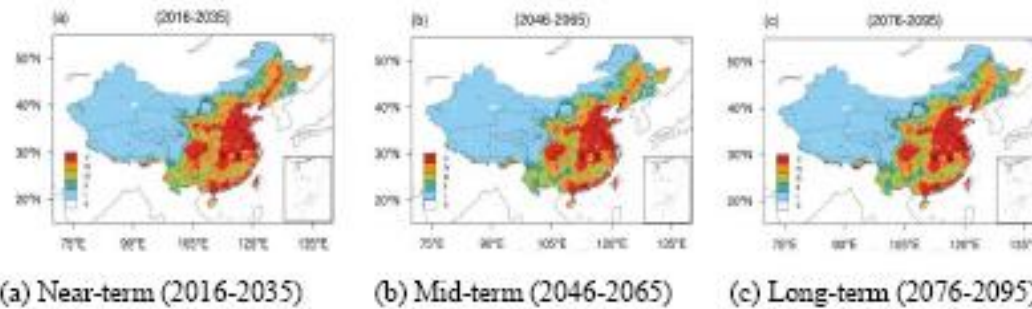


Fig. 24 Distribution of flood risk levels in China in the future in scenario RCP 8.5

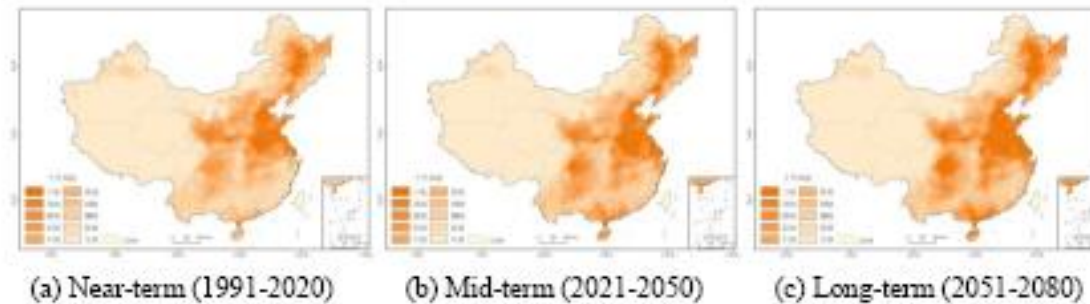


Fig. 25 Distribution of drought risk levels in China in the future in scenario SRES B2

# Challenges and Opportunities for China's Disaster Prevention and Reduction (1)

## ○ Challenges

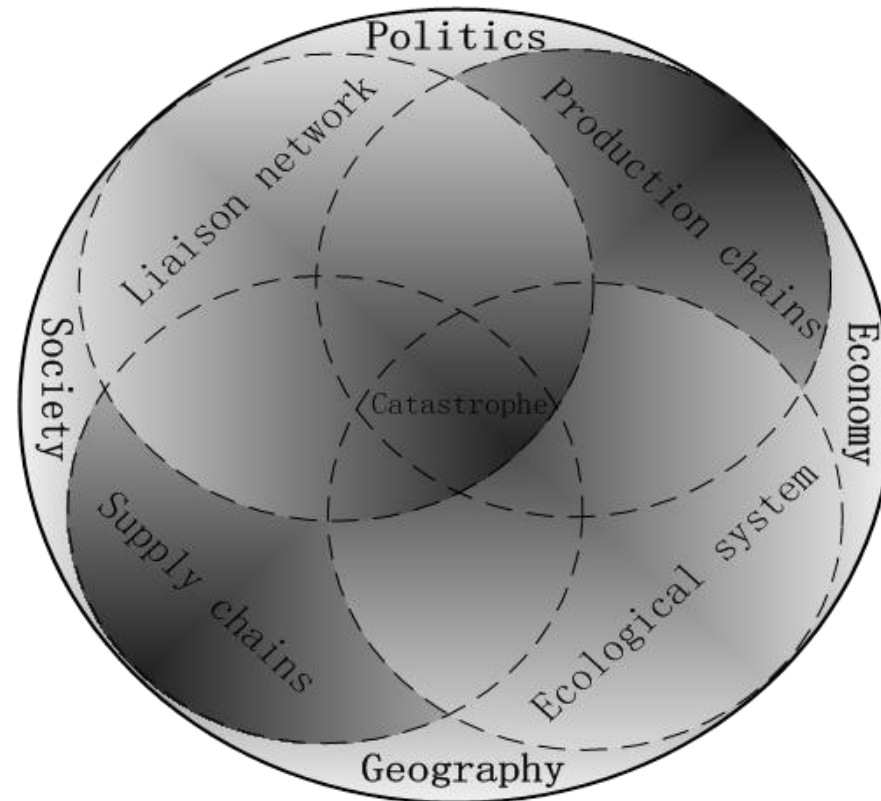
### ✓ Sustainable development is facing challenges of emerging risks

- Energy security
- Water resource security
- Food security
- Forest resources protection and ecological treatment
- Protection of coastal zone

# Challenges and Opportunities for China's Disaster Prevention and Reduction (1)

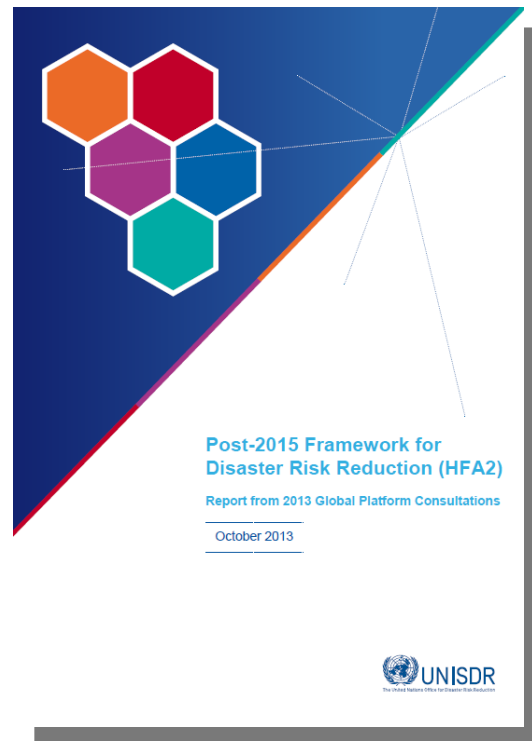
## ○ Challenges

### ✓ Challenges from Globally Networked Catastrophes



# Challenges and Opportunities for China's Disaster Prevention and Reduction (2)

## ○ New Opportunities by HFA2



SFDRR Priorities	
1	<b>Understanding disaster risk</b> [Assessment, data, baseline, capacity]
2	<b>Strengthening disaster risk governance</b> [standards, certification, capacity building]
3	<b>Investing in disaster risk reduction</b> [innovative products with private sector]
4	<b>Enhancing disaster preparedness</b> [guidance, instruments]



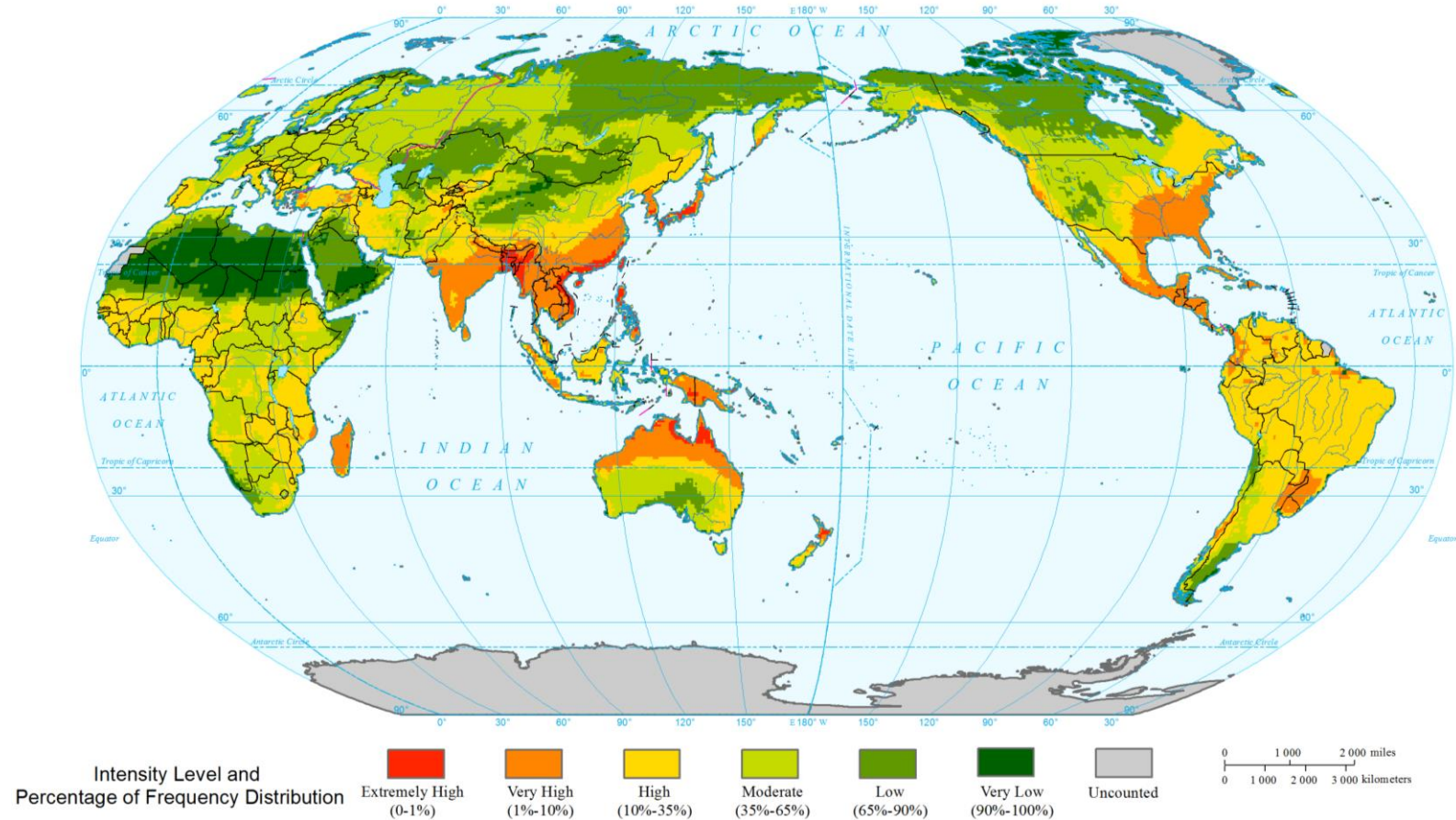
## The seven global targets are:

- (a) Substantially reduce global disaster mortality by 2030, aiming to lower the average per 100,000 global mortality rate in the decade 2020–2030 compared to the period 2005–2015;
- (b) Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 in the decade 2020–2030 compared to the period 2005–2015;
- (c) Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030;
- (d) Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030;
- (e) Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020;
- (f) Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of the present Framework by 2030;
- (g) Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030.

# **3** Future of Science and Technology for Disaster Risk Reduction in China

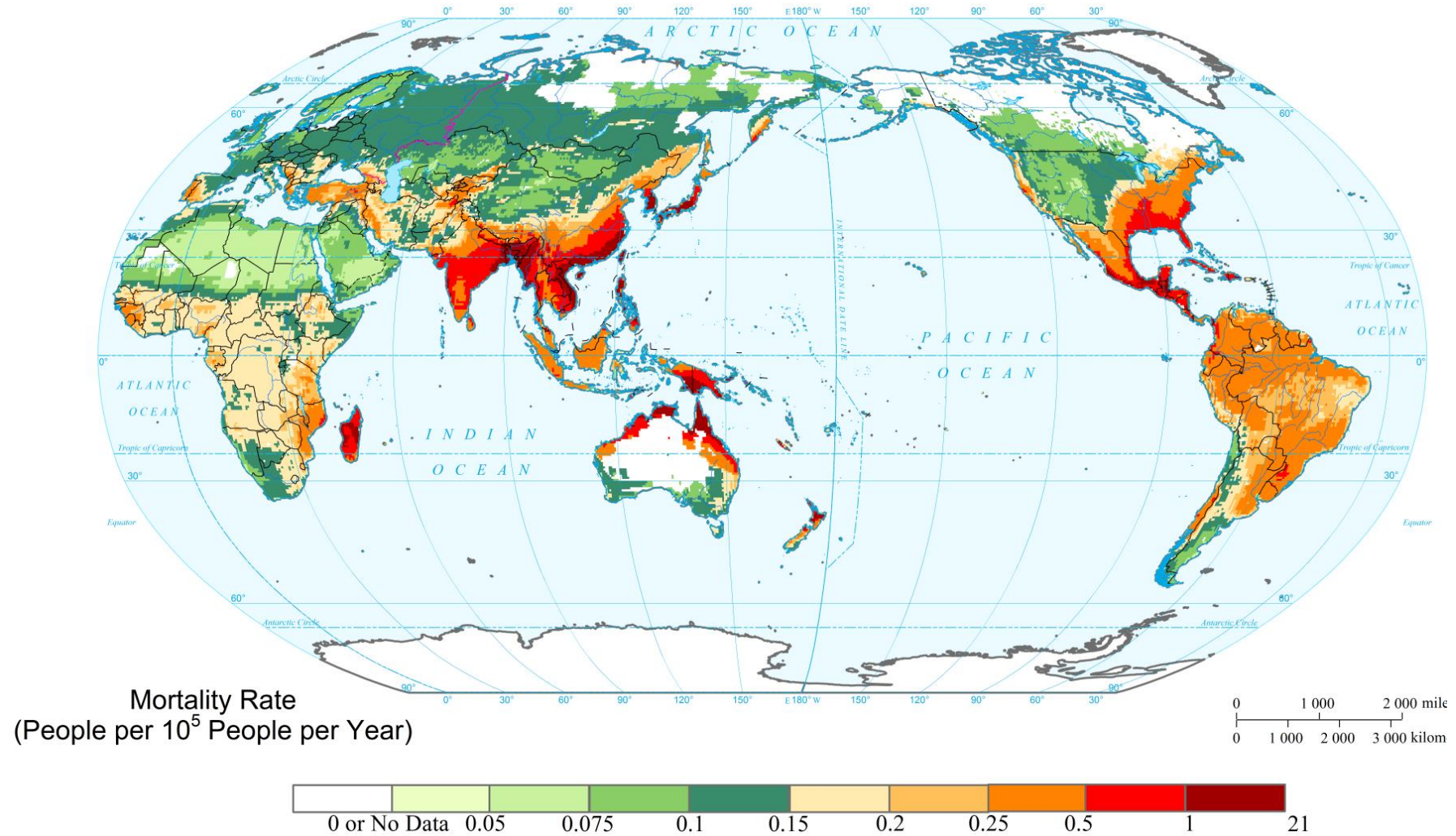
# Multiple Hazards ( $M_h$ )

## Expected Annual Multiple Hazards Intensity



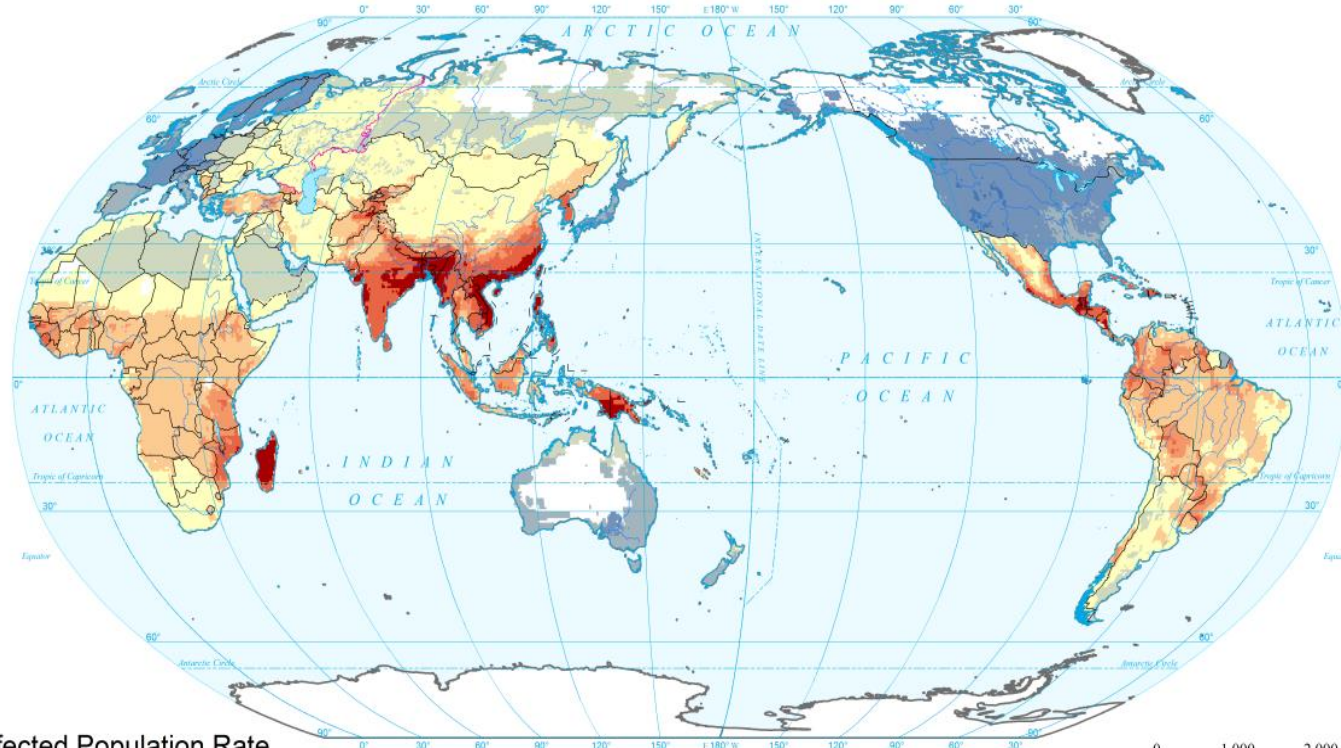
# Multiple Hazards Risks

## Global Expected Annual Mortality Rate for Multiple Hazards



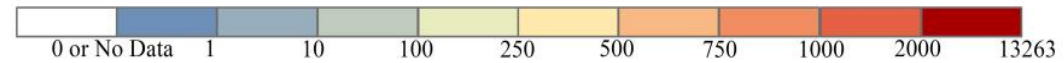
# Multiple Hazards Risks

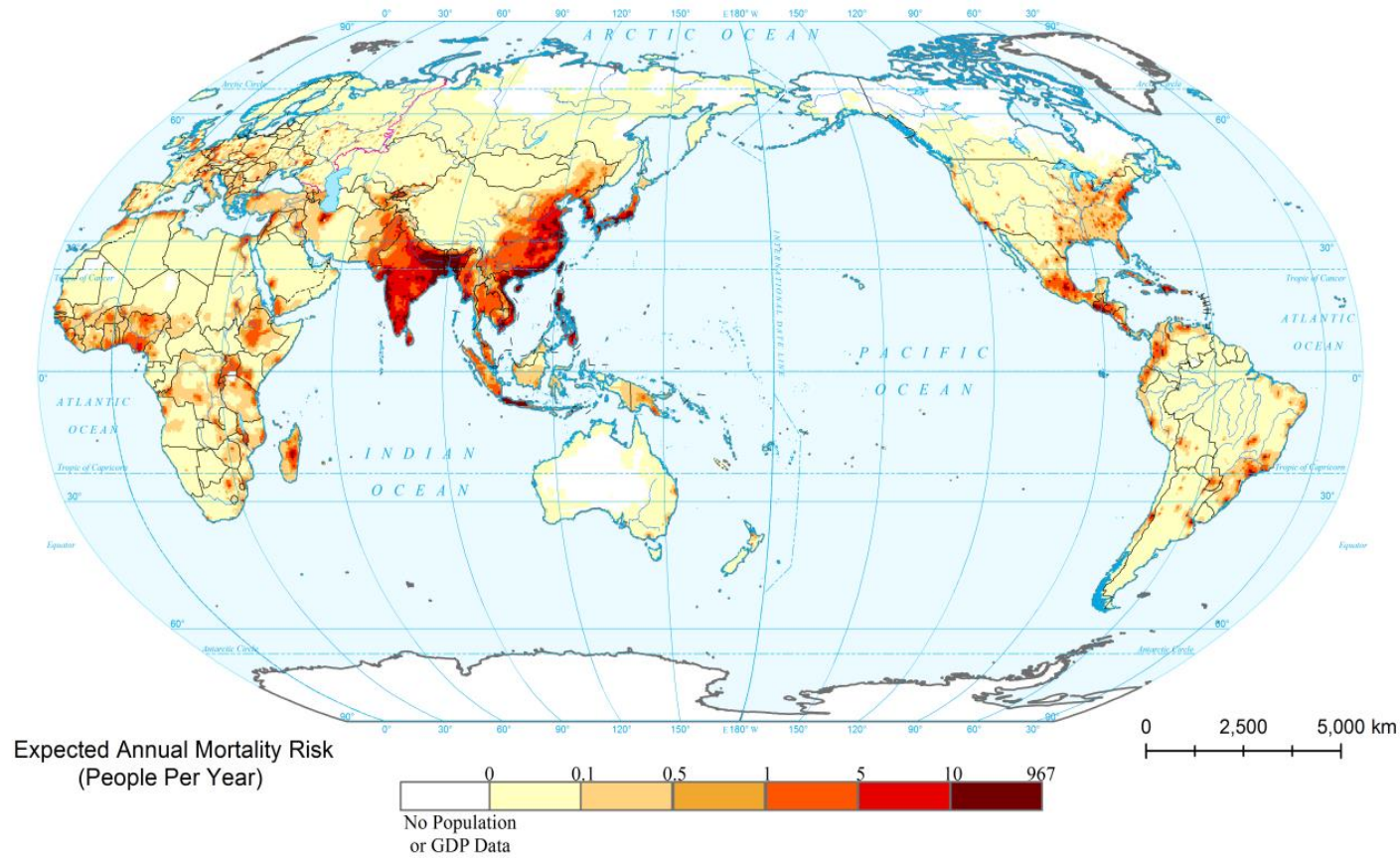
## Global Expected Annual Affected Population Rate for Multiple Hazards



Affected Population Rate  
(People per  $10^5$  People per Year)

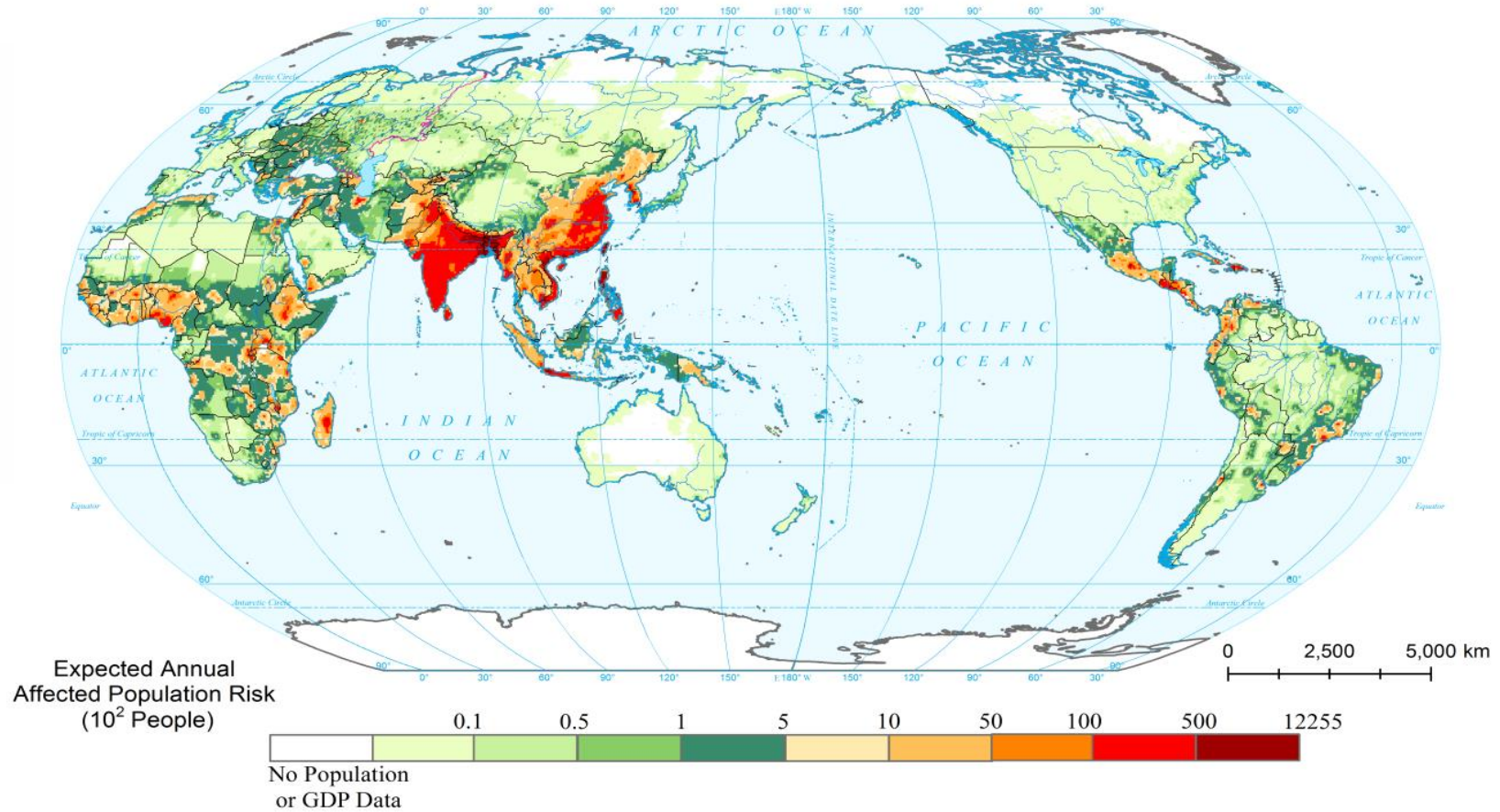
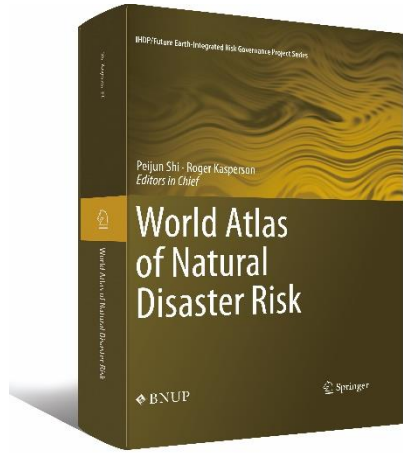
0 1 000 2 000 miles  
0 1 000 2 000 3 000 kilometers





Global **expected annual mortality risk** for multiple natural hazards (2020–2030) ( $0.5^\circ \times 0.5^\circ$  )

eBook can be downloaded **freely** at <http://link.springer.com/book/10.1007/978-3-662-45430-5>



Global **expected annual affected population risk** for multiple natural hazards (2020–2030) ( $0.5^\circ \times 0.5^\circ$ )

**Peijun Shi.Xu Yang.Wei Xu.Jing'ai Wang**

**Mapping Global Mortality and Affected Population Risks for Multiple Natural Hazards**

Int J Disaster Risk Sci (2016) 7:54–62 [www.ijdrs.com](http://www.ijdrs.com)

## ○ Responses to HFA2

### ✓ **Coping with Climate Change and Disaster Prevention and Reduction**

- Overall Consideration on Adaptation to Climate Change, Development and Disaster Reduction

### ✓ **Social Construction and Disaster Prevention and Reduction**

- Importance of the participation at the community level
- Focus on the most vulnerable and get them involved in disaster reduction work
- Underline the leadership of women in reducing the risk of disasters
- Pay close attention to children and youngsters: opportunity for the new generation
- Improve medical services and sanitation
- Sharing of knowledge and education
- Give play to science and technology



## ○ Responses to HFA2

### ✓ **Government's Commitments in Disaster Prevention and Reduction**

- Participation of the private sector in the disaster reduction work
- Capacity building: finance
- Political will and the power from the leadership

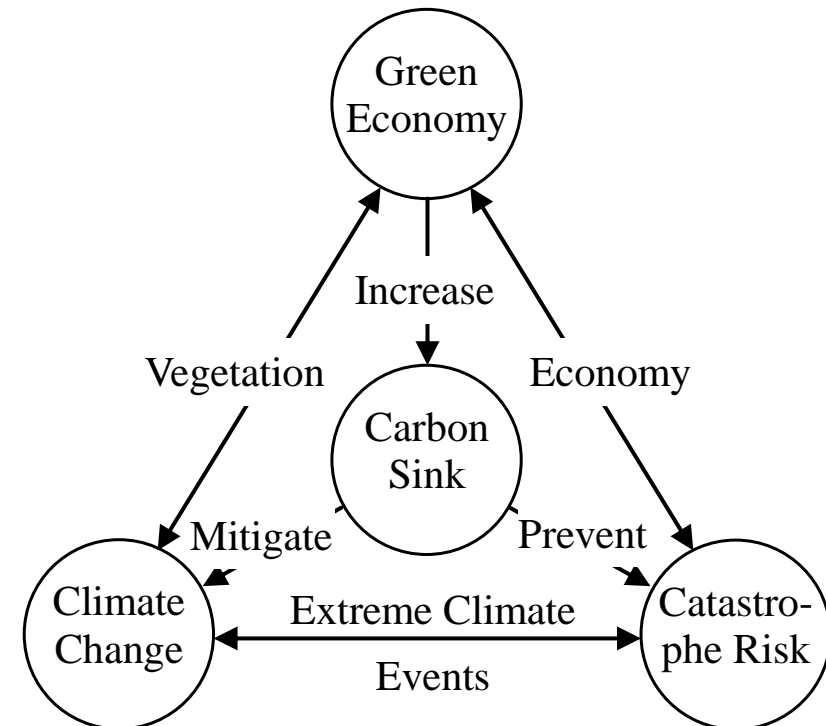
### ✓ **Performance Evaluation and Accountability for Disaster Prevention and Reduction**

- Prevention, accountability, transparency and inclusiveness
- Capacity building: risk assessment, preparedness and early-warning

# Challenges and Opportunities for Asia's Disaster Prevention and Reduction

## ○Promoting the Integration of Coping with Climate Change and Disaster Prevention and Reduction

- Incorporating economic development, life style and ecosystem service to better adapt to changing environment ..
- Vigorously promote the green economy strategy by balancing efforts on disaster loss mitigation and benefit enhancement..



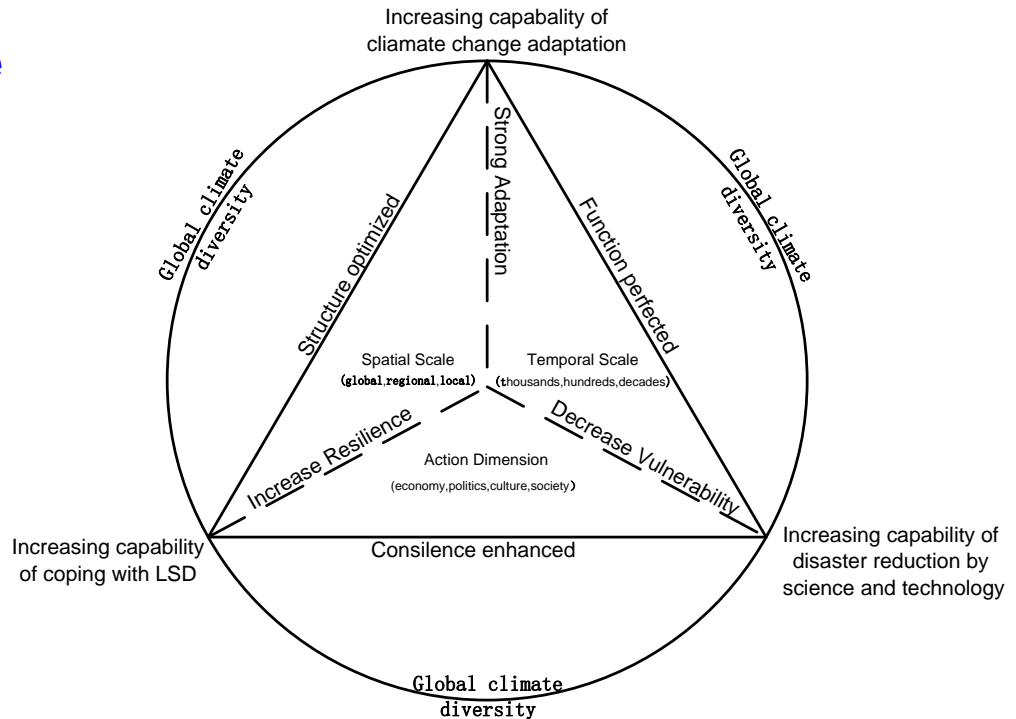
# Challenges and Opportunities for Asia's Disaster Prevention and Reduction

- **Holistically improve national and regional risk governance capacity for large-scale disasters**
  - **Accelerate the transition of economic growth patterns**
  - **Establish diversified energy security and supply chain system.**
  - **Comprehensively improving the catastrophe risk sharing capabilities of the nation and among regions.**

# Challenges and Opportunities for Asia's Disaster Prevention and Reduction

## ○Promoting the Establishment of Global Paradigm and Alliance for Large-scale Disaster Risk Governance

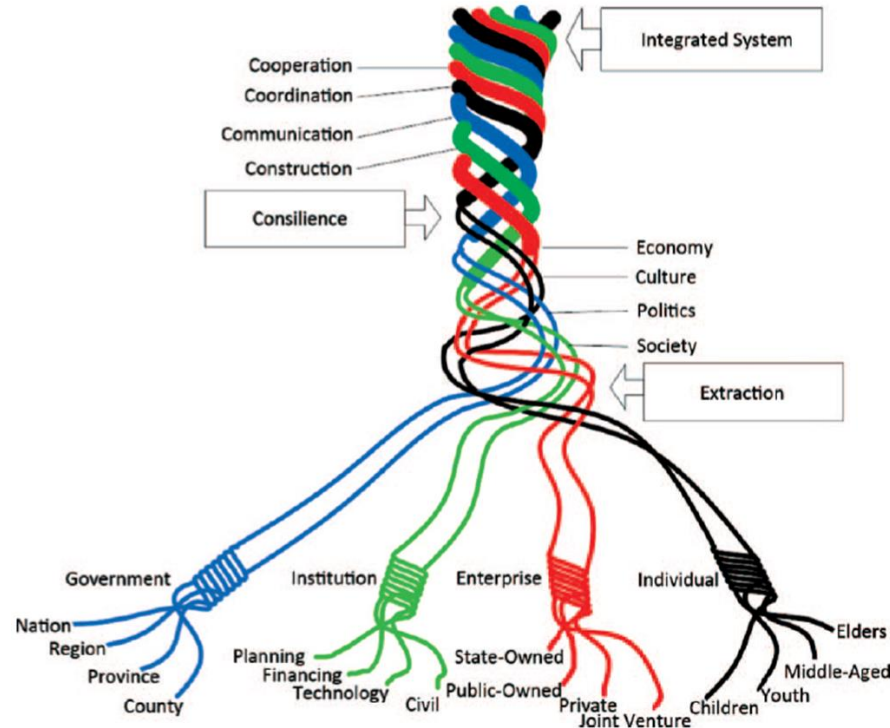
- Develop the Global Paradigm for Large-scale Disaster Risk Governance.
- Establish the Global Foundation for Large-scale Disaster Risk
- Establish the Global Network for Large-scale Disaster Response.



Government

Company

Community



## Consilience Model

Agricultural insurance

Catastrophe insurance

government

company

peasant

government

company

home owner

An aerial photograph of a vast agricultural landscape. The foreground is dominated by a dense forest of tall, thin trees with vibrant green foliage. Beyond the forest, the land is divided into large, rectangular green fields, likely used for agriculture. In the distance, a range of low mountains or hills is visible under a clear sky. The overall scene is bright and verdant, suggesting a healthy and productive environment.

**Thank You**