
Djillali BENOUAR
PERIPERI U Partner
IRDR SC Member
Periperi U

Conceptualised within Africa in early 2000s, then incubated & grown purposefully > 2006. Now an agile, fully operational univ. architecture for DR capacity building for integrated disaster risk research AND DRM practice.

12 univs, 185 staff, eight languages.

A Transboundary Partnership of African HEIs

Demonstrable expertise in DR curricula integration across multiple disciplines surge in (sub)national DR research capability.

28 DR-related academic progs & modules since 2005

+/- 1,000 students registered (2017),
87 short courses that reached 2,400 people (2011/16).

http://www.riskreductionafrica.org dbenouar@gmail.com
What Innovations Make Periperi U Work?

An HEI partnership that is transboundary and cross-disciplinary.

A deliberately incremental approach.

Flexibility in curriculum design.

Multiple mutually reinforcing interventions.
What Would Make it More Effective?

Innovative approaches to student funding

Internship and placement opportunities

Nationally and locally commissioned research

A ‘re-think’ on international technical assistance
THANK YOU

www.riskreductionafrica.org
Current Challenges on Disaster Risk Reduction

Scoping meeting CRA
Disaster Risk Reduction and Resilience – DR3

The Belmont Forum

Florence, Italy, 5-7 June 2017

Sálvano Briceño
Science Committee
Integrated Research on Disaster Risk (IRDR) of ICSU/ISSC/UNISDR
Former Director UNISDR (2001-2011)

What is Disaster Risk Reduction (DRR)?

• A conceptual framework consisting of ways and means:
  – To minimize disaster risks (hence, loss of lives, livelihoods and property) by reducing the degree of vulnerability and increasing resilience capacity
  – To avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of natural phenomena, as an essential requirement for sustainable development

\[
\text{Natural hazard} + \text{Exposure} \times \text{Vulnerability} - \text{Capacity} = \text{Disaster Risk}
\]
Global Trends - Disasters are NOT natural

Greater exposure to natural and human-induced hazards, climate change and variability

Socio-economic: poverty & unsustainable development styles, unplanned urban growth and migrations, lack of risk awareness & risk governance institutions & accountability...

Physical: insufficient land use planning and safety awareness, housing & critical infrastructure in hazard prone areas...

Ecosystem & natural resource depletion (coastal, - coral reefs, mangroves…--; mountains; watersheds; wetlands; forests…)

HAZARDS + EXTREME EVENTS
VULNERABILITY
“Quote from the 2015 UN Global Assessment Report on Disaster Risk Reduction (by UNISDR)”

• “Managing risk, rather than managing disasters as indicators of unmanaged risk, now has to become inherent to the art of development; not an add-on to development, but a set of practices embedded in its very DNA. Managing the risks inherent in social and economic activity requires a combination of three approaches:

  – 1. **Prospective risk management**, which aims to avoid the accumulation of new risks;
  – 2. **Corrective risk management**, which seeks to reduce existing risks;
  – 3. **Compensatory risk management** to support the resilience of individuals and societies in the face of residual risk that cannot be effectively reduced.
Priority issues for policy action and scientific research…

• 2015 Sendai Framework for Disaster Risk Reduction - SFDRR provides **general guidelines**, which require setting priorities…

• **Identifying priorities**, different in each nation and community but they have to be clearly identified for greater effectiveness…

• A general priority is **balancing implementation pace with accelerating need**, given the rapid increase of vulnerability…

• Giving higher priority does not always mean allocating more resources but rather **doing things differently** (a paradigm shift, i.e., integrating risk considerations, awareness-raising, education…)

• **Reducing vulnerability is a task for each sector** and policy needs to recognize and facilitate this (agriculture, health, education, energy, environment, tourism…) and at all levels (local to int’l)
Priority issues for policy action and scientific research

- Develop further SFDRR **targets and indicators** for sectors and levels for measuring and assessing progress

- **Governance** focusing on reducing risk and vulnerability, from local to international, ensuring the paradigm shift, separating it from the emergency management, important but different...

- **Awareness-raising** and education intensive efforts with involvement of leaders (high level authorities, private sector, NGOs, communities) at all levels, in particular for **building safety** for homes, schools, hospitals, critical infrastructure...

- DRR an essential requirement for various sustainable development goals - **SDGs**...

- DRR as key **first step for climate change adaptation** and main purpose of mitigation – 2015 Paris Agreement...

- Hazard risk reduction recognized as essential **ecosystem service** by environmental policies and legislation
Priority issues for policy action and scientific research...

- **Ethical perspective** of risk reduction, rights-based approach, equity & poverty reduction, accountability & transparency for disaster losses & impacts, participatory and democratic approaches, decentralisation, community engagement...

- Identifying **obstacles to DRR (cultural, economic, political, etc.)** is essential to avoid turning in circles and rehashing mistakes...

- Obstacles are difficult to address as they usually respond to specific interests, hence the need to be strategic and in the case of DRR, very patient as we are dealing with obstacles that have existed for centuries...

- E.g., the term “natural” disasters, which has traditionally enhanced the perception that these disasters are either acts of god or nature, hence little we can do about them, which in turn suits very well narrow minded or incompetent authorities who prefer to blame god or nature...
THANK YOU

www.irdrinternational.org
www.preventionweb.net
www.unisdr.org
www.gfdrr.org
www.globalnetwork-dr.org

谢谢
The vision of disaster risk reduction: building resilience into sustainable development

The six principles of sustainability

Community Sustainability
- Environmental Quality
- Economic Vitality
- Disaster Resilience
- Participatory Process
- Quality of Life
- Social & Intergenerational Equity

www.colorado.edu/hazards/publications/informer/infrmr3/informer3c.htm
Natural Disasters in Brazil: over 95% of disasters are climate-related.

- Forest fires, Floods, Drought, Mass Moviments
- Droughts, Floods, Flash Floods
- Wildfires, Floods, Erosions
- Wildfires, Flash Floods, Floods, Droughts, Landslides
- Flash Floods, Wind Storms, Hails, Landslides
Natural Disasters in Brazil

Percentage of reported people affected by disaster (%)

- Frost: 0.12
- Floods: 1.32
- Tornado: 0.12
- Wildfires: 0.48
- Erosion: 0.9
- Mass movement: 1.79
- Hail: 4.2
- Wind Storms: 7.07
- Floods: 12.04
- Flash Floods: 20.66
- Droughts: 51.31

Landslides and flash floods cause over 90% of fatalities!

Post-2011 DRR Policy in Brazil: A Paradigm Shift
National Plan for Risk Management and Response to Disasters

Relief and recovery

Prevention

Response

Monitoring and warning

Building structural resilience (slope, stabilization, drainage and flood control)

Mapping and understanding risk

High resolution mapping of risk areas for 1000 municipalities

Strengthening early warning networks (e.g., 4 thousand automated raingauges, 9 weather radars, 300 riverflow sensors, data integrations, modeling, hazard prediction, etc.)
STRATEGY OF THE PLAN

1. KNOWLEDGMENT
Data base data sharing and Research

2. MONITORING SYSTEM AND EARLY WARNING
Increase of the observational network

3. NATIONAL TASK FORCE
Multidisciplinary team
Atividade adotada pelo Brasil

4. INFORMATION AND COMMUNICATION

5. CAPACITY BUILDING
Development of the capacity to act at all levels (federal, state and municipality)
CEMADEN – National Early Warning and Monitoring Centre of Natural Disaster

MISSION: develop, test and deploy a police forecasting system of natural disasters in vulnerable areas throughout Brazil.

Created at July 2011
As CEMADEN works

- Operating since December 2011
- Full monitoring regime (24 x 7)
- Nearly 1000 cities monitored
- More than 7,000 warnings already issued
PROCEDURES TO WARNING EMISSION

Geological Analysis

Meteorological Analysis

Hydrological Analysis

diagnosis of the current situation

Forecast

Construction risk scenario
Process + Risk

multidisciplinary decision making
Plano Nacional de Gestão de Riscos e Resposta a Desastres Naturais
Rede Observacional Cemaden
20/10/2015
From a classical scientific point of view

1. Where is each type of hazard likely to be presented and why?
2. What scientific principles govern the process responsible for the disaster?
3. How often do these hazards develop into disasters?
4. How can each type of disaster be predicted and/or mitigated?
Disasters are complex problems requiring integrated knowledge and understanding. Holistic view

- Threats to local communities, national security
- Consequences amplified by unsustainable development
- Variability in exposure and vulnerability of communities and assets
We consider that, at least, four themes should be included in the DR$^3$

- DROUGHT, DESERTIFICATION, SAFETY (FOOD, WATER, ENERGY), ECOSYSTEM SERVICES AND RESILIENCE
- MANAGEMENT OF NATURAL DISASTER RISK IN URBAN AREAS
- RISK ASSESSMENTS AND MODELING OF NATURAL DISASTERS
- DISASTERS, SCIENCE AND PUBLIC POLICIES

co-designing, co-working, co-implementing
Disasters, Science and Public Policies

From a social science perspective, the concept of disaster implies a combination of social, political and cultural dynamics, and their occurrence mirrors interactions between ecosystems and social groups.

The application of this concept emphasizes that a disaster is not an isolated event in time and space. On the contrary, disaster is understood as a process that unfolds over time, affecting humans and nature in a spatial dimension much larger than the specific location of the critical event.

Socio-environmental disasters can be said to spark public debate and interest in science, both related to how the disaster happened and to how it can be mitigated. Brazil, for example, has suffered many socio-environmental disasters recently, including deaths related to heavy rains in Rio de Janeiro and the mining-related disaster in Mariana, Minas Gerais.

These disasters help to jump-start investments in Science (creating institutions such as CEMADEN) and research agendas around topics such as extreme events, climate change and adaptive capacity, as well as the damage to the Rio Doce basin and how to recuperate it. There is a need to develop a more nuanced and complex understanding of those interrelationships. Research that sheds light on how and to what extent disasters influence science and public perceptions and attitudes around it, and how these interactions help to harness science and technology to better address disasters in light of public worries and doubts would be particular interest.
Disasters, Science and Public Policies

- The role of education as a key element of increased resilience to natural disasters
- Communicating risk to policy and to society
- The use of mobile communications technology to increase resilience to natural disasters
- Socio-environmental disasters, science and the public
- Disaster risk governance and policies of vulnerability reduction
- Cost-benefit analysis of disaster risk reduction policies
- Human in the Loop of Managing Early Warning of Couple Dynamics and Risks with Poor Observations, Incomplete Understanding and Hybrid Modeling
- Production of Environmental Indicators on mapping vulnerabilities and impacts to reduce disaster risk
Many of the world’s most vulnerable people live in arid and semiarid regions. Close to 1 billion people, among the poorest in the planet, live in regions characterized by recurrent hydric stress. Drylands occupy nearly half of Earth’s land area and are home to a third of the human population. Drylands are highly vulnerable to increases in human pressures and climatic variability. In arid, semiarid regions as well as in drylands, water scarcity limits the production of crops, forage, wood, and other services ecosystems provide to humans. In this theme research project should brings out linkages between arid, semiarid regions, drylands, desertification and global climate change, biodiversity loss, and how different future development paths will affect these regions.
DROUGHT, DESERTIFICATION, FOOD, WATER, ENERGY SECURITY, ECOSYSTEM SERVICES AND RESILIENCE

• Integrated risk assessment and management of natural disasters on a changing climate
• Changing nature of climate extremes and risks to natural ecosystems (e.g., forest fires)
• Drought and desertification (including resilience, deforestation, fires, biodiversity conservation, water, energy and food security)
• Drought and Desertification: Threats to Water and Food Security
• Land degradation and Drought: Threats to Food Security
• Natural Disasters and Water security (or food)
• Climate Change-Drought and Food Security
• Modeling of soil water seepage and slope stability
• Nexus Food-Water-Energy Security in Brazil in the context of changes in climate and land-use;
• Climate Change extremes and Land Use Change in relation to land degradation and desertification processes in Semi-Arid regions of Brazil.
Increased urbanization and expansion of urban construction into hazardous areas, mainly in developing countries, have led to an escalating impact of landslides and flash floods. Landslides and flash floods are directly associated with loss of lives, property and infrastructure damage, and environmental destruction.

Understanding the multidimensional features of cities vulnerabilities is essential to find routes for disaster risk reduction. What are the root causes and dynamic pressures of vulnerability? How and to what extent, do vulnerabilities intertwine in the phases of anticipate, cope with and recover from harm?

Other important issue for this theme is that multi-hazards early warning systems (key recommendation in Sendai Framework) is poor addressed in scientific world. More studies are necessary in order to understanding the different characteristics of these types of EWS, as well as their needs of adaptation according to diverse social contexts of vulnerability.

Other important theme to be addressed is the development, integration and standardization of a database of natural disasters in order to generate information that allows for a broader understanding of the causative factors, the calculation of critical rainfall thresholds, and the magnitude and impact of natural disasters.
MANAGEMENT OF NATURAL DISASTER RISK IN URBAN AREAS

- Disaster risk management in urban areas (including resilience, landslide, flash floods, inundation, adaptability, ecosystem services)
- Qualitative and Quantitative Assessment of Vulnerability and risk to Disasters;
- Multi-hazards early warning systems
- Low cost monitoring systems for landslides
- Database modeling to manage landslides risk areas
- 3-D modeling and mapping of landslides hazard and risk areas
RISK ASSESSMENTS AND MODELING OF NATURAL DISASTERS

In recent years, there has been a growing recognition that disasters cannot be adequately handled within the framework of conventional models (met/hydro/geo/economic).

On the other hand empirical, input-output, social accounting, and other types of models are based on a number of assumptions that are questionable in catastrophes. The problem can be redefined considering a series of challenges that disasters pose to conventional modeling: data availability; scope; broad influences; uncertainty; non-linearity, etc. In this theme research project should tackle these challenges in order to understand and prepare for future events.

The following proposed lines of research addresses one or more of the challenges noted above.
RISK ASSESSMENTS AND MODELING OF NATURAL DISASTERS

- Data assimilation and mathematical modeling of natural hazards of hydrometeorological origin such as landslides, floods and coastal storm surges and floods
- Disaster risk modelling
- Computational intelligence-based nowcasting systems to flash floods forecasts
- Critical environmental thresholds in the deflagration of landslides and the influence of anthropic factors
- Attribution of impacts and extremes for disaster risk reduction
- Impacts and extremes on hydrological cycle for water consumption and use in agriculture
- Vulnerability indicators and coastal community resilience
- Community vulnerability and resilience to natural disasters.
- Mapping risk and vulnerability
Institutional Implementation on Solution-based Disaster Risk Reduction

Dr. Shang-Hsien (Patrick) Hsieh
Executive Secretary
the Program on Applying Science and Technology for Disaster Reduction
Institutional efforts on science-oriented disaster risk management

Key elements to follow

• Integrated research projects, but emphasize feasibility and practical implementation
• Inter- and intra-government partnership for topics design and implementation
• Always “Learn from Disasters!”

National Science & Technology Program for Hazard Mitigation

8 Years
NAPHM

4 Years
Program for Enhancing Innovation and Implementation of Disaster Risk Reduction

4 Years
Program for Application of S&T on Disaster Management

Historical events

Chi-Chi (E)  Toraji (T)  Mindulle (T)  Kalmaegi (T)  Megi (T)  Morakot (T)
Continuous investments on DRR through launching research projects at national level

- **LPDRP**: Large-scale Projects on Disaster Research Program
- **NAPHM**: National Science and Technology Program for Hazard Mitigation
- **PEIIRD**: Program for Enhancing Innovation and Implementation of Disaster Reduction
- **ASTDR**: Program on Applying Science and Technology for Disaster Reduction

**Graphical Data**

- **LPDRP**: 1982-1998, $0.74\,\text{bn}$
- **NAPHM (1,2)**: 1998-2006, $3.36\,\text{bn}$
- **PEIIRD**: 2007-2010, $1.48\,\text{bn}$
- **ASTDR 1**: 2011-2014, $2.76\,\text{bn}$
- **ASTDR 2**: 2015-2018, $3.32\,\text{bn}$

**Note**: $\text{bn}$: billion NTD ($\text{NTD}\,1\,\text{bn} = \text{USD}\,32.26\,\text{M}$)
To identify solutions for focal topics through inventory check on demand and supply of DRR (on-going process)

Program on Applying Science and Technology for Disaster Reduction

**Phase 1 (2010-2014)**

- **Data**
  - Topic 1. Large-scale slope-land disaster prevention
  - Topic 2. Floods prevention
  - Topic 3. CCA and DRR
  - Topic 4. Drought and water resources
  - Topic 5. Earthquakes
  - Topic 6. Infrastructure Safety
  - Topic 7. IMS for DRR
  - Topic 8. Nuclear disasters
  - Topic 9. Emerging issues

**Phase 2 (2015-2017)**

- **Model**
  - Sediment impacts and mitigation
  - Flood management platform
  - Extreme weather events
  - Mega quake in urban areas
  - Using Big Data and Open Data
  - Nuclear power, Volcano, ...

**Management**

- Evaluation on emergency response

**Topics setting**

- Typhoon
  - Floods
- Earthquakes
- Infrastructure
- Information Platform
- Emerging issues
- Social Economics

**Progress**

**Focal issues**

- Typhoon
  - Floods
- Earthquakes
- Infrastructure
- Information Platform
- Emerging issues
- Social Economics
1. To integrate sciences;
2. To work with policy makers/practitioners;
3. To provide the vision as well as the practical steps to be followed;
4. To reduce loss.
To promote a regional collaboration on Disaster Risk Reduction and Resilience (DR3)

• **Goals setting:**
  
  – Reviewing regional and sub-regional plans of disaster management to understand the current status of physical and social vulnerabilities.
  
  – Hosting dialogues with representatives of local governments to find out gaps and demands on science-based disaster management.
  
  – Seeking trans-boundary comparisons with others and inter-disciplinary collaborations through Blemont Froum and relevant scientific programs.

• **Core spirits of the project**
  
  – Co-design, Co-work and Co-implement with local governments proposing their demands
Possible topics to cover for enhancing regional capacity building

1. Natural Disaster Risk Management
2. Technological Disaster Risk Management
3. Disaster Forensics and Impact Assessment
4. Enhancing Decision-Making of Disaster Risk Reduction through Application of Science and Technology
5. Promoting Public-Private Partnership for Societal Resilience
6. Reducing Disaster Risk in Urban Areas
7. Plans and Implementations of Post-Disaster Recovery
Thanks for your attention
Scheme of the Disaster Management Information Platform (DMIP)

- **Display**
  - Data investigation
  - Overlay mapping
  - 2D & 3D display

- **Data**
  - Achievements of the program
  - Basic data, monitor data, and interpretation
  - Results of model-integrated computing

- **Model**
  - Disaster potential scale
  - Disaster simulation
  - Disaster damage assessment
  - Vulnerability assessment
  - Damage and loss assessment

- **Management**
  - Data interpretation
  - Climate index
  - Water resources index
  - Damage index of typhoon

- **Services**
  - Sharing achievements
  - Providing map files
  - Providing data
  - Model-integrated computing
  - Data display
  - Remote replication

- **Application**
  - Large scale slope land
  - Flood disaster
  - Climate change
  - Drought and water resources
  - Earthquakes
  - Disaster Management Information Platform

- **Users**
  - Government authorities
  - Emergency response platform
  - Disaster reduction platform
  - Communication and cooperation
  - Research and development
  - Academic and research institutes
  - Global science education
  - Disaster prevention education
  - Development of prediction models

- **Resources/Participants**
  - Research Models
  - Public Information
Lessons learned from Great East Japan Earthquake in 2011

6 years experiences from 2011 to 2017

Restoration Process & Roles of Multi Stakeholders

June 6 2017

Mikiko Ishikawa, Prof. of Chuo university, Japan
Resilience is defined as:

“The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions”,

United Nations Office for Disaster Risk Reduction (UNISDR),
“2009 UNISDR Terminology on Disaster Risk Reduction”,
Assumption: Resilient Infrastructure
Learned from 6 years’ experiences from Great East Japan Earthquake

Diagram:
- Social Resilience
- Community Resilience
- Regional Resilience
- Environmental Resilience
- Cultural Resilience

Process Planning
Great East Japan Earthquake in 2011
Great East Japan Earthquake

Date: March 11. 2011

dead 15,879
missing 2,712
Completely destroyed Houses 130,000
Partially destroyed Houses 265,000

Radiation Accident Fukushima

Many traditional Local Communities
For creating Resilient Infrastructure
We have to consider Structure & Diversity, together.

Rias Coastal Zone

Height of Tsunami 15-20 m
To escape to the higher land

Alluvial Flat Zone
Alluvial Flats Zone
There is no higher land to escape

Is it possible to find the safe place to live?
Resilient Infrastructure
Five components: Process Planning, Environmental Social, Cultural, and Community Resilience

1. Process Planning
In order to recover from the huge hazards, Timely action, that means Process Planning, is essential to be introduced.

Immediate Action
Example
Pairing Support
Introduced in Sichan Earthquake, and Great East Japan Earthquake

Different Stages of Restoration
2011-2017
Pairing Support in Sichuan Great Earth Quake in 2008

Since the damaged area was huge, Chinese Government ordered that undamaged city should help the certain damaged city from the starting point of recovery to the restoration process. Same system had introduced in Great East Japan Earthquake.
2. Environmental Resilience

In order to absorb, and recover from the hazard effectively, the basic structure and system of natural environment should be analyzed scientifically, and implemented based on the rational planning.
Case Study Area: Iwanuma City, Miyagi Pref. Japan
Population: 40,000, belong to Sendai Metropolitan Area

Problem: Alluvial Flats area
No higher land to escape
Comprehensive Survey, just after Tsunami, took place and found the place where some architectures and trees remained
(Role of University)

Findings

**Micro Geography** is the key factor to resist the power of Tsunami
Analysis of Damaged Area of Tsunami Micro Geography

Micro Geography

Relationship Between Micro Geography & Damage by Tsunami
Based on the analysis of Damaged Area, Fundamental Natural Landscape Unit was identified (Role of Planner)
Natural Landscape Units

Fundamental Unit for the Restoration (Role of Planner)

Identified safe place to remove
Resilient Infrastructure
Five components: Process Planning, Environmental Social, Cultural, and Community Resilience

3. Social Resilience

In order to proceed the restoration process for creating safe living environment, promoting economic activities, timely decision making system is essential, and various stakeholders have to work together.
<table>
<thead>
<tr>
<th>Period</th>
<th>Stage 1 Grand Design</th>
<th>Stage 2 Citizen Workshop</th>
<th>Stage 3 Formal committee</th>
<th>Stage 4 New Machizukuri</th>
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</thead>
<tbody>
<tr>
<td>Leading Organization</td>
<td>Reconstruction Committee</td>
<td>Citizen workshop Supported by university</td>
<td>Tamaura-Nishi Machizukuri Committee Appointed by City</td>
<td>Tamaura-Nishi Machizukuri created by survivors</td>
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<tr>
<td>Role of Miyagi Pref.</td>
<td>Restoration Plan</td>
<td>Restoration Plan established:Pref.Level</td>
<td>Observer</td>
<td>Observer</td>
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<td>Role of Iwanuma City</td>
<td>Grand Design Committee</td>
<td>Restoration Plan Established:City Level</td>
<td>Leader</td>
<td>Observer</td>
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<tr>
<td>Role of Refugees</td>
<td>Representatives To Grand Design Committee</td>
<td>Everybody had a right to join workshop</td>
<td>Making Restoration Plan</td>
<td>Community Rebuilding Activities</td>
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<tr>
<td>Role of university</td>
<td>Leading role to create plan</td>
<td>Leading role for running workshop</td>
<td>Leader &amp; Adviser</td>
<td>Collaborator</td>
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<td>NPO</td>
<td>Various Activities</td>
<td>Join the workshop</td>
<td>Observer, Various Activities</td>
<td>Various Activities</td>
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</table>
<7 Goals for the Restoration >

1: To Setting up temporary houses as soon as possible for the survivors.
2: Finding a suitable location to re-establishment of the six villages
3: Revitalizing agriculture as a first priority
4: Create new employment using the advantages of the city’s airport
5: Promote natural energy projects
6: Develop a system of multiple defense system against tsunami by creating a “Hill of Hopes for Thousand Years Hill of Hope” on coast
7: Revitalizing the cultural landscape as the city’s identity.

<Gendered Innovation>

1. Equal Representatives to the Reconstruction Committee
2. Promoting Small Agriculture by female as a first step.
   This step became a break-through in revitalizing agriculture
Stage 1: Small Agriculture for Tomatoes
Stage 2

Free Workshops

Survey

Workshop: Discussion & Presentation
Stage 2  Free Workshops
Creative Activities
For community
Opening
“Everybody’s House” July, 2013

Small Agriculture
Meeting Place for children
Stage 3

Formal Committee & Creative Actions together with Survivors and Supporters

Compact City
Original Restoration Plan proposed from Iwanuma City June, 2012

Final Plan
Together with Refugees, City, University, Supporters (Nov. 20, 2013)

Discussion More than 300 times
Keeping the tie of Community
Stage 4  New Machizukuri (Town Planning) (Feb. 2014 ~)
4. Cultural Resilience

It is essential to find cultural structure of the place for achieving “Resilience”. Sometimes, it is difficult to find, especially when the site had completely destroyed. However, we have to continue to seek for, and should be implemented.
Finding Cultural Landscape
Igune(Agricultural Forest)
Igune : Protect North-east Wind
Weaken the power of Tsunami
### Scientific Research (History & Vegetation)

#### 居久根毎木調査

**対象敷地 : A家**

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<th>幹周り</th>
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**調査日 : 2011/08/27**

**調査メンバー :**

石川・大澤・片桐・根岸・氏家
Advice for re-planting
Creating Community Forest (Igune)
5. Community Resilience & Regional Resilience

Community Resilience and Regional Resilience is synthesis of environmental, social, and cultural resilience through process planning.
Creating Commons as the core of community
(Aug. 2014----)

Planting Lawn
In Aug. 2014

Planting Symbolic Trees
Herb Garden (Sept. 2014)

Collaboration: Japan herb society, Miyagi Pref. Medicine Dept. Tohoku University
Creating Community Festival by Children
Regional, Earth Resilience
Creating Multi-Defense System for safe region

Community
Canal
Hill
Coastal Forest
Multi Defense System
Hills of Thousand Hopes
Multi-Defense System: Planting Coastal Forest
By Many people from all over the world
Ecosystem of Coastal Forest
Proposal for resilient forest and enriching bio-diversity
Innovation for Monitoring System

Utilizing UAV, we are developing the monitoring system of coastal forest.
Innovation for Identifying the spices
Iwanuma Model

Environmental Resilience

Cultural Resilience

Social Resilience

Wave Movement for Creating Community Ties
Resilient Infrastructure from Community to Region, and Earth

**Community Scale**
- Refugees, City, NPO, University

**Local Scale**
- Citizen, City, Pref., NPO, University

**Regional & National Scale**
- National Government, Pref., Scientist, Planner, University

- 海岸林再生方法の提案

- 国土保全
- 外部からの災害の脅威

- 安全・安心な地域形成の基盤

**Collaboration**
- 家族や知人、隣人との話し合い
- 集落の寄り合い（30〜80名程度）
- 外部からの支援（情報・技術）

**Innovation for new method for managing coastal area**

- 海岸林再生方法の提案

- 安全・安心な地域形成の基盤
In this presentation, I analyzed the characteristics of the resilient infrastructure through the 6 years’ experiences from Great East Japan Earthquake in 2011. The following 7 points have clarified.

1. To develop Resilient Infrastructure for promoting DR3.
2. Resilient Infrastructure consists of five major components; Process Planning, Environmental, Social, Cultural and Community Resilience.
3. To reduce the risk effectively, and create “Build Back Better”, it is essential to introduce Process Planning.
4. To enforce Natural Resilience, scientific approach for creating Green Infrastructure is the urgent issue.
5. To develop Social Resilience, multi-stakeholders should be involved, and diversity is the key factor.
6. To excavate Cultural Resilience, people find the pride of place and the dignity of life.
7. Community Resilience is the synthesis of four factors, and a fundamental structure of region and earth of our future society.
Risk, Life and Science

Fumiko Kasuga
Global Hub Director– Japan, Future Earth Secretariat
Senior Fellow, National Institute for Environmental Studies

Belmont Forum Scoping meeting CRA ‘Disaster Risk, Reduction and Resilience – DR3’ Florence, Italy, Accademia dei Georgofili, 5 – 7 June 2017
My professional career

- Government researcher until March 2016
- Ministry of Health, Labour and Welfare, Japan
  - National Institute of Infectious Diseases
  - National Institute of Health Sciences
    (research institute for food and drug safety)
  - Microbiological food safety
    - Risk assessment
    - Epidemiology
- Future Earth Global Hub Director – Japan since May 2015
Foodborne illnesses = disaster

- Foodborne infections, outbreaks: infectious diseases, food is a vehicle of pathogens

- Accidental contamination of food with toxic agents: manmade disasters

- Intentional contamination: crime, food defense
Outbreak investigations

- **Recognition** of foodborne events
- **Investigation**: Identification of causative hazards, vehicle food, and source of contamination
- **Control measures**
  1. Ban, Recall: To urgently stop the ongoing outbreak
  2. Penalties, Training programmes: To prevent similar incidents
- **Reporting and recording**
  1. Long-term monitoring for trend analysis
  2. Basic data for risk assessment
Large scale outbreaks of Enterohemorrhagic *E. coli* O157:H7 due to school lunches 1996

- In one of the outbreaks in Sakai City, Osaka, 7,966 people infected, 3 pupils died. Another patient died of sequelae in 2015.
- Radish sprout was highly suspected as causative food.

APPLIED AND ENVIRONMENTAL MICROBIOLOGY, 1998, p. 1532–1535 Vol. 64, No. 4
Enterohemorrhagic *Escherichia coli* O157:H7 Present in Radish Sprouts
Y. Itoh, Y. Sugita-Konishi, F. Kasuga et. al.
Inspection into school kitchens
Risk Analysis
- for understanding whole picture of the situation and for longer term risk control

Risk Assessment
* Science based evaluation of likelihood

Risk Management
* Decision Making process

Risk Communication
* Exchange of information and opinions among all stakeholders
A *hazard* is a biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect.

*Risk* is a function of the *probability* of an adverse health effect and the *severity* of that effect, consequential to a *hazard(s)* in food.

\[
\text{Risk} = f (\text{hazard, likelihood, impact})
\]
Risk assessment throughout the food chain

Public health impact

Interaction with employees, owners, local authorities at every step in the food chain is necessary.
Risk assessment team with diverse experts established.

Initiated by FAO/WHO JEMRA

Modified from slide by Leon Gorris
Elements of a Microbiological Risk Assessment

- **Data**: Published scientific literature, government data (surveillance reports, outbreak reports), industry data, contamination data (qualitative, quantitative), temperature, time, human behaviour data, etc.

- **Model**: Description of the system under analysis and how the elements of the system interact, (probabilistic vs deterministic, descriptive vs quantitative)

- **Assumptions**: Expert opinions, hypothesis
Result of *Campylobacter* risk assessment
- The number of infection per year

- “Raw-eat” consumers, only 30% of population, account for ca. 90% of the number of infection
- Ave. times of individual infection per year: Raw-eat consumers (3.5) are 19 times higher than non-raw-eat consumers (0.18)

Slide by Dr. A. Hasegawa
Which food should be controlled?

Listeria risk assessment by USFDA/USDA
Estimation of burden of illnesses

- Physician Consultation Rate: By e.g. telephone population based survey data
- Stool sampling rate: By e.g. telephone population based survey data
- Laboratory test sensitivity rate, coverage in the target population

What we want to know: Kubota, Kasuga et al.
### Foodborne illnesses and death estimated by WHO FERG

<table>
<thead>
<tr>
<th>HAZARD</th>
<th>FOODBORNE ILLNESSES</th>
<th>FOODBORNE DEATHS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL</strong></td>
<td>600 652 361 (417 646 804–962 834 044)</td>
<td>418 608 (305 128–598 419)</td>
</tr>
<tr>
<td>Diarrhoeal disease agents</td>
<td>548 595 679 (369 976 912–888 528 014)</td>
<td>230 111 (160 039–322 359)</td>
</tr>
<tr>
<td>Viruses</td>
<td>124 803 946 (70 311 254–251 352 877)</td>
<td>34 929 (15 916–79 620)</td>
</tr>
<tr>
<td>Bacteria</td>
<td>349 405 380 (223 127 469–590 002 559)</td>
<td>187 285 (131 742–254 037)</td>
</tr>
</tbody>
</table>

Median global number of foodborne illnesses and deaths, with 95% uncertainty intervals, 2010. (WHO estimates of the global burden of foodborne diseases: foodborne disease burden epidemiology reference group 2007-2015..World Health Organization)
Lessons learned

- Difference in definition, terminology should be noted.
- Systems and logical thinking and understanding are important.
- Collaboration with and engaging stakeholders in the society - critical
- Data, variability, uncertainty
  - Data collection is not easy.
  - Data sharing is even more difficult in many cases.
  - Modeling, simulation and scenario analysis are useful to complement what we observed.
- Science – policy interface - challenging
Science Council of Japan, Disaster Risk Reduction and Future Earth
Great East Japan Earthquake and TEPCO
Fukushima-Daiichi Nuclear Power Plant accident
March 11, 2011

news.livedoor.com

By TEPCO
Recommendations

Recommendations from
Science Council of Japan (SCJ)
— with Confident Steps towards Reconstruction —

April 9, 2012
Science Council of Japan
Committee on Supporting Reconstruction
after the Great East Japan Earthquake
Sendai Outcomes

Sendai Framework for Disaster Risk Reduction 2015-2030
Sendai Declaration
Voluntary commitments

Implementation and Commitments

Voluntary commitments by relevant stakeholders are important to identify modalities of cooperation and implement the Sendai Framework.

Segments

Proceedings of the World Conference
Preparatory Meetings
Inter-Governmental Segment
Multi-Stakeholder Segment
Public Forum

Selected Interviews

Interview videos at the Third UN World Conference on Disaster Risk Reduction

Awards

Sasakawa Award
Risk Award
TV film Award

Videos

5 Days in Sendai
Highlights of the Ignite St Awards

Inspiring Quotes

“Sendai Conference outcome represents the ‘first step of our journey to a new future’”
Ban Ki-moon
Secretary-General

Photos

Selected Blogs

Ten things to know about Sendai disaster risk reduction deal.
How can the world better prepare for natural disasters?
New Approach to Strengthen and Support Decision-making on DRR
HOW TO REDUCE RISK FROM EXTREME WEATHER EVENTS

The Colombia mudslide, the Peru floods, and last October’s Hurricane Matthew in Haiti highlight the need to address the underlying social and economic forces that place human settlements at risk.

HOW CAN THE WORLD REDUCE DISASTER LOSSES FOR THE POOR?

“The latest research findings on economic losses from disasters explain why this issue has emerged as the major concern for governments preparing for the Global Platform for Disaster Risk Reduction,” says UNISDR head Robert Glasser.
Emergent issues

(from UN Photo)

Air pollution

Epidemics

Ocean contamination

Land use change
Poverty, refugees

Extreme climate disasters

(from UN Photo)
Inter-related factors in the environment and in human society

- Many factors are related each other and have impacts on human health and life.
- Human life also give huge impacts on the environment.
- We need to address to multiple challenges in an integrated and inclusive way.

Holistic approaches are needed by Co-Design

Many individual research topics: they are important basis for understanding issues
Future Earth characteristics:

- Research informing solutions
- Interdisciplinarity
- Stakeholder engagement

Picture from the animation:
“Welcome to the Anthropocene”
Future Earth Alliance ⇒ Governing Council
Future Earth Secretariat
Executive Director and Global Hub Directors

Wendy Broadgate
Stockholm

To be announced very soon

Josh Tewksbury
Colorado

Anne Hélène Prieur-Richard
Montreal

Thorsten Kiefer
Paris

Fumiko Kasuga
Tokyo
How to get involved in Future Earth? – via Open Network

http://network.futureearth.org/home
Fee download
Not scientific articles or news, but new web magazine to connect people by sciences

anthropocenemagazine.org
Other outreach activities (http://www.futureearth.org/)

Early Career Professionals

One of Future Earth’s key focuses is on engaging diverse early-career professionals from a range of disciplines and sectors. We seek to bring together professionals from different domains and to strengthen their capacities in conducting inter- and transdisciplinary research around global sustainability — with the goal of generating solutions for sustainability and improving our understanding of the physical, biogeochemical and human dimensions of global environmental change.

Future Earth engages with a wide variety of early career researchers and other professionals. We work with researchers in the natural and social sciences and the humanities. We also reach out to professionals in policy, business, the technology industry, agriculture, civil society and much more.

If you are an early career professional and would like to get involved in Future Earth, we invite you to join the Future Earth Early Career Professionals Network.

Joining the Future Earth Early Career Professionals Network entails numerous benefits:

- Engage with other early career professionals through one-on-one and group conversations
- Get the latest scientific research results around sustainability
- Stay up-to-date with funding opportunities and relevant vacancies
- Be the first to know about exciting conferences and workshops

Members of our network also get the chance to be involved in various Future Earth activities and structures, such as our Knowledge-Action Networks, regional centres and conferences.

Future Earth engages and partners with a number of existing initiatives and networks that work to empowering the next generation. These include

- The Early Career Researchers Network of Networks, which brings together 17 global networks
- Young Leaders for Sustainability (Collective Leadership Institute)
- and many more to come

If you are interested in joining the Future Earth Early Career Professionals group, please contact us.

We define early career professionals as anyone whose career has started within the last 10 years and who is connected to sustainability. This includes researchers who have received their Bachelor’s or Master’s qualification within the last 10 years or their PhD within the last six years, as well as professionals working at the interface of society, policy, practice and research.
Our networks reach 50,000 global sustainability researchers and people interested in this research.

National networks established, and many more in progress.

Knowledge-Action Networks

Major international research projects

5 Global hubs

7 Regional centres

8 Knowledge-Action Networks

>20 National networks established, and many more in progress

>20 Major international research projects

Colorado, Montreal, France, Sweden, Europe, MENA, Asia, Africa, Latin America, Japan
Future Earth Global Research Projects
ICSU Interdisciplinary Bodies

Thematic Organizations
These bodies have been set up to address specific themes and to provide a platform to convene scientists with common interests across disciplinary borders, to plan and organize international scientific initiatives and to offer advice in a policy context. They differ from the other groupings in this section in that they do not plan and implement very large international research programmes nor do they carry out assessments. However, their work is critical to the larger research community.

- Integrated Research on Disaster Risk (IRDR)
- Committee on Space Research (COSPAR)
- Scientific Committee on Antarctic Research (SCAR)
- Urban Health and Wellbeing: A Systems Analysis Approach
- Scientific Committee on Oceanic Research (SCOR)
- Scientific Committee on Solar-Terrestrial Physics (SCOSTEP)

Global Environmental Change Programmes
ICSU’s Global Environmental Change Programmes recognize the Earth as a complex system, regulated by physical, chemical and biological processes—and influenced, as never before, by human factors. While each Programme focuses on a particular area (e.g. biogeochemical cycles, climate change, biodiversity, and how humans impact and adapt their environments), their collaborative efforts are addressing global issues such as food, water and carbon. In 2014, the previous Global Environmental Change Programmes DIVERSITAS, IGBP and IHDP merged into Future Earth.

- Future Earth: Research for Global Sustainability
- WMO-ICSU-IOC World Climate Research Programme (WCRP)

Monitoring and Observations
Global observing initiatives are critically important to policy-relevant science at national, regional and international scales. Moreover, the need to integrate data from ocean, terrestrial and climate systems is increasingly evident. ICSU’s Monitoring/Observation Programmes facilitate data collection and foster the development of international standards and methodologies that support universal equitable access.

- Global Climate Observing System (GCOS)
- Global Ocean Observing System (GOOS)
- Global Terrestrial Observing System (GTOS)

Data and Information
Cross community workshop on Extreme Events and Environments from Climate to Society (E³S), Feb 2016, Berlin, Germany

Conferences and events

2016

Cross community workshop on Extreme Events and Environments from Climate to Society (E³S)

Berlin, February 14th to 16th 2016 at Humboldt-Haus

Agenda (download)

The goal of this cross-community/co-design workshop is to identify and elaborate the scientific questions and associated research agendas which are scientifically challenging and of high societal relevance, in line with the goals of Future Earth. To this end we called for proposals for targeted co-design workshop sessions (call for proposals can be found here), which are organized independently of each other and happen in parallel. The workshop sessions have been selected by the E³S steering committee. The commitment of each session is to generate a 1-2 page document that will form the foundation of a research strategy and help to...
Mission:

To develop trans-disciplinary, multi-sectorial alliances for:
(1) in-depth, practical disaster risk reduction research studies, and
(2) the implementation of effective evidence-based disaster risk policies and practices
<table>
<thead>
<tr>
<th>Community-based Resilience, New Zealand</th>
<th>ICoE-CR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Education and Learning, South Africa</td>
<td>ICoE- REaL</td>
</tr>
<tr>
<td>Risk Interpretation and Action, UK</td>
<td>ICoE- RIA</td>
</tr>
<tr>
<td>Capacity building, research, Taipei</td>
<td>ICoE- Taipei</td>
</tr>
<tr>
<td>Understanding Risk &amp; Safety, Colombia</td>
<td>ICoE- UR&amp;S</td>
</tr>
<tr>
<td>Vulnerability &amp; Resilience Metrics, USA</td>
<td>ICoE- VaRM</td>
</tr>
<tr>
<td>Critical Infrastructure &amp; Strategic Planning, Germany</td>
<td>ICoE- CI&amp;SP</td>
</tr>
<tr>
<td>Disaster Resilient Homes, Buildings, and Public Infrastructure, Canada</td>
<td>ICoE- DRHBPI</td>
</tr>
<tr>
<td>National Society for Earthquake Technology, Nepal</td>
<td>ICoE- NEST</td>
</tr>
<tr>
<td>Disaster and Medical Humanitarian Response, Hong Kong</td>
<td>ICoE-CCOUC</td>
</tr>
<tr>
<td>Disaster Risk and Climate Extremes, Malaysia</td>
<td>ICoE-SEADPRI-UKM</td>
</tr>
<tr>
<td>Spatial Decision Support for Integrated Disaster Risk Reduction, the Netherlands</td>
<td>ICoE-SDS IDRR</td>
</tr>
</tbody>
</table>
World Climate Research Programme (WCRP)

Joint Scientific Committee
- Modeling Advisory Council
- Working Groups on: Numerical Experimentation (WGNE), Seasonal to Interannual Prediction (WGSIP), Coupled Modeling (WGCM), Regional Climate (WGRC)

Joint Planning Staff
- Data Advisory Council
- Working Groups on: Numerical Experimentation (WGNE), Seasonal to Interannual Prediction (WGSIP), Coupled Modeling (WGCM), Regional Climate (WGRC)

Working Groups:
- CliC: Water for Food Baskets, Melting Ice & Global Consequences
- CLIVAR: Weather & Climate Extremes, Carbon & Climate
- GEWEX: Near-Term Prediction (Decadal), Melting Ice & Global Consequences
- SPARC: Clouds, Circulation & Climate Sensitivity
- CORDEX: Regional Seal Level & Coastal Impacts

Focused, Measurable, Collaborative, Innovative

https://www.wcrp-climate.org/grand-challenges/gc-extreme-events
Global environmental change will affect the likelihood of extreme weather and climate events, which are among the key reasons for concern related to increasing global temperatures as they can have huge and costly impacts on ecosystems, natural resources and human society. Climate change will amplify the changes in weather and climate extremes we have seen so far and can reveal also unexpected or abrupt changes and tipping points. These are mediated through rapid social changes including urbanization, lifestyle, land use and socio-economic inequality.
Grand Challenge on Weather and Climate Extremes

Focus on research across temporal and spatial scales:
From global to regional and covering past, present, near-term and long-term future
Towards Extreme Events and Disaster Risk Reduction KAN initiative
Markus Reichstein, Fumiko Kasuga & Thorsten Kiefer (Future Earth), Mark Pelling (IRDR), Jana Sillmann (WCRP), Dorothea Frank & Miguel Mahecha (Future Earth E3S)

Background: 2016: E3S cross-community co-design workshop
1. Towards society-relevant metrics for climate extremes and their impacts
2. How to project climate extremes that really matter? – A transdisciplinary approach for new narratives of climate extreme impacts in the Future Earth context
3. Adaptive capacity of coupled socio-ecological systems to absorb climate extremes
4. Impact of hydrological and marine extreme events on coastal systems. Adaptation strategies and community resilience
5. Integrated Governance of Disaster Risk and Financial Uncertainties for Sustainable Development
6. Detecting, understanding and responding to extreme events: Towards a multi-dimensional “U3” data-and-knowledge base

Present: Objectives of KAN co-proposed by Future Earth, WCRP, IRDR
- To build a global partnership and network of science excellence across disciplines to accelerate integration and synthesis for ground breaking and solution oriented research for disaster risk reduction and its governance under global environmental and societal change
- To jointly identify priorities and support complementarity of research on systemic risk including the interaction of climate-change induced extreme events and other disasters
- To explore and enhance the role of science as an active participant in transformation to sustainability and resilience through systematic research, facilitation and convening roles among diverse science communities and in collaboration with stakeholders
Major Working principles proposed to the Belmont Forum

• Provide an open platform for scientific communities
• Define scientific focus with being added value
• Engage with societal actors from local/national/international levels
• Stimulate groundbreaking and solution-oriented scientific research
• Follow a common risk framing and terminology across science and practice
• Address systemic, complex and cascading risk to contribute to the Sendai Framework on DRR, UNFCCC, Sustainable Development Goals
• Support informed decision-making and societies seeking to transform

Strength in collaboration

By collaborating through the KAN, the programmes can

• Cover wide range of scientific expertise and identify and fill the gaps
• Provide integrative synthesis capacity across disciplines
• Jointly engage and contribute to international stakeholders
• Share experiences and methodologies in research and stakeholder engagement and resources
• Share funding opportunities
• Collaborate in capacity building
Key question examples (from KAN Document):

• What are the expected most serious potential impacts that might be caused by extreme events in the future across different sectors?
• What are the largest obstacles to overcome across and between sectors (lack of knowledge, lack of governance, etc.) in order to find and establish sustainable and just solutions?
• What are meaningful indices to describe and quantify extremes, their impacts and transitions to more sustainable and just development pathways?
• What are the most important measures to achieve resilience and transformation of development pathways?
• What kind of data needs urgent attention in order to better identify the factors and mechanisms that determine the location, intensity, and frequency of various extremes?
• How can science, research, teaching and learning be best positioned to support more resilient and sustainable development pathways?
• How to incorporate knowledge into decision-making tools and wider governance contexts to better deal with global systemic risks with unintended consequences?
Knowledge-Action Network (KAN) on Emergent Risks and Extreme Events
- Reducing Disaster Risks under Environmental Change -
Smart Preparedness and Capacity Building for Enhancing Regional Disaster Resilience

- information, scenario, big data and PPP

Wei-Sen Li

Secretary General
National Science and Technology Center for Disaster Reduction (NCDR)

Belmont Forum, Scoping meeting CRA, “Disaster Risk, Reduction and Resilience – DR3”
5 – 7 June 2017, Florence, Italy
Observations of “New normal” and its impacts - “unprecedented” becomes “normal”

• “New normal” could be found “increasing trends” in
  – Intensity of rainfall
  – Strength of typhoons
  – Occurrence of extreme weather events (floods, droughts)

• The adverse impacts would be amplified by
  – Rapid and unplanned urbanization
  – Increasing population
  – Poor land use
  – Climate change
  – Vulnerable global supply chain
  – Economic activities exposed to natural hazards
Global and regional trend – “New Normal”
2015 APEC in the Philippines

• How science, technology and research address “new normal”?
• How policy and capacity building are designed for disaster risk reduction and policy making?
• How can science, technology and research be applied to facilitate DRR collaboration between and among countries, the private sector, and international organizations?

Home elevation after Superstorm Sandy in New Jersey

“new normal”
Regional mechanisms on DRR, other than scientific communities
“The extreme” of Absolute Economic Exposure published by Maplecroft in 2011

Natural Hazards Risk – Absolute Economic Exposure Index 2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>US*</td>
<td>extreme</td>
</tr>
<tr>
<td>2</td>
<td>Japan *</td>
<td>extreme</td>
</tr>
<tr>
<td>3</td>
<td>China *</td>
<td>extreme</td>
</tr>
<tr>
<td>4</td>
<td>Chinese Taipei *</td>
<td>extreme</td>
</tr>
<tr>
<td>5</td>
<td>Mexico *</td>
<td>high</td>
</tr>
<tr>
<td>6</td>
<td>India</td>
<td>high</td>
</tr>
<tr>
<td>7</td>
<td>Philippines *</td>
<td>high</td>
</tr>
<tr>
<td>8</td>
<td>Turkey</td>
<td>high</td>
</tr>
<tr>
<td>9</td>
<td>Indonesia *</td>
<td>high</td>
</tr>
<tr>
<td>10</td>
<td>Italy</td>
<td>high</td>
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<td>11</td>
<td>Canada *</td>
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<td>12</td>
<td>Iran</td>
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<td>13</td>
<td>Bangladesh</td>
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<tr>
<td>20</td>
<td>Chile</td>
<td>medium</td>
</tr>
</tbody>
</table>

*Denotes countries with a significant exposure to natural hazards.
Issue 1: Scenario-based information for exercise and evaluation

- **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
  - How to make them “gray”

- **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 information**
  - Scenarios tools for **planning and drills**
  - Information system for providing **situation awareness**
  - **quick-relief demands** after large-scale compound disasters
  - Study of **evolutional characteristics** of compound disasters
• **Challenges of climate-change-related disasters**
  - Direct impacts: 1) Higher temperature; 2) Sea level rise; 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.....
  - **Change rules and practices to do business**

• **Demands for develop CCA and DRR**
  - To define “non-regret” measures to fit requests from both
  - Risk map to identify potential risks based on impacts by hazards like flood, slope land, land subsidence, vulnerability of coastal areas
Issue 3: Comprehensive vulnerability assessment

- Overlapping of hazard map and business operation on 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
  - Network of doing business
  - Models for loss estimation
  - Establishment of Social-economic Vulnerability Index

NHKDisaster Big Data  - Key to recovery
Issue 4: Critical infrastructure protection under threats from natural hazards

• **Threats**
  - CI is lifeline system to maintain daily life

• **Problems founds due to CI’s failures**
  - Security issue
  - 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
Further comprehensive collaboration on business resilience through regional synergy

- Emergency Response
  - Travel Facilitation
  - EPWG, SCCP, BMG

- Application of Open data and Big data to Emergency Preparedness
  - EPWG

- Global Supply Chain Resilience
  - TPTWG

- Critical Infrastructure Security and Resilience
  - CTWG

- APEC Contributions
  - UNISDR
  - SFDRR
  - Private sector’s involvement
APEC Disaster Risk Reduction Framework
- endorsed in Oct. 2015

Adaptive and Disaster-Resilient Asia-Pacific Economies
Supporting Inclusive and Sustainable Development

Prevention and Mitigation
Preparedness
Response
Rehabilitation and Build Back Better

Community Participation
Disaster Risk Governance
Disaster Risk Financing
Science and Technology

Critical Infrastructure Resiliency
Ecological Integrity
Inclusiveness of Women and Vulnerable Sectors in DRR
Innovations by making use of data and information to make stakeholders connected

learned lessons actions after Typhoon Marokot in 2009

Too much or too little information at emergency operations
- Channels to acquire useful information – multiple sources
- System of systems to integrate information – demand-oriented

Lack of common operating picture to coordinate actions
- Potential risk maps for planning – real time video + GIS info.
- Situation maps for operation – decisive operations

When and how to make timely operations
- Well-organized teams – evidence-based decisions
- Digital emergency preparedness – information sharing
### Smart preparedness on open data and big data

#### • Information intelligence
- Data Organizing
- Data Analyzing
- Data warehousing
- Data Presenting
- “Extract”, “Transform” and “Load”

#### • Use to big or open data
- Data archives
- Cloud system
- Data format
- Exchange protocols
- Official sites or social media

#### • Basic type of data sets
- Physical vulnerabilities
- Social vulnerabilities
- Historical events
- Numerical models
- Observations

#### • Inclusive stakeholders
- Governments
- Research institutes
- NGOs, NPOs
- Media, social media
- Citizens, netizens
The major challenges

- In order to apply “Big data and Open data” for better and smarter emergency preparedness, the major challenges to overcome

1. **Volume**: overwhelming amount of data sets, how to identify relationship for integration, especially social media and press
2. **Velocity**: during urgent moments, pop-up situations and information could hamper decision making, through the Internet and smart devices
3. **Varity**: different and diverse data sets are required to delivered information or maps by request, before during and after disasters
4. **Verification**: duplications or rumors from difference sources need rules and synergy to focus real issues, to trace and clarify rumors
Integration of big data sets based on demand

• **Source of Data**
  – produced, updated and maintained by **20 more regulating governmental agencies**
  – Number of big data set: **over 120**
  – Major four categories of data sets: fundamentals, monitoring, modeling and situation

• **Mechanism of data sharing and maintenance**
  – “Clouds”
  – Service-Oriented Architecture

• **Major challenges to overcome**
  – Mutual trust
  – Afraid of “openness”

Solutions

• Build up loyal partnership
• Top-down determination
How NCDR applies science and technology for disaster risk reduction and management

**Ministry of Science and Technology**
- Propose topics
- Supervise
- Provide operation funds

**NCDR**
- Since 2003

**100 full-time staff**
- Natural science
- Social science
- Engineering
- Emergency management
- Business management

**Major services**
- S&T transfer
- S&T innovation
- Knowledge base
- Data base
- International collaboration

**Major products**
- Applied and inter-disciplinary research
- Policy of DRR for central and local government
- Information integration
- Emergency operation (not search and rescue)
- Identification of urgent needs and long-term demands
- Integration of potential risk maps

**Partners and key stakeholders**

**Public sector**
- **Central government**
  - Ministries and agencies
- **Local Government**
  - Municipalities and townships

**Private sector**
- Universities, research institutes
- NGOs, NPOs
- Communities

**International outreach**
- IRDR, ICoE Taipei
- ADRC, NIED, DPRI (JP)
- PDC (US)
- ADPC (TH)
- NDMI (KR)
- APEC EPWG
Aggregating big data for open data—
“Cross-cutting Synergy”, “Information sharing”, “Actionable”

- Collect 200 big data sets from 20 agencies
- Categories: basic, monitoring, models and historical

- Adopt advanced model to process for early warning

- Produce common operating pictures under decision supporting system

Information Platform for Disaster Management

- Portal to access information
- Registration
- Authorization
- Information Exchange service

Integration

Database

- Basic Monitor Disaster GIS

Information

- Who, what, when, where, how

Actions

- Evacuation, Deployment, Responses, .......

Data

- Live data Monitor History

Value-added

Services
Using science and technology during typhoon emergency operation

Teamwork and dialogues among scientists, emergency responders and decision makers

<table>
<thead>
<tr>
<th>Emergency Developing Process and Impacts</th>
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<tbody>
<tr>
<td>Typhoon</td>
</tr>
<tr>
<td>Strong Wind</td>
</tr>
<tr>
<td>Wind Damage</td>
</tr>
<tr>
<td>Storm Surge</td>
</tr>
<tr>
<td>Floods</td>
</tr>
<tr>
<td>Landslide Mudslide</td>
</tr>
<tr>
<td>Torrential Rain</td>
</tr>
<tr>
<td>Possibly Induced impacts on</td>
</tr>
<tr>
<td>Affected areas/people</td>
</tr>
<tr>
<td>Emergency response units/responders</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operations by Stages + Requirement and Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Course • Intensity</td>
</tr>
<tr>
<td>• When Where Severity</td>
</tr>
<tr>
<td>• When Where Scale Scope of impact</td>
</tr>
<tr>
<td>• Prior to disaster: early evacuation</td>
</tr>
<tr>
<td>• After disaster: search and rescue,</td>
</tr>
<tr>
<td>emergency relief</td>
</tr>
</tbody>
</table>

- Teamwork and dialogues among scientists, emergency responders and decision makers
- Scientific outputs
- Cross-cutting synergies
- In-time operations
NCDR works with public and private sector – from top decision makers to communities

Decision supports
- Information integration
- Common operating picture

Practical implementations
- Knowledge transfer to co-work on hazard map
- Table top exercise to raise leadership

Evidence-based operation
- Understanding disaster risk

Minister
Premier
NCDR Director
Premier and President
NCDR Director
Group Discussion
Assessment
Training
Scenario-based drill
One of the key role: Helping emergency operation

Central Emergency Operation Center
Commander, Co-Commanders, Deputy Commanders

Command Post

Chief Staff Division
News and Medias Division
Operation Division
NCDR

Chief Staff Division:
- General staff
- Evaluation
- Situation Monitoring
- News release
- Web Information Collection
- Deployment
- Search & Rescue
- Evacuation
- Sheltering
- Lifeline system
- Transportation
- Agricultural loss and supply
- Coordination with private sectors
- Medical and environmental aid
- Foreign aid
- Administration
- Logistics
- Finance
Operation of the CEOC Assessment Group (Typhoon)

Central Emergency Operation Center (CEOC)

Situation Assessment Group
NCDR summons the meeting

NCDR
- Risk assessment
- Technology Support

Water Resources Agency
- Hydro info. of river
- Dam and pumping station operation.

National Fire Agency
- Loss estimation,
- co-ordination and communication.

Directorate General of Highways
- consultation

Office of Disaster Management
- Dynamic data of Typhoon.

Central Weather Bureau
- Potential streams of debris flow
- monitoring and warning

The Soil and Water Conservation Bureau

Central Emergency Operation Center (CEOC) (Typhoon)
Common Operating Picture through Web-GIS platform to bridge information gap at local level

- Overlapped Geo-spatial information
- Real-time Data display
- Bookmarks for highlights
- Situational information
Situation report about flood risk potential
- to identify location, situation and estimation

1. Numerical simulation of floods along a river basin
2. Real-time data of gauges to monitor developing situation
3. CCTV video to visualize understanding
Evidence-based emergency operation
– To decide timing to conduct early evacuation

The ideal criteria to conduct early evacuations
1. Day time: less danger to evacuees and emergency responders
2. Arranged transportation: to provide convenience

Potential Risk Map of debris flow at township level

Threshold value of debris flow
200 mm accumulated rainfall in 24hrs

Observed data

Red alert (Historical data)

Forecast of rainfall

Critical happens point at midnight

Intensity of rainfall (Model)

Time to conduct early evaluation
Typhoon Kong-Rey in 2013

Historical data

Threshold value

Observed data

Current situation

Numerical models

Forecast and nowcast

Take Action!

Decision maker
Local residents
Case of successful early evacuation based on S& T during Typhoon Fanapi, in Lai-Yi village, Sep. 2010

1. Buried houses: 50
2. Causality: 0
3. 400 residents evacuated

2009 after Typhoon Morakot

Issue land warning
Early warning of risk
Evacuation operation
Typhoon landfall time
Landslide in Lai-Yi

32 hours ahead
Open Data Platform for Disaster Information (Common Alerting Protocol format)

Develop disaster information open data platform (https://alerts.ncdr.nat.gov.tw)

Combine 14 kinds of alerts from DGPA, CWB, SWCB, WRA, THB, TRA, THSRC and etc.

Released a total of 14 categories of instant supporting information
Public-private partnership on enhancing information coverage (with Google)

- **Initiation of Open Data in 2013**, through Google Crisis Map and Google Public Alerts to disseminate typhoon warning messages.

  *Typhoon Soulik* (7/10-14): number of system access about **1.3 million**

- In 2014, the total number of accessing Google services is around **14 million**
- In 2015, the total number of accessing Google services is around **16 million**
- In 2016, the total number of accessing Google services is around **19 million**

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**Google Public Alerts**
Location-based

**Google Crisis Map**
Easy-to-use
Structural diagram of PWS in Taiwan

Government Agency
Alert delivery
Broadcasting
Applications

Common Alerting Protocol (CAP)

CMAS / EAS-CAP

Types of warnings
- Big thunder storm
- Earthquake
- Debris flow
- Dam discharge
- Pandemics
- Int’l outbreak
- Road closure
- Attack incident
- Suspension of office and school

Cell Broadcast Entity
Cell Broadcast Center

Alert Aggregator
Alert Gateway

Internet Gateway

CAP messages

APP developers
Automatic devices

CMSP Gateway
CMSP Network Infrastructure

Five 4G mobile service provides (15.2 m users)

XML API

2014 ~ 2015
2015 ~ 2017

Internet Gateway

Five 4G mobile service provides (15.2 m users)
Policy-framework for large-scale earthquake enhancement on old building

- Structural safety

Citizens’ safety and support
- Evacuation and sheltering

Functional continuity
- Government and business

Scientific supports
- Scenarios and impact assessment

Practical implementation
- Perception, drill & promotions

1. Seismic retrofitting
2. Early warning & alarm
3. Massive demands
4. Business continuity plan and management

1. Seismic retrofitting
2. Early warning & alarm
3. Massive demands

1. Seismic retrofitting
2. Early warning & alarm
3. Massive demands

1. Seismic retrofitting
2. Early warning & alarm
3. Massive demands
Adopting “Grid Method” to estimate impacts

• **Basic datasets for risk and damage assessment**
  - Tax data of houses or building
  - Census data of population and residency
  - Pipeline networks of water, power and natural gas
  - Information of bridges and highway
  - ........

• **Grid size:**
  - 500m x 500m geo-spatial grids as resolution
Geo-spatial distribution maps of lifeline systems

- Bridges: 8,616 units
- Highways: 584,965 units
- Power: 39,366 units
- Water: 36,795 units
- Hydro-utilities: 1,331 units
- Natural gas: 19,000 km

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Geospatial meshed Data

500m x 500m Meshed Map Sheet
Number of Meshes: 13,2712
Earthquake scenarios to Taipei city

- **Scenario:** selecting a specific fault as source
  - Full dislocation of Shanchiao Fault
  - Magnitude 6.3
  - Focal depth 10km
Capital-intensive investment

• Practice of TSMC, unit: USD 100 million

• Too big to fail

• For 2017, still over USD 10b
Expected or non-expected damages to production lines after 2016 quake

Fallen pipelines

Damaged assembly line
Concept of “the weakest link”
- theory of barrel

• Impact analysis through different “ground shaking levels”
  – Performance-based evaluations through “scenarios”
  – The worst case: to estimate extreme damages
  – Target: to promise a defense level for improving
  – Status-quo: to identify current capacity
Characteristics of risks for different scale of business – allowance of failure and interruption

- Accept certain level of failures
- Accept limited level of failures
- Accept “no” failures

Challenges to engineering design and construction

But anyhow “Black Sam” always exists “Residual risk”
Roles and functions of S&T to reduce loss
- From science to decision making

Scientific Prediction
- Provide forecasting based on scientific models
- Tool for pre-disaster deployment
- Reference for decision support
- Limited by technology development

Rea-time Monitoring
- Provide updated data based on gauges
- Tool for pinpointing blind areas by forecast
- Reference for revising decision support
- Limited by number, location, transmission

In-time Operation
- Provide reaction based on well-defined plan
- Tool for saving more time before it’s too late
- Reference for allocating emergency support
- Limited by determination of all levee administrators

Key elements to succeed
An integration of
- Natural science
- Social science
- Engineering
- ICT, Social media
- Emergency management
- Multiple key stakeholders
- Public-private partnership
- Emerging technologies
- ............
Directions to work together on DRR (1/2) - through regional capacity building

1. **Case studies on evidence-based disaster risk reduction**
   - To study policies and implementations on applying science and technology for DRR through finding gaps and needs
   - Possible topics: individual nation plans in science development, land-use planning, early warning, risk maps, etc.

2. **Build back better - trend & policy on post-disaster recovery**
   - To understand required and necessary elements for short-term, mid-term and long-term recovery
   - Possible topics: reviews on large disasters, reconstructions plan, economy revitalization, livelihood restoration, etc.

3. **Leadership and decision making on disaster management**
   - To learn skills and the best practices for leading a team at times of policy making, emergency response or on-field operations
   - Possible topics: risk communication, crisis management, principles of emergency operation, ICT & GIS tools of decision support, etc.
Directions to work together on DRR (2/2) - through regional capacity building

4. Role of NGO, NPO & business by public-private partnership

- To explore contributions on DRR by private sector and policy to engage them at different phases of disaster management.
- Possible topics: community-based disaster risk management, business continuity plan, risk perfection, etc.

5. Regional and global mechanisms and resources for DRR

- To understand frameworks, trend, policy guidelines, operations, projects, and funding agency at regional and global levels
- Possible topics: UN organizations, APEC, ASEAN, GFDRR, ICSU, the Sendai Framework for Disaster Risk Reduction etc.
Evolving processes on DRR
- stakeholders, actions, implementations

Science and technology

Understandable knowledge

People’s mindset

Take actions

Transformation
Investment

Interpretation
Understanding risk

Perception
Governance

Digest scientific outcomes as becoming feasible and applicable
- Risk Communication

Gov, research

Gov, research community, NGO, NPO, Volunteers, professional

To explain the relevance and importance related to daily life
- Enroot culture of DRR

Gov, research, citizens, NGO, NPO, volunteers, professionals

To empower the capability and capacity on when and how
- Conduct DRR lifecycle to build resilience

Disaster preparedness
Thanks for your attention