Disaster Risk and Resilience

How to measure?

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The 3rd UN World Conference on Disaster Risk Reduction

Leaders of 25 countries, Delegations of 187 countries, 16,000 participants

Sendai Framework for Disaster Risk Reduction 2015-2030

Global Targets

(a) Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015.
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(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 this framework by 2030.

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17 Sustainable Development Goals and 169 targets

SUSTAINABLE DEVELOPMENT GOALS

Goal 1. End poverty in all its forms everywhere
1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels

Goal 13. Take urgent action to combat climate change and its impacts*
13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

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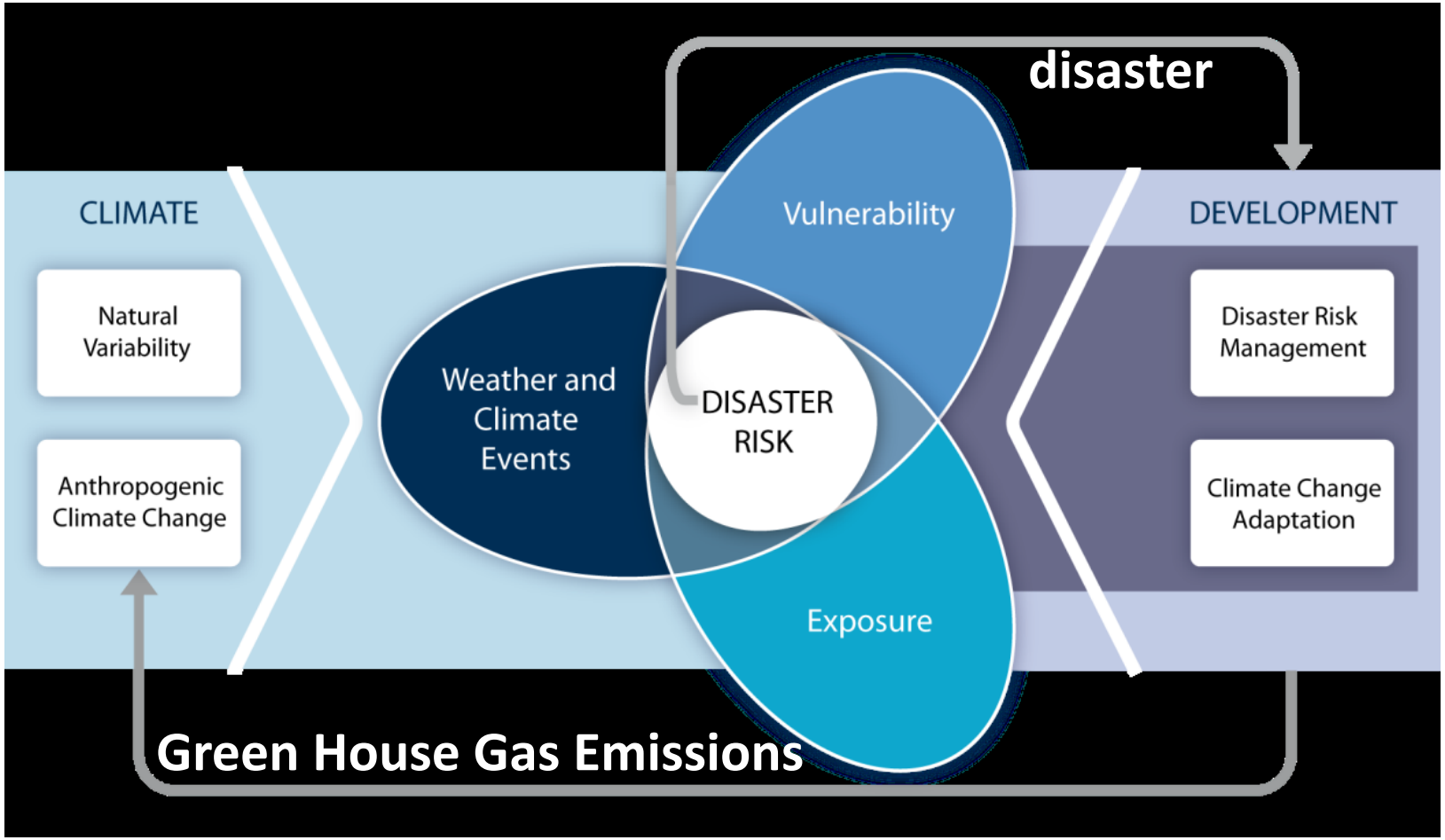
Disaster Risk

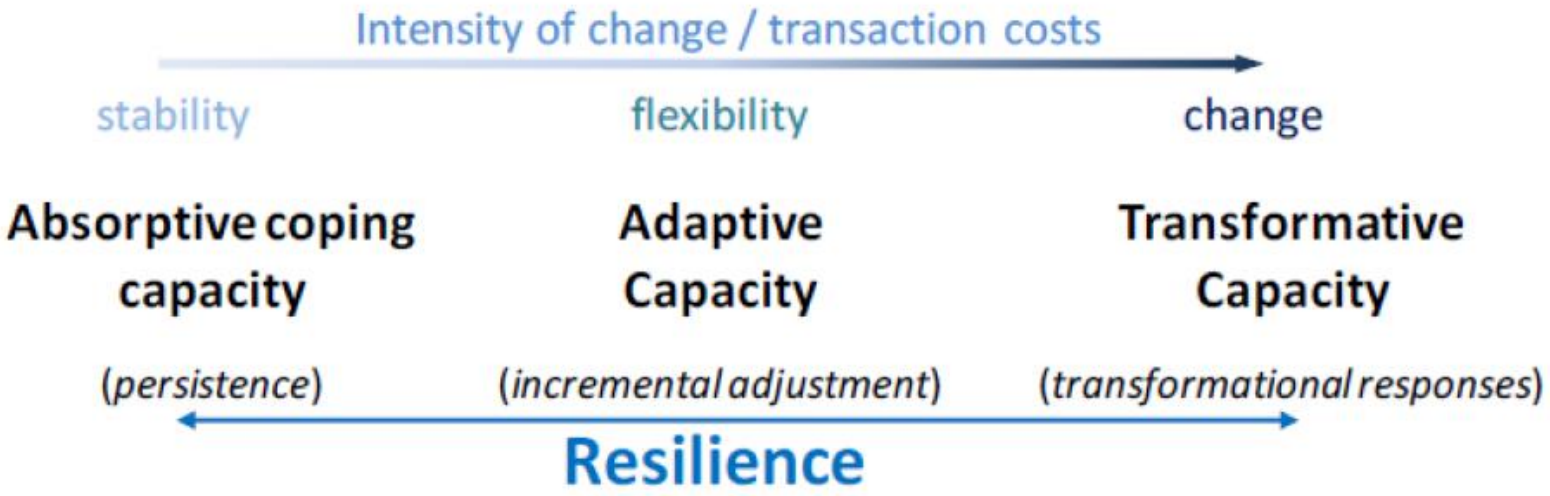


Source: IPCC SREX

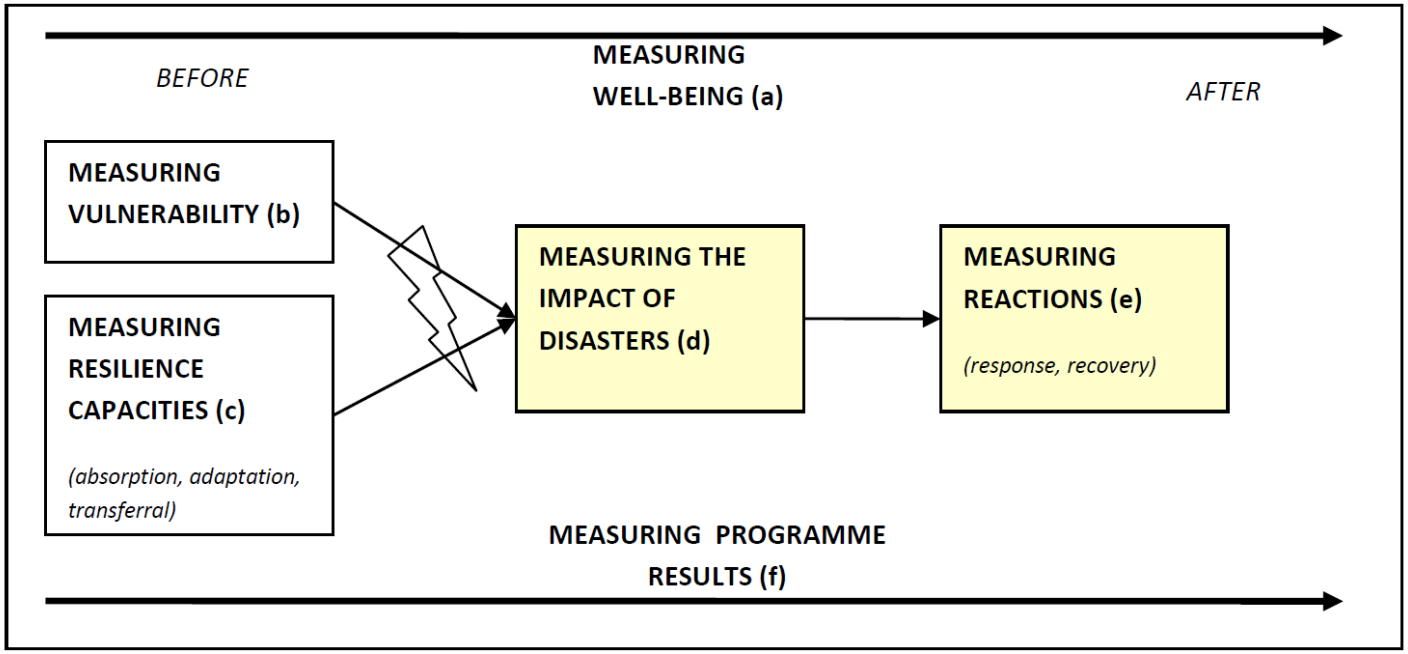
Disaster Resilience

Transformative process of strengthening the capacity of men, women, communities, institutions, and countries to anticipate, prevent, recover from and transform in the aftermath of shocks, stresses and change. (UNDP)

Resilience is frequently described as a ‘system’ or a ‘system of systems’. A systems approach usually refers to a view of resilience as a self-regulating system or cluster of systems - that are self-correcting through feedback. Such complex adaptive systems that create resilience share synergies, linkages and interactions across spatial and temporal scales (Gall 2013, p.18).



Individuals | Households | Communities | Systems/States



Phase of Measurement Maturity

Phase 1	a theoretic framework exists, but no indicators are defined yet
Phase 2	a theoretic framework exists and at least some potential indicators are suggested to measure disaster resilience
Phase 3	a clear indicator framework based on a theoretic framework has been defined, but data for the indicators is not collected systematically
Phase 4	as above, but at least some data for the indicators or data for a limited geographic area has been collected
Phase 5	as above, but the data collection for the indicators is institutionalized and data is collected regularly
Phase 6	the measurement has been empirical verified

Standardized or Tailored ?

Standard Metrics	general enough to permit comparison of different communities or countries. However, they are not flexible enough to capture local conditions and circumstances.
Context-Specific Metrics	tailored to countries, communities or groups of households or individuals by using participative processes and including perceptions.
Blended Approach	a core set of standard indicators and additional, locally tailored measurements

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Standardized Approach

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Number of

1. affected people per 100,000.
2. injured or ill people due to hazardous events
3. people who left their places of residence due to hazardous events
4. evacuated people due to hazardous events
5. relocated people due to hazardous events
6. people whose houses were damaged due to hazardous events
7. people whose houses were destroyed due to hazardous events
8. people who received food relief aid due to hazardous events

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Standardized Approach

Direct economic loss due to

1. hazardous events in relation to global gross domestic product.
2. industrial facilities damaged or destroyed by hazardous events
3. commercial facilities damaged or destroyed by hazardous events
4. houses damaged by hazardous events
5. houses destroyed by hazardous events
6. damage to critical infrastructure caused by hazardous events

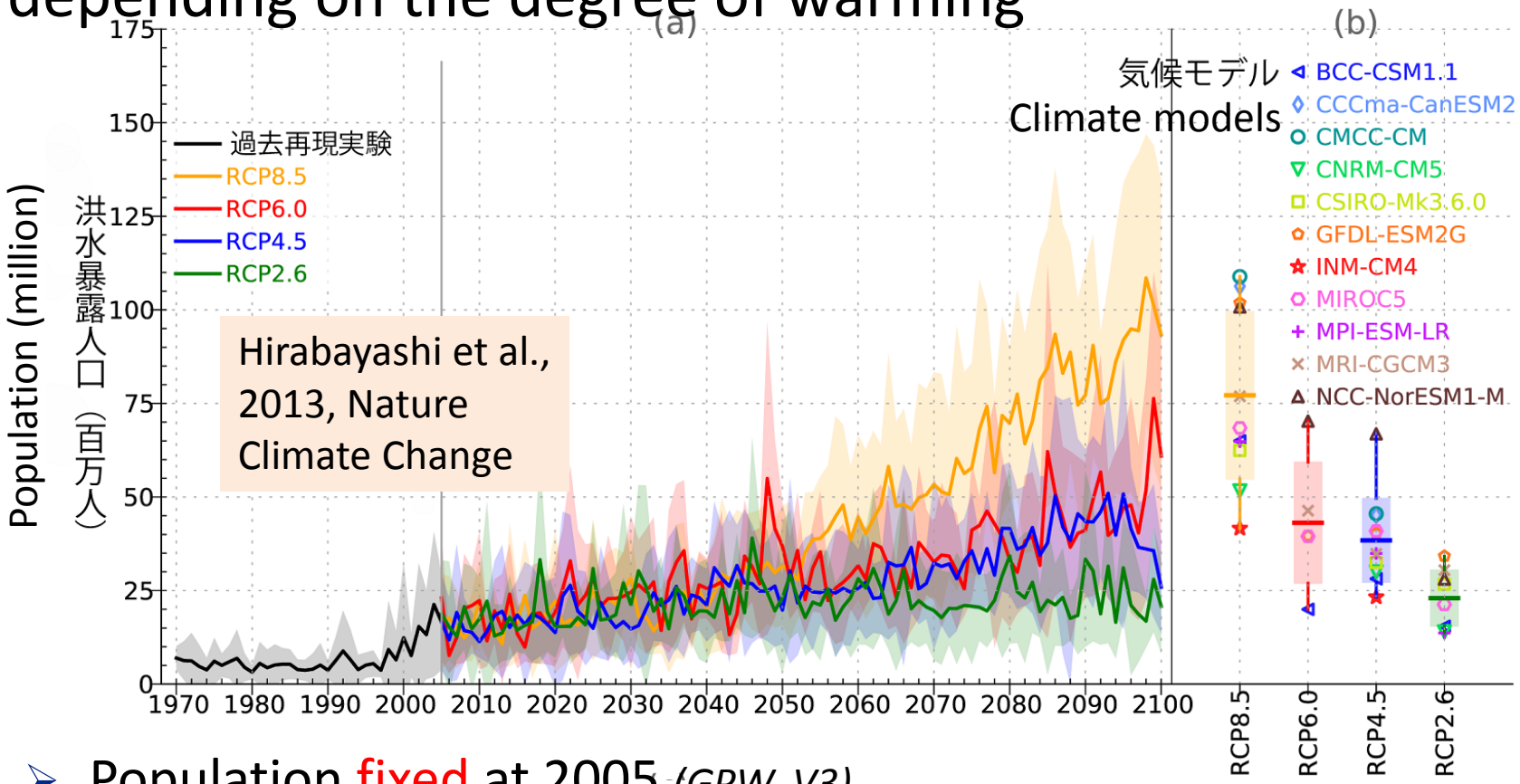
(c) Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.

7. Direct agricultural loss due to hazardous events

Standardized Approach

東京大学 THE UNIVERSITY OF TOKYO

Global flood exposure (>100-yr) will increase depending on the degree of warming



- Population fixed at 2005 *(GPW, V3)*
- Shaded region (height of bar) show 1 standard deviation
- RCP8.5: 14 (5-23) times more in 21C (2071-2100) [20C (1971-2000): ~5 million]
- RCP2.6: 4 (1-7) times more in 21C

Courtesy: Y. Hirabayashi

Standardized Approach

Globally, at any income level, vulnerability to flooding have been decreasing associated with the rising per-capita income.

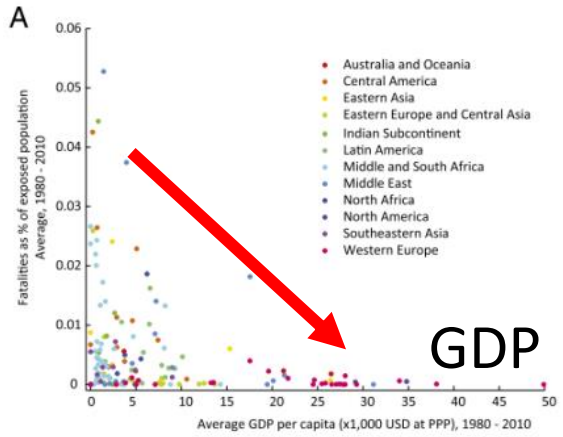
Damage ($, people) = Intensity (Hazard) × Target (Exposure) × Vulnerability

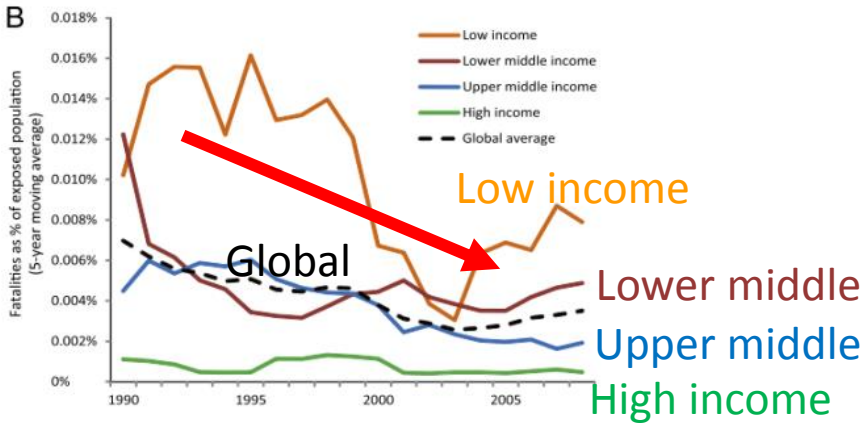
Disaster statistics. (Munic Re, EM-DAT, etc.)

model estimation

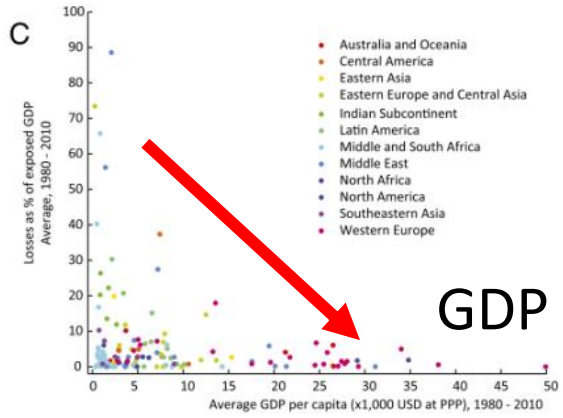
Vulnerability derived as the ratio of modeled exposure and observed damage

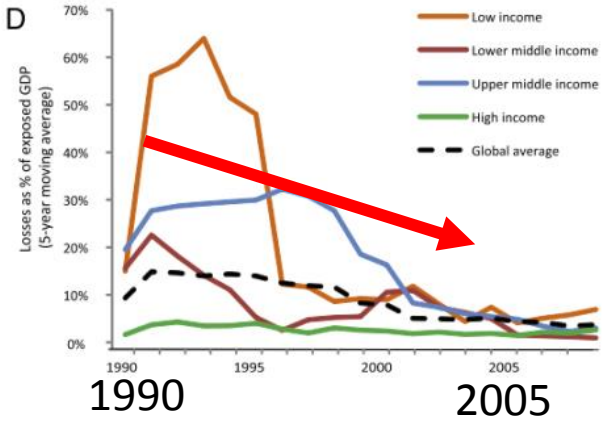
Vulnerability (mortality rate)





Vulnerability (loss rate)



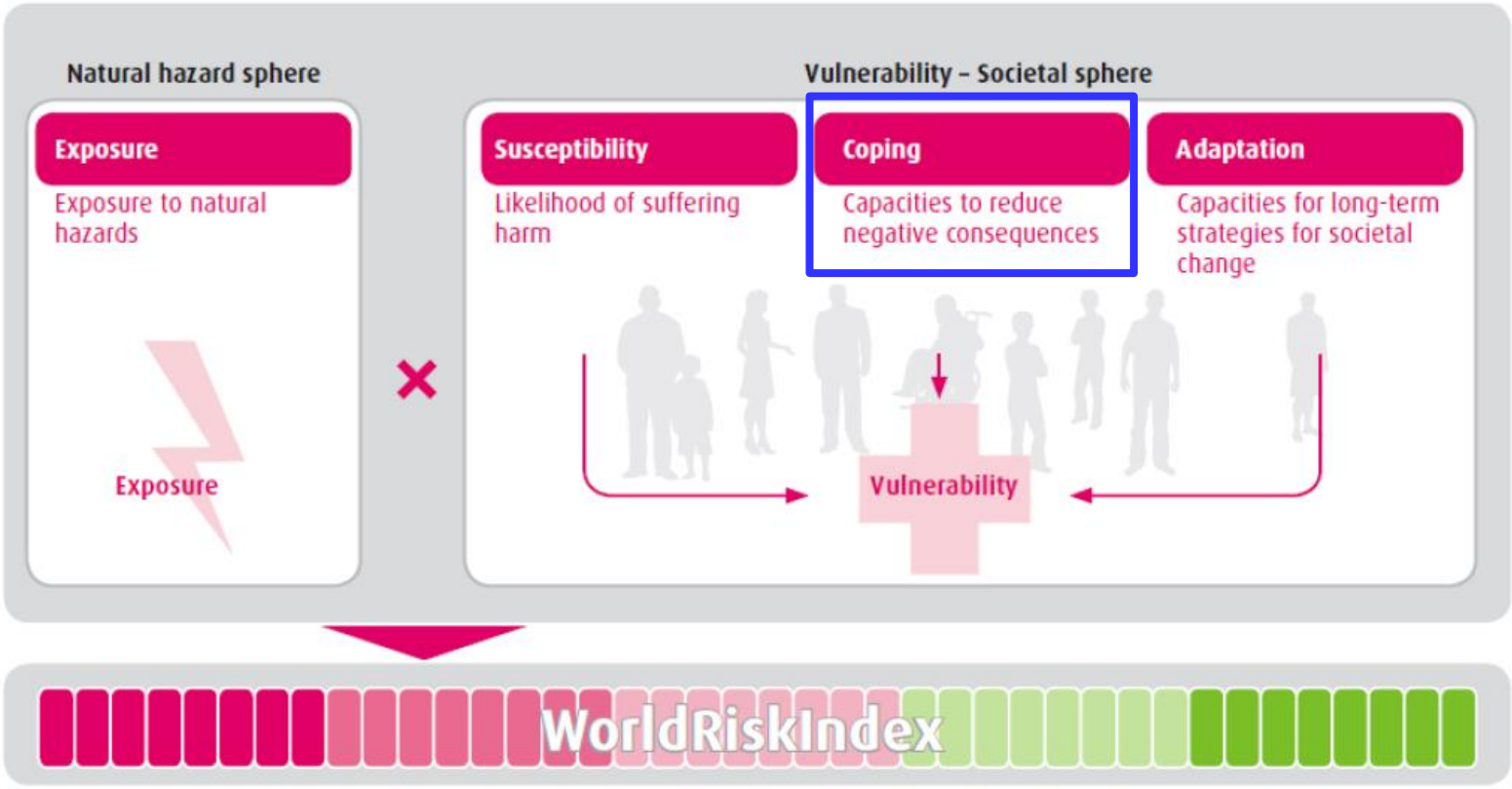


Jongman et al., 2015, PNAS

Courtesy: Y. Hirabayashi

World Risk Index

Environment and Human Security (EHS)
of the United Nations University (UNU)



Government and authorities

- A Corruption Perceptions Index
- B Good governance (Failed States Index)

Disaster preparedness and early warning

National disaster risk management policy according to report to the United Nations

Medical services

- C Number of physicians per 10,000 inhabitants
- D Number of hospital beds per 10,000 inhabitants

Social networks

Neighbors, family and self-help

Material coverage

- E Insurances (life insurances excluded)

28 indicators
173 countries

Standardized Approach

Tailored Approach

"Assistance for the Philippines in the development of a flood disaster response plan"

- ICHARM assists Calumpit City in the Philippines in developing a flood disaster response plan.
- The city is damaged by flood every year, but neither damage data nor other relevant data have been archived.

➡ **Necessary to collect and archive the basic damage data**

BUT! We have to consider "what kind of data" and "how" we should collect!

Development of Smartphone Application for Self-Inspection for Flood Damage to Buildings

- Homeowners upload building damage
  ↓
- Damage level are easily judged with less work load

Tailored Approach

"Study on flood risk to private houses in the Pampanga River basin of the Philippines"

- An on-site interview survey was conducted to the residents.
- No significant relationship was found between inundation depth and damage

→ Residents may not care about flood damage because floods have long been a regular part of their life.

→ Now considering assessing inconveniences in daily life as risk instead of damage in monetary terms.

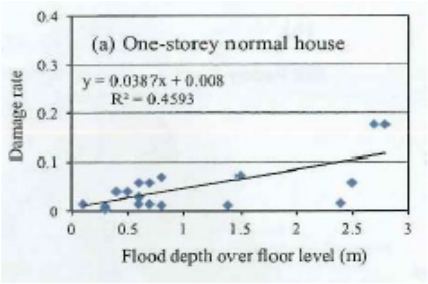


Fig. Relationship of household damage rates with the flood depth (Shrestha et al. 2014)

Important to understand flood damage from multi-perspectives, based on local needs and conditions.

"Quantitative assessment of agricultural flood risk in the Pampanga River basin of the Philippines"

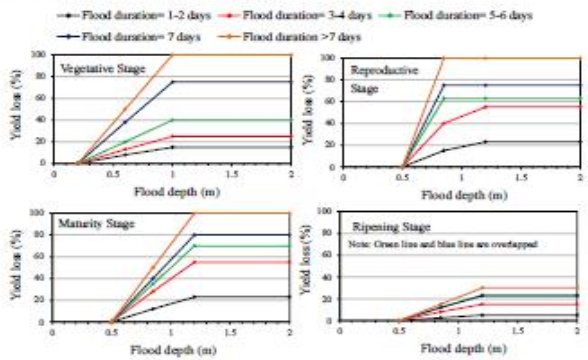


Fig. 1 Developed flood damage curves for rice crops (Shrestha et al. 2014)

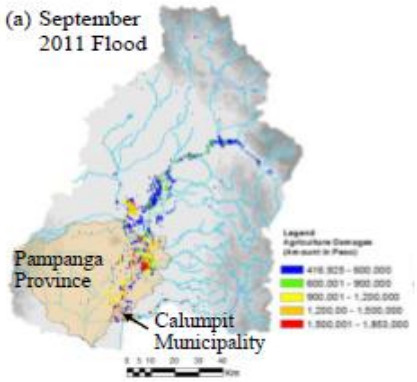


Fig. 2 Calculated agricultural damages for the September 2011 flood, 50- and 100 -years return -period flood cases (500 m × 500 m).

Original rice damage curve established by statistical data

Agricultural risk assessment using ICHARM inundation analysis (RRI model)

ICHARM

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Educational, Scientific and
Cultural Organization

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Thank you for your Attention.

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