Vulnerabilities – evidence and myths

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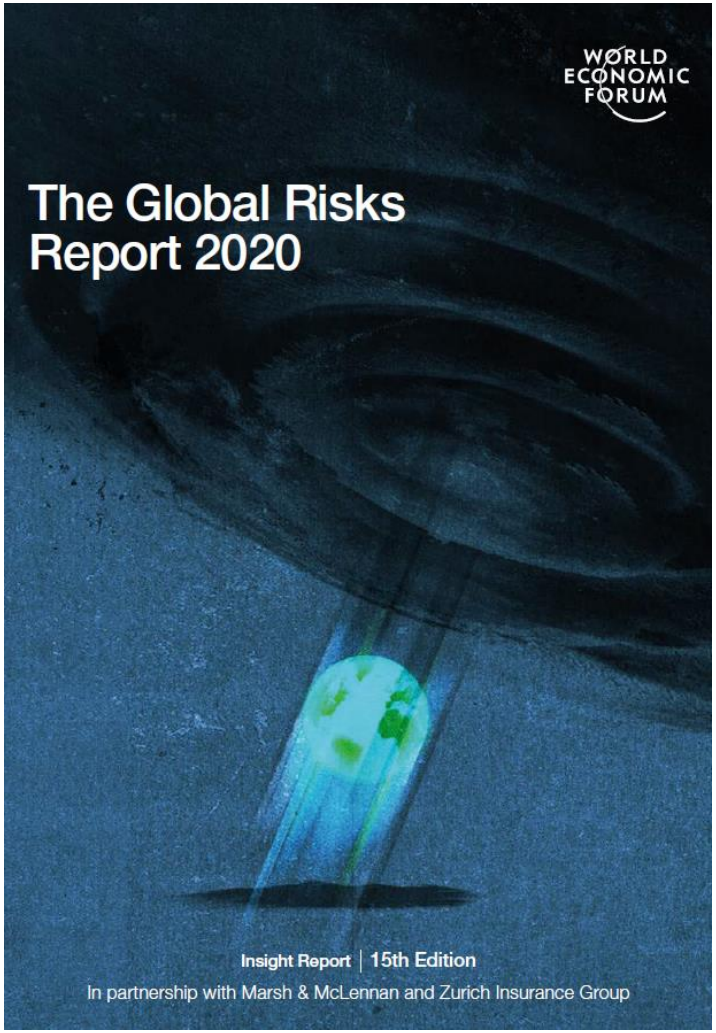
Agenda

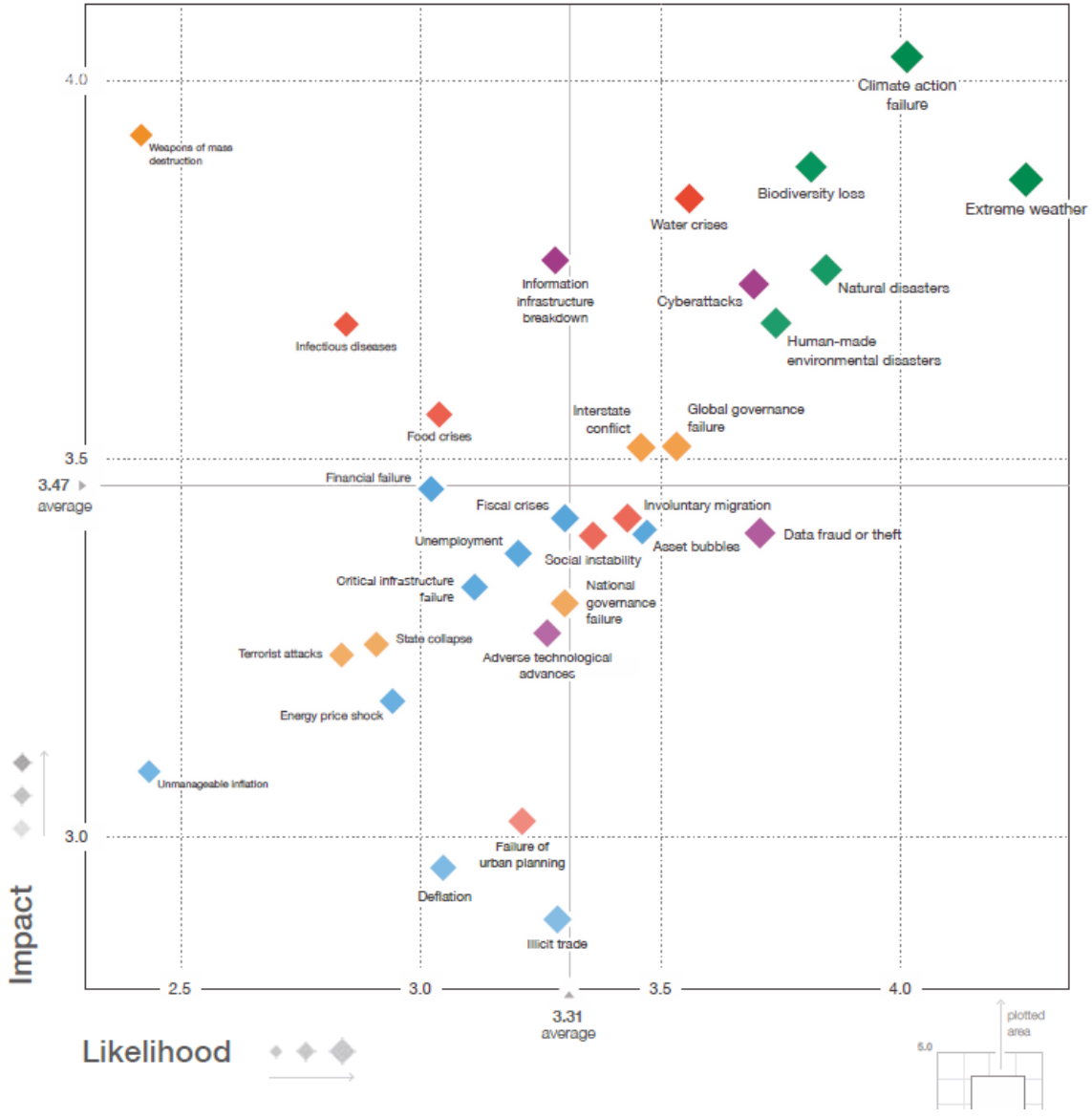
1. How do “we” think about complex risks?
2. What is vulnerability and where do we stand it its assessment?
3. Are current conceptual debates helpful in addressing complex risk?

How do “we” think about complex risks?

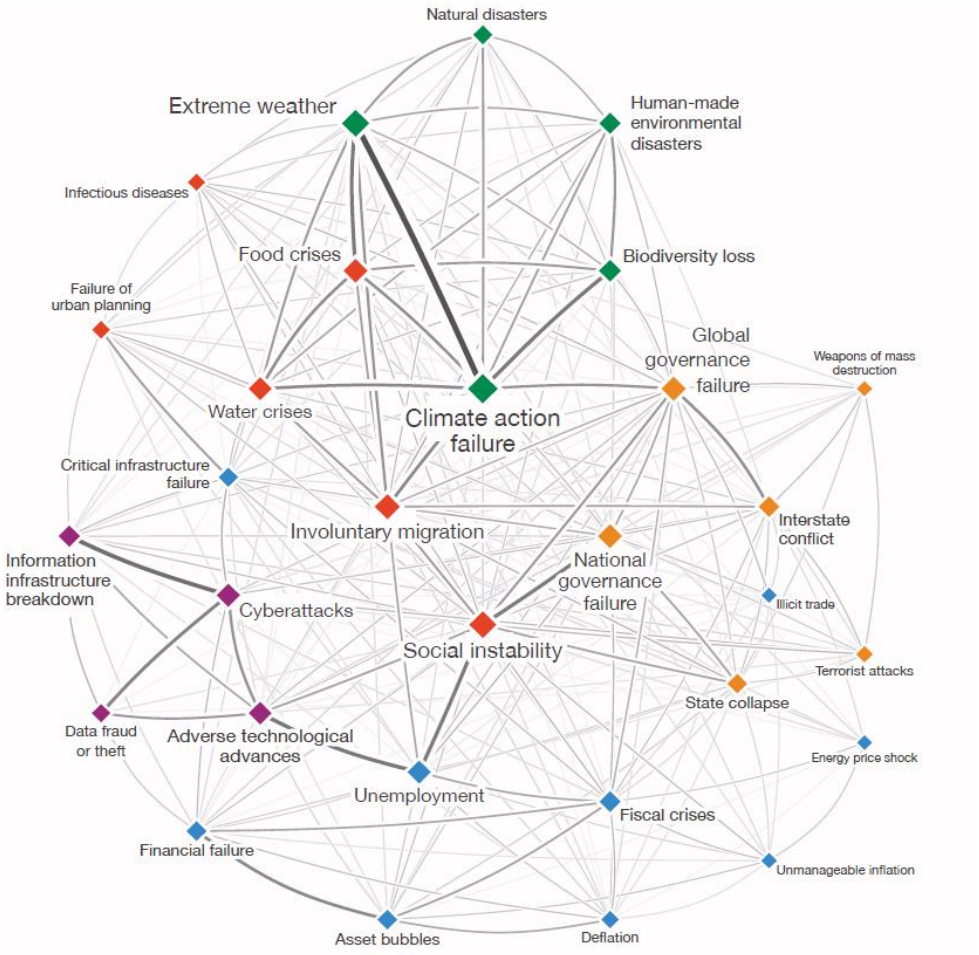
Global Risks Report 2020



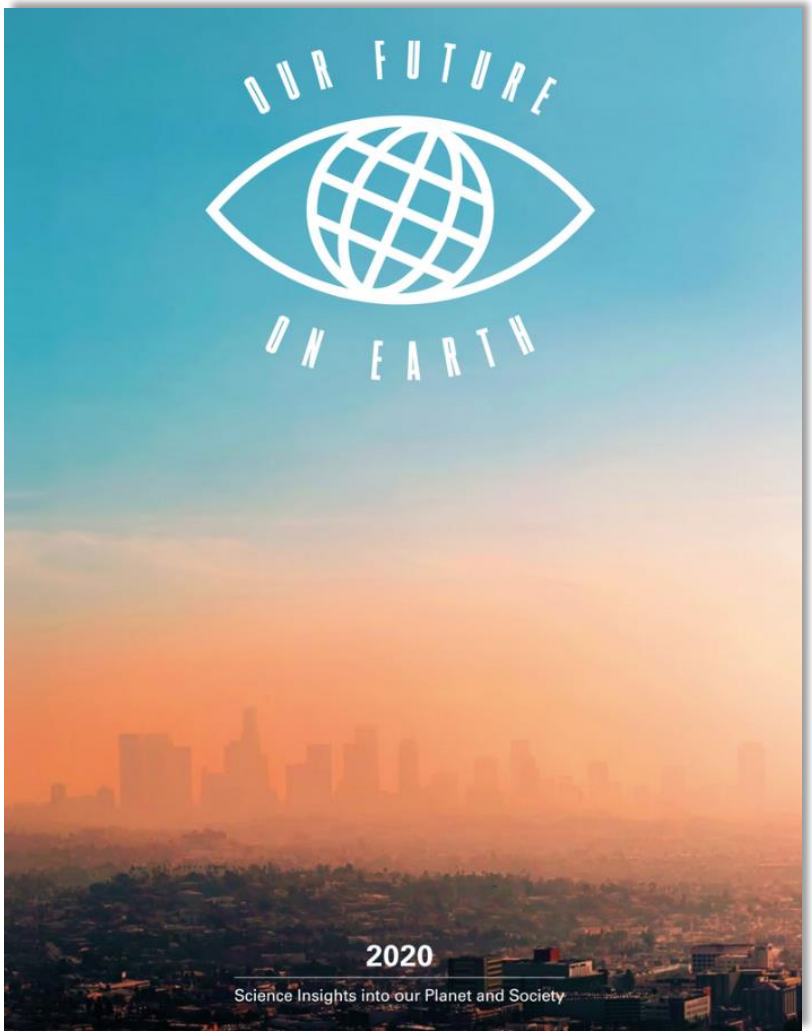
Environmental Risks

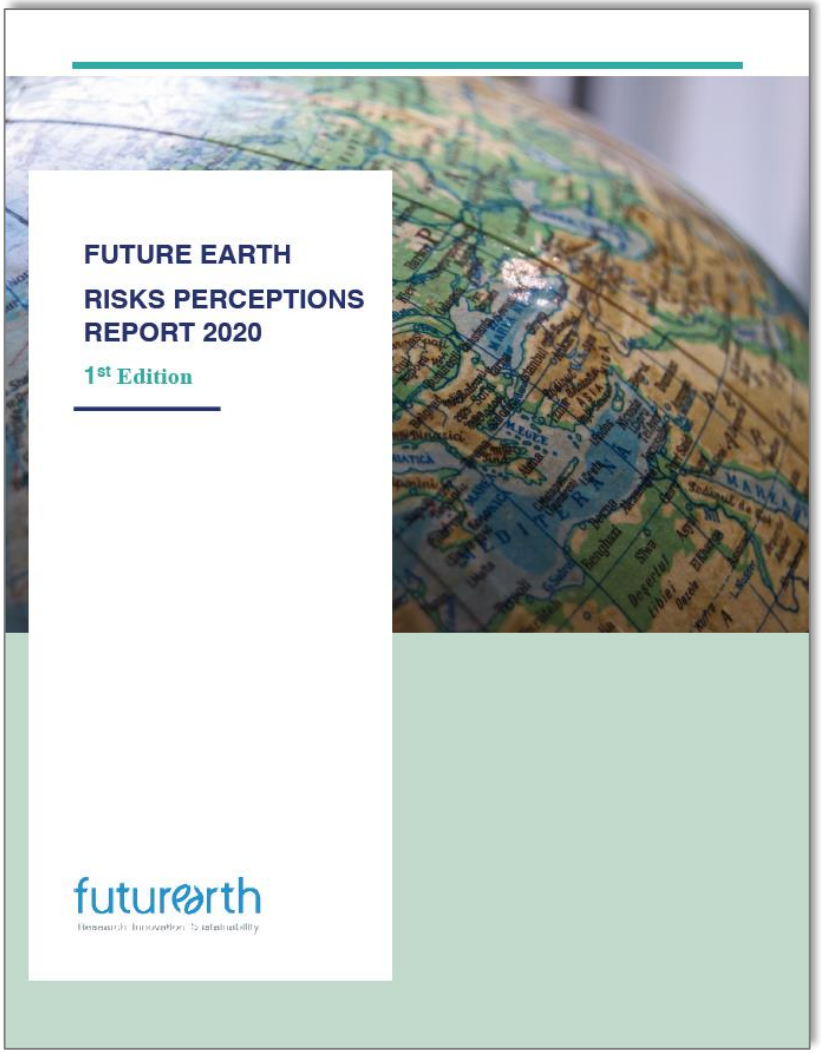


Environmental Risks

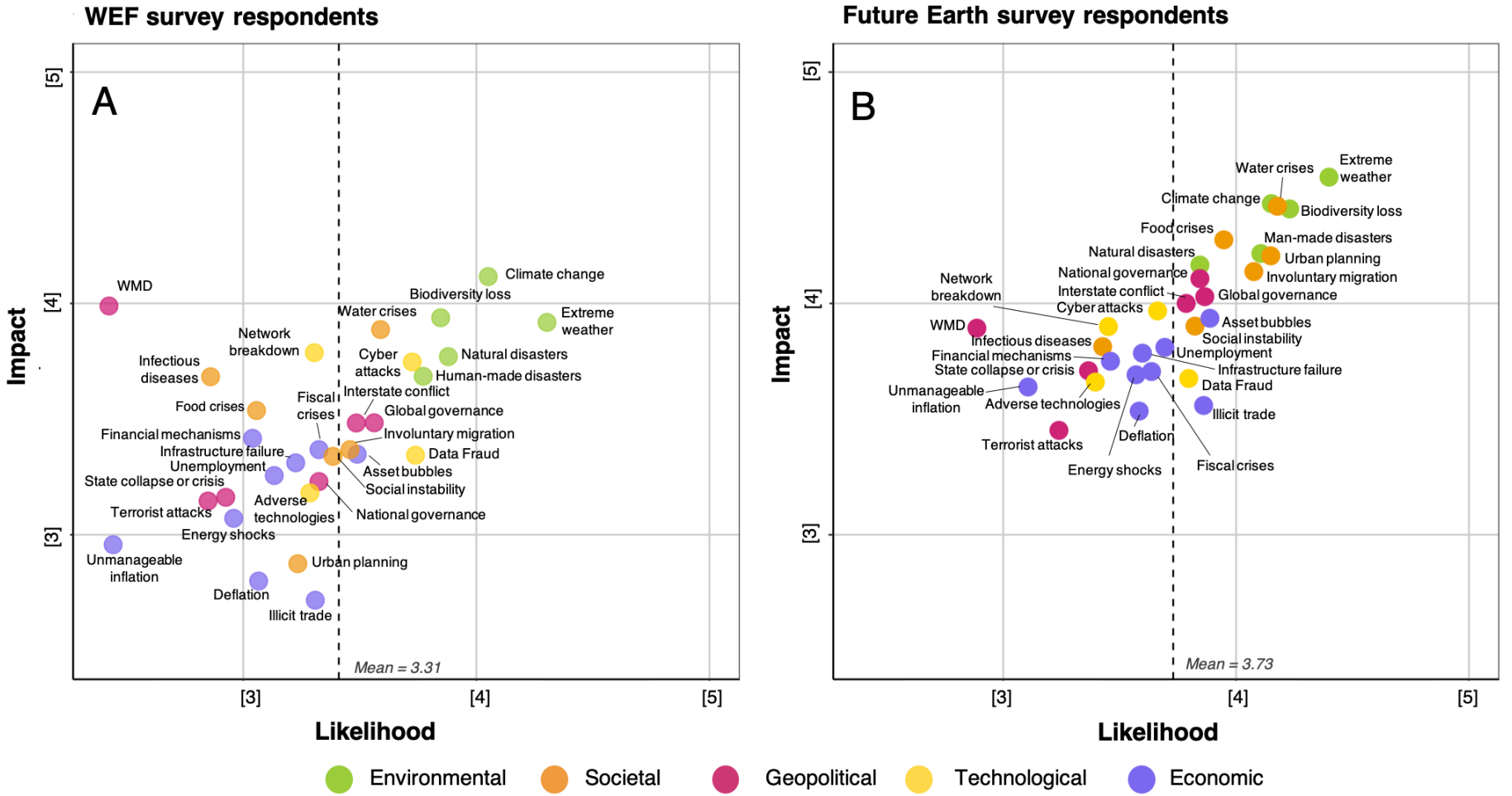


Our Future on Earth Report



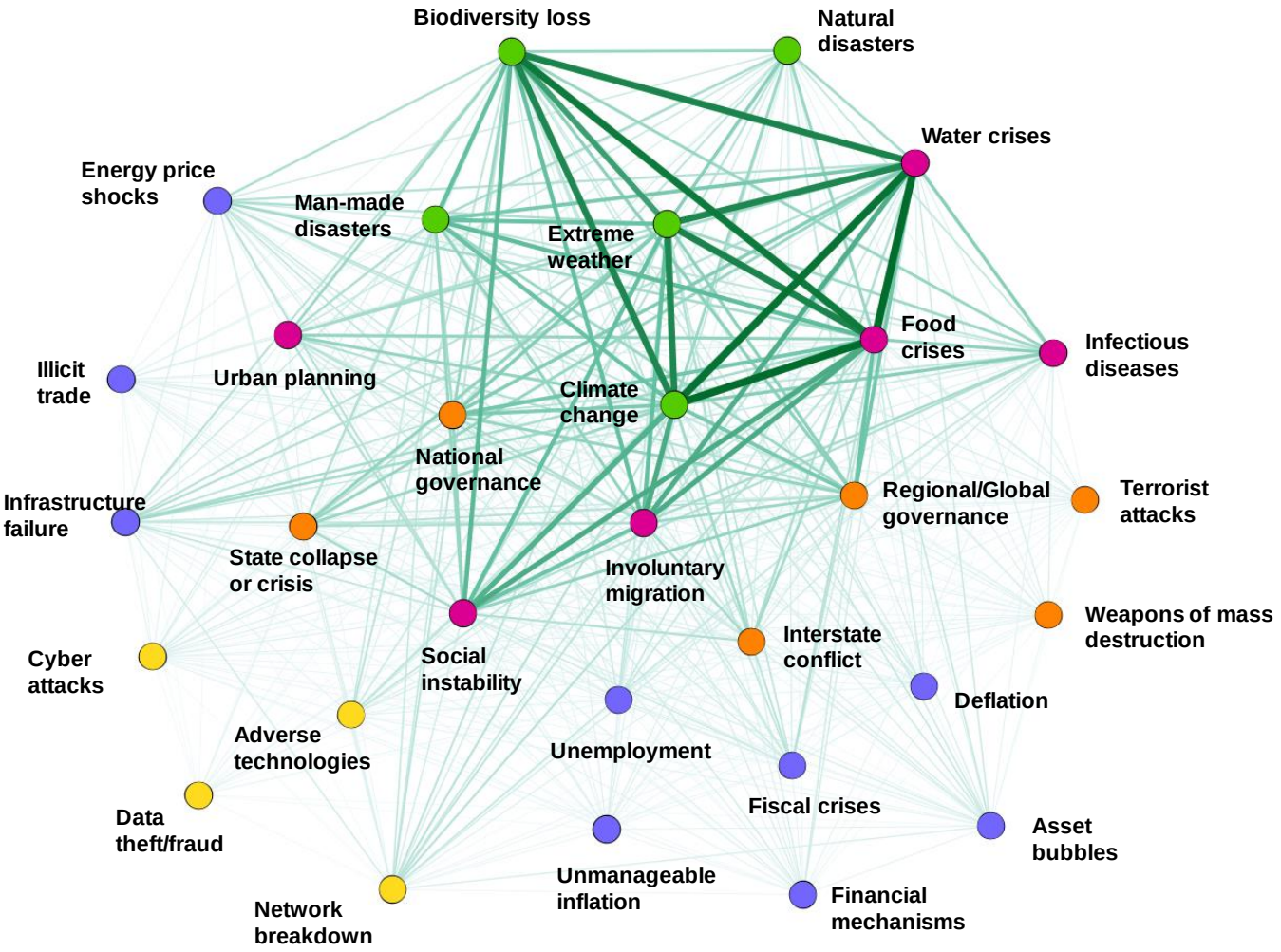


Overlaps and gaps in risk perception of different epistemic communities



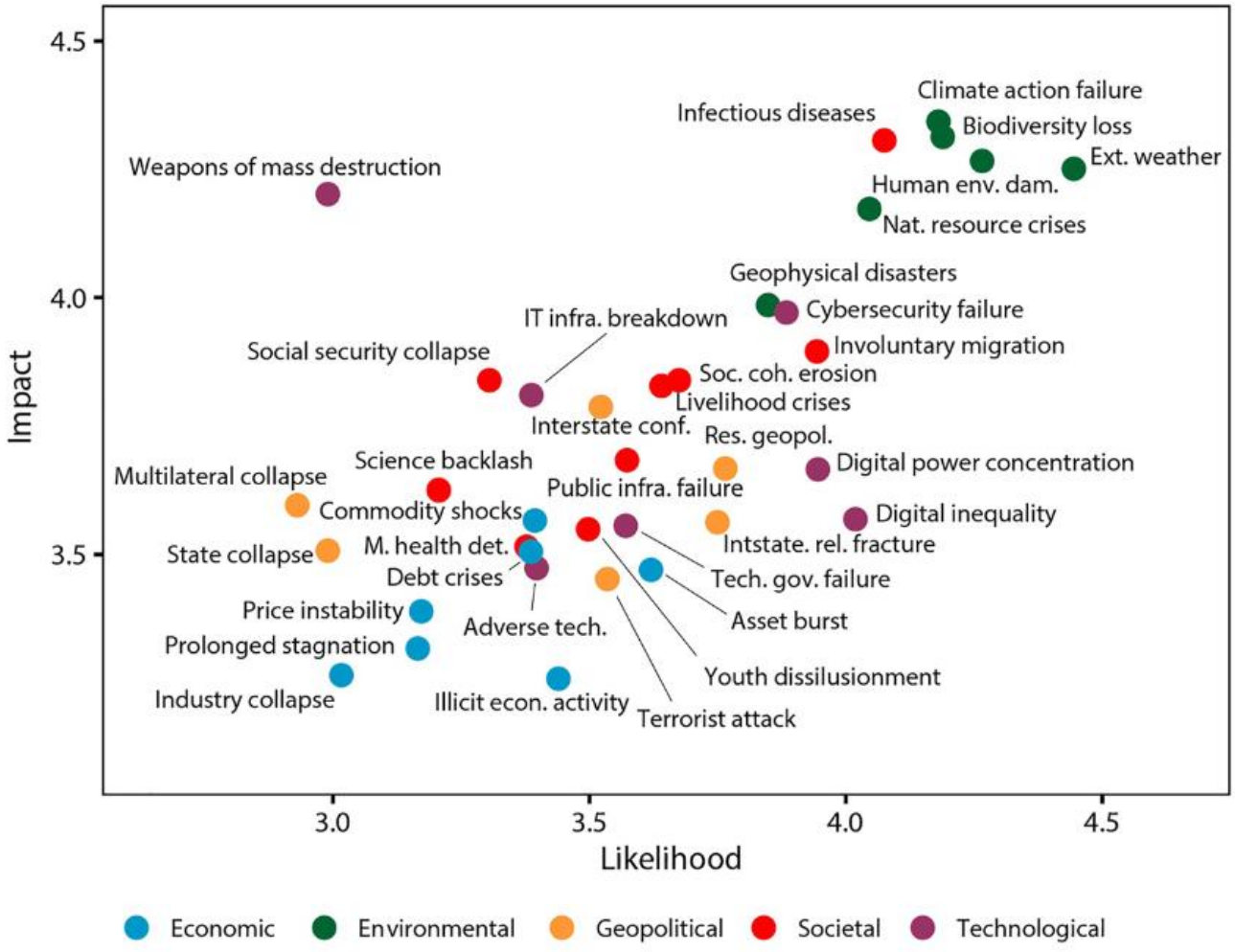
Source: Garschagen et al. 2020, in *Earth's Future*

Connections between global systemic risk – and the potential for global systemic crises



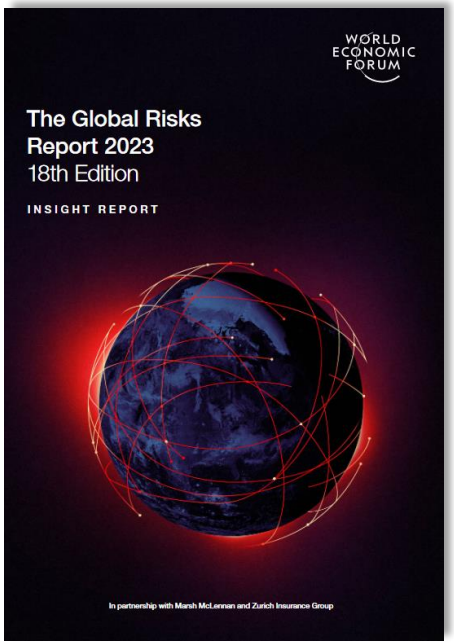
Source: Ivanova et al. 2020, in Our Future on Earth

Shifts in risk perception post Covid



Source: Wynes et al. 2022, in *Earth's Future*

2023 WEF



Global risks ranked by severity over the long term (10 years)

1	Failure to mitigate climate change	6	Natural resource crises
2	Failure of climate-change adaptation	7	Erosion of social cohesion and societal polarization
3	Natural disasters and extreme weather events	8	Widespread cybercrime and cyber insecurity
4	Biodiversity loss and ecosystem collapse	9	Geoeconomic confrontation
5	Large-scale involuntary migration	10	Large-scale environmental damage incidents

Risk categories: Economic | Environmental | Geopolitical | Societal | Technological

What is vulnerability and where do we stand in the assessment of vulnerability?

What is climate risk? More than hazard exposure!

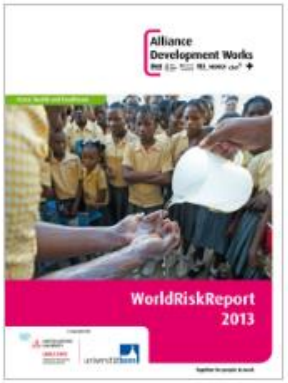
Source: own sketch, building on IPCC 2012,
inspired by e.g. O'Keefe et al. 1976, Hewitt 1983; Blaikie et al. 1994; Bohle 2001; Pelling 2001; Turner et al. 2003; Wisner et al. 2004

World Risk Report

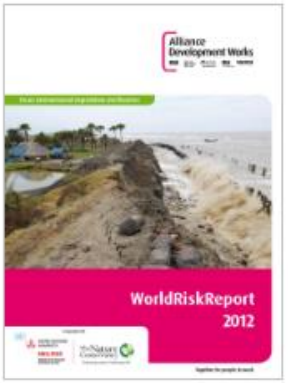
Logistic & infrastructure

Food security

The city as a risk area



Health and healthcare



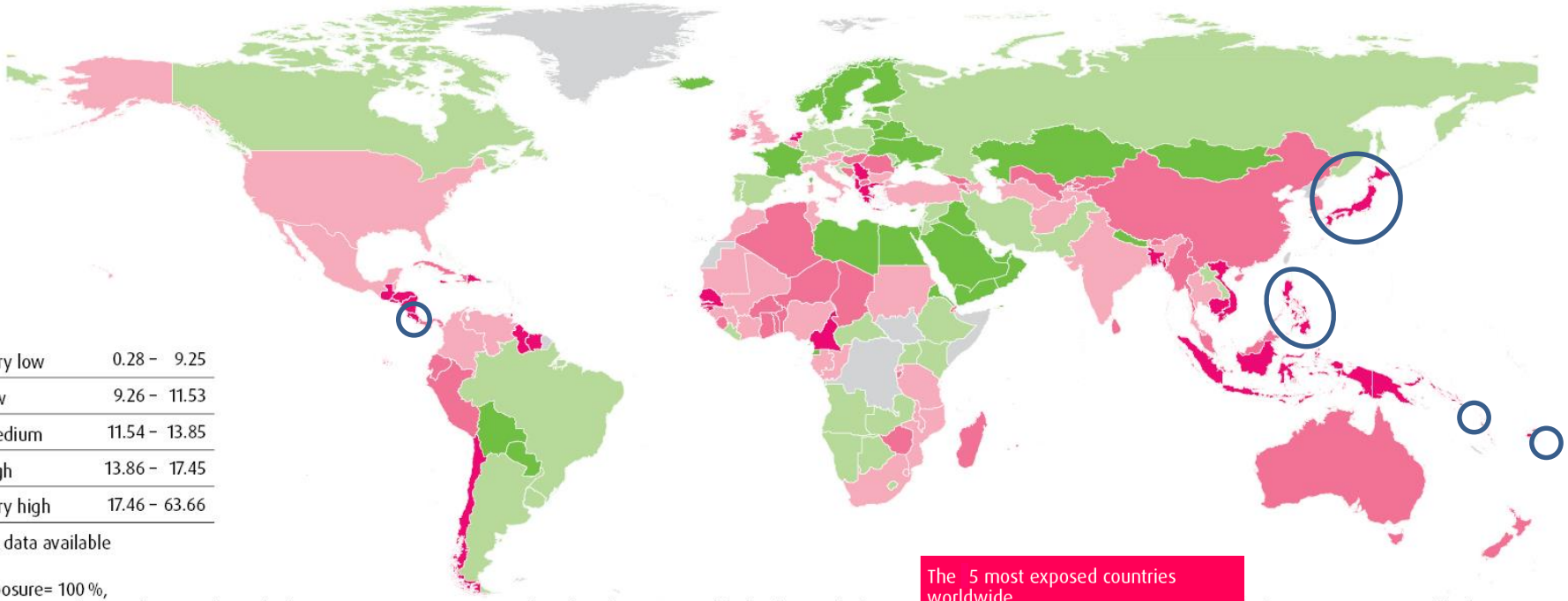
Environmental degradation & disaster risk

Governance & civil society

World Risk Report

Exposure

Exposure of the population to the natural hazards earthquakes, storms, floods, droughts and sea level rise.



very low	0.28 – 9.25
low	9.26 – 11.53
medium	11.54 – 13.85
high	13.86 – 17.45
very high	17.46 – 63.66
no data available	

Max. exposure= 100 %,
Classification according to the quantile method

The 5 most exposed countries worldwide

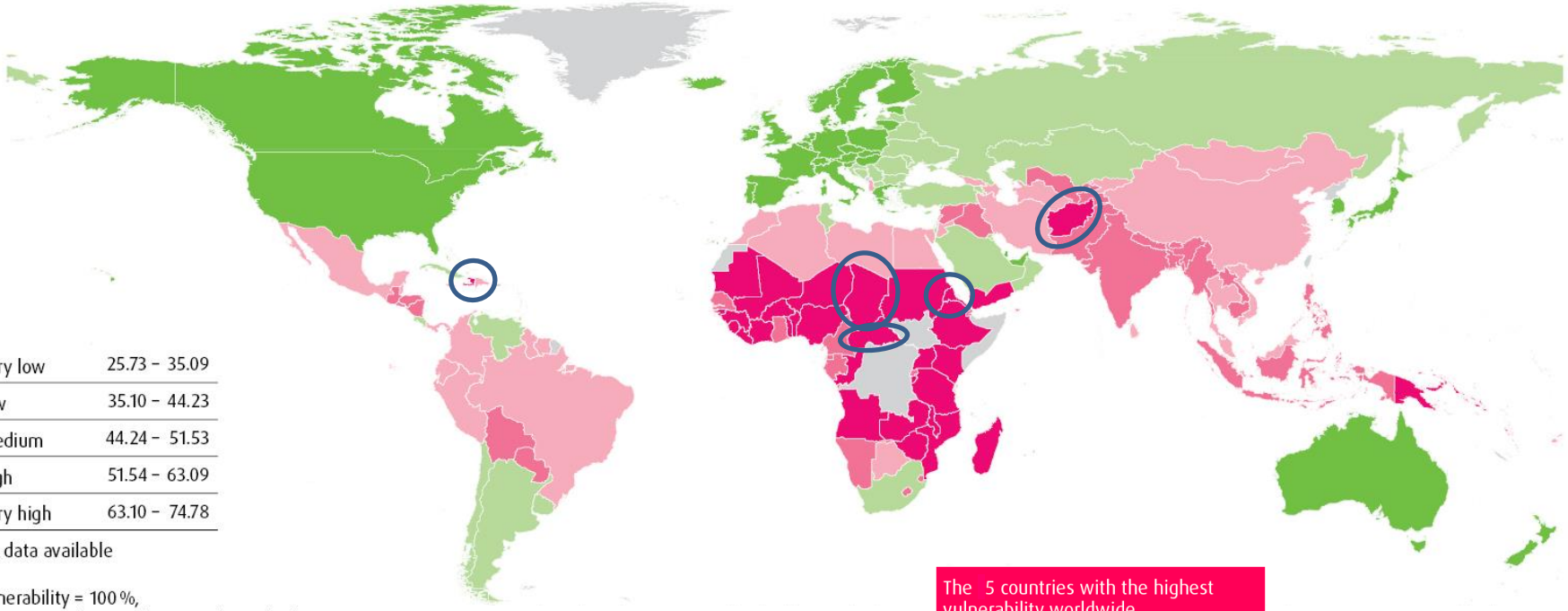
Country	Exp. (%)	Rank
Vanuatu	63.66	1
Tonga	55.27	2
Philippines	52.46	3
Japan	45.91	4
Costa Rica	42.61	5

UNU & BEH (2016)

World Risk Report

Vulnerability

Vulnerability of society as the sum of susceptibility, lack of coping capacities and lack of adaptive capacities



very low	25.73 – 35.09
low	35.10 – 44.23
medium	44.24 – 51.53
high	51.54 – 63.09
very high	63.10 – 74.78
no data available	

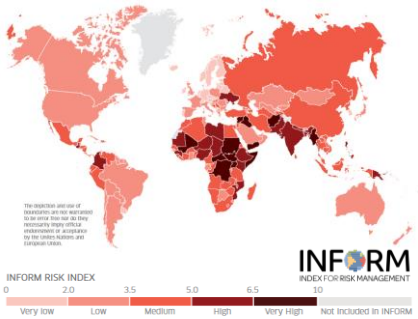
Max. vulnerability = 100 %,
Classification according to the quantile method

The 5 countries with the highest vulnerability worldwide

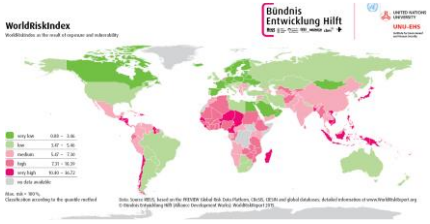
Country	Vuln. (%)	Rank
Central Afr. Rep.	74.78	1
Chad	74.19	2
Haiti	73.36	3
Eritrea	72.91	4
Afghanistan	72.49	5

UNU & BEH (2016)

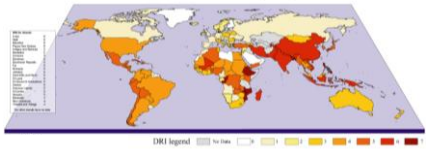
Other global risk indices



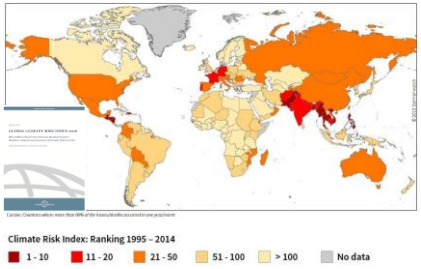
INFORM Index



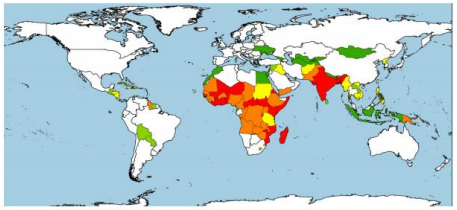
World Risk Index (WRI)



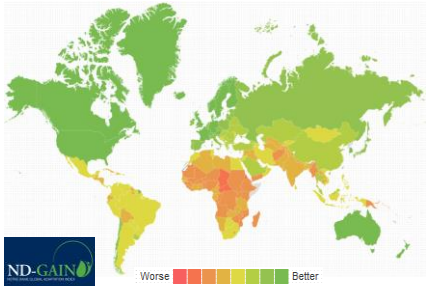
Disaster Risk Index (DRI)



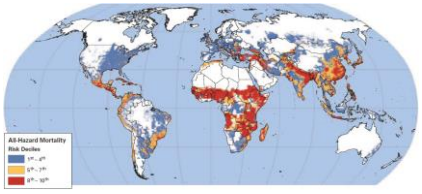
Climate Risk Index (CRI)



GCCA+ Index

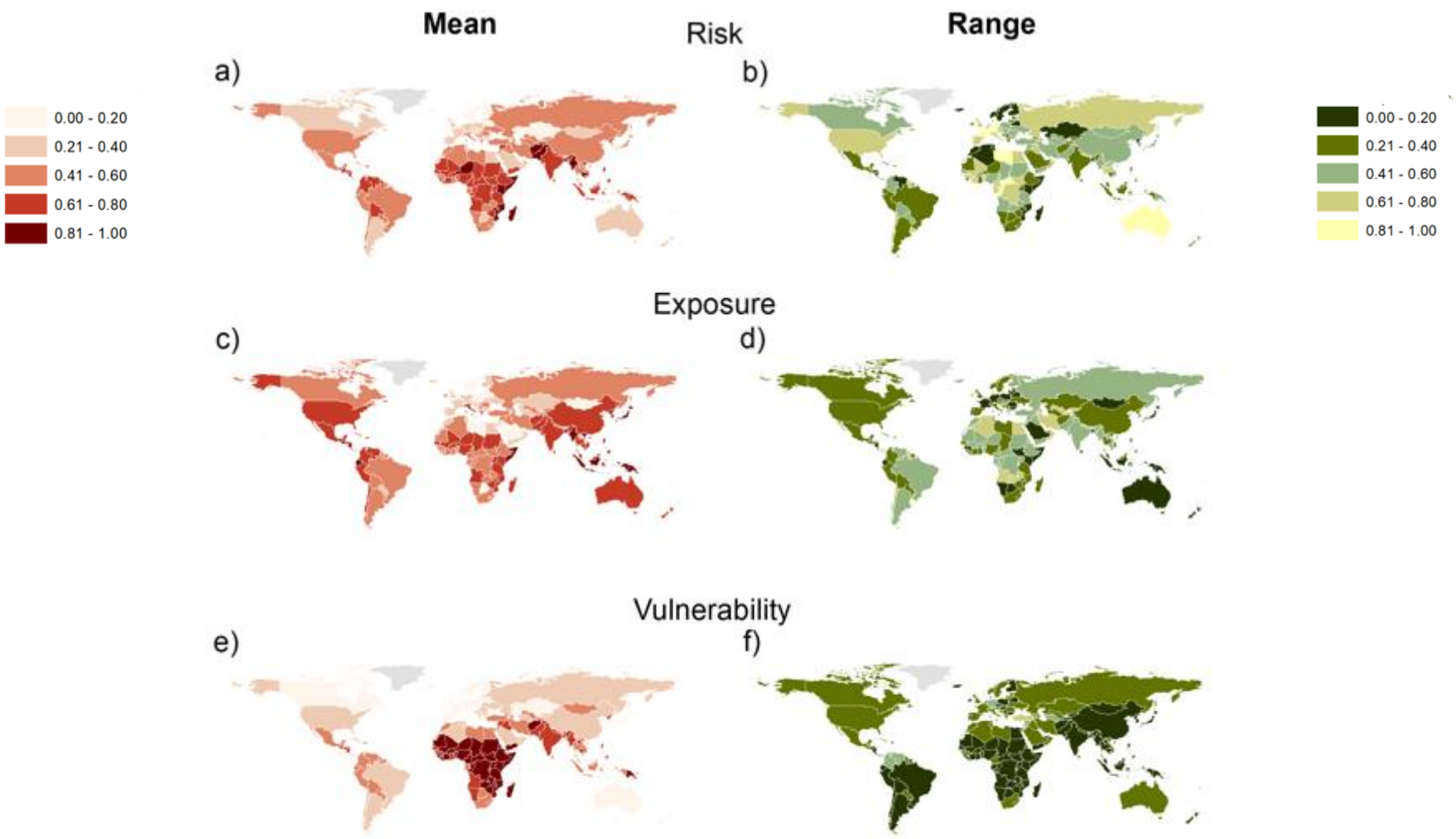


ND-GAIN Index



Disaster Risk Hotspots

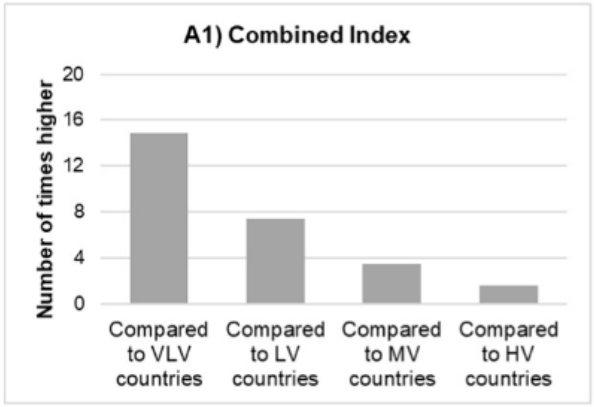
Consistency of vulnerability assessments

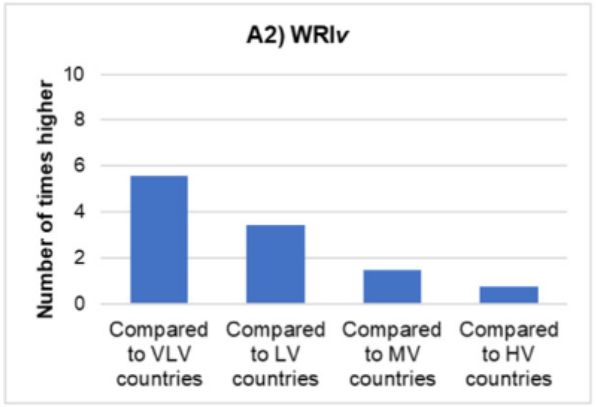


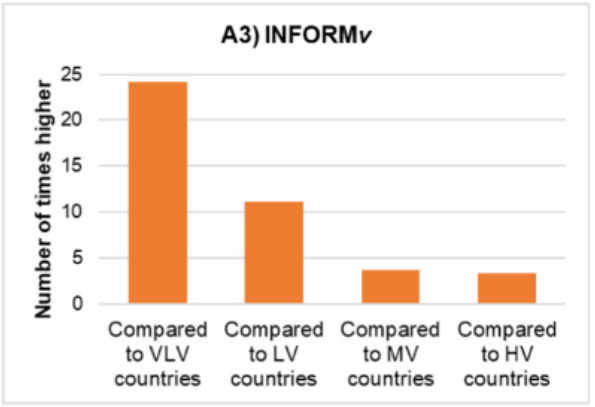
Source: Garschagen et al. 2021, in *Climatic Change*

Validation

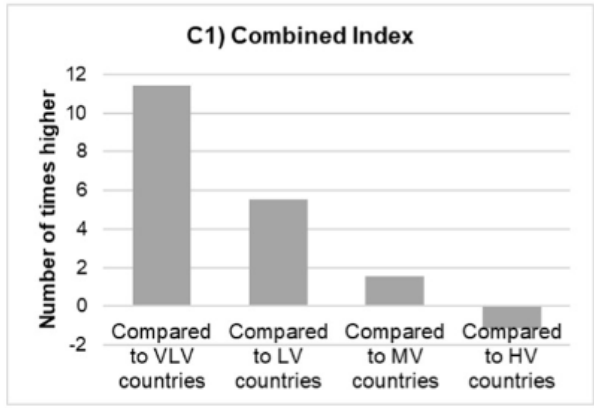
A: Mortality per event in Very High vulnerable countries compared to the countries in other vulnerability classes (x-axis)

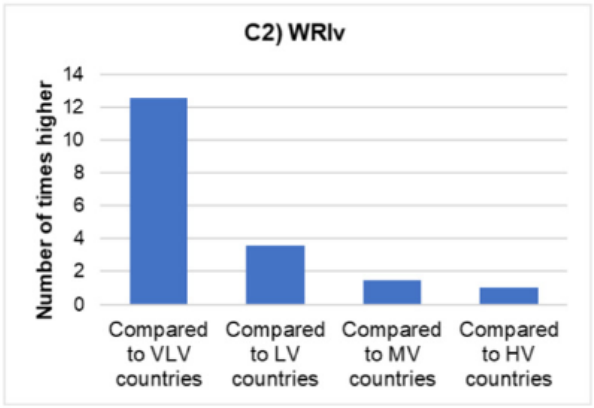


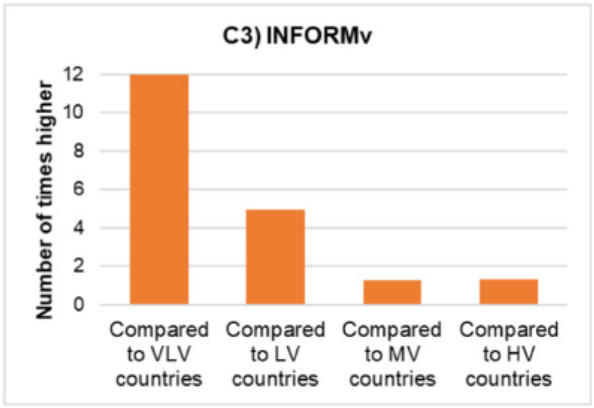




C: Population affected per event in Very High vulnerable countries compared to the countries in other vulnerability classes (x-axis)

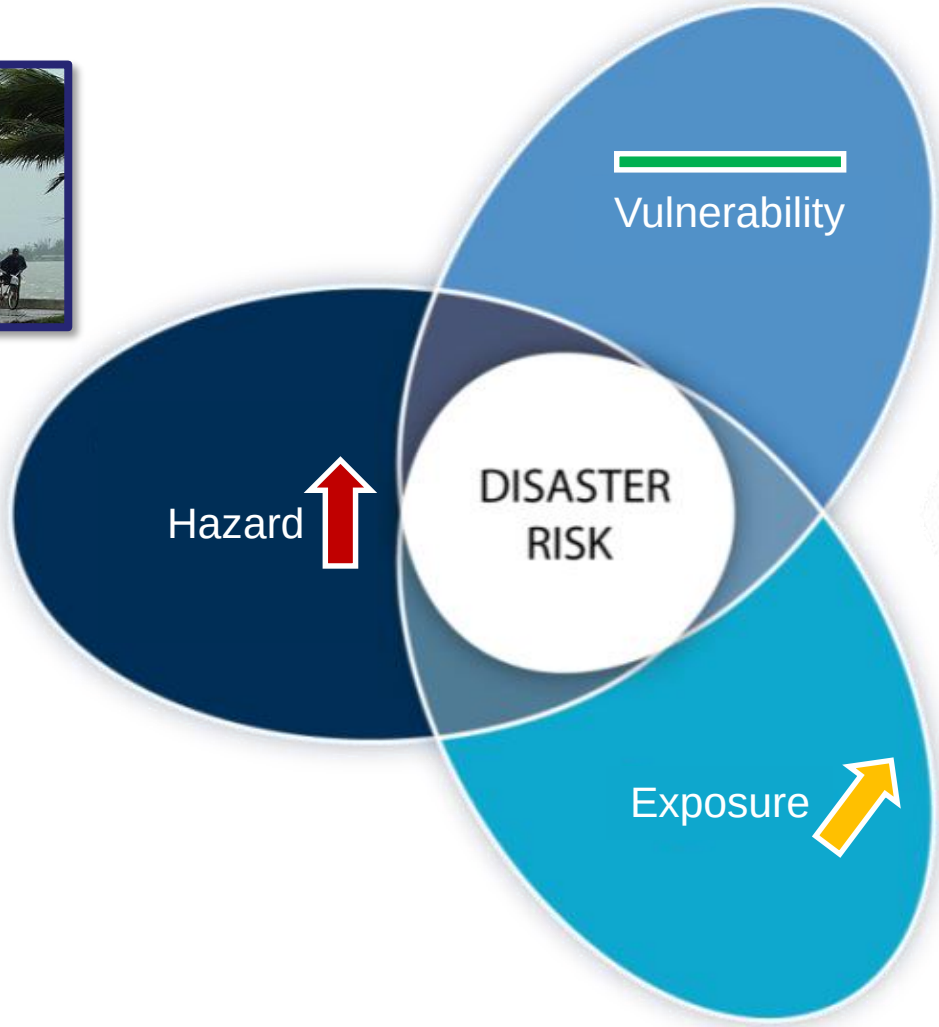






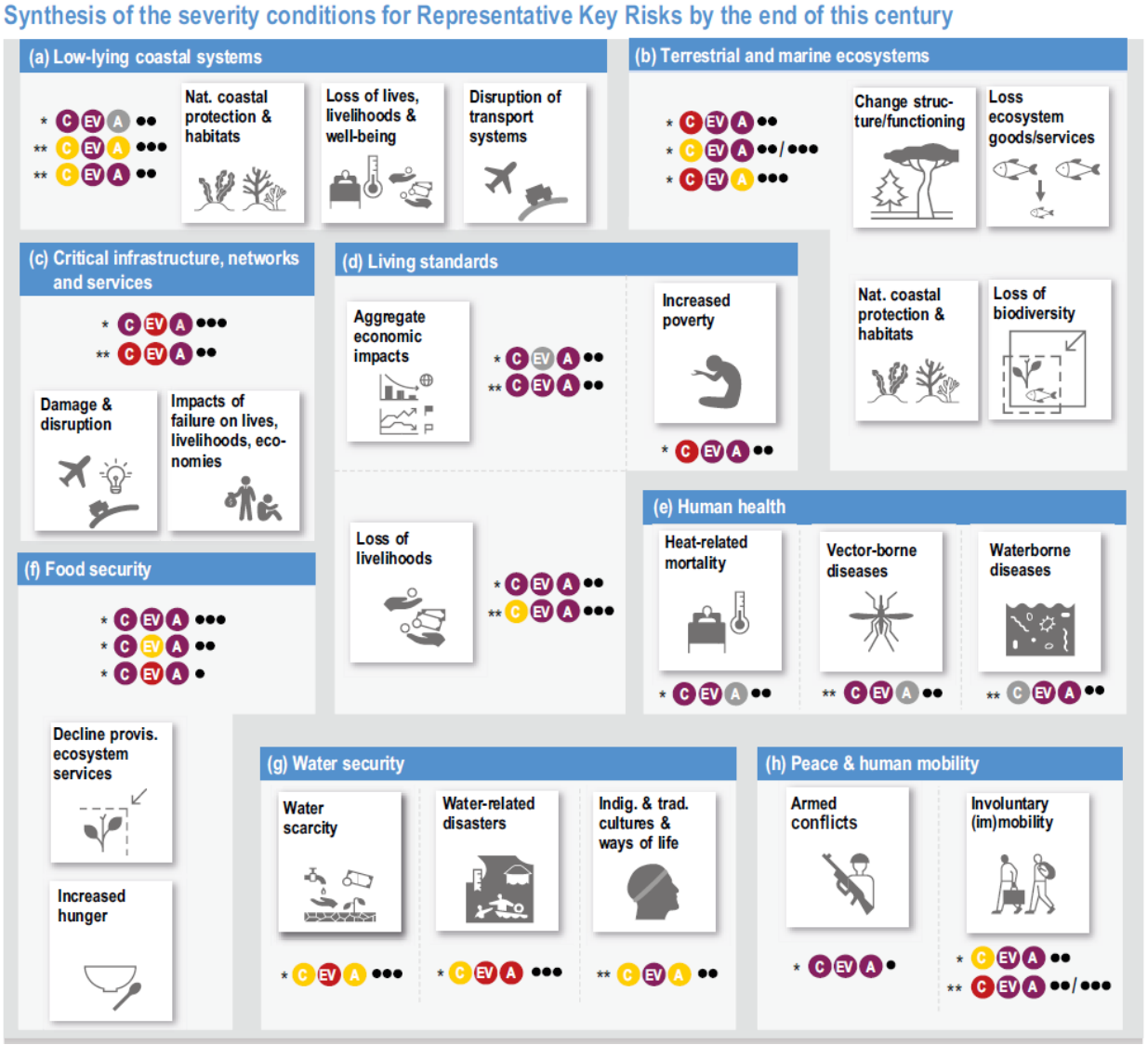
Source: Birkmann et al. 2022, in *Science of the Total Environment*

Risk dynamics:
Future trends in vulnerability and exposure matter!



Source: own figure, building on IPCC 2012,
inspired by O'Keefe et al. 1976, Hewitt 1983; Blaikie et al. 1994; Bohle 2001; Pelling 2001; Turner et al. 2003; Wisner et al. 2004

Severe risks possible with different combinations



Risk severity conditions by the end of this century

Type and level

- C — Climate (warming)
- EV — Exposure and Vulnerability
- A — Adaptation

High
Medium
Low

High
Low

Not fully assessed

Scope

* **Broadly applicable**
(risks are severe pervasively and even globally)

** **Specific**
(risks are to particular areas sectors or groups of people)

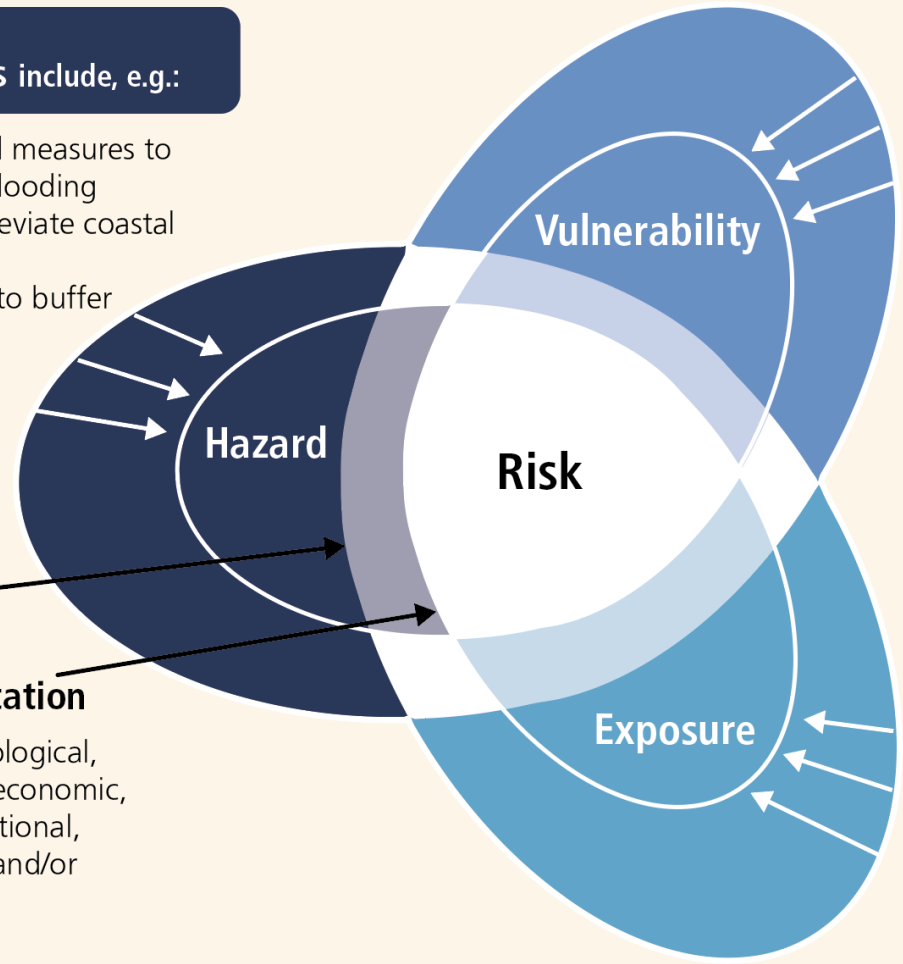
N.B.: for details and examples, see Table SM16.24 in the supplementary information associated with the chapter.

Confidence levels

●●● High
●● Medium
● Low

Source: O'Neill et al. 2022, in IPCC WGII AR6 Ch. 16

Linking risk and adaptation



Actions to reduce Hazards include, e.g.:

- ecosystem-based measures to reduce coastal flooding
- mangroves to alleviate coastal storm energy
- water reservoirs to buffer low-flows and water scarcity

Initial state of Risk

Limits to Adaptation

- e.g. physical, ecological, technological, economic, political, institutional, psychological, and/or socio-cultural

Actions to reduce Vulnerability include, e.g.:

- social protection
- livelihood diversification
- insurance solutions
- hazard-proof housing and infrastructure

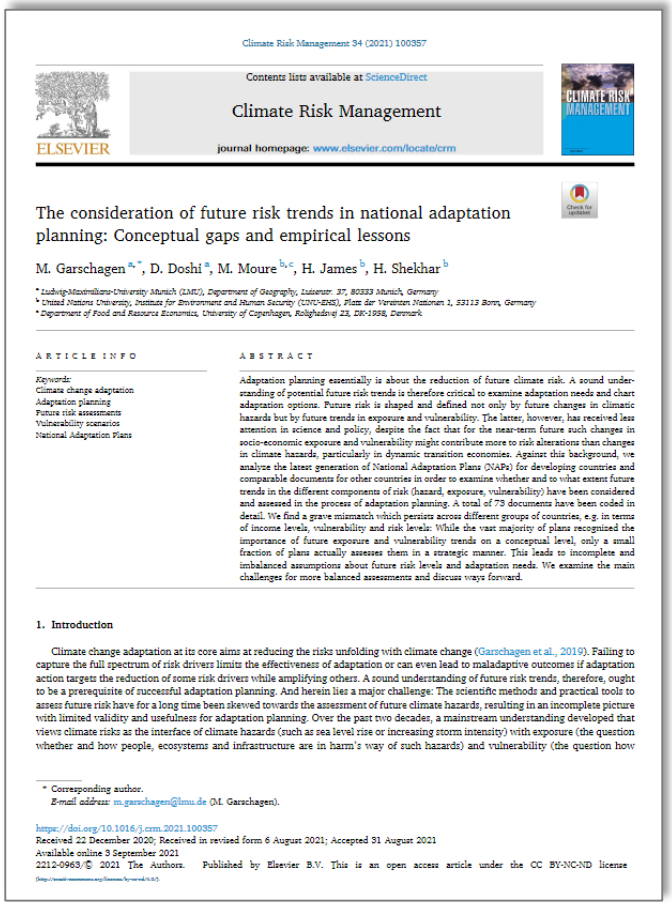
Actions to reduce Exposure include, e.g.:

- coastal retreat and resettlement
- risk sensitive land use planning
- early warning systems and evacuations

Source: Garschagen et al., in IPCC-SROCC 2019

Consideration in adaptation planning

- Most current national adaptation plans do not consider future trends in exposure and vulnerability!
- This leads to skewed assumptions about future adaptation needs!



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The consideration of future risk trends in national adaptation planning: Conceptual gaps and empirical lessons

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ABSTRACT

Adaptation planning essentially is about the reduction of future climate risk. A sound understanding of potential future risk trends is therefore critical to examine adaptation needs and chart adaptation options. Future risk is shaped and defined not only by future changes in climatic hazards but by future trends in exposure and vulnerability. The latter, however, has received less attention in science and policy, despite the fact that for the near-term future such changes in socio-economic exposure and vulnerability might contribute more to risk alterations than changes in climate hazards, particularly in dynamic transition economies. Against this background, we analyze the latest generation of National Adaptation Plans (NAPs) for developing countries and comparable documents for other countries in order to examine whether and to what extent future trends in the different components of risk (hazard, exposure, vulnerability) have been considered and assessed in the process of adaptation planning. A total of 73 documents have been coded in detail. We find a grave mismatch which persists across different groups of countries, e.g. in terms of income levels, vulnerability and risk levels: While the vast majority of plans recognized the importance of future exposure and vulnerability trends on a conceptual level, only a small fraction of plans actually assesses them in a strategic manner. This leads to incomplete and imbalanced assumptions about future risk levels and adaptation needs. We examine the main challenges for more balanced assessments and discuss ways forward.

1. Introduction

Climate change adaptation at its core aims at reducing the risks unfolding with climate change (Garschagen et al., 2019). Failing to capture the full spectrum of risk drivers limits the effectiveness of adaptation or can even lead to maladaptive outcomes if adaptation action targets the reduction of some risk drivers while amplifying others. A sound understanding of future risk trends, therefore, ought to be a prerequisite of successful adaptation planning. And herein lies a major challenge: The scientific methods and practical tools to assess future risk have for a long time been skewed towards the assessment of future climate hazards, resulting in an incomplete picture with limited validity and usefulness for adaptation planning. Over the past two decades, a mainstream understanding developed that views climate risks as the interface of climate hazards (such as sea level rise or increasing storm intensity) with exposure (the question whether and how people, ecosystems and infrastructure are in harm's way of such hazards) and vulnerability (the question how

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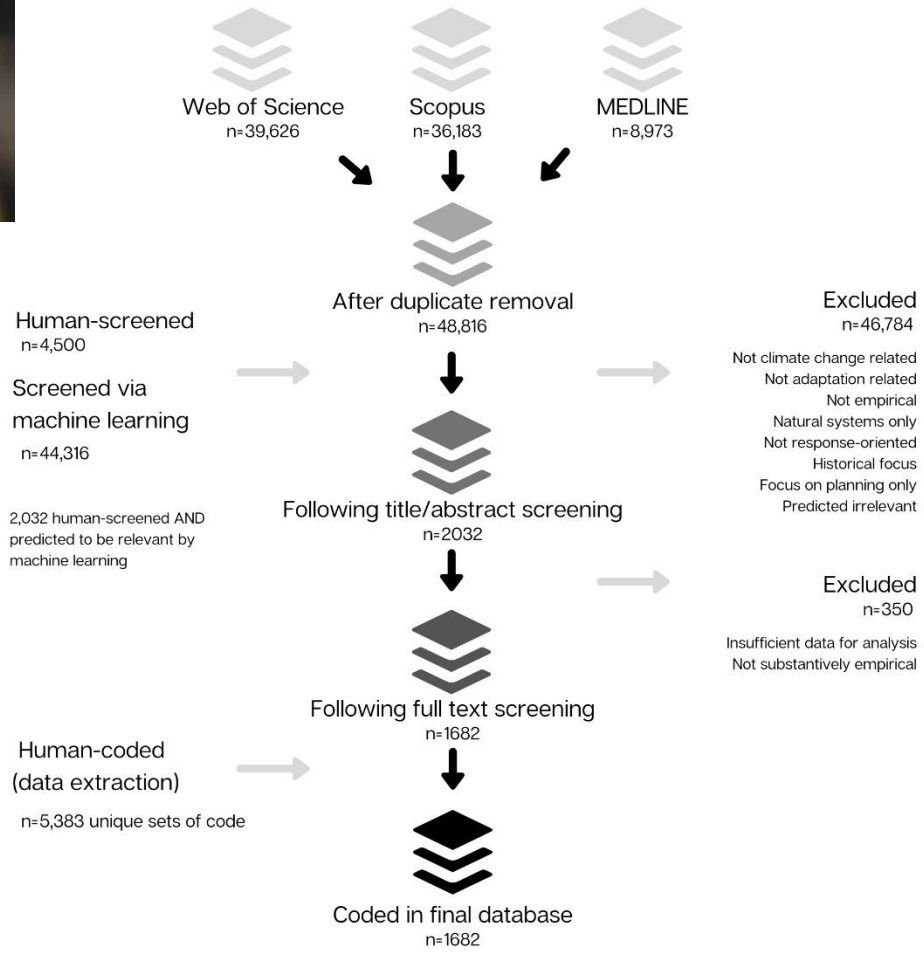
Source: Garschagen et al. 2021, in *Climate Risk Management*

GAMI – Global Adaptation Mapping Initiative

- Voluntary community exercise
- Over 125 scientists / coders
- Over 1,600 papers with empirical accounts on reported adaptation coded and analyzed



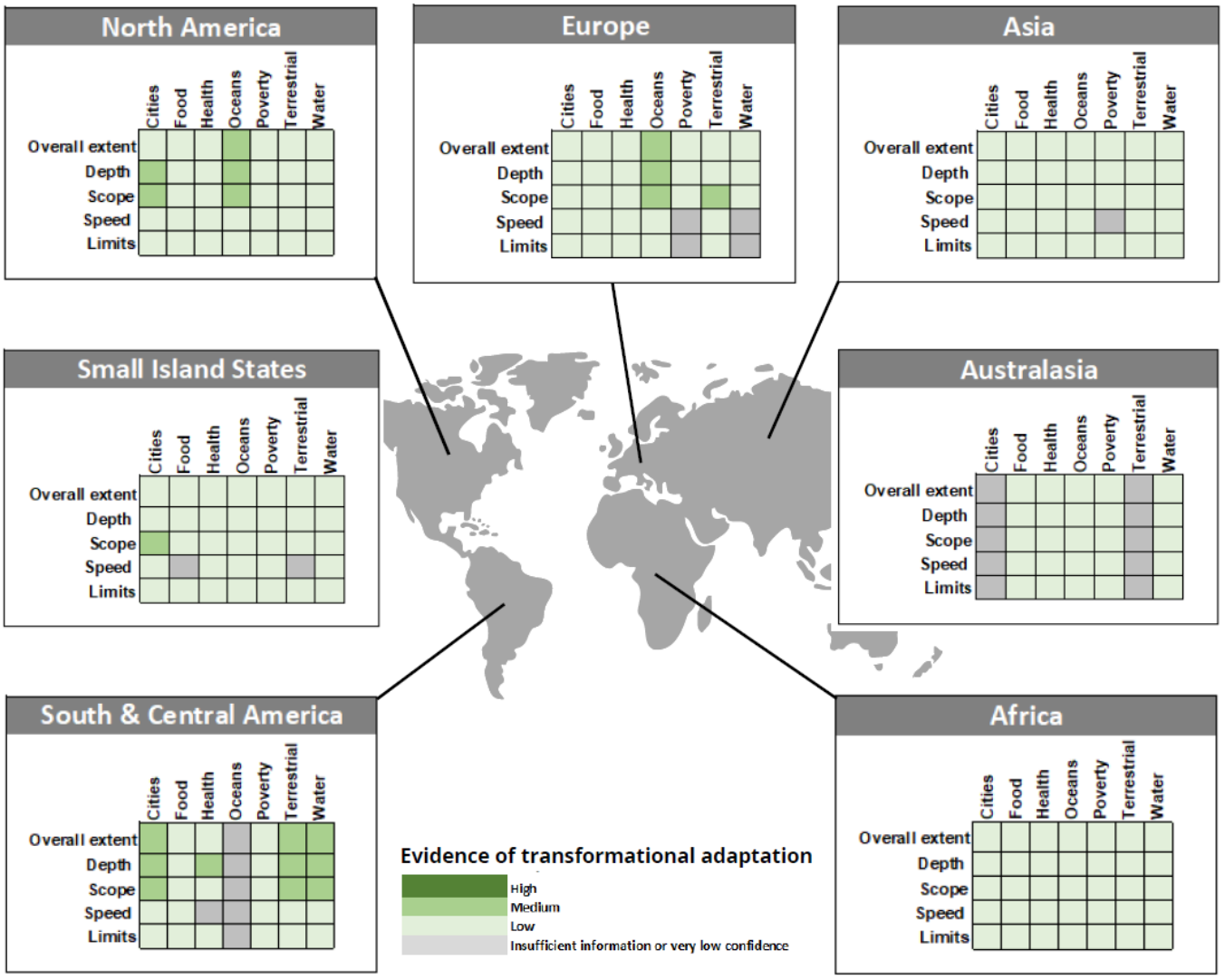
Source: Berrang-Ford et al. 2021, in *Nature Climate Change*

Overall results on observed adaptation

1. Documented adaptation largely fragmented
2. Mostly local
3. Almost entirely incremental
4. Limited evidence of transformational adaptation
5. Uncertain risk reduction outcomes

Source: Berrang-Ford et al. 2021, in *Nature Climate Change*

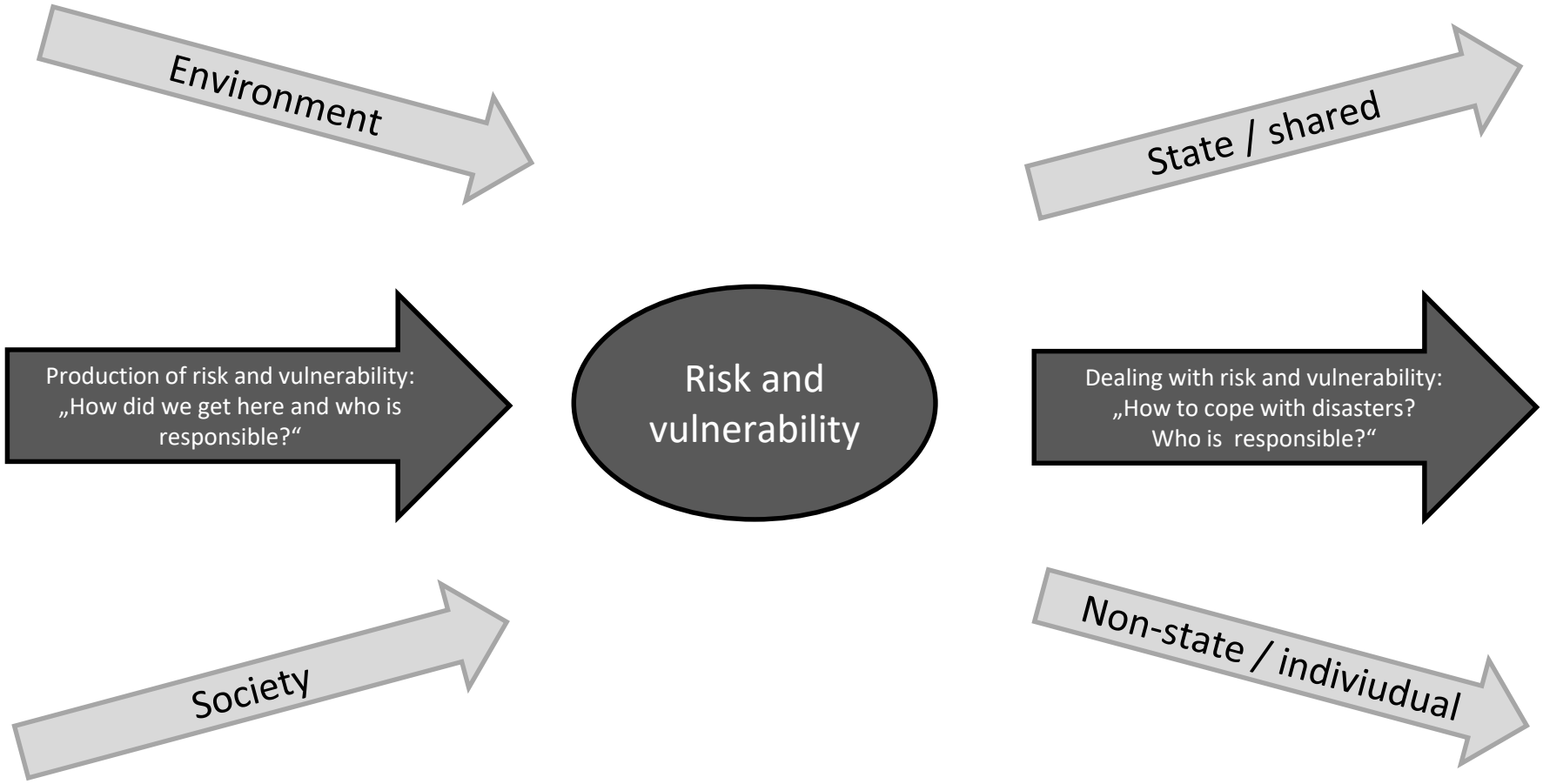
Depth, scope and speed of adaptation



Source: Berrang-Ford et al. 2021, in *Nature Climate Change*

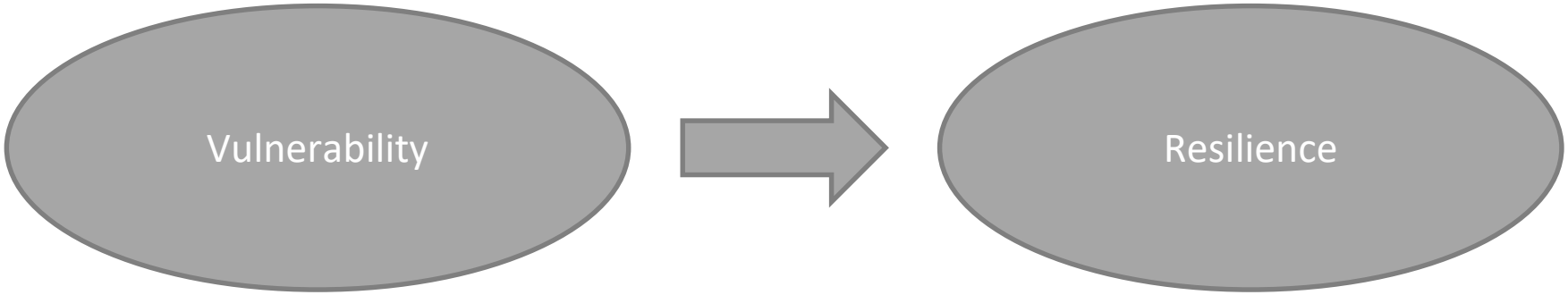
Are current conceptual debates helpful in addressing complex risk?

“Ins and outs” of risk



Source: Garschagen, *in preparation*

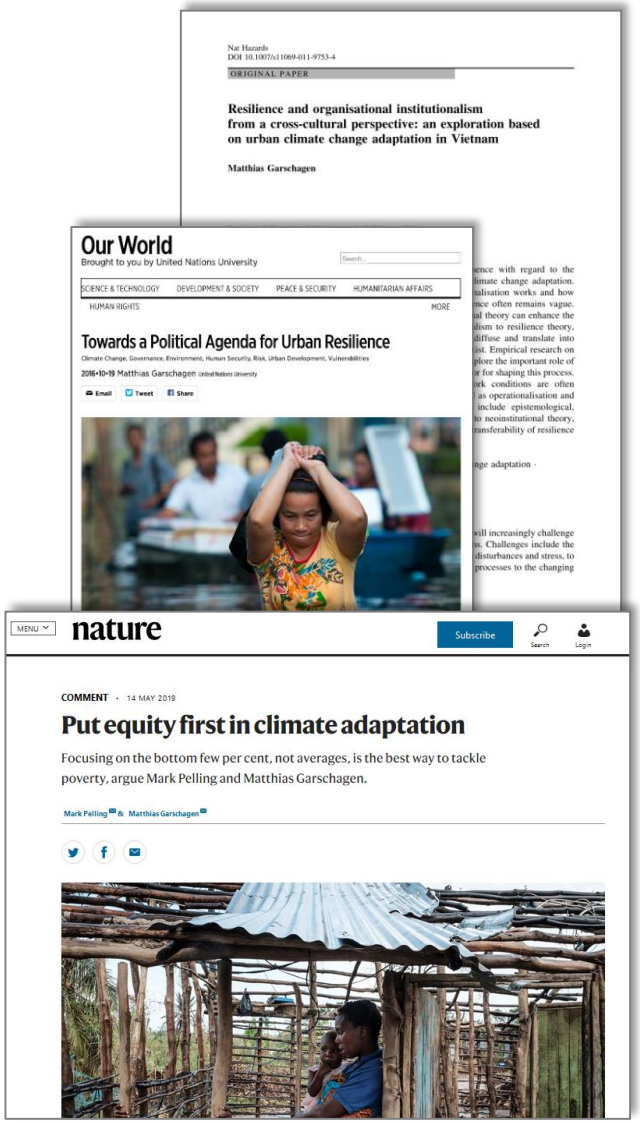
Conceptual shifts – and the question whether they are “helpful”



Sources:
Fünfgeld & Garschagen, *in preparation*

Trends in resilience building and social protection

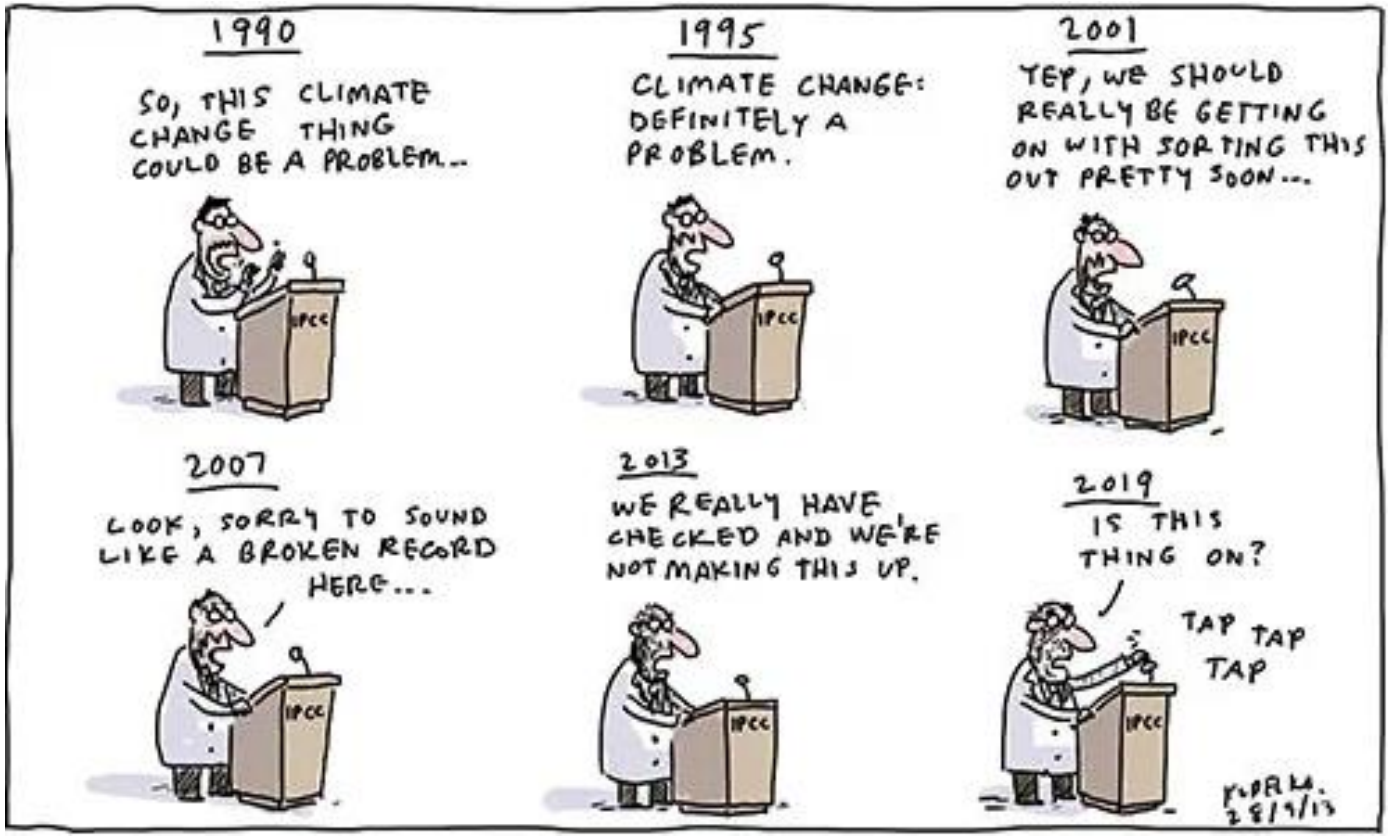
- conceptual and ontological difficulties
  - resilience has become a guiding concept and boundary object (e.g. Folke 2006; Brand and Jax 2007; Davoudi et al. 2012)
  - but: analytically ambiguous and normatively controversial (Garschagen 2015)
- depolitization (Garschagen 2016, 2018)
  - “key functions” for whom and who decides?
- Re-orientation towards the bottom-few, not averages



Sources:
Garschagen & Porter 2018, in *Planning Theory and Practice*
Garschagen 2016, in *Our World*
Garschagen 2015, in *Natural Hazards*
Pelling and Garschagen 2019, in *Nature*

Conclusions

- The pandemic has helped in creating a wide understanding of “vulnerability” within the society and its application in policy decisions.
- Nevertheless, systemic risks pose new conceptual challenges for vulnerability assessments – vulnerability to what?
- There is a risk that science and policy talk past each other when addressing complex risks and what needs to be done about them.
  - Dynamics and future orientation.
  - Complexity.
  - Synnergies.
- Recent conceptual shifts have in many respects moved us further away, rather than twoards, decoding and addressing vulnerability questions in systemic risk contexts.
- Particularly the debate of “resilience-building” needs address difficult political choices for which science can contribute one – but an important – voice.



Thank you very much for your kind attention!

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