

# E<sup>3</sup>S – a view on relevance, concepts and directions

*Markus Reichstein & Dorothea Frank  
(Max-Planck-Institute for Biogeochemistry)*

## **E<sup>3</sup>S Partners:**



AN IHDP CORE PROJECT



Integrated Land Ecosystem -  
Atmosphere Processes Study

# Welcome to the Harnack-House of the Max-Planck Society



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Max-Planck-Institut  
für Biogeochemie



**Cross community workshop on Extreme Events and  
Environments from Climate to Society (E<sup>3</sup>S)**  
Berlin, February 14<sup>th</sup> to 16<sup>th</sup> 2016

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Dr. Thorsten Kiefer  
*Future Earth Global Hub, Paris*

<http://www.futureearth.org/secretariat>



Rebecca Oliver  
*Future Earth Global Hub, Stockholm*

<http://www.futureearth.org/secretariat>

Prof. Dr. Ilan Chabay  
*IASS, Potsdam*

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Dr. Tanja Suni  
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<http://ea-globalchange.org/index.php/get-in-touch>

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*Secretary, MPI-BGC Jena*

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<http://rocs.hu-berlin.de/page23/index.html>



Dr. Thorsten Kiefer  
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Jun.-Prof. Dr. Björn Vollen  
Philipps-Universität Marburg

[https://www.uni-marburg.de/fb02/macie/team/index\\_html/bvollen](https://www.uni-marburg.de/fb02/macie/team/index_html/bvollen)



Dr. Paul Vossen  
EC Research & Innovation Directorate  
General

<http://ea-globalchange.org/index.php/8-news/64-piecing-together-the-puzzle-of-future-earth>



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**Dr. Jana Sillmann (CICERO), Sebastian Sippel (MPI-BGC)**



**Dr. Jakob Zscheischler (ETH Zürich), Dr. Carl-Friedrich Schleussner (Climate Analytics)**



**Dr. Kirsten Thonicke (PIK),  
Prof. Dr. Michael Bahn (University Innsbruck)**



**Dr. Damià Gomis (IMEDEA),  
Dr. Sathaporn Monprapussorn  
(Srinakharinwirot University)**



## Session leaders

**Dr. Qian Ye (Beijing Normal University)**

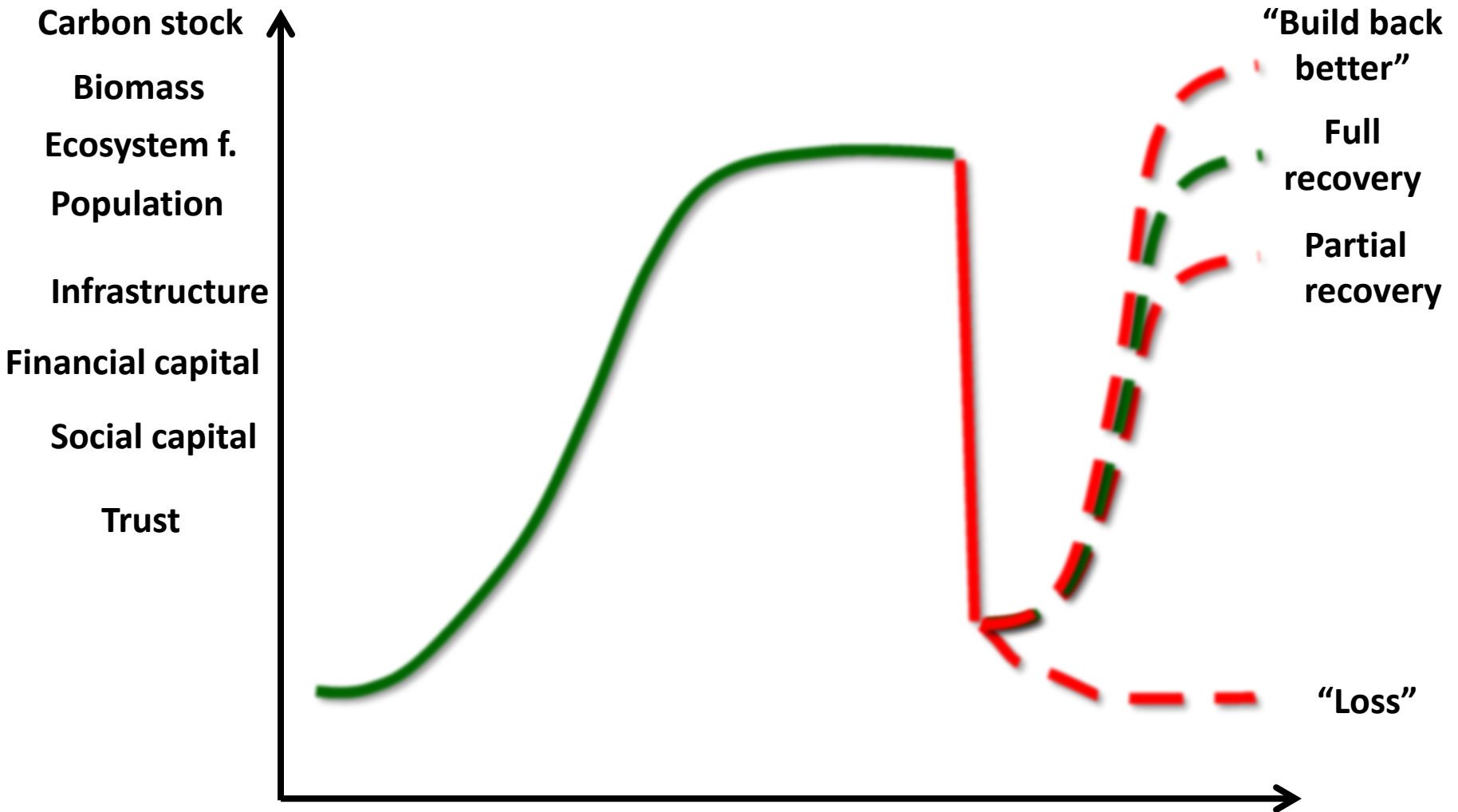


**Dr. Miguel Mahecha (MPI-BGC);  
Dr. Ursula Geßner (DLR); Dr. Ilona Otto (PIK)**





# A simple & general view...



# Recognition



**SUSTAINABLE  
DEVELOPMENT GOALS**

**17 GOALS TO TRANSFORM OUR WORLD**



<http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
- Integrate climate change measures into national policies, strategies and planning
- ...



## UN Secretary - General's Scientific Advisory Board

### 8 Top Challenges for the implementation of the Sustainable Development Goals (SDGs)

<https://en.unesco.org/un-sab/content/documents>  
[http://en.unesco.org/un-sab/sites/un-sab/files/SAB\\_4\\_INF\\_7\\_Dephi\\_Study.pdf](http://en.unesco.org/un-sab/sites/un-sab/files/SAB_4_INF_7_Dephi_Study.pdf)

Sustainable “Blue [Ocean] Economy”

Biodiversity (i.p. tropics)

Infectious Agents

Emissions Free Technology

Drinkable Water for All

**Averting Enormous Human Disasters Through Prediction**

Research and Education in Basic Science

Unequal Resource-use and Continued Population

Growth

#### ***Averting Enormous Human Disasters through Prediction***

Partly as a result of climate change we face extreme and disastrous weather events that threaten all planetary life, bringing with them large socioeconomic losses: hydro-meteorological disasters account for 74% of total reported losses of US \$2.6 trillion.

There is therefore a need to create a global network for Disastrous Extreme Event Prediction (DEEP), under the leadership of the UN. This can be achieved by strengthening and expanding the existing global prediction programmes, managing international observation data, coordinating present and future research activities, constructing mechanism to disseminate scientific knowledge, and providing regional populations with appropriate knowledge and technologies to reduce their vulnerability. ***The grand challenge is to enhance global collaboration on extreme event prediction to avert large scale environmental disasters.***



# Sendai Framework for Disaster Risk Reduction

## 2015 - 2030

### Scope and purpose

The present framework will apply to the risk of small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters, caused by natural or manmade hazards as well as related environmental, technological and biological hazards and risks. It aims to guide the multi-hazard management of disaster risk in development at all levels as well as within and across all sectors.

### Expected outcome

The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries

### Goal

Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience

### Targets

Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015

Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015

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

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

Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020

Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030

Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030

### Priorities for Action

There is a need for focused action within and across sectors by States at local, national, regional and global levels in the following four priority areas.

**Priority 1**  
Understanding disaster risk

**Priority 2**  
Strengthening disaster risk governance to manage disaster risk

**Priority 3**  
Investing in disaster risk reduction for resilience

**Priority 4**  
Enhancing disaster preparedness for effective response, and to «Build Back Better» in recovery, rehabilitation and reconstruction

[http://www.preventionweb.net/files/44983\\_sendaiframeworksimplifiedchart.pdf](http://www.preventionweb.net/files/44983_sendaiframeworksimplifiedchart.pdf)

## Grand Challenges

- > Clouds, Circulation & Climate Sensitivity
- > Melting Ice & Global Consequences
- > **Climate Extremes**
- > Regional Sea-level Change & Coastal Impacts
- > Water Availability



Heavy Precipitation



Heatwave

Document »

Understand »

Attribute »

Simulate »



Drought



Storm

<http://www.wcrp-climate.org/grand-challenges>; <http://www.wcrp-climate.org/gc-extreme-events>

# Extreme Events and Environments – from climate to Society (E<sup>3</sup>S)



Top left to top right : Craig Allen, USGS, Los Alamos, USA; [http://allnewsaboutpakistan2.blogspot.de/2011/05/flood-in-pakistan-2010\\_6807.html](http://allnewsaboutpakistan2.blogspot.de/2011/05/flood-in-pakistan-2010_6807.html) ; [http://www.angelfire.com/ult/hogeeheartoftheroach/2trackstudio/looters\\_will\\_be\\_killed.jpg](http://www.angelfire.com/ult/hogeeheartoftheroach/2trackstudio/looters_will_be_killed.jpg)  
Bottom left to bottom right : <https://www.flickr.com/photos/lubasi/4909683043> (@ Luis Barreiros); <https://travel.com.vn/mien-bac/tour-ha-giang.aspx>; <http://jetzt.sueddeutsche.de/texte/anzeigen/572668/Fluthilfe-aus-dem-Netz>

- Which system properties yield resistance and resilience to extreme conditions?*
- How do social and natural systems interact at different time-scales (dir. reaction to adaptation)?*
- How does perception and moral valuation affect societal response to extreme events?*
- What are meaningful indices of impact-relevant climate extremes (including adaptation)?*

## Exciting? Relevant? 10yr-Solvable?



# Extreme event recognized but also prone to perception bias!



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# Newsletter

Integrated Land Ecosystem - Atmosphere Process Study

Issue No. 14- April 2014

Extreme Events and  
Environments

## Perception is important

### Dual role of science:

- “Objective” information
- Understanding perception as a factual process



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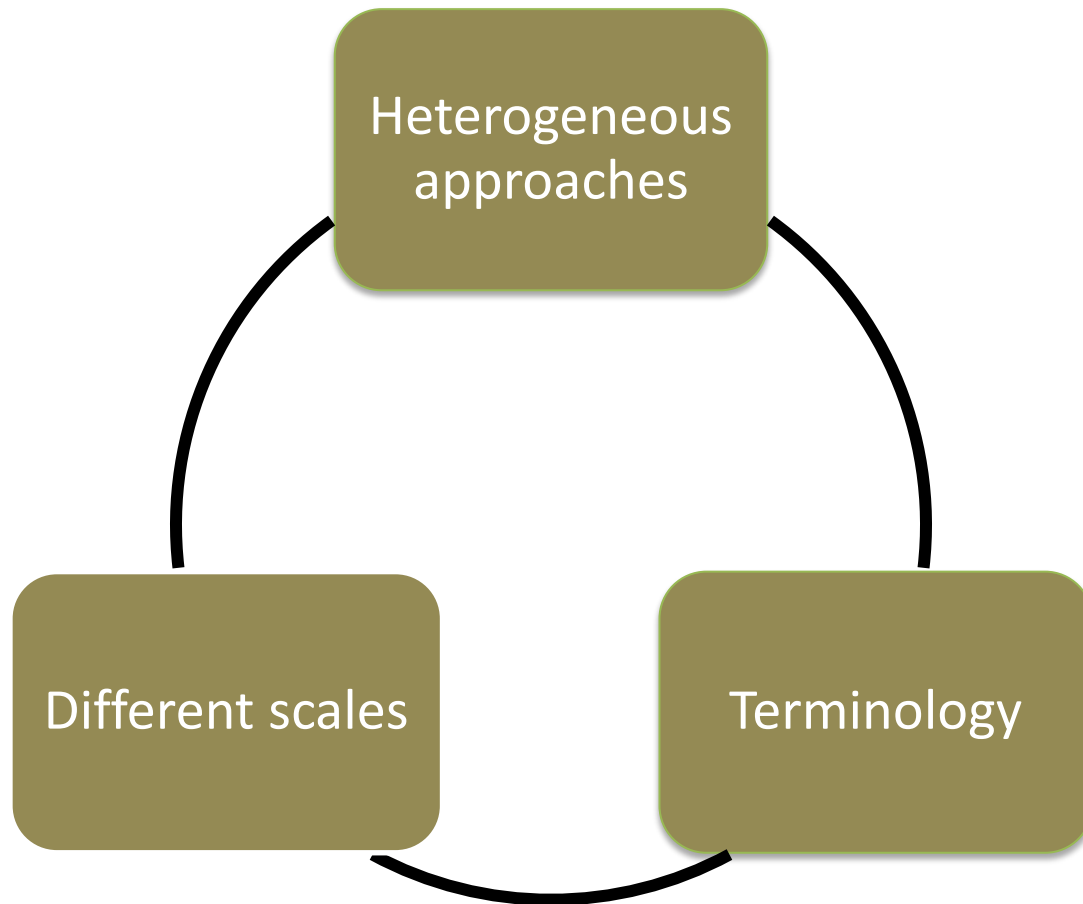
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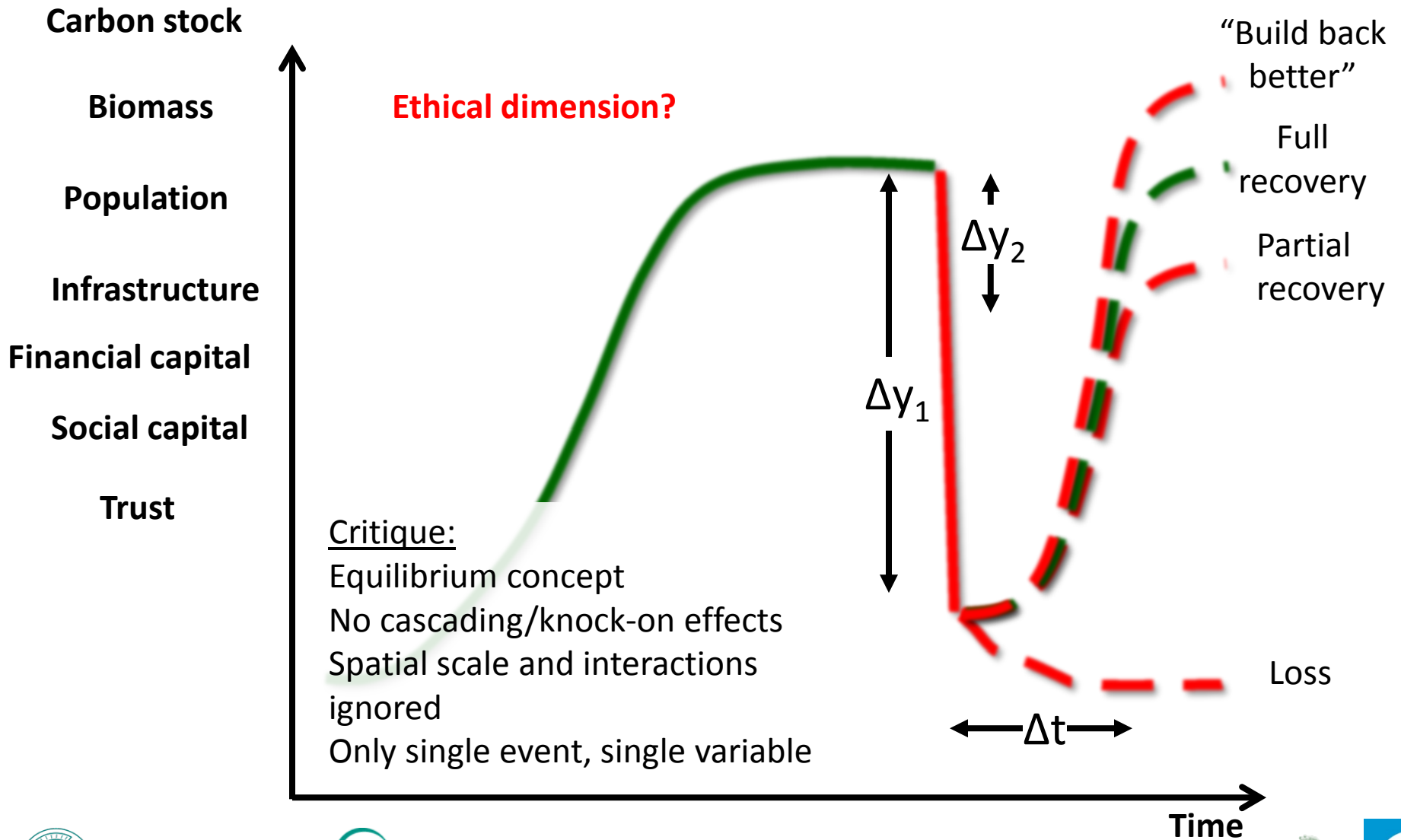




# Challenges



# Challenges exemplified...



# With all the diversity...

- System-oriented and evidence-based concepts as unifying approaches



# System-oriented approaches



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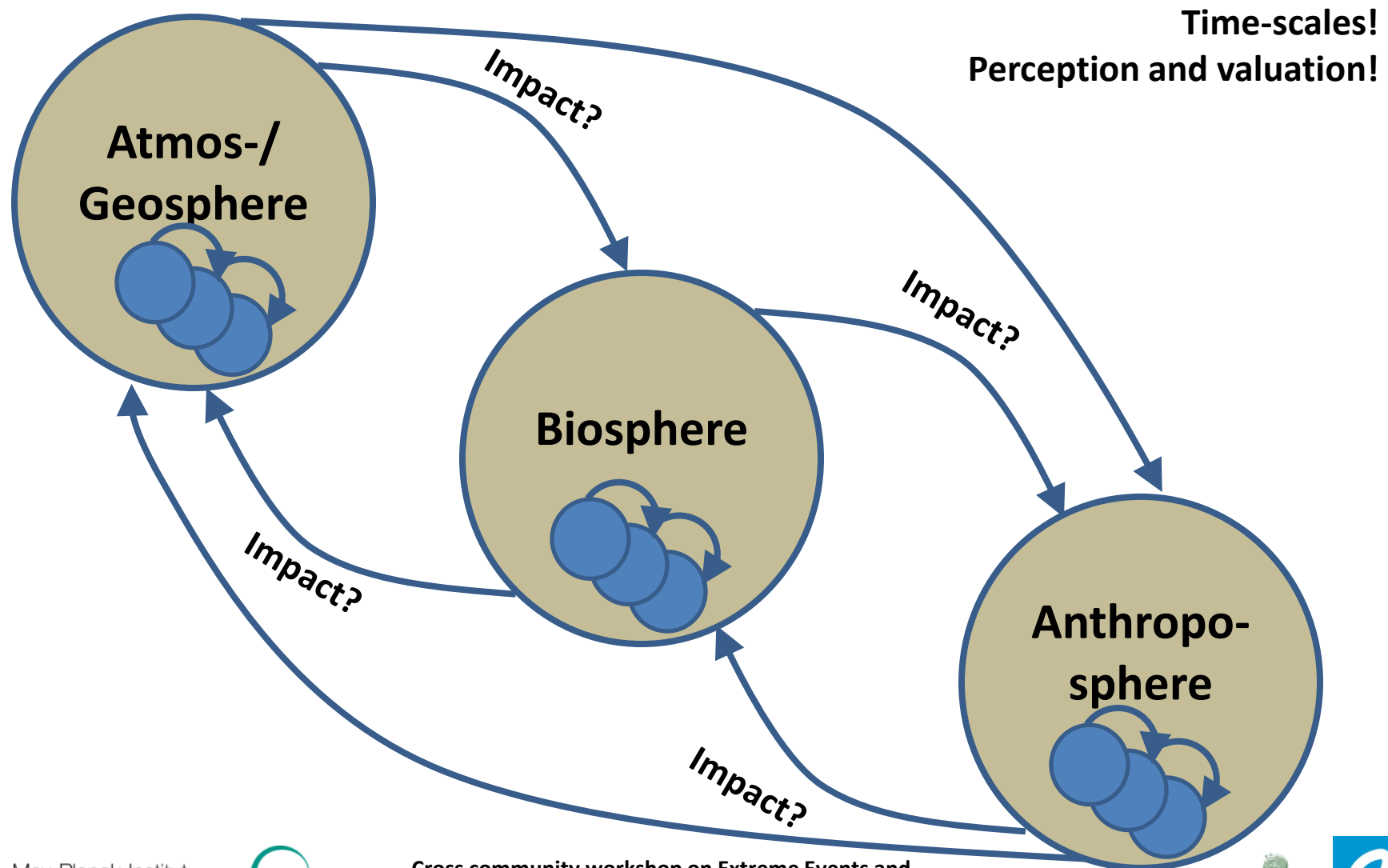


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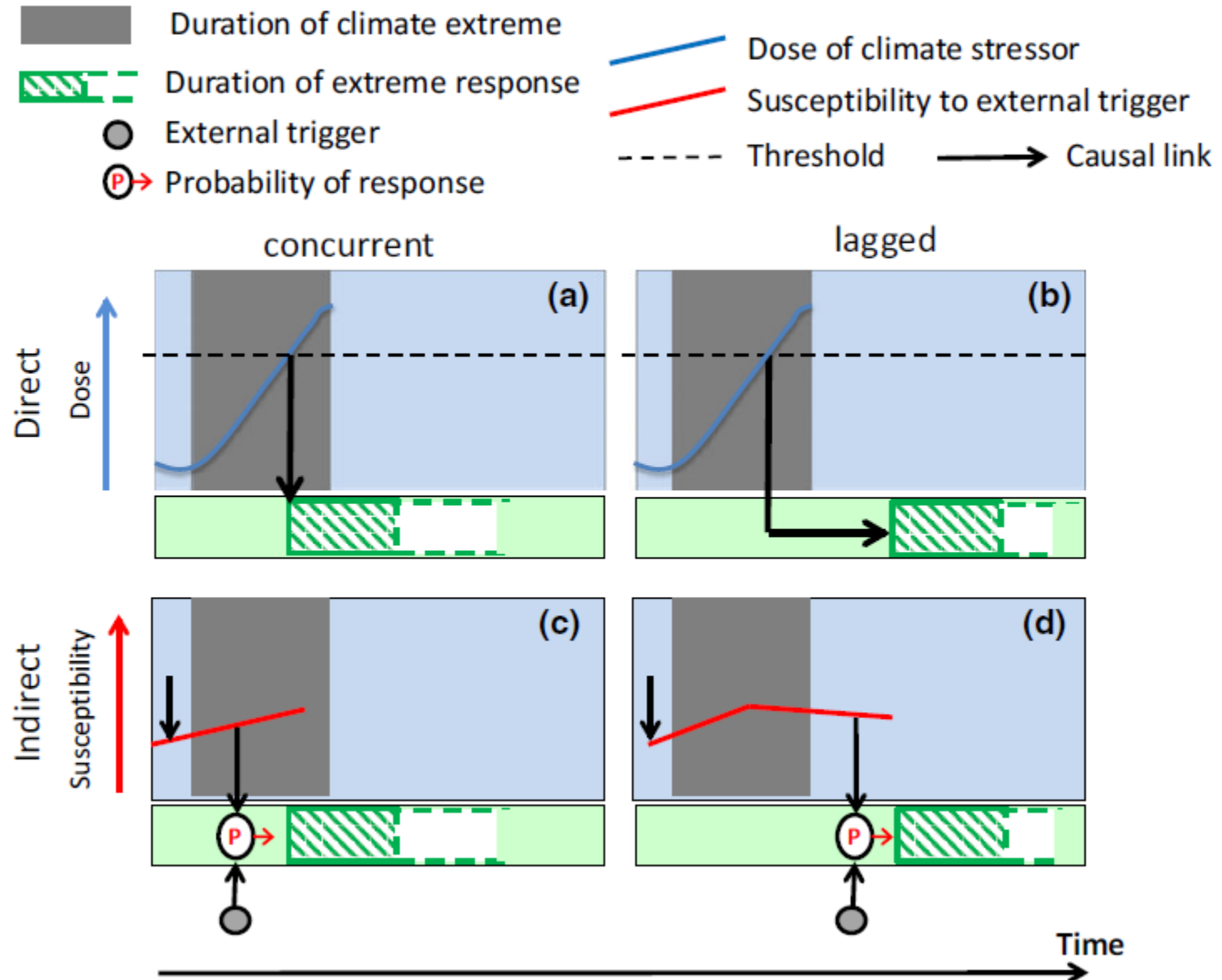


# System-cascading effects of extreme events





# Classification of extreme events in C-Cycle context



# Evidence-based approaches



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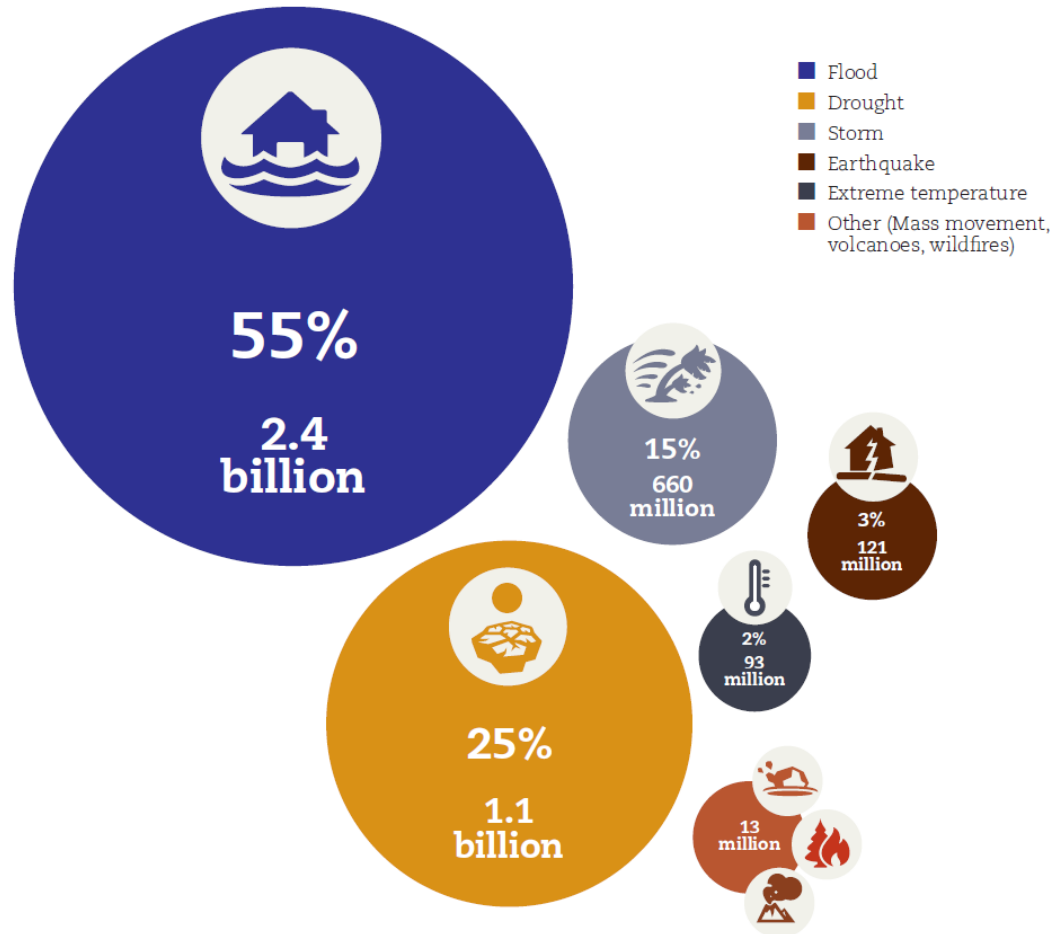


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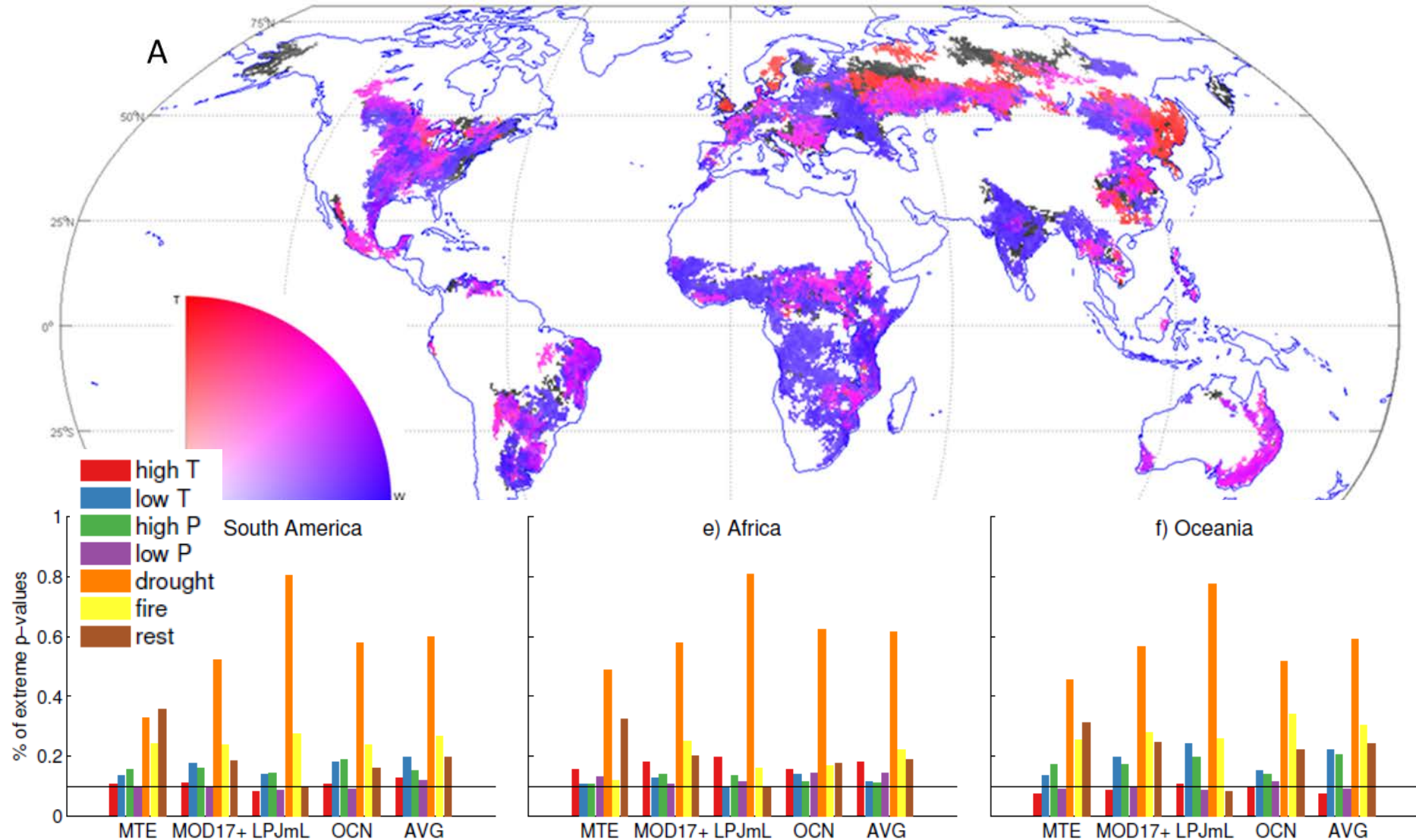
# People affected by natural disasters



18 | The Human cost of Natural Disasters

**CRED (2015) [Guha Sapir et al.]**

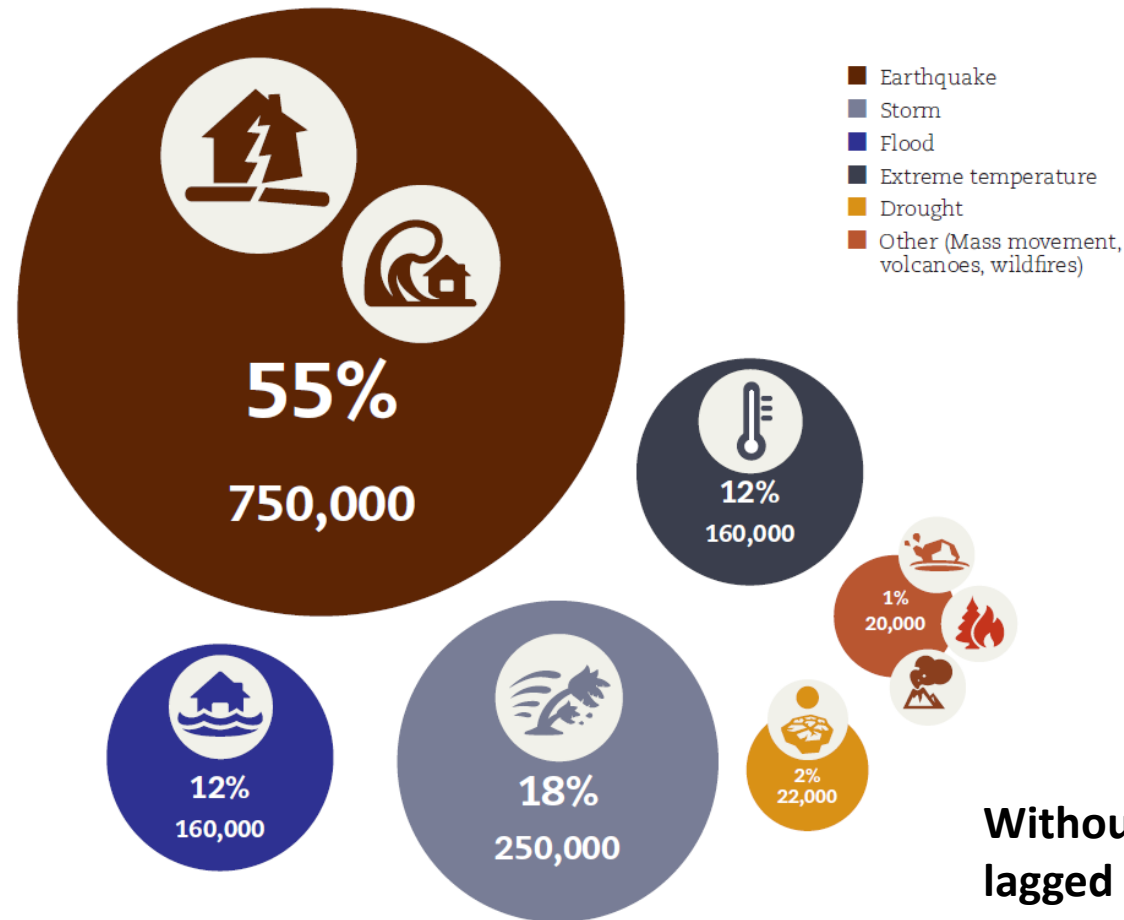
# Water is a key factor for carbon cycle extremes, too



Reichstein et al. (2013), Nature

Zscheischler et al. (2014), Biogeosciences

# Deaths caused by natural disasters



CRED (2015) [Guha Sapid et al.]



# Effects of disasters scale with income

Figure 15

Number of disasters per income group (1994-2013)

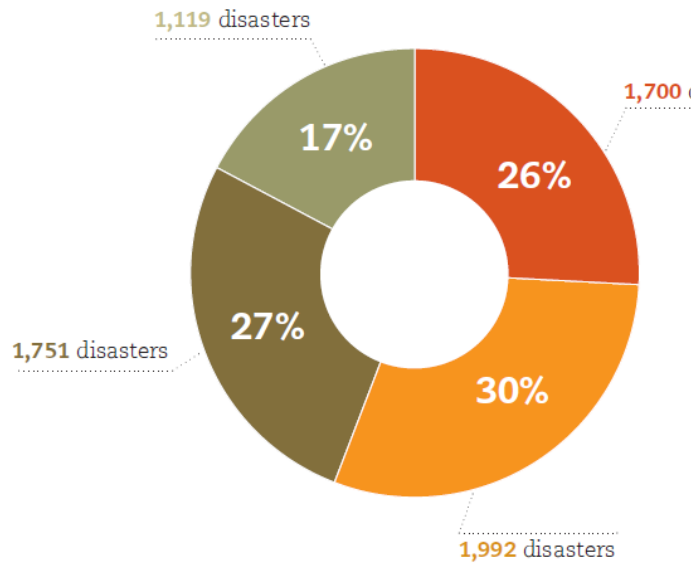
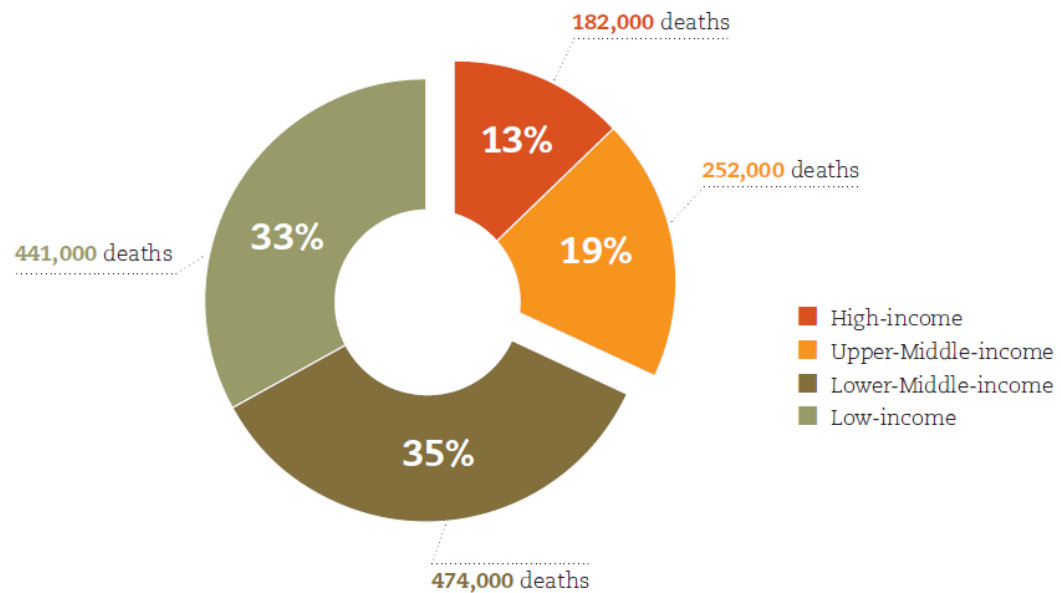


Figure 16

Number of deaths per income group (1994-2013)

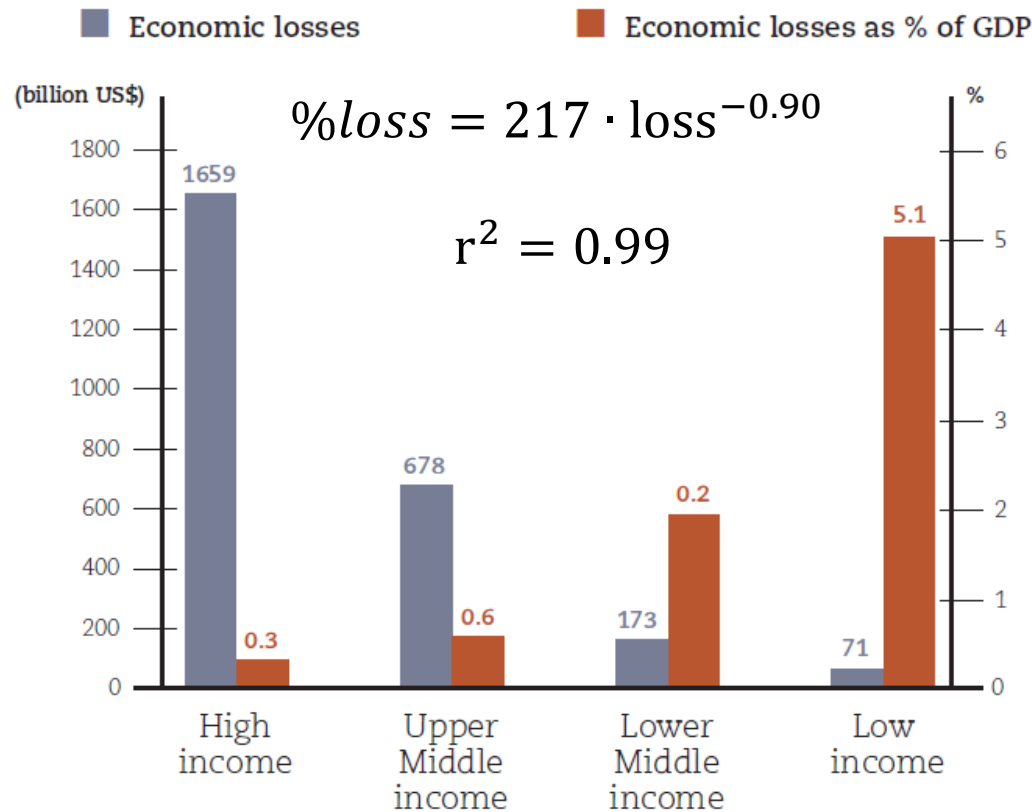


CRED (2015) [Guha Sapir et al.]

# Clear emergent relationships!

Figure 28

Economic losses in absolute values  
and compared to GDP



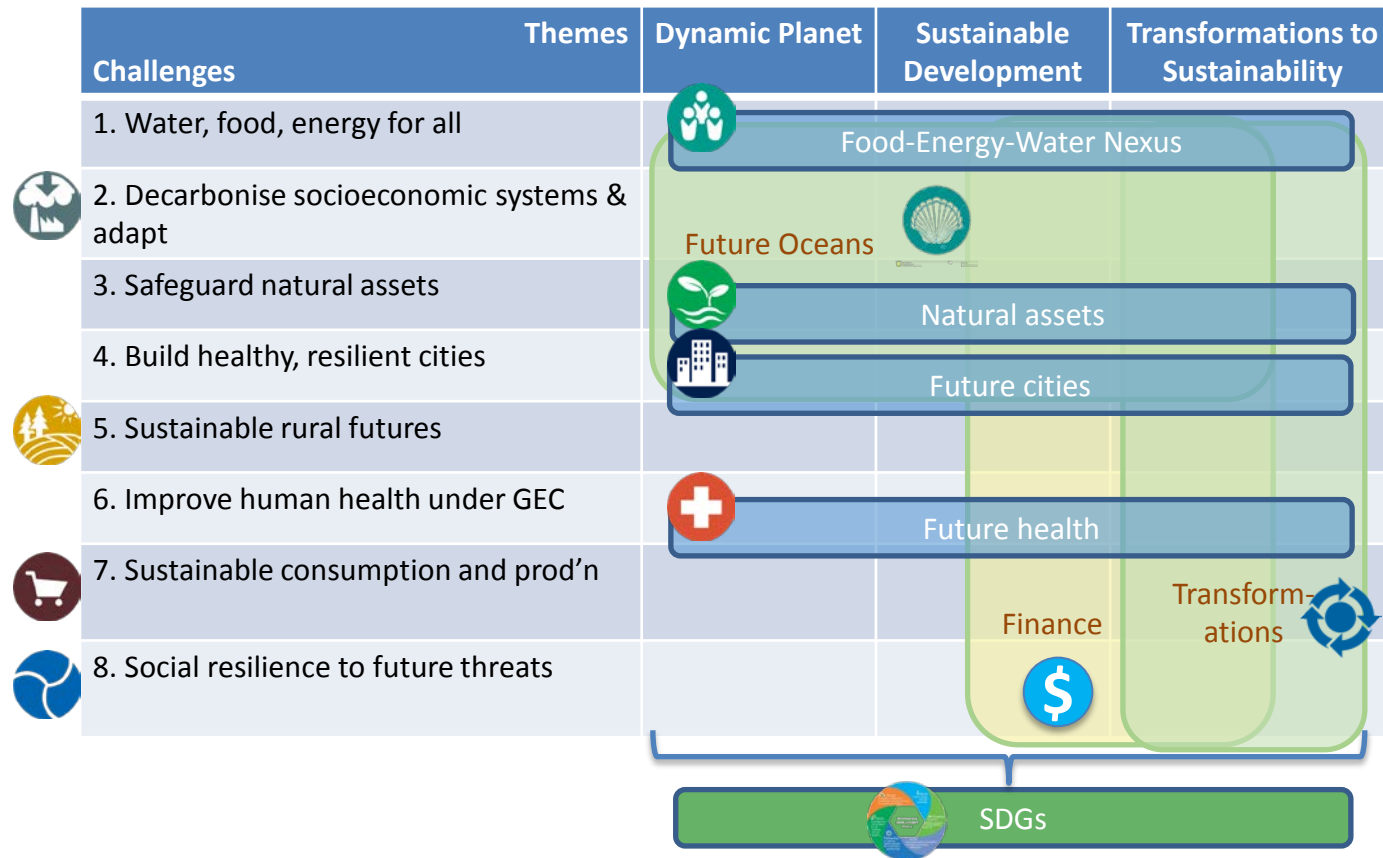
Education?

CRED (2015) [Guha Sapir et al.]

# Two (minimum) goals of the workshop

1. Define key research questions and research strategy
  - First only “internal documents”
  - Publication tbe
2. Build community & evaluate development of E<sup>3</sup>S topic within Future Earth landscape

# Knowledge-Action Network initial set



Does E3S have the potential/critical mass for a KAN?  
What aspects would be missing? (e.g. broadening the focus)

*courtesy of Thorsten Kiefer and Rebecca Oliver*

## Extreme Events and Environments - from climate to Society (E<sup>3</sup>S) -

Thanks!



(top left) Catedral Verde – Floresta Amazonica; <https://www.flickr.com/photos/lubasi/4909683043> (@ Luis Barreiros); (top middle): Craig Allen, USGS, Los Alamos, USA; (top right): U.S. Fish and Wildlife Service (2011); (bottom left) <https://travel.com.vn/mien-bac/tour-ha-giang.aspx>; (bottom middle): Jay Janner, The Statesman; (bottom right): Dr. Bernd Gross